



# **Regrowth – Kurri Kurri – Industrial Subdivision stages 1 and 2**

## **Biodiversity Development Assessment Report**

Loxford Project Management Pty Ltd

30 January 2023



Our ref: 12527690

30 January 2023

Dear Approver

**Regrowth Kurri Kurri Stage 1 – Biodiversity Development Assessment Report**

**Certification under Section 6.15 of the Biodiversity Conservation Act 2016**

I, Arien Quin (BAAS 17098), certify that this Biodiversity Development Assessment Report and the accompanying finalised credit report dated 30/01/2022 has been prepared in accordance with the requirements of (and information provided under) the Biodiversity Assessment Method (2020).

Sincerely



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#### Document status

| Status Code | Revision | Author | Reviewer |                                                                                     | Approved for issue |                                                                                       |          |
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|             |          |        | Name     | Signature                                                                           | Name               | Signature                                                                             | Date     |
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# Acknowledgement of Country

GHD acknowledges Aboriginal and Torres Strait Islander peoples as the Traditional Custodians of the land, water and sky throughout Australia on which we do business. We recognise their strength, diversity, resilience and deep connections to Country. We pay our respects to Elders of the past, present and future, as they hold the memories, knowledges and spirit of Australia. GHD is committed to learning from Aboriginal and Torres Strait Islander peoples in the work we do.





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# 1. Introduction

## 1.1 Overview

GHD Group Pty Ltd (GHD) has been engaged by Loxford Project Management Pty Ltd (Loxford Project Management) to prepare this Biodiversity Development Assessment Report (BDAR) to accompany a development application (DA) for a proposed subdivision, located within rural land at Gillieston Heights, NSW ('the proposal', refer Figure 1.1).

The proposal site is located within and adjacent to the former Hydro Aluminium Smelter site and is currently zoned IN1 (General Industrial), IN3 (Heavy Industrial) and RU2 (Rural Landscape). Several biodiversity assessments have been prepared across the former Hydro site, of which the proposal site forms a part. Results of these assessments have been reviewed and included in this BDAR where relevant.

This BDAR considers the assessment requirements of the NSW *Biodiversity Conservation Act 2016* (BC Act), NSW *Fisheries Management Act 1994* (FM Act) and Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). This BDAR has been prepared by an accredited assessor in accordance with the Biodiversity Assessment Method (BAM) (DPIE, 2020a).

## 1.2 Project description

The proposal comprises a 19 Lot industrial subdivision. This BDAR and associated DA represents Stages 1 and 2 of the lands that have been zones IN1– General Industrial, IN3 – Heavy Industrial and B5 – Business Development through planning proposal for 'Regrowth – Kurri Kurri' (PP-2021-477).

The proposal would include vegetation removal and earthworks associated with the proposed subdivision.

## 1.3 Purpose of this report

The purpose of this report is to assess the potential biodiversity impacts from the construction and operation of the proposal. The report:

- Outlines the methods used in the biodiversity assessment.
- Describes the existing environment of the proposal site, including the results of the desktop assessment and site surveys.
- Assesses the value and conservation significance of native vegetation and habitats at the proposal site and the potential for threatened biota and matters of national environmental significance (MNES) to occur at the proposal site or be affected by the proposal.
- Provides a description of the proposal, including potential impacts on biodiversity values and measures to avoid or mitigate impacts.
- Assesses the significance of impacts on threatened biota and MNES.
- Presents the data used to perform the BAM credit calculations for the proposal.
- Calculates the number and type of biodiversity credits that would be required to offset impacts of the proposal in accordance with the BAM.

## 1.4 Glossary of terms and acronyms

Table 1.1 Glossary of terms and acronyms

| Term                       | Definition                                                                                                                                                                                                                                                                                     |
|----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| AOBV                       | Areas of Outstanding Biodiversity Value                                                                                                                                                                                                                                                        |
| BAM                        | Biodiversity Assessment Method<br>The rules for biodiversity assessment established under the BC Act that determine credits created, credits required and the circumstances that improve or maintain biodiversity values.                                                                      |
| BAM-C                      | Biodiversity Assessment Method Calculator                                                                                                                                                                                                                                                      |
| BAR                        | Biodiversity Assessment Report                                                                                                                                                                                                                                                                 |
| BC Act                     | <i>Biodiversity Conservation Act 2016</i>                                                                                                                                                                                                                                                      |
| BC Regulation              | <i>Biodiversity Conservation Regulation 2017</i>                                                                                                                                                                                                                                               |
| BCS                        | Biodiversity, Conservation and Science Directorate of the Department of Planning, Industry and Environment                                                                                                                                                                                     |
| BCT                        | Biodiversity Conservation Trust                                                                                                                                                                                                                                                                |
| BCF                        | Biodiversity Conservation Fund                                                                                                                                                                                                                                                                 |
| BDAR                       | Biodiversity Development Assessment Report                                                                                                                                                                                                                                                     |
| Biodiversity credit        | A unit of biodiversity value to measure specific development impacts or conservation gains in accordance with the BAM. Includes ecosystem credits and species credits.                                                                                                                         |
| Biodiversity credit report | Specifies the number and type of biodiversity credits: required to offset the impacts of a development to obtain a Biodiversity Certification Agreement; or that would be generated through conservation and management of a Stewardship site under a Biodiversity Stewardship site agreement. |
| Biodiversity offsets       | Specific measures that are put in place to compensate for impacts on biodiversity values.                                                                                                                                                                                                      |
| Biodiversity values        | The composition, structure and function of ecosystems, including threatened species, populations and ecological communities, and their habitats.                                                                                                                                               |
| BOS                        | Biodiversity Offset Scheme                                                                                                                                                                                                                                                                     |
| CEEC                       | Critically endangered ecological community                                                                                                                                                                                                                                                     |
| CEMP                       | Construction environmental management plan                                                                                                                                                                                                                                                     |
| DBH                        | Diameter at breast height                                                                                                                                                                                                                                                                      |
| DAWE                       | The Commonwealth Department of Agriculture, Water and Environment (now DCCEEW)                                                                                                                                                                                                                 |
| DCCEEW                     | The Commonwealth Department of Climate Change, Energy, the Environment and Water (formally DAWE)                                                                                                                                                                                               |
| DPI                        | The NSW Department of Primary Industries                                                                                                                                                                                                                                                       |
| DPE                        | The NSW Department of Planning and Environment (formally DPIE)                                                                                                                                                                                                                                 |
| DPIE                       | The NSW Department of Planning, Industry and Environment (now DPE)                                                                                                                                                                                                                             |
| Ecosystem credit           | A credit that relates to a vegetation type and the threatened species that are reliably predicted by that vegetation type (as a habitat surrogate).                                                                                                                                            |
| EEC                        | Endangered ecological community                                                                                                                                                                                                                                                                |
| EHG                        | Environment and Heritage Group (of the DPE)                                                                                                                                                                                                                                                    |
| EPBC Act                   | Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i>                                                                                                                                                                                                              |
| FFMP                       | Flora and Fauna Management Plan                                                                                                                                                                                                                                                                |
| HTW                        | High threat weed                                                                                                                                                                                                                                                                               |
| IBRA                       | Interim Biogeographic Regionalisation for Australia                                                                                                                                                                                                                                            |
| LEP                        | Local Environment Plan                                                                                                                                                                                                                                                                         |

| Term              | Definition                                                                                                                                                                                                                                                                                                                                                                                               |
|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| LGA               | Local Government Area                                                                                                                                                                                                                                                                                                                                                                                    |
| Locality          | The area within a 10 km radius of the proposal site                                                                                                                                                                                                                                                                                                                                                      |
| Migratory species | Species listed under listed under international agreements (i.e. Ramsar, JAMBA, CAMBA and ROKAMBA conventions) to which Australia is a party                                                                                                                                                                                                                                                             |
| MNES              | Matters of National Environmental Significance                                                                                                                                                                                                                                                                                                                                                           |
| NSW               | New South Wales                                                                                                                                                                                                                                                                                                                                                                                          |
| NPW Act           | <i>National Parks and Wildlife Act 1974</i>                                                                                                                                                                                                                                                                                                                                                              |
| OEH               | Office of Environment and Heritage (now EHG of DP&E)                                                                                                                                                                                                                                                                                                                                                     |
| PCT               | Plant community type                                                                                                                                                                                                                                                                                                                                                                                     |
| Proposal site     | The area that would be directly impacted by construction and operation of the proposal. Encompasses road design shown on Figure 1.1. Comprises the 'development site' as referenced in the BAM                                                                                                                                                                                                           |
| SAIL              | Serious and irreversible impact                                                                                                                                                                                                                                                                                                                                                                          |
| SAIL entity       | Species and ecological communities that are at risk of serious and irreversible impacts (SAILs)                                                                                                                                                                                                                                                                                                          |
| SEPP              | State Environment Planning Policy                                                                                                                                                                                                                                                                                                                                                                        |
| Species credit    | A credit that relates to an individual threatened species that cannot be reliably predicted based on habitat surrogates. Threatened species that require species credits are identified in the Threatened Biodiversity Data Collection                                                                                                                                                                   |
| Study area        | The area that was subject to a site survey and assessed for direct or indirect impacts arising from construction and operation of the proposal. This included the area proposed for development as well as land within the adjoining former Hydro Site. Comprises the 'subject land' as referenced in the BAM. A buffer of 1,500 metres has been used in desktop assessments in accordance with the BAM. |
| TBDC              | Threatened Biodiversity Data Collection                                                                                                                                                                                                                                                                                                                                                                  |
| TEC               | Threatened ecological community                                                                                                                                                                                                                                                                                                                                                                          |
| Threatened biota  | Threatened species, populations or ecological communities listed under the BC Act, FM Act and/or the EPBC Act.                                                                                                                                                                                                                                                                                           |



## 1.5 Assumptions and limitations

This report has been prepared by GHD for Loxford Project Management Pty Ltd and may only be used and relied on by Loxford Project Management Pty Ltd for the purpose agreed between GHD and Loxford Project Management Pty Ltd as set out in Section 1.3 of this report.

GHD otherwise disclaims responsibility to any person other than Loxford Project Management Pty Ltd 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.

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

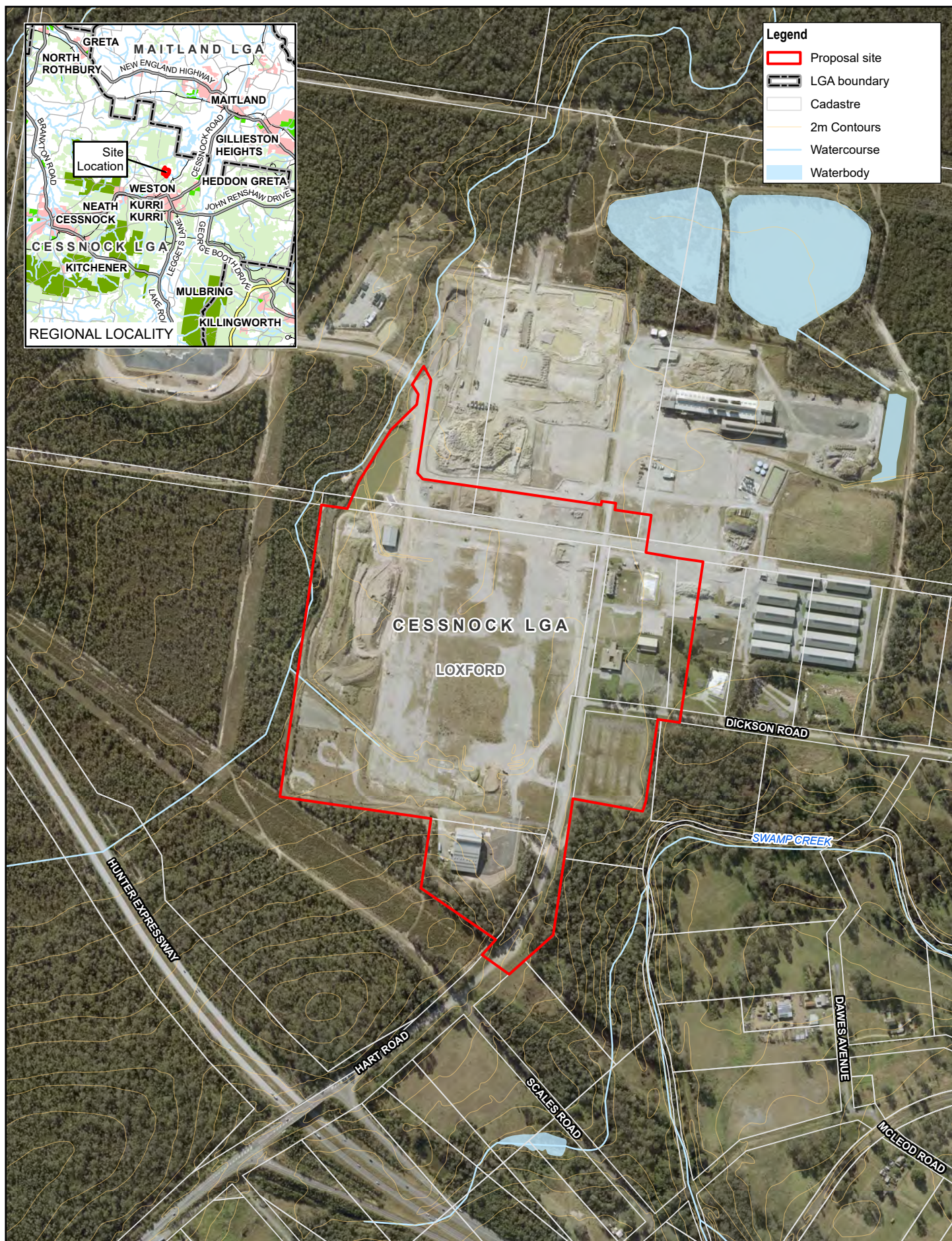
GHD has prepared this BDAR on the basis of information provided by Loxford Project Management Pty Ltd and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were

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, particular climatic conditions leading up to field surveys. As a result, not all relevant site features and conditions may have been identified in this report. Site conditions 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.

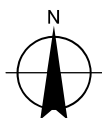
GHD is not responsible for any updates made by the Biodiversity, Conservation and Science Directorate (BCS) to the BAM credit calculator or and additional assessment requirements required due to new or updated survey guidelines or policies being published following issue of this report. If updates to this report are required due to changes made by BCS or other government departments GHD would not be responsible for these changes.





Paper Size ISO A4  
0 50 100 150 200  
Meters

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



**Loxford Project Group Pty Ltd**  
**Biodiversity Development Assessment Report**  
**Regrowth Industrial Subdivision (stages 1 and 2)**

Project No. 12527690  
Revision No. 0  
Date 30/01/2023

**Site map**

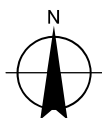
**FIGURE 1-1**





Paper Size ISO A4  
0 30 60 90 120  
Metres

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



**Loxford Project Group Pty Ltd**  
**Biodiversity Development Assessment Report**  
**Regrowth Industrial Subdivision (stages 1 and 2)**

Project No. 12527690  
Revision No. 0  
Date 30/01/2023

**Proposed site layout**

**FIGURE 1-2**



## 2. Legislative context

### 2.1 Biodiversity Conservation Act 2016

The NSW *Biodiversity Conservation Act 2016* (BC Act) provides legal protection for biota of conservation significance in NSW. The BC Act aims to, amongst other things, 'maintain a healthy, productive and resilient environment for the greatest well-being of the community, now and into the future, consistent with the principles of ecologically sustainable development'. It provides for the listing of threatened species and communities, establishes a framework to avoid, minimise and offset the impacts of proposed development (the Biodiversity Offsets Scheme), and establishes a scientific method for assessing the likely impacts on biodiversity values and calculating measures to offset those impacts (the Biodiversity Assessment Method, BAM 2020). These are discussed further below.

#### 2.1.1 Biodiversity Offset Scheme and Biodiversity Assessment Method

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

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

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

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

The Biodiversity Conservation Fund (BCF) ensures that landowners have the funds needed to carry out the management actions required each year and provides a financial incentive to landowners to carry out those actions. The scheme is administered by DPIE and ensures accountability and compliance through legislation, regular reporting requirements and financial measures. Under certain circumstances a developer may make a payment directly into the BCF to offset the impacts of a proposed development in lieu of purchasing and retiring biodiversity credits. The BCT must then use funds in the BCF to purchase and retire appropriate biodiversity credits.

The BOS and BAM have been addressed through the preparation of this BDAR by an accredited assessor.



## 2.2 Fisheries Management Act 1994

The objects of the NSW *Fisheries Management Act 1994* (FM Act) are to conserve, develop and share the fishery resources of the State for the benefit of present and future generations. It provides for the listing of threatened species, populations and ecological communities, listing of 'Key Threatening Processes', and the requirements or otherwise for the preparation of a Species Impact Statement (SIS).

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. To assist in the protection of key fish habitats, DPI has produced the Policy and guidelines for fish habitat conservation and management (DPI, 2013). This policy applies to the following developments, works or activities, each of which can impact on key fish habitat:

- Dredging or reclamation
- Impeding fish passage
- Damaging marine vegetation
- De-snagging

The FM Act has been considered in this assessment through:

- Desktop review to determine the threatened biota that are predicted to occur within the locality of the proposal and hence could occur, subject to the habitats present.
- Assessment of potential impacts on threatened biota and key fish habitat.
- Identification of suitable impact mitigation and environmental management measures for aquatic habitats, where required.

## 2.3 Biosecurity Act 2015

The NSW *Biosecurity Act 2015* provides for risk-based management of biosecurity in NSW. It provides a 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.

Two flora species listed as priority weeds for the Hunter region were recorded in the proposal site.

## 2.4 Environment Protection and Biodiversity Conservation Act 1999

The purpose of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (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 project, a development, an undertaking, an activity or a series of activities, or an alteration of any of these things. An action that 'has, will have or is likely to have a significant impact on a matter of national environmental significance (MNES)' is deemed to be a 'controlled action' and may not be undertaken without prior approval from the Australian Minister for the Environment. MNES relevant to this report include threatened species and ecological communities and migratory species.

The NSW Government and Australian Government finalised amendments to the Assessment Bilateral Agreement after changes to NSW legislation, and the Amending Agreement no. 1 was signed on 24 March 2020. The Australian Government formally endorsed the NSW BOS through the *EPBC Act Condition-setting Policy* (DAWE 2020).

The EPBC Act condition setting policy (DAWE 2020) notes that where a project demonstrates compliance with an endorsed state or territory policy, the proponent will not be required to simultaneously comply with the corresponding Australian Government policy. As such, a proponent is not required to calculate offsets separately using the EPBC Act offsets policy (DSEWPaC 2012) and associated calculator, unless offsets are required for a species not listed under the BC Act.

The EPBC Act has been considered in this assessment through:

- Desktop review to determine the listed biodiversity matters that are predicted to occur within the locality of the proposal and hence could occur, subject to the habitats present.
- Targeted field surveys for listed threatened biota and migratory species.
- Assessment of potential impacts on threatened and migratory biota, including assessments of significance in accordance with the EPBC Act Significant Impact Guidelines 3.1 (DotE 2013).
- Identification of suitable impact mitigation and environmental management measures for threatened and migratory biota, where required.

Based on the assessments of significance of impacts on MNES presented in this BDAR the proposal would not result in a significant impact on any MNES. Therefore, no further assessment or consideration of biodiversity offset requirements under the EPBC Act is required.

## 2.5 Assessment guidelines and information

This report has been prepared in accordance with the BAM (DPIE 2020a) and with reference to the following guidelines:

- *Surveying threatened plants and their habitats – NSW survey guide for the Biodiversity Assessment Method* (DPIE 2020b)
- *NSW survey guide for threatened frogs – A guide to the survey of threatened frogs and their habitats for the Biodiversity Assessment Method* (DPIE 2020c)
- *Species credit threatened bats and their habitats – NSW survey guide for the Biodiversity Assessment Method* (OEH 2018)
- *Koala (*Phascolarctos cinereus*) Biodiversity Assessment Method Survey Guide* (DPE 2022a)
- *Threatened reptiles Biodiversity Assessment Method survey guide* (DPE 2022b)



## 3. Methods

### 3.1 Desktop review

#### 3.1.1 Data review

A desktop database review was undertaken to identify threatened flora and fauna species, populations and ecological communities (threatened biota) listed under the BC Act and/or EPBC Act, that could be expected to occur in the locality, based on previous records, known distribution ranges, and habitats present. These were also used to obtain the necessary site data to perform BAM calculations.

A 10 kilometre (km) search radius from the proposal site was used to identify threatened species that were previously recorded in the locality. The threatened biota and migratory species identified in the desktop assessment are presented in Appendix A. Following collation of database records and threatened species and community profiles, a 'likelihood of occurrence' assessment was prepared for threatened biota and migratory species with reference to the broad vegetation types and habitats contained within the study area. This was further refined following field surveys and verification of vegetation types and identification and assessment of habitat present within the proposal site. A likelihood of occurrence ranking was attributed to these biota based on this information.

Information sources used in the preparation of this report include:

- NSW Department of Planning and Environment (DPE) BioNet Atlas for records of threatened biota previously recorded in the locality (website for the Atlas of NSW Wildlife) (DPE 2023a) and *Threatened Biodiversity Data Collection* (TBDC) profiles of threatened species listed under the BC Act (DPE 2022b).
- DPIE *Threatened biodiversity profile search* online database for threatened ecological communities and species listed under the BC Act (DPE 2023c).
- NSW *BioNet Vegetation Classification* (DPIE 2023c) to identify matching plant community types (PCTs) in the study area.
- EPBC Act Protected Matters Search Tool – for a 10 km radius around the proposal site (DCCEE 2022a).
- Species profile and threats database, online profiles (DCCEE 2022b).
- The list of species credit-type species and predicted species identified by the BAM calculator (DPE 2023?).

#### 3.1.2 Background research

Background research was conducted to identify:

- Landscape-scale features of the study area in accordance with Subsection 3.1.3 of the BAM (DPIE 2020).
- Site context of the study area that includes assessing vegetation cover and patch size as required under Section 3.2 and Subsections 4.3.2 of the BAM (DPIE 2020).
- The likely distribution of native vegetation and threatened ecological communities, based on previous mapping and aerial photograph interpretation, for targeted field verification as required under Section 4 of the BAM (DPIE 2020).
- A list of predicted and candidate threatened species and populations of flora and fauna to assess the habitat suitability and threatened biodiversity data collection as required under Section 5 of the BAM (DPIE 2020).
- Availability of baseline information to determine whether additional surveys, mapping and reporting is required to support project approval.

The background research included analysis of the following information sources:

- Aerial photographic imagery
- NSW (Mitchell) Landscapes mapping and landscape descriptions (DECC 2008b)
- Interim Biogeographic Regionalisation of Australia (IBRA version 7.0) mapping
- Initial BAM calculations
- Available regional-scale vegetation mapping of the site (NPWS 2000, Bell and Driscoll 2007)
- Atlas of Groundwater Dependent Ecosystems (GDE) (BoM 2023a)
- Aerial photographs and satellite imagery, 2 m contour data, and creek line data of the proposal site
- Department of Planning and Environment (DPE) eSpade V.2 online soil landscape mapping (DPE 2023d)
- Soil Landscapes of Central and Eastern NSW V2 (DPIE 2020d)
- Australian Wetlands Database (DPE 2023e)
- Aerial photographs and satellite imagery of the proposal site and buffer area

## 3.2 Site survey

### 3.2.1 Previous surveys completed within the proposal site

Several ecological surveys have been previously completed across the former Hydro site, of which the proposal site forms a part. Results of these surveys have been reviewed and referred to where relevant. Previous surveys completed within the former Hydro site are summarised in Table 3.1.

**Table 3.1** Summary of previous ecological surveys completed within and adjacent to the proposal site

| Survey                                                                        | Date/s of survey                                                                                                                                                                           | Survey techniques/effort                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|-------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Biodiversity Certification Assessment Report for Hydro Lands (ELA 2016)       | December 2014<br>February 2015<br>March 2014<br>March 2016<br>9 December 2014<br>24-19 December 2014<br>27 November 2014<br>27-29 December 2014<br>January 17-19 2015 and 23 February 2015 | <ul style="list-style-type: none"> <li>– Vegetation mapping</li> <li>– BBAM plot/transects</li> <li>– Threatened flora survey walking parallel transects spaces 5-10 metres apart</li> <li>– Plot based survey for threatened flora, including 80 20 X 50 plots</li> <li>– Arboreal hair tubes (1680 trap nights)</li> <li>– Next box monitoring (70 trap nights)</li> <li>– Camera traps (20 cameras over 10 week period)</li> <li>– Spotlighting</li> <li>– Call playback for forest owls and Koala</li> <li>– Amphibian survey, over six nights</li> <li>– Echolocation call recording</li> <li>– Diurnal bird surveys</li> </ul> |
| Flora assessment – Hydro Aluminium Kurri Kurri (FloraSeach 2004)              | 29 April – 14 May 2003<br>8-11 July 2003<br>23-15 October 2003<br>22-23 January 2004                                                                                                       | <ul style="list-style-type: none"> <li>– Vegetation mapping</li> <li>– Quadrat surveys (thirty 20 X 20 plots)</li> <li>– Spot sampling (77 survey points)</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Terrestrial Vertebrate Fauna Assessment (Cenwest Environmental Services 2004) | 12-24 May 2003<br>18-29 November 2003                                                                                                                                                      | <ul style="list-style-type: none"> <li>– Elliot A and B trapping on ground (180 trap nights)</li> <li>– Cage traps (72 trap nights)</li> <li>– Elliot A arboreal traps (120 trap nights)</li> <li>– Hair tubes on ground (1200 trap nights)</li> <li>– Arboreal Hair tubes (large and small) (560 trap nights)</li> <li>– Pitfall traps (432 trap nights)</li> <li>– Spotlighting</li> <li>– Systematic herpetological searches for 30 mins over 4 days</li> <li>– Bird surveys (20 hours)</li> <li>– Call playback (half hour at 10 sites over 4 nights)</li> <li>– Opportunistic observations</li> </ul>                           |

### 3.2.2 Survey overview

Staged surveys of the proposal site were conducted with reference to the appropriate threatened species survey guidelines for targeted species. Surveys were undertaken both within the proposal site and across a much larger 300 hectare study area associated with the wider Hydro site.

Site surveys have included:

- Initial site stratification, preliminary investigation of biodiversity values and vegetation mapping
- Vegetation integrity plots
- Incidental threatened flora surveys
- Opportunistic fauna surveys
- Habitat assessments
- Targeted surveys for threatened flora
- Targeted surveys for threatened fauna

Survey techniques and timing are summarised in Table 3.2.

**Table 3.2**      *Survey techniques and timing*

| Stage                                                                   | Date                                                                                                                                         | Survey Technique                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|-------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Preliminary investigation of biodiversity values and vegetation mapping | 26–29 August 2019<br>8–11 October 2019<br>18 June 2020                                                                                       | Ground-truthing of previous vegetation mapping.<br>Random meander in accordance with Cropper (1993) to: <ul style="list-style-type: none"> <li>– Document fauna habitats and features within the development area</li> <li>– Assess the general condition of vegetation and habitats present</li> <li>– Confirm vegetation boundaries</li> <li>– Identify potential habitat for threatened biota</li> <li>– Rapid aquatic habitat assessment</li> <li>– Opportunistic fauna observations</li> </ul> |
| Vegetation integrity                                                    | 20 December 2022                                                                                                                             | <ul style="list-style-type: none"> <li>– Vegetation integrity plots (x4)</li> <li>– Targeted threatened flora surveys, opportunistic fauna observations</li> <li>– Fauna habitat assessment</li> <li>– Hollow bearing tree assessment</li> </ul>                                                                                                                                                                                                                                                    |
| Winter targeted fauna survey                                            | 14–29 August 2019                                                                                                                            | <ul style="list-style-type: none"> <li>– Stag watching</li> <li>– Owl call playback</li> <li>– Spotlighting</li> <li>– Hollow-bearing tree assessments</li> <li>– Large forest owl tree survey</li> <li>– Targeted surveys for breeding habitat for Little Eagle, White-bellied Sea-eagle and Glossy Black-cockatoo</li> </ul>                                                                                                                                                                      |
| Targeted flora survey                                                   | 28–31 October 2019<br>13–15 November 2019<br>6–8 October 2020<br>5–6 October 2021<br>16 November 2021<br>7 December 2021<br>20 December 2022 | Systematic parallel traverses targeting candidate threatened flora species                                                                                                                                                                                                                                                                                                                                                                                                                          |



| Stage                        | Date                                     | Survey Technique                                                                                                                                                                                                                                                                                                                                                   |
|------------------------------|------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Spring targeted fauna survey | 25–29 November 2019                      | <ul style="list-style-type: none"> <li>– Ultrasonic call recording (Anabat)</li> <li>– Diurnal bird survey</li> <li>– Pitfall trapping</li> <li>– Spotlighting</li> <li>– Call playback for threatened owls</li> <li>– Remote camera traps</li> <li>– Active searches for scats and signs</li> </ul>                                                               |
| Summer targeted fauna survey | 24 –28 February 2020                     | <ul style="list-style-type: none"> <li>– Arboreal Elliot traps for small mammals</li> <li>– Spotlighting</li> <li>– Call playback for threatened owls and amphibians</li> <li>– Harp trapping</li> <li>– Ultrasonic call recording (Anabat)</li> <li>– Active searches for scats and signs</li> <li>– Remote camera traps</li> <li>– Habitat assessment</li> </ul> |
| SAll expert assessment       | 6 October 2021                           | Site visit to confirm plant community types and assess habitat values for Swift Parrot and Regent Honeyeater                                                                                                                                                                                                                                                       |
| Supplementary Frog Surveys   | 7–8 November 2021<br>23–24 November 2021 | <ul style="list-style-type: none"> <li>– Spotlighting</li> <li>– Call Playback</li> <li>– Active searches for amphibians</li> </ul>                                                                                                                                                                                                                                |

### 3.2.3 Vegetation mapping

Existing vegetation mapping of the proposal site completed by Bell and Driscoll (2007) and EcoLogical (ELA 2016) was ground-truthed in the field by walking the boundaries of vegetation types. Necessary adjustments were made by hand on aerial photographs of the proposal site with reference to a handheld Global Positioning System (GPS) unit. Other information recorded included observed vegetation structure, soil type, landscape position and condition. The overall condition of vegetation was assessed through general observation and comparison against the PCT condition benchmark data as well as using parameters such as species diversity, history of disturbance, weed invasion and canopy health. This data in combination with plot survey was then used to map the vegetation across the site. PCTs were identified based on vegetation structure, species composition, soil type and landscape position and with reference to the BioNet Vegetation Classification database (DPIE 2022b). The site was subsequently divided into relatively homogenous or discrete zones for assessment (i.e. vegetation zones). Vegetation zones represent a distinct PCT and broad condition state.

### 3.2.4 Vegetation integrity survey plots (assessment of site condition)

Following the stratification of the proposal site into vegetation zones, plot surveys were conducted in accordance with Section 4.3.3 and Section 4.3.4 the BAM (DPIE 2020a) to obtain vegetation integrity data for the calculation of biodiversity credits.

Plots were located to comply with the minimum number of plots required by Table 3 in the BAM (DPIE 2020a). In total, four plots were sampled within the proposal site. Plots were located randomly within each of the vegetation zones. Due to the small areas of impacts a number of the plots extended beyond the edge of the proposal site. Where possible all plots were located away from ecotones, tracks and track edges or other disturbed areas.

The location of survey plots are shown on Figure 3.2 and Figure 5.1. The minimum plot survey requirements are summarised in Table 3.3.

The site value was determined by assessing ten attributes used to assess function, composition and structure of vegetation within a 50 metre by 20 metre plot. These attributes were then assessed against benchmark values. Benchmarks are quantitative measures of the range of variability in condition in vegetation with relatively little evidence of alteration, disturbance or modification by humans since European settlement.

Attributes assessed within each plot are listed in Table 3.4. All flora species within a 20 metre by 20 metre quadrat nestled within the 50 metre by 20 metre plot were identified according to the nomenclature of the Royal Botanic Gardens and Domain Trust (RBGT 2022). Each species identified was allocated a growth form group<sup>1</sup> and designated as either native, exotic or high threat exotic in accordance with the lists accessed by assessors via the BAM calculator.

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

**Table 3.3** Minimum plot survey requirements within the proposal site

| Veg Zone     | PCT Number | PCT Name                                                                                                    | PCT condition         | Area (ha)    | Minimum number of plots required | Number of plots sampled |
|--------------|------------|-------------------------------------------------------------------------------------------------------------|-----------------------|--------------|----------------------------------|-------------------------|
| 1            | 1633       | Parramatta Red Gum-Narrow-leaved Ironbark-Grey Box shrub grass open forest of the lower hunter              | Intact                | 0.08         | 1                                | 1                       |
| 2            | 1600       | Spotted Gum – Red Ironbark – narrow-leaved Ironbark – Grey Box shrub –grass open forest of the lower Hunter | Intact                | 0.73         | 1                                | 1                       |
| 3            | 1591       | Grey Gum - Rough-barked Apple shrubby open forest of the lower Hunter intact condition                      | Intact                | 0.32         | 1                                | 1                       |
| 4            | 1591       | Grey Gum - Rough-barked Apple shrubby open forest of the lower Hunter intact condition                      | Disturbed             | 0.22         | 1                                | 1                       |
| 6            | N/A        | Planted vegetation                                                                                          | Planted               | 0.92         | 0                                | 0                       |
| Nil          | N/A        | Cleared                                                                                                     | Non-native vegetation | 32.81        | 0                                | 0                       |
| <b>Total</b> |            |                                                                                                             |                       | <b>35.08</b> | <b>4</b>                         | <b>4</b>                |

**Table 3.4** Site data collected within each BAM plot

| Attribute                                                                       | Sample area        |
|---------------------------------------------------------------------------------|--------------------|
| <b>Composition</b>                                                              |                    |
| Native plant species richness, total species richness of each growth form group | 20 x 20 metre plot |
| <b>Structure</b>                                                                |                    |

<sup>1</sup> TG – tree, SG – shrub, GG – grass/grasslike, FG – forb, EG – fern, OG – other (Table 2 of the BAM, DPIE 2020)

| Attribute                                                                        | Sample area              |
|----------------------------------------------------------------------------------|--------------------------|
| Percentage foliage cover for each species, total cover of each growth form group | 20 x 20 metre plot       |
| Estimated number of individuals for each species                                 | 20 x 20 metre plot       |
| <b>Function</b>                                                                  |                          |
| Number of large trees                                                            | 20 x 50 metre plot       |
| Tree regeneration (presence/absence)                                             | 50 x 20 metre plot       |
| Tree stem size class                                                             | 50 x 20 metre plot       |
| Total length of fallen logs                                                      | 50 x 20 metre plot       |
| Litter cover                                                                     | 5 times 1 x 1 metre plot |
| High threat exotic vegetation cover                                              | 20 x 20 metre plot       |
| Hollow-bearing trees                                                             | 50 x 20 metre plot       |

### 3.2.5 Targeted threatened flora surveys

Potential candidate species credit entities for the proposal site were identified and assessed in accordance with Section 5.2 and Section 5.3 of the BAM (DPIE 2020a). All threatened plants are classified under the BAM as species credit entities as their occurrence cannot be reliably predicted based on vegetation type.

The suite of threatened plants with potential to occur in the proposal site was identified based on the desktop assessment results and the species credit entities identified by preliminary BAM calculations (see Appendix A) Habitat for these species was identified and assessed based on threatened species profiles and the experience and judgement of GHD ecologists. A large area of the proposal site is highly modified and is dominated by exotic species, heavily grazed and can be readily discounted as supporting populations of threatened plant species.

Targeted searches were completed by experienced botanists systematically walking parallel traverses within areas of suitable habitat, with due consideration of the threatened plant survey guidelines (DPIE 2020b). Targeted threatened flora surveys were undertaken in October and November 2019, October and November 2020, October, November and December 2021 and December 2022, which according to the BAM, is a suitable time of the year to identify all of the candidate threatened flora species identified as having potential to occur. Surveys focused on areas of suitable habitat for candidate species within the proposal site.

Candidate flora species targeted during surveys are outlined in Table 3.5. The locations of threatened flora traverses within the proposal site are shown on Figure 3.2.

Further detail regarding candidate threatened flora species surveys is provided in Section 5.1.

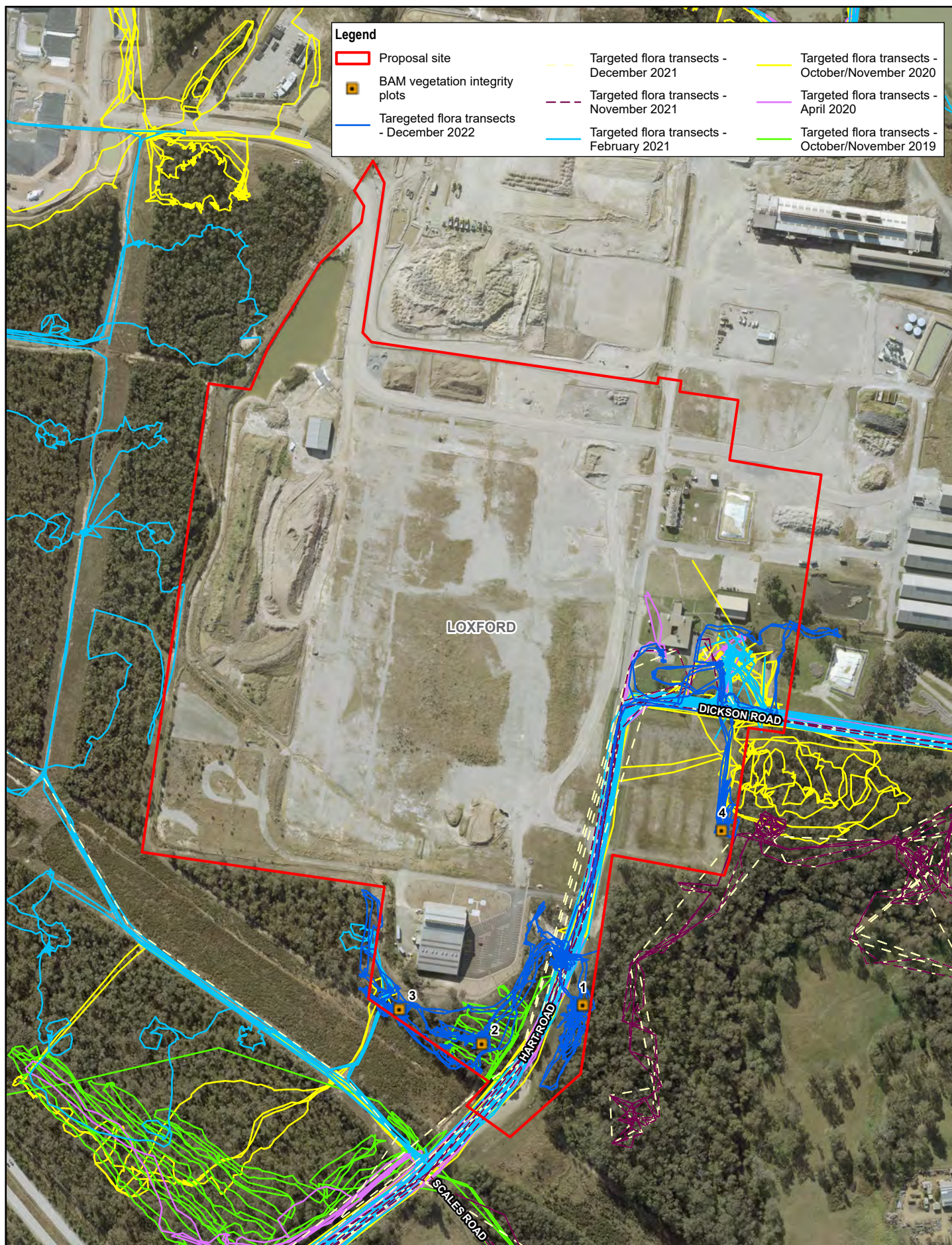
**Table 3.5** Candidate flora species targeted during surveys

| Common name                     | Scientific name                                         | Survey months | Survey completed |
|---------------------------------|---------------------------------------------------------|---------------|------------------|
| Bynoe's Wattle                  | <i>Acacia bynoeana</i>                                  | All year      | Oct, Nov and Dec |
| Netted Bottle Brush             | <i>Callistemon linearifolius</i>                        | Oct–Jan       | Oct, Nov and Dec |
| Leafless Tongue Orchid          | <i>Cryptostylis hunteriana</i>                          | Nov–Jan       | Nov              |
| White-flowered Wax Plant        | <i>Cynanchum elegans</i>                                | All year      | Oct, Nov and Dec |
| Pine Donkey Orchid              | <i>Diuris tricolor</i>                                  | Sep–Oct       | Oct              |
| Singleton Mallee                | <i>Eucalyptus castrensis</i>                            | All year      | Oct, Nov and Dec |
| Slaty Red Gum                   | <i>Eucalyptus glaucina</i>                              | All year      | Oct, Nov and Dec |
| Parramatta Red Gum              | <i>Eucalyptus parramattensis</i> subsp. <i>decadens</i> | All year      | Oct, Nov and Dec |
| Pokolbin Mallee                 | <i>Eucalyptus pumila</i>                                | All year      | Oct, Nov and Dec |
| Small-flower Grevillea          | <i>Grevillea parviflora</i> subsp. <i>parviflora</i>    | Aug–Nov       | Oct and Nov      |
| Large-leafed Monotaxis          | <i>Monotaxis macrophylla</i>                            | Aug–Feb       | Oct, Nov and Dec |
| <i>Ozothamnus tessellatus</i> - | <i>Ozothamnus tessellatus</i>                           | Sep–Oct       | Oct              |
| Scant Pomaderris                | <i>Pomaderris queenslandica</i>                         | All year      | Oct, Nov and Dec |



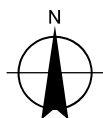
| Common name                    | Scientific name                 | Survey months | Survey completed |
|--------------------------------|---------------------------------|---------------|------------------|
| Singleton Mint Bush            | <i>Prostanthera cineolifera</i> | Sep–Oct       | Oct              |
| <i>Pterostylis chaetophora</i> | <i>Pterostylis chaetophora</i>  | Sep–Nov       | Oct and Nov      |
| Heath Wrinklewort              | <i>Rutidosia heterogama</i>     | All year      | Oct and Nov      |
| Black-eyed Susan               | <i>Tetraloche juncea</i>        | Sep–Oct       | Oct              |
| Austral Toadflax               | <i>Thesium australe</i>         | Nov–Feb       | Nov              |





Paper Size ISO A4  
0 30 60 90 120  
Metres

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



Loxford Project Group Pty Ltd  
Biodiversity Development Assessment Report  
Regrowth Industrial Subdivision (stages 1 and 2)

Project No. 12527690  
Revision No. 0  
Date 30/01/2023

Flora survey effort

FIGURE 3-1



## 3.2.6 Terrestrial fauna surveys

### 3.2.6.1 Fauna habitat assessment

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

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

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

- Hollow bearing trees and number of hollows in ecologically important size-classes (large >20 cm, medium >5–20 cm, small <5 cm).
- 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.
- Waterbodies.
- Evidence of activity such as feeding scars, scratches and diggings.
- Specific food trees and evidence of foraging (e.g. chewed *Allocasuarina* cones indicative of Glossy Black-cockatoos (*Calyptorhynchus lathamii*)).

The locations and qualitative descriptions of significant habitat features were captured with a handheld GPS unit.

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

Habitat assessments for Swift Parrot (*Lathamus discolor*) and Regent Honeyeater (*Anthochaera phrygia*) were also undertaken by species expert Dr Ross Crates on 6 October 2021. The focus of Dr Crates' assessment was to evaluate the habitat at the site to determine whether the vegetation present within the proposal site would constitute important foraging or breeding habitat for these species (refer to Appendix F).

### 3.2.6.2 Targeted surveys

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

Targeted, seasonal surveys are required for candidate threatened species entities i.e. species credit species and specific habitat resources such as nesting or roosting habitat for dual credit species. Candidate species credit entities that have a moderate potential to occur at the proposal site (refer to Appendix A) and that were targeted during these surveys are listed in Table 3.6.

Targeted threatened fauna surveys were undertaken during:

- 26–31 August 2019
- 25–28 November 2019
- 24–28 February 2020
- 23–24 November 2021
- 7–8 December 2021

Targeted fauna survey techniques and effort conducted in the study area are summarised in Table 3.6 and Table 3.7. Further detail regarding candidate fauna species targeted during surveys is provided in Section 6.1. Survey effort was stratified across the proposal site and wider Hydro lands (study area), noting that fauna species are mobile and may rely upon habitat resources in the proposal site even if not directly observed at the proposal site. All fauna observations were recorded on pro forma field data sheets.

**Table 3.6 Targeted fauna survey effort**

| Common name                        | Scientific name                  | Appropriate survey period | Month/s Surveyed               | Survey Method/s                                                                                                                                     |
|------------------------------------|----------------------------------|---------------------------|--------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| Bush Stone-curlew                  | <i>Burhinus grallarius</i>       | All year                  | November 2019                  | Spotlighting                                                                                                                                        |
| Eastern Pygmy-possum               | <i>Cercartetus nanus</i>         | Oct–March                 | November 2019                  | Elliot Traps<br>Spotlighting                                                                                                                        |
| Stripped Legless Lizard            | <i>Delma impar</i>               | September–December        | November 2019                  | Active searches<br>Pitfall trapping                                                                                                                 |
| White-bellied Sea-Eagle (breeding) | <i>Haliaeetus leucogaster</i>    | July - December           | August 2019                    | Active searches for scats and signs<br>Diurnal bird surveys<br>Active searches and inspection of candidate nest trees                               |
| Little Eagle (breeding)            | <i>Hieraaetus morphnoides</i>    | August–October            | August 2019                    | Diurnal bird surveys<br>Opportunistic observations<br>Active searches for scats and signs<br>Active searches and inspection of candidate nest trees |
| Pale-headed Snake                  | <i>Hoplocephalus bitorquatus</i> | November - March          | November 2019, February 2020   | Spotlighting                                                                                                                                        |
| Green and Golden Bell Frog         | <i>Litoria aurea</i>             | November - March          | December 2021                  | Spotlighting<br>Call playback<br>Active amphibian searches                                                                                          |
| Square-tailed Kite (breeding)      | <i>Lophoictinia isura</i>        | September–January         | November 2019                  | Active searches for scats and signs<br>Active searches for nests<br>Diurnal bird surveys                                                            |
| Southern Myotis                    | <i>Myotis macropus</i>           | October -March            | February 2020                  | Anabat detectors<br>Harp trapping<br>Inspection of breeding habitat                                                                                 |
| Squirrel Glider                    | <i>Petaurus norfolcensis</i>     | All year                  | February 2020                  | Elliot trapping<br>Spotlighting<br>Call playback                                                                                                    |
| Brush-tailed Phascogale            | <i>Phascogale tapoatafa</i>      | December–June             | February 2020                  | Elliot trapping<br>Spotlighting                                                                                                                     |
| Koala                              | <i>Phascolarctos cinereus</i>    | All year                  | November 2019<br>February 2020 | Spotlighting<br>Call playback<br>SAT assessments<br>Active searches for scats                                                                       |
| Common Planigale                   | <i>Planigale maculata</i>        | All year                  | November 2020                  | Pitfall traps<br>Spotlighting<br>Camera Traps                                                                                                       |



**Table 3.7 Targeted fauna survey techniques and effort**

| Survey technique                                                                                    | Survey effort                                                                                                                                                                                                                                                                                                                                                                |
|-----------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Camera trapping                                                                                     | Baited motion activated camera traps were set in vegetation to immediately adjacent to the proposal site between 25-28 November 2019 and 24-28 February 2020. These surveys targeted Brush-tailed Phascogale, Squirrel Glider, Pygmy Possum and Greater Glider.                                                                                                              |
| Call playback                                                                                       | Call playback surveys targeting Green and Golden Bell Frog were conducted on 26 November 2019, between 24 and 28 February 2020 and 24 and 25 February 2021.                                                                                                                                                                                                                  |
| Arboreal trapping                                                                                   | Arboreal trapping was conducted between 24 and 28 February 2020. A total of five transects were established adjacent to the site within the wider Hydro lands. Transects consisted of 10 arboreal Elliot B sized traps over 4 day/nights, totalling 200 trap nights. Arboreal traps were used to target Squirrel Glider, Brushed-tailed Phascogale and Eastern-Pygmy Possum. |
| Pitfall trapping                                                                                    | Four pitfall trapping transects were installed on the 25-29 November 2019 within the wider Hydro Lands. Each transect contained 6 traps that were open for 4 nights totalling 96 trap nights. Pitfall traps were used to target Common Planigale and Striped-legless Lizard.                                                                                                 |
| Spotlight survey                                                                                    | Spotlighting surveys were conducted on 26 and 27 November 2019. Additional spotlight surveys were completed between 24 and 27 February 2020, 7-8 December 2021 and on 24-25 November 2021. These spotlight surveys were conducted on two consecutive nights at each location.                                                                                                |
| Diurnal bird survey                                                                                 | Diurnal bird surveys conducted over three days between 25 -28 November 2019 and three days in February 2020 for a total of six person hours. A list of opportunistic bird sightings was recorded during the November 2019 and February 2020 surveys while undertaking other fieldwork components.                                                                            |
| Hollow-bearing tree and nest surveys                                                                | Systematic surveys for hollow bearing trees suitable as nest sites for forest owls and glossy black cockatoos were conducted on 14, 15 and 20 August 2019 and 21 November 2022.                                                                                                                                                                                              |
| Ultrasonic recording                                                                                | Anabat express detectors were placed in flyways and set to record whole nights of data between 25-28 November 2019 and 24-28 February 2020.                                                                                                                                                                                                                                  |
| Daytime traverses<br>Active reptile/amphibian searches<br>Active searches for scats and other signs | Active searches of woody debris, loose bark and other ground litter were conducted throughout the proposal site targeting threatened frogs and reptiles a total of five person hours was completed undertaking these searches in February 2020 and 22 person hours in November/December 2021 as well as 10 person hours in November 2022.                                    |

## 3.2.7 Survey conditions

The fauna field surveys were undertaken in August and November 2019, February 2020, November 2020 and November 2022. The Kurri Kurri region experienced drought conditions during the August and November 2019 surveys which likely impacted on the presence and detection of fauna species at the proposal site. Conditions were otherwise generally good for the detection of the species targeted. The wind conditions during diurnal bird surveys and call playback surveys were low to none and so would not have hampered the detection of bird species.

The Kurri Kurri area received approximately 47 mm of rainfall the week prior to the 24 –28 February 2020 fauna surveys. In addition, there was a further 9 mm of rain recorded during the February 2020 surveys. Although the site was still considerably dry as a result of long-term drought, these rainfall events resulted in suitable conditions to complete frog surveys within the site. As confirmed by presence of active calling frog species frog.

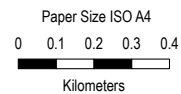
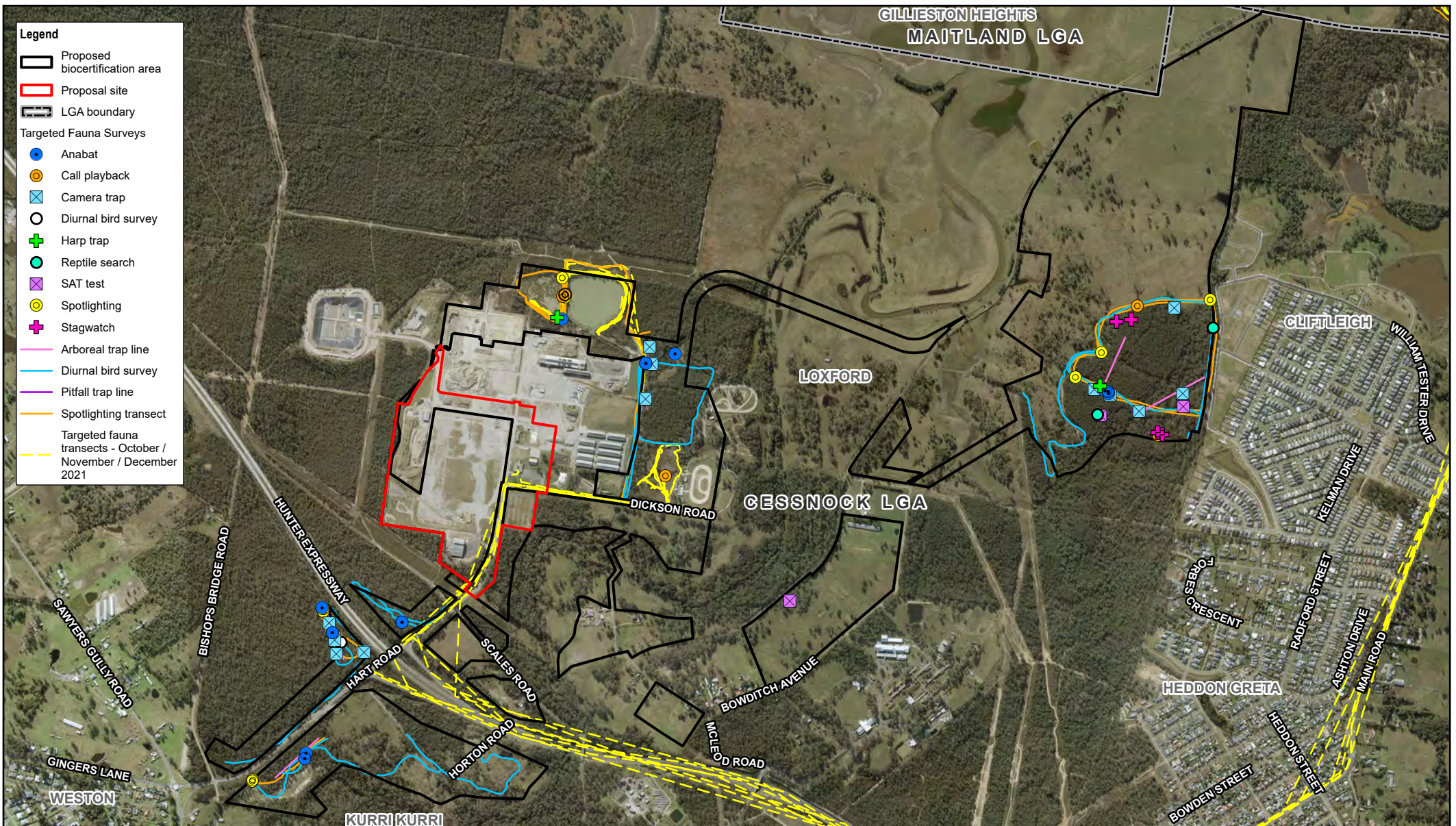
Supplementary frog surveys were also completed on 24–25 November 2021 and December 7 and 8 2021. These surveys were proceeded with 43.4 mm of rainfall in the three prior to the November surveys and 7 mm prior and during the December surveys. Numerous species of frog were calling within the proposal site at the time of these surveys and Green and Golden Bell Frogs were also confirmed to be calling at Kooragang Island (nearest known reference population) during the survey period (pers com Allen Cullen, Newcastle University).

Bureau of Meteorology (BoM) records for the survey periods are outlined in Table 3.8. These records were taken at Maitland Airport weather station (station 061428) located approximately 10 km east of the proposal site (BOM 2022b).

**Table 3.8**      *Daily weather observations during the survey period*

| Date                | Min temp<br>(Deg Celsius) | Max temp<br>(Deg Celsius) | Rainfall (mm) | Onsite weather<br>observations |
|---------------------|---------------------------|---------------------------|---------------|--------------------------------|
| 26–31 August 2019   |                           |                           |               |                                |
| 26/08/2019          | 10.7                      | 21.4                      | 0.0           | Light wind                     |
| 27/08/2019          | 6.5                       | 21.2                      | 0.2           | Clear, cool                    |
| 28/08/2019          | 6.9                       | 23.0                      | 0.2           | Clear, cool                    |
| 29/08/2019          | 5.5                       | 18.9                      | 0.0           | Clear, cool                    |
| 30/08/2019          | 10.0                      | 14.9                      | 2.2           | Clear, cool                    |
| 31/08/2019          | 9.9                       | 16.3                      | 43.8          | Moderate rain                  |
| 25–29 November 2019 |                           |                           |               |                                |
| 25/11/2019          | 17.8                      | 35.4                      | 0.0           | Hot, dry                       |
| 26/11/2019          | 14.0                      | 37.5                      | 0.2           | Hot, dry                       |
| 27/11/2019          | 10.0                      | 27.1                      | 0.0           | Hot, dry                       |
| 28/11/2019          | 8.8                       | 32.0                      | 0.0           | Hot, dry                       |
| 24–28 February 2020 |                           |                           |               |                                |
| 24/02/2020          | 18.8                      | 26.4                      | 0.0           | Clear, Warm                    |
| 25/02/2020          | 17.9                      | 30.2                      | 8.2           | Light rain                     |
| 26/02/2020          | 18.6                      | 32.5                      | 0.2           | Warm, light wind               |
| 27/02/2020          | 19.3                      | 26.3                      | 0.2           | Calm                           |
| 28/02/2020          | 16.3                      | 27.8                      | 0.2           | Calm                           |
| 19–25 November 2021 |                           |                           |               |                                |
| 19/11/2021          | 14.2                      | 25.3                      | 0.0           | Light wind                     |
| 24/11/2021          | 16.0                      | 23.5                      | 6.4           | Light wind                     |
| 25/11/2021          | 17.6                      | 29.8                      | 2.0           | Calm                           |
| 7–8 December 2021   |                           |                           |               |                                |
| 07/12/2021          | 16.7                      | 29.1                      | 5.2           | Warm, light wind               |
| 08/12/2021          | 17.0                      | 25.7                      | 1.2           | Warm, light wind               |
| 21 November 2022    |                           |                           |               |                                |
| 21/11/2022          | 14.1                      | 26.3                      | 0.0           | Warm, light wind               |





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



Loxford Project Group Pty Ltd  
Biodiversity Development Assessment Report  
Regrowth Industrial Subdivision (stages 1 and 2)

Project No. 12527690  
Revision No. 0  
Date 30/01/2023

Fauna survey effort

**FIGURE 3-2**



### 3.3 BAM calculations

The proposal was assessed according to the methodology presented in the BAM (DPIE 2020a), and the Biodiversity Assessment Methods Calculator Users Guide OEH 2018. The BAM calculator is a software application that is used to apply the BAM. Data is entered into the BAM calculator based on information collected in the desktop assessment, site surveys and from using GIS mapping software.

The BAM calculations were performed by Arien Quin (accredited BAM assessor number BAAS 17098) using calculator version 1.4.0.00 (DPE 2023) and reviewed by Andrew Smith (BAAS 19007). Data entered into the BAM calculator is provided in Appendix C. The biodiversity credit report is included in Appendix G.

### 3.4 Geographical Information System (GIS) analysis

GIS was used to:

- Plot the proposal site on a high-resolution aerial photo base and to map vegetation zones, survey effort, habitat resources and biodiversity values across the proposal site.
- Plot a 1,500 metre buffer area surrounding proposal site.
- Calculate the extent of native vegetation to be impacted, patch size and cover in the buffer area.
- Confirm the relevant IBRA bioregion, IBRA subregion and Mitchell Landscape for the site.

Native vegetation cover, extent and connectivity were assessed using aerial photography. Aerial photo interpretation was used to identify and record distinct vegetation patches, determine the broad condition state of vegetation types and the location and extent of vegetated habitat corridors.

### 3.5 Staff qualifications

This BDAR was prepared by Arien Quin in accordance with the BAM 2020. BAM plot data was collected by Rebecca Goodenough and James Baldry. A technical review of the report and credit calculations was undertaken by Rebecca Goodenough.

Fauna surveys were completed by Luke O'Brien (GHD) and Brendan Ryan (OMVI Ecological).

Qualifications of all staff involved in the field surveys and preparation of this BDAR are presented in Table 3.9.

**Table 3.9** GHD ecology staff and qualifications

| Name         | Position / Project Role                                                                                                                       | Qualifications                           | Relevant Experience |
|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|---------------------|
| Arien Quin   | Senior Ecologist-<br>Certifying accredited assessor and lead author of the BDAR<br>Targeted threatened flora surveys, BAM credit calculations | BA/BSc<br>Accredited BAM Assessor        | 15+ years           |
| Andrew Smith | Senior Ecologist Technical review                                                                                                             | BEnvSc (Hons)<br>Accredited BAM Assessor | 15+ years           |
| James Baldry | Ecologist<br>BAM plots<br>Targeted threatened flora surveys                                                                                   | MConsBio                                 | 4+                  |
| Ben Lewis    | Ecologist (Zoologist)<br>Lead Zoologist - Targeted threatened fauna surveys                                                                   | B. App. Sc                               | 20+ years           |
| Luke O'Brien | Fauna Ecologist<br>Threatened fauna surveys and reporting                                                                                     | BEnvSc<br>BSc (Hons)                     | 5+ years            |



| Name          | Position / Project Role                           | Qualifications                                                                                                                                                                                                                                                           | Relevant Experience |
|---------------|---------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| Craig Grabham | Senior Ecologist<br>Bat call Analysis             | B. App. Science (Hons) Anabat system training course (Titley Scientific, December 2012) Wildlife Accoustic's Song Meter/SongScope training (Faunatech, July 2015), Anabat Insight and bat call analysis workshop (Titley Scientific and Balance Environmental June 2019) | 22+ years           |
| Fiona MacKay  | Senior GIS Technician<br>GIS analysis and mapping | Engineering Drafting Certificate                                                                                                                                                                                                                                         | 30+ years           |

## 4. Landscape context

The BAM requires the assessment of landscape features to help describe the biodiversity values of the proposal site and assess the impacts of the proposal. Landscape features relevant to the BAM calculations are shown on Figure 4.1, discussed below and summarised in Table 4.2.

### 4.1 Location

The proposal site is located off Hart Road adjacent to the former Hydro Aluminium Smelter at Kurri Kurri, approximately 30 km north-west of Newcastle Central Business District within the Cessnock City Council LGA.

The site occurs within the Hunter Interim Biogeographic Regionalisation for Australia (IBRA) subregion of the Sydney Basin IBRA bioregion. The Sydney Basin IBRA bioregion lies on the central east coast of NSW, and extends north from Batemans Bay to Nelson Bay and west to Mudgee. It includes a significant proportion of the catchments of the Hawkesbury-Nepean, Hunter and Shoalhaven river systems.

The proposal site includes part of five Lots as listed in Table 4.1 as well as the entire Lot 3 DP 456769.

**Table 4.1** *Property Lots within proposal site*

| Lot number | Deposited Plan | Whole or part of Lot | Land Tenure |
|------------|----------------|----------------------|-------------|
| 16         | 1082775        | Part                 | Freehold    |
| 3          | 1286098        | Part                 | Freehold    |
| 318        | 755231         | Part                 | Freehold    |
| 411        | 755231         | Part                 | Freehold    |
| 420        | 755231         | Part                 | Freehold    |
| 3          | 456769         | Whole                | Freehold    |

### 4.2 Existing land use

The proposal site includes approximately 35.20 ha of land that was part of the former Hydro Aluminium Smelter site and associated buffer zone. The site contains cleared land, hardstand and buildings planted native vegetation, as well as several patches of remnant native vegetation. There are no waterbodies or other aquatic habitats present within the proposal site.

The site contains approximately 1.35 ha of native vegetation, of which 1.24 ha is in moderate to good condition and 0.22 ha is in poor condition. In addition, there is approximately 0.92 ha of planted vegetation and 32.81 ha of cleared land.

### 4.3 Climate

The site has a warm temperate climate. Based on data from the Maitland Airport weather station (station 061428) located approximately 10 km north of the proposal site, the site has a mean annual rainfall of 720 mm, falling predominantly in late summer to early autumn. The site can reach up to mean monthly maximum temperatures of 30.5 degrees Celsius and down to mean monthly minimum temperature of 4 degrees Celsius (BOM 2020a).

### 4.4 Landscape features

Landscape features within the proposal site are summarised in Table 4.2 and shown in Figure 4.1 as required by Section 3.1 of the BAM.

**Table 4.2** Summary of landscape features present within the proposal site

| Landscape feature                                                   | Proposal site                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|---------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Method applied for site context components                          | Site-based                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Interim Biogeographic regionalisation of Australia (IBRA) bioregion | Sydney Basin                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| IBRA subregion                                                      | Hunter                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Mitchell landscapes                                                 | Newcastle Coastal Ramp                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Percentage native vegetation extent within buffer area              | 51 percent (572.5 ha)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Rivers, streams and estuaries                                       | <p>The proposal site is located within the Wallis Creek catchment. Wallis creek flows into the Hunter River approximately 10 km to the north of the proposal site between East and West Maitland.</p> <p>There is a small second order drainage line mapped on the western edge of the site that flows into Black Waterhole Creek.</p> <p>Swamp Creek which is a fifth order stream, is located approximately 100 meters east of the proposal site. Both Swamp Creek is a major tributary of Wallis Creek. Both Creeks flow in a northerly direction in to Wentworth Swamp.</p> <p>Neither Black Waterhole Creek or Swamp Creek are identified by DPI as key fish habitat (DPI 2007, DPI 2022).</p> |
| Wetlands                                                            | <p>There are no natural wetlands within the proposal site.</p> <p>A large ephemeral wetland known as Wentworth Swamp occurs to the north of the proposal site (refer to Figure 1.2). This large wetland basin occurs on the floodplains of Black Waterhole and Swamp Creeks and is recognised as a regionally significant wetland.</p> <p>Testers Hollow floodplain wetland is located to the north-east of the proposal works. This wetland has been highly modified as a result of historic agricultural activities within the region.</p>                                                                                                                                                        |
| Connectivity features                                               | <p>The proposal site is bordered to the north by cleared industrial land associated with the former Hydro Aluminium Smelter site. Native vegetation extends to the east where there is a vegetated corridor that borders Swamp Creek. To the south and west vegetation connectivity has been impacted by clearing associated with a transmission line easement and further south by the Hunter Expressway.</p>                                                                                                                                                                                                                                                                                      |
| Areas of geological significance or soil hazard features            | <p>Areas of the proposal site have a high probability for containing Acid Sulfate Soils, occurring 2-4 m below ground surface (DPIE 1998; Naylor et al. 1998).</p> <p>There are no karst, caves, crevices, cliffs or other areas of geological significance located within the proposal site.</p>                                                                                                                                                                                                                                                                                                                                                                                                   |
| Areas of outstanding biodiversity value                             | <p>No areas identified under the BC Act as being of outstanding biodiversity value have been mapped in the development footprint.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Other landscape features                                            | Nil                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |

#### 4.4.1 NSW landscape region (Mitchell Landscapes)

The proposal site is located within the Newcastle Coastal Ramp Mitchell Landscape within the Sydney Basin Bioregion (DECC 2008a). Field surveys confirmed the presence of the soil types, landscape features and vegetation communities typically associated with the Newcastle Coastal Ramp Mitchell Landscape.



## 4.4.2 Soil landscapes

One soil landscape (Neath SI5601nh) has been mapped within the proposal site (DPIE 2023c).

This soil landscape typically occurs on undulating rises and swamps with elevations of 40–80 m. Local relief is typically under 30 m. Geology is associated with the Branxton Formation which is characterised by siltstone, pebbly sandstone and minor coal parent rock and alluvium derived from the parent rock.

Soils include Grey Solodic soils comprised of a brown clayey sand and loamy sand topsoil over an olive grey sandy clay, massive, orange and grey mottle subsoil. These soils have a high erodibility and generally low fertility (Kovak and Lawrie 1991).

## 4.4.3 Soils hazards

The Maitland LEP 2011 indicates a potential Class 5 Acid Sulphate Soils risk affecting the proposal site. Further development associated with the proposal site would require an Acid Sulfate Soil Management Plan.

## 4.5 Site context

To determine site context as required under Section 3 of the BAM (Section 3.2 and Subsection 4.3.2), an assessment of native vegetation cover and patch size has been undertaken and is outlined below.

### 4.5.1 Native vegetation cover

Native vegetation cover (woody and non-woody) was assessed on the proposal site and within a 1,500 metre buffer area surrounding the outside edge of the boundary of the site. Aerial photography was examined at scales between 1:2000 and 1:4000. The percent native vegetation cover within 1,500 metre buffer area was assessed to be 31 percent and includes (see Table 4.3):

- Remnant mapped native vegetation types (including wetland vegetation)
- Planted native vegetation types
- Areas mapped as canopy only

Areas that were excluded include:

- Cleared areas
- Non-native vegetation
- Dams, ponds and other waterbodies
- Buildings
- Non-native plantings

The identification of native vegetation in the buffer areas was based on review of the NSW State Vegetation Type Map (DPE 2023a) in combination with aerial photograph interpretation and ground-truthing during field surveys.

**Table 4.3** Native vegetation cover

| Native vegetation cover unit                          | 1,500 m buffer area          |
|-------------------------------------------------------|------------------------------|
| Total assessment area                                 | 1126 (nearest whole hectare) |
| Area of native vegetation cover (woody and non-woody) | 573 (nearest whole hectare)  |
| Percentage native vegetation cover                    | 51%                          |
| Cover class                                           | 30–70%                       |

## 4.5.2 Connectivity features

The proposal site includes and is bordered to the north by cleared agricultural land associated with the former Hydro Aluminium Smelter. To the south and east are small patches of vegetation that have been fragmented from a much larger connected patch by a transmission line easement. To the south-east of the site there is a vegetated corridor that extends along Swamp Creek. Further north and set of the site is a large patch of native vegetation (>2,000 ha) surrounding Sawyers Gully. Connectivity between the proposal site and remnant native vegetation to the west has been impacted by the construction of the former Hydro Aluminium Smelter and associated infrastructure (transmission lines, roads and buildings) (refer to Figure 4.1).

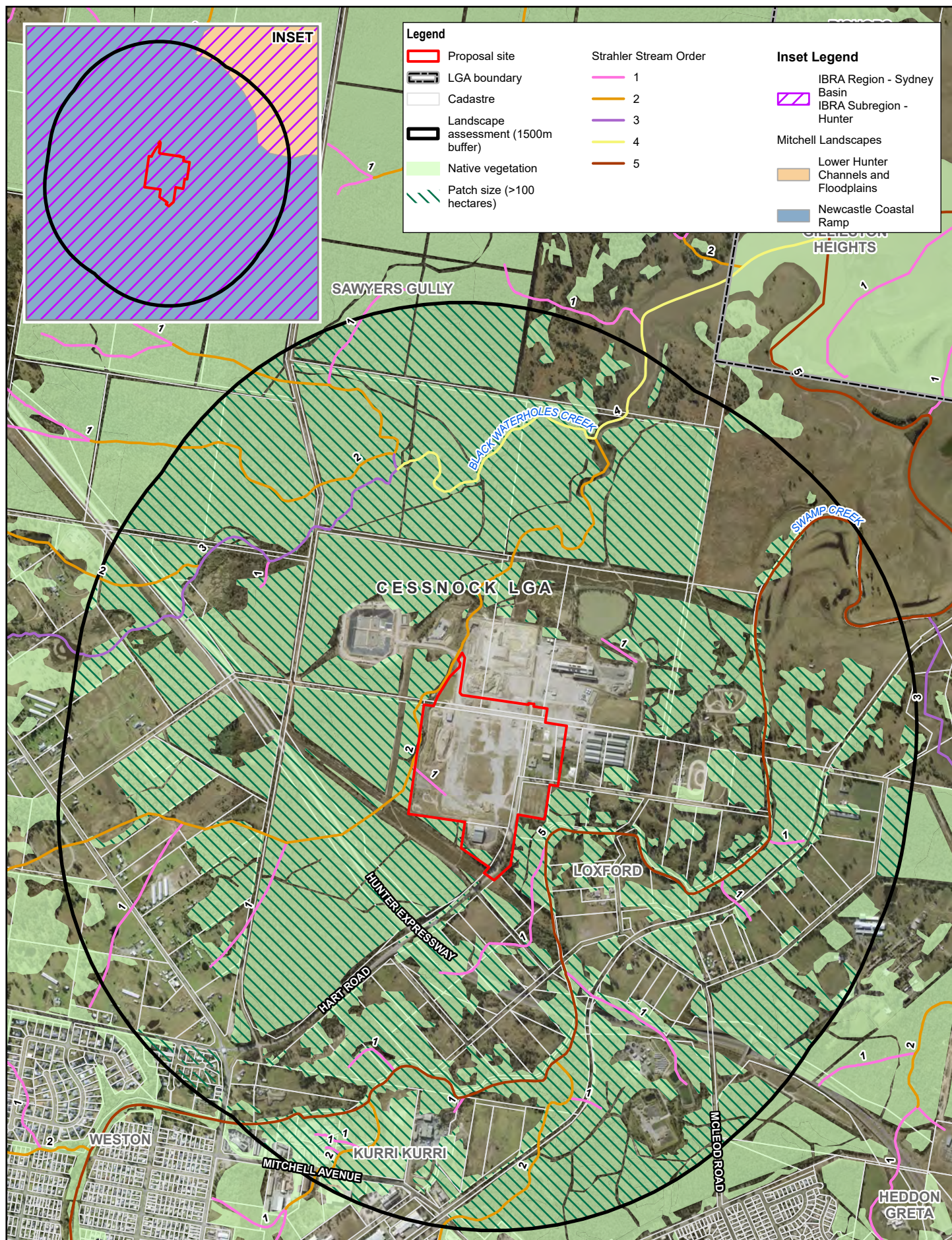
## 4.5.3 Areas of significance

No areas identified under the BC Act as being of outstanding biodiversity value have been mapped in the proposal site.

There are no karst, caves, crevices, cliffs or other areas of geological significance located within or adjacent to the proposal site.

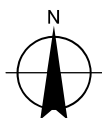
Vegetation along the southern edge of the site has been identified on the Biodiversity Values Map (DPIE 2022f) and is mapped as important habitat for the Regent Honeyeater and Swift Parrot (refer to Figure 9.3).





Paper Size ISO A4  
0 160 320 480 640  
Metres

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



Loxford Project Group Pty Ltd  
Biodiversity Development Assessment Report  
Regrowth Industrial Subdivision (stages 1 and 2)

Project No. 12527690  
Revision No. 0  
Date 30/01/2023

Landscape assessment

FIGURE 4-1



## 5. Native vegetation

### 5.1 Flora species

A total of 90 flora species from 31 families were recorded within the proposal site, comprising 73 native and 17 exotic species. The Myrtaceae (18 species, 16 indigenous and two native but not indigenous to the Hunter region), Poaceae (14 species, 11 native, three exotic), Asteraceae (seven species, one native and six exotic) and Fabaceae (Faboideae) (11 species, all native) were the most diverse families recorded. A full list of flora species recorded within the proposal site is provided in Appendix C.

Two individuals of the threatened flora species (*Eucalyptus parramattensis* subsp. *decadens* (Parramatta Red Gum) were recorded during field surveys. These individuals are located within a small patch of PCT 1633 that occurs along the south-eastern boundary of the proposal site.

Threatened flora survey effort was largely confined to areas of native vegetation in the south of the site as most of the remainder of the site contains cleared land and hardstand that does not provide suitable habitat for the threatened species with the potential to occur in the locality (refer to Figure 3-1).

#### 5.1.1 Priority and high threat species

Two flora species listed as priority weeds (*Senecio madagascariensis* (Fireweed) and *Lantana camara* (Lantana) in the Hunter region (which includes the Cessnock local government area) were recorded within the proposal site during the field surveys.

In addition, the following exotic species recorded in the proposal site are classified as high threat weeds for the purposes of the BAM:

- *Andropogon virginicus* (Whisky Grass)
- *Ehrharta erecta* (Panic Veldtgrass)
- *Cinnamomum camphora* (Camphor Laurel)
- *Corymbia torelliana* (Cadaghi)
- *Phoenix canariensis* (Canary Island Date Palm)

### 5.2 Vegetation within proposal site

#### 5.2.1 Patch size

Patch size is defined under the BAM (DPIE 2020a) as an area of native vegetation that:

- Occurs on the development site or biodiversity stewardship site (i.e. proposal site).
- Includes native vegetation that has a gap of less than 100 metres from the next area of native vegetation (or ≤ 30 metres for non-woody ecosystems).

Patch size may extend into adjoining land that is not part of a development site or a biodiversity stewardship site. Patch size area is assigned to each vegetation zone as a class, being < 5 hectares, 5-<25 hectares, 25-<100 hectares or ≥ 100 hectares.

Native vegetation at the proposal site is connected to a much larger patch that extends to the north and west of the site. The total size of this patch within the 1,500 meter buffer is about 573 ha. The overall patch size polygon includes additional areas of connected intact native vegetation, however for the purposes of this assessment, the total patch size has not been calculated outside of the buffer area, given the highest class was already reached within the buffer area. Therefore 101 ha was entered as the patch size for each of the vegetation zones in the BAM calculator.



## 5.2.2 Native vegetation extent

The majority of the proposal site has been cleared and includes hardstand areas and planted trees that make up part of the former Hydro Aluminium Smelter.

The site includes small areas of Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest (PCT 1600) occurring as scattered trees over a disturbed, understorey. On the south-eastern boundary of the proposal site is a patch of intact Grey Gum - Rough-barked Apple shrubby open forest of the lower Hunter (PCT 1591) as well as a small area of disturbed PCT 1591.

In the south-west of the site a number of small patches of Parramatta Red Gum - Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area (PCT 1633).

There is a total extent of 1.35 ha of native vegetation within the proposal site. Of this 1.13 ha is comprised of remnant woodland patches in moderate to good condition and 0.22 ha has been modified (see Figure 5.1). There is a further 0.92 ha of planted vegetation and 32.81 ha of cleared land that does not comprise native vegetation cover.

## 5.2.3 Planted native vegetation

The proposal site also contains approximately 0.92 ha of planted vegetation consisting of a patch of planted *Casuarina glauca* along heart road as well as numerous planted Eucalypts and amenity plantings within the former Hydro Aluminium Smelter car park,

An assessment of this planted native vegetation has been completed in accordance with the streamlined assessment module for planted native vegetation outlined in Appendix B of the BAM. This assessment determined that planted vegetation within the proposal site has been planted for functional and aesthetic purposes (landscaping) and as such Chapters 4 and 5 of the BAM are not required to be applied (refer to Appendix G). An assessment of planted native vegetation for threatened species habitat is included in Section 6.1.5 of this BDAR.

## 5.2.4 Plant community types

Existing vegetation mapping of the proposal site completed by Bell and Driscoll (2007) and EcoLogical (ELA 2016) was reviewed and ground-truthed. The overall condition of vegetation was assessed through general observation and comparison against the PCT condition benchmark data as well as using parameters such as species diversity, history of disturbance, weed invasion and canopy health. Candidate PCTs were identified using the BioNet Vegetation Classification database power query function. Plot survey data along with information collected regarding soil type and landscape position was then analysed and compared to PCT descriptions in the Vegetation Classification Database to confirm PCTs.

Results of field surveys and plot analysis indicate that vegetation within the proposal site corresponds to three native Plant Community Types (PCTs), one planted community and one exotic vegetation community. PCTs within the proposal site include:

- PCT 1600, Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter.
- PCT 1633 Parramatta Red Gum - Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area.
- PCT 1591 Grey Gum - Rough-barked Apple shrubby open forest of the lower Hunter.

Vegetation types within the proposal site are summarised in Table 5.1 and shown in Figure 5.1. The structure, species composition and condition of PCTs and vegetation zones within the proposal site are described in Table 5.2 to Table 5.6.

All three of the PCTs identified within the proposal site comprise occurrences of threatened ecological communities (TECs) under the BC Act. See Section 6.2.3 for additional description of occurrences of TECs at the proposal site.

- Planted vegetation has been assessed separately in accordance with Appendix D of the BAM.

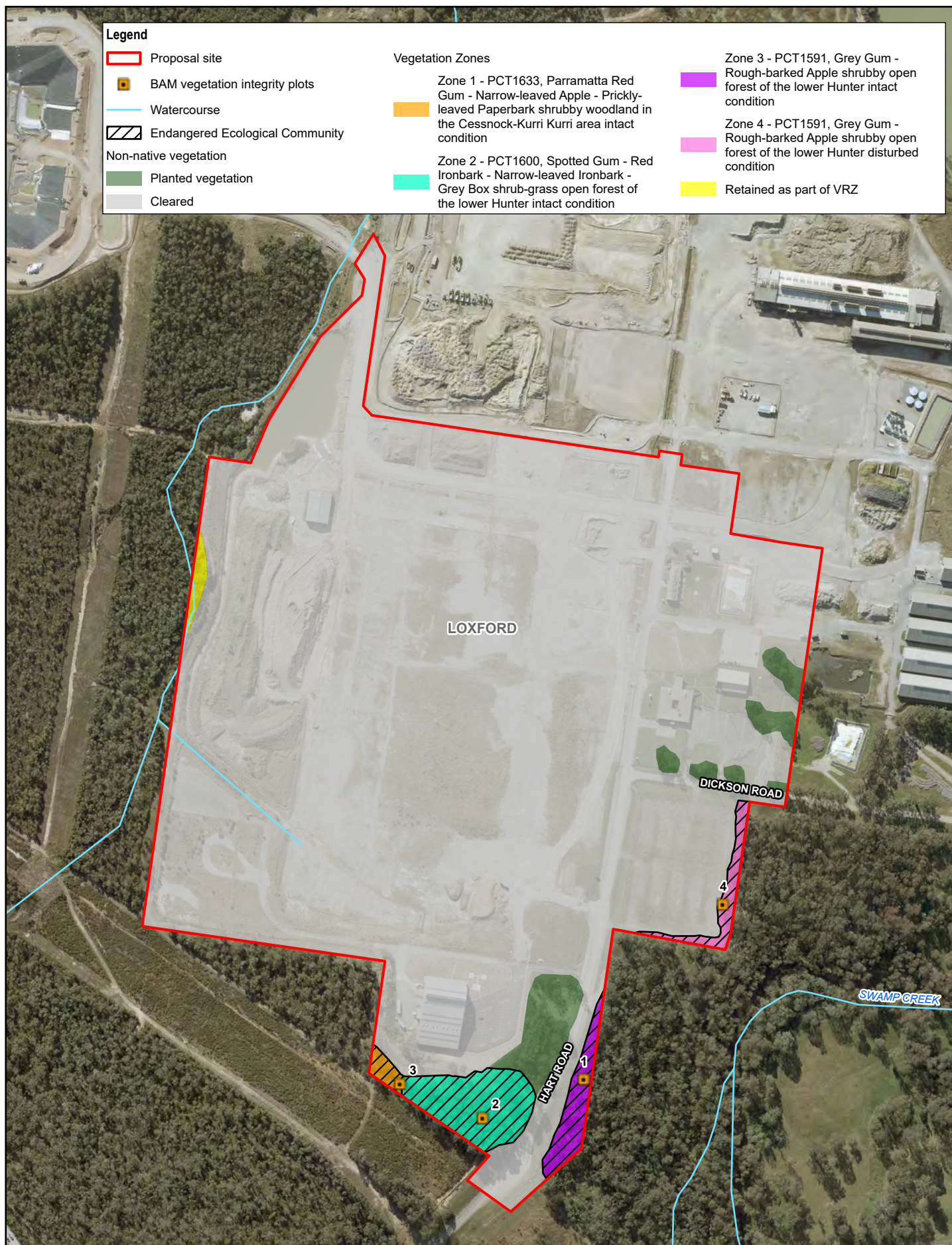
## 5.2.5 Vegetation zones

The historical clearing has resulted in areas of PCT 1591 that are in different condition states across the proposal site. Where appropriate, PCTs were split into different vegetation zones according to different vegetation condition classes.

There are a total of four native vegetation zones within the proposal site as outlined in Table 5.1. Planted vegetation has been assessed separately in accordance with Appendix D of the BAM.

**Table 5.1** *Vegetation within the proposal site*

| Vegetation zone                                                                                                                     | PCT ID | Condition class | Area in proposal site (ha) | Patch size (ha) | Percent cleared | Risk Rating | VI score | BC Act Status                                                                                     | EPBC Act Status |
|-------------------------------------------------------------------------------------------------------------------------------------|--------|-----------------|----------------------------|-----------------|-----------------|-------------|----------|---------------------------------------------------------------------------------------------------|-----------------|
| 1. Parramatta Red Gum- Narrow-leaved Apple-Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area (1633_Intact) | 1633   | Intact          | 0.08                       | 101             | 75              | 2           | 62.1     | Kurri Sand Swamp Woodland in the Sydney Basin Bioregion EEC                                       | Not listed      |
| 2. Spotted Gum – Red Ironbark – Narrow-leaved Ironbark – Grey Box shrub grass open forest of the lower Hunter (1600_Weedy)          | 1600   | Intact          | 0.73                       | 101             | 71              | 2           | 57.8     | Lower Hunter Spotted Gum – Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions EEC | Not listed      |
| 3. Grey Gum – Rough-barked Apple shrubby open forest of the lower Hunter (1591_intact)                                              | 1591   | Intact          | 0.32                       | 101             | 26              | 2           | 65.8     | Hunter Lowland Redgum Forest in the Sydney Basin and New South Wales North Coast Bioregion        | Not listed      |
| 4. Grey Gum – Rough-barked Apple shrubby open forest of the lower Hunter (1591_disturbed)                                           | 1591   | Disturbed       | 0.22                       | 101             | 26              | 2           | 35.9     | Hunter Lowland Redgum Forest in the Sydney Basin and New South Wales North Coast Bioregion        | Not listed      |
| <b>Total</b>                                                                                                                        |        |                 | <b>1.35</b>                |                 |                 |             |          |                                                                                                   |                 |





## 5.2.6 Vegetation zone profiles

Description profiles of the vegetation zones present in the proposal site are provided in Table 5.2 to Table 5.6.

**Table 5.2** *Parramatta Red Gum - Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area (intact)*

| 1. Parramatta Red Gum – Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area (intact) |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                    |
|-----------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|
| PCT(DPE, 2023b)                                                                                                                   | Parramatta Red Gum – Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |  |
| PCT ID                                                                                                                            | 1633                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                    |
| Equivalent Map Units                                                                                                              | Bell and Driscoll map unit 35a (Kurri Sand Heath Woodland)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                    |
| Survey effort                                                                                                                     | One VI plot (BAM plot 3)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                    |
| Vegetation formation                                                                                                              | Dry Sclerophyll Forests (Shrubby sub-formation)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                    |
| Vegetation class                                                                                                                  | Sydney Sand Flats Dry Sclerophyll Forests                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                    |
| Conservation significance                                                                                                         | Comprises an occurrence of “Kurri Sand Swamp Woodland in the Sydney Basin” which is listed as an EEC under the BC Act.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                    |
| Condition                                                                                                                         | Intact                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                    |
| Evidence used to define PCT                                                                                                       | <p>The PCT was chosen for the following reasons:</p> <ul style="list-style-type: none"><li>– The site occurs within the PCTs described range, within Cessnock LGA.</li><li>– The PCT is described as occurring on soils containing conglomerate variants and include brownish black gravelly loam overlayed on sandy clay loam and brown pedal clay. These soils are typical of those of the Bolwarra Heights and Neath Soil Landscapes that occur within the proposal site.</li><li>– The site occurs at a maximum elevation height of approximately 55 m; the PCT is described as occurring up to elevations of 100 m.</li><li>– Diagnostic species listed in the Bionet Vegetation Database are largely consistent with species recorded within this PCT with five of the seven diagnostic species recorded within the vegetation zone.</li><li>– Additional characteristic species identified below are largely consistent with those identified for this community in the BioNet Vegetation Classification Database.</li><li>– Mapping is largely consistent with vegetation community mapping completed for the site by Bell and Driscoll (2019) and EcoLogical (2016).</li><li>– Also see Section 5.2.4 for further discussion of evidence used to confirm the distribution of Kurri Sand Swamp Woodland EEC.</li></ul> |                                                                                    |
| Landscape position                                                                                                                | Low rises and flats                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                    |
| Occurrence in proposal site                                                                                                       | A small area of this PCT occurs in the south-western corner of the proposal site. There is a small patch on the western boundary of the that is proposed to be retained as part of a vegetated riparian zone.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                    |
| Structure                                                                                                                         | <p>Low intermittently low open woodland to 15 metres with a dense two-layered mid-storey comprised of sclerophyllous shrubs.</p> <p>The ground layer is typically dominated by grasses, low shrubs and scattered forbs.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                    |



| 1. Parramatta Red Gum – Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area (intact) |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|-----------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Over storey                                                                                                                       | Contains <i>Eucalyptus parramattensis</i> subsp. <i>decadens</i> (Parramatta Redgum), <i>Eucalyptus globoidea</i> (White Stringybark) and <i>Eucalyptus fibrosa</i> (Red Stringy Bark).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Mid storey                                                                                                                        | Dominated by <i>Melaleuca nodosa</i> , with other common species including with common species including <i>Acacia elongata</i> (Swamp Wattle), <i>Callistemon linearis</i> (Narrow-leaved Bottlebrush), <i>Acacia ulicifolia</i> (Prickly Moses), <i>Dillwynia retorta</i> , <i>Breynia oblongifolia</i> (Coffee Bush), <i>Daviesia ulicifolia</i> (Gorse Bitter Pea), <i>Acacia irrorata</i> (Green Wattle) and <i>Bursaria spinosa</i> (Native Blackthorn).                                                                                                                                                                                                                                                                                                                                                                  |
| Groundcover                                                                                                                       | Ground cover species are characteristic of native grasses and forbs. Native grass species which are dominant within the PCT include <i>Entolasia stricta</i> (Wiry Panic) and <i>Themeda triandra</i> (Kangaroo Grass). Other common species include <i>Panicum simile</i> (Two-colour Panic), <i>Echinopogon caespitosus</i> (Hedgehog Grass) and <i>Dichelachne crinata</i> . Common forb species include <i>Pomax umbellata</i> (Pomax), <i>Glycine clandestina</i> (Twining Glycine), <i>Pultanaea</i> spp., <i>Lomandra confertifolia</i> (Matrush), <i>Lepidosperma laterale</i> (Variable Sword-sedge) and <i>Xanthosia tridentata</i> (Rock Xanthosis). The climbers <i>Hardenbergia violaceae</i> (False Sarsparilla) and <i>Cassytha pubescens</i> (Downy Dodder-laurel) are also common within this vegetation zone. |
| Exotic species                                                                                                                    | Community has a low abundance of exotic species present. Species occasionally present include <i>Conyza bonariensis</i> (Flaxleaf Fleabane).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

Table 5.3 Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub grass open forest of the lower Hunter (intact)

| 2 Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub grass open forest of the lower Hunter (intact) |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                     |
|-----------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| PCT (DPE, 2023b)                                                                                                      | Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub grass open forest of the lower Hunter                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |
| PCT ID                                                                                                                | 1600                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                     |
| Equivalent map units                                                                                                  | Bell and Driscoll (2007) map unit 17a Lower Hunter Spotted Gum Ironbark Forest                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                     |
| Vegetation formation                                                                                                  | Dry Sclerophyll Forests (Shrub/grass sub-formation)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                     |
| Survey effort                                                                                                         | One VI plot (BAM plot 2)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                     |
| Vegetation class                                                                                                      | Hunter-Macleay Dry Sclerophyll Forests                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                     |
| Conservation significance                                                                                             | Comprises an occurrence of 'Lower Hunter Spotted Gum- Ironbark Forest in the Sydney Basin Bioregion' which is listed as an EEC under the BC Act.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                     |
| Condition                                                                                                             | Intact                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                     |
| Evidence used to define PCT                                                                                           | <p>PCTs considered to be possible matches for this vegetation include PCT 1600 and PCT 1593. Although this community has been modified PCT 1600 was chosen as the best fit for the following reasons:</p> <ul style="list-style-type: none"><li>– The site occurs within the PCTs described range, within Cessnock LGA, Hunter IBRA sub-region and within the Central Hunter Foothills Mitchell Landscape.</li><li>– The PCT is described as occurring on an underlying geology comprised of siltstone and conglomerate on hill slopes and low rises. This geology is aligned with the soil landscapes mapped for this vegetation zone (Bolwarra Heights).</li></ul> |                                                                                     |

## 2 Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub grass open forest of the lower Hunter (intact)

|                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|-------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                     | <ul style="list-style-type: none"> <li>– Dominant canopy species of the site are characteristic of those described by the BioNet Vegetation Classification database. These include <i>Eucalyptus fibrosa</i> (Red Ironbark), <i>Eucalyptus resinifera</i> (Red Mahogany) and <i>Corymbia maculata</i> (Spotted Gum).</li> <li>– Although this vegetation zone has been modified through past clearing and associated ongoing agricultural activities, the species present indicate that the community is more closely aligned to PCT 1600 than PCT 1593. The presence of <i>Corymbia maculata</i> (Spotted Gum) is the primary distinguishing factor along with the more open understorey in PCT 1600. Within this vegetation zone the understorey has been recently (burnt resulting in dense shrub regrowth) so the community structure cannot be used as a determining factor for distinguishing between these two communities. The presence of Spotted Gum (as well as other diagnostic species) suggests that this vegetation zone is more closely aligned to PCT 1600 than to 1953.</li> <li>– Regional mapping supports the classification of this community as PCT 1600.</li> </ul> |
| Landscape position                  | Low slopes and rises.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Occurrence within the proposal site | One small patch located in the south of the proposal site, on the western side of Hart Road                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Structure                           | This vegetation zone consists of scattered trees to 20 m with a dense shrub layer and grassy understorey.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Over storey                         | Remnant canopy species include <i>Eucalyptus fibrosa</i> (Red Ironbark), <i>Eucalyptus resinifera</i> (Red Mahogany) and <i>Corymbia maculata</i> (Spotted Gum). There are also a number of <i>Eucalyptus punctata</i> (Grey Gum) present, likely occurring due to transition of vegetation from adjacent PCT 1591.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Mid storey                          | Dominated by <i>Dodonaea triquetra</i> (Large-leaved Hop Bush). Other common species include <i>Denhamia silvestris</i> (Narrow-leaved Orangebark), <i>Melaleuca nodosa</i> , <i>Bursaria spinosa</i> (Native Blackthorn), <i>Callistemon linearis</i> (Narrow-leaved Bottlebrush), <i>Acacia irrorata</i> (Green Wattle), <i>Breynia oblongifolia</i> (Coffee Bush) and <i>Ozothamnus diosmifolius</i> (White Dogwood).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Groundcover                         | Comprises a mixture of exotic forbs and grasses and common native species. Characteristic native grass species include <i>Rytidosperma pallidum</i> (Silvertop Wallaby Grass), <i>Microlaena stipoides</i> (Weeping Grass), <i>Panicum simile</i> (Two-colour Panic), <i>Entolasia stricta</i> (Wiry Panic), <i>Imperata cylindrica</i> (Blady Grass) and <i>Entolasia marginata</i> (Bordered Panic). Native forb species include <i>Lomandra confertifolia</i> (Matrush), <i>Lepidosperma laterale</i> (Variable Sword-sedge), <i>Pomax umbellata</i> (Pomax), <i>Lobelia purpurascens</i> (Whiteroot), <i>Dichondra repens</i> (Kidney Weed) and <i>Dianella revoluta</i> (Flax-lily).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Exotic species                      | Exotic species present within this vegetation zone include <i>Ehrharta erecta</i> (Panic Veld Grass), <i>Conyza bonariensis</i> (Flaxleaf Fleabane), <i>Cyanthillium cinereum</i> (Purple Fleabane), <i>Cirsium vulgare</i> (Spear Thistle), <i>Hypochaeris radicata</i> (Catsear) and <i>Solanum nigrum</i> (Black-berry Nightshade).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |

**Table 5.4** Grey Gum – Rough Barked Apple shrubby open forest of the lower hunter (intact)

| 3 Grey-Gum – Rough-barked Apple shrubby open forest of the lower hunter (intact) |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                    |
|----------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|
| PCT (DPE, 2023b)                                                                 | Grey-Gum-Rough-barked Apple shrubby open forest of the lower hunter                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |  |
| PCT ID                                                                           | 1591                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                    |
| Equivalent map units                                                             | Bell and Driscoll map unit 19a (Grey Gum – Red Gum Forest)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                    |
| Survey effort                                                                    | One plot (BAM plot 1)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                    |
| Vegetation formation                                                             | Dry Sclerophyll Forests (shrub/grass sub-formation)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                    |
| Vegetation class                                                                 | Hunter-Macleay Dry Sclerophyll Forests                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                    |
| Conservation significance                                                        | Comprises an occurrence of “Hunter Lowland Red Gum Forest in the Sydney Basin and NSW North Coast Bioregions” which is listed as an EEC under the BC Act.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                    |
| Condition                                                                        | Disturbed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                    |
| Evidence used to define vegetation unit                                          | <p>PCT 1591 was chosen for the following reasons:</p> <ul style="list-style-type: none"><li>– The site occurs within the PCTs described range, within Cessnock LGA, Hunter IBRA sub-region and within the Newcastle Coastal Ramp Mitchell Landscape.</li><li>– Within the proposal site community occurs on flats and low rises.</li><li>– Dominant canopy species with the community are characteristic of those described by the BioNet Vegetation Classification database (OEH 2020c). Namely <i>Eucalyptus punctata</i> (Grey Gum) and <i>Angophora floribunda</i> (Rough-barked Apple).</li><li>– Other PCTs considered include PCT 1591 Forest Red Gum on Floodplains of the lower Hunter which although floristically similar was largely ruled out due to the absence of <i>Eucalyptus tereticornis</i> (Forest Red Gum) within the vegetation zone, the landscape position which is not on a floodplain and structural elements discussed above (i.e. the predominantly shrubby rather than open mid-storey).</li></ul> |                                                                                    |
| Landscape position                                                               | Low slopes and rises.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                    |
| Occurrence within the proposal site                                              | Within the proposal site this vegetation community occurs in a small patch south-east of the Former Smelter site.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                    |
| Structure                                                                        | An open forest to 20 m with a disturbed midstorey and sparse ground layer dominated by grasses, small ferns and forbs.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                    |
| Over storey                                                                      | The canopy structure within this vegetation community is dominated by <i>Eucalyptus punctata</i> (Grey Gum) and <i>Angophora floribunda</i> (Rough-barked Apple) with smaller occurrences of <i>Eucalyptus resinifera</i> (Red Mahogany), <i>Eucalyptus microcorys</i> (Tallowwood), <i>Eucalyptus siderophloia</i> (Grey Ironbark), <i>Casuarina glauca</i> (Swamp Oak) as well as a number of planted Eucalypts.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                    |
| Mid storey                                                                       | The shrub layer within this community has been previously disturbed and cleared. Species present included <i>Breynia oblongifolia</i> (Coffee Bush), <i>Acacia irrorata</i> (Green Wattle) and <i>Dodonaea triquetra</i> (Large-leaved Hop Bush).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                    |



| 3 Grey-Gum – Rough-barked Apple shrubby open forest of the lower hunter (intact) |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Groundcover                                                                      | The groundlayer is characterised by a diverse range of native grasses and forbs. Common species include species including <i>Microlaena stipoides</i> (Weeping Grass), <i>Digitaria breviglumis</i> and <i>Echingopogon caespitosus</i> (Bushy Hedghog-grass). Other groundcover species occurring in lower abundance include <i>Lomandra filiformis</i> (Wattle Matt-rush), <i>Lobelia purpurascens</i> (Whiteroot), <i>Dichondra repens</i> (Kidney Weed), <i>Gahnia clarkei</i> (Tall Saw-sedge), <i>Centella asiatica</i> (Indian Pennywort), <i>Dianella revoluta</i> (Blueberry Lily) and <i>Glycine clandestina</i> (Twining Glycine). |
| Exotic species                                                                   | Exotic species recorded within this vegetation zone included <i>Lantana camara</i> (Lantana), <i>Conyza bonariensis</i> (Flaxleaf Fleabane), <i>Bidens pilosa</i> (Cobbler's Pegs), <i>Hypochaeris radicata</i> (Catsear), <i>Solanum nigrum</i> (Blackberry Night Shade) and <i>Cinnamomum camphora</i> (Camphor Laurel).                                                                                                                                                                                                                                                                                                                    |

**Table 5.5** Grey Gum – Rough Barked Apple shrubby open forest of the lower hunter (disturbed)

| 4 Grey-Gum – Rough-barked Apple shrubby open forest of the lower hunter (disturbed) |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                     |
|-------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| PCT (OEH, 2020b)                                                                    | Grey-Gum- Rough-baked Apple shrubby open forest of the lower hunter                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |
| PCT ID                                                                              | 1591                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                     |
| Equivalent map units                                                                | Bell and Driscoll map unit 19a (Grey Gum – Red Gum Forest)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                     |
| Survey effort                                                                       | One VI plot (BAM plot 4)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                     |
| Vegetation formation                                                                | Dry Sclerophyll Forests (shrub/grass sub-formation)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                     |
| Vegetation class                                                                    | Hunter-Macleay Dry Sclerophyll Forests                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                     |
| Conservation significance                                                           | Comprises an occurrence of “Hunter Lowland Red Gum Forest in the Sydney Basin and NSW North Coast Bioregions” which is listed as an EEC under the BC Act.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                     |
| Condition                                                                           | Disturbed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                     |
| Evidence used to define vegetation unit                                             | <p>PCT 1591 was chosen for the following reasons:</p> <ul style="list-style-type: none"><li>– The site occurs within the PCTs described range, within Cessnock LGA, Hunter IBRA sub-region and within the Newcastle Coastal Ramp Mitchell Landscape.</li><li>– Within the proposal site community occurs on flats and low rises.</li><li>– Dominant canopy species with the community are characteristic of those described by the BioNet Vegetation Classification database (OEH 2020c). Namely <i>Eucalyptus punctata</i> (Grey Gum) and <i>Angophora floribunda</i> (Rough-barked Apple).</li><li>– The community has a predominantly shrubby mid-storey (plot data recorded a mean species richness for shrubs of 9 and 4 for grasses).</li><li>– Adjoining vegetation is typical of PCT 1591 (intact)</li><li>– Other PCTs considered include PCT 1591 Forest Red Gum on Floodplains of the lower Hunter which although floristically similar was largely ruled out due to the absence of <i>Eucalyptus tereticornis</i> (Forest Red Gum) within the vegetation zone, the landscape position which is not on a floodplain and structural elements discussed above (i.e. the predominantly shrubby rather than open mid-storey).</li></ul> |                                                                                     |



| 4 Grey-Gum – Rough-barked Apple shrubby open forest of the lower hunter (disturbed) |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Landscape position                                                                  | Low slopes and rises.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Occurrence within the proposal site                                                 | Within the proposal site this vegetation community occurs in a small patch south east of the former Hydro smelter site.                                                                                                                                                                                                                                                                                                                                                                                         |
| Structure                                                                           | An open forest to 20 m with a typically shrubby midstorey and disturbed ground layer dominated by grasses, small ferns and forbs.                                                                                                                                                                                                                                                                                                                                                                               |
| Over storey                                                                         | Dominated by <i>Eucalyptus punctata</i> (Grey Gum) and <i>Angophora bakeri</i> (Rough-barked Apple)                                                                                                                                                                                                                                                                                                                                                                                                             |
| Mid storey                                                                          | The shrub layer within this vegetation community is dominated by <i>Melaleuca nodosa</i> with <i>Grevillea montana</i> , <i>Persea linearis</i> (Narrow-leaved Geebung), <i>Exocarpos cupressiformis</i> (Cherry Ballart), <i>Acacia longifolia</i> , <i>Acacia elongata</i> (Swamp Wattle), <i>Acacia ulicifolia</i> (Prickly Moses), <i>Acacia falcata</i> and <i>Pimelea linifolia</i> (Slender Rice Flower) occurring in low abundance.                                                                     |
| Groundcover                                                                         | The groundlayer is dominated by exotic grasses and forbs. Native species present included <i>Lomandra longifolia</i> (Spiny-headed Mat-rush), <i>Dianella caerulea</i> (Blue Flax-lily), <i>Einadia hastata</i> and <i>Cynodon dactylon</i> (Couch).                                                                                                                                                                                                                                                            |
| Exotic species                                                                      | There is a high abundance and cover of native species present within the ground and shrub layers of this vegetation zone. Common species included <i>Richardia brasiliensis</i> (Mexican lover), <i>Plantago lanceolata</i> (Lamb's Tongues), <i>Andropogon virginicus</i> (Whisky Grass), <i>Hypochaeris radicata</i> (Catsear), <i>Cirsium vulgare</i> (Spear Thistle), <i>Sida rhombifolia</i> (Paddy's Lucerne), <i>Conyza bonariensis</i> (Flaxleaf Fleabane) and <i>Taraxacum officinale</i> (Dandelion). |

Table 5.6 Planted vegetation

| Planted Vegetation                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|-------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| PCT (DPIE, 2021b)                   | Nil                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| PCT ID                              | N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Equivalent map units                | N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Survey effort                       | Transect/ Meander                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Vegetation formation                | N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Vegetation class                    | N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Conservation significance           | None                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Occurrence within the proposal site | Occurs as a small patch along the western side of Hart Road and as scattered individuals within the former Hydro Aluminium smelter carpark                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Over storey                         | Native species include planted <i>Casuarina glauca</i> (Swamp Oak), <i>Eucalyptus robusta</i> (Swamp Mahogany), <i>Eucalyptus tereticornis</i> (Forest Red Gum), <i>Angophora floribunda</i> (Narrow-leaved Apple) and <i>Coymbia torelliana</i> (Cadaghi). Other planted species included <i>Phonex canariensis</i> (Canary Island Date Palm) and <i>Grevillea</i> sp..                                                                                                                                                                                                                                                         |
| Mid storey                          | Absent                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Groundcover                         | Dominated by exotic grasses and herbs including <i>Paspalum dilatatum</i> (Paspalum), <i>Sida rhombifolia</i> (Paddy's Lucerne), <i>Avena barbata</i> (Bearded Oats), <i>Lolium</i> sp. (Ryegrass), <i>Ehrharta erecta</i> (Panic Veldtgrass) and <i>Vulpia bromoides</i> (Squirrel Tail Fescue).                                                                                                                                                                                                                                                                                                                                |
| Exotic species                      | This vegetation community contains a high abundance of weeds, many of which are high threat weed. Common species <i>Cinnamomum camphora</i> (Camphor laurel), <i>Ligustrum sinense</i> (Small Leaved Privet), <i>Senecio madagascariensis</i> (Fireweed), <i>Ehrharta erecta</i> (Panic Veldtgrass), <i>Senecio madagascariensis</i> (Fireweed), <i>Cerastium glomeratum</i> (Mouse Ear Chickweed), <i>Briza major</i> (Quaking Grass), <i>Vulpia bromoides</i> (Squirrel Tail Fescue), <i>Lysimachia arvensis</i> (Scarlet Pimpernel), <i>Andropogon virginicus</i> (Whisky Grass) and <i>Hypochaeris radicata</i> (Flat Weed). |

## 5.3 Groundwater dependant ecosystems

Groundwater plays an integral role in sustaining a range of aquatic and terrestrial ecosystems including wetland, springs, rivers as well as a number of vegetation types.

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 on it (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 2020b). 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 with moderate potential for being reliant on the subsurface presence of groundwater.

## 5.4 Fauna species and resources

### 5.4.1 Fauna species

A total of 131 fauna species (126 native and five exotic) were recorded during surveys that were completed both within the proposal site as well as the wider Hydro site. A full list of fauna species recorded during surveys is provided in Appendix B. The faunal assemblage comprised of 10 frog, six reptile, 87 bird and 28 mammal species.

The majority of these species were recorded in larger patches of remnant vegetation within the wider Hydro site. The fauna species richness at the proposal site is likely to be considerable lower than for the wider Hydro site given the narrower range of habitat types and extent of cleared land/exotic grassland.

### 5.4.2 Fauna habitats

#### 5.4.2.1 Overview

The following habitat features, and resources were identified within the proposal site and indicate the potential presence of threatened species that contribute to the credit calculations:

- Mature canopy trees that provide nectar, fruits, leaves and foraging, roosting or nesting substrates, including supporting invertebrate prey diversity for insectivorous fauna.
- Leaf litter and fallen logs, which provide foraging and shelter substrate for small terrestrial animals.
- Scattered patches of dense understorey shrubs providing refuge habitat for small terrestrial animals.
- Flowering myrtaceous trees and shrubs which provide foraging habitat for a range of arboreal mammals and birds.
- Grassy understory within disturbed areas that would provide foraging habitat for macropods, raptors and some species of microbats.
- Drainage lines and waterbodies (retention basin in the north-west of the proposal site).

The proposal site or its surrounds does not contain any cliff lines, extensive rock outcrops, caves or disused mines.

The BAM assessment of habitat resources at the proposal site was completed with reference to the above observations. Additional discussion of habitat resources is provided below.

### 5.4.2.2 Habitat resources

The proposal site is comprised predominantly of cleared land dominated by hardstand and exotic grasses with scattered planted trees. There are several small patches of native vegetation that are comprised of remnant canopy trees over a native understorey of shrubs and grasses (Photo 1). These areas provide fauna habitat resources and would be utilised by species common to disturbed and urban environments:

- Small areas of remnant native vegetation occur along the southern edge of the site (Photo 2 and 3). These patches of vegetation contain a range of habitat resources, including mature canopy trees, blossom-bearing trees, leaf litter and small amounts of fallen timber that would provide potential foraging habitat for a range of fauna, including threatened birds and bats such as *Pomatostomus temporalis temporalis* (Grey-crowned Babbler), *Daphoenositta chrysoptera* (Varied Sittella), *Micronomus norfolkensis* (Eastern Coastal Free-tailed Bat), *Pteropus poliocephalus* (Grey-headed Flying-fox), *Myotis macropus* (Southern Myotis) and *Miniopterus australis* (Little Bent-winged Bat) as well as variety of more common fauna species.
- No hollow-bearing trees or nests were recorded within the proposal site.
- There is a small retention basin in the north-west of the proposal site that may provide foraging and breeding habitat for a range of species including waterbirds, amphibians and some species of microbats.



Photo 1 Areas of native grassland



Photo 2 PCT 1633 – intact



Photo 3 PCT 1600 - intact



## 6. Conservation significance

### 6.1 Identification of threatened species under the BAM

#### 6.1.1 Identifying threatened species for assessment

The BAM calculator automatically generates a list of threatened species potential ecosystem or species credits entities (i.e. 'predicted' and 'candidate' threatened species respectively) based on the IBRA subregion, percent native vegetation cover, patch size class and PCT data for the proposal site cross-referenced with the Threatened Biodiversity Database Collection (TBDC).

Additional species not generated by the BAM calculator can be added to the list to be assessed for ecosystem and/or species credits if the species are considered likely to occur within, or to use habitats within the proposal site (based on review of available ecology reports, environmental impact statements, scientific literature or detection on site during survey). For this reason, additional species identified through the desktop assessment (e.g. identified from database searches as occurring within, or having the potential to occur within 10 km of the Proposal site) were also considered for addition to the list of predicted and candidate species (refer to Appendix A). An assessment of the likelihood that additional species not predicted by the BAM calculator was undertaken. This assessment determined that it is unlikely that any additional threatened biota (not already predicted by the calculator) would occur and therefore no additional species were added to the list of species requiring targeted survey within the proposal site.

#### 6.1.2 Refinement of list of threatened species for assessment

Once the list of potential predicted and candidate threatened species have been identified, this list can be further refined by undertaking an additional assessment of the habitat constraints or microhabitats within the proposal site.

Predicted threatened species can be removed from assessment for ecosystem credits if all of the habitat constraints described for the species in the TBDC are absent from the site, otherwise the species must be retained for assessment of ecosystem credits.

Candidate threatened species can be removed from assessment for species credits if:

- All of the habitat constraints described for the species in the TBDC are absent from the site.
- Where habitat is determined to be significantly degraded.
- Where vegetation is missing key structural elements or other microhabitat features.

No targeted survey is required for species that are not confirmed candidate threatened species. For species that are confirmed, targeted seasonal survey is required to determine presence on site in order to assess species credits.

The following sections present the list of predicted and candidate species identified for the assessment of ecosystem and species credits. It also identifies and provides justifications for the exclusion of any threatened species from further assessment where applicable.

#### 6.1.3 Predicted threatened species (ecosystem credit entities)

Based on the bioregional context for the assessment and the PCTs, patch size, vegetation cover and habitat resources present at the proposal site, the BAM calculator generates a list of threatened fauna species that are associated with native vegetation at the proposal site (i.e. potential 'predicted threatened species', or potential 'ecosystem credit entities'). The potential for these predicted threatened species to occur within the site were further refined based on the desktop assessment, habitat resources observed during field surveys and the knowledge and experience of the assessor.

The suite of 'confirmed' predicted threatened species associated with ecosystem credits required for the proposal site, and with relevant habitat resources present on the site, are listed in Table 6.1. For each confirmed predicted threatened species, the vegetation zone association is provided. Targeted surveys are not required under the BAM for these species as they are assumed to be present. It is noted that three of these species were recorded adjacent to the proposal site during surveys.

It should be noted that several of these species would only occur in the woodland form of the PCTs present at the proposal site and are only associated with ecosystem credits generated for impacts to woodland vegetation zones. Notably many threatened species of woodland birds would only occur in vegetation with canopy vegetation, as part of relatively extensive patch and/or with habitat resources such as abundant fallen woody debris (Table 6.1 for further detail and justification).

The sensitivity to gain class is based on the species life history characteristics and ecological information. It estimates the ability of a species to respond to improvements in habitat condition at an offset site.

In accordance with Step 2 of Section 5.2 of the BAM (DPIE 2020), the following predicted species that was generated by the BAM calculator are excluded from further assessment for ecosystem credits:

- Painted Honeyeater (*Grantiella picta*).

Reasons for exclusion of this species are provided in Table 6.1.

Additional threatened species that were considered for assessment for ecosystem credits based on known occurrences within the locality (particularly within 1 km of the proposal site) are not considered likely to occur within, or to utilise habitats within the proposal site (see likelihood of occurrence assessment, Appendix A).

**Table 6.1 Predicted threatened species (ecosystem credit species)**

| Common name                                     | Scientific name                       | Sensitivity class <sup>1</sup> | Associated PCT (s) | Confirmed predicted species         | Reason for exclusion from predicted species list and /or additional comments |
|-------------------------------------------------|---------------------------------------|--------------------------------|--------------------|-------------------------------------|------------------------------------------------------------------------------|
| Regent Honeyeater (foraging) <sup>2</sup>       | <i>Anthochaera phrygia</i>            | High                           | 1600               | Yes                                 | -                                                                            |
| Gang-gang Cockatoo (foraging) <sup>2</sup>      | <i>Callocephalon fimbriatum</i>       | Moderate                       | 1633,1600          | Yes                                 | -                                                                            |
| Glossy Black-Cockatoo (foraging) <sup>2</sup>   | <i>Calyptorhynchus lathami</i>        | High                           | 1633,1600          | Yes                                 | -                                                                            |
| Speckled Warbler                                | <i>Chthonicola sagittata</i>          | High                           | 1633,1600          | Yes                                 | -                                                                            |
| Brown Treecreeper (eastern subspecies)          | <i>Climacteris picumnus victoriae</i> | High                           | 1633,1600          | Yes                                 | -                                                                            |
| Varied Sittella                                 | <i>Daphoenositta chrysoptera</i>      | Moderate                       | 1633,1600          | Yes (recorded adjacent to the site) |                                                                              |
| Spotted-tailed Quoll                            | <i>Dasyurus maculatus</i>             | High                           | 1633,1600          | Yes                                 | -                                                                            |
| Eastern False Pipistrelle                       | <i>Falsistrullus tasmaniensis</i>     | High                           | 1633,1600          | Yes                                 | -                                                                            |
| Little Lorikeet                                 | <i>Glossopsitta pusilla</i>           | High                           | 1633,1600          | Yes                                 | -                                                                            |
| Painted Honeyeater                              | <i>Grantiella picta</i>               | Moderate                       | 1633,1600          | No                                  | Mistletoe not present at density greater than five per hectare               |
| White-bellied Sea-Eagle (foraging) <sup>2</sup> | <i>Haliaeetus leucogaster</i>         | High                           | 1633,1600          | Yes                                 |                                                                              |

| Common name                                      | Scientific name                           | Sensitivity class <sup>1</sup> | Associated PCT (s) | Confirmed predicted species         | Reason for exclusion from predicted species list and /or additional comments |
|--------------------------------------------------|-------------------------------------------|--------------------------------|--------------------|-------------------------------------|------------------------------------------------------------------------------|
| Little Eagle (foraging) <sup>2</sup>             | <i>Hieraaetus morphnoides</i>             | Moderate                       | 1633,1600          | Yes                                 | -                                                                            |
| White-throated Needletail                        | <i>Hirundapus caudacutus</i>              | High                           | 1633,1600          | Yes                                 |                                                                              |
| Swift Parrot (foraging) <sup>2</sup>             | <i>Lathamus discolor</i>                  | Moderate                       | 1633,1600          | Yes                                 | -                                                                            |
| Square-tailed Kite (foraging) <sup>2</sup>       | <i>Lophoictinia isura</i>                 | Moderate                       | 1633,1600          | Yes                                 | -                                                                            |
| Hooded Robin (south eastern form)                | <i>Melanodryas cucullata cuculla</i>      | Moderate                       | 1633,1600          | Yes                                 | -                                                                            |
| Black-chinned Honeyeater (eastern subspecies)    | <i>Melithreptus gularis gularis</i>       | Moderate                       | 1633,1600          | Yes                                 | -                                                                            |
| Eastern Coastal Free-tailed Bat                  | <i>Micronomus norfolkensis</i>            | High                           | 1633,1600          | Yes                                 |                                                                              |
| Little Bent-winged Bat (foraging) <sup>2</sup>   | <i>Miniopterus australis</i>              | High                           | 1633,1600          | Yes                                 |                                                                              |
| Large Bent-winged Bat (foraging) <sup>2, 3</sup> | <i>Miniopterus orianae oceanensis</i>     | High                           | 1633,1600          | Yes                                 |                                                                              |
| Turquoise Parrot                                 | <i>Neophema pulchella</i>                 | High                           | 1633,1600          | Yes                                 |                                                                              |
| Barking Owl (foraging) <sup>2</sup>              | <i>Ninox connivens</i>                    | High                           | 1633,1600          | Yes                                 |                                                                              |
| Powerful Owl (foraging) <sup>2</sup>             | <i>Ninox strenua</i>                      | High                           | 1633,1600          | Yes                                 |                                                                              |
| Corben's Long-eared Bat                          | <i>Nyctophilus corbeni</i>                | High                           | 1633               | Yes                                 |                                                                              |
| Scarlet Robin                                    | <i>Petroica boodang</i>                   | Moderate                       | 1600               | Yes                                 |                                                                              |
| Grey-crowned Babbler (eastern subspecies)        | <i>Pomatostomus temporalis temporalis</i> | Moderate                       | 1633,1600          | Yes (recorded adjacent to the site) |                                                                              |
| Grey-headed Flying-fox (foraging) <sup>2</sup>   | <i>Pteropus poliocephalus</i>             | High                           | 1633,1600          | Yes (recorded flying over the site) |                                                                              |
| Yellow-bellied Sheath-tail-bat                   | <i>Saccolaimus flaviventris</i>           | High                           | 1633,1600          | Yes                                 | -                                                                            |
| Greater Broad-nosed Bat                          | <i>Scoteanax rueppellii</i>               | High                           | 1633,1600          | Yes                                 | -                                                                            |
| Diamond Firetail                                 | <i>Stagonopleura guttata</i>              | Moderate                       | 1600               | Yes                                 | -                                                                            |
| Masked Owl (foraging) <sup>2</sup>               | <i>Tyto novaehollandiae</i>               | High                           | 1633,1600          | Yes                                 | -                                                                            |

<sup>1</sup> Sensitivity to gain class – High = high sensitivity to potential gain, Moderate = moderate sensitivity to potential gain.

<sup>2</sup> These species are dual credits species (i.e. predicted ecosystem credit species based on the presence of foraging habitat as well as species credit species when breeding habitat occurs).



## 6.1.4 Candidate threatened species (species credit entities)

Threatened species that cannot be reliably predicted to occur at a site based on vegetation surrogates or landscape feature are identified by the TBDC as 'species credit species'. In some circumstances, the particular habitat components of species assessed for ecosystem credit species, such as the breeding habitat of a cave roosting bat or forest owls, are also assessed for species credits.

Searches of threatened species databases and review of previous ecological reports pertaining to the site were completed to determine if addition species to those generated by the BAM credit calculator that are known or predicted to occur in the locality (refer to likelihood of occurrence table in Appendix A). The likelihood of occurrence of these additional potential candidate threatened species were reviewed, giving consideration to the habitats available in the study area.

The full list of species credit species considered is presented in the threatened species assessment table in Section 3. A number of species could be reliably discounted as occurring within the proposal site area based on the habitat types present and/or the known distribution of the species. These species are not 'confirmed candidate species' for this assessment. Justification for their exclusion is provided in Table 6.2 and the 'habitat/constraints' fields in the credit calculator.

Potential candidate threatened species that could occur in the study area based on the habitat resources observed during field surveys were confirmed as candidate threatened species. 'Confirmed' candidate threatened species require targeted survey in accordance with Section 5.3 of the BAM (DPIE 2020). The list of confirmed candidate threatened species is presented in Table 6.2; these species were subjected to targeted survey. Surveys were conducted in the appropriate season for all confirmed candidate threatened species and so the targeted survey results can be considered a reliable indicator of their presence or absence at the proposal site.

**Table 6.2** Confirmed candidate species credit species

| Common name              | Scientific name                                         | Biodiversity risk rating | Survey months | Survey completed | Recorded within or adjacent to proposal site |
|--------------------------|---------------------------------------------------------|--------------------------|---------------|------------------|----------------------------------------------|
| Bynoe's Wattle           | <i>Acacia bynoeana</i>                                  | High (2)                 | All year      | Oct and Nov      | No                                           |
| Bush Stone Curlew        | <i>Burhinus grallarius</i>                              | High (2)                 | All year      | Nov              | No                                           |
| Netted Bottle Brush      | <i>Callistemon linearifolius</i>                        | Moderate (1.5)           | Oct–Jan       | Oct and Nov      | No                                           |
| Eastern Pygmy-possum     | <i>Cercartetus nanus</i>                                | High (2)                 | Oct–Mar       | Nov              | No                                           |
| Leafless Tongue Orchid   | <i>Cryptostylis hunteriana</i>                          | Moderate (1.5)           | Nov–Jan       | Nov              | No                                           |
| White-flowered Wax Plant | <i>Cynanchum elegans</i>                                | High (2)                 | All year      | Oct and Nov      | No                                           |
| Striped Legless Lizard   | <i>Delmar impar</i>                                     | Moderate (1.5)           | Sep–Dec       | Nov              | No                                           |
| Pine Donkey Orchid       | <i>Diuris tricolor</i>                                  | Moderate (1.5)           | Sep–Oct       | Oct              | No                                           |
| Singleton Mallee         | <i>Eucalyptus castrensis</i>                            | Very High (3)            | All year      | Oct, Nov and Dec | No                                           |
| Slaty Red Gum            | <i>Eucalyptus glaucina</i>                              | High (2)                 | All year      | Oct, Nov and Dec | No                                           |
| Parramatta Red Gum       | <i>Eucalyptus parramattensis</i> subsp. <i>decadens</i> | High (2)                 | All year      | Oct, Nov and Dec | Yes                                          |
| Pokolbin Mallee          | <i>Eucalyptus pumila</i>                                | Very High (3)            | All year      | Oct, Nov and Dec | No                                           |
| Small-flower Grevillea   | <i>Grevillea parviflora</i> subsp. <i>parviflora</i>    | High (2)                 | Aug–Nov       | Oct and Nov      | Yes                                          |

| Common name                        | Scientific name                  | Biodiversity risk rating | Survey months | Survey completed | Recorded within or adjacent to proposal site |
|------------------------------------|----------------------------------|--------------------------|---------------|------------------|----------------------------------------------|
| White-bellied Sea-Eagle (breeding) | <i>Haliaeetus leucogaster</i>    | High (2)                 | Jul–Dec       | Aug and Dec      | No                                           |
| Little Eagle (breeding)            | <i>Haliaeetus morphnoides</i>    | Moderate (1.5)           | Aug–Oct       | Aug              | No                                           |
| Pale-headed Snake                  | <i>Hoplocephalus bitorquatus</i> | High (2)                 | Nov–Mar       | Feb and Nov      | No                                           |
| Green and Golden Bell Frog         | <i>Litoria aurea</i>             | High (2)                 | Nov–Mar       | Feb and Nov      | No                                           |
| Square-tailed Kite (Breeding)      | <i>Lophoictinia isura</i>        | Moderate (1.5)           | Sep–Jan       | Nov              | No                                           |
| Large-leaved monotaxis             | <i>Monotaxis macrophylla</i>     | High (2)                 | Aug–Feb       | Oct and Nov      | No                                           |
| Southern Myotis                    | <i>Myotis macropus</i>           | High (2)                 | Oct–Mar       | Nov and Feb      | Yes                                          |
| -                                  | <i>Ozothamnus tessalatus</i>     | Moderate (1.5)           | Sep–Oct       | Oct              | No                                           |
| Squirrel Glider                    | <i>Petaurus norfolcensis</i>     | High (2)                 | All year      | Feb              | Yes <sup>1</sup>                             |
| Greater Glider                     | <i>Petauroides volans</i>        | High (2)                 | All year      | Feb              | No                                           |
| Brush-tailed Phascogale            | <i>Phascogale tapoatafa</i>      | High (2)                 | Dec–Jun       | Feb              | No                                           |
| Koala                              | <i>Phascolarctos cinereus</i>    | High (2)                 | All year      | Nov              | No                                           |
| Common Planigale                   | <i>Planigale maculata</i>        | High (2)                 | All year      | Nov              | No                                           |
| Scant Pomaderris                   | <i>Pomaderris queenslandica</i>  | High (2)                 | All year      | Oct and Nov      | No                                           |
| Singleton Mint Bush                | <i>Prostanthera cinoliffera</i>  | High (2)                 | Sep–Oct       | Oct and Nov      | No                                           |
| -                                  | <i>Pterostylis chaetophora</i>   | High (2)                 | Sep–Nov       | Oct and Nov      | No                                           |
| Heath Wrinklewort                  | <i>Rutidosis heterogama</i>      | High (2)                 | All year      | Oct and Nov      | No                                           |
| Austral Toadflax                   | <i>Thesium austral</i>           | Moderate (1.5)           | Nov–Feb       | Nov              | No                                           |

<sup>1</sup> Recorded during previous surveys completed adjacent to the proposal site (ELA 2015).

A number of species could be reliably discounted as occurring within the study area based on the habitat types present and/or the known distribution of the species. A number of dual credit fauna species have foraging habitat present but either no potential breeding habitat was identified during the field surveys, or the species does not breed in the area. These species are not 'confirmed candidate threatened species' for the purposes of this assessment and do not require further assessment. Detailed justification for the conclusion is provided in Table 6.3 and/or the 'habitat/constraints' fields in the credit calculator.

**Table 6.3** Potential candidate species not requiring survey

| Common name                      | Scientific name                 | Justification                                                                                           |
|----------------------------------|---------------------------------|---------------------------------------------------------------------------------------------------------|
| Regent Honeyeater (Breeding)     | <i>Anthochaera phrygia</i>      | Proposal site within an area of important habitat as mapped by BCS therefore species is assumed present |
| Pink-tailed Legless Lizard       | <i>Aprasia parapulchella</i>    | Proposal site does not contain rocky areas and/or within 50 m of rocky areas                            |
| Gang-gang Cockatoo (breeding)    | <i>Callocephalon fimbriatum</i> | No hollow bearing trees present within proposal site                                                    |
| Glossy Black-Cockatoo (breeding) | <i>Calyptorhynchus lathami</i>  | No hollow bearing trees present within proposal site                                                    |

| Common name                       | Scientific name                       | Justification                                                                                                                                                                                                                                  |
|-----------------------------------|---------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Large-eared Pied Bat (breeding)   | <i>Chalinolobus dwyeri</i>            | Proposal site does not contain cliffs and is not within two kilometres of rocky areas containing caves, overhangs, escarpments, outcrops or crevices and is not within two kilometres of old mines or tunnels                                  |
| Rough Doubletail                  | <i>Diuris praecox</i>                 | Not within the Newcastle LGA (geographic limitation)                                                                                                                                                                                           |
| Swift Parrot (Breeding)           | <i>Lathamus discolor</i>              | Proposal site not within an area of important habitat as mapped by BCS                                                                                                                                                                         |
| Green-thighed Frog                | <i>Litoria brevipalmata</i>           | Proposal site does not contain permanent or ephemeral wet areas, swamps or waterbodies                                                                                                                                                         |
| Large Bent-winged Bat (breeding)  | <i>Miniopterus orianae oceanensis</i> | Proposal site does not contain caves, tunnels, mines, culverts or any other structure known or suspected to be used for breeding including species records in BioNet with microhabitat code (IC) or observation type code E (nest-roost)       |
| Little Bent-winged Bat (breeding) | <i>Miniopterus australis</i>          | Proposal does not contain caves, tunnels, mines, culverts or any other structure known or suspected to be used for breeding including species records in BioNet with microhabitat code (IC) or observation type code E (nest-roost)            |
| Barking Owl (breeding)            | <i>Ninox connivens</i>                | No hollow bearing trees present within proposal site                                                                                                                                                                                           |
| Powerful Owl (breeding)           | <i>Ninox strenua</i>                  | No hollow bearing trees present within proposal site                                                                                                                                                                                           |
| North Rothbury Persoonia          | <i>Persoonia pauciflora</i>           | Proposal site not within 10 km of North Rothbury (geographic limitation)                                                                                                                                                                       |
| Brush-tailed Rock-wallaby         | <i>Petrogale penicillata</i>          | Land within 1 km of rocky escarpments, gorges, steep slopes, boulder piles, rock outcrops or cliffines                                                                                                                                         |
| Grey-headed Flying Fox (breeding) | <i>Pteropus poliocephalus</i>         | No breeding camps within the proposal site                                                                                                                                                                                                     |
| Masked Owl (breeding)             | <i>Tyto novaehollandiae</i>           | No hollow bearing trees present within proposal site                                                                                                                                                                                           |
| Eastern Cave Bat (breeding)       | <i>Vespadelus troughtoni</i>          | The proposal site does not contain caves and is not within two kilometres of rocky areas containing caves, overhangs, escarpments, outcrops, crevices or boulder piles, or within two kilometres of old mines, tunnels, old buildings or sheds |

## 6.1.5 Threatened species associated with planted vegetation

An assessment of planted native vegetation was completed to determine the potential value of this vegetation as habitat for threatened fauna. This assessment included walking the length of the planted vegetation and searching for nests, hollows, scats and/or other signs of threatened species utilising the vegetation. The habitat assessment did not record any threatened species or find any evidence that any of the planted vegetation within the proposal site is being utilised by threatened species. It is possible that when in flower this vegetation may be providing a small amount of foraging habitat for Swift Parrot, Regent Honeyeater, Squirrel Glider and Grey Headed Flying-fox as well as other blossom feeding threatened bats and birds known or predicted to occur within the locality. The value of these habitat resources would be limited by its landscape context, as a narrow, isolated small patch of vegetation adjacent to a road and amenity plantings in a carpark. Relative to the large amounts of alternative potential foraging habitat associated with remnant native vegetation in the locality it is highly unlikely that this small number of planted trees would provide important foraging habitat for any of these species.

No hollows, nests or other habitat features were observed within planted vegetation and given the location of this vegetation adjacent to a road and within a car park there is a very low probability that this vegetation would be used as breeding habitat for any threatened species.

## 6.2 Threatened species survey results

### 6.2.1 Threatened flora

Two threatened flora species were recorded during targeted survey completed within the proposal site:

- *Eucalyptus parramattensis* subsp. *decadens* (Paramatta Red Gum)
- *Grevillea parviflora* subsp. *parviflora* (Small-flower Grevillea)

Five Paramatta Red Gum individuals were recorded within or immediately adjacent to the proposal site and 19 Small Flowered Grevillea individuals were also recorded. All these records are located within woodland habitat (PCT 1633 and 1600) located in the south of the proposal site adjacent to Hart Road.

### 6.2.2 Threatened fauna

#### 6.2.2.1 Ecosystem credit species

Seven threatened fauna species classified as ecosystem credit species have been recorded within or adjacent to the proposal site during previous surveys. These are:

- Grey-crowned Babbler (eastern subspecies) (*Pomatostomus temporalis temporalis*)
- Eastern Coastal Free-tailed Bat (*Micronomus norfolkensis*)
- Grey-headed Flying-fox (*Pteropus poliocephalus*)
- Little Bent-winged Bat (*Miniopterus australis*)
- Large Bent-winged Bat (probable) (*Miniopterus orianae oceanensis*)
- Varied Sittella (*Daphoenositta chrysoptera*)
- White-bellied Sea-Eagle (*Haliaeetus leucogaster*)

All these species are listed as vulnerable under the BC Act. The Grey-headed Flying-fox is also listed as a vulnerable species under the EPBC Act and the White-bellied Sea-Eagle is listed as a migratory marine species.

There is potential foraging habitat for each of these species within the 1.35 ha of native vegetation that occurs within the proposal site.

#### 6.2.2.2 Dual credit species

The Grey-headed Flying-fox (*Pteropus poliocephalus*), Little Bent-winged Bat (*Miniopterus australis*), Large Bent-winged Bat (*Miniopterus orianae oceanensis*) and the White-bellied Sea-Eagle (*Haliaeetus leucogaster*) are listed in the TBDC as dual credit species meaning that they require offsets through ecosystem credit species for impacts to foraging habitat and through species credits where breeding habitat is impacted. For the purposes of this assessment all four of these species are considered to be ecosystem credit entities only, as there are no Grey-headed Flying-fox breeding camps or suitable breeding habitat for the Large Bent-winged Bat or Little Bent-winged Bat (i.e. caves, tunnels, mine shafts) located within or adjacent to the proposal site. Similarly, there were no large stick nests or White-bellied Sea-Eagles carrying nesting material observed within the proposal site during surveys completed to target breeding habitat for this species.

#### 6.2.2.3 Species credit species

Two species credit type threatened fauna species were identified within the proposal site during field surveys across the wider Hydro site that were completed for the BCAR between 2019–2021 (GHD 2022):

- Southern Myotis (*Myotis macropus*) (listed as a vulnerable species under the BC Act).
- Large-eared Pied Bat (*Chalinolobus dwyeri*) (listed as a vulnerable species under the BC Act and EPBC Act).

The Southern Myotis (*Myotis macropus*) was recorded during previous surveys completed across the Hydro site within a culvert located approximately 3.5 km north-west of the proposal site (GHD 2023). The species has also been recorded along Black Waterhole Creek approximately 1.5 km north-west of the site (DPE 2023b).



Calls of the Large-eared Pied Bat (*Chalinolobus dwyeri*) were recorded adjacent to the proposal site. There is potential that this species is utilising the site for foraging. There is no breeding habitat for this species (i.e. caves, scarps, cliffs, rock overhangs, disused mines or suitable old buildings) present within or nearby to the proposal site (within 2 km). As no breeding habitat occurs at or adjacent to the proposal site a species polygon is not required for this species (OEH 2018).

One additional species credit type threatened fauna species Squirrel Glider (*Petaurus norfolcensis*) has been previously identified within vegetation adjacent to the proposal site (DPIE 2020b, ELA 2016). Although this species was not recorded during targeted surveys completed by GHD across the site based on the known previous records and presence of suitable habitat it is assumed that this species may utilise the proposal site.

There is broadly suitable habitat for the remaining candidate threatened fauna species listed in Table 6.2 within the proposal site. However as none were recorded during multiple targeted field surveys undertaken at a suitable time of year to detect these species (including spotlighting, call play back, Anabat detector, camera trap, pit fall traps, harp traps, SAT surveys and Elliott trap surveys completed within and adjacent to the proposal site as well as previous comprehensive surveys within the wider Hydro site (ELA 2016, Cenwest 2004), these candidate threatened fauna species can be reliably discounted as occurring at the proposal site. As such no species credits are required to be calculated for the remaining candidate threatened fauna species which were not detected within or adjacent to the proposal site.

Species polygons have been mapped for all species credit species recorded within or adjacent to the proposal site. The method for calculating species polygons is outlined in Section 9.1.1.2.

#### **6.2.2.4 Dual credit species with mapped important habitat within the proposal site**

For a small number of species, the habitat constraint information in the TBDC refers to an important habitat map (Biodiversity Assessment Method (BAM) section 5.1.3). Important habitat maps identify areas that are considered essential to support critical life stages of the species, e.g. breeding areas or locations important for foraging/over-wintering for migratory species. These species are dual credit species assessed for species (important habitat map) and ecosystem credits (all other areas the species is likely to occur).

A small number of dual credit species have important habitat maps. The approach is restricted to species that are highly mobile and difficult to reliably detect by survey, and for which DPIE holds extensive, long-term data sets that indicate the importance of areas in the landscape.

No further survey is required if the subject land is on an important habitat map for a species unless the species profile in the TBDC states otherwise. The species is considered present and the part of the subject land that is within the important habitat map forms the species polygon used to generate species credits (BAM section 5.2.5 Box 2). Any remaining habitat on the subject land, e.g. foraging, unmapped locations used by these species is assessed for ecosystem credits.

There is important habitat mapped within the proposal site for two threatened species: the Regent Honeyeater (*Anthochaera phrygia*) and Swift Parrot (*Lathamus discolor*). Species credits have therefore been calculated for areas within the proposal site that are covered by the important habitat mapping for these species (refer to Figure 9.3) (DPE 2023g).

### **6.2.3 Threatened ecological communities**

Three endangered ecological communities (EECs) listed under the BC Act occur within the proposal site (refer to Figure 6.1):

- Vegetation mapped within the site as PCT 1600 in 'comprises part of an occurrence of Lower Hunter Spotted Gum –Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions EEC.
- Vegetation mapped within the site as PCT 1633 comprises part of an occurrence of Kurri Sand Swamp Woodland in the Sydney Basin Bioregion EEC.
- Vegetation within the site mapped as PCT 1591 comprises part of an occurrence of occurrence of Hunter Lowland Redgum Forest in the Sydney Basin and New South Wales North Coast Bioregions EEC.

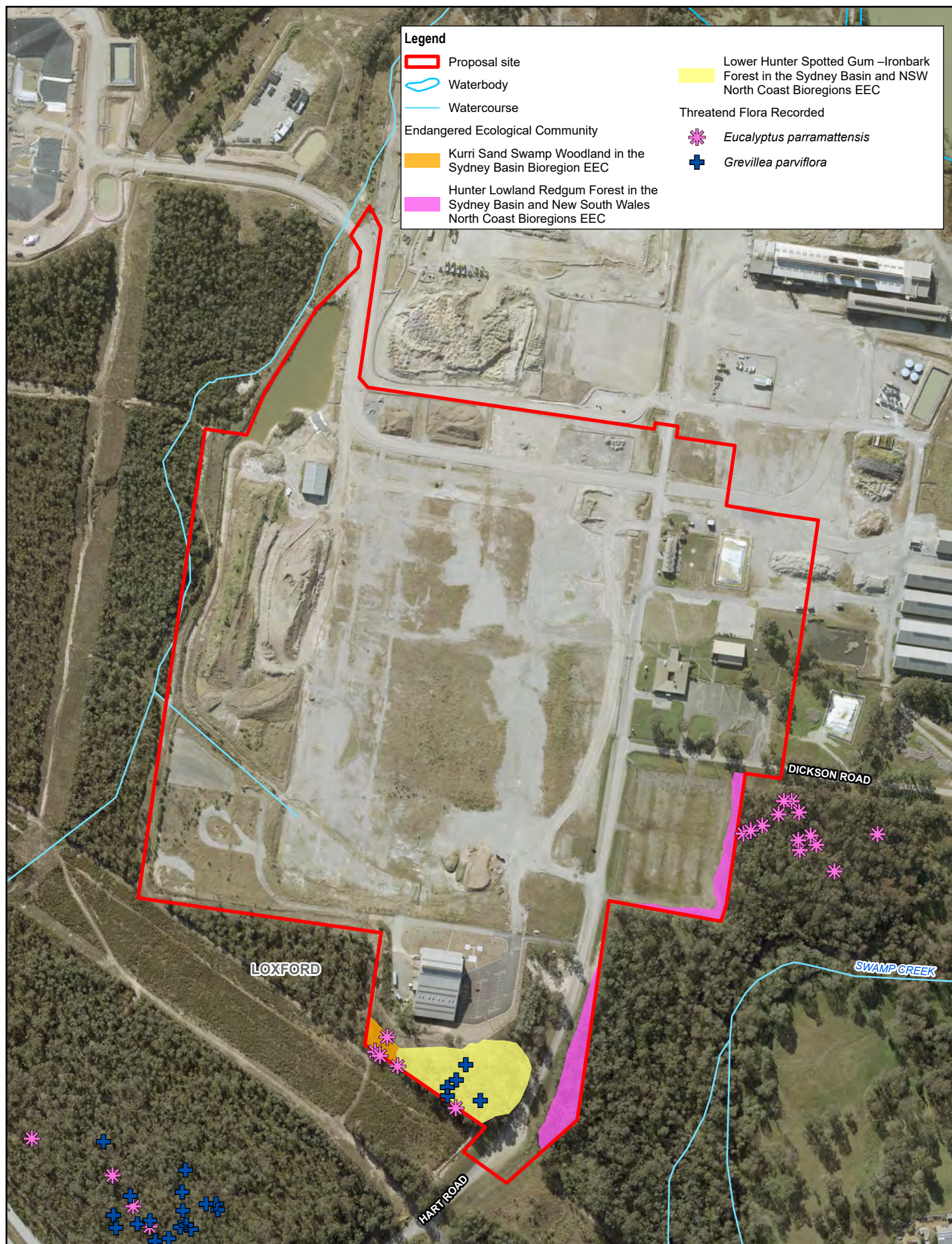
Table 6.4 identifies the PCTs within the proposal site that are commensurate with EECs and describes the key attributes of the EECs noting how these align with the assigned PCT.

**Table 6.4**      *Threatened ecological communities within the proposal site*

| PCT                                                                                                                              | EEC listing (BC Act)                                                                         | Conforming attributes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Area (ha) |
|----------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| (PCT 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                                      | <p>An analysis of the landscape position, soil landscape, geology and floristics of this PCT within the proposal site with reference to the final determination for Kurri Sand Swamp Woodland in the Sydney Basin Bioregions (TSSC 2010) indicates that PCT 1594 within the proposal site conforms to this EEC for the following reasons:</p> <ul style="list-style-type: none"> <li>– The community occurs within the Sydney Basin Bioregion and within the local government areas of Maitland and Cessnock, which is within the known distribution of the ecological community.</li> <li>– Occurs on soils developed over poorly-drained Tertiary sand deposits that blanket Permian sediments in the Kurri Kurri area.</li> <li>– Low woodland dominated by Parramatta Red Gum (<i>Eucalyptus parramattensis</i> subsp. <i>decadens</i>). <i>Angophora bakeri</i> also present in lower numbers.</li> <li>– Shrubby mid-storey dominated by <i>Melaleuca nodosa</i>.</li> <li>– Other characteristic species are present in this community, including <i>Eucalyptus capitellata</i>, <i>Eucalyptus fibrosa</i>, <i>Aristida vagans</i>, <i>Lambertia formosa</i>, <i>Leptospermum polygalifolium</i>, <i>Dillwynia retorta</i>, <i>Melaleuca thymifolia</i> and <i>Entolasia stricta</i>.</li> <li>– Disturbed remnants are considered to form part of the community.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 0.08      |
| (PCT 1591) Grey Gum –Rough-braked Apple shrubby open forest of the lower Hunter                                                  | Hunter Lowland Red Gum Forest in the Sydney Basin and New South Wales North Coast Bioregions | <p>An analysis of the landscape position, soil landscape, geology and floristics of this PCT within the proposal site with reference to the final determination for Hunter Lowland Red Gum Forest in the Sydney Basin and New South Wales North Coast Bioregions (TSSC 2011b) indicates that PCT 1591 within the proposal site conforms to this EEC for the following reasons:</p> <ul style="list-style-type: none"> <li>– Site located within the Sydney Basin bioregion</li> <li>– Within proposal site occurs on gentle slopes arising from depressions and drainage flats on Permian sediments</li> <li>– Dominate species include Grey Gum (<i>Eucalyptus punctata</i>) and Narrow-leaved Ironbark (<i>Eucalyptus crebra</i>)</li> <li>– Whilst the midstorey is quite shrubby in area rather than sparse as indicated by the EEC determination, this is likely a product of recent fires in the area</li> <li>– Detailed survey and analysis of this vegetation against key diagnostic characteristics outlined in the conservation advice for River-flat Eucalypt Forest on coastal floodplains of southern NSW and eastern Victoria confirms that 0.3 ha of PCT 1591 within the proposal site comprises a C2 moderate condition occurrence of the related CEEC listed under the EPBC Act for the following reasons: <ul style="list-style-type: none"> <li>• Occurs in the Sydney Basin IBRA region</li> <li>• Occurs within the lower hunter catchment</li> <li>• Occurs at elevation less than 50 meters ASL</li> <li>• Occurs on alluvial landforms on river terraces of swamp creek</li> <li>• Canopy cover greater than 20 percent and dominated by <i>Eucalyptus mollucana</i></li> <li>• Other species present are characteristic of the species listed in Appendix A of the conservation advice</li> <li>• Patch sizes included areas greater than 0.5 ha</li> </ul> </li> </ul> | 0.54      |

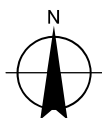
| PCT                                                                                                                   | EEC listing (BC Act)                                                                          | Conforming attributes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Area (ha) |
|-----------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| (PCT 1600) Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub grass open forest of the lower Hunter | Lower Hunter Spotted Gum – Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions | <p>An analysis of the landscape position, soil landscape, geology and floristics of this PCT within the proposal site with reference to the final determination for Lower Hunter Spotted Gum – Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions (TSSC 2019) indicates that PCT 1600 within the proposal site conforms to this EEC for the following reasons:</p> <p>Proposal site occurs on Permian geology in the Hunter Valley</p> <p>Vegetation forms an open forest</p> <ul style="list-style-type: none"> <li>– EEC known to occur in the Cessnock LGA</li> <li>– Community dominated by <i>Eucalyptus crebra</i> (Narrow-leaved Ironbark) and <i>Eucalyptus fibrosa</i> (Red Ironbark) with <i>Corymbia maculata</i> (Spotted Gum) and <i>Eucalyptus moluccana</i> (Grey Box) also occurring occasionally</li> <li>– Community is strongly associated with the Neath and Branxton soil landscapes</li> <li>– Shrub layer is characterised by Native Blackthorn (<i>Bursaria spinosa</i>), <i>Pultenaea spinosa</i>, <i>Melaleuca nodosa</i> and Coffee Bush (<i>Breynia oblongifolia</i>)</li> <li>– Grass and forb species characteristic of the EEC are present including Threeawn Speargrass (<i>Aristida vagans</i>), Weeping Grass (<i>Microlaena stipoides</i>), Kangaroo Grass (Weeping Grass), Wattle Matt-rush (<i>Lomandra filiformis</i>), Spiny-headed Mat-rush (<i>Lomandra longifolia</i>), Many-headed Mat-rush (<i>Lomandra multiflora</i>), and False Sarsaparilla (<i>Hardenbergia violacea</i>)</li> <li>– This ecological community belongs to a complex of communities that include Spotted Gum as a dominant species. An analysis against the key characteristics outlined in the Final <i>Determination</i> for Central Hunter Spotted Gum – Ironbark –Grey Box Forest (TSSC 2011c) which is also known to occur in the Cessnock region determined that the vegetation on site more closely aligns to Lower Hunter Spotted Gum-Ironbark Forest EEC for the following reasons: <ul style="list-style-type: none"> <li>• Presence of <i>Eucalyptus fibrosa</i> as a dominant species within canopy layer is one of the features that differentiates this community from Central Hunter Ironbark—Spotted Gum—Grey Box Forest in the New South Wales North Coast and Sydney Basin Bioregions EEC.</li> <li>• The shrub layer is dominated by prickly shrubs within the Lower Hunter Community.</li> </ul> </li> </ul> | 0.73      |





Paper Size ISO A4  
 0 30 60 90 120  
 Metres

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



Loxford Project Group Pty Ltd  
 Biodiversity Development Assessment Report  
 Regrowth Industrial Subdivision (stages 1 and 2)

Project No. 12527690  
 Revision No. 0  
 Date 30/01/2023

Threatened biota and habitat resources

**FIGURE 6-1**



## 7. Measures to avoid and minimise impacts

The proposed development site rezoning masterplan footprint, which the proposed subdivision forms a part, has undergone a number of revisions through the proposal planning and design process that have looked at how impacts to areas of higher conservation value could be avoided as far as is practical. Various iterations of the masterplan footprint have been developed and amended in response to detailed understanding of the site's biodiversity values and offsets requirements. The intention through the sites rezoning process and development of the preliminary masterplan has been to avoid and minimise impacts on high biodiversity values within the site. The collector road has been situated at its proposed location as it needs to connect with William Tester Drive in the south-east and with a proposed arterial road that is proposed for construction to the north of the site. The road has been designed to service proposed residential development and is required to provide flood free access to Gillieston Heights.

### 7.1 Avoidance measures

#### 7.1.1 Master planning

The proposal site assessed in this BDAR forms part of the former Hydro land parcel. Approximately 300 ha of this has been proposed for development (approximately 57 ha within the Maitland LGA, 243 ha located within the Cessnock LGA that is proposed for Biocertification and 35.20 ha that is the subject to this BDAR). A large portion of the remaining Hydro land (770 ha) will be conserved as a stewardship site that will be used to generate credits to offset the impacts of the proposed development on the site.

In 2014, an initial assessment was completed that assessed and evaluated a range of identifiable constraints within the entire 2000 ha Hydro land parcel. This assessment process produced a preliminary masterplan for the site. The intention of the preliminary masterplan was to be able to identify broad characteristics and potential land uses, which was then subject to more detailed study and refinement. In general, the characteristics that were considered when developing the preliminary masterplan for the site were developable land, conservation land and flood prone/rural land. Regarding the native vegetation on site, the assessment considered and put forward the conservation of areas of highest biodiversity value, which are located to the north-west of the site and focused areas for development predominantly in previously disturbed areas and isolated patches of low and/or poor condition vegetation or at the edges of larger patches of existing vegetation.

Following the design of the preliminary masterplan, a Biodiversity Certification Assessment (BCA) of the site was prepared in accordance with the provisions in the now repealed *Threatened Species Conservation Act 1995* (ELA 2016). As part of this assessment an initial desktop assessment using the BioBanking Assessment Methodology (BBAM) calculator was undertaken to determine if the quantum and type of offsets proposed would satisfy the credits required by the development footprint. It became clear that at this early stage that the proposed credits generated in the conservation area was not sufficient to offset the development footprint identified in the Preliminary Masterplan. The results of this assessment indicated there would be a considerable 'shortfall' in the credits required to offset the development impacts from the proposed onsite conservation area. Based on recommendations in the BCA (ELA 2016), Further amendments were then made to the masterplan to further avoid impacts on biodiversity values, with the footprint of the development lands reduced from 1229 ha to 657 ha, resulting in the avoidance of impacts to 570 ha of EEC. Initial calculations completed as part of the BCA indicated at that time the credit balance between development and conservation land was in positive, with surplus ecosystem credits likely to be generated.

Further refinement and update of the rezoning masterplan was undertaken in 2019 in order to further reduce impacts to areas of high biodiversity value. This resulted in the area of development land being further reduced to 301 ha. These amendments resulted in the further avoidance of approximately 45 ha of Kurri Kurri Sand Swamp Woodland EEC located around the proposed containment cell and areas to the north-east of the smelter site.

Within the area assessed for this BDAR the design process has further avoided impacts to native vegetation located along a drainage line in the west of the site.

## 7.1.2 Biodiversity Stewardship Site

Approximately 770 ha of the Hydro Lands will be secured within a biodiversity stewardship site (BSS). Credits generated within the BSS would be retired to enable the development to commence. The proposed BSS will be protected and managed through the establishment of a Biodiversity Stewardship Agreement (BSA) under the BC Act. The biodiversity credits generated by the BSS would be used to meet the credit requirements for development of the proposal site as far as possible. Additional credits may be needed to meet the credit requirements of the development in accordance with the BAM. Any shortfall in credits would be sourced from either alternative BSS site/s, purchased through the “open market” or via a payment into the BCF in accordance with the trading rules associated with the BOS and the requirements for offsetting impacts to MNES under the Amending Agreement, as applicable.

The proposed BSS broadly occurs on the large parcels of Hydro land that occur to the north and west of the proposal site, but also includes parts of the vegetated riparian corridors along Swamp Creek. PCTs within the BSS are broadly reflective of the vegetation community's that occur in the proposal site.

The proposed BSS contains areas of high biodiversity values, including a large population of Parramatta Red Gum as well as Small Flowered Grevillia and Netted Bottlebrush. The site also provides known habitat for the Squirrel Glider, Southern Myotis as well as a range of other threatened fauna. The BSS also contains areas of mapped important habitat for the Reagent Honeyeater and Swift Parrot.

The proposed stewardship site would be assessed in accordance with the BAM and a separate Biodiversity Stewardship Site Assessment Report (BSSAR) is currently being prepared that would describe the ecosystem and species credits generated at the site. A Site Management Plan (SMP) is also being drafted that describes the restoration and management actions required to be undertaken at the site to improve biodiversity values. The SMP would be accompanied by a Total Fund Deposit (TFD) amount which would determine the funds that would be required to implement the restoration and management program in perpetuity. Once these documents are finalised an application for a BSA would then be lodged with the Biodiversity Conservation Trust (BCT).

## 7.2 Mitigation measures

### 7.2.1 Construction phase

#### 7.2.1.1 Construction Environmental Management Plan

A construction environmental management plan (CEMP) would be required for the construction phase of the proposal.

The CEMPs would specify environmental safeguards for the protection of biodiversity values on neighbouring properties and waterways in accordance with relevant Government policy and guidelines and development conditions. Mitigation measures will typically include, as a minimum, industry-standard measures for the management of soil, surface water, weeds and pollutants, as well as site-specific mitigation measures and procedures for the management of flora and fauna.

The mitigation and management measures outlined in Table 7.1 would be expected to be implemented as part of the CEMPs for future development at the proposal site in order to minimise the potential impacts of the proposal on biodiversity values.

**Table 7.1**      *Mitigation measures (construction)*

| Impact                              | Mitigation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Timing                                                                            | Responsibility                                                                    |
|-------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|
| General                             | All workers are to be provided with an environmental induction prior to starting work on site. This will include information on the ecological values of the site, protection measures to be implemented to protect biodiversity and penalties for breaches.                                                                                                                                                                                                                                                                                                                                          | Prior to clearing/construction works.                                             | Construction contractor                                                           |
|                                     | A flora and fauna management sub-plan will be prepared as part of the CEMP, incorporating recommendations below, and expanding on specific details where necessary.                                                                                                                                                                                                                                                                                                                                                                                                                                   | Prior to clearing/construction works.                                             | Construction contractor                                                           |
|                                     | Measures to suppress dust will be implemented during clearing and construction.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Throughout clearing and construction phases                                       | Construction contractor                                                           |
|                                     | Disturbance of vegetation will be limited to the minimum necessary to undertake the proposal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Prior to works commencing                                                         | Construction contractor                                                           |
|                                     | Any lighting used during construction should be appropriately positioned to direct light away from adjoining bushland areas and to limit the impacts of light spill on native fauna habitats                                                                                                                                                                                                                                                                                                                                                                                                          | Prior to works commencing                                                         | Construction contractor                                                           |
| Vegetation clearing                 | Prior to the commencement of any work in or adjoining areas of native vegetation a survey would be carried out to mark the construction impact boundary. The perimeter of this area will be fenced using high visibility fencing and clearly marked as the limits of clearing. All vegetation outside this fence line will be clearly delineated as an exclusion zone to avoid unnecessary vegetation and habitat removal. Fencing and signage must be maintained for the duration of the construction period. Fencing should be designed to allow fauna to exit the site during clearing activities. | Prior to clearing /<br>Daily inspections of exclusion zones during works in area. | Construction contractor and qualified ecologist                                   |
|                                     | For individual trees being retained fencing will protect the entire Tree Protection Zone (i.e. 10 times the diameter of the trunk at breast height).                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Prior to clearing/ construction works                                             | Construction contractor                                                           |
|                                     | Stockpiles of fill or vegetation will be placed within existing cleared areas (and not within areas of adjoining native vegetation).                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Prior to clearing/ construction works                                             | Construction contractor                                                           |
|                                     | Sediment fences will be installed to prevent transfer of sediments into adjacent vegetation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Prior to clearing/ construction works                                             | Construction contractor                                                           |
| Introduction of Weeds and Pathogens | A weed and pest species management sub-plan will be developed and implemented as part of project CEMP to manage weeds and pathogens during the construction and operational phase of the proposal. This sub-plan would include but not be limited to the following:                                                                                                                                                                                                                                                                                                                                   | Prior to clearing/ construction works                                             | Construction contractor                                                           |
|                                     | Provisions for identify the location and extent of any priority and/or high threat environmental weeds within the site                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Prior to clearing/ construction works                                             | Construction contractor and qualified ecologist (or experienced bush regenerator) |
|                                     | Protocols for the management of noxious and environmental weeds                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Prior to clearing/ construction works                                             | Construction contractor and qualified ecologist (or experienced bush regenerator) |

| Impact                             | Mitigation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Timing                                                                   | Responsibility                                                                    |
|------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|-----------------------------------------------------------------------------------|
|                                    | Protocols to prevent the introduction and/or spread of pathogens and weeds                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Prior to any plant or machinery being brought onto the site              | Construction contractor and qualified ecologist (or experienced bush regenerator) |
|                                    | Protocols to limit the spread of weed propagules downstream of proposal site.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Prior to clearing/ throughout construction works                         | Construction contractor and qualified ecologist (or experienced bush regenerator) |
| Removal of fauna habitat           | <p>The flora and fauna management sub-plan will be developed and implemented to minimise impacts to fauna during clearing works. This plan will include but not be limited to:</p> <ul style="list-style-type: none"> <li>– Provisions for pre-clearing surveys to identify significant habitat features such as hollow bearing trees, logs and nests</li> <li>– Protocols to prevent introduction or spread of chytrid fungus in accordance with Office of Environment and Heritage Hygiene protocol for the control of disease in frogs (DECCW 2008c)</li> <li>– Protocols for the salvage and relocation of fallen logs and hollows (where appropriate)</li> <li>– Provisions to have suitably qualified ecologist present during vegetation clearing</li> <li>– Protocols for the appropriate handling, capture and release of fauna</li> <li>– Provisions for stages vegetation removal to increase the opportunity for fauna to vacate the site and disperse into areas of adjoining habitat to evade injury</li> <li>– Protocols for post clearing reporting</li> </ul> | Prior to clearing                                                        | Qualified Ecologist / Construction contractor                                     |
| Water Quality and aquatic habitats | Erosion and sediment control plans will be prepared in accordance with Volume 2D of Managing Urban Stormwater: Soils and Construction (DECC, 2008d). The erosion and sediment control plans would be established prior to the commencement of construction and be updated and managed throughout as relevant to the activities during the construction phase.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Prior to construction commencing                                         | Construction contractor                                                           |
|                                    | Erosion and sediment control controls will be regularly inspected, particularly following rainfall events, to ensure their ongoing functionality.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Weekly during construction phase or after any significant rainfall event | Construction contractor                                                           |
|                                    | Stabilised surfaces will be reinstated as quickly as practicable after construction.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Immediately following clearing                                           | Construction contractor                                                           |
|                                    | Appropriate speed limits will be enforced to limit dust generation and minimise chances of fauna mortality through vehicle strike.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | During construction                                                      | Construction contractor                                                           |
|                                    | All stockpiled material will be stored in bunded areas and kept away from waterways to avoid sediment or contaminants entering the waterway.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | During construction                                                      | Construction contractor                                                           |
|                                    | Spill kits will be made available and carried in construction vehicles. A management protocol for accidental spills would be put in place.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | During construction                                                      | Construction contractor                                                           |



## 7.2.2 Operational phase

The occupation of the proposal site and operation of industrial land uses has the potential for indirect impacts on biodiversity values in adjoining retained vegetation. There will be a need to explore different mechanisms to appropriately manage potential impacts across the interface between the proposal site and retained habitat, including plans for ongoing vegetation management within areas of retained vegetation.

Environmental Management Plans (EMPs) including a Vegetation Management Plan (VMP) and a Wildlife Management Plan (WMP) would be required for the operational life of the proposal and would be prepared prior to the issue of the subdivision certificates. Future plans would include, as a minimum, measures to appropriately manage matters such as stormwater infrastructure, open space and APZs as well as industry-standard measures for the management of soil, surface water, weeds and pollutants. The proposed mitigation measures would include environmental safeguards for protection of the retained areas, neighbouring properties and waterways in accordance with relevant policy documentation and Government guidelines.

In order to appropriately address the potential impacts of the proposal on biodiversity as discussed in Section 8, the mitigation and management measures outlined in Table 7.2 would be implemented as part of the EMP for the site. Table 7.2 has been prepared with reference to Section 7.13 of the BAM and includes an assessment of the risk of these mitigation measures not succeeding and adaptive management responses to address any consequences.

Further detail regarding environmental management and mitigation measures and details of monitoring required to help identify any shortfalls in the implementation of the proposed mitigation measures and appropriate management responses would be further developed once the subdivision layout and specific uses throughout the proposal site have been confirmed

**Table 7.2**      *Environmental management measures (operation)*

| Impact                            | Mitigation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Timing        | Responsibility     | Risk                                                                                                 | Adaptive management response                                                                                                                                   |
|-----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|--------------------|------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Fauna strike                      | Animal and speed limit signposting to raise awareness and enforce appropriate speed limits and to reduce the likelihood of vehicle strike and mortality of native fauna.                                                                                                                                                                                                                                                                                                                                 | In perpetuity | Developer          | Failure to comply with speed limits resulting in fauna mortality                                     | Reduction in speed limit other physical speed deterrents                                                                                                       |
|                                   | Design, installation and maintenance of appropriate fauna fencing                                                                                                                                                                                                                                                                                                                                                                                                                                        | In perpetuity | Developer/ council | Breaks in fencing may result in fauna being struck by vehicles                                       | Ongoing fence maintenance                                                                                                                                      |
| Edge effects                      | APZs will be managed to act as a buffer to minimise edge effects potentially including weed, light and erosion impacts on adjacent areas of retained vegetation.                                                                                                                                                                                                                                                                                                                                         | In perpetuity | Land owners        | Increased extent or cover of exotic plants in APZs threatening adjoining areas of native vegetation. | Periodic monitoring and adaption and/or intensification of bush regeneration activities to reduce weed cover, restore native vegetation cover etc as required. |
|                                   | Control of priority weeds within the proposal site to prevent the spread of propagules into adjacent areas of native vegetation.                                                                                                                                                                                                                                                                                                                                                                         | In perpetuity | Developer          | Increased extent or cover of priority weeds                                                          | Periodic monitoring and adaption and/or intensification of weed control activities                                                                             |
|                                   | Street lighting to be designed to direct light away from adjoining bushland areas and to limit the impacts of light spill on native fauna habitats. Lighting design must identify and adopt technologies that are least likely to adversely affect fauna use of habitat through impacts such as disruption of microbat foraging. This should consider light colour and intensity, provision of light shields and other measures as appropriate to the position of lighting relative to offsite habitats. | In perpetuity | Developer          | Disturbance of fauna habitat adjacent to proposal site                                               | Redesign lighting to minimise impacts to adjacent habitat                                                                                                      |
| Water Quality and aquatic habitat | Water Sensitive Design infrastructure, perimeter roads and setbacks would be included in APZ. Water Sensitive Urban Design infrastructure should be appropriately maintained. This includes Gross Water Pollution Traps, ponds and bioretention basins.                                                                                                                                                                                                                                                  | In perpetuity | Landowner/Council  | Poorly maintained infrastructure may result in downstream impacts to Swamp and or Blackwater Creeks  | Water Sensitive Urban Design infrastructure to be repaired or upgraded                                                                                         |

| Impact | Mitigation                                                                                                                                | Timing                               | Responsibility    | Risk                                                                                                                     | Adaptive management response                                                                         |
|--------|-------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|-------------------|--------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|
|        | Erosion and sediment control would be regularly inspected, particularly following rainfall events, to ensure their ongoing functionality. | After any significant rainfall event | Landowner/Council | Failure of erosion and sediment controls may result in downstream impacts to ephemeral drainage line and Wentworth swamp | Erosion and sediment controls showing signs of deterioration to be repaired or replaced as required. |

## 8. Impact assessment

### 8.1 Direct impacts

#### 8.1.1 Removal or modification of vegetation

The proposal would result in the direct clearing of 1.35 ha of native vegetation and 0.92 ha of planted vegetation as summarised in Table 8.1.

**Table 8.1** Extent of vegetation removal in the proposal site

| Vegetation zone                                                                                                                     | PCT ID | Condition | Area in proposal site (ha) | BC Act Status                                                                                     | EPBC Act Status |
|-------------------------------------------------------------------------------------------------------------------------------------|--------|-----------|----------------------------|---------------------------------------------------------------------------------------------------|-----------------|
| 1. Parramatta Red Gum- Narrow-leaved Apple-Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area (1633_Intact) | 1633   | Intact    | 0.08                       | Kurri Sand Swamp Woodland in the Sydney Basin Bioregion EEC                                       | Not listed      |
| 2. Spotted Gum – Red Ironbark – Narrow-leaved Ironbark – Grey Box shrub grass open forest of the lower Hunter (1600_Weedy)          | 1600   | Intact    | 0.73                       | Lower Hunter Spotted Gum – Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions EEC | Not listed      |
| 3. Grey Gum - Rough-barked Apple shrubby open forest of the lower Hunter (1591_intact)                                              | 1591   | Intact    | 0.32                       | Hunter Lowland Redgum Forest in the Sydney Basin and New South Wales North Coast Bioregion        | Not listed      |
| 4. Grey Gum - Rough-barked Apple shrubby open forest of the lower Hunter (1591_disturbed)                                           | 1591   | Disturbed | 0.22                       | Hunter Lowland Redgum Forest in the Sydney Basin and New South Wales North Coast Bioregion        | Not listed      |
| Planted vegetation                                                                                                                  | N/A    | Poor      | 0.92                       | Not listed                                                                                        | N/A             |
| Cleared land                                                                                                                        | N/A    | Poor      | 32.81                      | Not listed                                                                                        | N/A             |

#### 8.1.2 Removal of threatened flora

The proposal would result in impacts to five Parramatta Red Gum and five Small Leaved Grevillea individuals (refer to section 9.1.1 for further details regarding impacts to these threatened species).

#### 8.1.3 Removal of habitat and habitat resources

The proposal would clear of approximately 1.35 ha of woodland and 0.92 ha of planted trees.

Clearing of the site would include the removal of mature native trees, shrubs and grasses. Mature trees have value for fauna populations as sources of foraging resources such as leaves, nectar, sap or seed and substrate for invertebrate prey.

The proposal would also remove exotic grassland which would provide some habitat for some generalist fauna species typical of disturbed grassland environments such as Kangaroos, common birds and reptile species, including the Australian Magpie, Australian Raven, Common Myna and Dark-flecked Garden Skink.



In the context of the areas of remaining native woodland vegetation surrounding the proposal site, particularly in the large area proposed to be retained within the Loxford stewardship site, the proposal would remove a very small proportion of available habitat resources for local populations of native fauna. It is unlikely that the proposal would substantially impact on the available habitat resources for local fauna in the locality.

#### 8.1.4 Fauna injury and mortality

As described above, the proposal site provides a variety of habitat resources for native fauna species, including foraging, roosting and shelter resources for threatened species as well as common native fauna. Groundcover vegetation, leaf litter and woody debris would provide shelter and foraging substrate for reptiles, frogs and invertebrates. Construction may result in the injury or mortality of some individuals of these less mobile fauna species and other small terrestrial fauna that may be sheltering in vegetation within the proposal site during clearing activities. More mobile native fauna such as native birds, bats, terrestrial and arboreal mammals that may be sheltering in vegetation in the proposal site are likely to evade injury during construction activities.

Recommendations have been made in Section 7.2 above to minimise the risk of vegetation clearing activities resulting in the injury or mortality of resident fauna.

#### 8.1.5 Fragmentation and isolation of habitat

Habitat fragmentation through the clearing of vegetation can increase the isolation of remnant vegetation patches, increase edge effects and create barriers to the movements of small and sedentary fauna such as ground dwelling mammals, reptiles and amphibians. Furthermore, habitat fragmentation can create barriers to the movement of pollinator vectors, such as insects, and consequently affect the life cycle of both common and threatened flora.

The proposal site is mostly located in already cleared land, the majority of which has been previously covered with hardstand that was part of the former Hydro Aluminium smelter. Most of this hardstand has been removed as part of remediation works within the former smelter site. The ground within these areas now consists of bare earth. These areas would already comprise a gap in habitat for less mobile or shelter dependent native fauna.

Areas of remnant native vegetation occur to the west, south and south east of the proposal site. The vegetation proposed to be removed occurs along the edges of these larger patches of vegetation. The proposal would reduce the size of this patch but would not result in the isolation of any areas of habitat and would make a minor contribution to the degree of habitat fragmentation in the locality.

## 8.2 Indirect impacts

Indirect impacts that may result from the proposal are described in Table 8.3. Mitigation measures proposed to minimise the risk of these impacts are detailed in Section 7.2.

Given the small area and intensity of potential indirect impacts, proposed mitigation measures and substantially modified character of the receiving environment, indirect impacts are not likely to result in substantial negative impacts on native vegetation or other threatened species habitat. Regardless offsets have been calculated for indirect offsets by applying a 10-metre buffer adjacent to where native vegetation is proposed for removal. Calculations of offsets for these indirect impacts assume a total loss of this vegetation (noting that indirect impacts would not result in a total loss of function of this vegetation however the offset would account for any additional indirect impacts that may occur beyond the 10 metre buffer). The estimated extent of indirect impacts is summarised in Table 8.2 and a qualitative assessment of these impacts is provided in Table 8.3.

**Table 8.2** Areas used to calculate offsets associated with potential indirect impacts

| Vegetation zone                                                                                                                   | PCT ID | Condition | Indirect impact area (ha) | BC Act Status                                                                                     | EPBC Act Status |
|-----------------------------------------------------------------------------------------------------------------------------------|--------|-----------|---------------------------|---------------------------------------------------------------------------------------------------|-----------------|
| 1-Parramatta Red Gum-Narrow-leaved Apple-Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area (1633_Intact) | 1633   | Intact    | 0.06                      | Kurri Sand Swamp Woodland in the Sydney Basin Bioregion EEC                                       | Not listed      |
| 2 - Spotted Gum – Red Ironbark – Narrow-leaved Ironbark – Grey Box shrub grass open forest of the lower Hunter (1600_Weedy)       | 1600   | Intact    | 0.0                       | Lower Hunter Spotted Gum – Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions EEC | Not listed      |
| 3- Grey Gum - Rough-barked Apple shrubby open forest of the lower Hunter (1591_intact)                                            | 1591   | Intact    | 0.38                      | Hunter Lowland Redgum Forest in the Sydney Basin and New South Wales North Coast Bioregion        | Not listed      |
| 3- Grey Gum - Rough-barked Apple shrubby open forest of the lower Hunter (1591_disturbed)                                         | 1591   | Disturbed | 0.01                      | Hunter Lowland Redgum Forest in the Sydney Basin and New South Wales North Coast Bioregion        | Not listed      |
| Planted vegetation                                                                                                                | N/A    | Poor      | 0.92                      | Not listed                                                                                        | N/A             |
| Cleared land                                                                                                                      | N/A    | Poor      | 32.81                     | Not listed                                                                                        | N/A             |

**Table 8.3** Indirect impacts

| Impact                         | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|--------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Weed invasion and edge effects | <p>Weed species are effective competitors for food and habitat resources and have the potential to exclude native species and modify the composition and structure of vegetation communities.</p> <p>'Edge effects' can include increased noise and light or erosion and sedimentation at the interface of intact vegetation and cleared areas. Edge effects may result in impacts such as changes to vegetation type and structure, increased growth of exotic plants, increased predation of native fauna or avoidance of habitat by native fauna. Edge effects would result from construction activities and then continue to affect vegetation and habitats adjoining the proposal site.</p> <p>Altered environmental conditions along new edges can allow invasion by pest animals specialising in edge habitats and/or change the behaviour of resident animals. Edge zones can be subject to higher levels of predation by introduced mammalian predators and native avian predators.</p> <p>The proposal would result in the removal of vegetation along existing edges that adjoin relatively intact native vegetation in relatively good condition. There is therefore a risk that construction activities may increase the weed infestation through dispersal of weed propagules (seeds, stems and flowers) into areas of retained native vegetation adjacent to the site via erosion (wind and water) and associated construction activities.</p> |

| Impact                     | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                            | <p>The creation of new edges within areas of native vegetation also has the potential to introduce impacts associated with noise and light into areas of adjacent vegetation. This may result in disruptions to fauna utilising vegetation adjacent to the site (as described below).</p> <p>There is a risk that weed invasion and the influence of edge effects would have an ongoing negative impact on the adjoining areas of intact native vegetation. Mitigation measures including the development of a weed management sub-plan as part of the project CEMP would be implemented to mitigate these potential impacts (refer to Section 7.2.1).</p> <p>Other relevant mitigation measures to reduce the impacts of edge effects include ongoing weed management, lighting design to minimise light spill as well as dust suppression and erosion and sediment measures during construction.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Pests and pathogens        | <p>Disturbance associated with vegetation clearing, vehicle traffic and general day to day operations of the proposal during construction increase the potential for the spread, introduction and establishment of pest species, diseases and pathogens.</p> <p>Construction activities within the proposal site may, in general, have the potential to introduce or spread pathogens such as Phytophthora (<i>Phytophthora cinnamomi</i>), Myrtle Rust (<i>Uredo rangeli</i>) and Chytrid fungus (<i>Batrachochytrium dendrobatidis</i>) into adjacent habitat through vegetation disturbance and increased visitation. There is little available information about the distribution of these pathogens within the locality, and no evidence of these pathogens was observed during surveys. Phytophthora and Myrtle Rust may result in the dieback or modification of native vegetation and damage to fauna habitats. Chytrid fungus may harm frog populations once introduced into an area.</p> <p>Diseases and pathogens can be introduced or spread to site via dirt or organic material attached to machinery, vehicles, equipment and employees as well as soil imported to fill areas of the site. The potential for significant or new impacts associated with these pathogens is relatively low, given the suburban context of the proposal site. To help mitigate the risk of pathogens being brought onto and/or spread through the site all machinery brought to site will be washed down and inspected to be free of soils, seeds and other organic material in accordance with Section 7.2.1.</p> |
| Noise, light and vibration | <p>Construction activities would increase noise levels and vibration in the vicinity of the proposal site during construction, through plant and machinery operation. Native fauna may temporarily or permanently vacate or avoid areas disturbed by construction activities.</p> <p>The majority of the proposed construction works would be undertaken during standard, daytime construction hours. Exemptions and approval for works outside of the above standard construction hours may be required during certain circumstances and would require approval from consent authorities.</p> <p>As such, construction noise would be temporary and generally confined to daylight hours. There would be an increase above existing background noise and vibration levels. Once the development is completed there is likely to also be some indirect impacts from noise and light around the immediate periphery of the proposal site. To help mitigate these impacts lighting will be designed to limit the light spill into retained vegetation adjoining the site.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Sedimentation and erosion  | <p>The proposed development has the potential to result in sedimentation and erosion within the proposal site and adjoining areas through soil disturbance and construction activities. Sediment laden runoff to waterways can alter water quality and adversely affect aquatic life. Erosion may also impact native vegetation by undermining vegetation resulting in tree instability and potential for uprooting, especially vegetation associated with drainage lines. Impacts to the nearby creeks and drainage lines would be mitigated through the development and implementation an erosion and sediment control plan, including the CEMP for the project.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

## 8.3 Assessment of serious and irreversible impacts

Under the BC Act, a determination of whether an impact is serious and irreversible must be made in accordance with the principles set out in Section 6.7 of the BC Regulation.

The principles are aimed at capturing impacts which are likely to contribute significantly to the risk of extinction of a threatened species or ecological community in New South Wales. These impacts will:

- Cause a further decline of the species or ecological community that is currently observed, estimated, inferred or reasonably suspected to be in a rapid rate of decline, or
- Further reduce the population size of the species or ecological community that is currently observed, estimated, inferred or reasonably suspected to have a very small population size, or

- Impact on the habitat of a species or ecological community that is currently observed, estimated, inferred or reasonably suspected to have a very limited geographic distribution, or
- Impact on a species or ecological community that is unlikely to respond to measures to improve habitat and vegetation integrity and is therefore irreplaceable

The decision-maker must determine whether or not an impact on biodiversity values is likely to be a serious and irreversible impact (SAIL). The framework allows for decision-makers to take into account the scale of an impact and the potential for avoidance and mitigation. These factors are weighed against the status and vulnerabilities of the potential SAIL entity to ultimately determine if a proposal would result in a SAIL (DPIE 2019). If there is a SAIL for a State Significant Development, the development may be approved but the approval authority must take those impacts into consideration and determine whether there are any additional and appropriate measures that would minimise those impacts if approval is granted.

Two potential SAIL entities (the Regent Honeyeater and Swift Parrot) would be impacted by the proposal. Both of these species are considered to be SAIL entities on the basis of Principle 1 (evidence of rapid decline) and Principle 2 (species currently in a rapid rate of decline) listed in Appendix A of the *Guidance to assist a decision-maker to determine a serious and irreversible impact* (DPIE 2019a).

The area of important habitat for Swift Parrot and Regent Honeyeater within the proposal site has been identified based on the BAM Important Area Map contained within the BAM-C (DPIE 2023f). Based on this mapping, the Swift Parrot and the Regent Honeyeater are both assumed to potentially utilise part of the proposal site for foraging.

The Important Areas map for Swift Parrot has been developed based on applying a buffer area of 2 km to areas where there have been five or more birds recorded over any two or more years, or single sightings of more than 40 birds (DPIE 2023e). The NSW State Vegetation Type Map (including draft East Coast classification) was then used to select Plant Community Types associated with the Swift Parrot within the buffers. Any areas of vegetation less than one hectare were excluded.

Throughout the Hydro site the important habitat mapping appears to be somewhat arbitrary with the boundary of the mapped important habitat being located through the middle of a large patch of contiguous vegetation that extends to the north-west of the site that is known to contain similar vegetation types as the proposal site. As noted above the mapping has been developed using NSW State Vegetation Type Mapping, with mapped PCTs associated with the Swift Parrot within the buffer area selected as important habitat. This vegetation mapping has been completed at a broad scale and contains numerous inaccuracies. For example, areas of cleared land, exotic grassland and Typha wetland that would not provide any foraging habitat for this species have been mapped as important habitat.

To determine more accurately the extent and quality of important habitat for the Swift Parrot and Regent Honeyeater within the site a species expert was engaged to undertake a detailed assessment of habitat for these two SAIL entities across the Hydro site (including the proposal site and proposed adjacent BSS). The purpose of the expert assessment was to determine whether vegetation within the site is likely to be important for these two species and to also quantify the quality of habitat throughout the site.

The expert report determined that a large extent of the mapped important habitat within the site is not likely to comprise important habitat for either of these species and subsequently the species expert reduced the area that they believed to be important for both of these species within the wider Hydro site. This includes a portion of the mapped important habitat within the proposal site (refer to Appendix F).

Reasons provided in the expert report for the proposed reduction in areas of mapped important habitat included:

- Lack a canopy cover (some areas have been historically cleared, whilst in others there is no mature canopy cover present).
- Errors in the remote vegetation classification (some mapped habitat contains non-native, planted vegetation whilst in others key feed tree species are absent or only form a very small proportion of the total canopy cover).
- Poor tree health (some areas have trees that are dead or have been subject to historically high levels of disturbance).



- Lack of key habitat features or surrogate bird species for example long-flowered mistletoe is a key breeding resource for Regent Honeyeaters within the lower Hunter Valley. Surveys also found other threatened species that can serve as indicators of potential Swift Parrot Habitat were either not detected or were sparsely distributed at low abundances within the Hydro site) (Crates 2022).

The expert report states that the Regent Honeyeater and Swift Parrot habitat within the Hydro site is of low to moderate quality, relative to other areas of mapped important habitat within the lower Hunter Valley, such as parts of Werakata National Park and the Hunter Economic Zone (Roderick et al. 2014). The species expert determined that the site was not likely to provide any breeding habitat for the Regent Honeyeater and considered it unlikely that Swift Parrots or Regent Honeyeaters would utilise mapped habitats within the Hydro site (Crates 2022). The expert report also concludes that none of the mapped important habitat within the site is likely to be critical habitat for either species (Crates 2022).

Assessments of impacts associated with the proposal on these two SAI entities have been completed based on Dr Crates assessment of the Hydro site and are included as Appendix D of this BDAR.

SAI assessments have been completed for potential impacts to the Regent Honeyeater and Swift Parrot. This assessment concluded that it is the opinion of the accredited assessor that the proposal is not likely to result in a SAI for either of these species (refer to Appendix D for detailed SAI assessment):

- The proposal would impact a very small areas of mapped important habitat for Regent Honeyeaters and Swift Parrot (0.47 and 1.78 ha respectively) (representing less than 0.001 percent of the mapped important habitat within the Hunter IBRA subregion and 0.0001 percent of the mapped important habitat in the Sydney Basin bioregion).
- No breeding habitat for the species would be impacted.
- An assessment completed by a species expert concluded that the habitat within the site is of low to moderate value for Regent Honeyeater and Swift Parrot and in their opinion, it is unlikely that the species would utilise the site (Crates 2022).

## 8.4 Impacts on aquatic habitats

The proposal would result in the infilling of a small retention basin in the north-west corner of the site as well as potential indirect impacts to a second order drainage line. None of the aquatic habitats in the proposal site are classified as Key Fish Habitat and the retention basin and drainage lines are likely to provide habitat for threatened fish. Aquatic habitats may provide limited breeding and shelter resources for common frog, reptile species and waterbirds.

No habitat for threatened biota listed under the FM Act would be directly impacted by the proposal. There is potential that indirect impacts such as sediment and erosion during the construction phase of the project (discussed above) any impact on water quality within the ephemeral drainage line located along the western boundary of the site Given the ephemeral nature of this drainage line and limited habitat resources for aquatic biota, the risk of indirect impacts is low. There would be no blockage of fish passage or removal of snags as a result of the proposal.

There is potential that indirect impacts such as sediment and erosion during the construction phase of the project (discussed above) may impact on water quality within Swamp Creek which is located to the east of the site. Given the distance of this creek from the proposal site the risk of indirect impacts is low.

## 8.5 Prescribed impacts

The BAM requires the assessment of potential impacts on threatened species and their habitats beyond those associated with the removal of vegetation ('prescribed impacts'). Prescribed impacts include potential impacts to significant geological features, hydrological features, connectivity features and man-made structures that may provide habitat to threatened biota.

The potential for prescribed impacts associated with the proposal is considered below. Given the scale and context of the proposal there are unlikely to be any substantial impacts on threatened species and their habitats beyond those associated with the removal of vegetation and habitat in the proposal site.

### 8.5.1 Karst, caves crevices, cliffs, rocks and other geological features of significance

No areas of geological significance are present within or adjacent to the proposal site nor are any caves, karsts, crevices, cliffs or rocky outcroppings present.

### 8.5.2 Human made structures and non-native vegetation

The proposed development would include the removal of 32.50 ha of non-native vegetation associated with cleared land surrounding the former Hydro aluminium smelter. This vegetation does not comprise habitat for any threatened flora species and provides minimal habitat resources for threatened fauna species. It is highly unlikely that any threatened fauna species would rely on habitat resources in these areas for their survival in the locality, although some individuals may use these areas on occasion as part of a much larger home range.

The proposal would result in the removal of several buildings and man-made structures. These structures have been assessed for potential habitat for threatened fauna in particular threatened bats such as the Eastern Cave Bat (*Vespadelus troughtoni*) and Large Eared Pied Bat (*Chalinolobus dwyeri*) which are known to roost in old buildings. Buildings located on the site are not derelict concrete buildings (as per TBDC habitat descriptions) and are not likely to provide breeding habitat for any threatened bats or other threatened fauna species.

### 8.5.3 Habitat connectivity

Habitat fragmentation resulting from clearing of vegetation can increase the isolation of remnant vegetation and create barriers to the movements of small and sedentary fauna such as ground dwelling mammals, reptiles and amphibians. Furthermore, habitat fragmentation can create barriers to the movement of pollinator vectors, such as insects, or seed vectors, such as birds, and consequently affect the life cycle of both common and threatened flora. The proposal is not likely to result in any impacts to habitat connectivity or fragment any areas of vegetation.

Scattered planted trees and small patches of woodland present within the proposal site would provide 'stepping stones' of habitat between larger areas of vegetation for mobile species such as bats and birds. Removal of these patches and trees would reduce the availability of these stepping stones to a minor degree. Species that require larger tracts of connected vegetation would not occur in these small, already fragmented patches.

### 8.5.4 Water bodies, water quality and hydrological processes

A small retention basin would be removed by the proposal. Removal of this basin would reduce the number of watering points in the wider study area to a minor degree, however there is a substantial area of waterbodies adjacent to the site (including Wentworth swamp to the west) that would remain undisturbed. Targeted surveys were completed within this pond for candidate species, including the Green and Golden Bell Frog (*Litoria aurea*) and Green Thighed Frog (*Litoria brevipalmata*). Neither of these species were recorded during targeted surveys it is therefore considered unlikely that the removal of this pond would result in adverse impacts to threatened biota.

More mobile threatened species that may use these habitats (such as the Grey-crowned Babbler and microchiropteran bats) would likely use a number of similar watering points throughout their home range and are not likely to be impacted by the removal of this waterbody.

A small second order drainage line is located along the western edge of the proposal site. This drainage line would not be directly impacted by the proposal and vegetation would be retained along its banks and the riparian zone rehabilitated to create a buffer between the creek and adjacent industrial land. This drainage line is a second order stream that does not contain permanent or periodic flowing water and has been disturbed through past industrial activities associated with the Hydro site. There is potential for sedimentation and pollutants to be transported into adjacent waterways during construction and operation of the proposal. If uncontrolled, this could potentially impact on water quality further downstream. Potential water quality impacts would be managed through the implementation of mitigation measures, including the provision of sedimentation basins, silt fences and other structures to intercept runoff. Details would be included in a Stormwater Management Plan. A vegetated riparian zone will be established and managed along the second and order drainage line that is located to the west of the site. This will assist with filtering sediments and other contaminants as well as providing for connectivity between the drainage line and habitats to the north and south of the site.

No endangered aquatic communities, aquatic fauna or marine vegetation listed under the FM Act or EPBC Act occur in or adjacent to the footprint and no significant impacts on riparian vegetation or habitats downstream of the development footprint are anticipated as a result of the proposal.

### 8.5.5 Vehicle strike

The proposal site currently has moderate levels of vehicle activity typically associated with current industrial land uses. Regular movements of cars, trucks, utility vehicles and equipment occur throughout the proposal site.

The proposal is likely to result in an increase in cars and other vehicles during construction and operation. Exclusion fencing would be installed between the boundary of the site and the adjoining native vegetation to prevent movement of ground-dwelling fauna into the site. There is however still a risk that increased vehicle activity may result in native fauna being struck and killed. The potential risk of vehicle strike is most relevant to common species such as kangaroos which often graze along roadsides. Vehicle strike poses a higher risk for owls and ground feeding birds as they are known to utilise urban and industrial areas where they can take advantage of an abundance of prey such as mice, rats and possums that often thrive in these environments. Furthermore, owls will often pick up prey from the sides of roads making them more vulnerable to being struck.

Mitigation measures would include signposting and enforcement of appropriate speed limits to reduce the likelihood of vehicle strike and mortality of native fauna. Appropriate fencing would also be installed and maintained between the proposal site and areas of adjoining native vegetation.

## 8.6 Removal of planted native vegetation

The proposal would remove 0.92 ha of planted native vegetation. An assessment of threatened species habitat did not find any evidence of this vegetation being used by threatened biota. The removal of this vegetation would slightly reduce the available potential foraging habitat for several threatened fauna species including the Regent Honeyeater, Swift Parrot, Grey-headed Flying fox as well as other blossom feeding bats and birds that are known or predicted to occur in the locality.

Given the limited extent and context of this vegetation and extensive areas of alternative foraging habitat within the local area it is highly unlikely that the removal of this planted vegetation would result in any substantial impacts to any threatened fauna species.

## 8.7 Consideration of Matters of Environmental Significance (MNES)

The proposal would remove a small amount of potential foraging habitat for several species listed as threatened under the EPBC Act. This includes the Swift Parrot and Regent Honeyeater, both of which are listed as critically endangered species under the EPBC Act as well as the Grey Headed Flying-fox, Small Leaved Grevillea and Parramatta Red Gum which are listed as vulnerable species and the White-bellied Sea-Eagle which is listed as a migratory marine species. While these species may forage opportunistically on occasion there is not breeding habitat for the Swift Parrot, Regent Honeyeater or White-bellied Sea-Eagle and no Grey-headed Flying-fox roosts occur.

Assessments of significance have been prepared for these five species in accordance with the '*Matters of National Environmental Significance Significant impact guidelines 1.1 Environment Protection and Biodiversity Conservation Act 1999*' (DotE, 2013). These assessments are provided in Appendix E).

Given that only a small area of potential foraging habitat for these species would be impacted and that there are large areas of much higher quality habitat surrounding the proposal site and within locality, the proposal is unlikely to constitute a significant impact on the Regent Honeyeater, Swift Parrot or Grey-headed Flying Fox and no further assessment or approval of the proposal under the EPBC Act is likely to be required.

Similarly, the proposal would remove a relatively small number and area of potential habitat for Parramatta Red Gum and Small Flowered Grevillea. Assessments of significance determined that the proposal is not likely to result in a significant impact on either of these flora species and as such referral under the EPBC Act is not likely to be required.

## 9. Offsetting

### 9.1 Biodiversity Conservation Act offset requirements

Impacts associated with the proposal that require offsetting include the removal of 1.35 ha of native vegetation and associated habitat for threatened biota. Impacts within the proposal site that require biodiversity offsets are shown on Figure 9.5.

#### 9.1.1 Impacts requiring offsetting

##### 9.1.1.1 Ecosystem credits

The data from the fieldwork and mapping was entered into version 1.4.0.00 of the BAM calculator as a 'Development Assessment' to determine the number and type of biodiversity credits that would be required to offset impacts of the proposal (Case 00037534/BAAS17098/23/00037535\_Revision 0).

The biodiversity credit reports are included in Appendix H and are summarised below.

There are 1.35 ha of native vegetation and associated threatened species habitat that would be directly impacted within the proposal site. It has been assumed that all vegetation and habitat resources in the proposal site would be removed so the 'future vegetation integrity score' for this vegetation zone was entered as 0.

Additional ecosystem credits have also been included to account for any potential indirect impacts that may occur as a result of the development (this offset has been calculated by applying a 10 metre buffer to adjacent areas of native vegetation and adding a total 0.45 ha additional area to vegetation zones).

Ecosystem credits that would be required to offset the impacts of the proposal are shown in Table 9.1.

**Table 9.1** Ecosystem credits required to offset direct and indirect impacts of the proposal

| Vegetation zone / PCT                                                                                                              | Area (ha) (direct impacts) | Area (ha) (indirect impacts) | Total      | Current VI score | Future VI score | Change in VI score | BC Act status | Ecosystem credits required |
|------------------------------------------------------------------------------------------------------------------------------------|----------------------------|------------------------------|------------|------------------|-----------------|--------------------|---------------|----------------------------|
| 1. Parramatta Red Gum-Narrow-leaved Apple-Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area (1633_Intact) | 0.08                       | 0.06                         | 0.14       | 62.1             | 0               | -62.1              | EEC           | 4                          |
| 2. Spotted Gum – Red Ironbark – Narrow-leaved Ironbark – Grey Box shrub grass open forest of the lower Hunter (1600_Weedy)         | 0.73                       | 0.00                         | 0.73       | 57.8             | 0               | -57.8              | EEC           | 21                         |
| 3. Grey Gum - Rough-barked Apple shrubby open forest of the lower Hunter (1591_intact)                                             | 0.32                       | 0.38                         | 0.70       | 65.8             | 0               | -65.8              | EEC           | 23                         |
| 4. Grey Gum - Rough-barked Apple shrubby open forest of the lower Hunter (1591_disturbed)                                          | 0.22                       | 0.01                         | 0.23       | 35.8             | 0               | -35.8              | EEC           | 4                          |
| <b>Total</b>                                                                                                                       | <b>1.35</b>                | <b>0.45</b>                  | <b>1.8</b> |                  |                 |                    |               | <b>52</b>                  |



### 9.1.1.2 Species credits

Species credits would be required to offset impacts on the following threatened species:

- Parramatta Red Gum (*Eucalyptus parramattensis* subsp. *decadens*)
- Small-flower Grevillea (*Grevillea parviflora* subsp. *parviflora*)
- Squirrel Glider (*Petaurus norfolcensis*)
- Southern Myotis (*Myotis macropus*)
- Swift Parrot (*Lathamus discolor*)
- Regent Honeyeater (*Anthochaera phygia*)

Species credits species that have been assessed by direct stem counts include Parramatta Red Gum. All other species credit species have been assessed using an area polygon.

Species polygons have been prepared for all flora and fauna species credit species that have been confirmed as present through survey, assumed to be present, or are likely to use the suitable habitat at the proposal site. (see Figure 9.1, Figure 9.2, Figure 9.3 and Figure 9.4).

The species polygons were mapped following the protocols for each species listed in the Threatened Biodiversity Data Collection in accordance with the BAM. The methods for calculating the species polygons for the species credit species recorded at the proposal site are provided in Table 9.2.

The species credits required to offset future impacts associated with development within proposal site are provided in Table 9.3.

**Table 9.2** Methods for calculating species polygons

| Species credit                                                                  | Type  | Method                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|---------------------------------------------------------------------------------|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Parramatta Red Gum ( <i>Eucalyptus parramattensis</i> subsp. <i>decadens</i> )  | Count | <p>Targeted surveys for the species were undertaken in accordance with the survey guidelines for threatened flora in December 2022 (OEH 2016b).</p> <p>A total of five Parramatta Red Gum individuals were recorded within or immediately adjacent to the proposal site (refer to Figure 9.1).</p> <p>This species occurs as a co-dominant species within PCT 1633 Parramatta Red Gum – Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Small-flower Grevillea ( <i>Grevillea parviflora</i> subsp. <i>parviflora</i> ) | Area  | <p>Area of habitat is used as the unit of measurement to calculate species credits for this species in the BAM Calculator. The species polygon for Small-flowered Grevillea are shown on Figure 9.1</p> <p>In accordance with the BAM species polygon areas for these species was calculated based on the GHD accredited assessor's assessment of the area of occupied suitable habitat.</p> <p>A total of nineteen Small-flower Grevillea stems were recorded within the proposal site.</p> <p>The species polygon developed for Small-flowered Grevillea comprise a minimum buffer area of 30 meters from the point locations of individual stems, expanded to encompass continuous areas of suitable habitat between groups of stems. It is assumed that the area of suitable habitat ends 30 meters from the outermost recorded stems as environmental gradients change away from the core areas of occupied habitat. For this species within the development site, this is probably due to changing soil texture and chemical properties and/or local changes in relief or topography.</p> <p>The total size of the areas of habitat for Small-flower Grevillea within the proposal site was calculated to be 0.47 ha.</p> |
| Southern Myotis ( <i>Myotis macropus</i> )                                      | Area  | <p>Approximately ten Southern Myotis individuals were recorded roosting within a culvert that runs beneath the train line adjacent to the proposal site.</p> <p>The species polygon for this species was calculated in accordance with the requirements specified in Table 1 of the “<i>species credit threatened bats and their habitats: NSW survey guide for the BAM</i> (OEH 2018).</p> <p>Aerial imagery was used to map waterbodies with pools/stretches 3 m or wider or within 200 m of the subject land. All habitat within 200 m of mapped waterbodies was then mapped as the species polygon, with habitat defined as any PCTs on the subject land with which this species is associated (as listed in the TBDC) (refer to Figure 9.2).</p> <p>There is 0.77 ha of potential habitat for the Southern Myotis within the species polygon.</p>                                                                                                                                                                                                                                                                                                                                                                          |

| Species credit                                      | Type | Method                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|-----------------------------------------------------|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Squirrel Glider<br>( <i>Petaurus norfolcensis</i> ) | Area | <p>All woodland and forest PCTs within the proposal site contain suitable foraging and nesting habitat for the Squirrel Glider (refer to Figure 9.2).</p> <p>The species polygon for this species was mapped to include all areas of intact PCTs within the proposal site which are associated with this species (as listed in the TBDC).</p> <p>There is 1.35 ha of potential habitat for the Squirrel Glider within the species polygon.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Regent Honeyeater<br>( <i>Anthochaera phrygia</i> ) | Area | <p>DPIE has produced a map important habitat for Regent Honeyeater (DPIE 2022f).</p> <p>Areas identified in The Regent Honeyeater National Recovery Plan (2016) as critical to the survival of the species formed the basis of the mapping for use in the BAM. These were refined to only include areas of suitable habitat based on expert opinion and Plant Community Types (PCTs) associated with the species.</p> <p>BOAMS states that to develop the Regent Honeyeater Important habitat map "A dataset of occurrence records was generated from BioNet, BirdLife Australia, Australian National University Difficult Bird Research Group and expert opinion of historic, unrecorded breeding. Records were overlayed on the refined areas. All woodland vegetation within 200 m of a record was added.</p> <p>Records of known breeding events that occurred outside of the polygons created above were identified. Radial buffers of 1 km were applied to single breeding events (once off breeding at a location) and 5 km buffers applied to multiple breeding events (multiple events in the same year or over multiple years at one location). All woodland vegetation was selected within 1 km buffers. Within 5 km buffers, PCTs associated with the species were selected, along with all woodland vegetation within 200 m of a record"</p> <p>The species polygon for the Regent Honeyeater has been created based on the Regent Honeyeater Important Area mapped by DPE within the proposal site (Figure 9.3)</p> <p>There is 0.47 ha of mapped important habitat for the Regent Honeyeater (excluding cleared areas and exotic vegetation) within the species polygon.</p> |
| Swift Parrot<br>( <i>Lathamus discolor</i> )        | Area | <p>DPIE has produced a map important habitat for Swift Parrot (DPIE 2022f). Important habitat maps identify areas that are considered essential to support critical life stages of the species, e.g. breeding areas or locations important for foraging/over-wintering for migratory species. These species are dual credit species assessed for species (important habitat map) and ecosystem credits (all other areas the species is likely to occur).</p> <p>The BAM-C states that to produce the Swift Parrot important habitat map "sighting records from 1990-2020 were extracted from BioNet and BirdLife Australia Atlas. Records were checked and cleaned and a 2 km radial buffer was applied.</p> <p>Areas with sightings of five or more birds recorded over any two or more years, or single sightings of 40 or more birds, were identified as important for the species.</p> <p>The NSW State Vegetation Type Map (SVTM), including draft Eastern NSW classification SVTM v1.1.0 (Eastern NSW), was used to select PCTs associated with the Swift Parrot within the buffers. Any areas of vegetation less than one hectare were excluded".</p> <p>The species polygon for the Swift Parrot has been created based on the Swift Parrot Important Area mapped within the proposal site with areas of areas of planted vegetation and cleared areas excluded (as per BCD advise as these areas are not considered important habitat for the Swift Parrot (Figure 9.4).</p> <p>There is 1.34 ha of mapped important habitat for the Swift Parrot within the species polygon (DPIE 2023f).</p>                                                                                     |

**Table 9.3** Species credits required to offset impacts of the proposal in the proposal site

| Species Name                                            | Common Name            | Area of habitat (ha)/count | Species credits required |
|---------------------------------------------------------|------------------------|----------------------------|--------------------------|
| <i>Anthochaera phrgia</i>                               | Regent Honeyeater      | 0.47                       | 21                       |
| <i>Lathamus discolor</i>                                | Swift Parrot           | 1.34                       | 57                       |
| <i>Myotis macropus</i>                                  | Southern Myotis        | 0.77                       | 22                       |
| <i>Petaurus norfolcensis</i>                            | Squirrel Glider        | 1.35                       | 38                       |
| <i>Eucalyptus parramattensis</i> subsp. <i>decadens</i> | Paramatta Red Gum      | 5 individuals              | 10                       |
| <i>Grevillea parviflora</i> subsp. <i>parviflora</i>    | Small-flower Grevillea | 0.47                       | 14                       |

## 9.1.2 Impacts not requiring offsetting

Areas of cleared land (32.81 ha) and planted vegetation (0.92 ha) occur within the proposal site, these areas do not require offsetting under the BAM (refer to Figure 5.1 and Table 9.4).

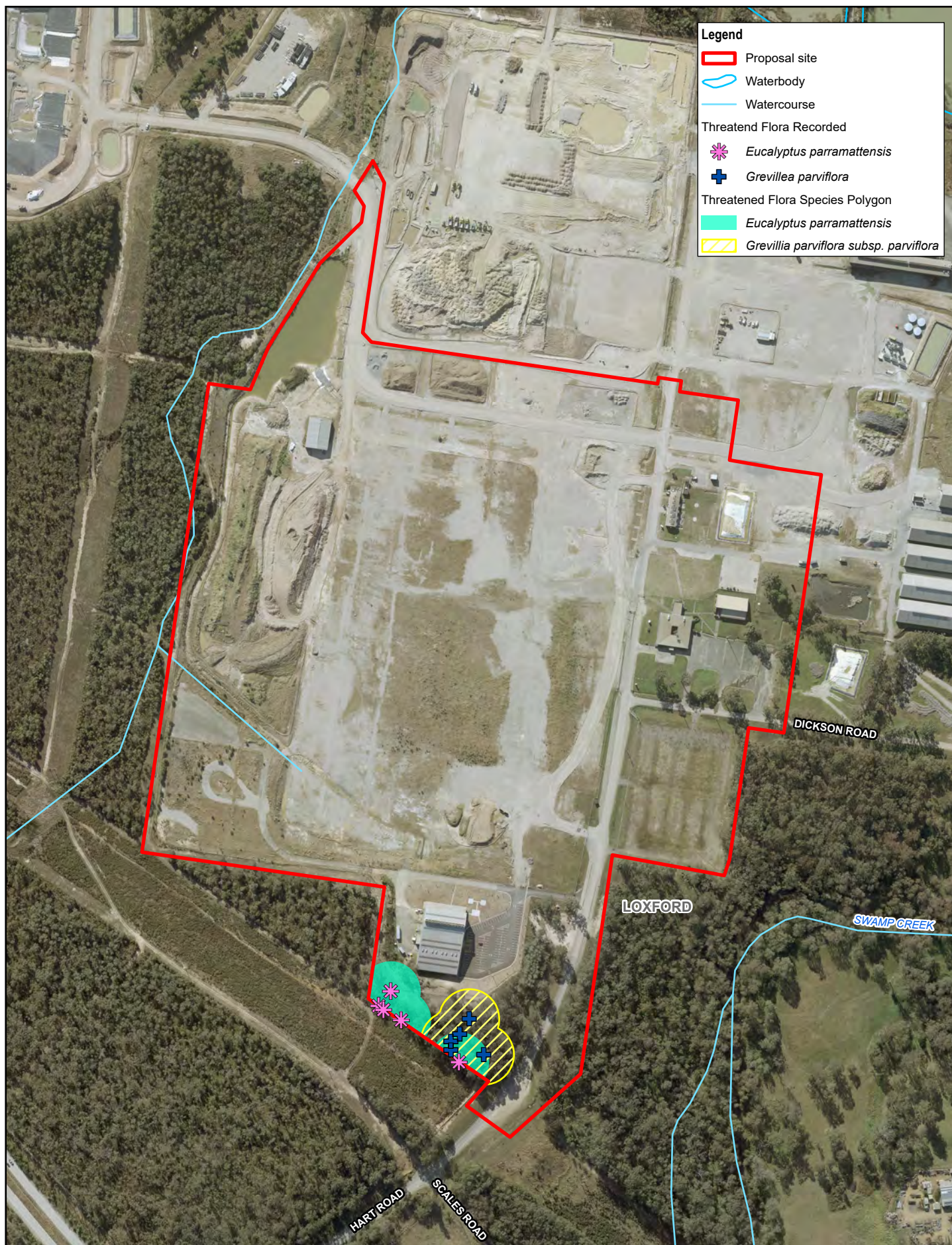
Cleared land within the proposal site does not contain native vegetation and therefore does not require offsetting under the BAM.

Assessment of planted vegetation within the proposal site in accordance with decision making key provided in Appendix D of the BAM (streamlined assessment module – planted native vegetation) determined that removal of this vegetation does not require offsetting (refer to Appendix E and Section 6.1.5. for results of assessment).

**Table 9.4** Impacts not requiring offsetting

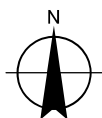
| Vegetation type                | Area (ha) (direct impacts) | Area (ha) (indirect impacts) | Current VI score | Future VI score | Change in VI score | BC Act status | Ecosystem credits required |
|--------------------------------|----------------------------|------------------------------|------------------|-----------------|--------------------|---------------|----------------------------|
| Cleared land/exotic vegetation | 32.81                      | 0                            | n/a              | n/a             | n/a                | Not listed    | 0                          |
| Planted vegetation             | 0.92                       | 0                            | n/a              | n/a             | n/a                | Not listed    | 0                          |





Paper Size ISO A4  
0 30 60 90 120  
Metres

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

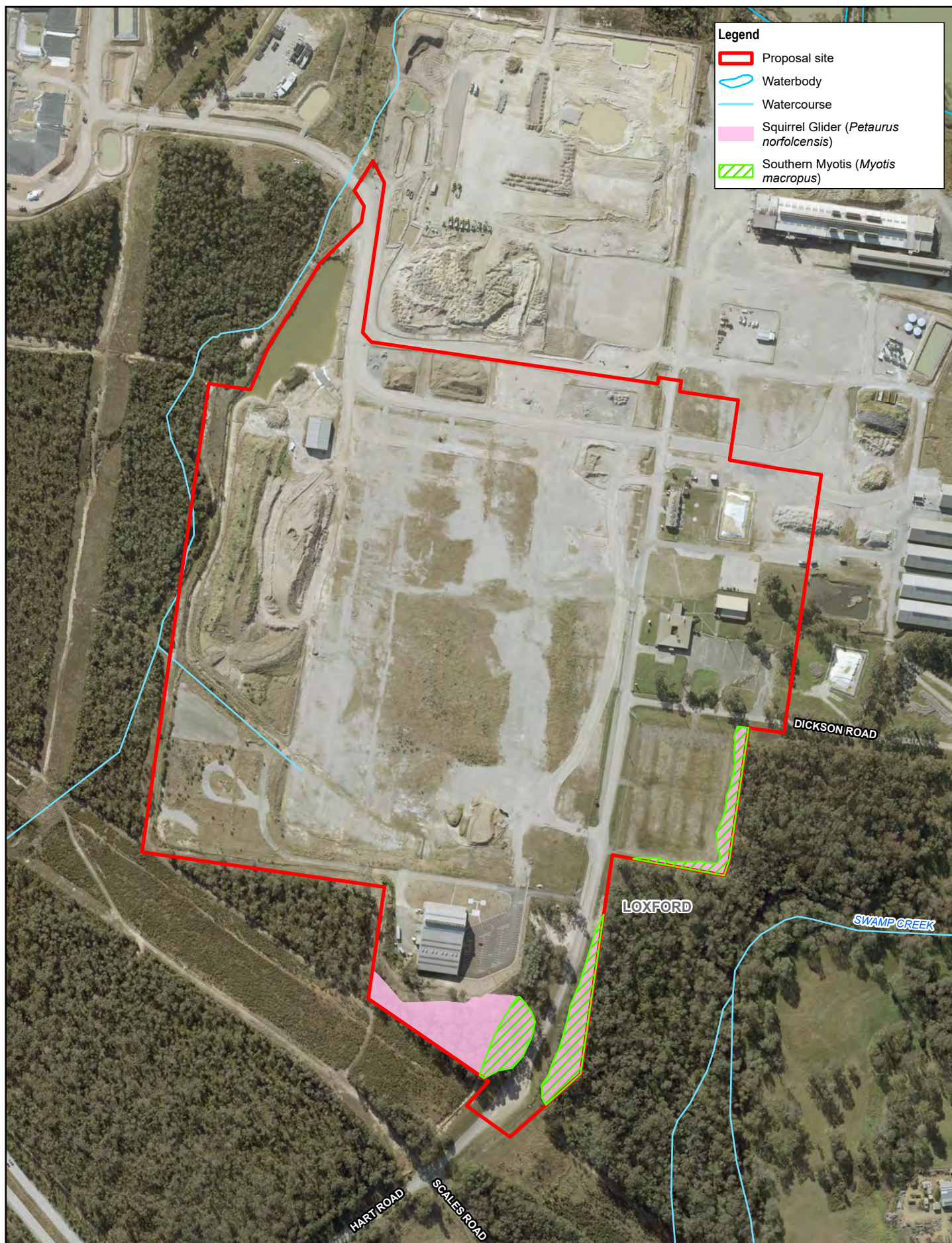


Loxford Project Group Pty Ltd  
Biodiversity Development Assessment Report  
Regrowth Industrial Subdivision (stages 1 and 2)  
**Threatened flora species polygons**  
***Eucalyptus parramattensis* and**  
***Grevillea parviflora subsp. parviflora***

Project No. 12527690  
Revision No. 0  
Date 30/01/2023

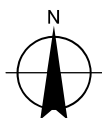
**FIGURE 9-1**





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Metres

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



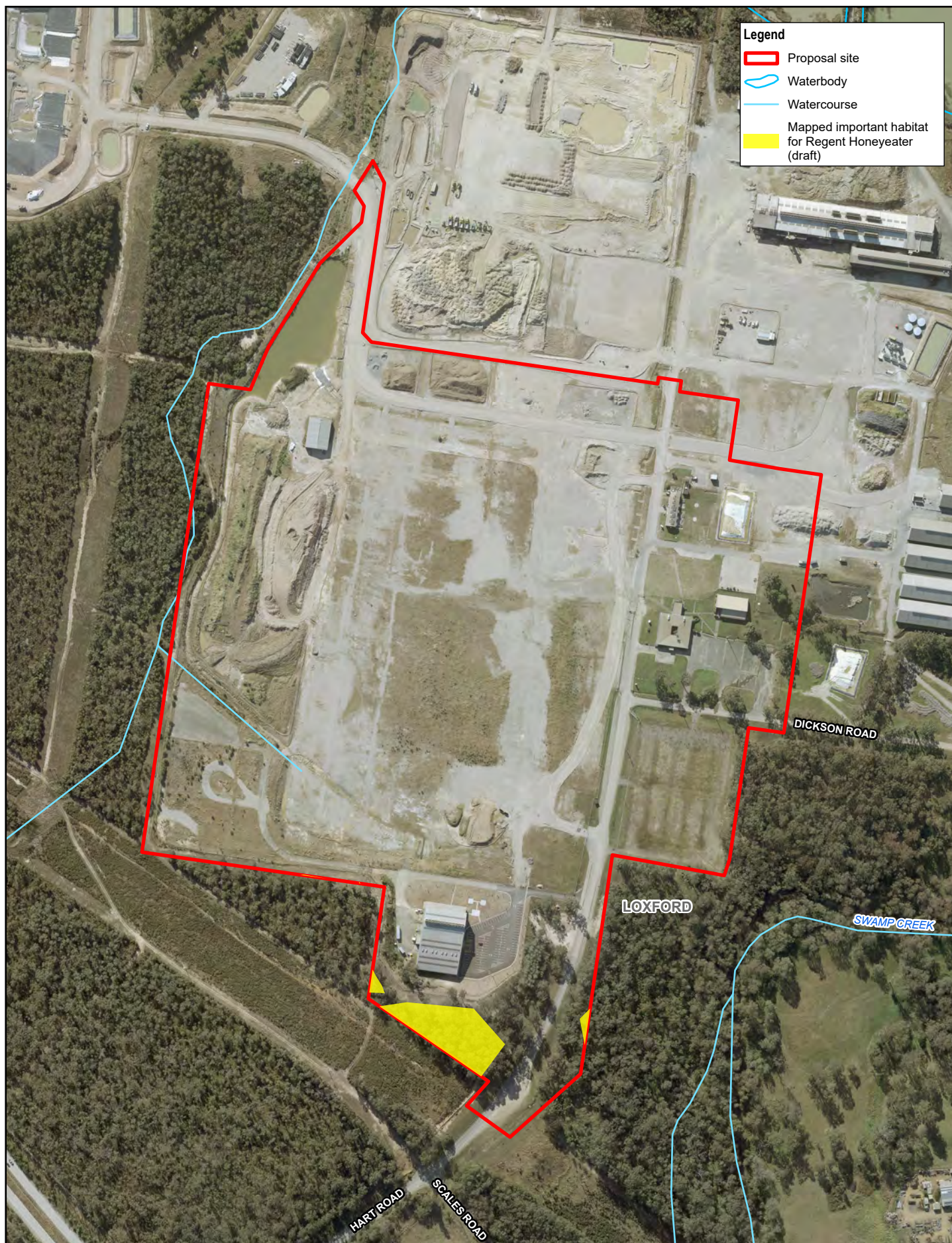
Loxford Project Group Pty Ltd  
Biodiversity Development Assessment Report  
Regrowth Industrial Subdivision (stages 1 and 2)

**Threatened fauna species polygons  
Southern Myotis and Squirrel Glider**

Project No. 12527690  
Revision No. 0  
Date 30/01/2023

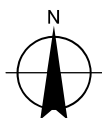
**FIGURE 9-2**





Paper Size ISO A4  
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Metres

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



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Biodiversity Development Assessment Report  
Regrowth Industrial Subdivision (stages 1 and 2)

**Threatened fauna species polygon  
for Regent Honeyeater**

Project No. 12527690  
Revision No. 0  
Date 30/01/2023

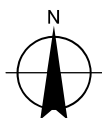
**FIGURE 9-3**





Paper Size ISO A4  
0 30 60 90 120  
Metres

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



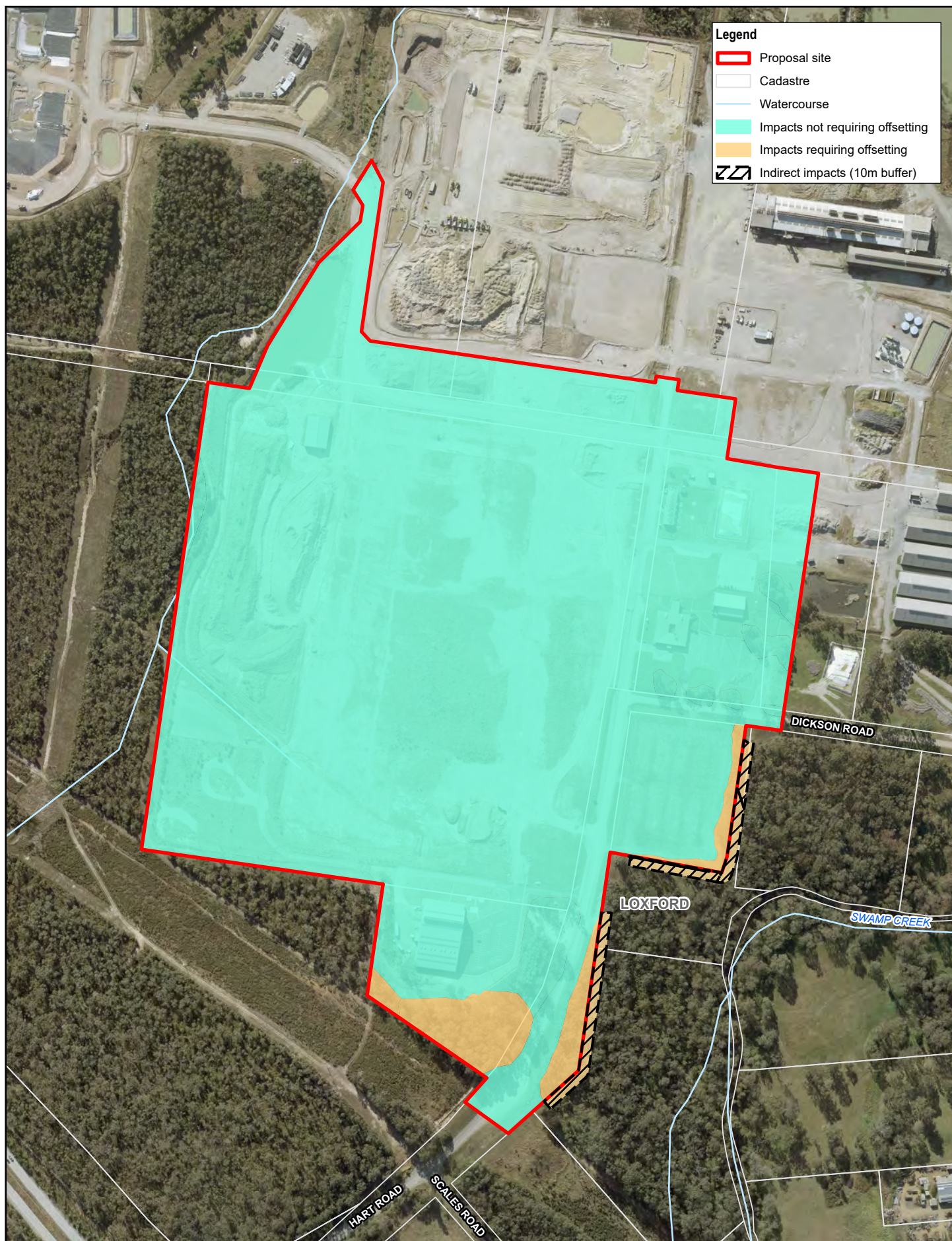
Loxford Project Group Pty Ltd  
Biodiversity Development Assessment Report  
Regrowth Industrial Subdivision (stages 1 and 2)

**Threatened fauna species polygon  
for Swift parrot**

Project No. 12527690  
Revision No. 0  
Date 30/01/2023

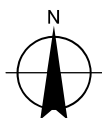
**FIGURE 9-4**





Paper Size ISO A4  
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 Metres

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



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 Regrowth Industrial Subdivision (stages 1 and 2)

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Areas requiring offsetting

**FIGURE 9-5**

### 9.1.3 Options to meet offset obligations/approach to delivering offsets

In accordance with the offset rules established by the *Biodiversity Conservation Regulation 2017* there are various means by which offset obligations described in Section 9.1 can be met. These include:

- Retiring the appropriate credits from an established stewardship site
- Monetary payment directly into the Biodiversity Conservation Trust Fund

### 9.1.4 Preferred offset approach

#### 9.1.4.1 Onsite stewardship site establishment

Loxford Project Management's preferred approach to offset the residual impacts of the proposed development is to secure and retire appropriate credits from a proposed 770 ha Biodiversity Stewardship Site (BSS), located adjacent to the development footprint (known as the Loxford Stewardship Site). The assessment of the proposed stewardship site has commenced and vegetation mapping at the site has determined that the proposed stewardship site contains each of the PCTs that would be impacted by the proposal. The required species credits for the Squirrel Glider, Southern Myotis and Regent Honeyeater would also be generated from the proposed BSS.

The proposed stewardship site would be assessed in accordance with the BAM and a separate Biodiversity Stewardship Site Assessment Report (BSSAR) would be prepared that would describe the ecosystem and species credits generated at the site. A Site Management Plan (SMP) would be prepared to describe the restoration and management actions required to be undertaken at the site to improve biodiversity values. The SMP would be accompanied by a Total Fund Deposit (TFD) amount which would determine the funds that would be required to implement the restoration and management program in perpetuity. An application for a Biodiversity Stewardship Agreement (BSA) would then be lodged with the Biodiversity Conservation Trust (BCT).

Vegetation types at the proposed stewardship site are similar to those within the proposal site and it is anticipated that the stewardship site would provide suitable habitat for a similar suite of threatened species and contain the appropriate credits to substantially meet offset obligations for the proposal. Once the stewardship site has been established appropriate like for like credits would be retired from the stewardship site accordingly.

#### 9.1.4.2 Biodiversity credit market

If the BSA has not been finalised by the time development is proposed to commence within the proposal site, like for like biodiversity credits and/or those that comply with the trading rules of the BOS would be secured through the open market.

'Like for like' trading rules for the ecosystem credits required for the proposal are shown in Table 9.5 and Table 9.6 and Appendix H. The 'like for like rules' for species credits require matching credits for each individual species, though these credits could be generated anywhere in NSW. An application to apply the 'variation to trading rules' is not preferred and would only be considered after all reasonable steps to seek like-for-like credits were undertaken (in accordance with the BAM) and suitable credits still could not be sourced.

**Table 9.5** 'Like for like' ecosystem credits required to offset impacts

| Name of Plant Community Type/ID                                                                              | Class                                                                                        | Trading groups | Hollow-bearing trees | Credits | IBRA subregions                                                                                                                                                                                             |
|--------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|----------------|----------------------|---------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| PCT 1633<br>Parramatta Red Gum – Narrow-leaved Ironbark-Grey Box shrub-grass open forest in the lower Hunter | Kurri Sand Swamp Woodland in the Sydney Basin Bioregion. This includes PCTs 1633, 1635, 1650 | -              | No                   | 4       | Hunter, Ellerton, Karuah Manning, Kerrabee, Liverpool Range, Peel, Tomalla, Upper Hunter, Wyong and Yengo<br>or<br>Any IBRA subregion that is within 100 kilometres of the outer edge of the impacted site. |



| Name of Plant Community Type/ID                                                                                     | Class                                                                                                                                        | Trading groups | Hollow-bearing trees | Credits | IBRA subregions                                                                                                                                                                                             |
|---------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|----------------|----------------------|---------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| PCT 1600 Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub grass open forest of the lower Hunter | Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions. This includes PCTs 1590, 1592, 1593, 1600, 1602 | -              | No                   | 21      | Hunter, Ellerton, Karuah Manning, Kerrabee, Liverpool Range, Peel, Tomalla, Upper Hunter, Wyong and Yengo<br>or<br>Any IBRA subregion that is within 100 kilometres of the outer edge of the impacted site. |
| PCT 1591 Grey Gum –Rough-braked Apple shrubby open forest of the lower Hunter                                       | Hunter Lowland Redgum Forest and NSW North Coast Bioregions<br>This includes PCT's: 1591, 1598, 1603, 1605, 1691, 1692, 1749                 | -              | No                   | 27      | Hunter, Ellerton, Karuah Manning, Kerrabee, Liverpool Range, Peel, Tomalla, Upper Hunter, Wyong and Yengo<br>or<br>Any IBRA subregion that is within 100 kilometres of the outer edge of the impacted site. |

**Table 9.6** 'Like for like' species credits required to offset impacts of the project

| Species                                                                           | PCT                                                         | Like-for-like retirement options species                                          | Like-for-like retirement options IBRA region |
|-----------------------------------------------------------------------------------|-------------------------------------------------------------|-----------------------------------------------------------------------------------|----------------------------------------------|
| Regent Honeyeater ( <i>Anthochaera phrygia</i> )                                  | 1633_intact<br>1600_intact<br>1591_intact<br>1591_disturbed | Regent Honeyeater ( <i>Anthochaera phrygia</i> )                                  | Any in NSW                                   |
| Swift Parrot ( <i>Lathamus discolor</i> )                                         | 1633_intact<br>1600_intact<br>1591_intact<br>1591_disturbed | Swift Parrot ( <i>Lathamus discolor</i> )                                         | Any in NSW                                   |
| Squirrel Glider ( <i>Petaurus norfolcensis</i> )                                  | 1633_intact<br>1600_intact<br>1591_intact<br>1591_disturbed | Squirrel Glider ( <i>Petaurus norfolcensis</i> )                                  | Any in NSW                                   |
| Southern Myotis ( <i>Myotis macropus</i> )                                        | 1633_intact<br>1600_intact<br>1591_intact<br>1591_disturbed | Southern Myotis ( <i>Myotis macropus</i> )                                        | Any in NSW                                   |
| Small-flowered Grevillea ( <i>Grevillea parviflora</i> subsp. <i>parviflora</i> ) | 1633_intact<br>1600_intact                                  | Small-flowered Grevillea ( <i>Grevillea parviflora</i> subsp. <i>parviflora</i> ) | Any in NSW                                   |
| Parramatta Red Gum ( <i>Eucalyptus parramattensis</i> subsp. <i>decadens</i> )    | 1633_intact                                                 | <i>Eucalyptus parramattensis</i> subsp. <i>decadens</i> )                         | Any in NSW                                   |

### 9.1.4.3 Biodiversity Conservation Fund Payment

Alternatively, a payment to the Biodiversity Conservation Fund would be considered to meet any residual credit requirements if the above two options are not available at the time credits need to be retired.

Cost to purchase credits through the BCF would be determined through the BCD Charge System.

# 10. Conclusion

Loxford Project Management Pty Ltd proposes to subdivide a portion of the former Hydro Aluminium Site into 19 separate Lots.

The proposal site includes approximately 35.20 ha of land that was part of the former Hydro Aluminium Smelter buffer zone. Areas of native vegetation within the site include small patches of remnant native vegetation adjoining larger tracks of vegetation along the southern and eastern boundaries of the site as well as a small patch along the western boundary.

Approximately 1.35 ha of the proposal site is comprised of native vegetation, 0.92 ha is planted vegetation and 32.81 ha is cleared land.

There are three PCTs present within the proposal site:

- PCT 1633 Parramatta Red Gum - Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area.
- PCT 1600 Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter.
- PCT 1591 Grey Gum –Rough-braked Apple shrubby open forest of the lower Hunter.

All three of these PCTs comprise local occurrences of endangered ecological communities listed under the BC Act.

Seven threatened fauna species classified as ecosystem credit species were recorded within vegetation adjacent to the proposal site These are:

- Grey-crowned Babbler (eastern subspecies) (*Pomatostomus temporalis temporalis*)
- Eastern Coastal Free-tailed Bat (*Micronomus norfolkensis*)
- Grey-headed Flying-fox (*Pteropus poliocephalus*)
- Little Bent-winged Bat (*Miniopterus australis*)
- Large Bent-winged Bat (probable) (*Miniopterus orianae oceanensis*)
- Varied Sittella (*Daphoenositta chrysoptera*)
- White-bellied Sea-Eagle (*Haliaeetus leucogaster*)

Each of these species are listed as vulnerable under the BC Act. The Grey-headed Flying-fox is also listed as a vulnerable species under the EPBC Act and White-bellied Sea-Eagle is listed as a migratory marine species.

Two species credit species Squirrel Glider (*Petaurus norfolcensis*) and Southern Myotis (*Myotis macropus*) have been assumed present based on the presence of previous records and the presence of suitable habitat within and adjacent to the proposal site (DPIE 2020b, ELA 2016).

There is mapped important habitat for the Regent Honeyeater and Swift Parrot within the proposal site. In accordance with the BAM these species have therefore also been assumed present. SAIL assessments have been completed and determined that in the opinion of the accredited assessor completing the assessment the proposal is unlikely to result in a SAIL for either the Regent Honeyeater or Swift Parrot.

The location and layout of the proposal has been designed to avoid impacts to areas adjacent to the site that have the best quality vegetation and highest biodiversity values. A range of mitigation measures are also proposed to minimise impacts of the development, including development and implementation of a Construction Environment Management Plan (CEMP) that would include comprehensive measures to maintain and improve vegetation adjacent to the site, manage habitat clearance, and prevent impacts associated with erosion and sedimentation, weeds, pest, noise light and vibration. These documents would also outline measures for the protection of vegetation to be retained on and adjacent to the site.

Credits to offset direct impacts within the site as well as potential indirect impacts adjacent to the site (applying a 10 metre buffer to areas of adjacent native vegetation) were calculated using version 1.4.0.00 of the BAM-C.

The following ecosystem and species credits would be required to offset the residual direct and indirect impacts of the proposal:

- Four ecosystem credits to offset direct impacts to 0.08 ha of PCT 1633, Parramatta Red Gum - Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area (intact) and indirect impacts to 0.06 ha of this PCT.
- 21 ecosystem credits to offset direct impacts to 0.72 ha of PCT 1600, Spotted Gum – Red Ironbark – Narrow-leaved Ironbark – Grey Box shrub grass open forest of the lower Hunter (intact).
- 23 ecosystem credits to offset direct impacts to 0.38 ha of PCT 1591 Grey Gum – Rough-braked Apple shrubby open forest of the lower Hunter (intact) and indirect impacts to 0.32 ha of this PCT.
- Four ecosystem credits to offset direct impacts to 0.22 ha of PCT 1591 Grey Gum – Rough-braked Apple shrubby open forest of the lower Hunter (disturbed) and indirect impacts to 0.01 ha of this PCT.
- 21 species credits to offset impacts to 0.47 ha of habitat mapped as important for the Regent Honeyeater.
- 57 species credits to offset impacts to 1.34 ha of habitat mapped as important for the Swift Parrot.
- 38 species credits to offset impacts to 1.35 ha of Squirrel Glider habitat.
- 22 species credits to offset impacts to 0.77 ha of Southern Myotis habitat.
- 10 species credits to offset impacts to five Parramatta Red Gum individuals.
- 14 species credits to offset impacts to 0.47 ha of Small-flower Grevillea habitat.

No ecosystem credits are required to offset removal of cleared land or planted vegetation.

There would be impacts on potential foraging habitat for six species Grey-headed Flying-fox, White-bellied Sea-Eagle, Regent Honeyeater, Swift Parrot, Parramatta Red Gum and Small-flower Grevillea listed as threatened or migratory under the EPBC Act. The proposal is unlikely to constitute a significant impact to any of these EPBC listed species. No further assessment or approval or provision of biodiversity offsets is likely to be required under the EPBC Act.

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# Appendices

# **Appendix A**

**Likelihood of occurrence of threatened  
and migratory biota**

## Likelihood of occurrence evaluation

An evaluation of the likelihood and extent of impact to threatened and migratory fauna recorded from within the Hunter LGA (BC Act threatened species and EPBC Act threatened and migratory species). Records are from a search of the NSW BioNet Atlas, and the EPBC Protected Matters Search Tool available from the Department of the Agriculture, Water and the Environment (DAWE) website. Ecology information has been obtained from the Threatened Species Profiles on the NSW Environment, Energy and Science website (<http://www.environment.nsw.gov.au/threatenedspecies/>) and from the Species Profiles and Threats Database on the Commonwealth DAWE website (<http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl>).

Status:

- National - Environment Protection and Biodiversity Conservation Act 1999
- NSW - Biodiversity Conservation Act 2016 and Fisheries Management Act 1994
- E - Endangered
- CE - Critically Endangered
- V - Vulnerable
- Mi - Migratory

Likelihood of occurrence in proposal site:

- Recorded – The species was observed in or adjacent to the proposal site during the current survey.
- High – It is highly likely that a species inhabits the study 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 and is known or likely to maintain resident populations in the study area. Also includes species known or likely to visit the proposal site during regular seasonal movements or migration.
- Moderate – Potential habitat is present in the study area. Species unlikely to maintain sedentary populations, however, may seasonally use resources within the study area opportunistically or during migration. The species is unlikely to be dependent (i.e. for breeding or important life cycle periods such as winter flowering resources) on habitat within the proposal site, or habitat is in a modified or degraded state.
- Low – It is unlikely that the species inhabits the study area and has not been recorded recently in the LGA. It may be an occasional visitor, but habitat similar to the study 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 study area or the species is a non-cryptic perennial flora species that were specifically targeted by surveys and not recorded. A category of 'Low' is also assigned for biota known or likely to be present in the proposal site but unlikely to be impacted by the project.
- None – Suitable habitat is absent from the proposal site

| Scientific Name                  | Common Name                                                 | Taxonomy | BC Act status | EPBC Act s | PMST (DAWE, 2020)                   | Candidate species (BAM-C) | Predicted species (BAM-C) | Habitat Association                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Likelihood of Occurrence | Justification                                                                                                                                                                                                                                   |
|----------------------------------|-------------------------------------------------------------|----------|---------------|------------|-------------------------------------|---------------------------|---------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Acacia bynoeana</i>           | Bynoe's Wattle                                              | -        | E             | V          | Habitat known to occur within area  | Y                         | -                         | Found in central eastern NSW, from the Hunter to the Southern Highlands to west of the Blue Mountains. Occurs in dry sclerophyll forest or heathlands on sandy soils. Associated with Red Bloodwood <i>Corymbia gummifera</i> , Scribbly Gum <i>Eucalyptus haemastoma</i> and Parramatta Red Gum <i>Eucalyptus parramattensis</i> .                                                                                                                                                                                                                                                                                                                                             | Low                      | Species known to occur in wider Hydro site however was not recorded during tageted surveys of the proposal site                                                                                                                                 |
| <i>Angophora inopina</i>         | Charmhaven Apple                                            | -        | V             | V          | Habitat may occur within area       | -                         | -                         | Endemic to the Central Coast of NSW. 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. Occurs in four main vegetation communities: <i>Eucalyptus haemastoma</i> - <i>Corymbia gummifera</i> - <i>Angophora inopina</i> woodland/forest; <i>Hakea teretifolia</i> – <i>Banksia oblongifolia</i> wet heath; <i>Eucalyptus resinifera</i> – <i>Melaleuca sieberi</i> – <i>Angophora inopina</i> sedge woodland; and <i>Eucalyptus capitellata</i> – <i>Corymbia gummifera</i> – <i>Angophora inopina</i> woodland/forest. | Low                      | No previous records within the proposal site. Vegetation communities within the proposal site do not correspond with known habitat for this species. Conspicuous species not recorded during targeted surveys.                                  |
| <i>Asperula asthenes</i>         | Trailing Woodruff                                           | -        | V             | V          | -                                   | Y                         | -                         | This herb occurs in scattered locations from Buladelah to Kempsey. Some records from Port Stephens/Wallis Lakes area. Occurs in damp sites, often along riverbanks (OEH 2012).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Low                      | No records within locality, suitable damp habitat not present within propal site.                                                                                                                                                               |
| <i>Caladenia tessellata</i>      | Thick-lipped Spider-orchid                                  | -        | E             | V          | Habitat may occur within area       | -                         | -                         | Known to exist within the Sydney and Central Coast area of NSW. It is found in grassy sclerophyll woodland. Found on clay loam or sandy soils. Flowers from September to November (this is reduced from late September to early October for southern populations).                                                                                                                                                                                                                                                                                                                                                                                                              | Low                      | The proposal site is located north of the Central Coast. Most of the sclerophyll woodland within the proposal site is shrubby. Not previously recorded in locality or known to occur within any of the PCTs that occur within the proposal site |
| <i>Callistemon linearifolius</i> | Netted Bottle Brush                                         | -        | V             | -          | -                                   | Y                         | -                         | Recorded from the Georges to Hawkesbury Rivers in Sydney, and north to Nelson Bay. There is also a recent record from the northern Illawarra. Grows in dry sclerophyll forest on the coast and adjacent ranges.                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Low                      | The species was found within wider Hydro site during targeted surveys. Not recorded during targeted surveys completed within the proposal site.                                                                                                 |
| <i>Cryptostylis hunteriana</i>   | Leafless Tongue-orchid                                      | -        | V             | V          | Habitat likely to occur within area | Y                         | -                         | Occurs in coastal areas from East Gippsland to southern Queensland. Habitat preferences not well defined. Grows mostly in coastal heathlands, margins of coastal swamps and sedgelands, coastal forest, dry woodland, and lowland forest. Prefers open areas in the understorey and is often found in association with Large Tongue Orchid and the Bonnet Orchid. Soils include moist sands, moist to dry clay loam and occasionally in accumulated eucalypt leaves. Flowers November-February.                                                                                                                                                                                 | Low                      | Suitable marginal habitat within the proposal site. Not found during targeted surveys and no previous records within or nearby to the proposal site. No other <i>Cryptostylis</i> species recorded during surveys.                              |
| <i>Cymbidium canaliculatum</i>   | Cymbidium canaliculatum population in the Hunter Catchment  | -        | EP            | -          | -                                   | -                         | -                         | The endangered population of this species occurs in the Hunter region, centred in the Upper Hunter north of Singleton but extending south to Weston and Pokolbin. Grows in hollows and forks of eucalypts and acacias, in dry sclerophyll forest or woodland. In the Hunter catchment most commonly found in White Box dominated communities.                                                                                                                                                                                                                                                                                                                                   | Low                      | Suitable habitat present, although no White Box occurs within the proposal site. Not recorded during surveys.                                                                                                                                   |
| <i>Cynanchum elegans</i>         | White-flowered Wax Plant                                    | -        | E             | E          | Habitat likely to occur within area | Y                         | -                         | Occurs from Gerroa (Illawarra) to Brunswick Heads and west to Merriwa in the upper Hunter. Most common near Kempsey. Usually occurs on the edge of dry rainforest or littoral rainforest, but also occurs in Coastal Banksia Scrub, open forest and woodland, and Melaleuca scrub. Soil and geology types are not limiting.                                                                                                                                                                                                                                                                                                                                                     | Low                      | No rainforest vegetation, banksia scrub or Melaleuca scrub within the proposal site. This species was not found during targeted surveys and no previous records of the species occur within the locality                                        |
| <i>Dichanthium setosum</i>       | Bluegrass                                                   | -        | V             | V          | Habitat likely to occur within area | -                         | -                         | Occurs on the New England Tablelands, North-west Slopes and Plains and the Central-west Slopes. Associated with heavy basaltic black soils and red-brown loams with clay subsoil. Often found in moderately disturbed areas, and appears to have wide environmental tolerances.                                                                                                                                                                                                                                                                                                                                                                                                 | None                     | No suitable habitat within the subject site due to the underlying soils predominantly sandstone influence.                                                                                                                                      |
| <i>Diuris pedunculata</i>        | Small Snake Orchid                                          | -        | E             | E          | -                                   | -                         | -                         | Originally found scattered from Tenterfield south to the Hawkesbury River, but is now mainly found on the New England Tablelands, around Armidale, Uralla, Guyra and Ebor. Grows on grassy slopes or flats, preferring moist areas between 50-900 m asl. Soils well-structured red-brown clay loams and stony loams, or occasionally on peaty soils, from shale and fine granite.                                                                                                                                                                                                                                                                                               | Low                      | Only one previous record within the locality, not suitable habitat present. Soil landscape within the proposal site unlikely to provide for suitable habitat.                                                                                   |
| <i>Eucalyptus camaldulensis</i>  | Eucalyptus camaldulensis population in the Hunter catchment | -        | EP            | -          | -                                   | -                         | -                         | Population occurs on the major floodplains of the Hunter and Goulburn Rivers. Grows in forested wetlands and grassy woodlands, especially in areas where water impoundment occurs after flood. Associated species include Forest Red Gum, Yellow Box, River Oak and Rough-barked Apple.                                                                                                                                                                                                                                                                                                                                                                                         | Low                      | Nearest record is approximately 8.5 km from the proposal site. Suitable wetland and woodland habitat does not occur within the proposal site. This species would be highly visible during site surveys.                                         |
| <i>Eucalyptus glaucina</i>       | Slaty Red Gum                                               | -        | V             | V          | Habitat known to occur within area  | Y                         | -                         | Distributed along the North coast of NSW. Occurs in grassy woodland and dry eucalypt forest. Prefers deep, moderately fertile and well-watered soils. Flowers from August to December.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Low                      | The species has an occurrence within the locality. Suitable habitat occurs within the proposal site however not detected during targeted surveys. The sandy soils indicate lack of optimal fertile soils.                                       |



| Scientific Name                                  | Common Name              | Taxonomy | BC Act statu | EPBC Act s | PMST (DAWE, 2020)                   | Candidate species (BAM-C) | Predicted species (BAM-C) | Habitat Association                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Likelihood of Occurrence | Justification                                                                                                                                                                                                                                                                                                                                                   |
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| <i>Eucalyptus parramattensis subsp. decadens</i> | Parramatta Red Gum       | -        | V            | V          | Habitat known to occur within area  | Y                         | -                         | Endemic to the Hunter Region of NSW. Occurs in low-lying, swampy areas. Found with Narrow-leaved Scribbly Gum <i>Eucalyptus racemosa</i> , Narrow-leaved Apple <i>Angophora bakeri</i> and White Stringybark <i>Eucalyptus globoidea</i> . Prefers deep low-nutrient sands.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Present                  | Two individuals recorded within PCT 1633 in south east of proposal site.                                                                                                                                                                                                                                                                                        |
| <i>Eucalyptus pumila</i>                         | Pokolbin Mallee          | -        | V            | V          | -                                   | Y                         | -                         | Currently known only from a single population west of Pokolbin in the Hunter Valley. Historical records also exist for Wyong and Sandy Hollow, however, has not been recorded recently in these areas. The single known population occupies north-west-facing slopes derived from sandstone. Present as a mid-canopy species to a height of 6 m within dry sclerophyll woodland which has a canopy comprising <i>Eucalyptus fibrosa</i> , <i>Callitris endlicheri</i> and, to a lesser extent, <i>Corymbia maculata</i> . Very little is known about the biology or ecology of this species.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Low                      | Proposal site is located east of Pobolkin and does not occur near the known current population. Marginal habitat occurs within the proposal site, the species was not found during targeted surveys and no previous records of this species occur within the locality,                                                                                          |
| <i>Euphrasia arguta</i>                          | -                        | -        | CE           | CE         | Habitat may occur within area       | -                         | -                         | Recently rediscovered near Nundle on the north-western slopes and tablelands, once known from scattered locations between Sydney, Bathurst and Walcha. Known populations occur in eucalypt forest with a mixed grass/shrub understorey, while previous records are described as occurring in open forest, grassy country and river meadows. Annual and dies back over winter. Dense stands observed in cleared firebreak areas, suggesting it may respond well to disturbance.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Low                      | Suitable Eucalypt habitat with a grassy/shrubby understorey occurs within the proposal site. Previous fire disturbance has also occurred within the proposal site however, this has resulted in dense thickets of <i>Acacia</i> spp, and is unlikely to provide preferred growing conditions. The species has not been previously recorded within the locality. |
| <i>Grevillea parviflora subsp. parviflora</i>    | Small-flower Grevillea   | -        | V            | V          | Habitat known to occur within area  | Y                         | -                         | Occurs between Moss Vale/Bargo and lower Hunter Valley, with most occurrences in Appin, Wedderburn, Picton and Bargo. Broad habitat range including heath, shrubby woodland and open forest on light clay or sandy soils, and often in disturbed areas such as on the fringes of tracks.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Low                      | Species recorded during targeted surveys adjacent to the proposal land. Conspicuous species that would likely have been detected if present within the proposal site                                                                                                                                                                                            |
| <i>Maundia triglochinoides</i>                   | -                        | -        | V            | -          | -                                   | Y                         | -                         | Coastal NSW: current southern limit at Wyong, former populations near Sydney now extinct. Grows on heavy clay, low nutrient soil in swamps, lagoons, dams, channels, creeks or shallow freshwater 30-60 cm depth.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Low                      | No wetland habitat present within proposal site                                                                                                                                                                                                                                                                                                                 |
| <i>Melaleuca biconvexa</i>                       | Biconvex Paperbark       | -        | V            | V          | Habitat may occur within area       | Y                         | -                         | Scattered, disjunct populations in coastal areas from Jervis Bay to Port Macquarie, with most populations in the Gosford-Wyong areas. Grows in damp places, often near streams or low-lying areas on alluvial soils over shale of low slopes or sheltered aspects                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Low                      | No damp, streamside habitat present within proposal site                                                                                                                                                                                                                                                                                                        |
| <i>Ozothamnus tesselatus</i>                     | -                        | -        | V            | V          | -                                   | Y                         | -                         | Restricted to a few locations in an east-west zone south of Bunnan and between west Bylong and east Ravensworth. Grows in eucalypt woodland.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Low                      | Suitable habitat within the proposal, however the species was not found during targeted surveys. No previous records within the locality.                                                                                                                                                                                                                       |
| <i>Persicaria elatior</i>                        | Knotweed                 | -        | V            | V          | Habitat likely to occur within area | Y                         | -                         | Tall Knotweed has been recorded in south-eastern NSW (Mt Dromedary (an old record), Moruya State Forest near Turlinjah, the Upper Avon River catchment north of Robertson, Bermagui, and Picton Lakes. In northern NSW it is known from Raymond Terrace (near Newcastle) and the Grafton area (Cherry Tree and Gibberagee State Forests). This species normally grows in damp places, especially beside streams and lakes. Occasionally in swamp forest or associated with disturbance.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Low                      | No damp, streamside habitat present within proposal site                                                                                                                                                                                                                                                                                                        |
| <i>Persoonia hirsuta</i>                         | Hairy Geebung            | -        | E            | E          | Habitat may occur within area       | -                         | -                         | Occurs within the Blue Mountains, Southern Highlands and Sydney coastal regions from Hilltop to Glen Davis and Royal NP to Gosford. Population within the Hills Shire particularly important due to high density of plants. Grows on sandy soils in dry sclerophyll open forest, woodland and heath on sandstone up to 600 m above sea level.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Low                      | Suitable habitat within the proposal site. The site is not located within the species known range. No previous records within the locality.                                                                                                                                                                                                                     |
| <i>Persoonia pauciflora</i>                      | North Rothbury Persoonia | -        | CE           | CE         | Habitat may occur within area       | -                         | -                         | Extremely restricted distribution; all but one of the plants which make up the only known population occur within a 2.5 km radius of the original specimen at North Rothbury in the Cessnock local government area. Within this range, there are three main sub-populations which comprise approximately 90% of the total population. The other 10% of the population occurs as scattered individuals in what is a relatively disturbed landscape. It is found in dry open forest or woodland dominated by Spotted Gum ( <i>Corymbia maculata</i> ), Broad-leaved Ironbark ( <i>Eucalyptus fibrosa</i> ) and/or Narrow-leaved Ironbark ( <i>E. crebra</i> ) and supporting a moderate to sparse shrub layer and grassy groundcover. The majority of the population is known to occur on silty sandstone soils derived from the Farley Formation. Flowers from January through to May. Its breeding system is unknown, but it is likely that native bees are required for pollination. Seedlings are present in most sub-populations which indicates that the population is capable of reproducing under favourable conditions. | Low                      | Nearest record is approximately 8.5 km from the proposal site. Soil landscape is not derived from the Farley Formation. Its highly restricted distribution indicates likelihood of occurrence is unlikely.                                                                                                                                                      |

| Scientific Name                 | Common Name                    | Taxonomy | BC Act statu | EPBC Act s | PMST (DAWE, 2020)                  | Candidate species (BAM-C) | Predicted species (BAM-C) | Habitat Association                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Likelihood of Occurrence | Justification                                                                                                                                                                                   |
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| <i>Pomaderris queenslandica</i> | Scant Pomaderris               | -        | E            | -          | -                                  | Y                         | -                         | Widely scattered but not common in north-east NSW and in Queensland. It is known from several locations on the NSW north coast and a few locations on the New England Tablelands and North West Slopes, including near Torrington and Coolata. Found in moist eucalypt forest or sheltered woodlands with a shrubby understorey, and occasionally along creeks.                                                                                                                                                                                                                                                                                                                                                                                           | Low                      | Marginal habitat within the proposal. Species not found during targeted surveys. There have also been no previous records within the locality.                                                  |
| <i>Prasophyllum sp. Wybong</i>  | a leek-orchid                  | -        | -            | CE         | Habitat may occur within area      | -                         | -                         | Endemic to NSW, known from seven populations within the Border Rivers, Central Rivers and Central West NRM regions. Known to occur in open eucalypt woodland and grassland.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Low                      | Despite suitable habitat occurring within the proposal site, it is located within predicted habitat only. No previous records within the locality. Not associated with PCTs present within site |
| <i>Prostanthera cineolifera</i> | Singleton Mint Bush            | -        | V            | V          | Habitat may occur within area      | -                         | -                         | Inhabits sclerophyll forests and open woodlands on exposed sandstone ridges, usually on shallow or skeletal sands. Restricted to few areas near Walcha, Scone and St Albans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Low                      | No suitable exposed sandstone ridges within proposal site. There have also been no previous records within the locality.                                                                        |
| <i>Pterostylis chaetophora</i>  | <i>Pterostylis chaetophora</i> | -        | V            | -          | -                                  | Y                         | -                         | Recorded in Queensland and NSW. In NSW it is currently known from 18 scattered locations in a relatively small area between Taree and Kurri Kurri, extending to the south-east towards Tea Gardens and west into the Upper Hunter, with additional records near Denman and Wingen. There are also isolated records from the Sydney region. The species occurs in two conservation reserves, Columbey National Park and Wingen Maid Nature Reserve. The preferred habitat is seasonally moist, dry sclerophyll forest with a grass and shrub understorey. Flowers from September to November. Vegetative reproduction is not common in this group of Greenhoods, but some species may form more than one dropper annually. Fails to flower in dry seasons. | Low                      | Suitable habitat within the proposal, however the species was not found during targeted surveys. There have also been no previous records within the locality.                                  |
| <i>Pterostylis gibbosa</i>      | Illawarra Greenhood            | -        | E            | E          | Habitat may occur within area      | -                         | -                         | Known from a small number of populations in the Illawarra, Nowra and Hunter regions. First collected in western Sydney. Only visible above the ground between late summer and spring, and only when soil moisture levels can sustain its growth. Grows in open forest or woodland, on flat or gently sloping land with poor drainage. In the Illawarra region, the species grows in woodland dominated by Forest Red Gum, Woollybutt and Melaleuca decora. Near Nowra, the species grows in an open forest of Spotted Gum, Forest Red Gum and Grey Ironbark. In the Hunter region, the species grows in open woodland dominated by Narrow-leaved Ironbark, Forest Red Gum and Black Cypress Pine.                                                         | Low                      | No cypress pine present within proposal site. Not associated with any of the PCTs present.                                                                                                      |
| <i>Rhizanthella slateri</i>     | Eastern Underground Orchid     | -        | V            | E          | Habitat may occur within area      | -                         | -                         | The species grows in eucalypt forest but no informative assessment of the likely preferred habitat for the species is available (DECC 2005b; c). Currently known only from 10 locations, including near Bulahdelah, the Watagan Mountains, the Blue Mountains, Wiseman's Ferry area, Agnes Banks and near Nowra. Flowers during October and November (Harden 1993).                                                                                                                                                                                                                                                                                                                                                                                       | Low                      | No previous records within the locality, species not known to occur in Hunter Valley area.                                                                                                      |
| <i>Rhodamnia rubescens</i>      | Scrub Turpentine               | -        | CE           | -          | -                                  | -                         | -                         | Occurs in coastal districts north from Batemans Bay in New South Wales, approximately 280 km south of Sydney, to areas inland of Bundaberg in Queensland. Populations of R. rubescens typically occur in coastal regions and occasionally extend inland onto escarpments up to 600 m a.s.l. in areas with rainfall of 1,000-1,600 mm. Found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest usually on volcanic and sedimentary soils.                                                                                                                                                                                                                                                                                  | None                     | No suitable habitat present within the subject site                                                                                                                                             |
| <i>Rhodomyrtus psidioides</i>   | Native Guava                   | -        | CE           | -          | -                                  | -                         | -                         | Occurs from Broken Bay, approximately 90 km north of Sydney, New South Wales, to Maryborough in Queensland. Populations are typically restricted to coastal and sub-coastal areas of low elevation however the species does occur up to c. 120 km inland in the Hunter and Clarence River catchments and along the Border Ranges in NSW. Pioneer species found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest often near creeks and drainage lines.                                                                                                                                                                                                                                                                    | None                     | No suitable habitat present within the subject site                                                                                                                                             |
| <i>Rutidosia heterogama</i>     | Heath Wrinklewort              | -        | V            | V          | Habitat known to occur within area | Y                         | -                         | This species has been recorded in several patches 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. Grows in heath on sandy sols and moist areas in open forest. Has also been recorded along disturbed roadsides.                                                                                                                                                                                                        | Low                      | A high number of previous records within the locality. The nearest record occurs approximately 2 km from the proposal site however species was not found during targeted surveys.               |
| <i>Syzygium paniculatum</i>     | Magenta Lilly Pilly            | -        | E            | V          | Habitat known to occur within area | -                         | -                         | Occurs in narrow coastal strip from Bulahdelah to Conjola State Forest. Grows in rainforest on sandy soils or stabilised Quaternary sand dunes at low altitudes in coastal areas, often in remnant littoral or gallery rainforests.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | None                     | No suitable habitat present within the subject site                                                                                                                                             |

| Scientific Name                        | Common Name             | Taxonomy | BC Act statu | EPBC Act s | PMST (DAWE, 2020)                  | Candidate species (BAM-C)                         | Predicted species (BAM-C) | Habitat Association                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Likelihood of Occurrence | Justification                                                                                                                                                                                                                                                                                                                                                                                      |
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| <i>Tetradthea juncea</i>               | Black-eyed Susan        | -        | V            | V          | Habitat known to occur within area | Y                                                 | -                         | Regarded as extinct within the Sydney area, current range from Wyong north to Bulahdelah and inland 50 km to edge of Sugarloaf Range. Occurs predominately in areas of over 1000 mm annual rainfall, within dry sclerophyll forest, and sometimes heath and moist forest, with a preference for Coastal Plains Smooth-barked Apple Woodland and Coastal Plains Scribbly Gum Woodland.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Low                      | The proposal site receives lower than 1000 mm annual rainfall. Despite potential habitat for the species to occur, the preferred vegetation types are not present within the site. A large number of previous records occur within the locality, however these are located approximately 7 km from the proposal site. Species not associated with any of the PCTs that occur within proposal site. |
| <i>Thesium australe</i>                | Austral Toadflax        | -        | V            | V          | Habitat may occur within area      | -                                                 | -                         | Found in small, scattered populations along the east coast, northern and southern tablelands. Occurs in grassland or grassy woodland, and is often found in association with Kangaroo Grass.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Low                      | No suitable habitat present. Historical grazing of grassland vegetation within the proposal site indicates that this species is unlikely to occur. Themeda not recorded within proposal site.                                                                                                                                                                                                      |
| <i>Zannichellia palustris</i>          | -                       | -        | E            | -          | -                                  | Y                                                 | -                         | Known from the Lower Hunter and Sydney Olympic Park. A submerged aquatic plant that grows in fresh or slightly saline water.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Low                      | No wetland habitat present within proposal site                                                                                                                                                                                                                                                                                                                                                    |
| <i>Anseranas semipalmata</i>           | Magpie Goose            | Bird     | V            | -          | -                                  | -                                                 | Y                         | Occurs in the tropics, increasing numbers in central and northern NSW and vagrants to south-east NSW. Inhabits shallow wetlands containing dense rushes or sedges, and nearby dry land used for grazing. It feeds on grasses, bulbs and rhizomes and roosts in tall vegetation within wetland areas. Breeding is occurs predominately in monsoonal areas and is unlikely in SE NSW. Nests are formed in trees over deep water.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Low                      | No wetlands present within proposal site                                                                                                                                                                                                                                                                                                                                                           |
| <i>Anthochaera phrygia</i>             | Regent Honeyeater       | Bird     | CE           | CE         | Habitat known to occur within area | Y (parts of the site mapped as important habitat) | Y                         | In NSW confined to two known breeding areas: the Capertee Valley and Bundarra-Barraba region. Non-breeding flocks occasionally seen in coastal areas foraging in flowering Spotted Gum and Swamp Mahogany forests, presumably in response to drought. Inhabits dry open forest and woodlands, particularly Box-Ironbark woodland and riparian forests of River Sheoak, with an abundance of mature trees, high canopy cover and abundance of mistletoes.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Moderate                 | Potential foraging habitat present Expert report indicates site does not contain suitable breeding habitat for this species. Mistletoe abundance is low.                                                                                                                                                                                                                                           |
| <i>Ardenna pacificus</i>               | Wedge-tailed Shearwater | Bird     | -            | Mi         | -                                  | -                                                 | -                         | The Wedge-tailed Shearwater breeds on the east and west coasts of Australia and on off-shore islands. The species is common in the Indian Ocean, the Coral Sea and the Tasman Sea. In Australia, Wedge-tailed Shearwaters have been observed feeding along the junction between inshore and offshore water masses.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | None                     | No suitable habitat within the subject site.                                                                                                                                                                                                                                                                                                                                                       |
| <i>Ardenna tenuirostris</i>            | Short-tailed Shearwater | Bird     | -            | Mi         | -                                  | -                                                 | -                         | This species breeds on Tasmania and off the coast of south Australia, with the bulk of the population in the south-east. Breeding occurs mainly on coastal islands, typically in areas of grassland or other vegetation, but sometimes cliffs or bare ground.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | None                     | No suitable habitat within the subject site.                                                                                                                                                                                                                                                                                                                                                       |
| <i>Arenaria interpres</i>              | Ruddy Turnstone         | Bird     | -            | Mi         | Habitat known to occur within area | -                                                 | -                         | Breeds in northern Hemisphere. In non-breeding season, widespread in most coastal regions of Australia with occasional inland records. Strongly prefers rocky shores or beaches with large seaweed deposits.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | None                     | No suitable habitat within the subject site.                                                                                                                                                                                                                                                                                                                                                       |
| <i>Artamus cyanopterus cyanopterus</i> | Dusky Woodswallow       | Bird     | V            | -          | -                                  | -                                                 | -                         | The Dusky Woodswallow is widespread from the coast to inland, including the western slopes of the Great Dividing Range and farther west. It is often recorded in woodlands and dry open sclerophyll forests, and has also been recorded in shrublands, heathlands regenerating forests and very occasionally in moist forests or rainforests. The understorey is typically open with sparse eucalypt saplings, acacias and other shrubs, often with coarse woody debris. It is also recorded in farmland, usually at the edges of forest or woodland or in roadside remnants or wind breaks with dead timber. The nest is an open shallow untidy cup frequently built in an open hollow, crevice or stump. Although Dusky Woodswallows have large home ranges, individuals may spend most of their time in about a 2 ha range and defend an area about 50 m around the nest. Dusky Woodswallows prefer larger remnants over smaller remnants. Competitive exclusion by Noisy Miners (Manorina melanoccephala) is a significant threat to this species. | Moderate                 | The species has a high number of records within the locality. Suitable dry sclerophyll forests occur within the proposal site for both foraging and breeding.                                                                                                                                                                                                                                      |
| <i>Botaurus poiciloptilus</i>          | Australasian Bittern    | Bird     | E            | E          | Habitat known to occur within area | -                                                 | Y                         | Widespread but uncommon over most NSW except the northwest. Favours permanent freshwater wetlands with tall dense reedbeds particularly Typha spp.and Eleocharis spp., with adjacent shallow, open water for foraging. Roosts during the day amongst dense reeds or rushes and feeds mainly at night on frogs, fish, yabbies, spiders, insects and snails.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Low                      | No wetland habitat present within proposal site                                                                                                                                                                                                                                                                                                                                                    |

| Scientific Name                  | Common Name            | Taxonomy | BC Act status | EPBC Act s | PMST (DAWE, 2020)                  | Candidate species (BAM-C) | Predicted species (BAM-C)           | Habitat Association                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Likelihood of Occurrence | Justification                                                                                                                                                                     |
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| <i>Burhinus grallarius</i>       | Bush Stone-curlew      | Bird     | E             | -          | -                                  | Y                         | -                                   | The Bush Stone-curlew is found throughout Australia except for the central southern coast and inland, the far south-east corner, and Tasmania. Only in northern Australia is it still common however and in the south-east it is either rare or extinct throughout its former range. Inhabits open forests and woodlands with a sparse grassy groundlayer and fallen timber. Nest on the ground in a scrape or small bare patch.                                                                                                                                                                                                      | Low                      | Suitable habitat occurs within the proposal site, however due to not found during targeted surveys and no previous records within the locality, the species is unlikely to occur. |
| <i>Calidris acuminata</i>        | Sharp-tailed Sandpiper | Bird     | -             | Mi         | Habitat known to occur within area | -                         | -                                   | Spends the non-breeding season in Australia with small numbers occurring regularly in New Zealand. Most of the population migrates to Australia, mostly to the south-east and are widespread in both inland and coastal locations and in both freshwater and saline habitats. Many inland records are of birds on passage. In Australasia, prefers muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation. Breeds in northern Siberia.                                                                                                                        | None                     | The wetland habitat within the subject site does not provide suitable muddy edges and saltmarsh for this species.                                                                 |
| <i>Calidris ferruginea</i>       | Curlew Sandpiper       | Bird     | E             | CE, Mi     | Habitat known to occur within area | Y                         | Y (not mapped as important habitat) | Breeds in northern hemisphere. In Australia generally occupies littoral and estuarine habitats. In NSW mainly found in intertidal mudflats on sheltered coasts. Roosts on beaches, spits or islands on the coast/in wetlands, or in saltmarsh on rocky shores.                                                                                                                                                                                                                                                                                                                                                                        | None                     | No suitable habitat within the subject site.                                                                                                                                      |
| <i>Calidris ruficollis</i>       | Red-necked Stint       | Bird     | -             | Mi         | Habitat known to occur within area | -                         | -                                   | Distributed along most of the Australian coastline with large densities on the Victorian and Tasmanian coasts. Breeds in Siberia and sporadically in north and west Alaska. In Australasia, mostly found in coastal areas, including in sheltered inlets, bays, lagoons and estuaries with intertidal mudflats, often near spits, islets and banks and, sometimes, on protected sandy or coralline shores. Occasionally they have been recorded on exposed or ocean beaches, and sometimes on stony or rocky shores, reefs or shoals.                                                                                                 | None                     | No intertidal mudflats occur within the subject site. No spits, islets, rocky shores or reefs.                                                                                    |
| <i>Calidris tenuirostris</i>     | Great Knot             | Bird     | V             | CE, Mi     | Habitat known to occur within area | Y                         | Y (not mapped as important habitat) | Breeds in northern hemisphere. In Australia, prefers sheltered coastal habitats with large intertidal mud or sandflats, including inlets, bays, harbours, estuaries and lagoons. Occasionally found on exposed reefs or rock platforms, mangroves, saltwork ponds, near-coastal swamps, saltlakes and non-tidal lagoons. Rarely occurs on inland lakes and swamps. Roosts in large groups in open areas, often at the water's edge or in shallow water close to feeding areas.                                                                                                                                                        | None                     | No suitable habitat within the subject site.                                                                                                                                      |
| <i>Callocephalon fimbriatum</i>  | Gang-gang Cockatoo     | Bird     | V             | -          | -                                  | Y (Breeding)              | Y                                   | Restricted to the south-eastern coast and highlands, from the lower Hunter and northern Blue Mountains to the Southwestern Slopes, south to and contiguous with the Victorian population. Inhabits eucalypt open forests and woodlands with an acacia understorey. In summer it lives in moist highland forest types, and in winter it moves to more open types at lower elevations. The Gang-Gang Cockatoo nests in hollows in the trunks, limbs or dead spouts of tall living trees, especially eucalypts, often near water. The Gang-gang Cockatoo feeds on seeds obtained in trees and shrubs, mostly from eucalypts and wattles. | Low                      | No suitable breeding habitat present within the site. The species was not found during targeted surveys                                                                           |
| <i>Calyptrorhynchus lathamii</i> | Glossy Black-Cockatoo  | Bird     | V             | -          | -                                  | Y (Breeding)              | Y                                   | Widespread but uncommon from coast to southern tablelands and central western plains. Feeds almost exclusively on the seeds of Allocasuarina species. Prefers woodland and open forests, rarely away from Allocasuarina. Roost in leafy canopy trees, preferably eucalypts, usually <1 km from feeding site. Nests in large (approx. 20 cm) hollows in trees, stumps or limbs, usually in Eucalypts (Higgins 1999).                                                                                                                                                                                                                   | Low                      | No presered feed trees (Casuarina or Allocasurina present within proposal site)                                                                                                   |
| <i>Charadrius leschenaultii</i>  | Greater Sand Plover    | Bird     | V             | V, Mi      | Habitat known to occur within area | -                         | -                                   | Does not breed in Australia. In NSW, recorded between the northern rivers and the Illawarra, with most records coming from the Clarence and Richmond estuaries. Occurs mainly on sheltered sandy, shelly or muddy beaches or estuaries with large intertidal mudflats or sandbanks. Roosts during high tide on sandy beaches and rocky shores; forage on wet ground at low tide.                                                                                                                                                                                                                                                      | None                     | No beaches within or in close proximity to the subject site in addition to estuaries with mudflats or sandbanks.                                                                  |
| <i>Charadrius mongolus</i>       | Lesser Sand Plover     | Bird     | V             | E, Mi      | Habitat known to occur within area | -                         | -                                   | Does not breed in Australia. Found along the entire coast of Australia, most common in northern NSW, QLD and the Gulf of Carpentaria. Rarely recorded south of the Shoalhaven. In NSW almost entirely coastal, on beaches of sheltered bays, harbours and estuaries with large intertidal sand or mudflats, occasionally on sandy beaches, coral reefs and rock platforms.                                                                                                                                                                                                                                                            | None                     | Subject site is located 30 km from the coast. No beaches or intertidal estuaries with mudflats or sandflats occur within the subject site.                                        |



| Scientific Name                       | Common Name                            | Taxonomy | BC Act status | EPBC Act s | PMST (DAWE, 2020)                   | Candidate species (BAM-C) | Predicted species (BAM-C) | Habitat Association                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Likelihood of Occurrence | Justification                                                                                                                                                                                                                           |
|---------------------------------------|----------------------------------------|----------|---------------|------------|-------------------------------------|---------------------------|---------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Chlidonias leucopterus</i>         | White-winged Black Tern                | Bird     | -             | Mi         | -                                   | -                         | -                         | Breeds in northern hemisphere, and one breeding record in New Zealand. In NSW, widespread east of the Great Divide, mainly north from Wollongong but with scattered records further south. Mostly inhabits a wide range of fresh, brackish or saline wetlands, which may be open or with floating emergent or marginal vegetation. Rarely occur on inland wetlands. Mainly forages aerially over water or muddy/ sandy wetland edges and adjacent habitats.                                                                                                                                             | Low                      | No suitable wetland habitat within proposal site.                                                                                                                                                                                       |
| <i>Chthonicola sagittata</i>          | Speckled Warbler                       | Bird     | V             | -          | -                                   | -                         | Y                         | Within NSW most frequently reported from the hills and tablelands of the Great Dividing Range, rarely from the coast. Inhabits a wide range of Eucalyptus-dominated communities with a grassy understorey, a sparse shrub layer, often on rocky ridges or in gullies. Sedentary and requires large, relatively undisturbed remnants to persist in an area. Forages on the ground for seeds and insects, and nests in a slight hollow in the ground or at the base of a low dense plant.                                                                                                                 | Low                      | No suitable habitat present within proposal site                                                                                                                                                                                        |
| <i>Circus assimilis</i>               | Spotted Harrier                        | Bird     | V             | -          | -                                   | -                         | Y                         | Occurs throughout Australian mainland, except in densely forested or wooded habitats of the coast, escarpment and ranges, and rarely in Tasmania. Individuals disperse widely in NSW and comprise a single population. Inhabits grassy open woodland including acacia and mallee remnants, inland riparian woodland, grassland and shrub steppe (e.g. chenopods). Most commonly in native grassland, but also in agricultural land, foraging over open habitats including edges of inland wetlands. Builds a stick nest in a tree and lays eggs in spring (or sometimes autumn).                        | Moderate                 | A low number of previous records within the locality. Potential foraging and breeding habitat within the proposal site. Known presence of other raptor species may discourage the Spotted Harrier from inhabiting the proposal site.    |
| <i>Climacteris picumnus victoriae</i> | Brown Treecreeper (eastern subspecies) | Bird     | V             | -          | -                                   | -                         | Y                         | Occurs from Corowa, Wagga Wagga, Temora, Forbes, Dubbo and Inverell to the east coast, in areas such as the Snowy River Valley, Cumberland Plain, Hunter Valley and parts of the Richmond and Clarence Valleys. Most common on the inland slopes and plains. Inhabits eucalypt woodlands and dry open forest, usually dominated by stringybarks or rough-barked species with open grassy understorey. Fallen timber is important foraging habitat. Nests in hollows in standing trees or stumps.                                                                                                        | High                     | The proposal site has suitable foraging habitat, which is characteristic of Eucalypt woodlands and dry open forest.Previously recorded adjacent to proposal site. No hollows or other breeding habitat present .                        |
| <i>Cuculus optatus</i>                | Oriental Cuckoo                        | Bird     | -             | Mi         | Habitat may occur within area       | -                         | -                         | This species migrates to northern and eastern Australia in the warmer months. Occurs south to the Shoalhaven area. Occurs in a range of habitats, including monsoon forest, rainforest edges, leafy trees in paddocks, river flats, roadsides and mangroves. It will forage from the ground, but requires shrubs or trees from which it sallies and returns to consume prey items.                                                                                                                                                                                                                      | Low                      | Marginal habitat occurs on site including remnant trees in paddocks and floodplain vegetation. No previous records within the locality of the proposal site.                                                                            |
| <i>Daphoenositta chrysoptera</i>      | Varied Sittella                        | Bird     | V             | -          | -                                   | -                         | Y                         | Sedentary, occurs across NSW from the coast to the far west. Inhabits eucalypt forests and woodlands, especially rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland. Sensitive to habitat isolation and loss of structural complexity, and adversely affected by dominance of Noisy Miners. Cleared agricultural land is potentially a barrier to movement. Builds a cup-shaped nest of plant fibres and cobwebs in an upright tree fork high in the living tree canopy, and often re-uses the same fork or tree in successive years.                    | High                     | Observed adjacent to the proposal land (Cessnock LGA) during targeted surveys. A high number of previous records within close proximity to the proposal site. Potential breeding and foraging habitat occurs within the proposal site.  |
| <i>Dasyornis brachypterus</i>         | Eastern Bristlebird                    | Bird     | E             | E          | Habitat likely to occur within area | -                         | -                         | Occurs in three disjunct areas of south-eastern Australia: southern Queensland/northern NSW, the Illawarra Region and in the vicinity of the NSW/Victorian border. Illawarra population comprises an estimated 1600 birds, mainly from Barren Grounds Nature Reserve, Budderoo National Park and the Jervis Bay area. Habitat characterised by dense, low vegetation including heath and open woodland with a heathy understorey. The fire history of habitat is important, and the Illawarra and southern populations reach maximum densities in habitat that have not been burnt for over 15 years.   | Low                      | The proposal site is not located within the three disjunct areas of known populations. No previous records within the locality. Recent fire within some areas of the proposal site may discourage the species from inhabiting the site. |
| <i>Ephippiorhynchus asiaticus</i>     | Black-necked Stork                     | Bird     | E             | -          | -                                   | -                         | Y                         | In NSW, becomes increasingly uncommon south of the Northern Rivers region, and rarely occurs south of Sydney. Breeding recorded as far south as Bulahdelah, though most breeding in NSW occurs in the north-east. Primarily inhabits permanent freshwater wetlands and surrounding vegetation including swamps, floodplains, watercourses and billabongs, freshwater meadows, wet heathland, farm dams and shallow floodwaters. Will also forage in inter-tidal shorelines, mangrove margins and estuaries. Feeds in shallow, still water. Breeds during summer, nesting in or near a freshwater swamp. | Low                      | No wetland or other suitable aquatic habitat present within proposal site                                                                                                                                                               |

| Scientific Name                 | Common Name             | Taxonomy | BC Act status | EPBC Act s | PMST (DAWE, 2020)                   | Candidate species (BAM-C) | Predicted species (BAM-C) | Habitat Association                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Likelihood of Occurrence | Justification                                                                                                                                                                                                                                                               |
|---------------------------------|-------------------------|----------|---------------|------------|-------------------------------------|---------------------------|---------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Epthianura albifrons</i>     | White-fronted Chat      | Bird     | V             | -          | -                                   | -                         | Y                         | This species occurs from southern Queensland to Western Australia and down to Tasmania, mostly in temperate to arid climates and very rarely in sub-tropical areas. It is found in damp open habitats, particularly wetlands containing saltmarsh areas that are bordered by open grasslands. Along the coast they are found in estuarine and marshy habitats with vegetation <1 m tall, and in open grasslands and areas bordering wetlands. Inland, they are often observed in grassy plains, saltlakes and saltpans along waterway margins.                                                                                                                                                                                                                                             | Low                      | No suitable habitat within proposal site. Only one previous record within the locality within approximately 8 km of the proposal site.                                                                                                                                      |
| <i>Erythroriorchis radiatus</i> | Red Goshawk             | Bird     | CE            | V          | Habitat likely to occur within area | -                         | -                         | Very rare in NSW, generally confined to the Northern Rivers bioregion with most records in the Clarence River catchment with few around the lower Richmond and Tweed Rivers. Inhabitat open woodland and forest, preferring mixed subtropical rainforest, Melaleuca swamp forest and riparian Eucalyptus forest of coastal rivers. Preferred habitats include a mosaic of vegetation types, a large population of birds (prey) and permanent water. Adults have large home ranges (up to 120 km <sup>2</sup> in NT), and in NSW appear to move from nesting areas in the ranges to coastal areas to coastal plains. Generally breed in tall trees within 1 km of a river or wetland.                                                                                                       | Low                      | No suitable aquatic habitats within or adjacent to site                                                                                                                                                                                                                     |
| <i>Falco subniger</i>           | Black Falcon            | Bird     | V             | -          | -                                   | -                         | -                         | The Black Falcon is widely, but sparsely, distributed in New South Wales, mostly occurring in inland regions. Some reports of 'Black Falcons' on the tablelands and coast of New South Wales are likely to be referable to the Brown Falcon. Occurs in plains, grasslands, foothills, timbered watercourses, wetland environs, crops, and occasionally over towns and cities. Breeding occurs along timbered waterways in in land areas.                                                                                                                                                                                                                                                                                                                                                   | Moderate                 | Potential foraging habitat within the proposal site. Known presence of other raptor species may discourage the Black Falcon from inhabiting the proposal site. NO breeding habitat present                                                                                  |
| <i>Gallinago hardwickii</i>     | Latham's Snipe          | Bird     | -             | Mi         | Habitat known to occur within area  | -                         | -                         | Occurs along the coast and west of the Great Dividing Range. Non breeding visitor to Australia. Inhabit permanent and ephemeral wetlands up to 2000 m asl. Typically in open, freshwater wetlands with low, dense vegetation (incl. swamps, flooded grasslands and heathlands). Can also occur in saline/brackish habitats and in modified or artificial habitats close to human activity.                                                                                                                                                                                                                                                                                                                                                                                                 | Low                      | No suitable wetland habitat within proposal site.                                                                                                                                                                                                                           |
| <i>Glossopsitta pusilla</i>     | Little Lorikeet         | Bird     | V             | -          | -                                   | -                         | Y                         | Occurs from coast to western slopes of the Great Dividing Range. Inhabits dry, open eucalypt forests and woodlands. Occurrence is positively associated with patch size, and with components of habitat complexity including canopy cover, shrub cover, ground cover, logs, fallen branches and litter. Feed primarily on profusely-flowering eucalypts and a variety of other species including melaleucas and mistletoes. On the western slopes and tablelands Eucalyptus albens and E. melliodora are particularly important food sources for pollen and nectar respectively. Mostly nests in small (opening approx. 3 cm) hollows in living, smooth-barked eucalypts, especially Eucalyptus viminalis, E. blakelyi and E. dealbata. Most breeding records are from the western slopes. | High                     | Observed adjacent to the proposal land (Cessnock LGA) during targeted surveys. May utilise flower eucalypts within the site for foraging.                                                                                                                                   |
| <i>Grantiella picta</i>         | Painted Honeyeater      | Bird     | V             | V          | Habitat likely to occur within area | -                         | Y                         | Nomadic, occurring in low densities across most of NSW. Highest concentrations and almost all breeding occur on inland slopes of the Great Dividing Range. Inhabits Boree, Brigalow and Box Gum woodlands and Box-Ironbark forests. Specialist forager on the fruits of mistletoes, preferably of the Amyema genus. Nests in outer tree canopy.                                                                                                                                                                                                                                                                                                                                                                                                                                            | Low                      | No breeding habitat within the proposal site, as it is not located on the inland sloped of the Great Dividing Range. Despite Box Gum woodlands and Box-Ironbark woodlands being present, mistletoe's are rare throughout the site. No previous records within the locality. |
| <i>Haliaeetus leucogaster</i>   | White-bellied Sea-Eagle | Bird     | V             | Ma         | -                                   | Y (Breeding)              | Y (foraging)              | Primarily coastal but may extend inland over major river systems. Breeds close to water, mainly in tall open forest/woodland but also in dense forest, rainforest, closed scrub or remnant trees. Usually forages over large expanses of open water, but also over open terrestrial habitats (e.g. grasslands).                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | High                     | Observed foraging adjacent to the site during site surveys (Cessnock LGA). A high number of previous records within the locality within very close proximity. Suitable foraging habitat within the site. No active nests were observed on site.                             |
| <i>Hamirostra melanosternon</i> | Black-breasted Buzzard  | Bird     | V             | -          | -                                   | -                         | -                         | Sparsely distributed in areas of less than 500 mm rainfall, north from north-western NSW. Inhabits a range of inland habitats, especially along timbered watercourses which is the preferred breeding habitat. Also hunts over grasslands and sparsely timbered woodlands. Breeds from August to October near water in a tall tree.                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Low                      | Some foraging and breeding habitat within the proposal site. Known presence of other raptor species may discourage the Black-breasted Buzzard from inhabiting the proposal site.                                                                                            |
| <i>Hieraaetus morphnoides</i>   | Little Eagle            | Bird     | V             | -          | -                                   | Y (Breeding)              | Y (foraging)              | Occurs throughout NSW except most densely forested parts of the Dividing Range escarpment. Occupies habitats rich in prey within open eucalypt forest, woodland or open woodland. Sheoak or acacia woodlands and riparian woodlands of interior NSW are also used. For nest sites it requires a tall living tree within a remnant patch, where pairs build a large stick nest in winter and lay in early spring.                                                                                                                                                                                                                                                                                                                                                                           | Moderate                 | Potential foraging and breeding habitat within the proposal site. Known presence of other raptor species may discourage the Little Eagle from inhabiting the proposal site.                                                                                                 |

| Scientific Name                   | Common Name                         | Taxonomy | BC Act status | EPBC Act s | PMST (DAWE, 2020)                  | Candidate species (BAM-C)   | Predicted species (BAM-C) | Habitat Association                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Likelihood of Occurrence | Justification                                                                                                                                                                                                                       |
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| <i>Hirundapus caudacutus</i>      | White-throated Needletail           | Bird     | -             | V, Mi      | Habitat known to occur within area | -                           | -                         | Recorded along NSW coast to the western slopes and occasionally from the inland plains. Breeds in northern hemisphere. Almost exclusively aerial while in Australia. Occur above most habitat types, but are more frequently recorded above more densely vegetated habitats (rainforest, open forest and heathland) than over woodland or treeless areas.                                                                                                                                                                                                                                                                                                                                                                                                                         | Moderate                 | Species likely to utilise the project are for fly-overs only. The open woodland and grassland areas within the proposal site provide lesser preferred habitat than densely vegetated habitats.                                      |
| <i>Irediparra gallinacea</i>      | Comb-crested Jacana                 | Bird     | V             | -          | -                                  | -                           | Y                         | Occurs on freshwater wetlands in northern and eastern Australia, mainly in coastal and subcoastal regions, from the north-eastern Kimberley Division of Western Australia to Cape York Peninsula then south along the east coast to the Hunter region of NSW – some recorded in south-eastern NSW potentially in response to unfavourable conditions (OEH 2012). Inhabit permanent freshwater wetlands, either still or slow-flowing, with a good surface cover of floating vegetation, especially water-lilies, or fringing and aquatic vegetation.                                                                                                                                                                                                                              | Low                      | No suitable wetland habitat within proposal site.                                                                                                                                                                                   |
| <i>Ixobrychus flavicollis</i>     | Black Bittern                       | Bird     | V             | -          | -                                  | -                           | Y                         | Occurs from southern NSW to Cape York and the Kimberley, and southwest WA. Inhabits terrestrial and estuarine wetlands, generally in areas of permanent water and dense vegetation. May occur in flooded grassland, forest, woodland, rainforest and mangroves as long as there is permanent water. Roosts by day in trees or within reeds on the ground. Nests in branches overhanging water and breeds from December to March.                                                                                                                                                                                                                                                                                                                                                  | Low                      | No suitable wetland habitat within proposal site.                                                                                                                                                                                   |
| <i>Lathamus discolor</i>          | Swift Parrot                        | Bird     | E             | CE         | Habitat known to occur within area | Y (mapped important habiat) | Y (foraging)              | Migratory, travelling to the mainland from March to October. Breeds in Tasmania from September to January. On the mainland, it mostly occurs in the southeast foraging on winter flowering eucalypts and lerps, with records of the species between Adelaide and Brisbane. Principal over-winter habitat is box-ironbark communities on the inland slopes and plains. Eucalyptus robusta, Corymbia maculata and C. gummifera dominated coastal forests are also important habitat.                                                                                                                                                                                                                                                                                                | Moderate                 | The species has a high number of previous records within close proximity to the proposal site. Marginal suitable foraging habitat present. Areas of mapped important habitat present                                                |
| <i>Limicola falcinellus</i>       | Broad-billed Sandpiper              | Bird     | V             | Mi         | Habitat known to occur within area | -                           | -                         | Breeds in the northern hemisphere. In the non-breeding season most common in north and north west of Australia, but is a regular visitor in small numbers to the NSW coast from Ballina to Shoalhaven Heads. Occurs on sheltered parts of the coast, favouring estuarine mudflats but also occasionally in saltmarshes, freshwater lagoons, saltworks and sewerage farms. Forage on exposed mudflats or wet sand.                                                                                                                                                                                                                                                                                                                                                                 | None                     | No suitable habitat within the subject site.                                                                                                                                                                                        |
| <i>Limosa lapponica baueri</i>    | Bar-tailed Godwit                   | Bird     | -             | V, Mi      | Habitat known to occur within area | -                           | -                         | Has been recorded in the coastal areas of all Australian states. It is widespread in the Torres Strait and along the east and south-east coasts of Queensland, NSW and Victoria, including the offshore islands. Breeds in the north of Scandinavia, Russia and north-west Alaska. Found mainly in coastal habitats such as large intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays.                                                                                                                                                                                                                                                                                                                                                   | None                     | No suitable habitat within the subject site.                                                                                                                                                                                        |
| <i>Limosa lapponica menzbieri</i> | Northern Siberian Bar-tailed Godwit | Bird     | -             | CE         | Habitat may occur within area      | -                           | -                         | The Northern Siberian Bar-tailed Godwit is a large Migratory shorebird which breeds in northern Siberia, Russia between the Khatanga River and the delta of the Kolyma River. During the non-breeding period, the distribution of L. l. menzbieri is predominantly in the north and north-west of Western Australia and in south-eastern Asia.                                                                                                                                                                                                                                                                                                                                                                                                                                    | None                     | No suitable habitat within the subject site.                                                                                                                                                                                        |
| <i>Limosa limosa</i>              | Black-tailed Godwit                 | Bird     | V             | Mi         | Habitat known to occur within area | -                           | -                         | The Black-tailed Godwit is a migratory wading bird that breeds in Mongolia and Eastern Siberia and flies to Australia for the southern summer, arriving in August and leaving in March. In NSW, it is most frequently recorded at Kooragang Island (Hunter River estuary), with occasional records elsewhere along the north and south coast, and inland. Records in western NSW indicate that a regular inland passage is used by the species, as it may occur around any of the large lakes in the western areas during summer, when the muddy shores are exposed. It is usually found in sheltered bays, estuaries and lagoons with large intertidal mudflats and/or sandflats. It has also been found around muddy lakes and swamps, wet fields and sewerage treatment works. | None                     | No previous records within the locality of the subject site. No muddy wetland flats or lakes occur within the subject site. May utilise adjacent wetland habitat which would provide better suited habitat for the species.         |
| <i>Lophoictinia isura</i>         | Square-tailed Kite                  | Bird     | V             | -          | -                                  | -                           | Y                         | Occurs across NSW, resident in North, northeast and along west-flowing rivers. Summer breeding migrant to southeast of state. Inhabits a variety of habitats including woodlands and open forests, with preference for timbered watercourses. Favours productive forests on the coastal plain, box-ironbark-gum woodlands on the inland slopes, and Coolibah/River Red Gum on the inland plains. In Sydney area nests in mature living trees within 100 m of ephemeral/permanent watercourse. Large home range > 100 km <sup>2</sup> .                                                                                                                                                                                                                                            | Low                      | Potential foraging and breeding habitat within the proposal site. Known presence of other raptor species may discourage the Square-tailed Kite from inhabiting the proposal site. The species was not found during targeted surveys |

| Scientific Name                        | Common Name                                   | Taxonomy | BC Act statu | EPBC Act s | PMST (DAWE, 2020)                   | Candidate species (BAM-C) | Predicted species (BAM-C) | Habitat Association                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Likelihood of Occurrence | Justification                                                                                                                                                                                                                                                                                                                                       |
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| <i>Melanodryas cucullata cucullata</i> | Hooded Robin (south-eastern form)             | Bird     | V            | -          | -                                   | -                         | Y                         | Considered a sedentary species, but local seasonal movements are possible. Prefers lightly wooded country, usually open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open areas. Occurrence is positively associated with patch size, and with components of habitat complexity including canopy cover, shrub cover, ground cover, logs, fallen branches and litter. Nests on low, live or dead forks or branches of trees or stumps, or occasionally on fallen trees or limbs.                                                                                                                                                                 | Moderate                 | Suitable open woodland habitat within the proposal site adjacent to clearings and open areas. Only one previous record within the locality. Potential breeding habitat within the proposal site.                                                                                                                                                    |
| <i>Melithreptus gularis gularis</i>    | Black-chinned Honeyeater (eastern subspecies) | Bird     | V            | -          | -                                   | -                         | -                         | Widespread in NSW, but rarely recorded east of Great Dividing Range except in Richmond and Clarence River areas and scattered sites in the Hunter, Central Coast and Illawarra regions. Mostly in upper levels of drier open forests /woodlands dominated by box and ironbark eucalypts, or less commonly smooth-barked gums, stringybarks and tea-treas. Forage over home range of >5 ha. Tend to occur within largest woodland patches in the landscape. They forage for insects, nectar and honeydew. The nest is hidden by foliage high in the crown of a tree.                                                                                                          | Moderate                 | Suitable box-ironbark vegetation within the proposal site for foraging and nesting. The species has previously been recorded in high number within the locality and has been recorded within approximately 2.5 km from the proposal site.                                                                                                           |
| <i>Monarcha melanopsis</i>             | Black-faced Monarch                           | Bird     | -            | Mi         | Habitat known to occur within area  | -                         | -                         | Found along the coast of eastern Australia, becoming less common further south. Found in rainforests, eucalypt woodlands, coastal scrub and damp gullies. It may be found in more open woodland when migrating. Resident in the north of its range, but is a summer breeding migrant to coastal south-eastern Australia, arriving in September and returning northwards in March. It may also migrate to Papua New Guinea in autumn and winter.                                                                                                                                                                                                                              | Moderate                 | No rainforest habitat within the proposal site. May utilise the open woodland within the proposal site for foraging or roosting, however it does not occur within a damp gully. Despite being characteristic of floodplain vegetation, these areas may still remain predominantly dry throughout the year. No previous records within the locality. |
| <i>Monarcha trivirgatus</i>            | Spectacled Monarch                            | Bird     | -            | Mi         | Habitat known to occur within area  | -                         | -                         | The Spectacled Monarch is found in coastal north-eastern and eastern Australia, including coastal islands, from Cape York, Queensland to Port Stephens, New South Wales. It is much less common in the south. Prefers thick understorey in rainforest, wet gullies and waterside vegetation as well as mangroves.                                                                                                                                                                                                                                                                                                                                                            | None                     | No suitable habitat within the subject site.                                                                                                                                                                                                                                                                                                        |
| <i>Motacilla flava</i>                 | Yellow Wagtail                                | Bird     | -            | Mi         | Habitat likely to occur within area | -                         | -                         | This species breeds in temperate Europe and Asia. They occur within Australia in open country habitat with disturbed ground and some water. Recorded in short grass and bare ground, swamp margins, sewage ponds, saltmarshes, playing fields, airfields, ploughed land and town lawns.                                                                                                                                                                                                                                                                                                                                                                                      | Low                      | Rare migrant to Australia, records in NSW concentrated in the Hunter Estuary. Unlikely to occur.                                                                                                                                                                                                                                                    |
| <i>Myiagra cyanoleuca</i>              | Satin Flycatcher                              | Bird     | -            | Mi         | Habitat known to occur within area  | -                         | -                         | In NSW widespread on and east of the Great Divide, sparsely scattered on the western slopes, very occasional records on the western plains. Inhabit heavily vegetated gullies in eucalypt-dominated forests and taller woodlands, often near wetlands and watercourses. On migration, occur in coastal forests, woodlands, mangroves and drier woodlands and open forests. Generally not in rainforests.                                                                                                                                                                                                                                                                     | Low                      | NO suitable gullies or wetland habitat present within or adjacent to the proposal site                                                                                                                                                                                                                                                              |
| <i>Neophema pulchella</i>              | Turquoise Parrot                              | Bird     | V            | -          | -                                   | -                         | Y                         | Occurs from coast to inland slopes. In coastal area, most common between Hunter and Northern Rivers, and further south in S Coast. Inhabits open eucalypt woodlands and forests, typically with a grassy understorey. Favours edges of woodlands adjoining grasslands or timbered creek lines and ridges. Feeds on the seeds of native and introduced grasses and other herbs. Grasslands and open areas provide important foraging habitat for this species while woodlands provide important roosting and breeding habitat. Nests in tree hollows, logs or posts from August to December.                                                                                  | Moderate                 | Some suitable foraging habitat present within the proposal site.                                                                                                                                                                                                                                                                                    |
| <i>Ninox connivens</i>                 | Barking Owl                                   | Bird     | V            | -          | -                                   | Y (Breeding)              | Y (foraging)              | Occurs from coast to inland slopes and plains, though is rare in dense, wet forests east of the Great Dividing Range and sparse in higher parts of the tablelands and in the arid zone. Inhabits eucalypt woodlands, open forest, swamp woodlands, and, especially in inland areas, timber along watercourses. Roosts along creek lines in dense, tall understorey foliage (e.g. in Acacia and Casuarina), or dense eucalypt canopy. Nests in hollows of large, old eucalypts including Eucalyptus camaldulensis, Eucalyptus albens, Eucalyptus polyanthemos and Eucalyptus blakelyi. Birds and mammals important prey during breeding. Territories range from 30 to 200 ha. | Low                      | The proposal site doesn't contain suitable hollow-bearing trees to support breeding for this species. Lack of suitable vegetated habitat suggests species is unlikely to occur.                                                                                                                                                                     |
| <i>Ninox strenua</i>                   | Powerful Owl                                  | Bird     | V            | -          | -                                   | Y (Breeding)              | Y (foraging)              | Occurs from the coast to the western slopes. Solitary and sedentary species. Inhabits a range of habitats from woodland and open sclerophyll forest to tall open wet forest and rainforest. Prefers large tracts of vegetation. Nests in large tree hollows (> 0.5 m deep), in large eucalypts (dbh 80-240 cm) that are at least 150 years old. Pairs have high fidelity to a small number of hollow-bearing nest trees and defend a large home range of 400 - 1,450 ha. Forages within open and closed woodlands as well as open areas.                                                                                                                                     | Low                      | Lack of suitable hollows within the proposal site to support breeding. May forage in forested areas of the site associated with the riparian corridor. Previously been recorded adjacent to the site.                                                                                                                                               |



| Scientific Name                  | Common Name      | Taxonomy | BC Act statu | EPBC Act s | PMST (DAWE, 2020)                  | Candidate species (BAM-C) | Predicted species (BAM-C) | Habitat Association                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Likelihood of Occurrence | Justification                                                                                                                                                                                                                                                                                                                                |
|----------------------------------|------------------|----------|--------------|------------|------------------------------------|---------------------------|---------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Numenius madagascariensis</i> | Eastern Curlew   | Bird     | -            | CE, Mi     | Habitat may occur within area      | -                         | -                         | Within Australia, the species has a primarily coastal distribution. The species is found in all states, particularly the north, east, and south-east regions including Tasmania. Breeds in Russia and north-eastern China. Most commonly associated with sheltered coasts, especially estuaries, bays, harbours, inlets and coastal lagoons, with large intertidal mudflats or sandflats, often with beds of seagrass. Occasionally, the species occurs on ocean beaches (often near estuaries), and coral reefs, rock platforms, or rocky islets. The birds are often recorded among saltmarsh and on mudflats fringed by mangroves, and sometimes use the mangroves. The birds are also found in saltworks and sewage farms.           | None                     | No suitable habitat within the subject site.                                                                                                                                                                                                                                                                                                 |
| <i>Numenius minutus</i>          | Little Curlew    | Bird     | -            | Mi         | -                                  | -                         | -                         | Generally spend the non-breeding season in northern Australia. In NSW, most records are scattered east of the Great Dividing Range, from Casino, south to Greenwell Point with a few scattered records west of the Great Dividing Range. Recorded breeding in Siberia. Most often found feeding in short, dry grassland and sedgeland, including dry floodplains and blacksoil plains, which have scattered, shallow freshwater pools or areas seasonally inundated. Open woodlands with a grassy or burnt understorey, dry saltmarshes, coastal swamps, mudflats or sandflats of estuaries or beaches on sheltered coasts, mown lawns, gardens, recreational areas, ovals, racecourses and verges of roads and airstrips are also used. | Low                      | No suitable habitat within the proposal site.                                                                                                                                                                                                                                                                                                |
| <i>Numenius phaeopus</i>         | Whimbrel         | Bird     | -            | Mi         | Habitat known to occur within area | -                         | -                         | A regular migrant to Australia and New Zealand, with a primarily coastal distribution. There are also scattered inland records in all regions. It is found in all states but is more common in the north. It is found along almost the entire coast of Queensland and NSW. Breeds in north and west Alaska, Eurasia and Iceland. Often found on the intertidal mudflats of sheltered coasts. It is also found in harbours, lagoons, estuaries and river deltas, often those with mangroves, but also open, unvegetated mudflats. It is occasionally found on sandy or rocky beaches, on coral or rocky islets, or on intertidal reefs and platforms.                                                                                     | None                     | No suitable habitat within the subject site.                                                                                                                                                                                                                                                                                                 |
| <i>Oxyura australis</i>          | Blue-billed Duck | Bird     | V            | -          | -                                  | -                         | Y                         | Partly migratory, travels short distances between breeding swamps and over-wintering lakes. Young birds disperse in April-May from breeding swamps in inland NSW to Murray River system and coastal lakes. Prefers deep water in large permanent wetlands and swamps with dense aquatic vegetation. Nests in Cumbungi over deep water or in trampled Lignum, sedges or spike-rushes. Completely aquatic, swimming along the edge of dense cover.                                                                                                                                                                                                                                                                                         | Low                      | No suitable aquatic habitats within or adjacent to site                                                                                                                                                                                                                                                                                      |
| <i>Pandion cristatus</i>         | Eastern Osprey   | Bird     | V            | -          | -                                  | Y (Breeding)              | Y (foraging)              | Favours coastal areas, especially the mouths of large rivers, lagoons and lakes. They feed on fish over clear, open water. Breeding takes place from July to September in NSW, with nests being built high up in dead trees or in dead crowns of live trees, usually within one kilometre of the sea, though there are a handful of records from inland areas.                                                                                                                                                                                                                                                                                                                                                                           | Low                      | Only one previous record within the locality approximately 9 km from the proposal site. Whilst foraging habitat occurs within the proposal site, the proposal site is located approximately 30 km from the coast.                                                                                                                            |
| <i>Pandion haliaetus</i>         | Osprey           | Bird     | V            | Mi         | Habitat known to occur within area | -                         | -                         | The Osprey is found around the Australian coast line, except for Victoria and Tasmania. They favour coastal areas, especially the mouths of large rivers, lagoons and lakes. Ospreys feed on fish over clear, open water and breed from July to September in NSW. Nests are made high up in dead trees or in dead crowns of live trees, usually within one kilometre of the sea.                                                                                                                                                                                                                                                                                                                                                         | Low                      | The proposal site is located within approximately 30 km of the coast. Whilst permanent stands of water occur within the proposal site, this does not meet the open water criteria for foraging habitat. Breeding and foraging behaviour unlikely to occur within the proposal site. No previous records within the locality.                 |
| <i>Petroica boodang</i>          | Scarlet Robin    | Bird     | V            | -          | -                                  | -                         | Y                         | In NSW occurs from coast to inland slopes. Breeds in drier eucalypt forests and temperate woodlands, often on ridges and slopes, within open understorey of shrubs and grasses and sometimes in open areas. In autumn and winter it migrates to more open habitats such as grassy open woodland or paddocks with scattered trees. Abundant logs and coarse woody debris are important habitat components.                                                                                                                                                                                                                                                                                                                                | Moderate                 | Suitable habitat within the proposal site. A low number of previous records within the locality with the nearest record being approximately 700 m from the proposal site.                                                                                                                                                                    |
| <i>Petroica phoenicea</i>        | Flame Robin      | Bird     | V            | -          | -                                  | -                         | -                         | Breeds in upland moist eucalypt forests and woodlands, often on ridges and slopes, in areas of open understorey. Migrates in winter to more open lowland habitats such as grassland with scattered trees and open woodland on the inland slopes and plains. Forages from low perches, feeding on invertebrates taken from the ground, tree trunks, logs and other coarse woody debris. Fallen logs and coarse woody debris are important habitat components. Open cup nest of plant fibres and cobweb is often built near the ground in a sheltered niche, ledge or shallow cavity in a tree, stump or bank.                                                                                                                             | Moderate                 | The proposal site is located on the lowland habitats from which grasslands and open woodlands within the proposal site provide Winter foraging habitat. Two previous records within the locality with the nearest record occurring approximately 1.2 km from the proposal site indicate that this species may utilise the habitat to forage. |

| Scientific Name                           | Common Name                               | Taxonomy | BC Act statu | EPBC Act s | PMST (DAWE, 2020)                  | Candidate species (BAM-C) | Predicted species (BAM-C) | Habitat Association                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Likelihood of Occurrence | Justification                                                                                                                                                                                                           |
|-------------------------------------------|-------------------------------------------|----------|--------------|------------|------------------------------------|---------------------------|---------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Phaethon lepturus</i>                  | White-tailed Tropicbird                   | Bird     | -            | Mi         | -                                  | -                         | -                         | In Australia, the Hwite-tailed Tropicbird breeds in the Cocos-Keeling Islands, Ashmore reef and Rowley Shoals off the northern coast of WA. In Australia, the White-tailed Tropicbird (Indian Ocean) nests in Pisonia trees amongst Pisonia-coconut vegetation, and on sandy ground.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | None                     | No suitable habitat within the subject site.                                                                                                                                                                            |
| <i>Philomachus pugnax</i>                 | Ruff                                      | Bird     | -            | Mi         | Habitat known to occur within area | -                         | -                         | In NSW the species has been recorded at Kurnell, Tomki, Casino, Ballina, Kooragang Island, Broadwater Lagoon and Little Cattai Creek. The species has also found around the Riverina, including Windouran Swamp, Wanganella, Fivebough Swamo abd the Tullakool Saltworks. Most NSW records come from the Sydney region. In Australia the Ruff is found on generally fresh, brackish of saline wetlands with exposed mudflats at the edges. It is found in terrestrial wetlands including lakes, swamps, pools, lagoons, tidal rivers, swampy fields and floodlands. They are occasionally seen on sheltered coasts, in harbours, estuaries, seashores and are known to visit sewage farms and saltworks. They are sometimes found on wetlands surrounded by dense vegetation including grass, sedges, saltmarsh and reeds.                                                                | Low                      | No suitable aquatic habitats within or adjacent to site                                                                                                                                                                 |
| <i>Pluvialis fulva</i>                    | Pacific Golden Plover                     | Bird     | -            | Mi         | Habitat known to occur within area | -                         | -                         | Widespread in coastal regions, though there are also a number of inland records (in all states), sometimes far inland and usually along major river systems, especially the Murray and Darling Rivers and their tributaries. Most Pacific Golden Plovers occur along the east coast, and are especially widespread along the Queensland and NSW coastlines. Breeds mostly in northern Siberia as well as in western Alaska. In Australia this species usually inhabits coastal habitats, though it occasionally occurs around inland wetlands.                                                                                                                                                                                                                                                                                                                                            | Low                      | No previous records within the locality of the proposal site. proposal site is located approximately 30 km from the coast.                                                                                              |
| <i>Pluvialis squatarola</i>               | Grey Plover                               | Bird     | -            | Mi         | Habitat known to occur within area | -                         | -                         | Breed in the northern Hemisphere. Widespread on Australian coast in the non-breeding season. Occur almost entirely in coastal areas, usually in sheltered embayments with mud or sandflats and occasionally on rocky coasts or near-coastal lakes and swamps. Very occasionally recorded further inland. Forage on exposed mudflats and beaches.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | None                     | No suitable habitat within the subject site.                                                                                                                                                                            |
| <i>Pomatostomus temporalis temporalis</i> | Grey-crowned Babbler (eastern subspecies) | Bird     | V            | -          | -                                  | -                         | Y                         | Occurs on western slopes and plains, as well as in the Hunter Valley and several locations on the north coast. Inhabits open Box-Gum Woodlands on the slopes, and Box-Cypress-pine and open Box Woodlands on alluvial plains. Family groups have territories between 1- 50 (generally around 10) ha. Nests typically built in shrubs or sapling eucalypts.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Hlgh                     | Suitable Box-Gum woodlands and alluvial plains occur within the proposal site. This species was observed adjacent to he propsoal site during surveys. A high number of previous records also occur within the locality. |
| <i>Rhipidura rufifrons</i>                | Rufous Fantail                            | Bird     | -            | Mi         | Habitat known to occur within area | -                         | -                         | Occurs in coastal and near coastal districts of northern and eastern Australia. Has breeding populations in NSW. Two subspecies intergrade in a zone between the Queensland-NSW border ranges and the Clarence-Orara rivers in NSW. The species mainly inhabits wet sclerophyll forests, often in gullies dominated by Eucalyptus microcorys, E. cypellocarpa, E. radiata, E. regnans, E. delegatensis, E. pilularis or E. resinifera; usually with a dense shrubby understorey, often including ferns. They also occur in subtropical and temperate rainforests. They occasionally occur in secondary regrowth, following logging or disturbance in forests or rainforests. When on passage, they are sometimes recorded in drier sclerophyll forests and woodlands, including Eucalyptus maculata, E. melliodora, ironbarks or stringybarks, often with a shrubby or heath understorey. | Low                      | No previous records within the locality. Marginal potential habitat occurs within the proposal site. .                                                                                                                  |
| <i>Rostratula australis</i>               | Australian Painted Snipe                  | Bird     | E            | E          | Habitat known to occur within area | -                         | Y                         | Normally found in permanent or ephemeral shallow inland wetlands, either freshwater or brackish. Nests on the ground amongst tall reed-like vegetation near water. Feeds on mudflats and the water's edge taking insects, worm and seeds. Prefers fringes of swamps, dams and nearby marshy areas with cover of grasses, lignum, low scrub or open timber.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Low                      | No suitable wetland habitat within proposal site.                                                                                                                                                                       |
| <i>Sternula albifrons</i>                 | Little Tern                               | Bird     | E            | Mi         | -                                  | -                         | -                         | In eastern Australia, many breeding colonies lie within conservation reserves, or within Ramsar-listed wetlands, or both. Little Terns occur in two Ramsar listed sites in NSW, Towra Point Nature Reserve and Hunter Estuary Wetlands (including Kooragang Nature Reserve). Inhabit sheltered coastal environments, including lagoons, estuaries, river mouths and deltas, lakes, bays, harbours and inlets, especially those with exposed sandbanks or sand-spits, and also on exposed ocean beaches.                                                                                                                                                                                                                                                                                                                                                                                   | Low                      | No suitable wetland habitat within proposal site.                                                                                                                                                                       |

| Scientific Name                          | Common Name         | Taxonomy | BC Act status | EPBC Act s | PMST (DAWE, 2020)                  | Candidate species (BAM-C) | Predicted species (BAM-C) | Habitat Association                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Likelihood of Occurrence | Justification                                                                                                                        |
|------------------------------------------|---------------------|----------|---------------|------------|------------------------------------|---------------------------|---------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------------------------------------------------------------------------------------------------------------------|
| <i>Stictonetta naevosa</i>               | Freckled Duck       | Bird     | V             | -          | -                                  | -                         | Y                         | Breeds in large, ephemeral swamps in the Murray-Darling, particularly along the Paroo and Lachlan Rivers and other Riverina rivers. In drier times moves to more permanent waters. Disperses during extensive inland droughts and may be found in coastal areas during such times. Prefers freshwater swamps/creeks with dense Cumbungi, Lignum or tea-tree. Nests in dense vegetation at or near water level.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Low                      | No suitable aquatic habitats within or adjacent to site                                                                              |
| <i>Thinornis rubricollis rubricollis</i> | Hooded Plover       | Bird     | CE            | V          | Habitat may occur within area      | -                         | -                         | The Hooded Plover is endemic to southern Australia and is nowadays found mainly along the coast from south of Jervis Bay. In the late 1920s and early 1930s the species was recorded from Port Stephens but are now considered locally extinct. It has not been seen in the Sydney area since the 1940s. Occasionally, individual birds are sighted slightly further north to the Shoalhaven River and Comerong Beach and one bird was sighted at Lake Illawarra in March 2001. Hooded Plovers prefer sandy ocean beaches backed by sparsely vegetated sand-dunes for shelter and nesting. Hooded Plovers display high nest site fidelity and nest solitarily. Occasionally Hooded Plovers are found on tidal bays and estuaries, rock platforms and rocky or sand-covered reefs near sandy beaches, and small beaches in lines of cliffs. They regularly use near-coastal saline and freshwater lakes and lagoons, often with saltmarsh. | None                     | No suitable habitat within the subject site.                                                                                         |
| <i>Tringa brevipes</i>                   | Grey-tailed Tattler | Bird     | -             | Mi         | Habitat known to occur within area | -                         | -                         | Non-breeding visitor to Australia. In NSW occurs along the coast from the Queensland border south to Tilba Lake, and has been recorded as far south as Gippsland. In NSW it is recorded more frequently north of Sydney. Found on sheltered coasts with reefs and rock platforms or with intertidal mudflats. Inland records are rare. Forages in shallow water in intertidal areas. Usually roosts in the branches of mangroves or rocks which may be partly submerged. Also rarely recorded in dense shrubs, on driftwood or sand dunes.                                                                                                                                                                                                                                                                                                                                                                                                | None                     | No suitable habitat within the subject site.                                                                                         |
| <i>Tringa glareola</i>                   | Wood Sandpiper      | Bird     | -             | Mi         | -                                  | -                         | -                         | Breeds in N Hemisphere. Occurs in largest numbers in NW Australia, with all sites of national importance within WA. In NSW there are records east of the Divide north from Nowra, and inland from the upper and lower Western regions. Uses well-vegetated, shallow, freshwater wetlands and are typically associated with wetlands supporting emergent aquatic plants or grass and taller fringing vegetation such as dense reeds/rushes, shrubs or trees. Also frequent flooded grasslands and irrigated crops. Rarely in brackish wetlands or saltmarsh. Known from artificial wetlands.                                                                                                                                                                                                                                                                                                                                               | Low                      | No suitable wetland habitat within proposal site.                                                                                    |
| <i>Tringa nebularia</i>                  | Common Greenshank   | Bird     | -             | Mi         | Habitat known to occur within area | -                         | -                         | Does not breed in Australia, but occurs in all types of wetlands. In NSW has been recorded in most coastal regions and is widespread west of the Great Dividing Range, particularly in the north-west, Macquarie Marshes and areas between the Lachlan and Murray Rivers and Darling River drainage basin. The Hunter River estuary is an internationally important site for the species. In coastal areas typically occurs in sheltered habitats with large mudflats and saltmarsh, mangroves or seagrass.                                                                                                                                                                                                                                                                                                                                                                                                                               | None                     | No suitable habitat within the subject site.                                                                                         |
| <i>Tringa stagnatilis</i>                | Marsh Sandpiper     | Bird     | -             | Mi         | Habitat known to occur within area | -                         | -                         | Breeds in N Hemisphere. Occurs in coastal and inland wetlands, including freshwater and estuarine habitats, throughout Australia. All regions of NSW but particularly central and south coasts and western slopes and plains. Sites of national importance in NSW include Parkes wetlands, Macquarie Marshes and Tullakool Evaporation Ponds.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Low                      | No suitable wetland habitat within proposal site.                                                                                    |
| <i>Tyto longimembris</i>                 | Eastern Grass Owl   | Bird     | V             | -          | -                                  | -                         | Y                         | Most common in N and NE Australia, but recorded in all mainland states. In NSW most likely to be resident in the NE. Inhabit areas of tall grass, including grass tussocks, in swampy areas, grassy plains, swampy heath, and in cane grass or sedges on flood plains. Nests on the ground in trodden grass, and are often accessed by tunnels through vegetation.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Low                      | No suitable habitat within proposal site                                                                                             |
| <i>Tyto novaehollandiae</i>              | Masked Owl          | Bird     | V             | -          | -                                  | Y (Breeding)              | Y (foraging)              | Occurs across NSW except NW corner. Most common on the coast. Inhabits dry eucalypt woodlands from sea level to 1100 m. Roosts and breeds in large (>40 cm) hollows and sometime caves in moist eucalypt forested gullies. Hunts along the edges of forests and roadsides. Home range between 500 ha and 1000 ha. Prey mostly terrestrial mammals but arboreal species may also be taken.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Low                      | . No previous records within the locality. Small amount of potential foraging habitat present. No suitable breeding habitat present. |

| Scientific Name                 | Common Name                | Taxonomy | BC Act status | EPBC Act s | PMST (DAWE, 2020)                   | Candidate species (BAM-C) | Predicted species (BAM-C)           | Habitat Association                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Likelihood of Occurrence | Justification                                                                                                                                                                                                                                                                                                            |
|---------------------------------|----------------------------|----------|---------------|------------|-------------------------------------|---------------------------|-------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Tyto tenebricosa</i>         | Sooty Owl                  | Bird     | V             | -          | -                                   | -                         | -                                   | Occurs in the coastal, escarpment and tablelands regions of NSW. More common in the north and absent from the western tablelands and further west. Inhabits tall, moist eucalypt forests and rainforests, and are strongly associated with sheltered gullies, particularly those with tall rainforest understorey. Roosts in tree hollows, amongst dense foliage in gullies or in caves, recesses or ledges of cliffs or banks. Nest in large (>40 cm wide, 100 cm deep) tree hollows in unlogged/unburnt gullies within 100 m of streams or in caves.                                                                                                                                                                                                 | Low                      | Species prefers moist eualypt forest and rainforest within sheltered gullies                                                                                                                                                                                                                                             |
| <i>Xenus cinereus</i>           | Terek Sandpiper            | Bird     | V             | Mi         | Habitat known to occur within area  | Y                         | Y (not mapped as important habitat) | The two main sites for this species in NSW are the Richmond River and Hunter River estuaries. Inhabits coastal mudflats, lagoons, creeks and estuaries. Favours mudbanks and sandbanks near mangroves, also observed on rocky pools and reefs and up to 10 km inland around brackish pools. Roost communally in mangroves or dead trees. Forages in open intertidal mudflats.                                                                                                                                                                                                                                                                                                                                                                          | None                     | No suitable habitat within subject site. No previous records within the locality.                                                                                                                                                                                                                                        |
| <i>Heleioporus australiacus</i> | Giant Burrowing Frog       | Frog     | V             | V          | Habitat may occur within area       | -                         | -                                   | Occurs along the coast and eastern slopes of the Great Dividing Range south from Wollemi National Park. Appears to exist as 2 populations with a 100 km gap in records between Jervis Bay and Eden. Northern population occurs on sandy soils supporting heath, woodland or open forest. Breeds in ephemeral to intermittent streams with persistent pools. Only infrequently moves to breeding sites, most commonly found on ridges away from creeks, several hundred metres from water.                                                                                                                                                                                                                                                              | None                     | Small section of intermittent creekline occurs on site however subject site is located north-east of Wollemi National Park and therefore outside of this species known range. No ridges occur within the subject site. No previous records of the species have been recorded.                                            |
| <i>Litoria aurea</i>            | Green and Golden Bell Frog | Frog     | E             | V          | Habitat known to occur within area  | Y                         | -                                   | Formerly occurred from Brunswick Heads to Victoria, but >80% populations now extinct. Inhabits marshes, natural and artificial freshwater to brackish wetlands, dams and in stream wetlands. Prefers sites containing cumbungi (Typha spp.) or spike rushes (Eleocharis spp.), which are unshaded and have a grassy area and/or rubble as shelter/refuge habitat nearby. Gambusia holbrooki is a key threat as they feed on green and Golden Bell Frog eggs and tadpoles.                                                                                                                                                                                                                                                                              | Low                      | Despite suitable habitat on site, species not found during targeted surveys.. The nearest previous record within the locality is approximately 800 m from the proposal site. Species expert (Frank Lemckert) concluded that there is a low liklihood of the species occurring within proposal site (refer to Appendix H) |
| <i>Litoria brevipalmata</i>     | Green-thighed Frog         | Frog     | V             | -          | -                                   | Y                         | -                                   | Occurs north from Gosford to Qld. Breeding occurs in flooded semi-permanent or ephemeral pools, usually in grassy areas and within 100 m of significant stands of native vegetation (Ehman 1997, Lemckert et al 2006). Can tolerate some disturbance but not found in >50% cleared grazing land or entirely urban areas (Ehmann 1997, Lemckert et al 2006). Usually associated with moist forest (swamp forest, wet sclerophyll or rainforest) but often recorded from dry sclerophyll forests in the northern part of its range (Lemckert et al 2006).                                                                                                                                                                                                | Low                      | No suitable aquatic habitats within or adjacent to site                                                                                                                                                                                                                                                                  |
| <i>Litoria littlejohni</i>      | Littlejohn's Tree Frog     | Frog     | V             | V          | Habitat likely to occur within area | -                         | -                                   | Occurs on plateaus and eastern slopes of the Great Dividing Range south from Watagan State Forest. Occurs along permanent rocky streams with thick fringing vegetation associated with eucalypt woodlands and heaths among sandstone outcrops, hunting either in shrubs or on the ground.                                                                                                                                                                                                                                                                                                                                                                                                                                                              | None                     | No suitable habitat within the subject site. There are no permanent rocky streams or sandstone outcrops within the site. The subject site is located approximately 28 km north of Watagan State Forest. Only one previous record occurs within the locality at approximately 6 km away from the subject site.            |
| <i>Mixophyes balbus</i>         | Stuttering Frog            | Frog     | E             | V          | Habitat likely to occur within area | -                         | -                                   | Occurs along the east coast of Australia. Has undergone a massive range reduction particularly in the south of its range: within the Sydney Basin, White (2008a) located only 3 populations south of Sydney (Macquarie Pass and Mt Werong) and Daly et al. (2002, in White 2008a) found only 2 extant populations between Macquarie Pass and Victoria. Inhabits rainforest and wet, tall, open forest. Shelter in deep leaf litter and thick understorey vegetation on the forest floor. Feeds on insects and smaller frogs, breeding in streams during summer after heavy rain. The species does not occur in areas where the riparian vegetation has been disturbed or where there have been significant upstream human impacts (Mahony et al 1997). | None                     | No previous records within the locality of the subject site. No rainforest habitat occurs within the site. The subject site is also located outside of the known species range.                                                                                                                                          |
| <i>Mixophyes iteratus</i>       | Giant Barred Frog          | Frog     | E             | E          | Habitat known to occur within area  | -                         | -                                   | Occurs on the coast and ranges from south-eastern QLD to the Hawkesbury River in NSW, particularly in Coffs Harbour - Dorrigo area. Forage and live amongst deep, damp leaf litter in rainforest, moist eucalypt forest and nearby dry eucalypt forest. Breed in shallow, flowing rocky streams. Within Sydney Basin, confined to small populations in tall, wet forest in the Watagan Mountains north of the Hawkesbury and the lower Blue Mountains (White 2008b).                                                                                                                                                                                                                                                                                   | None                     | No suitable rainforest habitat occurs within the subject site. Despite some ephemeral streams occurring, these a are not flowing rocky streams. The subject site is located approximately 28 km north of the Watagan Mountains. No previous records within the locality.                                                 |



| Scientific Name                   | Common Name               | Taxonomy     | BC Act statu | EPBC Act s | PMST (DAWE, 2020)                  | Candidate species (BAM-C) | Predicted species (BAM-C) | Habitat Association                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Likelihood of Occurrence | Justification                                                                                                                                                                                                                                                                                                                           |
|-----------------------------------|---------------------------|--------------|--------------|------------|------------------------------------|---------------------------|---------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Uperoleia mahonyi</i>          | Mahoney's toadlet         | Frog         | E            | -          | -                                  | Y                         | -                         | Mahony's Toadlet is endemic to the mid-north coast of New South Wales (NSW) between Kangy Angy and Seal Rocks. Mahony's Toadlet inhabits ephemeral and semi-permanent swamps and swales on the coastal fringe of its range occurring in heath or wallum habitats almost exclusively associated with leached (highly nutrient impoverished) white sand. Commonly associated with acid paperbark swamps wallum heath, swamp mahogany-paperbark swamp forest, heath shrubland and Sydney red gum woodland. Records are associated with shallow ephemeral/semi-permanent water bodies with limited flow of water. Aquatic vegetation at breeding sites includes sedges ( <i>Shoenoplectus</i> spp., <i>Baumea</i> spp. and <i>Lepironia articulata</i> ) and Broadleaf Cumbungi ( <i>Typha orientalis</i> ).                                                                                                                                                                                                                                                                                                                                         | Low                      | No suitable heath or wallum habitats within proposal site                                                                                                                                                                                                                                                                               |
| <i>Synemon plana</i>              | Golden Sun Moth           | Invertebrate | E            | CE         | Habitat may occur within area      | -                         | -                         | In NSW, this species is now found between Queanbeyan, Gunning, Young and Tumut. It occurs in Natural Temperate Grasslands and grassy Box-Gum Woodlands in which groundlayer is dominated by wallaby grasses <i>Austrodanthonia</i> spp.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Low                      | Extensive grassland areas occur within the proposal site however these are exotic. Box-Gum woodland also occurs however no <i>Austrodanthonia</i> has been recorded during site surveys.                                                                                                                                                |
| <i>Cercartetus nanus</i>          | Eastern Pygmy-possum      | Mammal       | V            | -          | -                                  | Y                         | -                         | The Eastern Pygmy-possum is found in south-eastern Australia, from southern Queensland to eastern South Australia and in Tasmania. In NSW it extents from the coast inland as far as the Pilliga, Dubbo, Parkes and Wagga Wagga on the western slopes. Found in a broad range of habitats from rainforest through sclerophyll (including Box-Ironbark) forest and woodland to heath, but in most areas woodlands and heath appear to be preferred, except in north-eastern NSW where they are most frequently encountered in rainforest. Feeds largely on nectar and pollen collected from banksias, eucalypts and bottlebrushes; an important pollinator of heathland plants such as banksias; soft fruits are eaten when flowers are unavailable. Shelters in tree hollows, rotten stumps, holes in the ground, abandoned bird-nests, Ringtail Possum ( <i>Pseudocheirus peregrinus</i> ) dreys or thickets of vegetation, (e.g. grass-tree skirts); nest-building appears to be restricted to breeding females; tree hollows are favoured but spherical nests have been found under the bark of eucalypts and in shredded bark in tree forks. | Low                      | Despite suitable Box-Ironbark habitat occurring within the proposal site, this species was not found during targeted surveys. No previous records within the locality. Suitable breeding habitat (hollows) and foraging ( <i>Banksia</i> , <i>Eucalypt</i> and <i>Callistemon</i> spp.) occur on site.                                  |
| <i>Chalinolobus dwyeri</i>        | Large-eared Pied Bat      | Mammal       | V            | V          | Habitat known to occur within area | Y                         | -                         | Occurs from the coast to the western slopes of the divide. Largest numbers of records from sandstone escarpment country in the Sydney Basin and Hunter Valley (Hoye and Schulz 2008). Roosts in caves and mines and most commonly recorded from dry sclerophyll forests and woodlands. An insectivorous species that flies over the canopy or along creek beds (Churchill 2008). In southern Sydney appears to be largely restricted to the interface between sandstone escarpments and fertile valleys.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Low                      | No suitable caves, mines or creek beds within or adjacent to proposal site                                                                                                                                                                                                                                                              |
| <i>Dasyurus maculatus</i>         | Spotted-tailed Quoll      | Mammal       | V            | E          | Habitat known to occur within area | -                         | Y                         | Inhabits a range of environments including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Den sites are in hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces. Females occupy home ranges of up to 750 ha and males up to 3,500 ha, usually traversed along densely vegetated creek lines.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Low                      | No breeding habitat within the proposal site, as it lacks small caves, rock crevices, boulder fields and rocky-cliff faces. Foraging habitat may occur, however is marginal and has been proposal to previous disturbance. A low number of records occur with the nearest record occurring approximately 5.5 km from the proposal site. |
| <i>Falsistrellus tasmaniensis</i> | Eastern False Pipistrelle | Mammal       | V            | -          | -                                  | -                         | Y                         | Occurs on southeast coast and ranges. Prefers tall (>20 m) and wet forest with dense understorey. Absent from small remnants, preferring continuous forest but can move through cleared landscapes and may forage in open areas. Roosts in hollow trunks of Eucalypts, underneath bark or in buildings. Forages in gaps and spaces within forest, with large foraging range (12 km foraging movements recorded) (Churchill 2008, Law et al 2008).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Low                      | No wet forests present within proposal site                                                                                                                                                                                                                                                                                             |
| <i>Miniopterus australis</i>      | Little Bent-winged Bat    | Mammal       | V            | -          | -                                  | Y (Breeding)              | Y (foraging)              | Occurs from Cape York to Sydney. Inhabits rainforests, wet and dry sclerophyll forests, paperbark swamps and vine thickets. Only one maternity cave known in NSW, shared with Eastern Bentwing-bats at Willi Willi, near Kempsey. Outside breeding season roosts in caves, tunnels and mines and has been recorded in a tree hollow on one occasion. Forages for insects beneath the canopy of well-timbered habitats (Churchill 2008, Hoye and Hall 2008).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Moderate                 | Suitable foraging habitat present within the proposal site.                                                                                                                                                                                                                                                                             |

| Scientific Name                       | Common Name                     | Taxonomy | BC Act status | EPBC Act s | PMST (DAWE, 2020)                   | Candidate species (BAM-C) | Predicted species (BAM-C) | Habitat Association                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Likelihood of Occurrence | Justification                                                                                                                                                                                                                                                                                                                                                            |
|---------------------------------------|---------------------------------|----------|---------------|------------|-------------------------------------|---------------------------|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Miniopterus orianae oceanensis</i> | Large Bent-winged Bat           | Mammal   | V             | -          | -                                   | Y (Breeding)              | Y (foraging)              | Generally occurs east of the Great Dividing Range along NSW coast (Churchill 2008). Inhabits various habitats from open grasslands to woodlands, wet and dry sclerophyll forests and rainforest. Essentially a cave bat but may also roost in road culverts, stormwater tunnels and other man-made structures. Only 4 known maternity caves in NSW, near Wee Jasper, Bungonia, Kempsey and Texas. Females may travel hundreds of kilometres to the nearest maternal colony (Churchill 2008).                                                                                                                                                              | Moderate                 | Suitable foraging habitat present within the proposal site.                                                                                                                                                                                                                                                                                                              |
| <i>Micronomus norfolkensis</i>        | Eastern Coastal Free-tailed Bat | Mammal   | V             | -          | -                                   | Y (Breeding)              | Y                         | Occurs in dry sclerophyll forest and woodland east of the Great Dividing Range. Forages in natural and artificial openings in vegetation, typically within a few kilometres of its roost. Roosts primarily in tree hollows but also recorded from man-made structures or under bark (Churchill 2008).                                                                                                                                                                                                                                                                                                                                                     | Moderate                 | Suitable foraging habitat present within the proposal site.                                                                                                                                                                                                                                                                                                              |
| <i>Myotis macropus</i>                | Southern Myotis                 | Mammal   | V             | -          | -                                   | Y                         | -                         | Mainly coastal but may occur inland along large river systems. Usually associated with permanent waterways at low elevations in flat/undulating country, usually in vegetated areas. Forages over streams and watercourses feeding on fish and insects from the water surface. Roosts in a variety of habitats including caves, mine shafts, hollow-bearing trees, stormwater channels, buildings, under bridges and in dense foliage, typically in close proximity to water (Campbell 2011). Breeds November or December (Churchill 2008).                                                                                                               | Moderate                 | The Southern Myotis was recorded within a culvert on the site. Species is likely to utilise the waterbodies within and adjacent to the proposal site for foraging.                                                                                                                                                                                                       |
| <i>Petauroides volans</i>             | Greater Glider                  | Mammal   | -             | V          | Habitat known to occur within area  | -                         | -                         | The greater glider is restricted to eastern Australia, occurring from the Windsor Tableland in north Queensland through to central Victoria (Wombat State Forest), with an elevational range from sea level to 1200 m above sea level. It prefers taller montane, moist eucalypt forest with relatively old trees and abundant hollows.                                                                                                                                                                                                                                                                                                                   | None                     | Despite an abundance of tree hollows on site, these trees are surrounded by young vegetation and lack the tall, open montane forests this species requires. The nearest previous record is approximately 8 km from the subject site with a total of 8 previous records within the locality.                                                                              |
| <i>Petaurus australis</i>             | Yellow-bellied Glider           | Mammal   | V             | -          | -                                   | -                         | Y                         | Occurs along the east coast to the western slopes of the Great Dividing Range. Inhabits a variety of forest types but prefers tall mature eucalypt forest with high rainfall and rich soils. Relies on large hollow-bearing trees for shelter and nesting, with family groups of 2-6 typically denning together. In southern NSW its preferred habitat at low altitudes is moist gullies and creek flats in mature coastal forests. Mostly feeds on sap, nectar and honeydew.                                                                                                                                                                             | None                     | Soils are sandy, indicating a low richness to support the tall mature eucalypt forests and moist gullies which this species requires. The vegetation within the subject site is mainly young eucalypt forests with remnant mature trees scattered within. The subject site is not likely to support the occurrence of this species.                                      |
| <i>Petaurus norfolcensis</i>          | Squirrel Glider                 | Mammal   | V             | -          | -                                   | Y                         | -                         | Occurs along the drier inland slopes as well as coastal habitats. Inhabits woodland and open forest with a Eucalyptus, Corymbia or Angophora overstorey and a shrubby understorey of Acacia or Banksia. Key habitat components include reliable winter and early-spring flowering Eucalypts, Banksia or other nectar sources, and hollow-bearing trees for roost and nest sites (van der Ree and Suckling 2008, Quin et al 2004), with social groups moving between multiple hollows. Social groups include one or two adult males and females with offspring, and have home ranges of 5-10 ha within NSW (van der Ree and Suckling 2008, Kavanagh 2004). | High                     | Despite not found during targeted surveys by GHD, species has been previously recorded adjacent to the proposal site. Suitable open forests with shrubby Acacia understoreys are present within the proposal site.                                                                                                                                                       |
| <i>Petrogale penicillata</i>          | Brush-tailed Rock-wallaby       | Mammal   | E             | V          | Habitat likely to occur within area | -                         | -                         | Occurs from the Shoalhaven north to the Queensland border. Now mostly extinct west of the Great Dividing Range, except in the Warrumbungles and Mt Kaputar. Occurs on rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges facing north. Diet consists of vegetation in adjacent to rocky areas eating grasses and forbs as well as the foliage and fruits of shrubs and trees.                                                                                                                                                                                                                | None                     | No suitable rocky habitat within the subject site including escarpments, outcrops and cliffs. Not found during targeted surveys                                                                                                                                                                                                                                          |
| <i>Phascogale tapoatafa</i>           | Brush-tailed Phascogale         | Mammal   | V             | -          | -                                   | Y                         | -                         | Predominately east of the Great Dividing Range, occasional records to the west. Prefers open forest with sparse groundcover but occurs in habitats ranging from mallees to rainforest. Home ranges span 20-40 ha (females) and >100 ha (males) though may be smaller in optimal habitats. Male ranges overlap with females and other males. May use up to 40 nests/ year in hollow trees, rotted stumps, buildings or bird nests. When breeding females prefer to nest in large tree cavities with small entrances. Forages preferentially in rough barked trees, large logs and dead standing trees (Soderquist and Rhind 2008).                         | Low                      | No mallee or rainforest vegetation occurs within the proposal site. Large home range suggests the proposal site may be a thoroughfare to increasingly suitable habitat. An abundance of hollows also occurs within the site. Despite being targeted during site surveys, the species was not found. The nearest record to the proposal site within the locality is 6 km. |
| <i>Phascolarctos cinereus</i>         | Koala                           | Mammal   | V             | V          | Habitat known to occur within area  | -                         | Y                         | Occurs from coast to inland slopes and plains. Restricted to areas of preferred feed trees in eucalypt woodlands and forests. Home range varies depending on habitat quality, from < 2 to several hundred ha.                                                                                                                                                                                                                                                                                                                                                                                                                                             | Low                      | Low number of feed trees occur within the proposal site. Not recorded during targeted surveys, nor were any signs of the species found (scats, scratches etc.).                                                                                                                                                                                                          |

| Scientific Name                         | Common Name                   | Taxonomy | BC Act status | EPBC Act s | PMST (DAWE, 2020)                   | Candidate species (BAM-C) | Predicted species (BAM-C) | Habitat Association                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Likelihood of Occurrence | Justification                                                                                                                                                                                                                                                                                                                                                                                                      |
|-----------------------------------------|-------------------------------|----------|---------------|------------|-------------------------------------|---------------------------|---------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Planigale maculata</i>               | Common Planigale              | Mammal   | V             | -          | -                                   | Y                         | -                         | Occurs in coastal north-eastern NSW, coastal east Queensland and Arnhem Land. The species reaches its confirmed southern distribution limit on the NSW lower north coast however there are reports of its occurrence as far south as the central NSW coast west of Sydney. Common Planigales inhabit rainforest, eucalypt forest, heathland, marshland, grassland and rocky areas where there is surface cover, and usually close to water. They are active at night and during the day shelter in saucer-shaped nests built in crevices, hollow logs, beneath bark or under rocks. | Low                      | No suitable habitat present within the proposal site                                                                                                                                                                                                                                                                                                                                                               |
| <i>Potorous tridactylus tridactylus</i> | Long-nosed Potoroo            | Mammal   | V             | V          | Habitat may occur within area       | -                         | -                         | Restricted to east of the Great Dividing Range, with annual rainfall >760 mm. Inhabits coastal heath and dry and wet sclerophyll forests. Requires relatively thick ground cover and appears restricted to areas of light and sandy soil (Johnston 2008). Feeds on fungi, roots, tubers, insects and their larvae, and other soft-bodied animals in the soil.                                                                                                                                                                                                                       | None                     | No suitable habitat within the subject site due to historical disturbance of the site. The dry sclerophyll forests within the subject site lack dense groundcover to provide for the species. No previous records within the subject site.                                                                                                                                                                         |
| <i>Pseudomys novaehollandiae</i>        | New Holland Mouse             | Mammal   | -             | V          | Habitat known to occur within area  | -                         | -                         | Occurs in disjunct, coastal populations from Tasmania to Queensland. In NSW inhabits a variety of coastal habitats including heathland, woodland, dry sclerophyll forest with a dense shrub layer and vegetated sand dunes (Wilson and Bradtke 1999). Populations may recolonise/ increase in size in regenerating native vegetation after wildfire, clearing and sandmining. Presence strongly correlated with understorey vegetation density, and high floristic diversity in regenerating heath (Lock and Wilson 1999).                                                          | Low                      | Species prefers coastal habiats. No heathland habiat present. Open grassland not typically associated with this species.                                                                                                                                                                                                                                                                                           |
| <i>Pteropus poliocephalus</i>           | Grey-headed Flying-fox        | Mammal   | V             | V          | Roosting known to occur within area | Y (Breeding)              | Y (foraging)              | Roosts in camps within 20 km of a regular food source, typically in gullies, close to water and in vegetation with a dense canopy. Forages in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths, swamps and street trees, particularly in eucalypts, melaleucas and banksias. Highly mobile with movements largely determined by food availability (Eby and Law 2008). Will also forage in urban gardens and cultivated fruit crops.                                                                                                            | High                     | Recorded nearby to proposal site during targeted surveys. Previous records with a high number of individuals also indicate historical presence. Known foraging Eucalypt species occur within the proposal site. No camps or breeding habitat found on site.                                                                                                                                                        |
| <i>Saccolaimus flaviventris</i>         | Yellow-bellied Sheathtail-bat | Mammal   | V             | -          | -                                   | -                         | Y                         | Migrates from tropics to SE Aus in summer. Forages across a range of habitats including those with and without trees, from wet and dry sclerophyll forest, open woodland, Acacia shrubland, mallee, grasslands and desert. Roosts communally in large tree hollows and buildings (Churchill 2008).                                                                                                                                                                                                                                                                                  | Moderate                 | Suitable foraging habitat present within site. Also likely to utilise the wetland areas within and adjacent to the proposal site for foraging. Despite not being recorded during site surveys, a moderate number of previous records within approximately 5.5 km to the proposal site suggests a possible occurrence of the species.                                                                               |
| <i>Scoteanax rueppellii</i>             | Greater Broad-nosed Bat       | Mammal   | V             | -          | -                                   | -                         | Y                         | Occurs on the east coast and Great Dividing Range. Inhabits a variety of habitats from woodland to wet and dry sclerophyll forests and rainforest, also remnant paddock trees and timber-lined creeks, typically below 500 m asl. Forages in relatively uncluttered areas, using natural or man-made openings in denser habitats. Usually roosts in tree hollows or fissures but also under exfoliating bark or in the roofs of old buildings. Females congregate in maternal roosts in suitable hollow trees (Hoye and Richards 2008, Churchill 2008).                             | Moderate                 | Despite not being recorded during site surveys, a high number of previous records within close proximity to the proposal site suggests it may occur.                                                                                                                                                                                                                                                               |
| <i>Vespadelus troughtoni</i>            | Eastern Cave Bat              | Mammal   | V             | -          | -                                   | Y (Breeding)              | Y                         | Occurs in NE NSW south to Kempsey and west to the Warrumbungles. Inhabits rainforest margins, wet and dry sclerophyll forests through to drier forests and woodlands in semi-arid environments. All records are within close proximity to sandstone or volcanic escarpments. Roosts in overhangs and caves, mines, boulder piles, abandoned Fairy Martin nests and occasionally in buildings, and regularly switches between alternate roost colonies. Forages over a small area, but are capable of flying 500 m over clear paddocks (Churchill 2008, Parnaby et al 2008).         | None                     | Marginal habitat occurs on site however it is not located in a sheltered gully or is characteristic of tall, moist eucalypt forests and rainforests. Subject site has previously been burnt and tree hollows are generally not located within dense foliage in gullies or caves. Previous records indicate that the species may utilise habitat within the locality (nearest record is 2 km from the subject site) |
| <i>Delma impar</i>                      | Striped Legless Lizard        | Reptile  | V             | V          | Habitat may occur within area       | Y                         | -                         | Occurs in the Southern Tablelands, South-west Slopes and possibly the Riverina. Found in natural or secondary grassland or open areas in grassy eucalypt woodland. May occur in modified grasslands with high exotic grass cover. Shelters in base of grass tussocks, under rocks or logs or in soil cracks (Smith and Robertson 1999).                                                                                                                                                                                                                                             | Low                      | Despite small amount of habitat present within the proposal site, this species was not observed during targeted surveys. These areas also lack high abundance of rocks and logs due to the disturbed nature of the site.                                                                                                                                                                                           |

| Scientific Name                  | Common Name       | Taxonomy | BC Act statu | EPBC Act s | PMST (DAWE, 2020) | Candidate species (BAM-C) | Predicted species (BAM-C) | Habitat Association                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Likelihood of Occurrence | Justification                                         |
|----------------------------------|-------------------|----------|--------------|------------|-------------------|---------------------------|---------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|-------------------------------------------------------|
| <i>Hoplocephalus bitorquatus</i> | Pale-headed Snake | Reptile  | V            | -          | -                 | -                         | Y                         | <p>A patchy distribution from north-east Queensland to the north-eastern quarter of NSW. In NSW it has historically been recorded from as far west as Mungindi and Quambone on the Darling Riverine Plains, across the north west slopes, and from the north coast from Queensland to Sydney. A small number of historical records are known for the New England Tablelands from Glenn Innes and Tenterfield; however, the majority of records appear to be from sites of relatively lower elevation.</p> <p>Although the Pale-headed snake distribution is very cryptic, it now appears to have contracted to a patchy and fragmented distribution. Found mainly in dry eucalypt forests and woodlands, cypress forest and occasionally in rainforest or moist eucalypt forest. In drier environments, it appears to favour habitats close to riparian areas. Shelter during the day between loose bark and tree-trunks, or in hollow trunks and limbs of dead trees. The Pale-headed Snake is a highly cryptic species that can spend weeks at a time hidden in tree hollows.</p> | Low                      | Unlikley no tree hollows present within proposal site |



# Appendix B

Survey results

**Table B.1**      *Flora species list*

| Family name            | Scientific name                | Common name              | Lifeform               |
|------------------------|--------------------------------|--------------------------|------------------------|
| Apiaceae               | <i>Centella asiatica</i>       | Indian Pennywort         | Forb (FG)              |
| Apiaceae               | <i>Xanthosia tridentata</i>    | Rock Xanthosia           | Forb (FG)              |
| Apocynaceae            | <i>Parsonsia straminea</i>     | Common Silkpod           | Other (OG)             |
| Arecaceae              | <i>Phoenix canariensis</i>     | Canary Island Date Palm  | HTW - Manageable       |
| Asteraceae             | <i>Bidens Pilosa</i>           | Cobbler's Pegs           | Exotic                 |
| Asteraceae             | <i>Cirsium vulgare</i>         | Spear Thistle            | Exotic                 |
| Asteraceae             | <i>Conyza bonariensis</i>      | Flaxleaf Fleabane        | Exotic                 |
| Asteraceae             | <i>Cyanthillium cinereum</i>   | Purple Fleabane          | Exotic                 |
| Asteraceae             | <i>Hypochaeris radicata</i>    | Catsear                  | Exotic                 |
| Asteraceae             | <i>Ozothamnus diosmifolius</i> | White Dogwood            | Shrub (SG)             |
| Asteraceae             | <i>Taraxacum officinale</i>    | Dandelion                | Exotic                 |
| Campanulaceae          | <i>Lobelia purpurascens</i>    | Whiteroot                | Forb (FG)              |
| Casuarinaceae          | <i>Allocasuarina torulosa</i>  | Forest Oak               | Tree (TG)              |
| Casuarinaceae          | <i>Casuarina glauca</i>        | Swamp Oak                | Tree (TG)              |
| Celastraceae           | <i>Denhamia silvestris</i>     | Narrow-leaved Orangebark | Shrub (SG)             |
| Chenopodiaceae         | <i>Einadia hastata</i>         | Berry Saltbush           | Forb (FG)              |
| Commelinaceae          | <i>Commelina cyanea</i>        | Native Wandering Jew     | Forb (FG)              |
| Convolvulaceae         | <i>Dichondra repens</i>        | Kidney Weed              | Forb (FG)              |
| Cyperaceae             | <i>Gahnia clarkei</i>          | Tall Saw-sedge           | Grass & grasslike (GG) |
| Cyperaceae             | <i>Lepidosperma laterale</i>   | Variable Sword-sedge     | Grass & grasslike (GG) |
| Fabaceae (Faboideae)   | <i>Daviesia ulicifolia</i>     | Gorse Bitter Pea         | Shrub (SG)             |
| Fabaceae (Faboideae)   | <i>Dillwynia retorta</i>       | -                        | Shrub (SG)             |
| Fabaceae (Faboideae)   | <i>Glycine clandestina</i>     | Twining glycine          | Other (OG)             |
| Fabaceae (Faboideae)   | <i>Hardenbergia violacea</i>   | False Sarsaparilla       | Other (OG)             |
| Fabaceae (Faboideae)   | <i>Pultenaea</i> spp.          | -                        | Shrub (SG)             |
| Fabaceae (Mimosoideae) | <i>Acacia elongata</i>         | Swamp Wattle             | Shrub (SG)             |
| Fabaceae (Mimosoideae) | <i>Acacia falcata</i>          | -                        | Shrub (SG)             |
| Fabaceae (Mimosoideae) | <i>Acacia irrorata</i>         | Green Wattle             | Shrub (SG)             |
| Fabaceae (Mimosoideae) | <i>Acacia longifolia</i>       | -                        | Shrub (SG)             |
| Fabaceae (Mimosoideae) | <i>Acacia</i> spp.             | Wattle                   | Shrub (SG)             |
| Fabaceae (Mimosoideae) | <i>Acacia ulicifolia</i>       | Prickly Moses            | Shrub (SG)             |
| Gentianaceae           | <i>Centaurium erythraea</i>    | Common Centaury          | Exotic                 |
| Juncaceae              | <i>Juncus</i> spp.             | -                        | Grass & grasslike (GG) |

| Family name      | Scientific name                         | Common name               | Lifeform               |
|------------------|-----------------------------------------|---------------------------|------------------------|
| Lauraceae        | <i>Cassytha glabella</i>                | -                         | Other (OG)             |
| Lauraceae        | <i>Cassytha pubescens</i>               | Downy Dodder-laurel       | Other (OG)             |
| Lauraceae        | <i>Cinnamomum camphora</i>              | Camphor Laurel            | HTW - Manageable       |
| Lomandraceae     | <i>Lomandra confertifolia</i>           | Matrush                   | Grass & grasslike (GG) |
| Lomandraceae     | <i>Lomandra filiformis</i>              | Wattle Matt-rush          | Grass & grasslike (GG) |
| Lomandraceae     | <i>Lomandra glauca</i>                  | Pale Mat-rush             | Grass & grasslike (GG) |
| Lomandraceae     | <i>Lomandra longifolia</i>              | Spiny-headed Mat-rush     | Grass & grasslike (GG) |
| Malvaceae        | <i>Sida rhombifolia</i>                 | Paddy's Lucerne           | Exotic                 |
| Myrtaceae        | <i>Angophora bakeri</i>                 | Narrow-leaved Apple       | Tree (TG)              |
| Myrtaceae        | <i>Angophora floribunda</i>             | Rough-barked Apple        | Tree (TG)              |
| Myrtaceae        | <i>Callistemon linearis</i>             | Narrow-leaved Bottlebrush | Shrub (SG)             |
| Myrtaceae        | <i>Callistemon viminalis</i>            | Weeping Bottlebrush       | Tree (TG)              |
| Myrtaceae        | <i>Corymbia maculata</i>                | Spotted Gum               | Tree (TG)              |
| Myrtaceae        | <i>Corymbia torelliana</i>              | Cadaghi                   | HTW - Manageable       |
| Myrtaceae        | <i>Eucalyptus fibrosa</i>               | Red Ironbark              | Tree (TG)              |
| Myrtaceae        | <i>Eucalyptus globoidea</i>             | White Stringybark         | Tree (TG)              |
| Myrtaceae        | <i>Eucalyptus microcorys</i>            | Tallowwood                | Tree (TG)              |
| <b>Myrtaceae</b> | <b><i>Eucalyptus parramattensis</i></b> | <b>Parramatta Red Gum</b> | <b>Tree (TG)</b>       |
| Myrtaceae        | <i>Eucalyptus punctata</i>              | Grey Gum                  | Tree (TG)              |
| Myrtaceae        | <i>Eucalyptus resinifera</i>            | Red Mahogany              | Tree (TG)              |
| Myrtaceae        | <i>Eucalyptus robusta</i>               | Swamp Mahogany            | Tree (TG)              |
| Myrtaceae        | <i>Eucalyptus siderophloia</i>          | Grey Ironbark             | Tree (TG)              |
| Myrtaceae        | <i>Eucalyptus tereticornis</i>          | Forest Red Gum            | Tree (TG)              |
| Myrtaceae        | <i>Eucalyptus spp.</i>                  | -                         | Tree (TG)              |
| Myrtaceae        | <i>Melaleuca nodosa</i>                 | -                         | Shrub (SG)             |
| Myrtaceae        | <i>Melaleuca thymifolia</i>             | Thyme Honey-myrtle        | Shrub (SG)             |
| Phormiaceae      | <i>Dianella caerulea</i>                | Blue Flax-lily            | Forb (FG)              |
| Phormiaceae      | <i>Dianella revoluta</i>                | Blueberry Lily            | Forb (FG)              |
| Phyllanthaceae   | <i>Breynia oblongifolia</i>             | Coffee Bush               | Shrub (SG)             |
| Pittosporaceae   | <i>Bursaria spinosa</i>                 | Native Blackthorn         | Shrub (SG)             |
| Plantaginaceae   | <i>Plantago lanceolata</i>              | Lamb's Tongues            | Exotic                 |
| Poaceae          | <i>Andropogon virginicus</i>            | Whisky Grass              | HTW                    |
| Poaceae          | <i>Cynodon dactylon</i>                 | Common Couch              | Grass & grasslike (GG) |
| Poaceae          | <i>Dichelachne crinita</i>              | Longhair Plumegrass       | Grass & grasslike (GG) |
| Poaceae          | <i>Digitaria breviglumis</i>            | -                         | Grass & grasslike (GG) |

| Family name       | Scientific name                                             | Common name                   | Lifeform               |
|-------------------|-------------------------------------------------------------|-------------------------------|------------------------|
| Poaceae           | <i>Echinopogon caespitosus</i>                              | Bushy Hedgehog-grass          | Grass & grasslike (GG) |
| Poaceae           | <i>Ehrharta erecta</i>                                      | Panic Veldtgrass              | HTW                    |
| Poaceae           | <i>Entolasia marginata</i>                                  | Bordered Panic                | Grass & grasslike (GG) |
| Poaceae           | <i>Entolasia stricta</i>                                    | Wiry Panic                    | Grass & grasslike (GG) |
| Poaceae           | <i>Imperata cylindrica</i>                                  | Blady Grass                   | Grass & grasslike (GG) |
| Poaceae           | <i>Microlaena stipoides</i>                                 | Weeping Grass                 | Grass & grasslike (GG) |
| Poaceae           | <i>Oplismenus aemulus</i>                                   | -                             | Grass & grasslike (GG) |
| Poaceae           | <i>Panicum simile</i>                                       | Two-colour Panic              | Grass & grasslike (GG) |
| Poaceae           | <i>Rytidosperma pallidum</i>                                | Silvertop Wallaby Grass       | Grass & grasslike (GG) |
| Poaceae           | <i>Sporobolus virginicus</i>                                | -                             | Grass & grasslike (GG) |
| Poaceae           | <i>Themeda triandra</i>                                     | Kangaroo Grass                | Grass & grasslike (GG) |
| Proteaceae        | <i>Grevillea montana</i>                                    | -                             | Shrub (SG)             |
| <b>Proteaceae</b> | <b><i>Grevillea parviflora</i> subsp. <i>parviflora</i></b> | <b>Small-flower Grevillea</b> | <b>Shrub (SG)</b>      |
| Proteaceae        | <i>Persoonia linearis</i>                                   | Narrow-leaved Geebung         | Shrub (SG)             |
| Ranunculaceae     | <i>Clematis glycinoides</i>                                 | Headache Vine                 | Other (OG)             |
| Rubiaceae         | <i>Pomax umbellata</i>                                      | Pomax                         | Forb (FG)              |
| Rubiaceae         | <i>Richardia brasiliensis</i>                               | Mexican Clover                | Exotic                 |
| Santalaceae       | <i>Exocarpos cupressiformis</i>                             | Cherry Ballart                | Shrub (SG)             |
| Sapindaceae       | <i>Dodonaea triquetra</i>                                   | Large-leaf Hop-bush           | Shrub (SG)             |
| Solanaceae        | <i>Solanum nigrum</i>                                       | Black-berry Nightshade        | Exotic                 |
| Thymelaeaceae     | <i>Pimelea linifolia</i>                                    | Slender Rice Flower           | Shrub (SG)             |
| Verbenaceae       | <i>Lantana camara</i>                                       | Lantana                       | HTW - Manageable       |
| Zamiaceae         | <i>Macrozamia flexuosa</i>                                  | -                             | Other (OG)             |

**Note:** HTW = High threat weed



## Fauna species (recorded across entire Hydro site)

V = Listed as vulnerable species, E = Endangered, CE = Critically endangered

BC Act = Biodiversity Conservation Act 2017

EPBC Act = Environment Protection and Biodiversity Conservation Act 1999

**Table B.2** Fauna species recorded in and adjacent to proposal site

| Class | Scientific name                     | Common name                  | Status |          | Observation type |
|-------|-------------------------------------|------------------------------|--------|----------|------------------|
|       |                                     |                              | BC Act | EPBC Act |                  |
| Aves  | <i>Acanthiza pusilla</i>            | Brown Thornbill              | -      | -        | Observed         |
| Aves  | <i>Acanthiza reguloides</i>         | Buff-rumped Thornbill        | -      | -        | Observed         |
| Aves  | <i>Acanthorhynchus tenuirostris</i> | Eastern Spinebill            | -      | -        | Observed         |
| Aves  | <i>Accipiter cirrocephalus</i>      | Collared Sparrowhawk         | -      | -        | Observed         |
| Aves  | <i>Accipiter novaehollandiae</i>    | Grey Goshawk                 | -      | -        | Observed         |
| Aves  | <i>Acridotheres tristis*</i>        | Common Myna                  | -      | -        | Observed         |
| Aves  | <i>Alisterus scapularis</i>         | Australian King-Parrot       | -      | -        | Observed         |
| Aves  | <i>Amblyornis newtonianus</i>       | Superb Fairy-wren            | -      | -        | Heard            |
| Aves  | <i>Anas castanea</i>                | Chestnut Teal                | -      | -        | Observed         |
| Aves  | <i>Anas gracilis</i>                | Grey Teal                    | -      | -        | Observed         |
| Aves  | <i>Anas superciliosa</i>            | Pacific Black Duck           | -      | -        | Observed         |
| Aves  | <i>Anthochaera carunculata</i>      | Red Wattlebird               | -      | -        | Observed         |
| Aves  | <i>Aquila audax</i>                 | Wedge-tailed Eagle           | -      | -        | Observed         |
| Aves  | <i>Ardea ibis</i>                   | Cattle Egret                 | -      | -        | Observed         |
| Aves  | <i>Ardea intermedia</i>             | Intermediate Egret           | -      | -        | Observed         |
| Aves  | <i>Ardea pacifica</i>               | White-necked Heron           | -      | -        | Observed         |
| Aves  | <i>Cacatua galerita</i>             | Sulphur-crested Cockatoo     | -      | -        | Observed         |
| Aves  | <i>Cacatua sanguinea</i>            | Little Corella               | -      | -        | Observed         |
| Aves  | <i>Calyptorhynchus funereus</i>     | Yellow-tailed Black-Cockatoo | -      | -        | Observed         |
| Aves  | <i>Chenonetta jubata</i>            | Australian Wood Duck         | -      | -        | Observed         |
| Aves  | <i>Colluricincla harmonica</i>      | Grey Shrike-thrush           | -      | -        | Observed         |
| Aves  | <i>Coracina novaehollandiae</i>     | Black-faced Cuckoo-shrike    | -      | -        | Observed         |
| Aves  | <i>Corcorax melanorhamphos</i>      | White-winged Chough          | -      | -        | Observed         |
| Aves  | <i>Cormobates leucophaeus</i>       | White-throated Treecreeper   | -      | -        | Observed         |
| Aves  | <i>Corvus coronoides</i>            | Australian Raven             | -      | -        | Observed         |
| Aves  | <i>Corvus orru</i>                  | Torresian Crow               | -      | -        | Observed         |
| Aves  | <i>Cracticus nigrogularis</i>       | Pied Butcherbird             | -      | -        | Observed         |
| Aves  | <i>Cracticus torquatus</i>          | Grey Butcherbird             | -      | -        | Observed         |
| Aves  | <i>Cygnus atratus</i>               | Black Swan                   | -      | -        | Observed         |
| Aves  | <i>Dacelo novaeguineae</i>          | Laughing Kookaburra          | -      | -        | Observed         |
| Aves  | <i>Daphoenositta chrysoptera</i>    | Varied Sittella              | V      | -        | Observed         |
| Aves  | <i>Dendrocygna eytoni</i>           | Plumed Whistling-Duck        | -      | -        | Observed         |
| Aves  | <i>Dicaeum hirundinaceum</i>        | Mistletoebird                | -      | -        | Observed         |

| Class | Scientific name                     | Common name              | Status |          | Observation type |
|-------|-------------------------------------|--------------------------|--------|----------|------------------|
|       |                                     |                          | BC Act | EPBC Act |                  |
| Aves  | <i>Elseyornis melanops</i>          | Black-fronted Dotterel   | -      | -        | Observed         |
| Aves  | <i>Eolophus roseicapilla</i>        | Galah                    | -      | -        | Observed         |
| Aves  | <i>Eopsaltria australis</i>         | Eastern Yellow Robin     | -      | -        | Observed         |
| Aves  | <i>Eudnamys orientalis</i>          | Eastern Koel             | -      | -        | Observed         |
| Aves  | <i>Eurystomus orientalis</i>        | Dollarbird               | -      | -        | Observed         |
| Aves  | <i>Falco cenchroides</i>            | Nankeen Kestrel          | -      | -        | Observed         |
| Aves  | <i>Falco longipennis</i>            | Australian hobby         | -      | -        | Observed         |
| Aves  | <i>Fulica atra</i>                  | Eurasian Coot            | -      | -        | Observed         |
| Aves  | <i>Geopelia humeralis</i>           | Bar-shouldered Dove      | -      | -        | Observed         |
| Aves  | <i>Geopelia placida (striata)</i>   | Peaceful Dove            | -      | -        | Observed         |
| Aves  | <i>Gerygone albogularis</i>         | White-throated Gerygone  | -      | -        | Observed         |
| Aves  | <i>Glossopsitta concinna</i>        | Musk Lorikeet            | -      | -        | Observed         |
| Aves  | <i>Glossopsitta pusilla</i>         | Little Lorikeet          | V      | -        | Observed         |
| Aves  | <i>Grallina cyanoleuca</i>          | Magpie-lark              | -      | -        | Observed         |
| Aves  | <i>Gymnorhina tibicen</i>           | Australian Magpie        | -      | -        | Observed         |
| Aves  | <i>Haliaeetus leucogaster</i>       | White-bellied Sea-Eagle  | V      | C        | Observed         |
| Aves  | <i>Haliastur sphenurus</i>          | Whistling Kite           | -      | -        | Observed         |
| Aves  | <i>Hirundo neoxena</i>              | Welcome Swallow          | -      | -        | Observed         |
| Aves  | <i>Lalage tricolor</i>              | White-winged Triller     | -      | -        | Observed         |
| Aves  | <i>Lichenostomus chrysops</i>       | Yellow-faced Honeyeater  | -      | -        | Observed         |
| Aves  | <i>Malurus lamberti</i>             | Variegated Fairy-wren    | -      | -        | Observed         |
| Aves  | <i>Manorina melanocephala</i>       | Noisy Miner              | KTP    | -        | Observed         |
| Aves  | <i>Manorina melanophrys</i>         | Bell Miner               | KTP    | -        | Observed         |
| Aves  | <i>Melithreptus brevirostris</i>    | Brown-headed Honeyeater  | -      | -        | Observed         |
| Aves  | <i>Merops ornatus</i>               | Rainbow Bee-eater        | -      | -        | Observed         |
| Aves  | <i>Myzomela sanguinolenta</i>       | Scarlet Honeyeater       | -      | -        | Observed         |
| Aves  | <i>Neochmia temporalis</i>          | Red-browed Finch         | -      | -        | Observed         |
| Aves  | <i>Ocyphaps lophotes</i>            | Crested Pigeon           | -      | -        | Observed         |
| Aves  | <i>Oriolus sagittatus</i>           | Olive-backed Oriole      | -      | -        | Observed         |
| Aves  | <i>Pachycephala rufiventris</i>     | Rufous Whistler          | -      | -        | Observed         |
| Aves  | <i>Pardalotus striatus</i>          | Striated Pardalote       | -      | -        | Observed         |
| Aves  | <i>Pelecanus conspicillatus</i>     | Australian Pelican       | -      | -        | Observed         |
| Aves  | <i>Phalacrocorax carbo</i>          | Great Cormorant          | -      | -        | Observed         |
| Aves  | <i>Phalacrocorax melanoleucos</i>   | Little Pied Cormorant    | -      | -        | Observed         |
| Aves  | <i>Phalacrocorax sulcirostris</i>   | Little Black Cormorant   | -      | -        | Observed         |
| Aves  | <i>Phaps chalcoptera</i>            | Common Bronzewing        | -      | -        | Observed         |
| Aves  | <i>Philemon corniculatus</i>        | Noisy Friarbird          | -      | -        | Observed         |
| Aves  | <i>Phylidonyris niger</i>           | White-cheeked Honeyeater | -      | -        | Observed         |
| Aves  | <i>Phylidonyris novaehollandiae</i> | New Holland Honeyeater   | -      | -        | Observed         |

| Class      | Scientific name                           | Common name                               | Status |          | Observation type  |
|------------|-------------------------------------------|-------------------------------------------|--------|----------|-------------------|
|            |                                           |                                           | BC Act | EPBC Act |                   |
| Aves       | <i>Platycercus eximius</i>                | Eastern Rosella                           | -      | -        | Observed          |
| Aves       | <i>Podargus strigoides</i>                | Tawny Frogmouth                           | -      | -        | Observed          |
| Aves       | <i>Pomatostomus temporalis temporalis</i> | Grey-crowned Babbler (eastern subspecies) | V      | -        | Observed          |
| Aves       | <i>Porphyrio porphyrio</i>                | Purple Swamphen                           | -      | -        | Observed          |
| Aves       | <i>Psophodes olivaceus</i>                | Eastern whipbird                          | -      | -        | Observed          |
| Aves       | <i>Rhipidura albiscapa</i>                | Grey Fantail                              | -      | -        | Observed          |
| Aves       | <i>Rhipidura leucophrys</i>               | Willie Wagtail                            | -      | -        | Observed          |
| Aves       | <i>Sericornis frontalis</i>               | White-browed Scrubwren                    | -      | -        | Heard             |
| Aves       | <i>Threskiornis spinicollis</i>           | Straw-necked Ibis                         | -      | -        | Observed          |
| Aves       | <i>Todiramphus sanctus</i>                | Sacred Kingfisher                         | -      | -        | Observed          |
| Aves       | <i>Trichoglossus chlorolepidotus</i>      | Scaly-breasted Lorikeet                   | -      | -        | Observed          |
| Aves       | <i>Trichoglossus haematodus</i>           | Rainbow Lorikeet                          | -      | -        | Observed          |
| Aves       | <i>Tyto javanica</i>                      | Eastern Barn owl                          | -      | -        | Observed          |
| Aves       | <i>Vanellus miles</i>                     | Masked Lapwing                            | -      | -        | Observed          |
| Aves       | <i>Zosterops lateralis</i>                | Silvereye                                 | -      | -        | Observed          |
| Amphibians | <i>Litoria quiritatus</i>                 | Screaming tree frog                       | -      | -        | Heard             |
| Amphibians | <i>Crinia signifera</i>                   | Common Eastern Froglet                    | -      | -        | Observed          |
| Amphibians | <i>Litoria caerulea</i>                   | Green Tree Frog                           | -      | -        | Observed          |
| Amphibians | <i>Limnodynastes dumerilii</i>            | Eastern Banjo Frog                        | -      | -        | Observed          |
| Amphibians | <i>Litoria fallax</i>                     | Eastern Dwarf Tree Frog                   | -      | -        | Observed          |
| Amphibians | <i>Platyplectrum ornatum</i>              | Ornate Burrowing Frog                     | -      | -        | Observed          |
| Amphibians | <i>Litoria peronii</i>                    | Peron's Tree Frog                         | -      | -        | Observed          |
| Amphibians | <i>Uperoleia laevigata</i>                | Smooth Toadlet                            | -      | -        | Trapped and heard |
| Amphibians | <i>Limnodynastes peronii</i>              | Brown-striped Frog                        | -      | -        | Observed          |
| Amphibians | <i>Limnodynastes tasmaniensis</i>         | Spotted Marsh Frog                        | -      | -        | Heard             |
| Amphibians | <i>Litoria tyleri</i>                     | Tyler's Tree Frog                         | -      | -        | Heard             |
| Reptilia   | <i>Pogona barbata</i>                     | Bearded Dragon                            | -      | -        | Observed          |
| Reptilia   | <i>Chelodina longicollis</i>              | Eastern Snake-necked Turtle               | -      | -        | Observed          |
| Reptilia   | <i>Ctenotus robustus</i>                  | Robust Ctenotus                           | -      | -        | Trapped           |
| Reptilia   | <i>Eulamprus quoyii</i>                   | Eastern Water-skink                       | -      | -        | Observed          |
| Reptilia   | <i>Lampropholis delicata</i>              | Dark-flecked Garden Sunskink              | -      | -        | Trapped           |
| Reptilia   | <i>Amphibolurus muricatus</i>             | Jacky Lizard                              | -      | -        | Observed          |
| Reptilia   | <i>Varanus varius</i>                     | Lace Monitor                              | -      | -        | Observed          |
| Reptilia   | <i>Pseudechis porphyriacus</i>            | Red-bellied Black Snake                   | -      | -        | Observed          |
| Reptilia   | <i>Furina diadema</i>                     | Red-naped Snake                           | -      | -        | Observed          |
| Mammalia   | <i>Antechinus stuartii</i>                | Brown Antechinus                          | -      | -        | Observed          |
| Mammalia   | <i>Rattus rattus</i>                      | Black Rat                                 | -      | -        | Observed          |
| Mammalia   | <i>Trichosurus vulpecula</i>              | Common Brushtail Possum                   | -      | -        | Observed          |

| Class    | Scientific name                 | Common name                     | Status |          | Observation type   |
|----------|---------------------------------|---------------------------------|--------|----------|--------------------|
|          |                                 |                                 | BC Act | EPBC Act |                    |
| Mammalia | <i>Sminthopsis murina</i>       | Common Dunnart                  | -      | -        | Trapped            |
| Mammalia | <i>Pseudocheirus peregrinus</i> | Common Ringtail Possum          | -      | -        | Observed           |
| Mammalia | <i>Vombatus ursinus</i>         | Common Wombat                   | -      | -        | Observed           |
| Mammalia | <i>Macropus giganteus</i>       | Eastern grey kangaroo           | -      | -        | Observed           |
| Mammalia | <i>Lepus europaeus</i>          | Brown Hare                      | -      | -        | Observed           |
| Mammalia | <i>Oryctolagus cuniculus</i>    | Rabbit                          | -      | -        | Observed           |
| Mammalia | <i>Vulpes vulpes</i>            | Fox                             | -      | -        | Observed           |
| Mammalia | <i>Macropus rufogriseus</i>     | Red-necked Wallaby              | -      | -        | Observed           |
| Mammalia | <i>Tachyglossus aculeatus</i>   | Short-beaked Echidna            | -      | -        | Observed           |
| Mammalia | <i>Petaurus breviceps</i>       | Sugar Glider                    | -      | -        | Trapped            |
| Mammalia | <i>Wallabia bicolor</i>         | Swamp Wallaby                   | -      | -        | Observed           |
| Mammalia | <i>Chalinolobus morio</i>       | Chocolate Wattled Bat           | -      | -        | Acoustic Recording |
| Mammalia | <i>Micronomus norfolkensis</i>  | Eastern Coastal Free-tailed Bat | V      | -        | Acoustic Recording |
| Mammalia | <i>Vespadelus pumilus</i>       | Eastern Forest Bat              | -      | -        | Acoustic Recording |
| Mammalia | <i>Mormopterus norfolkensis</i> | Eastern Freetail-bat            | V      | -        | Acoustic Recording |
| Mammalia | <i>Chalinolobus gouldii</i>     | Gould's Wattled Bat             | -      | -        | Acoustic Recording |
| Mammalia | <i>Pteropus poliocephalus</i>   | Grey-headed Flying-fox          | V      | V        | Observed           |
| Mammalia | <i>Nyctophilus geoffroyi</i>    | Lesser Long-eared Bat           | -      | -        | Acoustic Recording |
| Mammalia | <i>Miniopterus australis</i>    | Little Bent-winged Bat          | V      | -        | Acoustic Recording |
| Mammalia | <i>Myotis macropus</i>          | Southern Myotis                 | V      | -        | Observed           |



# **Appendix C**

**BAM calculator data**

Table C.1      Vegetation integrity plot data

| plot | pct  | area | patchsize | conditionclass | zone | easting | northing | bearing | compTree | compShrub | compGrass | compForbs | compFerns | compOther | strucTree | strucShrub | strucGrass | strucForbs | strucFerns | strucOther | funLargeTrees | funHollowtrees | funLitterCover | funLenFallenLogs | funTreeStem5to9 | funTreeStem10to19 | funTreeStem20to29 | funTreeStem30to49 | funTreeStem50to79 | funTreeRegen | funHighThreatExotic |
|------|------|------|-----------|----------------|------|---------|----------|---------|----------|-----------|-----------|-----------|-----------|-----------|-----------|------------|------------|------------|------------|------------|---------------|----------------|----------------|------------------|-----------------|-------------------|-------------------|-------------------|-------------------|--------------|---------------------|
| 3    | 1633 | 0.19 | 101       | Intact         | 55   | 357439  | 6370531  | 286.00  | 4        | 13        | 8         | 2         | 0         | 1         | 49.7      | 22         | 86.2       | 0.5        | 0          | 0.6        | 0             | 0              | 52             | 33               | 1               | 1                 | 1                 | 1                 | 0                 | 1            | 0                   |
| 2    | 1600 | 0.73 | 101       | Intact         | 55   | 357552  | 6370477  | 263.00  | 4        | 7         | 8         | 4         | 0         | 2         | 32        | 77.4       | 8.5        | 1          | 0          | 2.1        | 1             | 0              | 52             | 39               | 1               | 1                 | 1                 | 1                 | 1                 | 1            | 1                   |
| 1    | 1591 | 0.32 | 101       | Intact         | 55   | 357439  | 6370531  | 188.00  | 10       | 3         | 8         | 5         | 0         | 2         | 42.6      | 12.1       | 72.7       | 1          | 0          | 10.3       | 1             | 0              | 60             | 31               | 1               | 1                 | 1                 | 1                 | 1                 | 1            | 17.7                |
| 4    | 1591 | 0.22 | 101       | Disturbed      | 55   | 357791  | 6370690  | 14.00   | 2        | 9         | 4         | 2         | 0         | 2         | 8         | 6.3        | 42.2       | 0.4        | 0          | 0.2        | 0             | 0              | 14             | 11               | 1               | 1                 | 1                 | 1                 | 0                 | 1            | 0.3                 |

Table C.2      Summary of vegetation integrity data

| Vegetation zone | PCT                                                                                                                              | Current composition score | Future composition score | Current structure score | Future structure score | Current function score | Future function score | Current VI score | Future VI score |
|-----------------|----------------------------------------------------------------------------------------------------------------------------------|---------------------------|--------------------------|-------------------------|------------------------|------------------------|-----------------------|------------------|-----------------|
| 1               | Parramatta Red Gum- Narrow-leaved Apple-Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area (1633_Intact) | 66.2                      | 0                        | 58.5                    | 0                      | 61.8                   | 0                     | 62.1             | 0               |
| 2               | Spotted Gum – Red Ironbark – Narrow-leaved Ironbark – Grey Box shrub grass open forest of the lower Hunter (1600_Weedy)          | 59.5                      | 0                        | 44.6                    | 0                      | 72.9                   | 0                     | 57.8             | 0               |
| 3               | Grey Gum - Rough-barked Apple shrubby open forest of the lower Hunter (1591_intact)                                              | 52.6                      | 0                        | 75.7                    | 0                      | 71.6                   | 0                     | 65.8             | 0               |
| 4               | Grey Gum - Rough-barked Apple shrubby open forest of the lower Hunter (1591_disturbed)                                           | 42.2                      | 0                        | 32                      | 0                      | 34.1                   | 0                     | 35.8             | 0               |

# **Appendix D**

**Assessment of serious and irreversible impacts**

## Assessment of potential SAI for Regent Honeyeater

The proposal would result in an impact on a potential SAI entity through the proposed removal of 0.37 ha of mapped important habitat for the Regent Honeyeater (*Anthochaera phrygia*). This section presents the additional impact assessment provisions for threatened fauna species that may be considered a SAI entity, as required by Section 9.1.2 of the BAM (DPIE 2020a).

**1. The assessor is required to provide further information in the BDAR or BCAR for any species at risk of an SAI, including the action and measures taken to avoid the direct and indirect impact on the species at risk of an SAI. Where these have been addressed elsewhere the assessor can refer to the relevant sections of the BDAR or BCAR.**

The 35.20 ha proposal site is located within a much larger 1,900 ha land parcel of which approximately 300 ha is currently proposed for biodiversity certification (referred to as the Hydro Land Parcel). In 2014 initial investigations and environmental constraints studies were undertaken to inform a preliminary master plan for the proposal. The factors considered at that stage generally consisted of identifying conservation land, developable land and flood prone land.

The proposed development site rezoning masterplan footprint has undergone several revisions through the proposal planning and design process that have looked at how impacts to areas of higher conservation value within the larger land parcel could be avoided as far as is practical. Various iterations of the masterplan footprint have been developed and amended in response to detailed understanding of the site's biodiversity values and offsets requirements. The aim of the rezoning process and development of the preliminary masterplan was to avoid and minimise impacts on high biodiversity values within the site and to balance their offset requirements for land identified for development with likely credits that would be created within the areas proposed for conservation.

In 2014, an initial assessment was completed that assessed and evaluated a range of identifiable constraints within the entire Hydro land parcel. This assessment process produced a preliminary masterplan for the site. The intention of the preliminary masterplan was to be able to identify broad characteristics and potential land uses, which was then subject to more detailed study and refinement. Regarding the native vegetation on site, the assessment considered and put forward the conservation of areas of highest biodiversity value, which are located to the north-west of the site and focused areas for development (including the proposed collector road) predominantly in previously disturbed areas and isolated patches of low and/or poor condition vegetation or at the edges of larger patches of existing vegetation.

Following the design of the preliminary masterplan, a Biodiversity Certification Assessment (BCA) of the site was prepared in accordance with the provisions in the now repealed *Threatened Species Conservation Act 1995* (ELA 2016). Based on recommendations in the BCA (ELA 2016), The masterplan was amended to further avoid impacts on biodiversity values, with the footprint of the development lands reduced from 1229 ha to 657 ha, resulting in the avoidance of impacts to approximately 570 ha of potential Regent Honeyeater habitat (based on previous assessments).

Further refinement and update of the rezoning masterplan was undertaken in 2019 to further reduce impacts to areas of high biodiversity value. This resulted in the area of development land being further reduced to 243 ha. These amendments resulted in the additional avoidance of approximately 45 ha of mapped important habitat for the Regent Honeyeater.

Approximately 768 ha of land adjacent to the proposal site is proposed to be set aside for conservation in perpetuity under a Biodiversity Stewardship Agreement (BSA) as a Biodiversity Stewardship Site (BSS). A total of 607.25 ha of land mapped as important habitat for the Regent Honeyeater would be conserved within the proposed BSS. The BSS would form one of largest patches of Regent Honeyeater habitat to be conserved on private land within the Hunter IBRA Subregion.



**2. The assessor must consult the TBDC and/or other sources to report on the current population of the species including:**

**a. evidence of rapid decline (Principle 1, clause 6.7(2)(a) BC Regulation) presented by an estimate of the:**

**i. decline in population of the species in NSW in the past 10 years or three generations (whichever is longer).**

The Regent Honeyeater population continues to decline in NSW. Due to the species' life-history attributes of small population size, large range and irregular, long-distance movement patterns (Commonwealth of Australia 2016), it is challenging to estimate with confidence the size of the NSW Regent Honeyeater population and the rate at which it is declining. Best estimates suggest that the NSW Regent Honeyeater population may have halved over the past decade, with a contemporary population comprising between 150 and 300 individuals (Garnett et al. 2021). A population viability analysis based on parameters derived from monitoring of the wild population since 2015 predicts that the species will be very close to extinction within two decades (Heinsohn et al. 2022).

**ii. decline in population of the species in NSW in the past 10 years or three generations (whichever is longer) as indicated by: an index of abundance appropriate to the species; decline in geographic distribution and/or habitat quality; exploitation; effect of introduced species, hybridisation, pathogens, pollutants, competitors or parasites.**

In addition to the information provided in response to 2a (i) above, there is evidence of a decline in the geographic distribution of the Regent Honeyeater over the past decade. Regent Honeyeaters have not been seen and have not bred in the Pilliga / Warrumbungles region since 2015, whilst sightings in the NSW Northern Tablelands and the NSW South Coast regions have continued to dwindle (Garnett et al. 2021, NRHMP, unpublished data). There has been a substantial decline in the quality of known breeding habitat over recent years. The 2019/20 drought led to widespread eucalypt die-off in the Bundarra-Barraba area. Recent observations show that needle-leaf mistletoe *Amyema cambagei*- a key breeding resource for Regent Honeyeaters- is suffering widespread mortality (Crates et al. In revision). Consequently, there is good evidence that on top of an observable population decline and range contraction over the past decade, Regent Honeyeaters have also experienced a decline in the quality and quantity of known breeding and foraging habitat in recent years.

**b. evidence of small population size (Principle 2, clause 6.7(2)(b) BC Regulation) presented by:**

**i. an estimate of the species' current population size in NSW.**

The contemporary, wild Regent Honeyeater population is estimated to consist of 150-200 individuals in NSW (Crates et al. 2019, Garnett et al. 2021). The NSW population has been recently supplemented by the reintroduction of 58 zoo-bred birds into the Tomalpin Woodlands, south of Kurri Kurri in 2020-21. Monitoring of the reintroduced birds suggests that approximately 50 of these zoo-bred individuals may survive in the wild as of November 2021 (Dr Ross Crates Pers Com). Therefore, it is estimated that the NSW Regent Honeyeater currently comprises 200-250 individuals.

**ii. an estimate of the decline in the species' population size in NSW in three years or one generation (whichever is longer).**

The available evidence from sightings data and population viability analysis suggests that the NSW population has declined by approximately 30-50% in three years. In 2017 (the last productive season for the species), the National Regent Honeyeater Monitoring Program (NRHMP) managed by the Australian National University detected approximately 140 mature wild individuals in NSW. In 2021 with conditions comparable to 2017, the NRHMP has located approximately 80 mature wild individuals. These figures represent a 43% decrease in the population over four years. Capacity to identify the extent to which the population has declined in the short-term is hindered by the species' small population size, large range and irregular settlement patterns.

**iii. where such data is available, an estimate of the number of mature individuals in each subpopulation, or the percentage of mature individuals in each subpopulation, or whether the species is likely to undergo extreme fluctuations**

The majority of the NSW Regent Honeyeater population occurs within the greater Blue Mountains region, encompassing key breeding areas such as the Capertee, lower Hunter, Goulburn, Burratorang and Widden River valleys. Colour banding data confirm individual birds frequently move between these areas within the greater Blue Mountains (Commonwealth of Australia 2016). The population is known to undergo extreme fluctuations based on environmental conditions. During drought conditions, the birds do not occupy their regular breeding areas and the number of individuals sighted by the public or through the NRHMP falls substantially. There is little information available on what areas Regent Honeyeaters occupy during drought years and what impact droughts have on Regent Honeyeater breeding productivity.

Genetic data suggest that the NSW Regent Honeyeater population comprises a single genetic management unit, but there is evidence of some weak population genetic structure (Kvistad et al. 2015, Crates et al. 2019). Song data shows that the Blue Mountains and Northern Tablelands populations have distinct vocal dialects, though there is vocal evidence that some birds from the Northern Tablelands immigrate into the Blue Mountains population (Crates et al. 2021).

**c. evidence of limited geographic range for the threatened species (Principle 3, clause 6.7(2)(c) BC Regulation) presented by:**

**i. extent of occurrence**

Regent Honeyeaters do not have a limited geographic range in NSW. NSW DPIE BAM support have indicated that measures of EOO are not relevant to Regent Honeyeater SAIL assessments.

**ii. area of occupancy**

Regent Honeyeaters do not have a limited geographic range in NSW. NSW DPIE BAM support have indicated that measures of AOO are not relevant to Regent Honeyeater SAIL assessments.

**iii. number of threat-defined locations (geographically or ecologically distinct areas in which a single threatening event may rapidly affect all species occurrences).**

Although Regent Honeyeaters are known to repeatedly occur and breed in a small number of important areas when conditions allow, the population is generally not concentrated in threat-defined locations given the species' high mobility. The most important areas for the species include the Capertee Valley, parts of the lower Hunter Valley, the Burratorang Valley and the upper Hunter Valley including the Goulburn, Merriwa and Widden river valleys. When breeding in these areas, Regent Honeyeaters tend to form small nesting aggregations where multiple pairs will breed in close proximity (Geering and French 1998, Crates et al. 2019). Were a single threatening event such as a bushfire or severe thunderstorm to occur in any of these locations (particularly during a breeding event), it would have a significant impact on subsequent species' occurrences in that location. However, because the Regent Honeyeater is highly mobile, with birds tending to nest in (a small number of) different locations each year, a single threatening event would have a significant impact on the population but is likely to impact only a proportion of the population. Catastrophic wildfires such as the 2019/20 wildfires are a possible exception (Crates et al. 2021).

**iv. whether the species' population is likely to undergo extreme fluctuations**

The number of Regent Honeyeaters detected in NSW through the NRHMP and through public sightings undergoes extreme fluctuations. For example, since 2015 the number of mature Regent Honeyeaters detected through the NRHMP has ranged from 140 in 2017 to around 30 in 2019. Whilst there are recent records of Regent Honeyeaters in Queensland (BirdLife Australia, unpublished data), it is anticipated that most birds remain within NSW during droughts and that the fluctuation in numbers reflects a current lack of knowledge on the areas Regent Honeyeaters occupy during drought events.

**d. evidence that the species is unlikely to respond to management (Principle 4, clause 6.7(2)(d) BC Regulation) because:**

**i. known reproductive characteristics severely limit the ability to increase the existing population on or occupy new habitat (e.g., species is clonal) on, a biodiversity stewardship site.**

The nomadic movement and unpredictable settlement patterns of Regent Honeyeaters make it extremely challenging to implement management actions that will positively benefit the species in the short term. Noisy Miner suppression in recent years has successfully reduced threats in some key breeding areas such as the Capertee Valley and Goulburn River (Crates et al. 2019, Crates et al. in preparation), however it is considered unlikely that Regent Honeyeaters would respond positively to management to the extent that population declines observed over recent decades may be reversed (Heinsohn et al. 2022). Nest protection measures have anecdotally been beneficial in some areas (R. Crates, pers. Obs.), but implementing nest protection measures will only ever benefit a proportion of the population that can be located early each breeding season.

Habitat restoration and biodiversity stewardship will benefit Regent Honeyeaters in the longer term and are undoubtedly required at a large scale if the species is to achieve long-term population recovery. However, given the observed rate of population decline and population viability predictions (Garnett et al. 2021, Heinsohn et al. 2022), habitat restoration and / or biodiversity stewardship are considered unlikely in and of themselves to save Regent Honeyeaters from extinction in the coming decades.

**ii. the species is reliant on abiotic habitats which cannot be restored or replaced (e.g. karst systems) on a biodiversity stewardship site.**

Regent Honeyeaters are not dependent upon abiotic habitats which cannot be restored or replaced; however the species' is extremely selective in terms of its breeding habitat. Habitats within the proposed proposal site are unlikely to be utilised by Regent Honeyeaters for breeding. Even within the lower Hunter IBRA sub-region, known breeding activity is limited to a very small proportion of the species' mapped important habitat. Loss of important (i.e. known) breeding habitat is very unlikely to be replaced on a biodiversity stewardship site in the short to medium term (i.e. the time frame in which the species' conservation needs are most pressing).

The mapped important habitat within the proposal site is very unlikely to be used for breeding, and the vast majority of the highest quality Regent Honeyeater habitat within the Hydro site is contained within the proposed Biodiversity Stewardship Site, totalling 607.25 Ha of important Regent Honeyeater habitat.

**iii. life history traits and/or ecology is known but the ability to control key threatening processes at a biodiversity stewardship site is currently negligible (e.g. frogs severely impacted by chytrid fungus).**

Life-history traits of the Regent Honeyeater are relatively well-known (Franklin et al. 1989) however knowledge of the species' movement patterns is a major knowledge gap. Some of the threats faced by Regent Honeyeaters such as high rates of nest predation (Crates et al. 2019) and exclusion from habitats by Noisy Miners (Mac Nally et al. 2012) can in theory be managed through predator suppression (Crates et al. 2020). Exclusion from foraging habitats by larger nectarivorous bird species is also a threat that is very challenging to manage, particularly when Regent Honeyeaters occur by themselves or in small flocks (Crates et al. 2017).

The biggest challenge in terms of managing threats facing Regent Honeyeaters at biodiversity stewardship sites is to encourage the birds to occupy those sites. Regent Honeyeaters are now extremely rare and have very specific habitat requirements, and so the probability that birds would occupy stewardship sites is small, as is the case for the majority of the species' mapped important habitat in NSW. However, since (i) the vast majority of important Regent Honeyeater habitat within the Hydro site (including the highest quality areas) are contained within the proposed BSS; and (ii) the proposed BSS is over ten times the size of the mapped important Regent Honeyeater habitat within the proposal site, it is considered that Regent Honeyeaters are already more likely to occupy habitats within the BSS than they are to occupy mapped habitats within the proposed proposal site.

It is considered unlikely that Regent Honeyeaters will respond positively to management to the extent that population declines observed over recent decades may be reversed (Heinsohn et al. 2022).

**3. Where the TBDC indicates data is 'unknown' or 'data deficient' for a species for a criterion listed in Subsection 9.1.2(2.), the assessor must record this in the BDAR or BCAR.**

Regent Honeyeaters are not listed as data unknown or data deficient.

**4. In relation to the impacts from the proposal on the species at risk of an SAIL, the assessor must include data and information on:**

**a. the impact on the species' population (Principles 1 and 2) presented by:**

**i. an estimate of the number of individuals (mature and immature) present in the subpopulation on the subject land (the site may intersect or encompass the subpopulation) and as a percentage of the total NSW population.**

No Regent Honeyeaters have been detected occupying the proposal site during targeted surveys and there are no historical records of Regent Honeyeaters within the proposal site.

The most probable number of Regent Honeyeaters occupying the proposal site is zero. Should any Regent Honeyeaters occupy habitats within the proposal site, it is considered likely that this would be for foraging only and that, based on expert habitat assessments, it is considered unlikely that wild Regent Honeyeaters would utilise habitats within the proposal site for nesting (Crates 2021). It is also considered unlikely that zoo-bred and released birds would utilise habitats within the proposal site for nesting (Crates 2021).

The largest known number of Regent Honeyeaters occurring in the lower Hunter Valley IBRA subregion in the past 10 years is 80-100 birds in 2012 (Roderick & Ingwersen 2012) and in the past 5 years this number is 40 birds in 2017. It is therefore considered very unlikely that given the very small size of the proposal site that more than one Regent Honeyeater would use habitats within the proposal site at any one time. This precautionary estimate of one bird represents between 0.8 and 1% of the population (including zoo-bred birds) occurring in the Hunter IBRA subregion and between eight and 2.5 % of the total estimated NSW population. It is noted that these estimates are a precautionary upper limit estimate. The most likely proportion of the NSW Regent Honeyeater population that could utilize habitats with the proposal site is zero. Given how selective Regent Honeyeaters are in terms of breeding habitat, it is considered that the species is very unlikely to nest within the proposed proposal site.

**ii. an estimate of the number of individuals (mature and immature) to be impacted by the proposal and as a percentage of the total NSW population, or**

**iii. if the species' unit of measure is area, provide data on the number of individuals on the site, and the estimated number that will be impacted, along with the area of habitat to be impacted by the proposal.**

There are 541,997 ha of mapped important habitat for the Regent Honeyeater in NSW (BAM support 2021). The 0.31 ha of mapped important habitat to be impacted within the proposal site therefore represents 0.00006% of the total mapped habitat in NSW. The approximate area of mapped Important Regent Honeyeater habitat within the Hunter IBRA sub-region is 20,985 ha, with 250,011 ha mapped within the Sydney Basin IBRA region. The proposal will remove 0.31 ha of habitat mapped as important for the Regent Honeyeater, representing a reduction of approximately 0.001 % of mapped important habitat in the Hunter IBRA sub-region and a 0.0001 % reduction in the mapped important Regent Honeyeater habitat within the Sydney Basin bioregion (Crates 2022).

**b. impact on geographic range (Principles 1 and 3) presented by:**

**i. the area of the species' geographic range to be impacted by the proposal in ha, and a percentage of the total AOO, or EOO within NSW.**

The proposal site will lead to the loss of 0.31 ha of mapped important habitat for the Regent Honeyeater, representing 0.00006% of mapped important Regent Honeyeater habitat within NSW. BAM support have indicated that the percentage of AOO or EOO within NSW is not relevant for Regent Honeyeater SAIL assessments.

**ii. the impact on the subpopulation as either: all individuals will be impacted (subpopulation eliminated); OR impact will affect some individuals and habitat; OR impact will affect some habitat, but no individuals of the species will be directly impacted.**

The proposal site will result in the loss of a very small area of potential foraging habitat, but it is not anticipated than any individual Regent Honeyeaters will be directly impacted by the development.

**iii. to determine if the persisting subpopulation that is fragmented will remain viable, estimate (based on published and unpublished sources such as scientific publications, technical reports, databases or documented field observations) the habitat area required to support the remaining population, and habitat available within dispersal distance, and distance over which genetic exchange can occur (e.g. seed dispersal) and pollination distance for the species.**

It is difficult to estimate the amount of habitat required to support the remaining Regent Honeyeater population, particularly considering that the population appears to be declining even with the amount of habitat currently available. The Tomalpin Woodlands of the lower Hunter Valley in the vicinity of the proposal site are a key breeding and wintering area for the Regent Honeyeater (Roderick et al. 2014, Commonwealth of Australia 2016). The fact that Regent Honeyeaters have not been detected occupying or breeding within the proposal site, despite its proximity to these key areas suggest that higher quality habitats than are present within the proposal site are available within the broader area. Some of these sections of higher quality habitat are present within the proposed Hydro biodiversity stewardship site.

It is acknowledged that survey effort in the proposal site has been lower than in other areas of the lower Hunter (e.g. Werakata NP) because there is no public access to the Hydro site. However expert assessment of the habitats within the proposal site considers the 0.31 ha of important Regent Honeyeater habitat to be of low to medium priority for the species, considering both the quality and quantity of available habitat elsewhere within the lower Hunter Valley IBRA subregion.

Regent Honeyeaters are a highly mobile species that regularly undertake long-distance movements. As such it is considered that the loss of 0.31 ha of important Regent Honeyeater habitat within the proposal site will not result in additional fragmentation on the local or regional Regent Honeyeater subpopulation to the extent that the (sub)population becomes (more) unviable.

**iv. to determine changes in threats affecting remaining subpopulations and habitat if the proposed impact proceeds, estimate changes in environmental factors including changes to fire regimes (frequency, severity); hydrology, pollutants; species interactions (increased competition and effects on pollinators or dispersal); fragmentation, increased edge effects, likelihood of disturbance; and disease, pathogens and parasites. Where these factors have been considered elsewhere in relation to the target species, the assessor may refer to the relevant sections of the BDAR or BCAR.**

The primary threat associated with fragmentation of habitats arising as a result of the Hydro development are potential increases in the local population of Noisy Miners. Noisy Miners are edge specialists (Piper & Catterall 2003) and can prevent Regent Honeyeaters occupying potential foraging or breeding habitats when their numbers exceed a threshold density of approximately 0.65 birds per hectare (Thompson et al. 2015). Noisy miners are already present in areas of mapped important habitat within and adjacent to the proposal site, it is unlikely that the proposal would result in the population of Noisy Miners increasing adjacent to the proposal site.

It is not envisaged that the proposed development would lead to changes in other threats to the remaining Regent Honeyeater population, such as hydrology, pollutants, fragmentation, disturbance, disease or parasites. Threats should be considered in the context that the probability of Regent Honeyeaters occurring within and surrounding the proposal site are considered to be low.



## Assessment of proposal to result in potential SAIL for Swift Parrot

The BAM states that “To assist the consent authority to evaluate the extent and severity of the impact on an entity at risk of a serious and irreversible impact (SAIL), the BDAR or BCAR must contain details of the assessment SAIL, in accordance with the criteria set out in Subsection 9.1.1 for impacts on each TEC and in Subsection 9.1.2 for each threatened species”.

The following information is provided in accordance with the requirements of Section 9.1.2. of the BAM (DPIE 2020a) in relation to the extent and severity of potential impacts of the proposal on the Swift Parrot (*Lathamus discolor*).

**1. The assessor is required to provide further information in the BDAR or BCAR for any species at risk of an SAIL, including the action and measures taken to avoid the direct and indirect impact on the species at risk of an SAIL. Where these have been addressed elsewhere the assessor can refer to the relevant sections of the BDAR or BCAR.**

The 35.20 ha proposal site is located within a much larger 1,900 ha land parcel of which approximately 300 ha is currently proposed for biodiversity certification (referred to as the Hydro Land Parcel). In 2014 initial investigations and environmental constraints studies were undertaken to inform a preliminary master plan for the proposal. The factors considered at that stage generally consisted of identifying conservation land, developable land and flood prone land.

The proposed development site rezoning masterplan footprint has undergone a number of revisions through the proposal planning and design process that have looked at how impacts to areas of higher conservation value within the Hydro lands could be avoided as far as is practical.

Various iterations of the masterplan footprint have been developed and amended in response to detailed understanding of the site's biodiversity values and offsets requirements. Hydro's intention through the rezoning process and development of the preliminary masterplan was to avoid and minimise impacts on high biodiversity values within the site (including habitat for Swift Parrot) and to balance their offset requirements for land identified for development with likely credits that would be created within the areas proposed for conservation (which are generally in better condition than those within the proposal site). This includes the avoidance of large intact vegetation remnants that would provide higher quality potential foraging habitat for the Swift Parrot.

In 2014, a preliminary assessment was completed that assessed and evaluated a range of identifiable constraints within the entire Hydro land parcel. This assessment process produced a preliminary masterplan for the site. The intention of the preliminary masterplan was to be able to identify broad characteristics and potential land uses, which was then subject to more detailed study and refinement. Regarding the native vegetation on site, the assessment considered and put forward the conservation of areas of highest biodiversity value, which are primarily located to the north-west of the site and focused areas for development predominantly in previously disturbed areas that have been subject to clearing and ongoing grazing practices, isolated patches of low and/or poor condition vegetation or at the edges of larger patches of existing vegetation.

Following the design of the preliminary masterplan, a Biodiversity Certification Assessment (BCA) of the site was prepared in accordance with the provisions in the now repealed Threatened Species Conservation Act 1995 (ELA 2016). Based on recommendations in the BCA (ELA 2016), Hydro amended the masterplan to further avoid impacts on biodiversity values, with the footprint of the development lands reduced from 1229 ha to 657 ha, resulting in the avoidance of impacts to a further 572 ha of potential Swift Parrot Habitat (based on previous assessments).

Further refinement and update of the rezoning masterplan was undertaken in 2019 in order to further reduce impacts to areas of high biodiversity value including potential Swift Parrot habitat. This resulted in the area of development land being further reduced to 301 ha. These amendments resulted in the further avoidance of approximately 45 ha of potential foraging habitat for the Swift Parrot.

768 ha of land adjacent to the proposal site is proposed to be set aside for conservation in perpetuity under a Biodiversity Stewardship Agreement (BSA) as a Biodiversity Stewardship Site (BSS). The majority of the BSS (607.25 ha) contains vegetation types that would provide potential foraging resources for the Swift Parrot (Crates 2022) (refer to Appendix F). The proposed Stewardship site would form one of largest patches of Swift Parrot Habitat to be conserved on private land within the Hunter IBRA subregion.

**2. The assessor must consult the TBDC and/or other sources to report on the current population of the species including:**

**a. evidence of rapid decline (Principle 1, clause 6.7(2)(a) BC Regulation) presented by an estimate of the:**

**i. decline in population of the species in NSW in the past 10 years or three generations (whichever is longer).**

Sightings data and population viability analysis both support evidence of rapid population decline of the Swift Parrot in NSW over the past decade. Population models predict that a greater than 80% population decline within three generations is likely to occur (BirdLife Australia, unpublished data, Heinsohn et al. 2015).

**ii. decline in population of the species in NSW in the past 10 years or three generations (whichever is longer) as indicated by: an index of abundance appropriate to the species; decline in geographic distribution and/or habitat quality; exploitation; effect of introduced species, hybridisation, pathogens, pollutants, competitors or parasites.**

Population models predict a decline in the Swift Parrot population of 78.8 - 94.7% over three generations, equalling 12-18 years (Heinsohn et al. 2015). The estimated generation length for Swift Parrots is 5.4 years (Garnett et al. 2011). Sightings data of Swift Parrots in NSW provide evidence of a decline in the species' abundance and to a lesser extent the species' geographic distribution over the past decade (BirdLife Australia). Because the primary drivers of Swift Parrot population decline- namely predation of nests by sugar gliders *Petaurus breviceps* and loss of breeding habitat to logging (Stojanovic et al. 2014)- occur within their Tasmanian breeding grounds (Heinsohn et al. 2015), the effects of introduced species, hybridisation, pathogens, pollutants and parasites within their NSW wintering range are likely to be minimal. The 2019/20 bushfires affected approximately 12% of mapped important Swift Parrot habitat in NSW, and the species' habitat selection in NSW may be impacted by the presence of large numbers of Noisy Miners (Mac Nally et al. 2012; Thompson et al. 2015).

**b. evidence of small population size (Principle 2, clause 6.7(2)(b) BC Regulation) presented by:**

**i. an estimate of the species' current population size in NSW.**

Because Swift Parrots are highly mobile, have a very large range within NSW and occur in different parts of the state in different years contingent on environmental conditions, it is challenging to estimate accurately the current NSW population size. Combining data from sightings in recent years (BirdLife Australia), population models (Heinsohn et al. 2015), genetic evidence (Olah et al. 2021) and expert opinion (Garnett & Baker 2021), a current NSW Swift Parrot population of 200 to 1500 individuals is considered to be a credible estimate. It is noted that there is high annual variation in the size of the NSW Swift Parrot population depending on environmental conditions in other parts the species' winter range (Kennedy & Tzaros 2005).

**ii. an estimate of the decline in the species' population size in NSW in three years or one generation (whichever is longer).**

Population models predict a decline in the Swift Parrot population of 78.8 - 94.7% over three generations, equalling 12-18 years (Heinsohn et al. 2015). Given that the species forms a single genetic management unit (Stojanovic et al. 2018), it is assumed that this rate of population decline is occurring on average within NSW, although there is substantial inter-annual variation in the NSW Swift Parrot population size driven by environmental variation within the species' wintering range (Kennedy & Tzaros 2005).

**iii. where such data is available, an estimate of the number of mature individuals in each subpopulation, or the percentage of mature individuals in each subpopulation, or whether the species is likely to undergo extreme fluctuations**

The number of mature individuals in the NSW Swift Parrot population is likely to range between 200 and 1500 individuals in any one year. The population size is likely to undergo extreme fluctuations dependent on environmental conditions throughout the species' winter range (Kennedy & Tzaros 2005).

**c. evidence of limited geographic range for the threatened species (Principle 3, clause 6.7(2)(c) BC Regulation) presented by:**

**i. extent of occurrence**

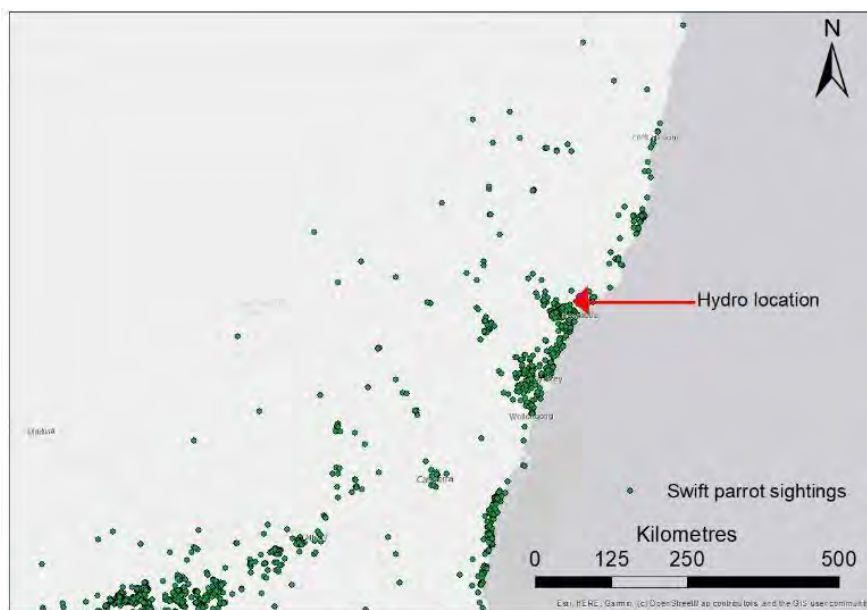
Swift parrots do not have a limited geographic range in NSW. NSW DPIE BAM support have indicated that measures of EOO are not relevant to Swift Parrot SAIL assessments.

## **ii. area of occupancy**

Swift parrots do not have a limited geographic range in NSW. NSW DPIE BAM support have indicated that measures of AOO are not relevant to Swift Parrot SAIL assessments.

## **iii. number of threat-defined locations (geographically or ecologically distinct areas in which a single threatening event may rapidly affect all species occurrences).**

Winter occurrence records of Swift Parrot in NSW are widespread throughout the eastern part of the state (Figure 1).



**Figure 1:** Distribution of Swift Parrot sightings within NSW 2010-2021. Source: BirdLife Australia.

Significant proportions of the population can at times aggregate in very small parts of the species' NSW range (Saunders & Heinsohn 2008). This means that on rare occasions, a significant proportion of the population could be affected if a threatening event occurred at such a location at a time when Swift Parrots were occupying it. However, given the high mobility of the species, the fact that Swift Parrots do not breed in NSW and the fact that the population is generally widely distributed in NSW when present, it is considered very unlikely that a single threatening event could rapidly affect all species occurrences, and that any such effects are likely to be indirect (e.g. temporary loss of habitat associated with wildfire) rather than direct (e.g. mortality of individuals in wildfire).

## **iv. whether the species' population is likely to undergo extreme fluctuations**

The NSW Swift Parrot population is known to undergo extreme fluctuations in both size and distribution (Saunders & Heinsohn 2008, BirdLife Australia, unpublished data). These fluctuations are primarily driven by environmental conditions (predominantly lagged rainfall) that determine the distribution of nectar and lerp resources at state-wide levels (Saunders & Heinsohn 2008, Saunders & Tzaros 2011).

### **d. evidence that the species is unlikely to respond to management (Principle 4, clause 6.7(2)(d) BC Regulation) because:**

#### **i. known reproductive characteristics severely limit the ability to increase the existing population on or occupy new habitat (e.g. species is clonal) on, a biodiversity stewardship site.**

Swift Parrots do not breed in NSW so reproductive characteristics are not relevant to the species' ability to increase the existing population on, or occupy new habitat within, a NSW biodiversity stewardship site.

#### **ii. the species is reliant on abiotic habitats which cannot be restored or replaced (e.g. karst systems) on a biodiversity stewardship site.**

Swift Parrots are not reliant on abiotic habitats that cannot be restored or replaced on a biodiversity stewardship site. However, Swift Parrots are generally reliant upon mature, high-quality woodland or forest in NSW (Saunders & Heinsohn 2008). The loss of such habitats cannot be restored or replaced in NSW within a timescale that would be of conservation relevance to the Swift Parrot (i.e. approximately two decades), given the species' predicted rate of population decline over that period (Heinsohn et al. 2015). However, the extent of the mapped important Swift Parrot habitat within the proposed proposal site is considered to be of low to medium importance (Crates 2022). The vast majority of the highest quality important Swift Parrot habitat within the Hydro site is contained within the proposed Biodiversity Stewardship Site (BSS) (Crates 2022).

**iii. life history traits and/or ecology is known but the ability to control key threatening processes at a biodiversity stewardship site is currently negligible (e.g. frogs severely impacted by chytrid fungus).**

The ecology of Swift Parrots is well known in NSW and threatening processes of partial relevance to the Swift Parrot such as feral species, weed infestation, fire risk and window / fence collisions can be managed within a biodiversity stewardship site. However, the species' high mobility, small population size and specific habitat requirements make it challenging to ensure that lost important foraging habitat within NSW can be replaced with functional foraging habitat within a BSS. Whilst the habitat characteristics of a biodiversity stewardship site could have similar attributes to those within a proposal site, there is no practical way to encourage Swift Parrots to utilise habitats within stewardship sites instead.

However, since (i) the vast majority of important Swift Parrot habitat (including the highest quality areas) are contained within the proposed BSS (Crates 2022); and (ii) the proposed BSS is over ten times the size of the mapped important Swift Parrot habitat within the proposal site, it is considered that Swift Parrots are already more likely to occupy habitats within the BSS than they are to occupy habitats within the proposed proposal site.

**3. Where the TBDC indicates data is 'unknown' or 'data deficient' for a species for a criterion listed in Subsection 9.1.2(2.), the assessor must record this in the BDAR or BCAR.**

Swift Parrots are not listed as data unknown or data deficient.

**4. In relation to the impacts from the proposal on the species at risk of an SAIL, the assessor must include data and information on:**

**a. the impact on the species' population (Principles 1 and 2) presented by:**

**i. an estimate of the number of individuals (mature and immature) present in the subpopulation on the subject land (the site may intersect or encompass the subpopulation) and as a percentage of the total NSW population.**

No Swift Parrots have been detected within the proposal site during previous targeted surveys, and there are no historical records of Swift Parrots occurring within the proposal site. It is noted however, that the majority of the proposal site is private property and therefore observer coverage of the proposal site for Swift Parrots is very likely to be lower than in other, nearby mapped important Swift Parrot habitat (e.g. Werakata NP).

The most likely estimate of the number of individuals present within the subject land is zero. Based on expert habitat assessment of vegetation communities and condition within the proposal site and the number of sightings of Swift Parrots within the Hunter IBRA subregion in the past decade, the maximum plausible number of Swift Parrots that could potentially occupy habitats within the proposal site at any one time is estimated to be 50 individuals, though the likelihood of this occurring is considered to be very small. Therefore, the number of individual Swift Parrots potentially present at times within the proposal site is estimated to represent between zero and 33% of the NSW population (assuming a minimum NSW population of 150 birds in years when environmental conditions are poor) or between zero and 3.3% of the NSW population (assuming a minimum NSW population of 1500 individuals in years when environmental conditions are particularly good). These estimates are based on the precautionary principle, and it should therefore be noted that based on expert opinion, the probability that more than 1% of the NSW Swift Parrot population would occupy foraging habitats within the proposed proposal site at any one time is considered to be low.

**ii. an estimate of the number of individuals (mature and immature) to be impacted by the proposal and as a percentage of the total NSW population, or**

**iii. if the species' unit of measure is area, provide data on the number of individuals on the site, and the estimated number that will be impacted, along with the area of habitat to be impacted by the proposal.**

There are 112,301 ha of mapped important habitat for the Swift Parrot in NSW (BAM support 2021). The proportion of mapped important habitat to be impacted within the proposal site represents 0.042% of the total mapped habitat in NSW. The approximate area of mapped Important Swift Parrot habitat within the Hunter IBRA sub-region is 17,473 ha, with 41,142 ha mapped within the Sydney Basin IBRA region. The proposal will remove 47.55 ha of important foraging habitat, representing a reduction of approximately 0.3% of mapped important habitat in the Hunter IBRA sub-region and a 0.12 % reduction in the mapped important Swift Parrot habitat within the Sydney Basin bioregion. Note these calculations are based on important habitat mapping provided by BCD and have been altered in accordance with the proposed modifications to the important habitat mapping suggested in the expert report provided in Appendix F.

**b. impact on geographic range (Principles 1 and 3) presented by:**

**i. the area of the species' geographic range to be impacted by the proposal in ha, and a percentage of the total AOO, or EOO within NSW.**

The proposal site will lead to the loss of approximately 47.55 ha of important Swift Parrot habitat. This figure represents 0.042% of mapped important Swift Parrot within NSW. BAM support have indicated that the percentage of AOO or EOO within NSW is not relevant for Swift Parrot SAI assessments.

**ii. the impact on the subpopulation as either: all individuals will be impacted (subpopulation eliminated); OR impact will affect some individuals and habitat; OR impact will affect some habitat, but no individuals of the species will be directly impacted.**

The proposal site will result in the loss of some habitat, however no individual Swift Parrots are likely to be directly impacted by the development.

**iii. to determine if the persisting subpopulation that is fragmented will remain viable, estimate (based on published and unpublished sources such as scientific publications, technical reports, databases or documented field observations) the habitat area required to support the remaining population, and habitat available within dispersal distance, and distance over which genetic exchange can occur (e.g. seed dispersal) and pollination distance for the species.**

Swift parrots are known to undertake long-distance movements both during migration from Tasmania to mainland Australia (Higgins 1999) and within mainland Australia during the winter (Saunders & Heinsohn 2008). The extent to which individual birds exhibit a degree of philopatry to wintering sites is poorly understood, however. Since the entire Swift Parrot population represents a single genetic management unit, with genetic exchange (i.e. breeding) occurring solely within Tasmania (Olah et al. 2021), it is reasonable to assume that individual Swift Parrots could occupy habitats anywhere within the species' NSW range (including 112,301 ha of mapped important habitat).

If it is conservatively assumed that Swift Parrot dispersal within NSW is less than predicted and that Swift Parrots occupying the lower Hunter IBRA sub-region are predominantly restricted to the Sydney Basin bioregion, then any Swift Parrots impacted by loss of foraging habitat within the proposal site could occupy 41,142 ha of mapped important habitat elsewhere within the Sydney Basin bioregion (i.e. their conservatively-estimated maximum winter dispersal distance).

It is predicted with a high degree of confidence that the impact of the proposal site will not lead to additional fragmentation of the Swift Parrot (sub)population and therefore will not affect the viability of the Swift Parrot (sub)population in this respect.

**iv. to determine changes in threats affecting remaining subpopulations and habitat if the proposed impact proceeds, estimate changes in environmental factors including changes to fire regimes (frequency, severity); hydrology, pollutants; species interactions (increased competition and effects on pollinators or dispersal); fragmentation, increased edge effects, likelihood of disturbance; and disease, pathogens and parasites. Where these factors have been considered elsewhere in relation to the target species, the assessor may refer to the relevant sections of the BDAR or BCAR.**



The primary threat associated with fragmentation of habitats arising as a result of the Hydro development are potential increases in the local population of Noisy Miners. Noisy Miners are edge specialists (Piper & Catterall 2003) and can prevent Swift Parrots from occupying potential foraging or breeding habitats when their numbers exceed a threshold density of approximately 0.65 birds per hectare (Thompson et al. 2015). Noisy miners are already present in some areas of mapped important Swift Parrot habitat adjacent to the proposal site, but there are some additional areas of mapped habitat that could become exposed to Noisy Miners as a result of fragmentation of habitats surrounding the proposal site.

It is not envisaged that the proposed development would lead to changes in other threats to the remaining Swift Parrot population, such as hydrology, pollutants, fragmentation, disturbance, disease or parasites. Threats should be considered in the context that the probability of Swift Parrots occurring within and surrounding the proposal site which is considered to be low.

# **Appendix E**

**Assessments of significance for MNES  
potentially impacted by proposal**

# Threatened flora

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

### Distribution

Small-flower Grevillea (*Grevillea parviflora* subsp. *parviflora*) occurs as several disjunct populations within NSW. The distribution of the species comprises two relatively distinct regional populations, one in the Lower Hunter and Central Coast regions, and the other generally south-west of Sydney. There are also several outlying populations that have been recorded in the Port Stephens, Great Lakes, Singleton, Campbelltown, Wollondilly and Wingecarribee LGAs.

### Habitat requirements

Small-flower Grevillea is known to grow on sandy to gravelly clay over shale on crests, upper slopes or plains in a range of topographic positions including riparian areas. The species is known from a range of vegetation types from heath and shrubby woodland to open forests. Populations have also been recorded on disturbed sites along roads and tracks and within open areas of habitat (TSSC 2008). The species is capable of suckering via underground rhizomes. Due to this habitat it is often difficult to determine the numbers of plants present at a site and population estimates are essentially a reflection of the number of suckers rather than individual plants.

The NPWS impact assessment guidelines for this species state that although most populations of Small-Flower Grevillea are relatively large due to the suckering nature of the species, the health and long-term viability of populations is likely to be dependent on adequate seedling recruitment. As such any activity or development that impacts on the accumulation of seed in the soil seedbank, seed germination or seedling growth is likely to be a threat to the population or species (NPWS 2002).

### Occurrence with the proposal site

There are 19 Small-flower Grevillea (*Grevillea parviflora* subsp. *parviflora*) stems within the proposal site. The stems within the site form part of the large regional, Kurri Kurri population. This population extends east to Heddon Greta, north through the Hydro buffer lands to near Bishops Bridge, west to near Ettalong and south to near Stanford Merthyr (DPIE 2022a). The total area of this larger regional population is approximately 5000 ha. The Kurri Kurri population is considered to be an important population of the species as it is a disjunct species and the Kurri population is near the northern extent of its range. The population is also likely to be a key source population and is likely to play an important role in maintaining genetic diversity of the species.

**EPBC Act - Assessment of Significance - Small-flower Grevillea (*Grevillea parviflora* subsp. *parviflora*)**

**According to the DotE (2013c) '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 are approximately 19 Small-flower Grevillea (*Grevillea parviflora* subsp. *parviflora*) stems within the project site. The stems were recorded within a small patch of Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub grass open forest of the lower Hunter (PCT 1600) that occurs along the southern boundary of the proposal site.

The stems recorded within the site occur within approximately 0.47 ha of occupied habitat.

The plants within the proposal site form part of an important regional population that extends east to Heddon Greta, north through the Hydro buffer land to near Bishops Bridge, west to near Ettalong and south to near Stanford Merthyr (DPIE 2022a). The total area of this larger regional population is approximately 5000 ha (DPIE 2022a).

Clearing activities associated with the proposal would result a very small decrease, in the size of this important population, however this impact would be negligible relative to the size of the regional population (approximately 0.01 percent). Although the proposal although result in a very small decrease in the in the Kurri Kurri population of Small-flower Grevillea it is unlikely it would lead to a long term decrease in the size of the important population.

**Reduce the area of occupancy of an important population**

The proposal would result in the removal of approximately 0.74 ha of Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub grass open forest of the lower Hunter (PCT 1600) that occurs along the southern boundary of the proposal site.. Within this vegetation type the area of occupancy of Small-flower Grevillea has been calculated to be approximately 0.47 ha (applying a 30 metre buffer around individuals and including contiguous vegetation between groups of individuals recorded during targeted surveys that were completed across the entire site). The proposal would therefore result in an approximate 0.47 ha reduction in the known area of an important population of Small-flower Grevillea. There is also potential that proposal would impact a small area (up to 0.27 ha) where this species may be present within the stored soil seed bank.

Although the proposal would result in the reduction in the area of occupancy of an important population of Small-flower Grevillea. This species is known to occur within at least 22 ha of occupied habitat adjacent to the site which forms part of a proposed 800 ha biodiversity stewardship site. This estimate of occupied habitat within adjoining vegetation however is conservative as detailed targeted surveys have not been completed though this vegetation and in reality, the extent of the population and occupied habitat is likely to be much larger.

**Fragment an existing important population into two or more populations**

The individuals proposed to be impacted by the proposal are located near the edges of the known local population (DPIE 2022a). The removal of these individuals would therefore not result in the fragmentation of the population into two or more populations.

**Adversely affect habitat critical to the survival of the species**

There are no areas of habitat that have been declared or are known to be critical to the survival of the Small-flower Grevillea.

**Disrupt the breeding cycle of an important population**

There is limited information available on the breeding cycle of the Small-flower Grevillea although the species is known to regenerate from both suckering and seeds. The NSW National Parks and Wildlife Service Environmental Impact Assessment guidelines identify that impacts on the accumulation of seed in the soil seedbank, seed germination or seedling growth is likely to be a threat to the population or species (NPWS 2002). Inappropriate fire regimes are cited as the primary threat to these stages of the species life cycle. The proposed action would include provisions for buffers and fire protection zones that would minimise potential impacts from fire on individuals that may be present within vegetation adjacent to the proposal site. Regular mowing or slashing of vegetation adjacent to the proposed Hunter Express Way off ramps could also result in the prevention of some individuals present within this vegetation from maturing or setting seed. Overall, however it is unlikely that the removal of five individuals would disrupt the breeding cycle of the greater regional population.

**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 approximately 0.47 ha of occupied habitat for the Small-flower Grevillea. This represents a very small area relative to the area known to be inhabited by the regional population (approximately 0.01 percent) which includes approximately 5000 ha of known habitat. The proposal also has the potential to modify or decrease the availability and/or quality of habitat for this species adjacent to the site through the introduction of weeds or pathogens during construction or operation. The construction of industrial development may also result in modification of adjacent habitat as a result of overshadowing, altered hydrology and dumping of fill, rubbish and or garden waste. Mitigation measures would be implements to minimise the potential impacts of weeds, waste and water runoff on adjacent potential habitat and as such it is unlikely that the proposal would modify, destroy, remove isolate or decrease the availability of quality of habitat to such an extent that the species would decline.

**Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat**

**EPBC Act - Assessment of Significance - Small-flower Grevillea (*Grevillea parviflora* subsp. *parviflora*)**

There is potential that the construction and/or operation of the proposal would result in the establishment of weeds within areas of potential habitat for this species located adjacent the proposal site. The introduction of weeds into these areas may result in competition for resources such as light, space and/or nutrients and consequently decrease the value of this habitat. Mitigation measures would be implemented to limit the potential impacts of weeds on adjacent vegetation during construction and operation of the proposal.

**Introduce disease that may cause the species to decline**

The proposed action is not likely to result in the introduction of any diseases that may cause the species to decline.

**Interfere substantially with the recovery of the species**

There is no adopted or made Recovery Plan for this species.

**Conclusion of Assessment of Significance**

On consideration of the above criteria, the proposed action is unlikely to have a significant effect on Small-flower Grevillea given that:

Approximately 19 stems would be removed, this represents a very small proportion of the local and regional population

The proposal is unlikely to lead to a long-term decrease in the population

The proposal is not modify, destroy, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

The proposal would not disrupt the breeding cycle of the population.

## Parramatta Red Gum (*Eucalyptus parramattensis* subsp. *decadens*) – vulnerable

### Distribution

Parramatta Red Gum is a small smooth barked tree to 15 m tall (although generally around 7 m). The species is endemic to the Hunter Region where it occurs within two distinct meta populations, one occurring on the Tomago Sandbeds and one within Cessnock-Kurri Kurri region (Bell 2006). Within the Cessnock-Kurri Kurri region, 15 sub-populations of the species have been identified, with an estimated total abundance of 2,500 to more than 8,000 individuals (Bell 2006). This estimate was based on the number of BioNet Atlas Records as is unlikely to be a true representation of the number of individuals within the population. Assessments completed on the Hydro Lands indicate that the population in the Kurri Kurri area is much larger, with some assessments indicating that population within the Hydro land alone is between 23,000 and 54,000 individuals (the majority of which occur within land surrounding the proposal site that is proposed to be conserved within a biodiversity stewardship site) (ELA 2016).

### Habitat requirements

Parramatta Red Gum generally occupies deep, low-nutrient sands, and often those subject to periodic flooding or where the water table is high (OEH, 2019). This subspecies occurs often as a dominant component of dry sclerophyll woodland with an understorey of dry heath, or as an emergent in dry or wet heath (OEH 2019).

### Occurrence within the proposal site

The proposed action would result in impacts of up to five Parramatta Red Gum individuals (two of which occur within the project footprint and three immediately adjacent) within 0.19 ha of habitat. These plants are considered to be part of an important population due to the endemic nature of the species which indicates that the entire Kurri Kurri/Cessnock regional population is likely to be considered an important population for maintaining genetic diversity of the species within the region.



**EPBC Act - Assessment of Significance - Parramatta Red Gum (*Eucalyptus parramattensis* subsp. *decadens*)**

**According to the DotE (2013c) '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**

A total of five Parramatta Red Gum individuals occur within or immediately adjacent to the proposal site within PCT 1633 (Parramatta Red Gum – Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area) Within the proposal site there is approximately 0.19 ha of PCT 1633, in which Parramatta Red Gum is the dominant canopy species.

PCT 1633 Parramatta Red Gum – Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland extends to the east and south of the proposal site. Within this area the community forms a 300 ha contiguous patch, as well as several smaller fragmented patches. Parramatta Red Gum individuals within the proposal site form part of this local sub-population that is characteristic of this PCT. Regional vegetation mapping indicates that there is approximately 2,330 ha of PCT 1633 within 10 km of the proposal site and approximately 7,320 ha within the Hunter IBRA sub-region.

The removal of 0.19 ha of occupied habitat would represent impacts to approximately 0.08 percent of the known habitat within 10 km of the site and less than 0.002 % in the Hunter IBRA sub-region.

The removal of up to five individuals is considered to represent a small impact to the size of the local population of Parramatta Red Gum and is not likely to lead to a long term decrease in the population.

**Reduce the area of occupancy of an important population**

The proposal would result in the removal of approximately 0.19 ha of habitat for *Eucalyptus parramattensis* subsp *decadens* within areas of Parramatta Red Gum – Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland within the proposal site. The known area of occupancy of the species has been calculated to include all areas of PCT 1633 within the proposal site. There is also potential that proposal could impact additional areas of occupancy where this species may be present within the stored soil seed bank.

This likely decrease in occupancy for Parramatta Red Gum represents an approximate 0.008 percent decrease in the area of occupancy within 10 km of the site and less than 0.002 % decrease in the area of occupancy within the Hunter IBRA sub-region.

**Fragment an existing important population into two or more populations**

The individuals proposed to be impacted by the proposal are located at the margins of the known local population. The removal of these individuals would therefore not result in the fragmentation of the population into two or more populations.

**Adversely affect habitat critical to the survival of the species**

There are no areas of habitat that have been declared or are known to be critical to the survival of *Eucalyptus parramattensis* subsp *decadens*.

**Disrupt the breeding cycle of an important population**

Parramatta Red Gum flowers 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 (House 1997 cited in DECCW NSW 2009). Parramatta Red Gum germinates easily and readily re-sprouts after bushfire or other disturbance (Bell 2006). The proposal would impact up to individuals from a much larger local population and as such would result in a very small reduction in the abundance of pollen available to other individuals within the population. The proposal would not impact on mechanisms for pollination of the species. Considering the above it is unlikely that the proposal would disrupt the breeding cycle of an important population of Parramatta Red Gum.

**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 approximately 0.19 ha of known habitat Parramatta Red Gum. The proposal also has the potential to modify or decrease the availability and/or quality of habitat for this species adjacent to the site through the introduction of weeds or pathogens during construction or operation. The construction of urban and industrial development may also result in modification of adjacent habitat as a result of overshading, altered hydrology and dumping of fill, rubbish and or garden waste. Mitigation measures would be implemented to minimise the potential impacts of weeds, waste and water runoff on adjacent potential habitat and as such it is unlikely that the proposal would modify, destroy, remove isolate or decrease the availability of quality of habitat to such an extent that the species would decline.

**Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat**

There is potential that the construction and/or operation of the proposal would result in the establishment of weeds within areas of potential habitat for this species located adjacent the proposal site. The introduction of weeds into these areas may result in competition for resources such as light, space and/or nutrients and consequently decrease the value of this habitat. Mitigation measures would be implemented to limit the potential impacts of weeds on adjacent vegetation during construction and operation of the proposal.

**EPBC Act - Assessment of Significance - Parramatta Red Gum (*Eucalyptus parramattensis* subsp. *decadens*)****Introduce disease that may cause the species to decline**

The proposed action is not likely to result in the introduction of any diseases that may cause the species to decline.

**Interfere substantially with the recovery of the species**

There is no adopted or made Recovery Plan for this species.

**Conclusion of Assessment of Significance**

On consideration of the above criteria, the proposed action is unlikely to have a significant effect on *Eucalyptus parramattensis* subsp. *decadens* given that:

The proposal would remove up to five individuals which would represent less than 0.008 % of the population within the Hunter IBRA sub-region.

The proposal is not likely to result in the size of occupancy of the population

The proposal is not likely to disrupt the breeding cycle of the population

The proposal is not likely to result in invasive species that are harmful to Parramatta Red Gum becoming established

The proposal is not likely to modify, remove, isolate or the availability or quality of habitat such that the population would decline.

## Threatened fauna

### Grey-headed Flying-fox (*Pteropus poliocephalus*) – vulnerable species

#### Distribution

The Grey-headed Flying-fox population throughout Australia is spatially structured into colonies (Parry-Jones & Wardle 2004). However, no separate or distinct populations occur due to the constant genetic exchange and movement between camps over the entire species' geographic range, indicating one single interbreeding population (Webb & Tidemann 1995; DSE 2005).

In winter, the species congregates in coastal lowlands north of the Hunter Valley and is occasionally found on the south coast of NSW (associated with flowering Spotted Gum (*Corymbia maculata*) and on the northwest slopes (generally associated with flowering White Box (*Eucalyptus albens*) or Mugga Ironbark (*Eucalyptus sideroxylon*) (NSW DECCW 2010).

#### Habitat requirements

The Grey-headed Flying-fox roosts in congregations (camps) typically located near water, such as lakes, rivers or the coast (van der Ree et al. 2005). Camps can occur in a variety of vegetation types including; rainforest, Melaleuca stands, mangroves and riparian vegetation (Nelson 1965; Ratcliffe 1931). The species is also known to roost and forage in highly modified urban areas (Birt et al. 1998; Tidemann & Vardon 1997; van der Ree et al. 2005).

The Grey-headed Flying-fox is a canopy-feeding frugivore and nectarivore, which primarily feeds on blossom from Myrtaceous species (Eby 1998). The species is highly mobile and utilises a range of vegetation including rainforests, open forests, closed and open woodlands, Melaleuca swamps and Banksia woodlands. The species is also known to feed on introduced tree species in urban areas and commercial fruit crops. None of the species the Grey-headed Flying-fox feed on flower continuously throughout the year. As a result, the species developed complex migration behaviours due to ephemeral and patchy food resources (Duncan et al. 1999; Eby 1996, 1998; Nelson 1965; Parry-Jones & Augee 1992; Spencer et al. 1991).

The species has historically been subject to culling as a result of impacts to commercial fruit crops. However, in more recent times non-lethal methods of crop protection such as full exclusion netting have been used to prevent damage to crops (OEH 2015).

The primary food source is blossom from Eucalyptus and related genera but in some areas, it also utilises a wide range of rainforest fruits (Eby 1998). None of the vegetation communities used by the Grey-headed Flying-fox produce continuous foraging resources throughout the year. As a result, the species has adopted complex migration traits in response to ephemeral and patchy food resources (Duncan et al. 1999; Eby 1996, 1998; Nelson 1965; Parry-Jones & Augée 1992; Spencer et al. 1991).

### **Habitat within proposal site**

The proposal site contains a small amount 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. None of the tree species within the site have been identified as significant food trees for the Grey-headed Flying-fox (Peggy & Law 2008). Within the proposal site there is approximately 1.35 ha of potential foraging habitat for the Grey-headed Flying Fox.

**EPBC Act - Assessment of Significance - Grey-headed Flying-fox (*Pteropus poliocephalus*)**

**According to the DoE (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 approximately 1.35 hectares of potential 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 fibrosa* (Broad-leaved Ironbark) and *Corymbia maculata* (Spotted Gum) which are recognised as providing abundant and seasonally important resources for the species (Eby and Law 2008).

The Grey-headed Flying-fox has been recorded foraging within and adjacent to the proposal site. Grey-headed Flying-fox camps are known to occur within the locality at East Cessnock, Lorn, Maitland (Hannan St) and Stockrington. The closest known Grey-headed Flying-fox camp is located at East Cessnock. This camp is mapped on the National Flying-fox monitoring viewer as a nationally important camp and lies approximately 10 km southwest of the study area (DoE 2020).

Given the high mobility of this species and the proximity of large areas of native vegetation containing foraging habitat in the locality (including Mt Sugarloaf Flora and Fauna Reserve, Lower Hunter National Park, Cessnock State Forest and Werakata National Park), habitat within the proposal site would make a minor contribution to maintenance of the Grey Headed Flying Fox 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 1.35 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 1.35 hectares of potential foraging habitat that would be impacted would constitute a very small proportion of the available foraging habitat within the locality, is not at the edge of the species' known range 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 proposal would not isolate or fragment the existing population of this highly mobile species.

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 local scale, the proposal may widen some existing gaps in vegetation, however the resulting gap in vegetation cover would be readily traversed by these highly mobile, aerial species. The proposed action would not impact on any camp/roost sites for this species. The action would not prevent Grey-headed Flying-fox individuals from travelling between camps and foraging habitat.

It is therefore highly unlikely that the proposal would cause fragmentation of the Grey-headed Fox population 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 (DoEE 2017).

The draft recovery plan for Grey-headed Flying-fox, identifies habitat critical to the survival of Grey-headed Flying-fox as vegetation communities that contain important winter and spring flowering myrtaceous species. PCT 1600 within the proposal site contains a low abundance of Spotted Gum (*Corymbia maculata*) which has been identified as an important winter foraging species for the Grey-headed Flying fox (Eby and Law 2008).

The resources present in the proposal site, however occur in very low abundance and are minor in comparison to available similar foraging resources in nearby areas, including conserved habitat in Mt Sugarloaf Flora and Fauna Reserve, Lower Hunter National Park, Cessnock State Forest and Werakata National Park.

In this context the removal of 0.84 hectares of potential foraging habitat containing a very small number of important feed trees is unlikely to adversely affect critical habitat for the Grey-headed Flying fox within the region.

**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 (DoEE 2017). Flying-foxes have been known to abort fetuses and have premature births in response to environmental stress (DoEE 2017).

There are three Grey-headed Flying-fox camps known to support breeding females (maternity camps) within or close by the locality; East Cessnock, Lorn and Maitland (Hannan St). Of these camps, East Cessnock is known to support breeding females (maternity camp) and is mapped as critical for survival of the species. However, no camps occur within the proposal site.

**EPBC Act - Assessment of Significance - Grey-headed Flying-fox (*Pteropus poliocephalus*)**

The proposal site is likely to be used by the Grey-headed Flying-foxes from the surrounding camps for foraging habitat. However, the foraging habitat within the locality would likely provide sufficient ample foraging resources. Considering this, the proposal is unlikely to disrupt the breeding cycle of the Grey-headed Flying-fox. Furthermore, the proposal would not create a barrier to migratory or dispersal movements for this species that could interfere with breeding behaviours.

**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 0.84 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 large area of potential alternative foraging habitat within the locality, and the highly mobile nature of the species, the removal of 1.35 hectares of potential foraging habitat it is 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 to mitigate this risk. The introduction and/or spread of weeds is not likely to tangibly decrease the value of potential foraging habitat for this species as: here is already a high abundance of weeds within the local area, mainly comprising exotic groundcover species of agricultural landscapes, and the species relies on canopy vegetation. The introduction on new infestations or increase in the severity of weed 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 2007). 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 2007). 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.

There are no clinical disease or mortality in flying-foxes associated with Hendra or Menangle virus, regardless the proposal is not likely to lead to an increase in either of these viruses within the Grey-headed Flying-fox population.

Construction activities have the potential to introduce or spread pathogens such as Phytophthora (*Phytophthora cinnamomi*) and Myrtle Rust (*Uredo rangellii*) 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 proposed action.

**Interfere substantially with the recovery of the species**

As discussed above, foraging habitat within the proposal site is consistent with the definition of habitat critical to the survival of the Grey-headed Flying-fox as it contains winter flowering feed trees. The proposal is therefore inconsistent with one of the stated objectives of the draft recovery plan (DoEE 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 proposal site contains the winter flowering species *Corymbia maculata* (Spotted Gum) that could be utilised by Grey-headed Flying-fox individuals of this species occur in very low numbers through the site. The 1.35 hectares of potential foraging habitat within the proposal site is minor in proportion of available foraging habitat for this highly mobile species within the locality. It is therefore considered unlikely, that the proposed action 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.



# Swift Parrot (*Lathamus discolor*) - critically endangered species

## Distribution

The Swift Parrot breeds in Tasmania during the summer and the entire population migrates north to southeast mainland Australia for the winter, with the majority being found in Victoria and NSW (DEE 2019b).

## Habitat requirements

While on the mainland, Swift Parrots are nomadic, spending weeks or months at some sites and only a few hours at others, determined by the supply of nectar (Parks 2010). On the mainland they occur in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations (EES 2019b). Favoured feed trees include winter flowering species such as Swamp Mahogany (*Eucalyptus robusta*), Spotted Gum (*Corymbia maculata*), Red Bloodwood (*Corymbia gummifera*), Forest Red Gum (*Eucalyptus tereticornis*), Mugga Ironbark (*Eucalyptus sideroxylon*), and White Box (*Eucalyptus albens*) (EES 2019b). Commonly used lerp infested trees include Inland Grey Box (*Eucalyptus microcarpa*), Grey Box (*Eucalyptus moluccana*), Blackbutt (*Eucalyptus pilularis*) and Yellow Box (*Eucalyptus melliodora*). The Swift Parrot returns to some foraging sites on a cyclic basis depending on food availability (EES 2019b).

The extent of habitat use in each region varies according to food availability and competition, with Swift Parrots briefly passing through some habitats feeding opportunistically, and remaining in other habitats foraging for several days, weeks or months. The Hunter Valley has been identified as providing important winter foraging resources for the Swift Parrot.

## Habitat in the proposal site

No Swift Parrot individuals have been recorded during any of the many surveys that have been completed within or adjacent to the proposal site.

One PCT within the site (PCT 1600) is known to provide habitat for the Swift Parrot (TBDC 2022). A total of 1.3 ha of potential foraging habitat would be impacted by the proposal. None of the tree species present within the proposal site are recognised as key feed species for the Swift Parrot.

### EPBC Act - Assessment of Significance - Swift Parrot (*Lathamus discolor*)

**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 a population**

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 Swift Parrot occurs as single, migratory population that disperses widely in Victoria and New South Wales. Small numbers of this species are often observed in the Australian Capital Territory and south eastern Queensland and less often in south eastern South Australia. (Saunders and Tzaros 2011). All individuals are considered to be part of the one population.

The Swift Parrot has not been recorded during any of the numerous ecological assessments that have been completed within the Hydro site. The closest record of the species is from approximately 2 km south of the proposal site within the township of Kurri Kurri. There are also numerous records from approximately 4 km south-west of the site within a large patch of native vegetation that forms part of the Hunter Economic Zone (HEZ).

There is a total of 1.3 ha of potential foraging habitat for the Swift Parrot within the proposal site, most of this habitat contains a low abundance of foraging resources for the species. The proposal would not remove any known breeding habitat for the species.

Regional vegetation mapping indicates that within the Hunter IBRA subregion there is approximately 46,565 ha of habitat that contains key foraging species for the Swift Parrot (DPIE 2022f). The removal of 1.3 ha of potential foraging habitat of foraging resources would reduce the available foraging habitat within the Hunter IBRA subregion by about 0.003 percent. This habitat loss will decrease the availability of winter forage for individual birds that disperse throughout the area during winter. It is unlikely however that this small reduction in potential foraging habitat would lead to a long-term decrease in the size of the Swift Parrot Population.

**Reduce the area of occupancy of a population**

## EPBC Act - Assessment of Significance - Swift Parrot (*Lathamus discolor*)

The distributional range of the Swift Parrot extends from Tasmania through parts of Victoria and NSW to southeast Queensland. Within this range, the area of occupancy for the species would include breeding grounds in Tasmania, migration routes and foraging habitats on mainland Australia. The proposal site is not at the edge of this range.

The proposal would result in the removal of 1.3 ha of potential foraging habitat which includes a small number of Swamp Mahogany (*Eucalyptus robusta*) and Forest Red Gum (*Eucalyptus tereticornis*) which are known key feed species for the Swift Parrot.

No Swift Parrots have been recorded utilising the proposal site during any of the numerous surveys that have been completed through the Hydro site over many years. There is no evidence of frequent or long-term occupancy of the proposal site by the species.

Regional vegetation mapping indicates that within the Hunter IBRA subregion there is approximately 46,565 ha of habitat that contains key trees species for the Swift Parrot (DPIE 2022f). The removal of 1.3 ha of potential habitat containing a low abundance of foraging resources would reduce the available foraging habitat within the Hunter IBRA subregion by about 0.003 percent. This reduction in potential habitat would not substantially reduce or fragment the extent of habitat in the Hunter IBRA subregion or otherwise reduce the area of occupancy of this highly mobile species.

### Fragment an existing population into two or more populations

The Swift Parrot is a highly mobile species that routinely traverses large expanses of open water and open country, including Bass Strait, agricultural land and other clearings during its annual migration. The Swift Parrot would rely on 'stepping stones' of suitable foraging and roosting habitat during migrations and is thought to prefer 'corridors' of woodland vegetation over which to traverse. While the proposal would, in places widen an existing gap, dispersal or movement of the Swift Parrot across the landscape is unlikely to be affected as clearings created by the proposal would not be of a scale that would isolate habitat with respect to this species. The removal of 1.3 ha of potential habitat would not substantially increase the risk or energy cost of migration. As such, the proposal would not fragment the existing population into two or more populations.

### Adversely affect habitat critical to the survival of the species

The *Recovery Plan for the Swift Parrot* (Swift Parrot Recovery Team 2001) notes the important breeding habitats for the species within Tasmania and important foraging habitats within mainland Australia.

The proposal would remove 1.3 ha of potential foraging habitat for the species, none of which has been mapped as important habitat, and is therefore unlikely to impact on habitat critical to the survival of the species.

### Disrupt the breeding cycle of a population

Breeding does not occur on mainland Australia. Adult birds would only occur within the study area as part of seasonal foraging behaviour during winter.

Habitat loss could decrease the availability of winter forage for individuals that may disperse throughout the region during winter. The reduced availability of foraging habitat, particularly during poor flowering seasons and/or drought periods, could theoretically reduce the health and condition of adult birds, which could in turn, lead to poor condition and reduced breeding success. However due to the relatively low abundance of key feed species within the proposal site it is unlikely that the condition and health of individuals that may forage in the study area on occasion would be compromised to the extent that breeding success of individuals would be affected. Furthermore, the proposed action would not fragment a population of the Swift Parrot or create a barrier to local or regional movements of the species between foraging and breeding areas.

Given the above points, the proposal is unlikely to disrupt the breeding cycle of a population of Swift Parrot.

### Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

The removal of 0.84 ha of potential foraging habitat will not modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline. Regional vegetation mapping indicates that within the Hunter IBRA subregion there is approximately 46,565 ha of habitat that contains key trees species for the Swift Parrot (DPIE 2022f). The removal of 1.3 ha of potential habitat containing a low abundance of foraging resources would reduce the available foraging habitat within the Hunter IBRA subregion by about 0.003 percent

Within the Hunter region potential foraging resources occur within a number of reserves including Mt Sugarloaf Flora and Fauna Reserve, Lower Hunter National Park, Cessnock State Forrest and Werakata National Park and further throughout the region, including extensive areas in Yengo and Wollemi National Parks.

This species is highly mobile and has a home range spanning several hundreds of kilometres. The removal of 1.3 ha of potential foraging habitat represents a small fraction of the potential foraging habitat for the species and is unlikely to cause a decline in the population of Swift Parrot.

Given that no breeding habitat would be impacted and that no areas of habitat would become isolated, it is unlikely that the proposal would result in the overall decline of the species.

### Result in invasive species that are harmful to a critically endangered species becoming established in the critically endangered species' habitat

## EPBC Act - Assessment of Significance - Swift Parrot (*Lathamus discolor*)

Several invasive flora species have been recorded in the proposal site and are known from the locality. A vegetation management plan would be produced as part of the proposal and would include guidance on managing transmission of plant propagules (e.g. seeds, spores and suckers) to mitigate the risk of invasive species becoming established or spreading throughout areas of adjacent vegetation. Introduction and spread of weeds is unlikely to substantially impact foraging habitat for this species.

The proposal site is in close proximity to urban areas, therefore invasive fauna species such as feral cats, wild dogs and foxes are common within the locality. The proposal would be unlikely to increase the risk of predation by these species or result in new incursions of invasive fauna species that would become established in Swift Parrot habitat.

### Introduce disease that may cause the species to decline

Psittacine beak and feather disease is a common and potentially deadly disease of parrots. Susceptibility to the infection may be influenced by environmental factors, such as climate, nutrition, habitat quality and social factors (DEH 2005).

The proposal is unlikely to introduce Psittacine beak and feather disease, however cumulative impacts of further land clearing and impacts on habitat has the potential to increase susceptibility of individuals.

### Interfere substantially with the recovery of the species

Habitat loss is a key factor in the current threatened status of the Swift Parrot. The proposal would remove 1.3 ha of potential foraging habitat containing a low abundance of preferred feed species for this species. This vegetation has been impacted by past clearing and none has been mapped as important habitat for the species.

This habitat loss will slightly decrease the availability of winter foraging resources for individual Swift Parrots that disperse throughout the region during winter. Given the abundance of alternative foraging habitat in the locality it is unlikely that the removal of this small amount of potential foraging habitat would substantially interfere with the recovery of the species.

### Conclusion of Assessment of Significance

The proposal is unlikely to result in a significant impact on the Swift Parrot as:

- Vegetation to be removed comprises a small 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 or substantially increase the risk or energy cost of migration.
- The proposal would not isolate any area of habitat.
- The proposal would not impact on the breeding cycle of the Swift Parrot.
- The proposal would remove only a very small area of potential foraging habitat containing a low abundance of key winter feed species.
- The proposal is unlikely to result in invasive species that are harmful to Swift Parrots becoming established within adjacent habitat.
- The proposal is unlikely to introduce disease that may cause the Swift Parrot population to decline.
- The proposal is unlikely to substantially interfere with the recovery of the species.

# Regent Honeyeater (*Anthochaera phrygia*) – Critically endangered species

## Characteristics and distribution

The Regent Honeyeater (*Anthochaera phrygia*) is a medium-sized honeyeater with predominantly black plumage with bright yellow edges to the wing and tail feathers. The distribution of the species is extremely patchy with contractions in the home range of the species having been observed in past decades (Franklin et al., 1989).

The Regent Honeyeater formerly occurred throughout south-eastern Australia in the Adelaide region to 100 km north of Brisbane, Queensland. The population has been continually contracting with the species northern extent primarily restricted to Gore-Karara region south of Brisbane and the species no longer observed in South Australia (Franklin et al., 1989).

The Regent Honeyeater occurs as a single population with exchanges of individuals between regularly used areas (Garnett *et al.*, 2011). The total Regent Honeyeater population is estimated to be fewer than 1,000 individuals however may be as low as 350-400 individuals (Crates et. al., 2017).

## Habitat requirements

There are few known key breeding regions remaining for the Regent Honeyeater: north-east Victoria (Chiltern-Albury), and in NSW at Capertee Valley, the Bundarra-Barraba region near Gunnedah, the Hunter Valley and the Burratorang Valley. In NSW the distribution is very patchy and mainly confined to the vicinity of breeding areas and surrounding fragmented woodlands. In some years flocks converge on flowering coastal woodlands and forests (EES 2019a).

The timing of breeding varies between regions, and appears to correspond with the flowering of key eucalypt and mistletoe species (Franklin et al., 1989; Geering & French 1998). Breeding mostly occurs during spring and summer, from August to January (Franklin et al., 1989). While nectar flows are important for breeding, some pairs have been recorded to successfully fledge their young using insects and lerps only (Geering & French 1998).

The Regent Honeyeater is a generalist forager, although it feeds mainly on the nectar from a relatively small number of eucalypts that produce high volumes of nectar. Most records of regent honeyeaters come from box-ironbark eucalypt associations, where the species seems to prefer more fertile sites with higher soil water content, including creek flats, broad river valleys and lower slopes. Regent honeyeaters may use different areas in different years depending on food resources (DoE 2016).

Key eucalypt species include Mugga (or Red) Ironbark (*Eucalyptus sideroxylon*), Yellow Box (*Eucalyptus melliodora*), White Box (*Eucalyptus albens*), Yellow Gum (*Eucalyptus leucoxylon*) Spotted Gum (*Corymbia maculata*) and Swamp Mahogany (*Eucalyptus robusta*). Nectar and fruits from Mistletoes including Needle-leaf Mistletoe (*Amyema cambagei*), Box Mistletoe (*Amyema miquelii*) *Amyema pendula* Long-flower Mistletoe (*Dendrophthoe vitellina*) are also utilised (EES 2019a). When nectar is scarce lerp and honeydew can comprise a large proportion of the diet. Insects make up about 15% of the total diet and are important components of the diet of nestlings.

Lower Hunter Spotted Gum forests in the Hunter Valley (including the Tomalpin woodland located to the south of Kurri Kurri) the have recently been demonstrated to support regular breeding events of Regent Honeyeaters (Roderick et al., 2014). Flowering of associated species such as Thin-leaved Stringybark (*Eucalyptus eugenioides*) and other stringybark species, and Broad-leaved Ironbark (*Eucalyptus fibrosa*) can also contribute important nectar flows at times (DotE 2016).

## Habitat within the proposal site

There is at total of approximately 1.3 ha of potential foraging habitat for the Regent Honeyeater within the proposal site, most of this habitat however contains a low abundance of key foraging resources for the Regent Honeyeater. An area of 0.47 ha within the proposal site has been mapped by BCD as important habitat for the Regent Honeyeater (DPIE 2022f). An assessment by a species expert however concluded that vegetation within the proposal site is of low to moderate value relative to other areas of mapped important habitat for the Regent Honeyeater within the lower Hunter Valley, such as parts of Werakata National Park and the Hunter Economic Zone (Roderick et al. 2014). The species expert considered it unlikely that Regent Honeyeaters would utilise mapped habitats within the proposed Hydro development footprint (Crates 2021)(refer to Appendix F).

Although Dr Crates concluded in his expert report that and none of the mapped important habitat within the proposal site is not considered in his opinion to be critical habitat for the Regent Honeyeater, the National Recovery Plan states that any areas where the species is likely to breed or forage is considered critical habitat for the species. The plan notes that habitat within the Hunter Valley would therefore be critical to the survival of the Regent Honeyeater.

### EPBC Act - Assessment of Significance

Regent Honeyeater (*Anthochaera phrygia*)

**According to the DoE (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 a 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 (DoE 2013).

The Regent Honeyeater occurs as a single population with exchanges of individuals between regularly used areas (Garnett et al., 2011). The total Regent Honeyeater population is estimated to be no more than 1000 birds, however numbers may be as low as 200–250 individuals (Roderick et al 2014, Crates et. al., 2017).

The Regent Honeyeater has not been recorded during any of the numerous ecological assessments that have been completed within the within or adjacent to the proposal site. The closest record of the species is from approximately 6 km south of the proposal site within the township of Kurri Kurri. There are also numerous records including observations of breeding from approximately 9 km south-west of the site within a large patch of native vegetation that forms part of the Hunter Economic Zone (HEZ).

There is at total of 1.3 ha of potential foraging habitat for the Regent Honeyeater within the proposal site, most of this habitat however contains a low abundance of key foraging resources for the Regent Honeyeater. The proposal would not remove any known breeding habitat for the species. Due to the close proximity of the proposal site to known breeding habitat for the Regent Honeyeater there is the possibility that breeding individuals within the Lower Hunter breeding population may forage at the proposal site. Due to the low abundance of foraging resources within the site and the presence of much higher quality habitat within the locality, it is highly unlikely that the site would be used by Regent Honeyeaters for breeding.

Regional vegetation mapping indicates that within the Hunter IBRA subregion there is approximately 39,162 ha of habitat that contains key trees species for the Regent Honeyeater (DPIE 2022b). The removal of 1.3 ha of potential habitat containing a low abundance of foraging resources would reduce the available foraging habitat within the Hunter IBRA subregion by about 0.003 percent. It is unlikely that this reduction in potential foraging habitat would lead to a long term decrease in the size of the Regent Honeyeater population.

### Reduce the area of occupancy of the species

The distributional range of the Regent Honeyeater extends from parts of Victoria, through NSW to southeast Queensland. The area of occupancy is estimated at 300,000 km<sup>2</sup>. The extent of occurrence is likely to be declining based on historical declines and the present status of the species (DoE 2016).

The proposal would result in the removal of 01.3 ha of potential foraging habitat which includes known scattered individuals of the important feed species *Eucalyptus robusta* (Swamp Mahogany) and *Eucalyptus fibrosa* (Broad-leaved Ironbark).

No Regent Honeyeaters have been recorded utilising the proposal site during any of the numerous surveys that have been completed through and adjacent to the proposal site over many years. There is therefore no evidence of frequent or long-term occupancy of the proposal site by the species.

Regional vegetation mapping indicates that within the Hunter IBRA subregion there is approximately 39,162 ha of habitat that contains key trees species for the Regent Honeyeater. The removal of 1.3 ha of potential habitat containing a low abundance of foraging resources would reduce the available foraging habitat within the Hunter IBRA subregion by about 0.002 percent. It is therefore unlikely that this reduction in potential habitat would substantially reduce the area of occupancy of this highly mobile species.



## EPBC Act - Assessment of Significance

### Fragment an existing population into two or more populations

The Regent Honeyeater occurs as a single population with exchanges of individuals between regularly used areas (Garnett et al., 2011). This species is capable of moving long distances to occupy new locations in response to changing food availability (Roderick et al 2013). There is an estimated 20,985 ha of available potential Regent Honeyeater foraging and breeding habitat in the Hunter IBRA subregion including large areas within close proximity to the proposal site. Vegetation proposed to be cleared occurs as small scattered remnants within agricultural paddocks. Highly mobile species such as the Regent Honeyeater are expected to be less impacted by fragmentation and this species is well-adapted to accessing widely spaced habitat resources given its mobility and preference for seasonal foraging resources. The removal of 0.84 ha of potential habitat would not substantially increase the risk or energy cost of movement. Given the clearing occurs on the edge of patches, the high mobility of the species, and large areas of alternative habitat within the locality, the proposal is would not result in fragmentation of the population into two or more populations.

### Adversely affect habitat critical to the survival of the species

The National Recovery Plan for the Regent Honeyeater specifies that any breeding or foraging habitat in areas where the species is likely to occur (as defined by the distribution map provided in Figure 2 of the Recovery Plan) is considered critical to the survival of the species (DotE 2016). The proposal site contains tree species that could provide foraging resources for the Regent Honeyeater (*Corymbia maculata* and *Eucalyptus fibrosa*) and is within the area mapped as key breeding habitat within the Hunter Valley on Figure 2 of the Recovery Plan. As such the proposal site meets the definition of critical habitat for the Regent Honeyeater. The removal of 0.84 ha of potential habitat with a low abundance of tree species that could provide foraging resources would comprise a minor adverse effect on habitat critical to the survival of the species.

### Disrupt the breeding cycle of the population

Numerous field surveys of the Hydro site have not found any evidence of Regent Honeyeater breeding (nests or pairs) within the proposal site. However, as mentioned above there is known breeding habitat for the Regent Honeyeater within close proximity to the site (9 km to the south). Although it is unlikely that the species would utilise the site for breeding due to the relatively low abundance of key feed species and the disturbed nature of the vegetation, the site could provide a small contribution to the overall foraging resources of breeding pairs within the locality. Given the small areas of disturbed potential foraging habitat that would be removed relative to the large areas of higher quality foraging habitat in the locality is highly unlikely that the removal of 0.84 ha of marginal foraging habitat from the site would disrupt the breeding cycle of the Regent Honeyeater population.

### 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 of 0.84 ha of marginal foraging habitat for the Regent Honeyeater. The potential habitat within the site contains a low abundance of preferred feed species for the species and no known breeding habitat would be removed.

The proposal would remove small patches of potential habitat that may contribute to cumulative fragmentation of habitat in the landscape. Given the high mobility of the species however it is unlikely that the proposal would lead to any fragmentation or isolation of any habitat for this species.

Given the small areas of disturbed potential foraging habitat that would be removed relative to the large areas of higher quality foraging habitat in the locality is highly unlikely that the removal of 1.3 ha of marginal foraging would decrease the availability or quality of habitat to the extent that the species is likely to decline.

### Result in invasive species that are harmful to a critically endangered species becoming established in the critically endangered species' habitat

Several invasive flora species have been recorded in the proposal area and are known from the locality. A vegetation management plan would be produced as part of the proposal and would include guidance on managing transmission of plant propagules (e.g. seeds, spores and suckers) to mitigate the risk of invasive species becoming established or spreading throughout areas of adjacent vegetation. Introduction and spread of weeds would be unlikely to substantially impact foraging habitat for this species.

The proposal site is located in close proximity to urban areas, therefore invasive fauna species such as feral cats, wild dogs and foxes are common within the locality. The proposal would be unlikely in new incursions of invasive fauna species that would become established in Regent Honeyeater habitat.

### Introduce disease that may cause the species to decline

No diseases are likely to be introduced as part of the proposal. A detailed assessment of the disease risk to the Regent Honeyeater was conducted by Jakob-Hoff et al. (2014) and identified the release of birds in captive breeding programs as the main vector for the transmission of diseases into the wild population. As no captive Regent Honeyeaters are being released as part of this proposal it is unlikely that any diseases that would affect the local wild population would occur.

### Interfere substantially with the recovery of the species

The proposal would result in the clearing of 1.3 ha of marginal foraging habitat for the Regent Honeyeater. The removal of this habitat is not likely to interfere substantially with the recovery of the species.

## EPBC Act - Assessment of Significance

### Conclusion of Assessment of Significance

The proposal is unlikely to result in a significant impact on the Regent Honeyeater as:

- Although the proposal will remove a very small amount of marginal foraging habitat defined by DAWE as critical to this species (as it occurs in the Hunter Valley). Due to the disturbed nature of this vegetation and low abundance of feed trees the vegetation to be removed comprises a very small proportion of foraging habitat present in surrounding areas and the broader locality.
- The proposal would not isolate any area of Regent Honeyeater habitat.
- The proposal is not likely to impact on the breeding cycle of the Regent Honeyeater.
- The proposal would remove only a very small area of potential foraging habitat containing a low abundance of key winter feed species.
- The proposal is unlikely to result in invasive species that are harmful to Regent Honeyeaters becoming established within adjacent habitat.
- The proposal is unlikely to introduce disease that may cause the Regent Honeyeater population to decline.
- The proposal is unlikely to substantially interfere with the recovery of the species.

## Assessment of Significance for Migratory Species potentially impacted by proposed action

### White-bellied Sea-Eagle (*Haliaeetus leucogaster*)

The White-bellied Sea-eagle (*Haliaeetus leucogaster*) is a large raptor with a wingspan of up to 220 cm. It feeds on opportunistically on a variety of fish, reptiles, birds, mammals, crustaceans and carrion (del Hoyo et al. 1994; Ferguson-Lees & Christie 2001; Marchant & Higgins 1993; Rose 2001).

Some White-bellied Seas-Eagles may travel several hundred kilometres in order to find foraging and breeding habitat with reports of one individual being recorded travelling from its natal territory at Cowell, South Australia to Fraser Island, Queensland, a distance of approximately 3000 km (Marchant & Higgins 1993).

The main threats to the White-bellied Sea-Eagle are the loss of habitat due to land development, and the disturbance of nesting pairs by human activity (DotE 2020).

### Migratory Species

**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**

An area of 'important habitat' for a migratory species is defined in the Significant Impact Guidelines (DotE 2013) as:

'Habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species'.

The White-bellied Sea-eagle generally forages and breeds in habitats near the coast and within coastal lowland areas. The study area provides some marginal foraging habitat for this species with water fowl, mammal and reptile species occurring within the study area. However, the study area is unlikely to support a significant proportion of the total population of this species.

The proposed action would reduce the area of potential foraging habitat for these species by a very small amount (6.13 ha) relative to the potential habitat within the locality. No breeding habitat for this species would be impacted by the proposal.

Habitat within the proposed action site is not considered critical during the lifecycle of the White-bellied Sea-eagle.

'Habitat utilised by a migratory species which is at the limit of the species range'.

Habitat within the proposed action site is not at the limit of the species range. Distribution of habitat for this species extends well beyond the proposal site throughout coastal Australia and larger inland water courses.

'Habitat within an area where the species is declining'.

Populations of the White-bellied Sea-Eagle are considered relatively stable (DAWE 2020a and DAWE 2020b). The proposal would therefore not impact on habitat of a species that is in decline.

**Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species**

The proposed action would not seriously disrupt the lifecycle of an ecologically significant proportion of the population of the White-bellied Sea-Eagle as the site is not being utilised by the species for breeding. The proposal would impact on a relatively small area of marginal foraging habitat however it would be unlikely that the proposal site would support an ecologically significant proportion of the population of this species.

## **Migratory Species**

### **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 incidence of weeds in vegetation immediately surrounding the study area. The Construction Environmental Management Plan (CEMP) 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.

### **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 White-bellied Sea-eagle as it would not:

- Substantially modify and/or destroy an area of important habitat for these species, noting that vegetation within the study area is only likely to represent marginal foraging habitat for these species. Given the extensive other areas of foraging habitat in the locality it is unlikely that impacts from the proposal would be significant to this species.
- Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of any of these species.
- Result in an invasive species that is harmful to the species becoming established in an area of important habitat.
- The proposal site does not comprise important habitat for White-bellied Sea-eagle.

# **Appendix F**

**Species expert assessment of Regent  
Honeyeater and Swift Parrot habitat**

# Hydro Swift Parrot and Regent Honeyeater important habitat expert assessment

Dr Ross Crates

## Executive summary:

GHD Pty. Ltd. engaged Dr Ross Crates on behalf of Hydro Aluminium Pty Ltd. to undertake an expert assessment of important habitat for Swift Parrot (*Lathamus discolor*) and Regent Honeyeater (*Anthochaera phrygia*) as part of the supporting documents to the Biodiversity Certification Assessment report for the Hydro development site located at Kurri Kurri, NSW. The proposed development footprint contains 68.6 Ha of mapped important habitat for the Swift Parrot and 50.6 Ha of mapped important habitat for the Regent Honeyeater.

## Aims:

- Undertake a comprehensive assessment of vegetation condition within the Hydro development footprint mapped as important habitat for Regent Honeyeater and / or Swift Parrot.
- Undertake habitat and targeted bird surveys within the Hydro development footprint mapped as important habitat for Regent Honeyeater and / or Swift Parrot.
- Refine the important habitat mapping for both species based on field surveys and expert elicitation such that only important habitat for either species is included in the mapping.
- Undertake habitat assessments and bird surveys within the proposed Hydro Biodiversity Stewardship Site. Refine the important habitat mapping based on the results of the field surveys and expert elicitation to determine the quantity of important Regent Honeyeater and Swift Parrot habitat contained within the proposed Biodiversity Stewardship Site.
- Undertake an assessment of serious and irreversible impacts of the proposed Hydro development on the Swift Parrot and Regent Honeyeater based on the results of the revised important habitat mapping for both species.

## Results

- The proposed development will result in the loss of 47.55 Ha of important Swift Parrot habitat and 34.63 ha of important Regent Honeyeater habitat.
- These figures represent 0.042 % and 0.006 % of the mapped important habitat for the Swift Parrot and Regent Honeyeater in New South Wales, respectively.
- The proposed Hydro Biodiversity Stewardship Site will protect in perpetuity approximately 607.25 Ha of important Swift Parrot and Regent Honeyeater habitat.
- A serious and irreversible impact statement regarding the potential impact of the proposed Hydro development on both the Swift Parrot and Regent Honeyeater accompanies this document.

## Caveats to the report.

- The expert advice in this report is provided on the understanding that all possible measures have already been taken in the planning process to first avoid and second to minimise potential impacts to Swift Parrot and Regent Honeyeater as is required under the NSW *Biodiversity Conservation Act 2016* and the *Local Land Services Act 2013*.
- Bird surveys were undertaken outside of the period Swift Parrots are present on mainland Australia. Bird survey data provided in this report cannot be used to infer absence of Swift Parrots from the site.
- Due to a lack of data availability and uncertainty surrounding future planning approvals, the report does not assess potential cumulative impacts of the loss of important Swift Parrot and Regent Honeyeater habitat that may occur as a result of multiple development approvals both within the Lower Hunter region or further afield. However, it is acknowledged that cumulative impacts arising from piecemeal loss of mapped Swift Parrot and Regent Honeyeater habitat should be taken into consideration.



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## List of supporting material:

File S1: Hydro habitat assessment data

File S2: Hydro bird survey data

File S3: Shapefiles and .mxd file containing GIS layers detailed within the document.

## 1 Introduction

### 1.1 Swift Parrot and Regent Honeyeater population status and requirement for an expert report.

The Swift Parrot and Regent Honeyeater are listed as Critically Endangered under the *Environmental Protection and Biodiversity Conservation Act* (Department of the Environment 2015, 2016), having undergone rapid population decline in recent decades.

The Hydro site at Kurri Kurri contains mapped important habitat for both species, with 68.6 and 50.6 Ha of mapped important Swift Parrot and Regent Honeyeater habitat falling within the proposed development footprint, respectively. The important habitat mapping for both species is based on remotely-sensed vegetation data in New South Wales, and is constructed based on buffers of confirmed sighting/breeding locations. Therefore, the mapping potentially includes habitat that does not in reality constitute important habitat for either species, and also potentially omits habitat that does represent important habitat for either species.

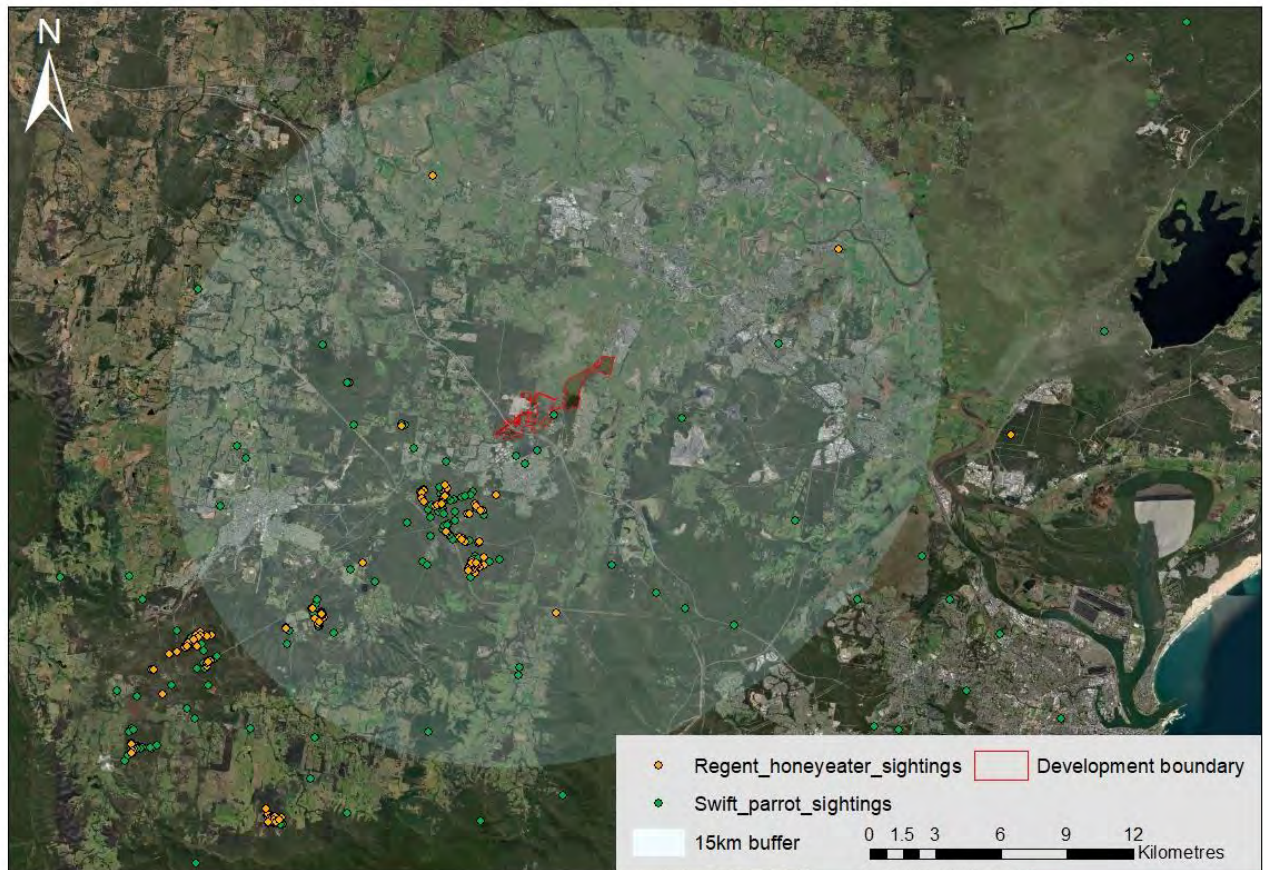
Following a review of the draft Biodiversity Certification Assessment Report (BCAR), the Biodiversity Conservation Division (BCD) requested a recognised expert of both species undertake habitat assessments and surveys to quantify the condition, extent and relative importance of habitats within both the proposed Hydro development footprint and the proposed Biodiversity Stewardship Site, such that potential impacts of the proposed Hydro development can as much as possible avoid, minimise and offset any potential impacts on the Swift Parrot and Regent Honeyeater.

## **1.2 Background information- Swift Parrots and Regent Honeyeaters in the Tomalpin Woodlands near Kurri Kurri.**

The woodlands of the lower Hunter Valley are one of the most important areas in the country for Swift Parrots and Regent Honeyeaters (Commonwealth of Australia 2011, 2016). Most records of both species within the locality occur to the south-west of the Hydro site (Figure 1), reflecting a higher proportion of wooded/forested habitat in that area. Although habitats of the Lower Hunter Valley are used in many years, they are particularly important for both species as drought refugia, when conditions are less suitable in more western parts of their ranges (Saunders & Heinsohn 2008).

There are four contemporary records of Swift Parrots within 2km of the proposed Hydro development boundary (Figure 1). The closest Regent Honeyeater record is approximately 2.8km away. Hydro is private property, so it is noted that a lack of Regent Honeyeater or Swift Parrot sightings within the development footprint could be in part due to low observer coverage in the area.

In 2020 and 2021, a total of 80 captive-bred Regent Honeyeaters have been released in the Lower Hunter valley, approximately 4.5km south-west of the Hydro site (SWIFFT 2021).



**Figure 1:** Location of Swift Parrot and Regent Honeyeater sightings since 2010 in the lower Hunter Valley with respect to the Hydro development footprint. Source: BirdLife Australia.



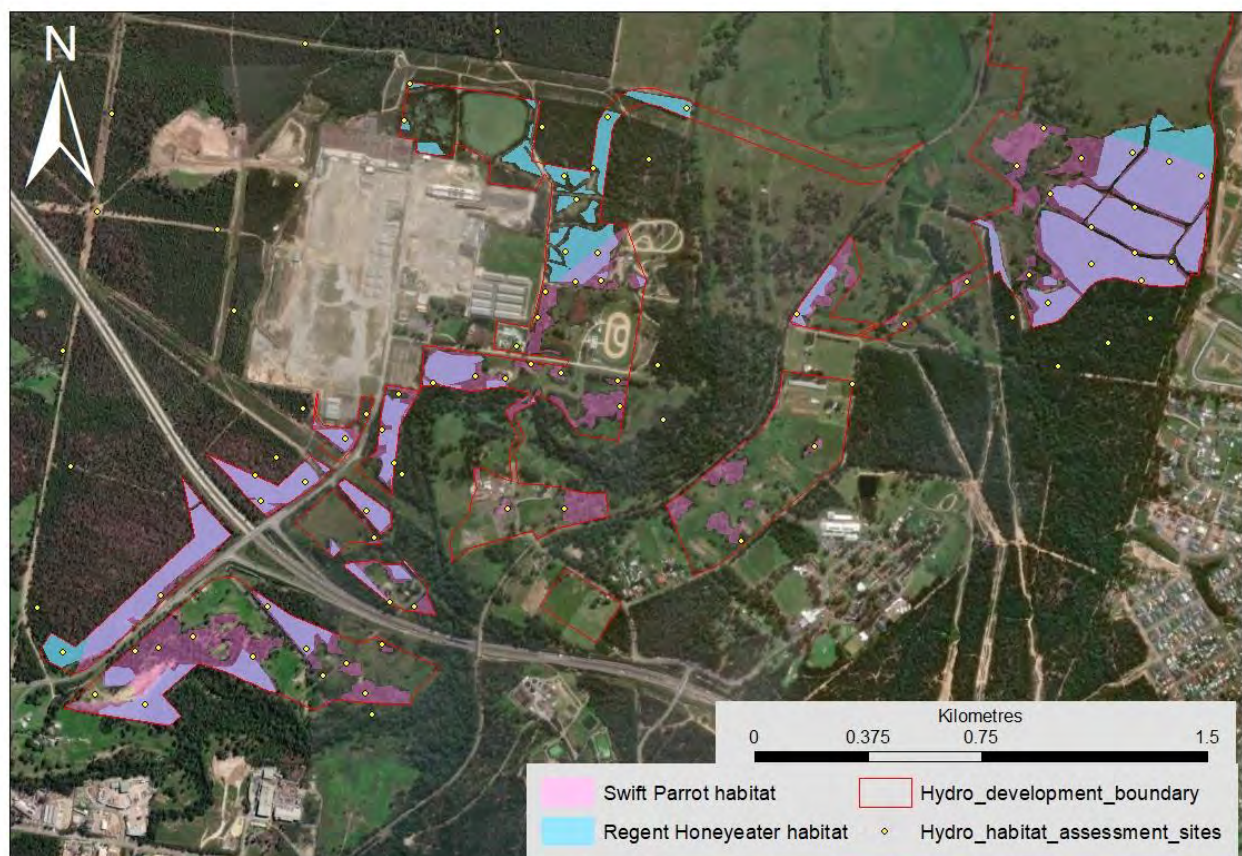
## 2: Assessments of mapped Swift Parrot and Regent Honeyeater habitat within the proposed Hydro development footprint

### 2.1 Methodology

#### 2.1.1 Habitat assessments

Five days of field surveys, focussed on areas within the Hydro development footprint intersecting mapped important habitat for the Regent Honeyeater and/or Swift Parrot (Figure 2), were undertaken. A total of 74 habitat assessment sites were established within the proposed development footprint during this period (Figure 2). An additional three days of field surveys were conducted within the proposed Hydro Biodiversity Stewardship Site (BSS), where 45 habitat assessment sites were established. Further information on the methodology used within the BSS is provided in section 4 of this report.

The habitat assessments collected the same data as collected at survey sites for the National Regent Honeyeater and Swift Parrot Monitoring Programs (NRHMP & NSPMP, Crates et al., 2017) coordinated by the Australian National University and BirdLife Australia. The survey site is defined as a 50m radius surrounding the survey location. The data collected are outlined in Table 1. One to two photographs were taken at each habitat assessment site to provide a visual representation of the vegetation community, structure, composition and condition within the site. Of the habitat data collected, particular focus was paid to the habitat features outlined in Table 2 (Crates et al. 2017).



**Figure 2:** Location of habitat assessment sites with respect to BAM mapped important habitat for the Swift Parrot and Regent Honeyeater within the Hydro development proposal footprint, Kurri Kurri. Note that Regent Honeyeater mapped habitat overlapping with Swift Parrot mapped habitat appears as lilac colouring under semi-transparent Swift Parrot habitat, rather than light blue.



**Table 1:** Habitat covariates collected at each habitat assessment site within the Hydro development footprint.

| Covariate                  | Description                                                                                                             | Citation                             |
|----------------------------|-------------------------------------------------------------------------------------------------------------------------|--------------------------------------|
| Spatial location           | WGS84 decimal latitude longitude to 2m accuracy                                                                         | (Webb et al., 2014)                  |
| Canopy cover               | Canopy cover to the nearest 5%.                                                                                         | (Mac Nally et al., 2000)             |
| Tree species               | Proportional contribution to total canopy cover of each tree species present.                                           | (Downey, 1998)                       |
| Tree age                   | Proportion of trees present defined as young, immature, mature or old growth based on diameter and breast height (DBH). | (Downey, 1998; Griebel et al., 2017) |
| Tree health                | Proportion of trees in the site that are: dead, dying, stressed, mildly stressed or healthy.                            | (Nolan et al., 2021)                 |
| Shrub cover                | % shrub cover (vegetation height 30cm to 2m) to the nearest 5%                                                          | (Maron et al., 2011)                 |
| Live mistletoe             | Total number of clumps of live mistletoe across all mistletoe species                                                   | (Watson & Herring, 2012)             |
| Woody debris               | 4-level factor: 0 = no coarse woody debris, 3 = abundant woody debris                                                   | (Ford, 2011)                         |
| Distance to standing water | 6-level factor: 0 = water present within site, 4 = water >300m away, 5 = unknown                                        | (Crates et al., 2017)                |

**Table 2:** Habitat features of particular relevance when determining potential importance to Swift Parrots and Regent Honeyeaters.

| Habitat feature                                                                                                | Justification                                                                                                                                                                                                                                                  | Relevant species  | Citation                       |
|----------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|--------------------------------|
| The proportion of mature or old growth trees*                                                                  | Regent Honeyeaters and Swift Parrots tend to prefer to nest and forage in old growth trees where available. Larger trees flower more profusely or for longer periods, thus providing a reliable nectar resource for both species.                              | Both              | Commonwealth of Australia 2016 |
| Presence/absence of long-flowered mistletoe <i>Dendrophloe vitellina</i>                                       | Long-flowered mistletoe is a key nectar resource and breeding substrate for Regent Honeyeaters in the Tomalpin woodlands. Most records of Regent Honeyeaters in the lower Hunter Valley are in areas with a relatively high abundance of <i>D. vitellina</i> . | Regent Honeyeater | Roderick et al., 2014          |
| Proportion of key feed tree species (nectar-producing or lerp-hosting) within associated plant community types | Within associated plant community types, the proportion of key feed tree species may be relatively minor. Key feed tree species may be absent from some sections of mapped important habitat within the development footprint.                                 | Both              | NSW DPIE 2016                  |
| Tree health/vegetation condition.                                                                              | Within associated plant community types, tree health may render habitat unviable if most trees are dead or dying.                                                                                                                                              | Both              | Nolan et al. 2021              |

\*Old growth trees are defined here as those with a diameter at breast height exceeding 1 metre.

A total of 82 survey sites were assessed, throughout the mapped habitat for Regent Honeyeaters and Swift Parrots within and surrounding the proposed development footprint (Figures 2 & 11).

### 2.1.2 Bird surveys.

A total of 119 bird surveys were undertaken at 99 habitat assessment sites across the development footprint (n = 74 sites) and the Biodiversity Stewardship Site (n = 45 sites) between October and December 2021. Repeat

surveys were conducted at 20 sites within the proposed development footprint where blossom was found to be present. Surveys followed the methodology used for the NRHMP and NSPMP (Crates et al., 2017). Surveys lasted five minutes, with the abundance of all bird species detected visually or aurally within 50m of the site location recorded. A simple factorial score of local blossom abundance from zero (no blossom) to four (very heavy blossom) was also recorded. Bird surveys were repeated at some sites in November 2021 when key *Eucalyptus* or *Corymbia* feed trees were in blossom to increase the probability of detecting any Regent Honeyeaters present within the development footprint. Note that bird surveys were conducted outside of the period Swift Parrots are present on mainland Australia (i.e. May-September, Higgins 1999).

In addition to potentially determining the presence of Regent Honeyeaters within the development footprint, data from bird surveys can provide useful information on the presence of other specialist woodland bird species. The specialist woodland bird species considered as surrogates / indicators of important habitat for Swift Parrots or Regent Honeyeaters within the lower Hunter Valley were:

- Brown Treecreeper *Climacteris picumnus*,
- Black-chinned Honeyeater *Melithreptus gularis*
- Fuscous Honeyeater *Lichenostomus fuscus*
- Dusky Woodswallow *Artamus cyanopterus*
- Little Lorikeet *Glossopsitta pusilla*.

Presence of these surrogate species can indicate relatively high-quality habitat and provides indirect evidence that these habitats could at times be exploited by Regent Honeyeaters or Swift Parrots.

## 2.2 Refinement of mapped important Regent Honeyeater and Swift Parrot habitat.

Important habitat mapping for Swift Parrot in New South Wales is based on remote vegetation classification and buffering of the location of confirmed Swift Parrot sightings. A 2 km radial buffer is placed around areas with five or more Swift Parrot records, where observations have occurred over two or more years and are within 2 km of one another, or areas with a single record of 40 or more birds (NSW DPIE 2020). For Regent Honeyeaters, a 5 km buffer is placed around confirmed breeding records, and a 1 km buffer around foraging records of any number of individuals (NSW DPIE 2021).

This mapping methodology is necessary given the vast wintering and breeding range of the Swift Parrot and Regent Honeyeater, respectively within NSW. However, it means that at a finer scale, the mapping could include areas that in reality are very unlikely to represent potential foraging habitat for either species, or breeding habitat for the Regent Honeyeater. Conversely, other areas that do represent potential important habitat for either species may not be included within the mapping. Fine-scale field validation and refinement of the Swift Parrot and Regent Honeyeater important habitat mapping within the proposed Hydro development area by a species' expert is therefore an important step to ensure that 'the avoid, minimize and offset' procedure (NSW DPIE 2019) is implemented as effectively as possible.

The proposed Hydro development footprint contains 68.6 Ha of mapped important Swift Parrot habitat and 50.6 Ha of mapped important Regent Honeyeater habitat (Figure 2). The important habitat mapping for both species was refined based on the results of field habitat assessments, bird surveys and expert opinion.

The approach to refine the important habitat mapping was to construct new shapefile polygons of areas that were mapped as important habitat within the proposed development footprint for the Swift Parrot and/or Regent Honeyeater. These new numbered polygons (n = 57) outline areas that, in the expert opinion of the author, should not be included as important Swift Parrot or Regent Honeyeater habitat, with accompanying justification and supporting images.

The revised mapping shapefile accompanies this report, within the 'mapping' sub-folder under the name 'Hydro\_mapped\_important\_swift\_parrot\_regent\_honeyeater\_habitat\_to\_remove\_from\_development\_boundary.shp'. Note that the revised mapping does not account for any required buffers around mapped important habitat for either species.

### 3. Results

#### 3.1 Bird surveys

Blossom was present at 52 of the 119 site surveys, with the majority of blossom occurring in either *E. fibrosa*, *E. parramattensis* or *Callistemon* sp.

No Regent Honeyeaters were detected during bird surveys. Only two indicator species (Little Lorikeet and Fuscous Honeyeater) were detected at five of 54 sites within the proposed development footprint and five sites within the proposed stewardship site (Table 3). The raw bird survey data is provided in supplementary file S2.

**Table 3:** Summary of Regent Honeyeater and other indicator species detected at bird monitoring sites within the Hydro development footprint and Stewardship site.

| Species                  | Development footprint<br>(54 sites, 74 surveys) | Stewardship Site<br>(45 sites, 45 surveys) |
|--------------------------|-------------------------------------------------|--------------------------------------------|
| Regent honeyeater        | 0                                               | 0                                          |
| Little lorikeet          | 3                                               | 4                                          |
| Fuscous honeyeater       | 2                                               | 1                                          |
| Dusky woodswallow        | 0                                               | 0                                          |
| Brown treecreeper        | 0                                               | 0                                          |
| Black-chinned honeyeater | 0                                               | 0                                          |

#### 3.2 Swift Parrot and Regent Honeyeater habitat within the Hydro development footprint- Overview.

The former Hydro Aluminium site is located within one of the most important areas in the country for the Regent Honeyeater and Swift Parrot, with multiple records of both species occurring within 15km of the development footprint over the past decade (Figure 1). Vegetation communities within the Hydro development footprint are highly variable, however, and generally speaking the habitats within the Hydro development footprint are of low to moderate importance for both species, relative to other known important sites for both species within the lower Hunter Valley, such as Werakata National Park and the Hunter Economic Zone (Roderick et al. 2014). Variability in habitat quality within the Hydro development footprint is explained primarily by soil type, stand age, tree health and vegetation community type.

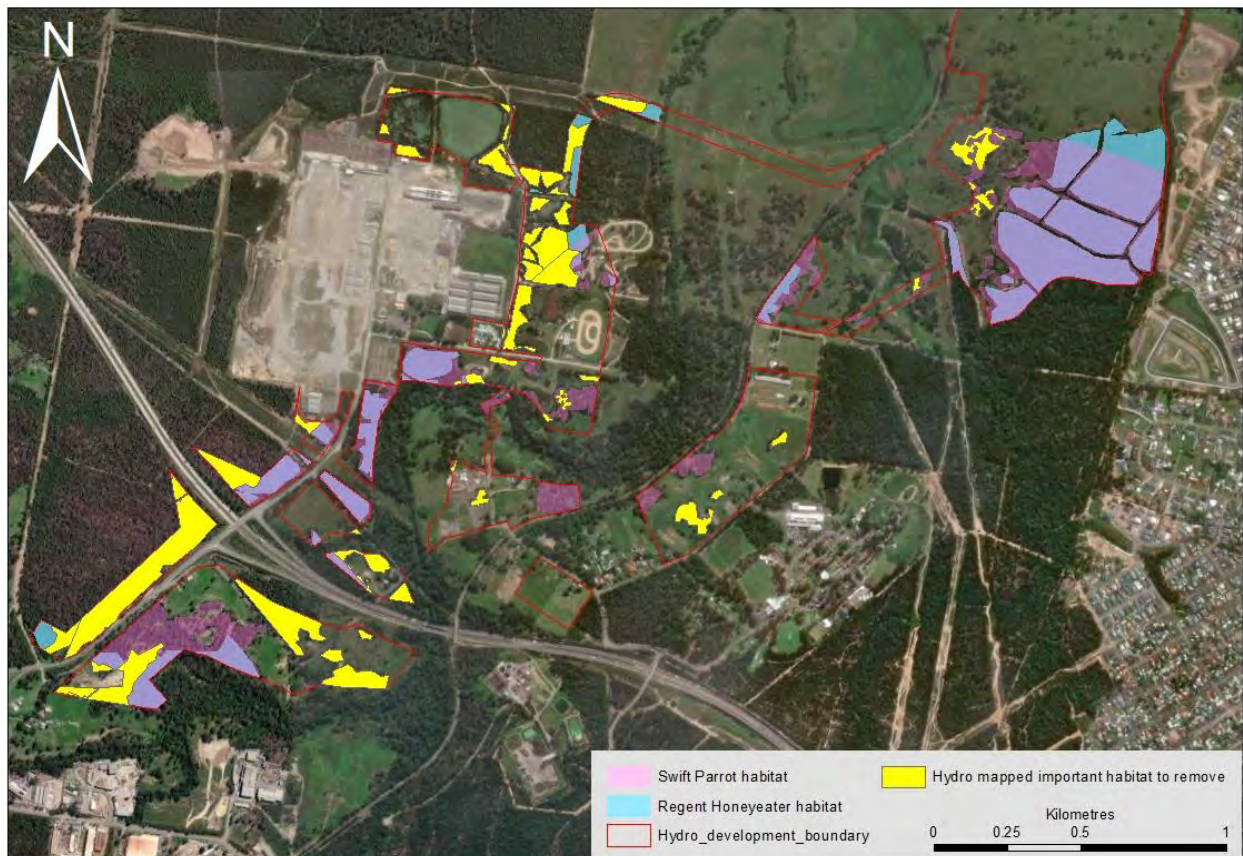
#### 3.3 Areas to be removed from important habitat mapping.

Results of the field surveys led to the suggested removal of 57 vegetation polygons, totalling 27.3 Ha of mapped important habitat for the Swift Parrot and / or Regent Honeyeater (Figure 3). The polygons for removal intersected with 21.05 Ha of mapped Swift Parrot habitat and 15.97 Ha of mapped Regent Honeyeater important habitat. The proposed Hydro development footprint therefore intersects with 47.55 Ha of important Swift Parrot habitat and 34.63 Ha of important Regent Honeyeater habitat. Explanations as to reasons for removal from important habitat mapping are provided in Table 4.

The proposed revisions to the important habitat mapping for the Swift Parrot and Regent Honeyeater, described below, are based on field surveys of habitats within the development footprint. The primary reasons why some areas of mapped important habitat for both species are suggested to be removed from the mapping include:

- A lack of canopy cover: Some mapped habitat has been historically cleared, whilst in other areas there is no mature canopy cover present.
- Errors in the remote vegetation classification: Some mapped habitat contains non-native, planted vegetation, whilst in others key feed tree species within mapped important plant community types are absent or only form a very small proportion of the total canopy cover.
- Poor tree health: In some areas, trees are predominantly in poor health, are dead, or have been subject to historically high levels of disturbance.

- A lack of key habitat features or surrogate bird species: Long-flowered mistletoe is a key breeding resource for Regent Honeyeaters within the lower Hunter Valley (Roderick et al. 2014), however field surveys revealed that all mistletoe species are extremely scarce within the proposed Hydro development footprint. Bird surveys found that other threatened species that can serve as indicators of potential Regent Honeyeater or Swift Parrot habitat were either not detected or were sparsely-distributed at low abundances within the development footprint.



**Figure 3:** Proposed areas to be removed from Swift Parrot and / or Regent Honeyeater important habitat mapping within the proposed Hydro development footprint following field assessments. Note that Regent Honeyeater mapped habitat overlapping with Swift Parrot mapped habitat appears as lilac colouring under semi-transparent Swift Parrot habitat, rather than light blue.

Mapped important habitat for Regent Honeyeaters and/or Swift Parrots within the development footprint to be retained is shown in Figure 3. The areas include patches of mature woodland or forest, predominantly comprising the key Regent Honeyeater and Swift Parrot feed tree species of grey gum (*Eucalyptus punctata*), coastal grey box (*E. moluccana*), broad-leaved ironbark (*E. fibrosa*), cabbage gum (*E. amplifolia*) or stringybark spp (Figure 4). Spotted gum (*Corymbia maculata*) is only very sparsely distributed within the proposed development footprint. In addition to producing nectar when in blossom, *E. punctata*, *E. moluccana* and *E. amplifolia* are also known to host lerp (Psyllid spp.), infestations of which could provide both Swift Parrots and Regent Honeyeaters with additional food resources even when key feed tree species are not in blossom.





**Figure 4:** Areas of important mapped habitat for Swift Parrot and / or Regent Honeyeater within the Hydro proposed development footprint. Images obtained from habitat assessment sites HYD.001, HYD.043 and HYD.060.





**Figure 5:** Example polygons of mapped important Swift Parrot or Regent Honeyeater habitat that is suggested to be removed from the mapping. Top: Polygon #26, HYD.063. Habitat already cleared. Middle: Polygon 55, HYD.034. Largest trees dead, no mature canopy cover remaining. Bottom: Polygon 23, HYD.064. Primarily non-native vegetation.

**Table 4:** Polygons to be removed from the important habitat mapping for the Swift Parrot and Regent Honeyeater within the proposed Hydro development footprint.

| Polygon No. | Species | Closest survey site | Canopy cover | Ppn. mature / old growth trees | Long-flowered mistletoe abundance | Ppn. Key feed tree species | Ppn healthy trees | No. surrogate Species detected | Comments                                                                                                                                                                                                                                                                                                                                                                                                   |
|-------------|---------|---------------------|--------------|--------------------------------|-----------------------------------|----------------------------|-------------------|--------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 32          | SP      | HYD.048             | 5            | 0                              | 0                                 | 0                          | 100               | 0                              | This is young <i>Casuarina</i> sp. and does not constitute Swift Parrot foraging habitat.                                                                                                                                                                                                                                                                                                                  |
| 33          | SP      | HYD.048             | 5            | 0                              | 0                                 | 0                          | 0                 | 0                              | The small section has been previously cleared. There are no trees to the west of the track.                                                                                                                                                                                                                                                                                                                |
| 34          | SP RH   | HYD.028             | 35           | 30                             | 0                                 | 40                         | 90                | 0                              | Mapped as Swift Parrot habitat but the vegetation community is <i>E. parramattensis</i> and <i>A. bakeri</i> . Images from HYD.028 show this is primarily low-shrubby forest with a dense understorey of <i>Melaleuca</i> sp. on poor quality sandy soil. While this PCT is an EEC in and of itself, this polygon is not considered to represent important habitat for Swift Parrots or Regent Honeyeaters |
| 35          | SP      | HYD.022             | 25           | 25                             | 0                                 | 100                        | 90                | 0                              | Aerial imagery shows there are no trees in this section.                                                                                                                                                                                                                                                                                                                                                   |
| 36          | SP      | HYD.022             | 25           | 25                             | 0                                 | 100                        | 90                | 0                              | Aerial imagery shows there are no trees in this section.                                                                                                                                                                                                                                                                                                                                                   |
| 37          | SP      | HYD.022             | 25           | 25                             | 0                                 | 100                        | 90                | 0                              | Aerial imagery shows there are no trees in this section.                                                                                                                                                                                                                                                                                                                                                   |
| 38          | SP      | TBC                 |              |                                | 0                                 |                            |                   |                                | Aerial imagery shows there are no trees in this section.                                                                                                                                                                                                                                                                                                                                                   |
| 39          | SP      | HYD.047             | 40           | 50                             | 0                                 | 80                         | 100               | 0                              | Aerial imagery shows there are no trees in this section.                                                                                                                                                                                                                                                                                                                                                   |
| 40          | SP      | HYD.054             | 55           | 30                             | 0                                 | 70                         | 90                | 0                              | Aerial imagery shows there are no trees in this section.                                                                                                                                                                                                                                                                                                                                                   |
| 41          | SP      | HYD.054             | 55           | 30                             | 0                                 | 70                         | 90                | 0                              | Aerial imagery shows there are no trees in this section.                                                                                                                                                                                                                                                                                                                                                   |
| 42          | SP      | HYD.052             | 30           | 10                             | 0                                 | 100                        | 100               | 0                              | Trees in this strip have been planted. The proportion of grey gum is very small. There is a higher proportion of exotic pines. Does not constitute important Swift Parrot habitat.                                                                                                                                                                                                                         |
| 43          | SP      | HYD.063             | 10           | 35                             | 0                                 | 0                          | 75                | 0                              | This area is a pure stand of fire-affected <i>A. floribunda</i> .                                                                                                                                                                                                                                                                                                                                          |
| 44          | RH      | HYD.030             | 30           | 35                             | 0                                 | 70                         | 80                | 0                              | Mapped as Regent Honeyeater habitat but see comment with FID 22: poor quality low shrubby woodland. The area of <i>E. parramattensis</i> – <i>A. bakeri</i> has been removed from this section of mapped Regent Honeyeater habitat. The area containing PCT 1600 has been retained- see image attached to HYD.030.                                                                                         |

|    |       |                    |    |     |   |     |     |   |                                                                                                                                                                                                                                                                                                                                                                                                   |
|----|-------|--------------------|----|-----|---|-----|-----|---|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 45 | SP RH | HYD.027            | 10 | 20  | 0 | 50  | 70  | 0 | Habitat transitions to low shrubby woodland on sandy soil, more similar to vegetation community in proximity to HYD.027. Not important Swift Parrot or Regent Honeyeater habitat.                                                                                                                                                                                                                 |
| 46 | SP    | HYD.036            | 25 | 15  | 0 | 0   | 80  | 0 | Vegetation within the development footprint here is 100% <i>A. floribunda</i> / <i>bakeri</i> . Not important Swift Parrot habitat.                                                                                                                                                                                                                                                               |
| 47 | SP RH | HYD.023            | 35 | 25  | 0 | 80  | 30  | 0 | Small trees, mostly dead on poor sandy soils. Not Regent Honeyeater or Swift Parrot habitat.                                                                                                                                                                                                                                                                                                      |
| 48 | SP    | HYD.035            | 25 | 15  | 0 | 0   | 80  | 0 | Pure stand of young <i>A. floribunda</i> . Not important Swift Parrot habitat                                                                                                                                                                                                                                                                                                                     |
| 49 | SP RH | HYD.032<br>HYD.033 | 20 | 80  | 0 | 40  | 80  | 0 | Young, shrubby forest on poor sandy soil. Not important Swift Parrot or Regent Honeyeater habitat.                                                                                                                                                                                                                                                                                                |
| 50 | SP RH | HYD.050            | 15 | 30  | 0 | 90  | 90  | 0 | This polygon contains a cleared area dominated by exotic shrubs. Remove from the mapping for both species.                                                                                                                                                                                                                                                                                        |
| 51 | SP    | HYD.049            | 15 | 10  | 0 | 80  | 85  | 0 | Appears to be planted roadside veg. Some exotic species including pines. Some bigger trees in poor health. Can be removed from mapping.                                                                                                                                                                                                                                                           |
| 52 | SP    | HYD.058            | 10 | 100 | 0 | 20  | 80  | 0 | Polygon removes 2 <i>E. crebra</i> and 2 <i>A. bakeri</i> . Single mature <i>E. tereticornis</i> retained.                                                                                                                                                                                                                                                                                        |
| 53 | SP    | HYD.057            | 10 | 100 | 0 | 0   | 100 | 0 | Stand is 100% <i>E. crebra</i> and can be removed from the Swift Parrot habitat mapping.                                                                                                                                                                                                                                                                                                          |
| 54 | SP    | HYD.057            | 30 | 40  | 0 | 50  | 80  | 0 | Patch is mainly non-native vegetation. Definitely not thin-leaved apple / grey gum as mapped. Mainly narrow-leaved mahogany. Can be removed from Swift Parrot mapping.                                                                                                                                                                                                                            |
| 55 | SP    | HYD.034            | 15 | 10  | 0 | 100 | 50  | 0 | Trees are mostly dead. Can be removed from mapping.                                                                                                                                                                                                                                                                                                                                               |
| 56 | SP    | HYD.041            | 10 | 0   | 0 | 10  | 100 | 0 | Mostly dense scrub. No mature trees. Remove from mapping.                                                                                                                                                                                                                                                                                                                                         |
| 57 | SP RH | HYD.028            | 35 | 30  | 0 | 0   | 90  | 0 | Mapped as Swift Parrot habitat but the vegetation community is <i>E. parramattensis</i> and <i>E. bakeri</i> . Images from HYD.028 show this is primarily low-shrubby forest with a dense understorey of <i>Melaleuca</i> sp. on poor quality sandy soil. While this PCT is an EEC in and of itself, it is not considered to represent important habitat for Swift Parrots or Regent Honeyeaters. |
| 26 | SP RH | HYD.063            | 0  | 0   | 0 | 0   | 0   | 0 | Has been cleared- see images associated with HYD.063.                                                                                                                                                                                                                                                                                                                                             |
| 24 | SP RH | HYD.058            | 15 | 70  | 0 | 80  | 70  | 0 | Some large old trees to remain but some are dead.                                                                                                                                                                                                                                                                                                                                                 |
| 30 | SP RH | HYD.058            | 20 | 5   | 0 | 20  | 70  | 0 | The north-western section contains no trees, trees present are in poor health and small.                                                                                                                                                                                                                                                                                                          |

|    |       |                     |    |     |   |     |     |   |                                                                                                                                                                                                                                                                                   |
|----|-------|---------------------|----|-----|---|-----|-----|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 11 | SP    | HYD.057             | 10 | 10  | 0 | 50  | 90  | 0 | Mainly <i>Melaleuca</i> swamp/scrub with minimal eucalypt canopy. Not important Swift Parrot habitat.                                                                                                                                                                             |
| 20 | SP    | HYD.057             | 10 | 10  | 0 | 50  | 90  | 0 | Mainly <i>Melaleuca</i> swamp/scrub with minimal eucalypt canopy. Not important Swift Parrot habitat.                                                                                                                                                                             |
| 23 | SP    | HYD.064             | 15 | 100 | 0 | 0   | 65  | 0 | Primarily non-native vegetation including silky oak and pine. Not important Swift Parrot habitat.                                                                                                                                                                                 |
| 21 | RH    | HYD.051,<br>HYD.056 | 25 | 5   | 0 | 100 | 100 | 0 | This section contains some planted Eucalypts. Native veg is young, generally sparse and shrubby. Although there are some key feed tree species present (including <i>E. sideroxylon</i> which is presumably planted), it does not constitute important Regent Honeyeater habitat. |
| 22 | SP RH | HYD.053-055         | 15 | 5   | 0 | 40  | 100 | 0 | No spotted gum present here, it is immature <i>E.fibrosa</i> and <i>Melaleuca</i> sp. The section containing mature <i>E. fibrosa</i> in proximity to the raceway has been retained, but the rest does not constitute important Swift Parrot or Regent Honeyeater habitat.        |
| 19 | SP    | HYD.019             | 0  | 0   | 0 | 0   | 0   | 0 | No trees present in this segment of mapping                                                                                                                                                                                                                                       |
| 3  | RH    | HYD.053,<br>HYD.066 | 15 | 0   | 0 | 60  | 100 | 0 | The vegetation here is young and shrubby on poor quality sandy soils.                                                                                                                                                                                                             |
| 1  | RH    | HYD.066             | 15 | 0   | 0 | 60  | 100 | 0 | The vegetation here is young and shrubby on poor quality sandy soils.                                                                                                                                                                                                             |
| 8  | RH    | HYD.066             | 15 | 0   | 0 | 60  | 100 | 0 | The vegetation here is young and shrubby on poor quality sandy soils.                                                                                                                                                                                                             |
| 2  | RH    | HYD.066             | 15 | 0   | 0 | 60  | 100 | 0 | The vegetation here is young and shrubby on poor quality sandy soils.                                                                                                                                                                                                             |
| 11 | RH    | HYD.067             | 10 | 10  | 0 | 0   | 95  | 0 | Primarily <i>Melaleuca</i> and <i>Allocasuarina</i> swamp. Does not constitute important Regent Honeyeater habitat.                                                                                                                                                               |
| 7  | RH    | HYD.067             | 10 | 10  | 0 | 50  | 100 | 0 |                                                                                                                                                                                                                                                                                   |
| 4  | RH    | HYD.067             | 40 | 40  | 0 | 60  | 100 | 0 | Some key feed tree species present but soils are sandy, no mistletoe present. A proportion of the mapping containing mature stringybarks has been retained.                                                                                                                       |
| 6  | RH    | HYD.069             |    |     |   |     |     |   |                                                                                                                                                                                                                                                                                   |
| 10 | RH    | HYD.068             | 35 | 30  | 0 | 70  | 85  | 0 | Some mature grey gum/stringybark woodland in the gully to the eastern side of this polygon has been retained. The proportion removed is less mature with a smaller proportion of key feed tree species. No long-flowered mistletoe, or any other mistletoe species.               |



|    |    |         |    |    |   |    |     |   |                                                                                                                                                                                                         |
|----|----|---------|----|----|---|----|-----|---|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 9  | RH | HYD.073 | 40 | 0  | 0 | 40 | 100 | 0 | The eastern (downslope, Creekside vegetation) containing grey box and cabbage gum has been retained. Higher up the slope the vegetation contains immature <i>E.fibrosa</i> and <i>E. parramattensis</i> |
| 5  | RH | HYD.069 | 40 | 0  | 0 | 20 | 100 | 0 | Young, shrubby regrowth on poor-quality soils. Not important Regent Honeyeater habitat.                                                                                                                 |
| 12 | RH | HYD.070 | 15 | 0  | 0 | 50 | 100 | 0 | Young, dense, scrubby woodland on sandy soils.                                                                                                                                                          |
| 13 | RH | HYD.070 | 15 | 0  | 0 | 50 | 100 | 0 | Young, dense, scrubby woodland on sandy soils.                                                                                                                                                          |
| 14 | RH | HYD.070 | 15 | 0  | 0 | 50 | 100 | 0 | Young, dense, scrubby woodland on sandy soils. Some grey gum present.                                                                                                                                   |
| 15 | RH | HYD.070 | 30 | 10 | 0 | 50 | 100 | 0 | Young, dense, scrubby woodland on sandy soils. Some grey gum present.                                                                                                                                   |
| 18 | RH | HYD.071 | 20 | 0  | 0 | 40 | 100 | 0 | Young, dense regrowth of <i>E. parramattensis</i> and narrow-leaved apple. Not important Regent Honeyeater habitat.                                                                                     |
| 17 | RH | HYD.072 | 20 | 10 | 0 | 20 | 100 | 0 | Young, dense regrowth of <i>E. parramattensis</i> and narrow-leaved apple. Not important Regent Honeyeater habitat.                                                                                     |
| 16 | RH | HYD.072 | 20 | 10 | 0 | 20 | 100 | 0 | Young, dense regrowth of <i>E. parramattensis</i> and narrow-leaved apple. Not important Regent Honeyeater habitat.                                                                                     |

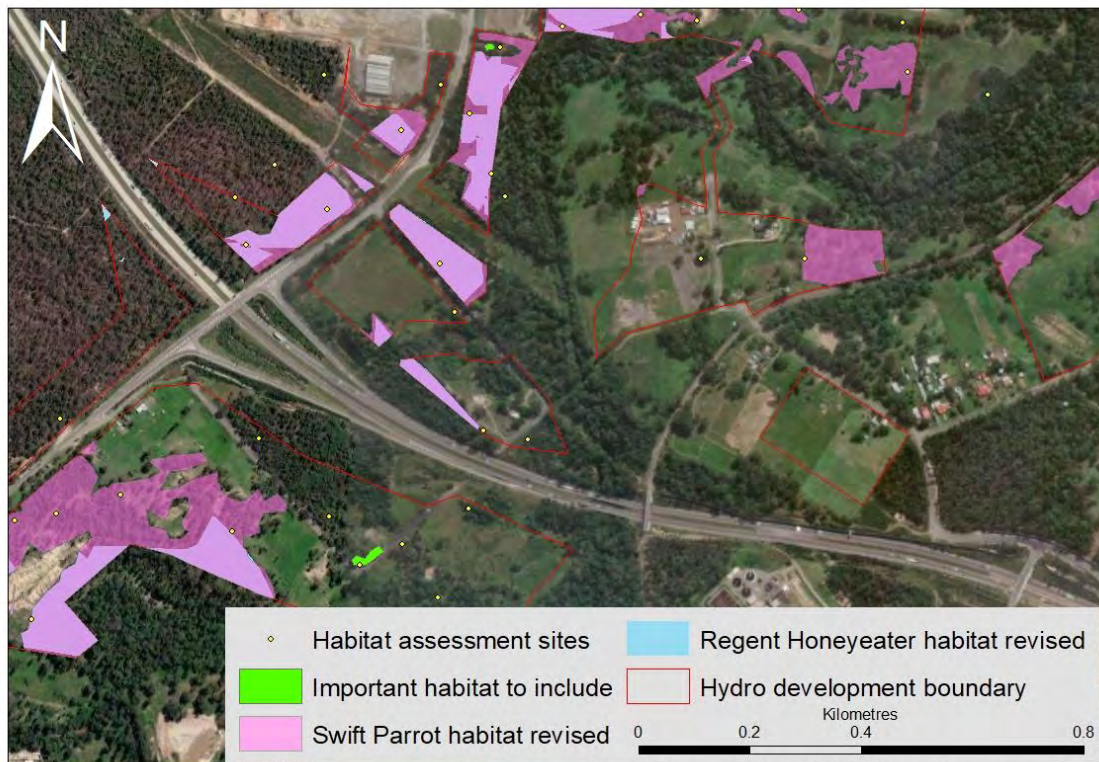
### 3.4 Areas to be included in the important habitat mapping.

Two polygons, totalling approximately 0.19 Ha, containing a single mature *E. fibrosa* and three mature *E. punctata* within the development footprint should be included within the important habitat mapping for both species (Figures 6 & 7).

**Table 5:** Important Regent Honeyeater and Swift Parrot habitat within the proposed Hydro development footprint to be included in the mapping.

| Polygon No. | Species | Closest survey site | Canopy cover | Ppn. mature / old growth trees | Long-flowered mistletoe abundance | Ppn. Key feed tree species | Ppn healthy trees | No. surrogate Species detected | Index score | Comments                                                                                                                                               |
|-------------|---------|---------------------|--------------|--------------------------------|-----------------------------------|----------------------------|-------------------|--------------------------------|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1           | SP RH   | HYD.045             | 100          | 100                            | 0                                 | 100                        | 100               | 1                              |             | Single mature <i>E. fibrosa</i> has been removed from the important habitat within a cleared area. This tree should be re-instated within the mapping. |
| 2           | SP RH   | HYD.059             | 100          | 100                            | 0                                 | 100                        | 100               | 0                              |             | Three large old <i>E. punctata</i> currently not included in the mapping but should be.                                                                |





**Figure 6:** Locations of important Swift Parrot and Regent Honeyeater habitat within the proposed Hydro development footprint to be included within the important habitat mapping. Note that overlapping Regent Honeyeater and Swift Parrot important habitat appears lilac coloured in the figure.



**Figure 7:** Habitat within polygons 1 and 2, Table 6, to be included within the important Regent Honeyeater and Swift Parrot mapping.



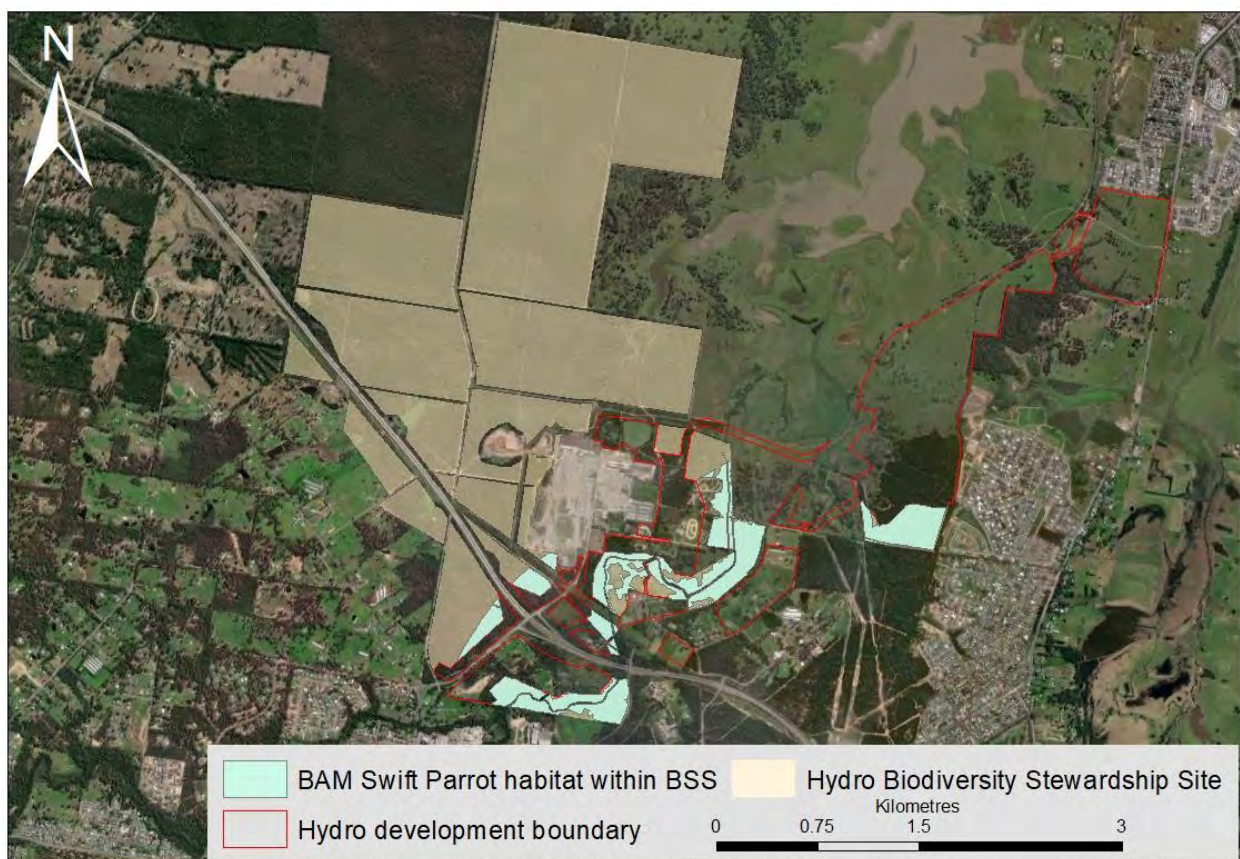
#### 4. Assessments of Swift Parrot and Regent Honeyeater habitat within the proposed Hydro Biodiversity Stewardship Site.

##### 4.1 Background.

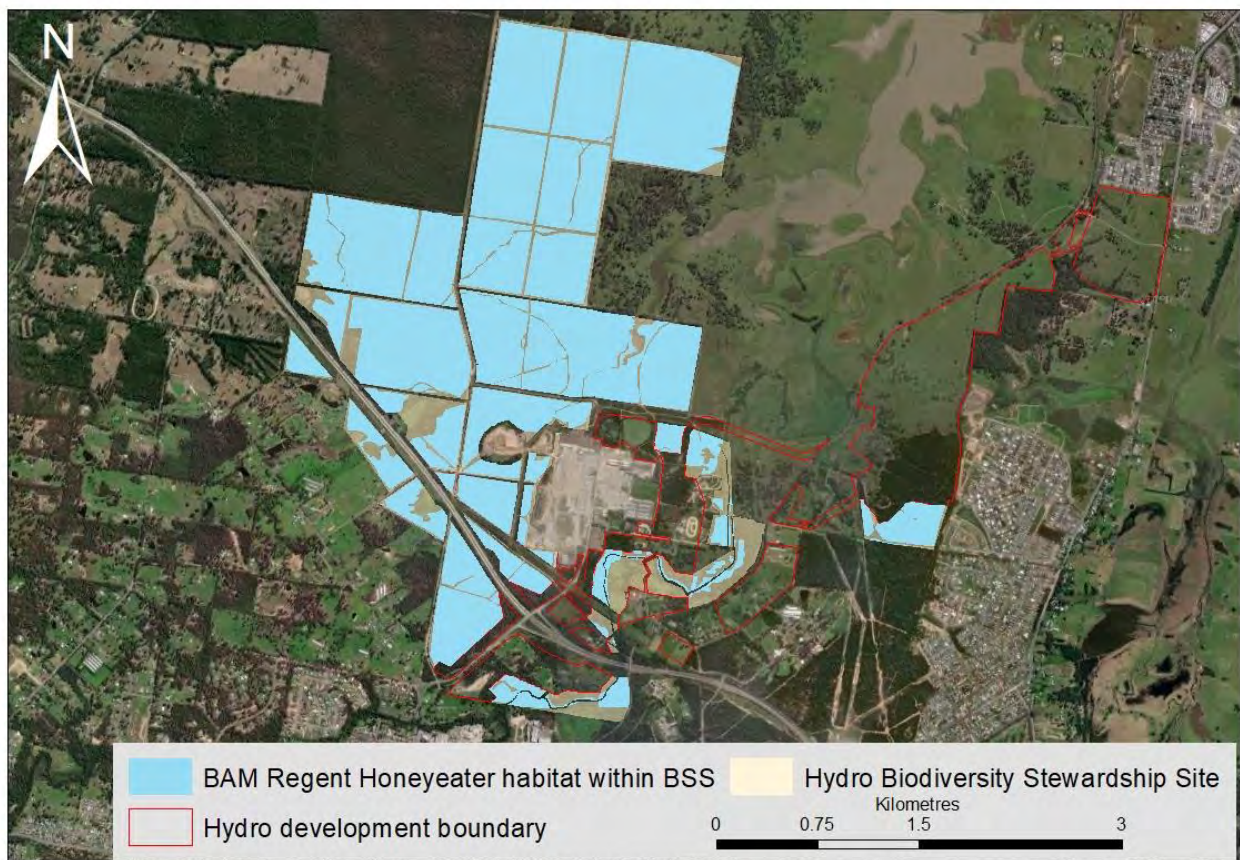
The proposed Hydro Biodiversity Stewardship site contains 767.9 Ha of habitat within and surrounding the proposed Hydro development footprint (Figure 8).

Of this 767.9 Ha, 204.8 Ha is mapped as important Swift Parrot habitat (Figure 8). However, because of the methodology used to produce the Swift Parrot important habitat mapping (i.e. buffering of Swift Parrot sightings), there is potential for more important Swift Parrot habitat to be present within the proposed stewardship site that is currently not mapped because the habitat lies more than 2-5 km from a Swift Parrot sighting.

In contrast to Swift Parrots, 647.1 Ha of the proposed Hydro Biodiversity Stewardship Site is mapped as important Regent Honeyeater habitat, but some of this habitat may, in reality, not represent important habitat for the Regent Honeyeater (Figure 9).



**Figure 8:** Distribution of the proposed Hydro Biodiversity Stewardship Site. Shown in blue is the current mapped important Swift Parrot habitat within the proposed stewardship boundary based on the original BAM mapping.



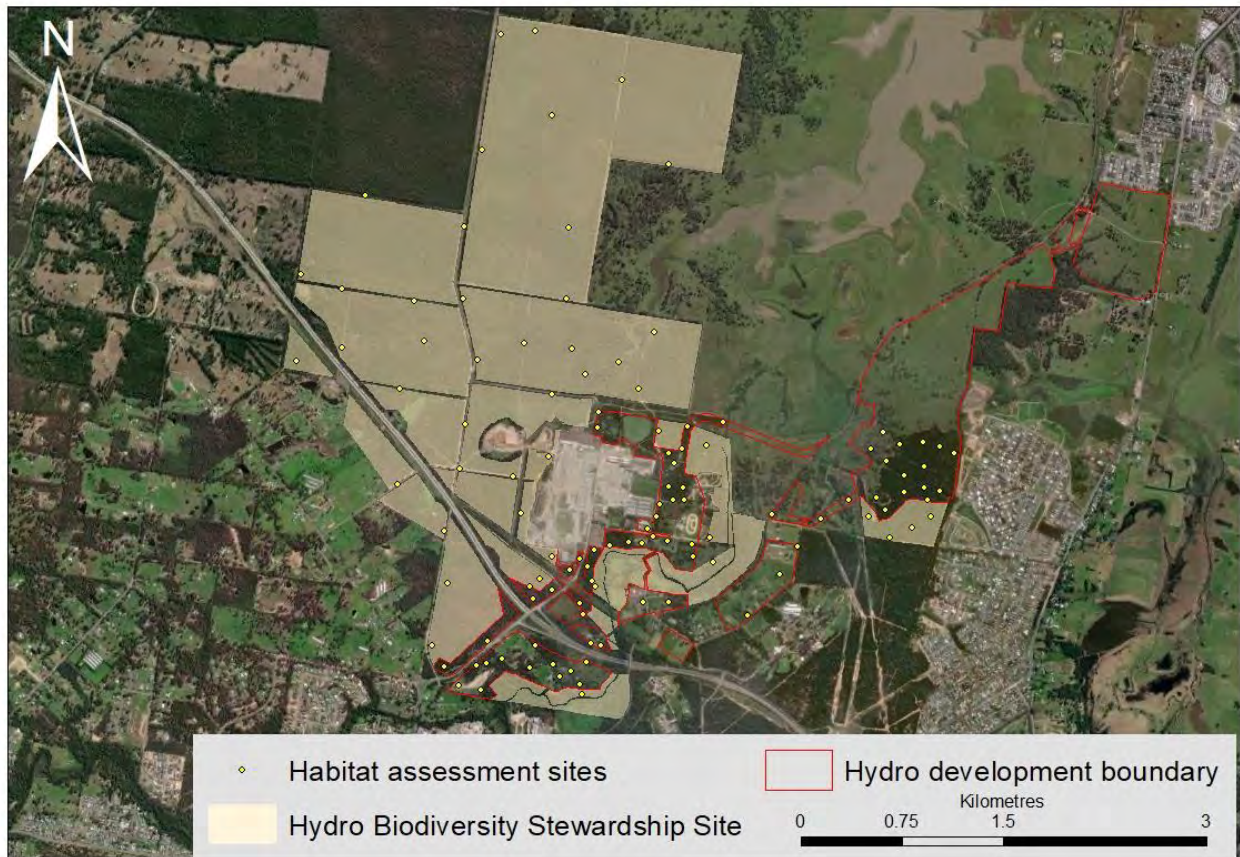
**Figure 9:** Distribution of the proposed Hydro biodiversity stewardship site. Shown in blue is current mapped important Regent Honeyeater habitat within the proposed stewardship boundary based on the original BAM mapping.

There is a requirement therefore, to refine the important habitat mapping for both the Swift Parrot and the Regent Honeyeater within the proposed Hydro Biodiversity Stewardship site based on field assessments of the vegetation communities and condition within the Stewardship Site by a species' expert.

## 4.2 Methodology

The same methodology used to assess habitat and conduct bird surveys within the proposed development footprint was used within the proposed stewardship sites (see section 2.1.1). All accessible tracks were driven within and surrounding the stewardship site. A total of 45 habitat and bird assessment sites were established within and surrounding the Stewardship Site (refer to Figure 10). Assessment sites were focussed as much as possible on areas where trees were in blossom.





**Figure 10:** Distribution of habitat assessment and bird monitoring sites within and surrounding the Hydro Biodiversity Stewardship Site.

Based on visual assessments of the habitats encountered within the stewardship boundary and the results of the habitat assessments, the mapping for both species within the stewardship site was revised such that only important habitat for either species was included.

### 4.3 Results

Vegetation communities within the Hydro stewardship boundary were variable with respect to their importance to Regent Honeyeaters and Swift Parrots. Areas to the north and north-west of the Stewardship Site represent important habitat for both species, with large stands of *E. fibrosa* interspersed with patches of *C. maculata*. These areas represent the most important areas for both species within the stewardship site and development footprint. Other important areas for both species include the vegetation communities surrounding the creek line running through the south-eastern area of the stewardship boundary and the wetland area to the north of the industrial zone. These areas are dominated by *E. amplifolia* interspersed with *E. punctata*, *A. floribunda*, *E. moluccana* and stringybark spp. (Figure 11).

No Regent Honeyeaters were detected at any of the 45 survey sites within the Hydro Stewardship site. Two indicator species- Fuscous Honeyeater and Little Lorikeet- were detected at 1 and 4 sites, respectively (Table 3). The raw bird survey data is provided accompanying this report in the sub-folder 'Bird survey data.'



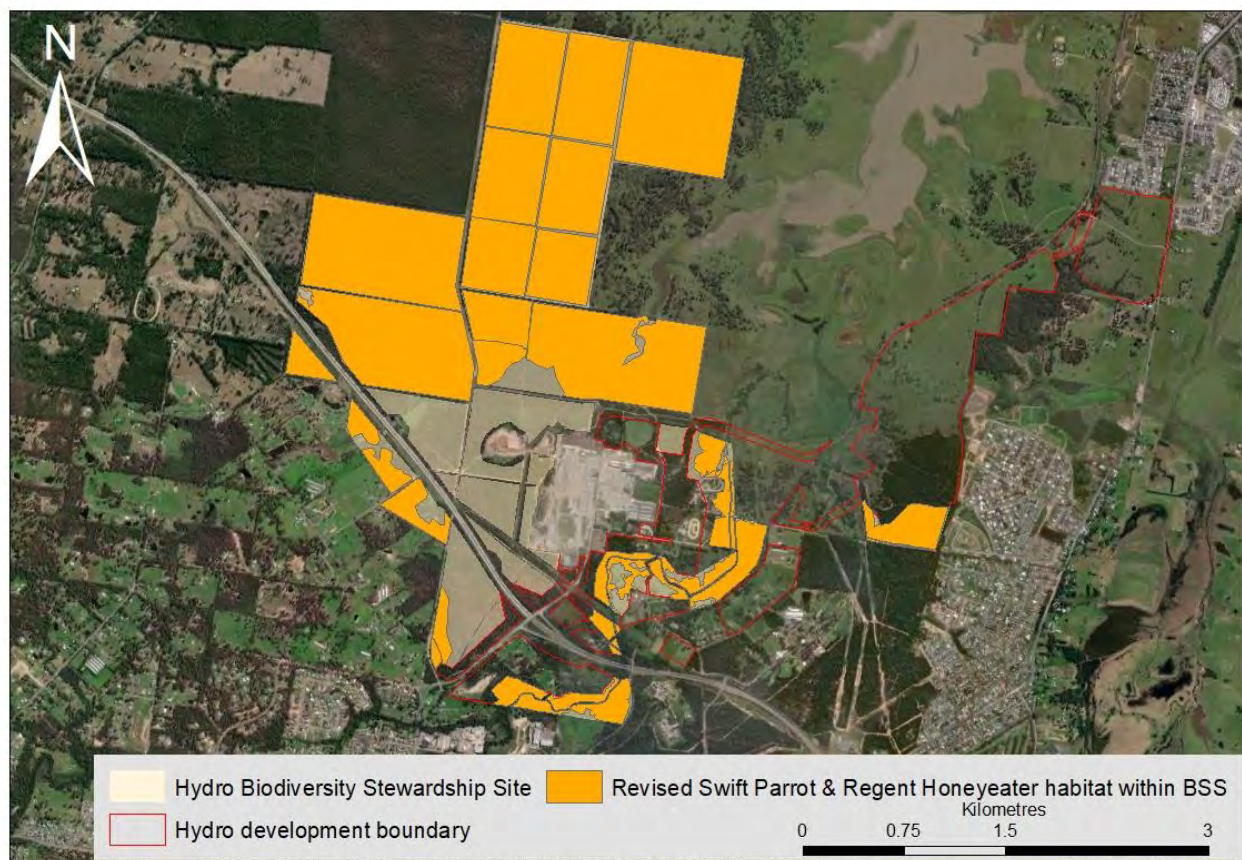


**Figure 11:** Examples of important Swift Parrot and Regent Honeyeater habitat within the Hydro Biodiversity Stewardship Site. Top and middle: *E. fibrosa* / *C. maculata* forest (HYD. 089 & HYD.092); Bottom: *E. amplifolia* woodland (HYD.075).



Other parts of the stewardship site, particularly those at slightly higher elevations on poorer quality, sandy soils do not represent potential habitat for Regent Honeyeaters or Swift Parrots. These areas are primarily near the centre of the stewardship area, to the west of the industrial area and are dominated by areas of *E. parramattensis* similar in structure and composition to areas that have been suggested to be removed from the Swift Parrot important habitat mapping within the proposed development footprint (Figure 12). It is noted that some parts of the stewardship site were affected badly by fire in 2016, most of which are not considered to represent important Swift Parrot or Regent Honeyeater habitat.

The areas considered to represent important Swift Parrot and Regent Honeyeater habitat within the Hydro stewardship site are shown in Figure 12. The revised mapping indicates there is 607.25 Ha of important Regent Honeyeater and Swift Parrot habitat within the Hydro Biodiversity Stewardship Site.



**Figure 12:** Revised mapping showing the distribution of important habitat for the Swift Parrot and Regent Honeyeater within the Hydro Biodiversity Stewardship Site.

## 5. Conclusion

Following extensive field-based habitat and bird surveys, an assessment by a recognised species expert, Dr Ross Crates, has concluded that the quantity of mapped important habitat for the Swift Parrot and Regent Honeyeater within the Hydro development footprint is 47.55 Ha and 34.63 Ha, respectively. These values represent a reduction of 21.05 Ha and 15.97 Ha on previous estimates of important habitat for both species, respectively. The remaining mapped important habitat within the proposed Hydro development footprint is considered to be of low to moderate quality, relative to other areas of mapped important habitat for the Swift Parrot and Regent Honeyeater within the lower Hunter Valley, such as parts of Werakata National Park and the Hunter Economic Zone (Roderick et al. 2014). It is considered unlikely that Swift Parrots or Regent Honeyeaters would utilise mapped habitats within the proposed Hydro development footprint, and none of the remaining mapped important habitat within the Hydro development footprint is considered critical habitat for either species. See the serious and irreversible impact assessment accompanying this report for further details on the likely impacts of the proposed development on both species.

The most important habitat for the Swift Parrot and Regent Honeyeater within the Hydro estate is contained within the proposed Hydro Biodiversity Stewardship Site. In particular, the areas of (i) *E.fibrosa* / *C.maculata* forest in the north of the BSS, and (ii) *E.amplifolia* / *E.punctata* woodlands surrounding the wetlands north of the industrial zone (Figure 11) are most similar to those habitats that Swift Parrots and Regent Honeyeaters are known to occupy within the lower Hunter Valley. Water is a key habitat feature for both species, and most of the important habitat for Swift Parrots and Regent Honeyeaters is in close proximity to water bodies that could be used for drinking or bathing is already contained within the BSS. This includes the creek line running through the south-east section of the Hydro estate, as well as the larger wetland area to the north of the proposed development footprint and to the east of the main BSS. Similarly, areas of highest soil fertility adjacent to waterbodies on which key Swift Parrot and Regent Honeyeater feed tree species grow are principally located within the BSS, unless they have been retained in the revised important habitat mapping within the development footprint.

Since Swift Parrots and Regent Honeyeaters are both highly mobile species, potential impacts of the loss of mapped important habitat on the dispersal capacity of both species through habitat corridors are considered to be low. See the SAIL assessment for further assessment of risks of habitat fragmentation and barriers to dispersal associated with habitat loss.

Field surveys revealed that some mapped important Regent Honeyeater habitat within the proposed Hydro BSS does not represent important habitat for this species. The area of important Regent Honeyeater habitat within the BSS has been revised down from 647.1 Ha to 602.75 Ha. Areas removed from the BSS mapping are primarily ridge top plant community types on poorer-quality, sandy soils. The area of important Swift Parrot habitat within the BSS has been revised up from 204.8 Ha to 602.75 Ha.

Further changes to the proposed development footprint to avoid and minimise impacts on Regent Honeyeaters and Swift Parrots are beyond the scope of this expert assessment. However, additional ways in which potential impacts of the proposed Hydro development on the Swift Parrot and Regent Honeyeater could be reduced or mitigated include:

- Seeding of Long-flowered Mistletoe within the BSS, particularly within *E. fibrosa* - *C. maculata* forests. This would require a rigorous study to assess the efficacy of seeding as a viable conservation strategy, but if successful could substantially increase the value of the BSS for Regent Honeyeaters.
- Noisy Miner management. Suppression of Noisy Miners within the BSS could reduce the impact of Noisy Miners on any Swift Parrots and Regent Honeyeaters that may look to utilise habitats within the BSS. This would also require monitoring to assess the efficacy of noisy miner management within the Hydro BSS as a long-term conservation strategy and ensure that rapid recolonisation by Noisy Miners does not occur.

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## 7. Author Curriculum Vitae

### Dr Ross Crates

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Academic website: [www.difficultbirds.com](http://www.difficultbirds.com) Business website: [www.futurefauna.com.au](http://www.futurefauna.com.au)

### Selected employment history:

- October '21 – present: **Owner, FutureFauna-** Ecological consulting, research and conservation.
- September '18 – present: **Postdoctoral Fellow, Australian National University-** Designing, implementing and managing national monitoring programs for the regent honeyeater and swift parrot. Publication of peer-reviewed articles pertaining to woodland bird conservation. Student supervision, teaching.
- September '10 – November '13: **Edward Grey Institute, University of Oxford- Graduate research assistant.** RA to professor Ben Sheldon, on a major ERC grant to study the social ecology and dispersal of wild birds.

### Academic history:

- 2015-2018 - Australian National University, Australia. PhD, conservation biology.
- 2006-2010 - University of East Anglia. BSc (1<sup>st</sup> class Hons) Ecology with a year in Australasia.
- 1999-2006 - Barton Court Grammar School, Canterbury. 4 A-levels grade A and 8 GCSEs grade A\*- A.

### Academic awards:

- Michael Graham prizes for best performance in Ecology & best conservation project, University of East Anglia.
- Australian National University, Australian Postgraduate Award Research Scholarship.

### Selected publications:

- Heinsohn, R, Crates, R. et al. (2022). Population viability in data deficient nomadic species: What it will take to save regent honeyeaters from extinction. *Biological Conservation* **266**: 109430.
- Crates, R. et al. (2021). Poor quality monitoring data underestimate the impact of Australia's megafires on a critically endangered songbird. *Diversity and Distributions*.
- Crates, R. et al. (2021). Loss of vocal culture and fitness costs in a critically endangered songbird. *Proceedings of the Royal Society series B*. **288**: 20210225.
- Crates, R. et al. (2020). Sustained and delayed noisy miner suppression at an avian hotspot. *Austral Ecology* **45**: 636-643.
- Crates, R. et al. (2019). Genomic impact of severe population decline in a nomadic songbird. *PLoS ONE* **14**: e0223953.
- Crates, R. et al. (2019). Contemporary breeding biology of critically endangered regent honeyeaters: implications for conservation. *Ibis* **161**: 521-532.
- Crates, R. et al. (2018). Spatially and temporally targeted suppression of despotic noisy miners has conservation benefits for highly mobile and threatened woodland birds. *Biological Conservation* **227**: 343-351.



- Crates, R. et al. (2017). Undetected Allee effects in Australia's threatened birds: implications for conservation. *Emu* **117**: 207-221.
- Crates, R., et al. (2017). An occupancy approach to monitoring regent honeyeaters. *Journal of Wildlife Management* **81**: 669-677.

#### **Selected Grants:**

- NSW Local Land Services: Regent honeyeater population monitoring program. \$300,000
- CWP renewables: Sapphire Wind Farm swift parrot and regent honeyeater biodiversity offset. \$250,000
- Commonwealth of Australia Department of Agriculture, Water & Environment: Noisy miner management assessment. \$70,000
- Commonwealth of Australia Department of Agriculture, Water & Environment: King Island scrubtit and brown thornbill population genetics \$70,000
- BirdLife Australia: Regent honeyeater monitoring, nest protection and noisy miner management. \$60,000
- Bin Zayed Species Conservation Fund: Ecology and conservation of the regent honeyeater. \$28,000

# **Appendix G**

**Assessment of planted vegetation**

**Table G.1** *Decision making key used to assess planted vegetation within the development site (pathway through key highlighted in bold print)*

| 1 | Does the planted native vegetation occur within an area that contains a mosaic of planted and remnant native vegetation and which can be reasonably assigned to a PCT known to occur in the same IBRA subregion as the proposal?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <p>i) Yes .... The planted native vegetation must be allocated to the best-fit PCT and the BAM must be applied.</p> <p>ii) <b><u>No the planted vegetation does not occur in an area that contains a mosaic of planted and remnant native vegetation Go to 2</u></b></p>                                                                                                                                                                                                                                     |
|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2 | Is the planted native vegetation:<br>a. planted for the purpose of environmental rehabilitation or restoration under an existing conservation obligation listed in BAM Section 11.9(2.), and<br>b. the primary objective was to replace or regenerate a plant community type or a threatened plant species population or its habitat?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <p>i) Yes .... The planted native vegetation must be assessed in accordance with Chapters 4 and 5 of the BAM.</p> <p>ii) <b><u>No the planted vegetation has been planted for screening and amenity purposes ..... Go to 3.</u></b></p>                                                                                                                                                                                                                                                                      |
| 3 | Is the planted/translocated native vegetation individuals of a threatened species or other native species planted/translocated for the purpose of providing threatened species habitat under one of the following:<br>a. a species recovery project<br>b. Saving our Species project<br>c. other types of government funded restoration project<br>d. condition of consent for a development approval that required those species to be planted or translocated for the purpose of providing threatened species habitat<br>e. legal obligation as part of a condition or ruling of court. This includes regulatory directed or ordered remedial plantings (e.g. Remediation Order for clearing without consent issued under the BC Act or the Native Vegetation Act)<br>f. ecological rehabilitation to re-establish a PCT or TEC that was, or is carried out under a mine operations plan, or<br>g. approved vegetation management plan (e.g. as required as part of a Controlled Activity Approval for works on waterfront land under the NSW Water Management Act 2000)? | <p>i) Yes .... The planted native vegetation must be assessed in accordance with Chapters 4 and 5 of the BAM. Biodiversity Assessment Method 77</p> <p>ii.) <b><u>No. the planted vegetation has been planted for screening and amenity purposes..... Go to 4.</u></b></p>                                                                                                                                                                                                                                   |
| 4 | Was the planted native vegetation (including individuals of a threatened flora species) undertaken voluntarily for revegetation, environmental rehabilitation or restoration without a legal obligation to secure or provide for management of the native vegetation?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <p>i. Yes..... Go to D.2 Assessment of planted native vegetation for threatened species habitat (the use of Chapters 4 and 5 of the BAM are not required to be applied).</p> <p>ii. <b><u>No the planted vegetation has been planted for screening and amenity purposes..... Go to 5</u></b></p>                                                                                                                                                                                                             |
| 5 | Is the native vegetation (including individuals of a threatened flora species) planted for functional, aesthetic, horticultural or plantation forestry purposes? This includes examples such as: windbreaks in agricultural landscapes, roadside plantings (including street trees, median strips, roadside batters), landscaping in parks, gardens and sport fields/complexes, macadamia plantations or tea-tree farms?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <p>i. <b><u>Yes .... Go to D.2 Assessment of planted native vegetation for threatened species habitat (the use of Chapters 4 and 5 of the BAM are not required to be applied). – Planted vegetation within the site includes horticultural plantings and roadside screening plantings.</u></b><br/><b><u>Assessment of planted native vegetation for threatened species habitat has been completed in accordance with appendix D2 and is including in section 6.1.5.</u></b></p> <p>ii. No..... Go to 6.</p> |

# **Appendix H**

**BAM credit reports**

## Proposal Details

|                                |                                               |                                                                    |
|--------------------------------|-----------------------------------------------|--------------------------------------------------------------------|
| Assessment Id                  | Proposal Name                                 | BAM data last updated *                                            |
| 00037534/BAAS17098/23/00037535 | Regrowth Kurri Kurri - Industrial subdivision | 19/12/2022                                                         |
| Assessor Name                  | Report Created                                | BAM Data version *                                                 |
| Arien Quin                     | 30/01/2023                                    | 56                                                                 |
| Assessor Number                | BAM Case Status                               | Date Finalised                                                     |
| BAAS17098                      | Finalised                                     | 30/01/2023                                                         |
| Assessment Revision            | Assessment Type                               | BOS entry trigger                                                  |
| 1                              | Part 4 Developments (General)                 | BOS Threshold: Biodiversity Values Map and area clearing threshold |

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

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

| Zone | Vegetation zone name | TEC name | Current Vegetation integrity score | Change in Vegetation integrity (loss / gain) | Area (ha) | Sensitivity to loss (Justification) | Species sensitivity to gain class | BC Act Listing status | EPBC Act listing status | Biodiversity risk weighting | Potential SAIL | Ecosystem credits |
|------|----------------------|----------|------------------------------------|----------------------------------------------|-----------|-------------------------------------|-----------------------------------|-----------------------|-------------------------|-----------------------------|----------------|-------------------|
|      |                      |          |                                    |                                              |           |                                     |                                   |                       |                         |                             |                |                   |



## Grey Gum - Rough-barked Apple shrubby open forest of the lower Hunter

|   |                |                                                                                             |      |      |      |                                              |                          |                                 |            |      |                 |           |
|---|----------------|---------------------------------------------------------------------------------------------|------|------|------|----------------------------------------------|--------------------------|---------------------------------|------------|------|-----------------|-----------|
| 3 | 1591_Intact    | Hunter Lowland Redgum Forest in the Sydney Basin and New South Wales North Coast Bioregions | 65.8 | 65.8 | 0.7  | Biodiversity Conservation Act listing status | High Sensitivity to Gain | Endangered Ecological Community | Not Listed | 2.00 |                 | 23        |
| 4 | 1591_Disturbed | Hunter Lowland Redgum Forest in the Sydney Basin and New South Wales North Coast Bioregions | 35.8 | 35.8 | 0.23 | Biodiversity Conservation Act listing status | High Sensitivity to Gain | Endangered Ecological Community | Not Listed | 2.00 |                 | 4         |
|   |                |                                                                                             |      |      |      |                                              |                          |                                 |            |      | <b>Subtotal</b> | <b>27</b> |

## Parramatta Red Gum - Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area

|   |             |                                                         |      |      |      |                                              |                          |                                 |            |      |                 |          |
|---|-------------|---------------------------------------------------------|------|------|------|----------------------------------------------|--------------------------|---------------------------------|------------|------|-----------------|----------|
| 1 | 1633_Intact | Kurri Sand Swamp Woodland in the Sydney Basin Bioregion | 62.1 | 62.1 | 0.14 | Biodiversity Conservation Act listing status | High Sensitivity to Gain | Endangered Ecological Community | Not Listed | 2.00 |                 | 4        |
|   |             |                                                         |      |      |      |                                              |                          |                                 |            |      | <b>Subtotal</b> | <b>4</b> |

| Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter |             |                                                                                             |      |      |      |                                              |                          |                                 |            |                 |           |
|------------------------------------------------------------------------------------------------------------|-------------|---------------------------------------------------------------------------------------------|------|------|------|----------------------------------------------|--------------------------|---------------------------------|------------|-----------------|-----------|
| 2                                                                                                          | 1600_Intact | Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions | 57.8 | 57.8 | 0.73 | Biodiversity Conservation Act listing status | High Sensitivity to Gain | Endangered Ecological Community | Not Listed | 2.00            | 21        |
|                                                                                                            |             |                                                                                             |      |      |      |                                              |                          |                                 |            | <b>Subtotal</b> | <b>21</b> |
|                                                                                                            |             |                                                                                             |      |      |      |                                              |                          |                                 |            | <b>Total</b>    | <b>52</b> |

## Species credits for threatened species

| Vegetation zone name                                            | Habitat condition (Vegetation Integrity) | Change in habitat condition | Area (ha)/Count (no. individuals) | Sensitivity to loss (Justification)          | Sensitivity to gain (Justification)                | BC Act Listing status | EPBC Act listing status | Potential SAIL | Species credits |
|-----------------------------------------------------------------|------------------------------------------|-----------------------------|-----------------------------------|----------------------------------------------|----------------------------------------------------|-----------------------|-------------------------|----------------|-----------------|
| <b><i>Anthochaera phrygia</i> / Regent Honeyeater ( Fauna )</b> |                                          |                             |                                   |                                              |                                                    |                       |                         |                |                 |
| 1591_Intact                                                     | 65.8                                     | 65.8                        | 0.02                              | Biodiversity Conservation Act listing status | Effectiveness of management in controlling threats | Critically Endangered | Critically Endangered   | True           | 1               |
| 1600_Intact                                                     | 57.8                                     | 57.8                        | 0.41                              | Biodiversity Conservation Act listing status | Effectiveness of management in controlling threats | Critically Endangered | Critically Endangered   | True           | 18              |

## BAM Credit Summary Report

|                                                                                                               |      |      |      |                                                            |                                                    |                       |                       |                 |           |
|---------------------------------------------------------------------------------------------------------------|------|------|------|------------------------------------------------------------|----------------------------------------------------|-----------------------|-----------------------|-----------------|-----------|
| 1633_Intact                                                                                                   | 62.1 | 62.1 | 0.04 | Biodiversity Conservation Act listing status               | Effectiveness of management in controlling threats | Critically Endangered | Critically Endangered | True            | 2         |
|                                                                                                               |      |      |      |                                                            |                                                    |                       |                       | <b>Subtotal</b> | <b>21</b> |
| <b><i>Eucalyptus parramattensis subsp. decadens / Eucalyptus parramattensis subsp. decadens ( Flora )</i></b> |      |      |      |                                                            |                                                    |                       |                       |                 |           |
| 1633_Intact                                                                                                   | N/A  | N/A  | 5    | Geographic Distribution                                    | Seedbank Persistence                               | Vulnerable            | Vulnerable            | False           | 10        |
|                                                                                                               |      |      |      |                                                            |                                                    |                       |                       | <b>Subtotal</b> | <b>10</b> |
| <b><i>Grevillea parviflora subsp. parviflora / Small-flower Grevillea ( Flora )</i></b>                       |      |      |      |                                                            |                                                    |                       |                       |                 |           |
| 1600_Intact                                                                                                   | 57.8 | 57.8 | 0.47 | Biodiversity Conservation Act listing status               | Quantity class of viable seeds produced            | Vulnerable            | Vulnerable            | False           | 14        |
|                                                                                                               |      |      |      |                                                            |                                                    |                       |                       | <b>Subtotal</b> | <b>14</b> |
| <b><i>Lathamus discolor / Swift Parrot ( Fauna )</i></b>                                                      |      |      |      |                                                            |                                                    |                       |                       |                 |           |
| 1591_Intact                                                                                                   | 65.8 | 65.8 | 0.32 | Environment Protection and Conservation Act listing status | Effectiveness of management in controlling threats | Endangered            | Critically Endangered | True            | 16        |

## BAM Credit Summary Report

|                                                           |      |      |      |                                                            |                                                    |            |                       |                 |           |
|-----------------------------------------------------------|------|------|------|------------------------------------------------------------|----------------------------------------------------|------------|-----------------------|-----------------|-----------|
| 1600_Intact                                               | 57.8 | 57.8 | 0.72 | Environment Protection and Conservation Act listing status | Effectiveness of management in controlling threats | Endangered | Critically Endangered | True            | 31        |
| 1633_Intact                                               | 62.1 | 62.1 | 0.08 | Environment Protection and Conservation Act listing status | Effectiveness of management in controlling threats | Endangered | Critically Endangered | True            | 4         |
| 1591_Disturbed                                            | 35.8 | 35.8 | 0.21 | Environment Protection and Conservation Act listing status | Effectiveness of management in controlling threats | Endangered | Critically Endangered | True            | 6         |
|                                                           |      |      |      |                                                            |                                                    |            |                       | <b>Subtotal</b> | <b>57</b> |
| <b><i>Myotis macropus / Southern Myotis ( Fauna )</i></b> |      |      |      |                                                            |                                                    |            |                       |                 |           |
| 1591_Intact                                               | 65.8 | 65.8 | 0.32 | Biodiversity Conservation Act listing status               | Species dependent on habitat attributes            | Vulnerable | Not Listed            | False           | 11        |
| 1600_Intact                                               | 57.8 | 57.8 | 0.23 | Biodiversity Conservation Act listing status               | Species dependent on habitat attributes            | Vulnerable | Not Listed            | False           | 7         |

## BAM Credit Summary Report

|                                                                 |      |      |      |                                              |                                         |            |            |                 |           |
|-----------------------------------------------------------------|------|------|------|----------------------------------------------|-----------------------------------------|------------|------------|-----------------|-----------|
| 1591_Disturbed                                                  | 35.8 | 35.8 | 0.22 | Biodiversity Conservation Act listing status | Species dependent on habitat attributes | Vulnerable | Not Listed | False           | 4         |
|                                                                 |      |      |      |                                              |                                         |            |            | <b>Subtotal</b> | <b>22</b> |
| <b><i>Petaurus norfolcensis / Squirrel Glider ( Fauna )</i></b> |      |      |      |                                              |                                         |            |            |                 |           |
| 1633_Intact                                                     | 62.1 | 62.1 | 0.08 | Biodiversity Conservation Act listing status | Species dependent on habitat attributes | Vulnerable | Not Listed | False           | 2         |
| 1600_Intact                                                     | 57.8 | 57.8 | 0.73 | Biodiversity Conservation Act listing status | Species dependent on habitat attributes | Vulnerable | Not Listed | False           | 21        |
| 1591_Intact                                                     | 65.8 | 65.8 | 0.32 | Biodiversity Conservation Act listing status | Species dependent on habitat attributes | Vulnerable | Not Listed | False           | 11        |
| 1591_Disturbed                                                  | 35.8 | 35.8 | 0.22 | Biodiversity Conservation Act listing status | Species dependent on habitat attributes | Vulnerable | Not Listed | False           | 4         |
|                                                                 |      |      |      |                                              |                                         |            |            | <b>Subtotal</b> | <b>38</b> |





## BAM Biodiversity Credit Report (Like for like)

### Proposal Details

|                                                                    |                                                                                                                                                                                       |                         |
|--------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|
| Assessment Id                                                      | Proposal Name                                                                                                                                                                         | BAM data last updated * |
| 00037534/BAAS17098/23/00037535                                     | Regrowth Kurri Kurri - Industrial subdivision                                                                                                                                         | 19/12/2022              |
| Assessor Name                                                      | Assessor Number                                                                                                                                                                       | BAM Data version *      |
| Arien Quin                                                         | BAAS17098                                                                                                                                                                             | 56                      |
| Proponent Names                                                    | Report Created                                                                                                                                                                        | BAM Case Status         |
| Jeffrey Bretag                                                     | 30/01/2023                                                                                                                                                                            | Finalised               |
| Assessment Revision                                                | Assessment Type                                                                                                                                                                       | Date Finalised          |
| 1                                                                  | Part 4 Developments (General)                                                                                                                                                         | 30/01/2023              |
| BOS entry trigger                                                  | * Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet. |                         |
| BOS Threshold: Biodiversity Values Map and area clearing threshold |                                                                                                                                                                                       |                         |

### Potential Serious and Irreversible Impacts

| Name of threatened ecological community | Listing status | Name of Plant Community Type/ID |
|-----------------------------------------|----------------|---------------------------------|
| Nil                                     |                |                                 |
| Species                                 |                |                                 |
| Lathamus discolor / Swift Parrot        |                |                                 |
| Anthochaera phrygia / Regent Honeyeater |                |                                 |

## BAM Biodiversity Credit Report (Like for like)

### Additional Information for Approval

PCT Outside Ibra Added

None added

PCTs With Customized Benchmarks

PCT

No Changes

Predicted Threatened Species Not On Site

Name

**Grantiella picta** / Painted Honeyeater

### Ecosystem Credit Summary (Number and class of biodiversity credits to be retired)

## BAM Biodiversity Credit Report (Like for like)

| Name of Plant Community Type/ID                                                                                            | Name of threatened ecological community                                                     | Area of impact | HBT Cr | No HBT Cr | Total credits to be retired |
|----------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|----------------|--------|-----------|-----------------------------|
| 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                                     | 0.1            | 0      | 4         | 4                           |
| 1600-Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter            | Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions | 0.7            | 0      | 21        | 21                          |
| 1591-Grey Gum - Rough-barked Apple shrubby open forest of the lower Hunter                                                 | Hunter Lowland Redgum Forest in the Sydney Basin and New South Wales North Coast Bioregions | 0.9            | 0      | 27        | 27                          |

### 1591-Grey Gum - Rough-barked Apple shrubby open forest of the lower Hunter

#### Like-for-like credit retirement options

| Name of offset trading group                                                                                                                                    | Trading group | Zone        | HBT | Credits | IBRA region                                                                                                                                                                                                       |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|-------------|-----|---------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Hunter Lowland Redgum Forest in the Sydney Basin and New South Wales North Coast Bioregions<br>This includes PCT's:<br>1591, 1598, 1603, 1605, 1691, 1692, 1749 | -             | 1591_Intact | No  | 23      | Hunter, Ellerston, Karuah Manning, Kerrabee, Liverpool Range, Peel, Tomalla, Upper Hunter, Wyong and Yengo.<br><br>or<br>Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site. |

## BAM Biodiversity Credit Report (Like for like)

|                                                                                                                        |                                                                                                                                                              |               |                |     |         |                                                                                                                                                                                                               |
|------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|----------------|-----|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                        | Hunter Lowland Redgum Forest in the Sydney Basin and New South Wales North Coast Bioregions<br>This includes PCT's: 1591, 1598, 1603, 1605, 1691, 1692, 1749 | -             | 1591_Disturbed | No  | 4       | Hunter, Ellerston, Karuah Manning, Kerrabee, Liverpool Range, Peel, Tomalla, Upper Hunter, Wyong and Yengo.<br>or<br>Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site. |
|                                                                                                                        |                                                                                                                                                              |               |                |     |         |                                                                                                                                                                                                               |
|                                                                                                                        |                                                                                                                                                              |               |                |     |         |                                                                                                                                                                                                               |
| <b>1600-Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter</b> | <b>Like-for-like credit retirement options</b>                                                                                                               |               |                |     |         |                                                                                                                                                                                                               |
|                                                                                                                        | Name of offset trading group                                                                                                                                 | Trading group | Zone           | HBT | Credits | IBRA region                                                                                                                                                                                                   |
|                                                                                                                        | Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions<br>This includes PCT's: 1590, 1592, 1593, 1600, 1602             | -             | 1600_Intact    | No  | 21      | Hunter, Ellerston, Karuah Manning, Kerrabee, Liverpool Range, Peel, Tomalla, Upper Hunter, Wyong and Yengo.<br>or<br>Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site. |
|                                                                                                                        |                                                                                                                                                              |               |                |     |         |                                                                                                                                                                                                               |
|                                                                                                                        |                                                                                                                                                              |               |                |     |         |                                                                                                                                                                                                               |

## BAM Biodiversity Credit Report (Like for like)

**1633-Parramatta Red Gum -  
Narrow-leaved Apple -  
Prickly-leaved Paperbark  
shrubby woodland in the  
Cessnock-Kurri Kurri area**

### Like-for-like credit retirement options

| Name of offset trading group                                                                     | Trading group | Zone        | HBT | Credits | IBRA region                                                                                                                                                                                                       |
|--------------------------------------------------------------------------------------------------|---------------|-------------|-----|---------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Kurri Sand Swamp Woodland in the Sydney Basin Bioregion<br>This includes PCT's: 1633, 1635, 1650 | -             | 1633_Intact | No  | 4       | Hunter, Ellerston, Karuah Manning, Kerrabee, Liverpool Range, Peel, Tomalla, Upper Hunter, Wyong and Yengo.<br><br>or<br>Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site. |

### Species Credit Summary

| Species                                        | Vegetation Zone/s                            | Area / Count | Credits |
|------------------------------------------------|----------------------------------------------|--------------|---------|
| <b>Anthochaera phrygia</b> / Regent Honeyeater | <b>1591_Intact, 1600_Intact, 1633_Intact</b> | 0.5          | 21.00   |



## BAM Biodiversity Credit Report (Like for like)

|                                                                                              |                                                              |     |       |
|----------------------------------------------------------------------------------------------|--------------------------------------------------------------|-----|-------|
| <b>Eucalyptus parramattensis subsp. decadens</b> / Eucalyptus parramattensis subsp. decadens | <b>1633_Intact</b>                                           | 5.0 | 10.00 |
| <b>Grevillea parviflora subsp. parviflora</b> / Small-flower Grevillea                       | <b>1600_Intact</b>                                           | 0.5 | 14.00 |
| <b>Lathamus discolor</b> / Swift Parrot                                                      | <b>1591_Intact, 1600_Intact, 1633_Intact, 1591_Disturbed</b> | 1.3 | 57.00 |
| <b>Myotis macropus</b> / Southern Myotis                                                     | <b>1591_Intact, 1600_Intact, 1591_Disturbed</b>              | 0.8 | 22.00 |
| <b>Petaurus norfolcensis</b> / Squirrel Glider                                               | <b>1633_Intact, 1600_Intact, 1591_Intact, 1591_Disturbed</b> | 1.4 | 38.00 |

### Credit Retirement Options

Like-for-like credit retirement options

|                                                                                              |                                                                                              |                |
|----------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|----------------|
| <b>Anthochaera phrygia</b> / Regent Honeyeater                                               | Spp                                                                                          | IBRA subregion |
|                                                                                              | <b>Anthochaera phrygia</b> / Regent Honeyeater                                               | Any in NSW     |
| <b>Eucalyptus parramattensis subsp. decadens</b> / Eucalyptus parramattensis subsp. decadens | Spp                                                                                          | IBRA subregion |
|                                                                                              | <b>Eucalyptus parramattensis subsp. decadens</b> / Eucalyptus parramattensis subsp. decadens | Any in NSW     |
| <b>Grevillea parviflora subsp. parviflora</b> / Small-flower Grevillea                       | Spp                                                                                          | IBRA subregion |
|                                                                                              | <b>Grevillea parviflora subsp. parviflora</b> / Small-flower Grevillea                       | Any in NSW     |

## BAM Biodiversity Credit Report (Like for like)

|                                                   |                                                |                |
|---------------------------------------------------|------------------------------------------------|----------------|
| <b>Lathamus discolor</b> /<br>Swift Parrot        | Spp                                            | IBRA subregion |
|                                                   | <b>Lathamus discolor</b> / Swift Parrot        | Any in NSW     |
| <b>Myotis macropus</b> /<br>Southern Myotis       | Spp                                            | IBRA subregion |
|                                                   | <b>Myotis macropus</b> / Southern Myotis       | Any in NSW     |
| <b>Petaurus norfolcensis</b> /<br>Squirrel Glider | Spp                                            | IBRA subregion |
|                                                   | <b>Petaurus norfolcensis</b> / Squirrel Glider | Any in NSW     |

# BAM Biodiversity Credit Report (Variations)

## Proposal Details

|                                                                    |                                                                                                                                                                                       |                         |
|--------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|
| <b>Assessment Id</b>                                               | Proposal Name                                                                                                                                                                         | BAM data last updated * |
| 00037534/BAAS17098/23/00037535                                     | Regrowth Kurri Kurri - Industrial subdivision                                                                                                                                         | 19/12/2022              |
| Assessor Name                                                      | Assessor Number                                                                                                                                                                       | BAM Data version *      |
| Arien Quin                                                         | BAAS17098                                                                                                                                                                             | 56                      |
| Proponent Name(s)                                                  | Report Created                                                                                                                                                                        | BAM Case Status         |
| Jeffrey Bretag                                                     | 30/01/2023                                                                                                                                                                            | Finalised               |
| Assessment Revision                                                | Assessment Type                                                                                                                                                                       | Date Finalised          |
| 1                                                                  | Part 4 Developments (General)                                                                                                                                                         | 30/01/2023              |
| BOS entry trigger                                                  | * Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet. |                         |
| BOS Threshold: Biodiversity Values Map and area clearing threshold |                                                                                                                                                                                       |                         |

## Potential Serious and Irreversible Impacts

| Name of threatened ecological community        | Listing status | Name of Plant Community Type/ID |
|------------------------------------------------|----------------|---------------------------------|
| <b>Nil</b>                                     |                |                                 |
| Species                                        |                |                                 |
| <b>Lathamus discolor</b> / Swift Parrot        |                |                                 |
| <b>Anthochaera phrygia</b> / Regent Honeyeater |                |                                 |

## Additional Information for Approval

PCT Outside Ibra Added  
None added

# BAM Biodiversity Credit Report (Variations)

## PCTs With Customized Benchmarks

PCT

No Changes

## Predicted Threatened Species Not On Site

Name

**Grantiella picta** / Painted Honeyeater

## Ecosystem Credit Summary (Number and class of biodiversity credits to be retired)

| Name of Plant Community Type/ID                                                                                            | Name of threatened ecological community                                                     | Area of impact | HBT Cr | No HBT Cr | Total credits to be retired |
|----------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|----------------|--------|-----------|-----------------------------|
| 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                                     | 0.1            | 0      | 4         | 4.00                        |
| 1600-Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter            | Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions | 0.7            | 0      | 21        | 21.00                       |
| 1591-Grey Gum - Rough-barked Apple shrubby open forest of the lower Hunter                                                 | Hunter Lowland Redgum Forest in the Sydney Basin and New South Wales North Coast Bioregions | 0.9            | 0      | 27        | 27.00                       |

**1591-Grey Gum - Rough-barked Apple shrubby open forest of the lower Hunter**

### Like-for-like credit retirement options

| Class | Trading group | Zone | HBT | Credits | IBRA region |
|-------|---------------|------|-----|---------|-------------|
|       |               |      |     |         |             |

## BAM Biodiversity Credit Report (Variations)

|  |                                                                                                                                                              |                                |                |     |         |                                                                                                                                                                                                              |
|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|----------------|-----|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | Hunter Lowland Redgum Forest in the Sydney Basin and New South Wales North Coast Bioregions<br>This includes PCT's: 1591, 1598, 1603, 1605, 1691, 1692, 1749 | -                              | 1591_Intact    | No  | 23      | Hunter, Ellerton, Karuah Manning, Kerrabee, Liverpool Range, Peel, Tomalla, Upper Hunter, Wyong and Yengo.<br>or<br>Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site. |
|  | Hunter Lowland Redgum Forest in the Sydney Basin and New South Wales North Coast Bioregions<br>This includes PCT's: 1591, 1598, 1603, 1605, 1691, 1692, 1749 | -                              | 1591_Disturbed | No  | 4       | Hunter, Ellerton, Karuah Manning, Kerrabee, Liverpool Range, Peel, Tomalla, Upper Hunter, Wyong and Yengo.<br>or<br>Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site. |
|  | <b>Variation options</b>                                                                                                                                     |                                |                |     |         |                                                                                                                                                                                                              |
|  | Formation                                                                                                                                                    | Trading group                  | Zone           | HBT | Credits | IBRA region                                                                                                                                                                                                  |
|  | Dry Sclerophyll Forests (Shrub/grass sub-formation)                                                                                                          | Tier 3 or higher threat status | 1591_Intact    | No  | 23      | IBRA Region: Sydney Basin,<br>or<br>Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.                                                                                 |
|  | Dry Sclerophyll Forests (Shrub/grass sub-formation)                                                                                                          | Tier 3 or higher threat status | 1591_Disturbed | No  | 4       | IBRA Region: Sydney Basin,<br>or<br>Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.                                                                                 |



## BAM Biodiversity Credit Report (Variations)

|                                                                                                                                   |                                                                                                                                                  |                                |             |     |         |                                                                                                                                                                                                               |
|-----------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|-------------|-----|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1600-Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter</b>            | <b>Like-for-like credit retirement options</b>                                                                                                   |                                |             |     |         |                                                                                                                                                                                                               |
|                                                                                                                                   | Class                                                                                                                                            | Trading group                  | Zone        | HBT | Credits | IBRA region                                                                                                                                                                                                   |
|                                                                                                                                   | Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions<br>This includes PCT's: 1590, 1592, 1593, 1600, 1602 | -                              | 1600_Intact | No  | 21      | Hunter, Ellerston, Karuah Manning, Kerrabee, Liverpool Range, Peel, Tomalla, Upper Hunter, Wyong and Yengo.<br>or<br>Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site. |
|                                                                                                                                   | <b>Variation options</b>                                                                                                                         |                                |             |     |         |                                                                                                                                                                                                               |
|                                                                                                                                   | Formation                                                                                                                                        | Trading group                  | Zone        | HBT | Credits | IBRA region                                                                                                                                                                                                   |
| <b>1633-Parramatta Red Gum - Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area</b> | Dry Sclerophyll Forests (Shrub/grass sub-formation)                                                                                              | Tier 3 or higher threat status | 1600_Intact | No  | 21      | IBRA Region: Sydney Basin,<br>or<br>Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.                                                                                  |
|                                                                                                                                   | <b>Like-for-like credit retirement options</b>                                                                                                   |                                |             |     |         |                                                                                                                                                                                                               |
|                                                                                                                                   | Class                                                                                                                                            | Trading group                  | Zone        | HBT | Credits | IBRA region                                                                                                                                                                                                   |
|                                                                                                                                   | Kurri Sand Swamp Woodland in the Sydney Basin Bioregion<br>This includes PCT's: 1633, 1635, 1650                                                 | -                              | 1633_Intact | No  | 4       | Hunter, Ellerston, Karuah Manning, Kerrabee, Liverpool Range, Peel, Tomalla, Upper Hunter, Wyong and Yengo.<br>or<br>Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site. |
|                                                                                                                                   | <b>Variation options</b>                                                                                                                         |                                |             |     |         |                                                                                                                                                                                                               |
|                                                                                                                                   | Formation                                                                                                                                        | Trading group                  | Zone        | HBT | Credits | IBRA region                                                                                                                                                                                                   |

## BAM Biodiversity Credit Report (Variations)

|  |                                                    |                                   |             |    |   |                                                                                                                                    |
|--|----------------------------------------------------|-----------------------------------|-------------|----|---|------------------------------------------------------------------------------------------------------------------------------------|
|  | Dry Sclerophyll Forests<br>(Shrubby sub-formation) | Tier 3 or higher threat<br>status | 1633_Intact | No | 4 | IBRA Region: Sydney Basin,<br>or<br>Any IBRA subregion that is within 100<br>kilometers of the outer edge of the<br>impacted site. |
|--|----------------------------------------------------|-----------------------------------|-------------|----|---|------------------------------------------------------------------------------------------------------------------------------------|

### Species Credit Summary

| Species                                                                                      | Vegetation Zone/s                                                | Area / Count | Credits |
|----------------------------------------------------------------------------------------------|------------------------------------------------------------------|--------------|---------|
| <b>Anthochaera phrygia</b> / Regent Honeyeater                                               | <b>1591_Intact, 1600_Intact,<br/>1633_Intact</b>                 | 0.5          | 21.00   |
| <b>Eucalyptus parramattensis subsp. decadens</b> / Eucalyptus parramattensis subsp. decadens | <b>1633_Intact</b>                                               | 5.0          | 10.00   |
| <b>Grevillea parviflora subsp. parviflora</b> / Small-flower Grevillea                       | <b>1600_Intact</b>                                               | 0.5          | 14.00   |
| <b>Lathamus discolor</b> / Swift Parrot                                                      | <b>1591_Intact, 1600_Intact,<br/>1633_Intact, 1591_Disturbed</b> | 1.3          | 57.00   |
| <b>Myotis macropus</b> / Southern Myotis                                                     | <b>1591_Intact, 1600_Intact,<br/>1591_Disturbed</b>              | 0.8          | 22.00   |
| <b>Petaurus norfolcensis</b> / Squirrel Glider                                               | <b>1633_Intact, 1600_Intact,<br/>1591_Intact, 1591_Disturbed</b> | 1.4          | 38.00   |

### Credit Retirement Options Like-for-like options

| Anthochaera phrygia/<br>Regent Honeyeater | Spp                                                                                                                                                   | IBRA region |
|-------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
|                                           | <b>Anthochaera phrygia</b> /Regent Honeyeater                                                                                                         | Any in NSW  |
|                                           | <i>Note: Variation rules do not apply for Critically Endangered species and impacts on Commonwealth listed entities that are a controlled action.</i> |             |

## BAM Biodiversity Credit Report (Variations)

|                                                                                                |                                                                                             |                                                                                            |                                                                                                                                                                                                              |
|------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Eucalyptus parramattensis subsp. decadens/</b><br>Eucalyptus parramattensis subsp. decadens | Spp                                                                                         |                                                                                            | IBRA region                                                                                                                                                                                                  |
|                                                                                                | <b>Eucalyptus parramattensis subsp. decadens/</b> Eucalyptus parramattensis subsp. decadens |                                                                                            | Any in NSW                                                                                                                                                                                                   |
|                                                                                                | <b>Variation options</b>                                                                    |                                                                                            |                                                                                                                                                                                                              |
|                                                                                                | Kingdom                                                                                     | Any species with same or higher category of listing under Part 4 of the BC Act shown below | IBRA region                                                                                                                                                                                                  |
| <b>Grevillea parviflora subsp. parviflora/</b><br>Small-flower Grevillea                       | Flora                                                                                       | Vulnerable                                                                                 | Hunter, Ellerton, Karuah Manning, Kerrabee, Liverpool Range, Peel, Tomalla, Upper Hunter, Wyong and Yengo.<br>or<br>Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site. |
|                                                                                                | Spp                                                                                         |                                                                                            | IBRA region                                                                                                                                                                                                  |
|                                                                                                | <b>Grevillea parviflora subsp. parviflora/</b> Small-flower Grevillea                       |                                                                                            | Any in NSW                                                                                                                                                                                                   |
|                                                                                                | <b>Variation options</b>                                                                    |                                                                                            |                                                                                                                                                                                                              |
|                                                                                                | Kingdom                                                                                     | Any species with same or higher category of listing under Part 4 of the BC Act shown below | IBRA region                                                                                                                                                                                                  |

## BAM Biodiversity Credit Report (Variations)

|                                            |                                         |                                                                                            |                                                                                                                                                                                                               |
|--------------------------------------------|-----------------------------------------|--------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                            | Flora                                   | Vulnerable                                                                                 | Hunter, Ellerston, Karuah Manning, Kerrabee, Liverpool Range, Peel, Tomalla, Upper Hunter, Wyong and Yengo.<br>or<br>Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site. |
| <b>Lathamus discolor/</b><br>Swift Parrot  | Spp                                     |                                                                                            | IBRA region                                                                                                                                                                                                   |
|                                            | <b>Lathamus discolor</b> /Swift Parrot  |                                                                                            | Any in NSW                                                                                                                                                                                                    |
|                                            | <b>Variation options</b>                |                                                                                            |                                                                                                                                                                                                               |
|                                            | Kingdom                                 | Any species with same or higher category of listing under Part 4 of the BC Act shown below | IBRA region                                                                                                                                                                                                   |
|                                            | Fauna                                   | Endangered                                                                                 | Hunter, Ellerston, Karuah Manning, Kerrabee, Liverpool Range, Peel, Tomalla, Upper Hunter, Wyong and Yengo.<br>or<br>Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site. |
| <b>Myotis macropus/</b><br>Southern Myotis | Spp                                     |                                                                                            | IBRA region                                                                                                                                                                                                   |
|                                            | <b>Myotis macropus</b> /Southern Myotis |                                                                                            | Any in NSW                                                                                                                                                                                                    |
|                                            | <b>Variation options</b>                |                                                                                            |                                                                                                                                                                                                               |

## BAM Biodiversity Credit Report (Variations)

|                                                  |                                               |                                                                                            |                                                                                                                                                                                                                   |
|--------------------------------------------------|-----------------------------------------------|--------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                  | Kingdom                                       | Any species with same or higher category of listing under Part 4 of the BC Act shown below | IBRA region                                                                                                                                                                                                       |
|                                                  | Fauna                                         | Vulnerable                                                                                 | Hunter, Ellerston, Karuah Manning, Kerrabee, Liverpool Range, Peel, Tomalla, Upper Hunter, Wyong and Yengo.<br><br>or<br>Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site. |
| <b>Petaurus norfolcensis/</b><br>Squirrel Glider | Spp                                           |                                                                                            | IBRA region                                                                                                                                                                                                       |
|                                                  | <b>Petaurus norfolcensis/</b> Squirrel Glider |                                                                                            | Any in NSW                                                                                                                                                                                                        |
|                                                  | <b>Variation options</b>                      |                                                                                            |                                                                                                                                                                                                                   |
|                                                  | Kingdom                                       | Any species with same or higher category of listing under Part 4 of the BC Act shown below | IBRA region                                                                                                                                                                                                       |
|                                                  | Fauna                                         | Vulnerable                                                                                 | Hunter, Ellerston, Karuah Manning, Kerrabee, Liverpool Range, Peel, Tomalla, Upper Hunter, Wyong and Yengo.<br><br>or<br>Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site. |



## BAM Vegetation Zones Report

### Proposal Details

|                                |                                               |                                                                       |
|--------------------------------|-----------------------------------------------|-----------------------------------------------------------------------|
| Assessment Id                  | Assessment name                               | BAM data last updated *                                               |
| 00037534/BAAS17098/23/00037535 | Regrowth Kurri Kurri - Industrial subdivision | 19/12/2022                                                            |
| Assessor Name                  | Report Created                                | BAM Data version *                                                    |
| Arien Quin                     | 30/01/2023                                    | 56                                                                    |
| Assessor Number                | Assessment Type                               | BAM Case Status                                                       |
| BAAS17098                      | Part 4 Developments (General)                 | Finalised                                                             |
| Assessment Revision            | Date Finalised                                | BOS<br>entry<br>trigger                                               |
| 1                              | 30/01/2023                                    | BOS Threshold: Biodiversity Values Map<br>and area clearing threshold |

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

### Vegetation Zones

| # | Name | PCT | Condition | Area | Minimum<br>number<br>of plots | Management zones |
|---|------|-----|-----------|------|-------------------------------|------------------|
|---|------|-----|-----------|------|-------------------------------|------------------|

## BAM Vegetation Zones Report

|   |                |                                                                                                                            |           |      |   |  |
|---|----------------|----------------------------------------------------------------------------------------------------------------------------|-----------|------|---|--|
| 1 | 1633_Intact    | 1633-Parramatta Red Gum - Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area | Intact    | 0.14 | 1 |  |
| 2 | 1600_Intact    | 1600-Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter            | Intact    | 0.73 | 1 |  |
| 3 | 1591_Intact    | 1591-Grey Gum - Rough-barked Apple shrubby open forest of the lower Hunter                                                 | Intact    | 0.7  | 1 |  |
| 4 | 1591_Disturbed | 1591-Grey Gum - Rough-barked Apple shrubby open forest of the lower Hunter                                                 | Disturbed | 0.23 | 1 |  |

# BAM Predicted Species Report

## Proposal Details

|                                |                                                                       |                         |
|--------------------------------|-----------------------------------------------------------------------|-------------------------|
| Assessment Id                  | Proposal Name                                                         | BAM data last updated * |
| 00037534/BAAS17098/23/00037535 | Regrowth Kurri Kurri - Industrial subdivision                         | 19/12/2022              |
| Assessor Name                  | Report Created                                                        | BAM Data version *      |
| Arien Quin                     | 30/01/2023                                                            | 56                      |
| Assessor Number                | Assessment Type                                                       | BAM Case Status         |
| BAAS17098                      | Part 4 Developments (General)                                         | Finalised               |
| Assessment Revision            | BOS entry trigger                                                     | Date Finalised          |
| 1                              | BOS Threshold: Biodiversity Values<br>Map and area clearing threshold | 30/01/2023              |

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

**Threatened species reliably predicted to utilise the site. No surveys are required for these species. Ecosystem credits apply to these species.**

| Common Name                                   | Scientific Name                | Vegetation Types(s)                                                                                                        |
|-----------------------------------------------|--------------------------------|----------------------------------------------------------------------------------------------------------------------------|
| Barking Owl                                   | Ninox connivens                | 1633-Parramatta Red Gum - Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area |
|                                               |                                | 1600-Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter            |
|                                               |                                | 1591-Grey Gum - Rough-barked Apple shrubby open forest of the lower Hunter                                                 |
| Black-chinned Honeyeater (eastern subspecies) | Melithreptus gularis gularis   | 1633-Parramatta Red Gum - Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area |
|                                               |                                | 1600-Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter            |
| Brown Treecreeper (eastern subspecies)        | Climacteris picumnus victoriae | 1633-Parramatta Red Gum - Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area |
|                                               |                                | 1600-Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter            |
|                                               |                                | 1591-Grey Gum - Rough-barked Apple shrubby open forest of the lower Hunter                                                 |

## BAM Predicted Species Report

|                                           |                            |                                                                                                                                                                                                                                                                                                                             |
|-------------------------------------------|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Corben's Long-eared Bat                   | Nyctophilus corbeni        | 1633-Parramatta Red Gum - Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area                                                                                                                                                                                                  |
| Diamond Firetail                          | Stagonopleura guttata      | 1600-Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter                                                                                                                                                                                                             |
| Eastern Coastal Free-tailed Bat           | Micronomus norfolkensis    | 1633-Parramatta Red Gum - Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area<br>1600-Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter                                                                               |
| Eastern False Pipistrelle                 | Falsistrellus tasmaniensis | 1633-Parramatta Red Gum - Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area<br>1600-Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter                                                                               |
| Gang-gang Cockatoo                        | Callocephalon fimbriatum   | 1633-Parramatta Red Gum - Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area<br>1600-Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter<br>1591-Grey Gum - Rough-barked Apple shrubby open forest of the lower Hunter |
| Glossy Black-Cockatoo                     | Calyptorhynchus lathami    | 1633-Parramatta Red Gum - Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area<br>1600-Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter                                                                               |
| Greater Broad-nosed Bat                   | Scoteanax rueppellii       | 1633-Parramatta Red Gum - Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area<br>1600-Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter                                                                               |
| Grey-crowned Babbler (eastern subspecies) | Pomatostomus temporalis    | 1633-Parramatta Red Gum - Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area<br>1600-Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter                                                                               |
| Grey-headed Flying-fox                    | Pteropus poliocephalus     | 1633-Parramatta Red Gum - Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area                                                                                                                                                                                                  |

## BAM Predicted Species Report

|                                   |                                        |                                                                                                                            |
|-----------------------------------|----------------------------------------|----------------------------------------------------------------------------------------------------------------------------|
| Grey-headed Flying-fox            | <i>Pteropus poliocephalus</i>          | 1600-Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter            |
| Hooded Robin (south-eastern form) | <i>Melanodryas cucullata cucullata</i> | 1633-Parramatta Red Gum - Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area |
|                                   |                                        | 1600-Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter            |
|                                   |                                        | 1591-Grey Gum - Rough-barked Apple shrubby open forest of the lower Hunter                                                 |
| Large Bent-winged Bat             | <i>Miniopterus orianae oceanensis</i>  | 1633-Parramatta Red Gum - Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area |
|                                   |                                        | 1600-Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter            |
| Little Bent-winged Bat            | <i>Miniopterus australis</i>           | 1633-Parramatta Red Gum - Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area |
|                                   |                                        | 1600-Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter            |
| Little Eagle                      | <i>Hieraaetus morphnoides</i>          | 1633-Parramatta Red Gum - Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area |
|                                   |                                        | 1600-Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter            |
|                                   |                                        | 1591-Grey Gum - Rough-barked Apple shrubby open forest of the lower Hunter                                                 |
| Little Lorikeet                   | <i>Glossopsitta pusilla</i>            | 1633-Parramatta Red Gum - Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area |
|                                   |                                        | 1600-Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter            |
|                                   |                                        | 1591-Grey Gum - Rough-barked Apple shrubby open forest of the lower Hunter                                                 |
| Masked Owl                        | <i>Tyto novaehollandiae</i>            | 1633-Parramatta Red Gum - Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area |
|                                   |                                        | 1600-Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter            |



## BAM Predicted Species Report

|                      |                              |                                                                                                                            |
|----------------------|------------------------------|----------------------------------------------------------------------------------------------------------------------------|
| Powerful Owl         | <i>Ninox strenua</i>         | 1633-Parramatta Red Gum - Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area |
|                      |                              | 1600-Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter            |
| Regent Honeyeater    | <i>Anthochaera phrygia</i>   | 1600-Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter            |
| Scarlet Robin        | <i>Petroica boodang</i>      | 1600-Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter            |
|                      |                              | 1591-Grey Gum - Rough-barked Apple shrubby open forest of the lower Hunter                                                 |
| Speckled Warbler     | <i>Chthonicola sagittata</i> | 1633-Parramatta Red Gum - Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area |
|                      |                              | 1600-Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter            |
|                      |                              | 1591-Grey Gum - Rough-barked Apple shrubby open forest of the lower Hunter                                                 |
| Spotted-tailed Quoll | <i>Dasyurus maculatus</i>    | 1633-Parramatta Red Gum - Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area |
|                      |                              | 1600-Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter            |
|                      |                              | 1591-Grey Gum - Rough-barked Apple shrubby open forest of the lower Hunter                                                 |
| Square-tailed Kite   | <i>Lophoictinia isura</i>    | 1633-Parramatta Red Gum - Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area |
|                      |                              | 1600-Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter            |
| Swift Parrot         | <i>Lathamus discolor</i>     | 1633-Parramatta Red Gum - Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area |
|                      |                              | 1600-Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter            |
| Turquoise Parrot     | <i>Neophema pulchella</i>    | 1633-Parramatta Red Gum - Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area |
|                      |                              | 1600-Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter            |

## BAM Predicted Species Report

|                                |                                  |                                                                                                                            |
|--------------------------------|----------------------------------|----------------------------------------------------------------------------------------------------------------------------|
| Turquoise Parrot               | <i>Neophema pulchella</i>        | 1591-Grey Gum - Rough-barked Apple shrubby open forest of the lower Hunter                                                 |
| Varied Sittella                | <i>Daphoenositta chrysoptera</i> | 1633-Parramatta Red Gum - Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area |
|                                |                                  | 1600-Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter            |
|                                |                                  | 1591-Grey Gum - Rough-barked Apple shrubby open forest of the lower Hunter                                                 |
| White-bellied Sea-Eagle        | <i>Haliaeetus leucogaster</i>    | 1633-Parramatta Red Gum - Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area |
|                                |                                  | 1600-Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter            |
| White-throated Needletail      | <i>Hirundapus caudacutus</i>     | 1633-Parramatta Red Gum - Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area |
|                                |                                  | 1600-Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter            |
|                                |                                  | 1591-Grey Gum - Rough-barked Apple shrubby open forest of the lower Hunter                                                 |
| Yellow-bellied Glider          | <i>Petaurus australis</i>        | 1633-Parramatta Red Gum - Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area |
|                                |                                  | 1600-Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter            |
| Yellow-bellied Sheath-tail-bat | <i>Saccolaimus flaviventris</i>  | 1633-Parramatta Red Gum - Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area |
|                                |                                  | 1600-Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter            |

### Threatened species Manually Added

None added

### Threatened species assessed as not within the vegetation zone(s) for the PCT(s)

| Common Name        | Scientific Name         | Plant Community Type(s)                                                                                                    |
|--------------------|-------------------------|----------------------------------------------------------------------------------------------------------------------------|
| Painted Honeyeater | <i>Grantiella picta</i> | 1633-Parramatta Red Gum - Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area |

## BAM Predicted Species Report

|                    |                  |                                                                                                                 |
|--------------------|------------------|-----------------------------------------------------------------------------------------------------------------|
| Painted Honeyeater | Grantiella picta | 1600-Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter |
|--------------------|------------------|-----------------------------------------------------------------------------------------------------------------|

### Threatened species assessed as not within the vegetation zone(s) for the PCT(s)

Refer to BAR for detailed justification

| Common Name        | Scientific Name  | Justification in the BAM-C |
|--------------------|------------------|----------------------------|
| Painted Honeyeater | Grantiella picta | Refer to BAR               |

# BAM Candidate Species Report

## Proposal Details

|                                |                                               |                                                                             |
|--------------------------------|-----------------------------------------------|-----------------------------------------------------------------------------|
| Assessment Id                  | Proposal Name                                 | BAM data last updated *                                                     |
| 00037534/BAAS17098/23/00037535 | Regrowth Kurri Kurri - Industrial subdivision | 19/12/2022                                                                  |
| Assessor Name                  | Report Created                                | BAM Data version *                                                          |
| Arien Quin                     | 30/01/2023                                    | 56                                                                          |
| Assessor Number                | Assessment Type                               | BAM Case Status                                                             |
| BAAS17098                      | Part 4 Developments (General)                 | Finalised                                                                   |
| Assessment Revision            | Date Finalised                                | BOS entry trigger                                                           |
| 1                              | 30/01/2023                                    | BOS Threshold:<br>Biodiversity Values Map<br>and area clearing<br>threshold |

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

## List of Species Requiring Survey

| Name                                                   | Presence              | Survey Months                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|--------------------------------------------------------|-----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b><i>Acacia bynoeana</i></b><br>Bynoe's Wattle        | No (surveyed)         | <div> <input type="checkbox"/> Jan           <input type="checkbox"/> Feb           <input type="checkbox"/> Mar           <input type="checkbox"/> Apr         </div> <div> <input type="checkbox"/> May           <input type="checkbox"/> Jun           <input type="checkbox"/> Jul           <input type="checkbox"/> Aug         </div> <div> <input type="checkbox"/> Sep           <input type="checkbox"/> Oct           <input checked="" type="checkbox"/> Nov           <input type="checkbox"/> Dec         </div> <div> <input type="checkbox"/> Survey month outside the specified months?         </div> |
| <b><i>Anthochaera phrygia</i></b><br>Regent Honeyeater | Yes (assumed present) | <div> <input type="checkbox"/> Jan           <input type="checkbox"/> Feb           <input type="checkbox"/> Mar           <input type="checkbox"/> Apr         </div> <div> <input type="checkbox"/> May           <input type="checkbox"/> Jun           <input type="checkbox"/> Jul           <input type="checkbox"/> Aug         </div> <div> <input type="checkbox"/> Sep           <input type="checkbox"/> Oct           <input type="checkbox"/> Nov           <input type="checkbox"/> Dec         </div> <div> <input type="checkbox"/> Survey month outside the specified months?         </div>            |

## BAM Candidate Species Report

|                                                                 |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|-----------------------------------------------------------------|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b><i>Burhinus grallarius</i></b><br>Bush Stone-curlew          | No (surveyed) | <div> <input type="checkbox"/> Jan <input type="checkbox"/> Feb <input type="checkbox"/> Mar <input type="checkbox"/> Apr<br/> <input type="checkbox"/> May <input type="checkbox"/> Jun <input type="checkbox"/> Jul <input type="checkbox"/> Aug<br/> <input type="checkbox"/> Sep <input type="checkbox"/> Oct <input checked="" type="checkbox"/> Nov <input type="checkbox"/> Dec </div> <div> <input type="checkbox"/> Survey month outside the specified months? </div>            |
| <b><i>Callistemon linearifolius</i></b><br>Netted Bottle Brush  | No (surveyed) | <div> <input type="checkbox"/> Jan <input type="checkbox"/> Feb <input type="checkbox"/> Mar <input type="checkbox"/> Apr<br/> <input type="checkbox"/> May <input type="checkbox"/> Jun <input type="checkbox"/> Jul <input type="checkbox"/> Aug<br/> <input type="checkbox"/> Sep <input type="checkbox"/> Oct <input checked="" type="checkbox"/> Nov <input type="checkbox"/> Dec </div> <div> <input type="checkbox"/> Survey month outside the specified months? </div>            |
| <b><i>Cercartetus nanus</i></b><br>Eastern Pygmy-possum         | No (surveyed) | <div> <input type="checkbox"/> Jan <input type="checkbox"/> Feb <input type="checkbox"/> Mar <input type="checkbox"/> Apr<br/> <input type="checkbox"/> May <input type="checkbox"/> Jun <input type="checkbox"/> Jul <input type="checkbox"/> Aug<br/> <input type="checkbox"/> Sep <input type="checkbox"/> Oct <input checked="" type="checkbox"/> Nov <input type="checkbox"/> Dec </div> <div> <input type="checkbox"/> Survey month outside the specified months? </div>            |
| <b><i>Cryptostylis hunteriana</i></b><br>Leafless Tongue Orchid | No (surveyed) | <div> <input type="checkbox"/> Jan <input type="checkbox"/> Feb <input type="checkbox"/> Mar <input type="checkbox"/> Apr<br/> <input type="checkbox"/> May <input type="checkbox"/> Jun <input type="checkbox"/> Jul <input type="checkbox"/> Aug<br/> <input type="checkbox"/> Sep <input type="checkbox"/> Oct <input checked="" type="checkbox"/> Nov <input checked="" type="checkbox"/> Dec </div> <div> <input type="checkbox"/> Survey month outside the specified months? </div> |
| <b><i>Cynanchum elegans</i></b><br>White-flowered Wax Plant     | No (surveyed) | <div> <input type="checkbox"/> Jan <input type="checkbox"/> Feb <input type="checkbox"/> Mar <input type="checkbox"/> Apr<br/> <input type="checkbox"/> May <input type="checkbox"/> Jun <input type="checkbox"/> Jul <input type="checkbox"/> Aug<br/> <input type="checkbox"/> Sep <input type="checkbox"/> Oct <input checked="" type="checkbox"/> Nov <input type="checkbox"/> Dec </div> <div> <input type="checkbox"/> Survey month outside the specified months? </div>            |
| <b><i>Delma impar</i></b><br>Striped Legless Lizard             | No (surveyed) | <div> <input type="checkbox"/> Jan <input type="checkbox"/> Feb <input type="checkbox"/> Mar <input type="checkbox"/> Apr<br/> <input type="checkbox"/> May <input type="checkbox"/> Jun <input type="checkbox"/> Jul <input type="checkbox"/> Aug<br/> <input type="checkbox"/> Sep <input type="checkbox"/> Oct <input checked="" type="checkbox"/> Nov <input type="checkbox"/> Dec </div> <div> <input type="checkbox"/> Survey month outside the specified months? </div>            |



## BAM Candidate Species Report

|                                                                                                      |                |                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|------------------------------------------------------------------------------------------------------|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b><i>Diuris tricolor</i></b><br>Pine Donkey Orchid                                                  | No (surveyed)  | <input type="checkbox"/> Jan <input type="checkbox"/> Feb <input type="checkbox"/> Mar <input type="checkbox"/> Apr<br><input type="checkbox"/> May <input type="checkbox"/> Jun <input type="checkbox"/> Jul <input type="checkbox"/> Aug<br><input checked="" type="checkbox"/> Sep <input type="checkbox"/> Oct <input type="checkbox"/> Nov <input type="checkbox"/> Dec<br><input type="checkbox"/> Survey month outside the specified months? |
| <b><i>Eucalyptus castrensis</i></b><br>Singleton Mallee                                              | No (surveyed)  | <input type="checkbox"/> Jan <input type="checkbox"/> Feb <input type="checkbox"/> Mar <input type="checkbox"/> Apr<br><input type="checkbox"/> May <input type="checkbox"/> Jun <input type="checkbox"/> Jul <input type="checkbox"/> Aug<br><input type="checkbox"/> Sep <input type="checkbox"/> Oct <input type="checkbox"/> Nov <input checked="" type="checkbox"/> Dec<br><input type="checkbox"/> Survey month outside the specified months? |
| <b><i>Eucalyptus glaucina</i></b><br>Slaty Red Gum                                                   | No (surveyed)  | <input type="checkbox"/> Jan <input type="checkbox"/> Feb <input type="checkbox"/> Mar <input type="checkbox"/> Apr<br><input type="checkbox"/> May <input type="checkbox"/> Jun <input type="checkbox"/> Jul <input type="checkbox"/> Aug<br><input type="checkbox"/> Sep <input type="checkbox"/> Oct <input type="checkbox"/> Nov <input checked="" type="checkbox"/> Dec<br><input type="checkbox"/> Survey month outside the specified months? |
| <b><i>Eucalyptus parramattensis subsp. decadens</i></b><br>Eucalyptus parramattensis subsp. decadens | Yes (surveyed) | <input type="checkbox"/> Jan <input type="checkbox"/> Feb <input type="checkbox"/> Mar <input type="checkbox"/> Apr<br><input type="checkbox"/> May <input type="checkbox"/> Jun <input type="checkbox"/> Jul <input type="checkbox"/> Aug<br><input type="checkbox"/> Sep <input type="checkbox"/> Oct <input type="checkbox"/> Nov <input checked="" type="checkbox"/> Dec<br><input type="checkbox"/> Survey month outside the specified months? |
| <b><i>Eucalyptus pumila</i></b><br>Pokolbin Mallee                                                   | No (surveyed)  | <input type="checkbox"/> Jan <input type="checkbox"/> Feb <input type="checkbox"/> Mar <input type="checkbox"/> Apr<br><input type="checkbox"/> May <input type="checkbox"/> Jun <input type="checkbox"/> Jul <input type="checkbox"/> Aug<br><input type="checkbox"/> Sep <input type="checkbox"/> Oct <input type="checkbox"/> Nov <input checked="" type="checkbox"/> Dec<br><input type="checkbox"/> Survey month outside the specified months? |
| <b><i>Grevillea parviflora subsp. parviflora</i></b><br>Small-flower Grevillea                       | Yes (surveyed) | <input type="checkbox"/> Jan <input type="checkbox"/> Feb <input type="checkbox"/> Mar <input type="checkbox"/> Apr<br><input type="checkbox"/> May <input type="checkbox"/> Jun <input type="checkbox"/> Jul <input type="checkbox"/> Aug<br><input type="checkbox"/> Sep <input type="checkbox"/> Oct <input checked="" type="checkbox"/> Nov <input type="checkbox"/> Dec<br><input type="checkbox"/> Survey month outside the specified months? |

## BAM Candidate Species Report

|                                                                 |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|-----------------------------------------------------------------|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b><i>Haliaeetus leucogaster</i></b><br>White-bellied Sea-Eagle | No (surveyed)         | <input type="checkbox"/> Jan <input type="checkbox"/> Feb <input type="checkbox"/> Mar <input type="checkbox"/> Apr<br><input type="checkbox"/> May <input type="checkbox"/> Jun <input type="checkbox"/> Jul <input checked="" type="checkbox"/> Aug<br><input type="checkbox"/> Sep <input type="checkbox"/> Oct <input type="checkbox"/> Nov <input type="checkbox"/> Dec<br><input type="checkbox"/> Survey month outside the specified months?            |
| <b><i>Hieraaetus morphnoides</i></b><br>Little Eagle            | No (surveyed)         | <input type="checkbox"/> Jan <input type="checkbox"/> Feb <input type="checkbox"/> Mar <input type="checkbox"/> Apr<br><input type="checkbox"/> May <input type="checkbox"/> Jun <input type="checkbox"/> Jul <input checked="" type="checkbox"/> Aug<br><input type="checkbox"/> Sep <input type="checkbox"/> Oct <input type="checkbox"/> Nov <input type="checkbox"/> Dec<br><input type="checkbox"/> Survey month outside the specified months?            |
| <b><i>Hoplocephalus bitorquatus</i></b><br>Pale-headed Snake    | No (surveyed)         | <input type="checkbox"/> Jan <input checked="" type="checkbox"/> Feb <input type="checkbox"/> Mar <input type="checkbox"/> Apr<br><input type="checkbox"/> May <input type="checkbox"/> Jun <input type="checkbox"/> Jul <input type="checkbox"/> Aug<br><input type="checkbox"/> Sep <input type="checkbox"/> Oct <input checked="" type="checkbox"/> Nov <input type="checkbox"/> Dec<br><input type="checkbox"/> Survey month outside the specified months? |
| <b><i>Lathamus discolor</i></b><br>Swift Parrot                 | Yes (assumed present) | <input type="checkbox"/> Jan <input type="checkbox"/> Feb <input type="checkbox"/> Mar <input type="checkbox"/> Apr<br><input type="checkbox"/> May <input type="checkbox"/> Jun <input type="checkbox"/> Jul <input type="checkbox"/> Aug<br><input type="checkbox"/> Sep <input type="checkbox"/> Oct <input type="checkbox"/> Nov <input type="checkbox"/> Dec<br><input type="checkbox"/> Survey month outside the specified months?                       |
| <b><i>Litoria aurea</i></b><br>Green and Golden Bell Frog       | No (surveyed)         | <input type="checkbox"/> Jan <input checked="" type="checkbox"/> Feb <input type="checkbox"/> Mar <input type="checkbox"/> Apr<br><input type="checkbox"/> May <input type="checkbox"/> Jun <input type="checkbox"/> Jul <input type="checkbox"/> Aug<br><input type="checkbox"/> Sep <input type="checkbox"/> Oct <input type="checkbox"/> Nov <input checked="" type="checkbox"/> Dec<br><input type="checkbox"/> Survey month outside the specified months? |
| <b><i>Lophoictinia isura</i></b><br>Square-tailed Kite          | No (surveyed)         | <input type="checkbox"/> Jan <input type="checkbox"/> Feb <input type="checkbox"/> Mar <input type="checkbox"/> Apr<br><input type="checkbox"/> May <input type="checkbox"/> Jun <input type="checkbox"/> Jul <input type="checkbox"/> Aug<br><input type="checkbox"/> Sep <input type="checkbox"/> Oct <input checked="" type="checkbox"/> Nov <input type="checkbox"/> Dec<br><input type="checkbox"/> Survey month outside the specified months?            |

## BAM Candidate Species Report

|                                                                |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|----------------------------------------------------------------|-----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b><i>Monotaxis macrophylla</i></b><br>Large-leafed Monotaxis  | No (surveyed)         | <div> <input type="checkbox"/> Jan           <input type="checkbox"/> Feb           <input type="checkbox"/> Mar           <input type="checkbox"/> Apr         </div> <div> <input type="checkbox"/> May           <input type="checkbox"/> Jun           <input type="checkbox"/> Jul           <input type="checkbox"/> Aug         </div> <div> <input type="checkbox"/> Sep           <input type="checkbox"/> Oct           <input checked="" type="checkbox"/> Nov           <input type="checkbox"/> Dec         </div> <div> <input type="checkbox"/> Survey month outside the specified months?         </div> |
| <b><i>Myotis macropus</i></b><br>Southern Myotis               | Yes (assumed present) | <div> <input type="checkbox"/> Jan           <input type="checkbox"/> Feb           <input type="checkbox"/> Mar           <input type="checkbox"/> Apr         </div> <div> <input type="checkbox"/> May           <input type="checkbox"/> Jun           <input type="checkbox"/> Jul           <input type="checkbox"/> Aug         </div> <div> <input type="checkbox"/> Sep           <input type="checkbox"/> Oct           <input type="checkbox"/> Nov           <input type="checkbox"/> Dec         </div> <div> <input type="checkbox"/> Survey month outside the specified months?         </div>            |
| <b><i>Ozothamnus tessellatus</i></b><br>Ozothamnus tessellatus | No (surveyed)         | <div> <input type="checkbox"/> Jan           <input type="checkbox"/> Feb           <input type="checkbox"/> Mar           <input type="checkbox"/> Apr         </div> <div> <input type="checkbox"/> May           <input type="checkbox"/> Jun           <input type="checkbox"/> Jul           <input type="checkbox"/> Aug         </div> <div> <input checked="" type="checkbox"/> Sep           <input type="checkbox"/> Oct           <input type="checkbox"/> Nov           <input type="checkbox"/> Dec         </div> <div> <input type="checkbox"/> Survey month outside the specified months?         </div> |
| <b><i>Petauroides volans</i></b><br>Greater Glider             | No (surveyed)         | <div> <input type="checkbox"/> Jan           <input checked="" type="checkbox"/> Feb           <input type="checkbox"/> Mar           <input type="checkbox"/> Apr         </div> <div> <input type="checkbox"/> May           <input type="checkbox"/> Jun           <input type="checkbox"/> Jul           <input type="checkbox"/> Aug         </div> <div> <input type="checkbox"/> Sep           <input type="checkbox"/> Oct           <input type="checkbox"/> Nov           <input type="checkbox"/> Dec         </div> <div> <input type="checkbox"/> Survey month outside the specified months?         </div> |
| <b><i>Petaurus norfolcensis</i></b><br>Squirrel Glider         | Yes (assumed present) | <div> <input type="checkbox"/> Jan           <input type="checkbox"/> Feb           <input type="checkbox"/> Mar           <input type="checkbox"/> Apr         </div> <div> <input type="checkbox"/> May           <input type="checkbox"/> Jun           <input type="checkbox"/> Jul           <input type="checkbox"/> Aug         </div> <div> <input type="checkbox"/> Sep           <input type="checkbox"/> Oct           <input type="checkbox"/> Nov           <input type="checkbox"/> Dec         </div> <div> <input type="checkbox"/> Survey month outside the specified months?         </div>            |
| <b><i>Phascogale tapoatafa</i></b><br>Brush-tailed Phascogale  | No (surveyed)         | <div> <input type="checkbox"/> Jan           <input checked="" type="checkbox"/> Feb           <input type="checkbox"/> Mar           <input type="checkbox"/> Apr         </div> <div> <input type="checkbox"/> May           <input type="checkbox"/> Jun           <input type="checkbox"/> Jul           <input type="checkbox"/> Aug         </div> <div> <input type="checkbox"/> Sep           <input type="checkbox"/> Oct           <input type="checkbox"/> Nov           <input type="checkbox"/> Dec         </div> <div> <input type="checkbox"/> Survey month outside the specified months?         </div> |

## BAM Candidate Species Report

|                                                                  |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|------------------------------------------------------------------|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b><i>Phascolarctos cinereus</i></b><br>Koala                    | No (surveyed) | <input type="checkbox"/> Jan <input checked="" type="checkbox"/> Feb <input type="checkbox"/> Mar <input type="checkbox"/> Apr<br><input type="checkbox"/> May <input type="checkbox"/> Jun <input type="checkbox"/> Jul <input type="checkbox"/> Aug<br><input type="checkbox"/> Sep <input type="checkbox"/> Oct <input checked="" type="checkbox"/> Nov <input type="checkbox"/> Dec<br><input type="checkbox"/> Survey month outside the specified months? |
| <b><i>Planigale maculata</i></b><br>Common Planigale             | No (surveyed) | <input type="checkbox"/> Jan <input type="checkbox"/> Feb <input type="checkbox"/> Mar <input type="checkbox"/> Apr<br><input type="checkbox"/> May <input type="checkbox"/> Jun <input type="checkbox"/> Jul <input type="checkbox"/> Aug<br><input type="checkbox"/> Sep <input type="checkbox"/> Oct <input checked="" type="checkbox"/> Nov <input type="checkbox"/> Dec<br><input type="checkbox"/> Survey month outside the specified months?            |
| <b><i>Pomaderris queenslandica</i></b><br>Scant Pomaderris       | No (surveyed) | <input type="checkbox"/> Jan <input type="checkbox"/> Feb <input type="checkbox"/> Mar <input type="checkbox"/> Apr<br><input type="checkbox"/> May <input type="checkbox"/> Jun <input type="checkbox"/> Jul <input type="checkbox"/> Aug<br><input type="checkbox"/> Sep <input type="checkbox"/> Oct <input checked="" type="checkbox"/> Nov <input type="checkbox"/> Dec<br><input type="checkbox"/> Survey month outside the specified months?            |
| <b><i>Prostanthera cineolifera</i></b><br>Singleton Mint Bush    | No (surveyed) | <input type="checkbox"/> Jan <input type="checkbox"/> Feb <input type="checkbox"/> Mar <input type="checkbox"/> Apr<br><input type="checkbox"/> May <input type="checkbox"/> Jun <input type="checkbox"/> Jul <input type="checkbox"/> Aug<br><input checked="" type="checkbox"/> Sep <input type="checkbox"/> Oct <input type="checkbox"/> Nov <input type="checkbox"/> Dec<br><input type="checkbox"/> Survey month outside the specified months?            |
| <b><i>Pterostylis chaetophora</i></b><br>Pterostylis chaetophora | No (surveyed) | <input type="checkbox"/> Jan <input type="checkbox"/> Feb <input type="checkbox"/> Mar <input type="checkbox"/> Apr<br><input type="checkbox"/> May <input type="checkbox"/> Jun <input type="checkbox"/> Jul <input type="checkbox"/> Aug<br><input type="checkbox"/> Sep <input type="checkbox"/> Oct <input checked="" type="checkbox"/> Nov <input type="checkbox"/> Dec<br><input type="checkbox"/> Survey month outside the specified months?            |
| <b><i>Rutidosia heterogama</i></b><br>Heath Wrinklewort          | No (surveyed) | <input type="checkbox"/> Jan <input type="checkbox"/> Feb <input type="checkbox"/> Mar <input type="checkbox"/> Apr<br><input type="checkbox"/> May <input type="checkbox"/> Jun <input type="checkbox"/> Jul <input type="checkbox"/> Aug<br><input type="checkbox"/> Sep <input type="checkbox"/> Oct <input checked="" type="checkbox"/> Nov <input type="checkbox"/> Dec<br><input type="checkbox"/> Survey month outside the specified months?            |

## BAM Candidate Species Report

|                                                     |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|-----------------------------------------------------|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b><i>Tetratheca juncea</i></b><br>Black-eyed Susan | No (surveyed) | <input type="checkbox"/> Jan <input type="checkbox"/> Feb <input type="checkbox"/> Mar <input type="checkbox"/> Apr<br><input type="checkbox"/> May <input type="checkbox"/> Jun <input type="checkbox"/> Jul <input type="checkbox"/> Aug<br><input checked="" type="checkbox"/> Sep <input type="checkbox"/> Oct <input type="checkbox"/> Nov <input type="checkbox"/> Dec<br><input type="checkbox"/> Survey month outside the specified months? |
| <b><i>Thesium australe</i></b><br>Austral Toadflax  | No (surveyed) | <input type="checkbox"/> Jan <input type="checkbox"/> Feb <input type="checkbox"/> Mar <input type="checkbox"/> Apr<br><input type="checkbox"/> May <input type="checkbox"/> Jun <input type="checkbox"/> Jul <input type="checkbox"/> Aug<br><input type="checkbox"/> Sep <input type="checkbox"/> Oct <input checked="" type="checkbox"/> Nov <input type="checkbox"/> Dec<br><input type="checkbox"/> Survey month outside the specified months? |

### Threatened species Manually Added

None added

### Threatened species assessed as not on site

Refer to BAR for detailed justification

| Common name                | Scientific name                | Justification in the BAM-C |
|----------------------------|--------------------------------|----------------------------|
| Barking Owl                | Ninox connivens                | Refer to BAR               |
| Brush-tailed Rock-wallaby  | Petrogale penicillata          | Refer to BAR               |
| Eastern Cave Bat           | Vespadelus troughtoni          | Refer to BAR               |
| Gang-gang Cockatoo         | Callocephalon fimbriatum       | Refer to BAR               |
| Glossy Black-Cockatoo      | Calyptorhynchus lathami        | Refer to BAR               |
| Green-thighed Frog         | Litoria brevipalmata           | Refer to BAR               |
| Grey-headed Flying-fox     | Pteropus poliocephalus         | Refer to BAR               |
| Large Bent-winged Bat      | Miniopterus orianae oceanensis | Refer to BAR               |
| Large-eared Pied Bat       | Chalinolobus dwyeri            | Refer to BAR               |
| Little Bent-winged Bat     | Miniopterus australis          | Refer to BAR               |
| Masked Owl                 | Tyto novaehollandiae           | Refer to BAR               |
| North Rothbury Persoonia   | Persoonia pauciflora           | Refer to BAR               |
| Pink-tailed Legless Lizard | Aprasia parapulchella          | Geographic limitations     |



## BAM Candidate Species Report

|                  |                |              |
|------------------|----------------|--------------|
| Powerful Owl     | Ninox strenua  | Refer to BAR |
| Rough Doubletail | Diuris praecox | Refer to BAR |



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