28ºS ENVIRONMENTAL

Ripley View Residential Subdivision

Preliminary Documentation Report

EPBC Referral 2020/8615

VOLUME 1 - REPORT

23/02/2024 - *version 7.1*

Report prepared for Arxhe Ripley View Investment Trust

Acknowledgment of Country

28 South Environmental Pty Ltd acknowledges the Traditional Custodians of the land and their unique relationship with their ancestral Country. We pay respect to all Aboriginal and Torres Strait Islander Elders and recognise their strength and wisdom.

DOCUMENT CONTROL

Project No. 2018-079c

Project Ripley View Residential Development (EPBC 2020/8615)

Document Preliminary Documentation Report

Client Arxhe Ripley View Investment Trust

www.28south.com.au
28 South Environmental Pty Ltd

Document history and status

Revision	Date	Description	By	Review
1.0	23/11/2021	First issue to DCCEEW	M. Taylor	W. Moffit
2.0	25/10/2022	Second issue to DCCEEW	A. Dickinson	M. Taylor
3.0	04/08/2023	Third issue to DCCEEW	A. Dickinson	W. Moffit
4.0	24/10/2023	Fourth issue to DCCEEW, without Greater Glider	A. Dickinson	W. Moffitt
5.0	12/01/2024	Fifth issue with Greater glider	A. Dickinson	W. Moffitt
6.0	02/02/2024	Sixth issue post adequacy review	A. Dickinson	W. Moffitt
7.0	09/02/2024	Seventh issue post adequacy review	A. Dickinson	W. Moffitt
7.1	23/02/2024	Seventh issue with CAR appended	A. Dickinson	W. Moffitt

Approval for Issue

Name	Position	Date
W. Moffitt	Director	23/02/2024

Non-Technical Executive Summary

This Preliminary Documentation has been prepared on behalf of the proponent, **Arxhe Ripley View Investment Trust (Arxhe)** in direct response to additional information requested by the Commonwealth Department of Environment, Energy, Climate Change and Water (**DEECCW**) (formerly the Department of Agriculture, Water and the Environment (**DAWE**)) as part of the 'controlled action' assessment by 'preliminary documentation' determination for Ripley View Residential Development (EPBC 2020/8615).

The controlled action decision is based on DAWE's assessment of the project as potentially resulting in a Significant Impact on the following Matters of National Environmental Significance (**MNES**):

- Listed Threatened Species & Communities (Sections 18 & 18A) of the *Environment Protection and Biodiversity Conservation Act 1999* (**EPBC Act**), more specifically defined in the request for further information on the:
    - *Phascolarctos cinereus* (koala) combined populations of QLD, NSW and the ACT, listed as *Endangered*
    - *Pteropus poliocephalus* (grey-headed flying fox) listed as *Vulnerable*.

Following a change in the status listing, and changes to the statutory Approved Conservation Advice outlining what is considered to be critical habitat, DEECCWs Draft Preliminary Documentation Review second round comments (dated 22 February 2023) requested an assessment to determine impacts on the *Petauroides volans* (greater glider (central and southern)). Greater glider is listed under Sections 18 & 18A as *Endangered.*

Information provided within this report includes:

- A summary of the proposed development and a description of the assessment process.
- A description of the action including timeframes and staging.
- A description of MNES which may be affected by the proposal.
- Comments on 'critical habitat' for the koala and grey-headed flying-fox and the quantification of impacts on the habitat of these species.
- A discussion of empirical research about the impacts of the development on MNES which may be affected by the proposal.
- Procedures to be implemented prior and during vegetation clearing and construction.
- Measures to avoid, minimise and mitigate potential impacts on MNES.
- Consideration of social and economic matters.
- Details of the proposed environmental offset for listed significant impacts.
- A number of preliminary mitigation and management measures for protection of MNES.

***Phascolarctos cinereus* (koala)**

The koala is listed as an 'endangered' species under the EPBC Act. A significant proportion of Queensland's native vegetation, especially in South East Queensland, is identified under the *National Recovery Plan for the Koala Phascolarctos cinereus (combined populations of Queensland, New South Wales and the Australian Capital Territory)* (DAWE 2022b) as critical habitat for koala due to the prevalence of recognised Koala food tree species across most landscapes.

The Ripley View Residential Subdivision referral area predominantly maintains disturbed open paddock with an open woodland matrix, with advanced regrowth and remnant open forest along an un-named tributary of Bundanba Creek. The habitat comprises native vegetation that includes species that are identified as koala food and shelter trees (with respect to the statutory documentation – habitat critical to the survival of koala). This is a primary consideration for the DEECCW determination.

Koala has regularly been recorded, both directly and indirectly on the Site of the 'Proposed Action'.

The proposed action will result in the removal and functional loss of 'critical habitat' for Koala that has the potential to have a 'significant impact' on the species based on utilisation of the Site by Koalas and knowledge of their broader population dynamics.

***Pteropus poliocephalus* (grey-headed flying-fox)**

The grey-headed flying-fox is listed as a 'vulnerable' species under the EPBC Act. It is considered highly mobile and able to utilise a wide range of floral food resources, including flowering eucalypts predominantly in the winter, across relatively expansive foraging areas. For this reason, it periodically displays overlap with Koala habitat in South East Queensland when foraging for eucalypt nectar, with suitable foraging habitat widespread in the Ripley Valley, Warrill View and Ipswich areas.

The referral guidelines for grey-headed flying-fox focus on the assessment of potential impacts on roosting camps, with relatively minor provisions for the consideration of important winter flowering foraging habitat. Where presence occurs, this habitat is considered critical habitat to the survival of the species. Not grey-headed flying-fox were observed, however critical habitat is present. This area contains many mature *Eucalyptus tereticornis* (Queensland blue gum) a known winter flowering species affords foraging habitat during known foraging resource bottleneck periods (i.e. winter). No roosting camps were recorded on the Site, nor were any historic records of past encampment detected.

Given the widespread distribution of the species across SEQ, the availability of habitat throughout the Ripley Valley, Warrill View and Ipswich areas and temporal dynamic of the overlap with Koala habitat, potential impacts on the latter matter by default are presumed to be considered by DEECCW to significantly impact on the grey-headed flying-fox.

Petauroides volans (greater glider (central and southern))

A third MNES, the Greater glider, has not been recorded from the Subject Site, nor from adjoining development sites.

The greater glider is listed as an 'endangered' species under the EPBC Act. *The Conservation Advice for Petauroides volans (greater glider (southern and central))* (DEECCW 2022) identifies that where potential habitat as defined by Eyre et al. 2022) is present, a precautionary approach is adopted and identified habitat is considered to be habitat critical for the survival of the species, as there is opportunity for greater glider to exploit this habitat at some point in the future.

Impacts

The Ripley View Residential Subdivision covers a total land area of 47.47 ha, all of which is considered to support vegetation defined by DEECCW as 'critical habitat' for the koala, greater glider and grey-headed flying-fox.

Unmitigated, the Proposed Action would have a impact (habitat loss) on 37.78 ha of habitat critical to koala, greater glider and grey-headed flying-fox. This is comprised 31.62 ha of permanent impact, arising from civil earthworks and the establishment of lots, roads, childcare and neighbourhood park, and 5.69 ha of temporary impact arising from the construction and revegetation of batters, overland flow paths and stormwater management infrastructure.

Measures to mitigate the effects of the development include functional ecological restoration of riparian open forest habitat comprising 9.69 ha of vegetation avoided by the proposed action and the rehabilitation of 5.69 ha (i.e. temporary impact area) of batters adjoining the waterway and stormwater detention basins and overland flow paths.

On account of edge effects arising from lighting and noise associated with the proposed development and interspecific competition the Linear Habitat Corridor is considered to become 'compromised habitat' for greater glider.

The proposal area will result in a Significant Residual Impact (**SRI**) resulting from the clearing and functional loss of:

- 37.92 ha of habitat critical to grey-headed flying-fox.
- 38.40 ha of habitat critical to koala.
- 47.47 ha of habitat critical to greater glider.

Environmental Offsets

The SRI to koala, greater glider and grey-headed flying-fox arising from the proposed action will be resolved by providing an environmental offset on land external to the Site. Arxhe will enter into an agreement with a third party offset provider (Koala Fund) to deliver and manage the offset for a 20-year period.

The 184.31 ha Offset Receiving Site (**Offset Site**) is situated within 65 kilometres (**km**) of the proposed action, within the Somerset Regional Council (**SRC**) Local Government Area (**LGA**). The Offset Site is located 11 km to the west north-west of Esk, and 26 km to the east north-east of Crows Nest. Contextually, the Offset Site lies 2.5 km to the east of Deongwar State Forest (which the State has committed to progressing National Park) and 5 km to the north of Esk State National Park. Other reserves within the locality, to which the Offset Site is contiguously linked / connected, include Crows Nest National Park, Ravensbourne National Park, Lockyer National Park and Peachey State Forest.

This region occupying the eastern footslopes of the Great Dividing Range lie in an area of ecological importance identified by State conservation assessments as important biodiversity values containing State and Regional corridors. The Offset Site is situated within several hundred metres of a Regional Corridor. Bioregionally, the Impact Site and Offset Site are situated in the South East Queensland Bioregion, lying within the Moreton Basin[1] and the Brisbane – Baranbah Volcanics[2] sub-regions respectively.

Both greater glider and koala have been recorded by site survey (May 2023) as being present within habitat adjoining the ORS. Koala, greater glider and grey-headed flying-fox are known from the landscape surrounding the ORS, including within the adjacent Deeongwar State Forest.

Environmental offsets have been calculated and will be delivered in accordance with the EPBC Act Environmental Offset Policy.

How the Proposed Action will achieve a net benefit for MNES

To date the proponent has implemented to date the following measures, demonstrating the avoid, mitigate and offset, to achieve a net benefit to MNES impacted by the project:

- Site selection based on the absence of mapped biodiversity corridors and the presence of historical disturbances (i.e. agricultural activities).
- Iterative design based on ground-truthed ecological values (including koala bushland habitat), where the more intact habitats (the linear habitat associated with the Linear Park in the central riparian areas of the Site, and the inclusion of a 25 m fully vegetated Melrose Drive interface buffer) are avoided by and excluded from the proposed residential uses.

1. Interim Biogeographic Regionalisation of Australia (IBRA) Subregion code SEQ2
2. IBRA Subregion code SEQ5

- Involvement during the field assessment and layout refinement process of pre-eminent zoological expert (Mark Sanders) to provide guidance to the project team in order to achieve desirable outcomes for the species of interest.
- Consolidating and linking retained habitat (as Linear Park, ultimately to be dedicated to Ipswich City Council or another suitable custodian) to achieve a minimum 120 m-wide internal corridor of open forest through rehabilitation and restoration that is connective with adjoining waterways corridors and is buffered from residential uses by esplanade roads and/or parkland and open space uses. The restored habitat will be reflective of pre-clearing vegetation communities and will provide endemic canopy species that flower at different times throughout the year, so as to maintain seasonal diversity of flowering resource for bird and bat species, year-round.

The proponent **will implement** following approval, a number of measures to avoid, minimise and mitigate impacts on the MNES species of interest.

- A rehabilitation management process commencing concurrent to the operational and construction works associated with the Proposed Action. This will **retain and enhance** the highest quality habitat values within the Site that form habitat, resources and **safe movement opportunities** for both MNES that are impacted by the Proposed Action (i.e. koala, greater glider and grey-headed flying-fox).
- Delivery of an off-site offset (located within a strategically important area) to counterbalance any residual adverse impacts on the koala, greater glider and grey-headed flying-fox and described within an Offset Management Strategy. Investigations to locate and secure an appropriate Offset Site are near-complete, with the Proponent having completed negotiations with the land owner, Koala Fund, a prominent offset provider to ensure a *net environmental gain* is achieved.
- Commitment to water-sensitive urban design and no worsening of water quality or quantity into Bundamba Creek and its associated tributaries for water that is not retained on the Site.

It has been concluded that by implementation of the above measures (described in more detail in this report), the Proposed Action will have no net detrimental impact, and wholistically lead to a net benefit, for both koala and grey-headed flying-fox

Management Plans & Mitigation Measures

Numerous management and mitigation measures and controls will be adopted as part of mandatory requirements conditioned by Ipswich City Council as delegate for the Ripley Valley Priority Development Area and best practice management adopted by Arxhe and its contractors. This Preliminary Documentation Report documents includes a number of preliminary management measures relating specifically to koala, greater glider and grey-headed flying-fox.

The management measures remain preliminary to provide DEECCW with some certainty that potential impacts can be mitigated and managed. Vegetation, Fauna, Stormwater, Erosion and Sediment Control issues will all be managed through a mandatory need to deliver management plans to ICC as delegate for the RVPDA through compliance assessment.

Table of Contents

List of Tables

List of Insets

List of Plates

List of Figures

List of Appendices

Acronyms, Abbreviations and Definitions

28 South – 28 South Environmental Pty Ltd

AHD – Australian height datum

Arxhe – Arxhe Ripley View Investment Trust. Arxhe purchased the property from CLAG Pty Ltd with settlement 10 October 2022.

Avoidance Area – The area of the site contained retained vegetation within the Linear Habitat area comprising 10.16 ha

BPA – Biodiversity Planning Assessment

CAR – Controlled Action Referral

CBD – Central Business District

Covenant (Statutory Covenant) - means the enduring protection mechanism to provide ongoing conservation protection, on the title of the land under Chapter 6 Part 4 Division 8A of the *Land Act 1994* (Qld).

DAWE – (Commonwealth) Department of the Agriculture, Water and the Environment

DEECCW – (Commonwealth) Department of Environment, Energy, Climate Change and water, formerly **DAWE**

Direct disturbance footprint – consists of a disturbance area totalling 37.31 ha, comprised of an area of permanent impact of 31.62 ha and a temporary impact area of targeted revegetation on created batters and stormwater detention basins comprising 5.69 ha which will form an interface between the residential area and the linear habitat.

DBH – Diameter at Breast Height

EPBC Act – *Environment Protection and Biodiversity Conservation Act 1999* (Cth)

ESD – Ecologically Sustainable Development, as defined by Section 3A of the EPBC Act

EVNT – Endangered, Vulnerable or Near Threatened species listed under Queensland's *Nature Conservation Act 1992*

Fauna Spotter Catcher - means a person holding an appropriate license issued under the *Nature Conservation Act 1992* (Qld) to detect, capture, care for, assess, and release wildlife disturbed by vegetation clearance activities who have at least three years' experience undertaking this work with **Protected Matters**

FTE – Full-time equivalent

Greater glider - refers to the EPBC Act listed threatened species *Pteropus poliocephalus*.

Greater glider habitat - means any area that provides known or potential foraging and denning resources as described by Eyre, T.J., Smith, G., Venz, M.F., Mathieson, M.T., Hogan, L.D., Starr, Corymbia, Winter, J. & McDonald, K. (2022). Guide to greater glider habitat in Queensland. Report prepared for the Department of Agriculture, Water and the Environment, Canberra. Department of Environment and Science, Brisbane and Australian Government, Department of Climate Change, Energy, the Environment and Water (2022). Conservation Advice for Petauroides volans (greater glider (southern and central)).

Grey-headed flying-fox – refers to the EPBC Act listed threatened species *Pteropus poliocephalus*.

Grey-headed flying-fox camp – means any area that provides roosting requirements of the Grey-headed flying-fox, as described in DAWE 2021, *National Recovery Plan for the Grey-headed Flying-fox 'Pteropus poliocephalus*', Department of Agriculture, Water and the Environment, Canberra.

Grey-headed flying-fox habitat – means any area that provides or is likely to provide foraging and roosting habitat of the Grey-headed Flying-fox, as described in Department of Agriculture, Water and the Environment (2021) *National Recovery Plan for the Grey-headed Flying-fox Pteropus poliocephalus.* Canberra: Commonwealth of Australia.

ha – hectare

ICC – Ipswich City Council (the local government authority)

Information Request – The DAWE letter dated 6 August 2020 outlining the additional information required for the Preliminary Documentation.

In-stream (farm) dams – water retention structure created by installing an earthen weir over drainage lines and lower order waterways to allow water to pool.

Interface Corridor – the east / west corridor of retained vegetation and habitat approximately 25 m in width, located along the Melrose Drive frontage.

Isohyet - a line on a map which connects points that have the same amounts of precipitation in a given period.

km – Kilometres

km/hr – kilometres per hour

KMP – Koala Management Plan

Koala(s) – means the EPBC Act listed threatened species *Phascolarctos cinereus* (combined populations of Queensland, New South Wales and the Australian Capital Territory).

Koala Habitat – means the following:

a) Any area that provides or is likely to provide the essential life cycle requirements of the Koala, including dispersal, foraging and or breeding habitat as described in:

i. Conservation Advice for Phascolarctos cinereus (**Koala**) combined populations of Queensland, New South Wales and the Australian Capital Territory, Commonwealth of Australia 2022

ii. National Recovery Plan for the **Koala** Phascolarctos cinereus (combined populations of Queensland, New South Wales and the Australian Capital Territory), Commonwealth of Australia 2022

iii. A review of **Koala Habitat** assessment criteria and methods, Youngentob, K.N, Marsh, K.F., Skewes, J. 2021 Koala Exclusion Fencing is exclusion fencing as described in Table 4.2 of the Koala-Sensitive Design Guideline: A guide to koala sensitive designed measures for planning and development activities 2022 (Qld).

Koala Escape / Dispersal Pole(s) – means timber posts securely erected to remain in a vertical position at least until this approval expires, each at least 4 metres in height and 125 mm diameter and each with at least one fork large enough to enable an adult Koala to sit and rest at least 3 m above the ground surface as described in the *Koala Sensitive Design Guideline: Department of Environment and Science. DES 2022.*

Koala Sensitive Design Guideline – means *Koala Sensitive Design Guideline: Department of* **Linear (Habitat) Corridor** – Comprising Linear Park, and drainage reserve area (overland flow areas and bioretention basins). It is at its narrowest 140 m wide, north/south tending open forest habitat located centrally within the Site, and which is associated with the Bundamba Creek Tributary, which is to be retained to provide local movement habitat and additionally incorporates bioretention basins which will be revegetated and a drainage easement adjoining Melrose Street (northern boundary) comprising retained native vegetation and revegetated areas. Primarily dedicated for koala habitat retention, the Linear Park contains the ecological infrastructure, centred on an un-named ephemeral tributary of Bundamba Creek, which is designed to provide habitat for resident native fauna and to facilitate fauna movement within and through the Site and beyond. The restored habitat will be reflective of pre-clearing vegetation communities and will provide endemic canopy species that flower at different times throughout the year, so as to maintain seasonal diversity of flowering resource for bird and bat species. The Central -southern portion of the Linear Park wholly contains the identified Significant Vegetation (Endangered Remnant Regulated Vegetation RE12.3.3) and will achieve a minimum 140 m wide internal corridor of open forest that is connected with adjoining offsite waterways corridors to the south and north. It is buffered from residential uses by esplanade roads and/or parkland and open space uses.

Locality – the Site, the wider suburb of Flinders View, and the adjacent suburbs of Swanbank and Flinders View, within 3 km of the Site. Refer **Figure 1**.

LGA – Local Government Area

m – metre

m^2 – square metre

Mitigation Area – The revegetated bioretention basins, overland flow paths and batters forming interface areas (i.e., temporary disturbance areas) totalling 5.08 ha, lying between the development and the linear habitat.

MNES – Matter(s) of National Environmental Significance. Under the *Environment Protection and Biodiversity Conservation Act 1999* there are nine defined matters the require consideration when proposing to undertake an 'Action'. One of these are is *Nationally listed threatened species and ecological communities.* MNES relevant to the Ripley View Residential Development are identified and described herein.

NC Act – *Nature Conservation Act 1992* (Qld)

Northern Interface Corridor – 25 m Overland Flow Path on the Melrose Drive boundary.

Offset (Receiving) Site – KoalaFund site situated at Little Kipper Creek Road, Biarra

PD Report – Preliminary Documentation Report (this document)

Planning Regulation – *Planning Regulation 2017* (Qld)

Proponent – Arxhe Ripley View Investment Trust

Proposed Action – the Flinders Valley Residential Development (EPBC Referral 2020/8615)

Protected Matter(s) – means a matter protected under a controlling provision in Part 3 of the EPBC Act for which this Preliminary Documentation Report has effect (koala and grey-headed flying-fox and greater glider).

Regional Ecosystem (RE) – means vegetation communities in a bioregion that are consistently associated with a particular combination of geology, landform and soil (Sattler and Williams 1999, *Vegetation Management Act 1999* (Qld)).

REDD – Regional Ecosystem Description Database

Regional area – Southeast Queensland area.

Rehabilitation – the ecological restoration of the Site. Restoration work will follow the South-East Queensland Ecological Restoration guideline with the tiered response comprising increasing intensity of effort being; 1. Natural Regeneration, 2. Assisted Natural Regeneration, 3. Ecological Reconstruction, 4. Fabrication.

Residential Area – the location of the Proposed Action's urban development including; residential dwellings, road infrastructure, services (electricity, sewer, water), neighbourhood hub (commercial) and childcare centre.

RVPDA – the Ripley Valley Priority Development Area

Safe movement solution(s) – means measures to minimise the risk of injury or deaths to koalas from vehicle strike, specifically including Koala Exclusion Fencing, fauna underpasses or overpasses, and/or bridges as described in the **Koala-sensitive design guidelines**.

Sequential Clearing Conditions – has the same meaning as Sequential Clearing Conditions in the *Nature Conservation (Koala) Conservation Plan 2017* under the *Nature Conservation Act 1992* (Qld).

ShapingSEQ – ShapingSEQ;- South East Queensland Regional Plan 2017

Significant Residual Impact – The area of enduring habitat loss at the Impact Site after all avoidance and mitigation strategies have been deployed as a result of direct impacts associated with the Proposed Action.

Significant Vegetation – is the mapped Endangered Remnant Regulated Vegetation consisting of the Category B RE12.3.3 within the southern central portions of the Site as defined under the RVPDA Development Scheme.

SRC – Sommerset Regional Council

Site – The five (5) consolidated properties over which the Proponent intends to develop for the Proposed Action (refer **Figure 2** and **Table 3**) totalling 47.47 ha.

Study Area – the five (5) consolidated properties intended to develop for the proposed action and the immediate adjoining vegetation.

Sub-regional area – nominally 3-25 km from the Site

Suitable habitat – means habitat featuring ecological characteristics that may provide for the breeding, feeding, resting, or sheltering of any endangered and/or threatened wildlife species.

Suitably Qualified Ecologist – means a person who has professional qualifications, training, skills and/or experience related to the nominated ecological subject matter and can give authoritative independent assessment, advice and analysis on performance relative to the ecological subject matter using the relevant protocols, standards, methods and/or literature.

SWMP – Stormwater Management Plan

WSUD – Water Sensitive Urban Design

1 Introduction

1.1 Background

In January 2020, 28 South Environmental Pty Ltd (**28 South**) submitted a Controlled Action Referral (**CAR**) to the Commonwealth Department of Environment, Energy, Climate Change and Water (**DEECCW**) (formerly as Department of Agriculture, Water and the Environment (**DAWE**)) on behalf of CLAG Pty Ltd (**CLAG**) the former proponent of the Proposed Action. The CAR (**Appendix 1.1**) was lodged in regard to the proposed Ripley View Residential Development (the **Proposed Action**) which is situated in the Ripley Valley Priority Development Area (**RVPDA**) wholly located in the in the Ipswich City Council (**ICC**) Local Government Area (**LGA**) of south-east Queensland. ICC acts as assessment manager on behalf of the Minister for Economic Development Queensland for development within the RVPDA.

Arxhe Ripley View Investment Trust (**Arxhe**) purchased the property from CLAG Pty Ltd 10 October 2022. On the 21st of July 2023, a letter outlining a 'change of person and proponent proposing to take referral action' variation request signed by all relevant stakeholders was lodged with DEECCW. Arxhe is now registered with DEECCW as the **Proponent** for the Ripley View Residential Subsivision.

The Proposed Action is located over five properties that are more properly described as Lot 208 on SL11067, Lot 209 on SL11067, Lot 210 on SL9238, Lot 211 on RP906067 and Lot 2 on RP90967, herein are referred to as the '**Site**'. The Site comprises an area of 47.47 hectares (**ha**). The locality and context of the Site are shown in **Figure 1** and **Figure 2** respectively. The character of these areas is described further in **Section 2**.

On 2 June 2020, DAWE issued a referral decision notice notifying that the Proposed Action was a Controlled Action, and that it would require further assessment and approval under the *Environment Protection and Biodiversity Conservation Act 1999* (**EPBC Act**) before it could proceed. The decision notice identified the relevant controlling provision as listed threatened species and communities, with the Proposed Action considered likely to have a significant impact on two (2) Matters of National Environmental Significance (**MNES**) – *Phascolarctos cinereus* (koala – combined populations of Queensland, New South Wales and the Australian Capital Territory) (**koala**), and *Pteropus poliocephalus* (grey-headed flying-fox). Furthermore, DEECCW has requested the proponent consider whether the Proposed Action has the potential to have a significant impact on two additional MNES species, being *Lathamus discolor* (swift parrot) which is listed in the schedules of the EPBC Act as Critically Endangered, and *Petauroides volans* (greater glider – central and southern), listed as Endangered.

The decision notice identified that further assessment was to be undertaken along the Preliminary Documentation pathway. The decision notice and associated correspondence are provided in **Appendix 1.2**.

On 6 August 2020, the DAWE issued a letter outlining the additional information required for the Preliminary Documentation (**Information Request**). This Information Request is provided in **Appendix 1.2**.

1.2 Site Context

The study area comprises the impact area for the proposed action, located approximately 4.8 kilometres (**km**) south-west of Ipswich CBD (**Figure 1**). The study area is predominantly bound to the south by a residential subdivision under construction (ICC Ref 7231/2020/MAPDA), (small lot) residential properties to the west and north and large lot semi-rural properties to the east. However, it also comprises road reserves including Cunningham Highway (east), Boyland Way (south), Fischer Road (east) and Melrose Drive (north).

As mentioned in Section 1.1 of this report, the Site is wholly located within the RVPDA (previously Ripley Valley Urban Development Area) pursuant to the repealed Urban Land Development Authority Act 2007 (ULDA Act). The ULDA Act allowed the Queensland Government, by means of regulation to declare an area to be an urban development area, The RVPDA was declared by regulation on 8 October 2010.

The purpose of the ULDA Act was to facilitate:

- the availability of land for urban purposes
- the provision of a range of housing
- ecological sustainability and best practice urban design, and
- the availability of affordable housing for low to moderate income households.

Development and planning within the RVPDA is subject to the 'Ripley Valley Urban Development Planning Scheme', which commenced on October 2011. The Urban Land Development Authority (ULDA) delegated responsibility for development assessment within the RVPDA to Ipswich City Council. As such, all applications lodged with and assessed by Ipswich City Council as Assessment Manager.

The UDLA Act was repealed on 1 February 2013 and replaced with *Economic Development Act 2012* (**ED Act**). Pursuant to Section 190 of the ED Act part of the State that was an Urban Development Area under the repealed ULDA Act is taken to be a priority development area under the ED Act. Under the ED Act, the ULDA has been replaced with the Minister for Economic Development (MEDQ). The Site is comprised of road reserves and rural land historically used primarily for agricultural activities, which is generally undulating until it is intersected by an unnamed tributary of Bundamba Creek which traverses south to north through the Site.

Areas of native vegetation have been identified on the site, with vegetation associated within the unnamed tributary of Bundamba Creek identified as Endangered RE 12.3.3. The study area is located within the jurisdiction of the Ipswich City Council, but development is controlled under the Ripley Valley Priority Development Scheme (**RVPDS**) (refer **Appendix 2**). Relevant RVPDS overlays which apply to the study area are detailed in **Appendix 3** of this report.

At the time that the EPBC referral (EPBC 2020/8615) was lodged in January 2020, the total area of direct disturbance was 38.86 ha. More recently the area of direct physical impact arising from the Proposed Action has been reduced to 37.31 ha (**Impact Area**). Of this disturbance, 31.62 ha is an area of **Permanent Impact** which will comprise of residential lots, roads, a neighbourhood park, and childcare centre. An area 5.69 ha comprising land disturbed for the creation of stormwater detention basins, bioretention cells and revegetated batters situated between residential areas and retained linear habitat (along the unnamed tributary of Bundamba Creek) will be revegetated to form an interface to assist with mitigating the effects of development (**Temporary Impact**) and 10.16 ha of retained *Eucalyptus tereticornis* (Queensland blue gum) woodland / open forest (**Avoidance Area**). Combined, this area of open space forms a linear habitat corridor (**Linear Habitat Corridor**) of 15.85 ha in area. The unnamed tributary is identified as a significant riparian corridor under the RVPDA (*…retain where possible locally significant wetlands, remnant*

endangered vegetation where proven by ground truthing to be viable and essential habitat for fauna[3]). The breakdown of Site areas within the development are shown in **Table 1** (see also **Figure 3**).

Table 1: Area of Development and Land Use Themes

Impact Type	Proposed Land Use	Area (ha)		
Permanent impact	Residential lots	30.80	31.6	37.31
	Roads			
	Childcare Centre	0.27		
	Neighbourhood Park	0.55		
Temporary impact	Stormwater detention, bioretention pods and drainage reserve	2.73	5.69	
	Revegetated batters to the waterway	2.96		
Avoidance area	Portion of northern overland flow adjoining the northern site boundary (Melrose Drive)	0.48	10.16	10.16
	Linear habitat corridor: open forest	9.69		
Permanent + Temporary Impact		37.31		
Avoided Impact		10.16		
Total		**47.47**		

1.3 Proposed Action

Arxhe is proposing to develop a 512 lot, residential development, (refer **Figure 3** and **Appendix 4**) which includes One (1) Childcare Centre, internal road network, local park, Linear Park and stormwater drainage and external road widening on five (5) consolidated lots in Ripley Valley over 13 Stages. The protection and ecological restoration / reconstruction of the Linear Park is currently proposed to occur within Stage 8 (northern linear park) and Stage 10 (southern linear park). The anticipated start date for the project is Quarter 1 - 2024. Subject to the proposed 3-year construction period being maintained, the anticipated practical completion for the residential development is Quarter 4 - 2027.

For the purposes of this Preliminary Documentation Report (**PD Report**), the Proposed Action is described as the Residential Area and Ecological Corridor (linear movement corridor).

Construction Activities will include:

- removal of vegetation within the Site for the development footprint[4] of the Proposed Action
- bulk earthworks and associated civil works to create appropriate levels and lot areas, and
- services, roads and other infrastructure for establishing the proposed childcare centre and ancillary infrastructure.

Whilst the final development may be subject to minor modifications during the detailed design phase, an indication of the type and extent of the development as approved through the RVPDA is provided in **Appendix 4**. At this stage the Proposed Action will occur over 13 stages with a timeframe to be determined though sales progress. Stockpiling of stripped topsoil, subgrade, fill and felled vegetative material will be required during the earthworks and construction activities and stockpiling will occur within the areas of

3: Ripley Valley Development Scheme, section 3.3.6, p11
https://www.statedevelopment.qld.gov.au/__data/assets/pdf_file/0019/12448/ripley-valley-development-scheme.pdf
4 The initial direct disturbance footprint comprises all associated earthworks and civil works for residential, stormwater management solutions and open space areas requiring earthworks within the Site totals of 37.31 ha.

identified permanent disturbance. No material shall be stored within, or 30 m of avoidance / retention areas. The project will be staged and noting the above necessary limitations, stockpiling within the impact footprint will be approved as part of any relevant site management plans prior to work commencing.

During construction the avoidance / retention areas shall be fenced with temporary construction / koala exclusion fencing. Stockpiled vegetative material will be utilised in ecological restoration / reconstruction works where appropriate (i.e. as coarse woody debris or as site mulch), and any excess topsoil will be removed from the Site.

The Proposed Action will assume the loss of all vegetation and fauna habitat within the Impact Area. Efforts have been made to maximise the width of the Linear Park to avoid impacts to the Sites highest quality and intact native vegetation and fauna habitat. It is anticipated that the proposed action will commence in Quarter 1, 2024.

1.4 Purpose of this Preliminary Documentation Report

The primary purpose of this Preliminary Documentation Report (**PD Report**) is to adequately respond to DAWE's Information Request (**Appendix 1.2**). Specifically, this PD Report aims to:

(i) provide relevant information from the CAR
(ii) provide further details in relation to the Site's ecological values
(iii) analyse the potential impacts of the Proposed Action on the MNES of interest
(iv) propose measures to avoid, minimise and mitigate the potential impacts of the Proposed Action
(v) describe the residual impacts of the Proposed Action on the MNES of interest
(vi) demonstrate that the Proponent has no history of environmental offences, and is a responsible corporate entity whose track record provides confidence that purported mitigation measures will be achieved
(vii) describe the beneficial social and economic impacts of the Proposed Action, and
(viii) demonstrate how the Proposed Action achieves the principles of Ecologically Sustainable Development (**ESD**).

This PD Report achieves these aims through:

- evidence-based conclusions based on the best available scientific literature and/or by peer reviewed literature, with supporting references cited or expert opinion provided
- maps, plans, diagrams and technical information
- scientifically robust methodologies appropriate to the purpose and justifications for selected methodologies
- risk assessment of scientific/ecological uncertainties associated with the potential impacts, and
- relevant Approved Conservation Advice, Recovery Plans, or comparable policy guidelines for all species, and explanation of how these have been considered.

Preparation of this PD Report has been guided by:

- 28 South Technical Ecologists and Environmental Planning Team
- Mark Sanders, a recognised pre-eminent zoologist
- Dr Stephen Debus, researcher and recognised pre-eminent ornithologist.

1.5 Reference Table for Information Request Response

Table 2 provides a summary of the key ecological issues identified in the DAWE Information Request on 6 August 2020 and the section of this PD Report in which the requested information is provided. The complete Information Request in provided in **Appendix 1.2**.

Table 2: Reference Table for Information Request Response

Requested Information	Response Section
2. DESCRIPTION OF THE ACTION	
a) The location, boundaries, and size (in hectares) of the disturbance footprint, and of adjoining areas and vegetation, which may be indirectly impacted by the proposal.	**Section 2.1**
b) A description of all components of the proposed action, including the anticipated timing and duration, (including start and completion dates) of each component of the proposed action. This should include a detailed outline of the expected timing of all components of the proposed action and any staged clearing over the construction period.	**Section 2.3**
c) A description of the construction and operation of the residential development and associated works (i.e. activities that comprise its operation).	**Section 2.3**
d) Information and clarification on whether the proposed action is related to other proposals nearby and/or if it is a component of a larger action. Further details on 'split referrals' and components of a larger action can found at https://www.environment.gov.au/resource/epbc-act-policy-statement-staged-developments-split-referrals-section-74a-epbc-act.	**Section 2.3**
3. DESCRIPTION OF THE ENVIRONMENT AND MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE	
The preliminary documentation must provide a description of the environment affected by and surrounding the proposed action area, over both the short and long term. Specific matters this section must address, including, but are not limited to:	
3.1 A description of any potential Matters of National Environmental Significance (MNES) (including but not limited to those listed above) that occur in the project area and adjacent areas.	**Section 3. 3.1 and 3.4**
3.2 A description of the current land use, land topography, surface and ground water bodies, waterways and vegetation communities (habitat types as they relate to the above listed threatened species) on the proposed action site and adjoining areas.	**Sections 2.3, 3.2 and 3.3**
3.3 For listed threatened species and ecological communities that have the potential or are likely to be present at and in the vicinity of the	**Section 3.4** details these considerations for koala, grey

Requested Information	Response Section
project site, including but not limited to those listed above, this section must provide the following: a) Information on the abundance, distribution, ecology and habitat preference of the species or community. b) Quantification of the extent of habitat and (if known) the number of individuals present, or historical patterns of use on and surrounding the development footprint (including maps identifying known or potential habitat). c) Assessment of the quality and importance of known or potential habitat for the species or community within the proposed action and surrounding areas. d) Information detailing known populations or records within at least five kilometres of the development footprint and (if known), the size of these populations. e) An assessment of the adequacy of any surveys undertaken (including survey effort and timing). In particular, the extent to which these surveys were appropriate for the species and undertaken in accordance with relevant survey guidelines.	headed flying fox, swift parrot, and greater glider
3.4 Information about the methods, data and scientific literature used to identify and assess the environmental values on the proposed action site and surrounding areas, including survey data and historical records. Survey data for the proposed action site must be provided for the above listed threatened species, should be as recent as possible, and must not have been collected more than five years before the date of this letter.	**Sections 3.2-3.4**
4. QUANTIFICATION OF IMPACTS	
Based on the information provided in the referral and additional information provided in support of the referral, the Department considers that: • The proposed action directly impacts 38.86 ha of habitat critical to the survival of the Koala, and potentially indirectly impacts 8.64 ha of habitat along the riparian corridor proposed to be retained and rehabilitated on-site. Indirect impact may result from: o Isolation/fragmentation of habitat within the riparian corridor o Mortality or injury to Koala from increased traffic o Predation from domestic dogs. • Due to the presence of key foraging resources and the proximity of the proposed site to a nationally significant GHFF camp, there is a real chance or possibility that the proposed action may significantly impact on habitat critical to the survival of the GHFF.	**Sections 4** (assessment of Impacts) and **Section 5** (Residual Impacts)

Requested Information	Response Section
Further information regarding the presence of habitat and potential impacts are required to determine whether or not the proposed action is likely to have a significant impact on the swift parrot. To clarify the extent and nature of impact on listed threatened species and ecological communities as a result of the proposed action, the preliminary documentation must:	
4.1 Provide a description of the intended land uses proposed as part of the completed development, including of the proposed open space and conservation areas and associated ongoing activities, and details of the intended party that would be responsible for future management activities.	**Section 2.3**
4.2 Include current maps and coordinates/shapefiles of the proposed impact area and areas of koala and GHFF habitat to be retained. Maps must clearly identify development footprints, buffer zones, and any conservation areas where impacts will be avoided, and areas of adjacent habitat that would be subject to indirect impacts.	Outlined in **Figure 5**
4.3 Confirm the area of habitat that will be directly and indirectly impacted by the proposed action, including areas where: a) Connectivity to surrounding habitat will be retained or removed. b) Adjacent habitat will be subject to intensification of ongoing impacts (for example, through increased levels of dust or polluted runoff).	**Section 1.2 (Table 1), Section 3, Section 6** (Avoidance and connectivity), and **Section 6.2.2 (**Mitigation Measures – Koala).
4.4 Confirm the quality of habitat to be impacted within the development footprint.	**Sections 3.4.1** and **4.1**
4.5 Provide an assessment of the direct, indirect, consequential and cumulative impacts, including: a) The nature of impacts, including timing and whether the impact is temporary or permanent. b) Details of any policy guidelines, relevant studies, surveys or consultations with species experts/field specialists, which were not included in the referral or additional information provided in support of the referral. c) A local and regional scale analysis of likely impacts, with reference to the project's potential contribution to cumulative impacts in the context of development patterns in the locality and region. d) A risk assessment of potential impacts from the action that are likely to be unpredictable, severe, or irreversible.	**Section 5**
5. AVOIDANCE AND MITIGATION	

Requested Information	Response Section
5.1 Provide a consolidated description of all proposed measures to avoid and mitigate impacts, including those provided in the referral and any additional to those described in the referral. This should include: a) Details about pre-clearance and clearance procedures to ensure that species are detected and managed to minimise mortality, stress, injury, or introduction of disease. b) A description (including maps and imagery) of the location, boundaries and size of buffer areas or proposed exclusion zones, and details on how these areas will be enhanced, protected and maintained. Also include a description of any fences or barriers which may be installed around areas where impacts will be avoided. c) Details of any rehabilitation measures to be implemented for disturbed areas, including rehabilitation objectives, target species, timing of rehabilitation stages, methodology, maintenance measures, schedules, and monitoring. d) Details of any ongoing mitigation and management measures during the operation of the facility, including (but not limited) installation of Koala exclusion fencing, safe fauna movement solutions, local traffic management measures, and/or wildlife signage guidelines.	**Section 6**
5.2 For each measure proposed, indicate the: a) Responsible party b) Environmental outcomes to be achieved c) Millstones/performance/completion criteria d) Proposed monitoring and evaluation program.	**Sections 6.2** and **6.3**
5.3 Provide an assessment of the predicted effectiveness of each proposed avoidance or mitigation measure, noting that the effectiveness of a particular measure is a reflection of confidence in the ability of the measure to reduce the risk of a threat. The assessment of effectiveness should be evidence based and include examples of demonstrated success of a particular measure to achieve the desired avoidance/mitigation outcome.	**Sections 6.2** and **6.3**
6. OFFSETS	
Based on the referral information and additional information submitted in support of the referral, the Department considers that the proposed action is likely to have a residual significant impact on the koala and potentially the GHFF.	**Section 5** (residual impacts) and **Section 7** (offsets)

Requested Information	Response Section
Where residual significant impacts remain after consideration of avoidance and mitigation measures, an environmental offset will be required to compensate for the impacts in accordance with the *Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy*. Offsets must be specific to the species or ecological community being impacted and must improve or maintain the viability of the species. If a residual significant impact is identified, the preliminary documentation must include an offset proposal, which must:	
6.1 Demonstrate how the offset proposal: a) Meets the principles outlined in the *Environmental Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy*. b) Directly contributes to the ongoing viability of the EPBC listed species or ecological community and will deliver an overall conservation outcome that improves or maintains the viability of the protected matter in the region, as compared to what is likely to have occurred under the status quo, i.e. if neither the action nor the offset had taken place. c) Compensates for the impact over the entire duration of the impact (i.e. should impacts be in perpetuity, the offsets must also be delivered in perpetuity). Note: while the offsets do not need to be secured before the decision on whether to approve the proposed action, should the proposed action be approved, conditions of an approval are likely to require that offsets are secured, and management measures are in place, before commencement of the proposed action.	**Section 7, Section 7.**5 (Policy Principles), **Section 7.4** (Offset Area Management Plan) **and Appendix 25.**
6.2 For further details regarding offset requirements refer to section 6 of the *Environmental Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy* and see Appendix B.	**Section 7, Section 7.**5 (Policy Principles), **Section 7.4** (Offset Area Management Plan) **and Appendix 25.**
7. ECONOMIC AND SOCIAL MATTERS	
7.1 Provide details on the social and economic costs and/or benefits of undertaking the proposed action, including the basis for any estimations of costs and/or benefits. Where possible, please include the total economic capital investment and economic ongoing value of the project.	**Section 8 – social and economic impacts**
7.2 Identify if economic benefits and employment opportunities are in addition to what would have been expected if the action were not to take place.	**Section 8 – social and economic impacts**

Requested Information	Response Section
7.3 Provide details of any public stakeholder consultation activities, including the outcomes of those consultations.	**Section 8.3.1**
7.4 Provide details of any consultation with Indigenous stakeholders.	**Section 8.3.2**
8. ECOLOGICAL SUSTAINABLE DEVELOPMENT	
The preliminary documentation must: (a) Provide a description of how the proposed action meets the principles of ecologically sustainable development, as defined in section 3A of the EPBC Act.	**Section 9 – ESD**

2 The Impact Area and Proposed Action

The Proposed Action occurs over five (5) consolidated lots in the suburb of Flinders View, totalling approximately 47.47 ha of land. These properties (shown in **Figure 1** and listed in **Table 3**) collectively form the Site for the purposes of this PD Report and the Proposed Action.

The Site is located approximately 2.1 km west of the Swanbank Power Station complex and 4.8 km south-east of the Ipswich Central Business District (**CBD**).

Table 3: Properties that Comprise the Site

Lot/Plan	Address	Total area
Lot 209 on SL11067	Melrose Drive, Flinders View, Ipswich City	47.47 ha
Lot 208 on SL11067	63-89 Fischer Road, Flinders View, Ipswich City	
Lot 210 on SL9238	Melrose Drive, Flinders View, Ipswich City	
Lot 211 on RP906067	39-49 Fischer Road Flinders View QLD Ipswich City	
Lot 2 on RP906067	35-37 Fischer Road Flinders View QLD Ipswich City	

Fischer Road forms the eastern boundary of the Site. To the south is Boyland Way, Josie Street to the west, and Melrose Drive and Rourkes Park to the north. Further to the north and west are neighbourhoods of more contemporary residential development with lots ranging from 450 m^2 to 1,240 m^2. These lots are substantially smaller than the present rural residential lot sizes.

The Site is intersected in a north-east to south-west direction by an unnamed tributary of Bundamba Creek (Refer to **Figure 3**).

2.1 Site and Locality

The Site has generally been subjected to disturbance associated with historical broad-scale clearing and selective thinning associated with rural-agricultural pursuits. More recently, the Site has been subjected to rural-residential land uses, with apparent selective clearing to facilitate individual dwellings, urban infrastructure development (sewer pipelines) and the establishment of in-stream 'farm' dams of various sizes.

Ongoing degradation within the west, east and north of the Site has generally seen a reduction in vegetation cover and habitat utility. The larger and more in-tact areas of vegetation (remnant and regrowth) are associated with a central south to north traversing waterway which bisects the Site, which is an unnamed tributary of Bundamba Creek.

The Site occurs at the northern most point of RVPDA and is effectively surrounded by either established, or under construction urban development[5]. The Site has limited areas of remnant vegetation and is isolated from the identified significant bioregional corridors. There is existing ecological connectivity from land to the south, through the Site, to less intensively developed rural-residential land to the north-east and east, along remnant and regrowth vegetation along the central south to north waterway.

5: Refer to **Figure 9**

It can be inferred that from a landscape ecological perspective, the Site plays a marginal function of providing a stepping-stone value between the significant ecological corridors throughout the region, particularly given the large developments now bounding it to the west and south and rural residential areas to the north. Corridors retained within the development to the south will be maintained and directly connect into those proposed within the Proposed Action.

2.2 Historical Context

Historically, land use within the Site, the broader RVPDA to the south and land to the northwest (of the Cunningham Highway), comprising the present-day suburbs of Flinders View and Raceview has been influenced by agricultural pursuits; broadscale clearing for intensive cropping, selective clearing and rural residential development. Agricultural activity influenced the locality until the late 1970's when more intensive forms of urban residential development commenced to the north, north-west and west. In ca.1982, construction on the Ipswich bypass on the Cunningham Highway commenced. Within the site at this time (ca.1982), much of the north-west quadrant had been cleared, and degradation along the central waterway was evident.

The period 1982 to present has seen further intensification of urban residential development to the north, north-west and west, and rural residential development to the east.

By 1993, the Site, which prior to this had been a single parcel, had been subdivided into the five properties forming the Site, and internal fence lines and associated clearing established. From 1993 to present, extensive clearing of three (south-west, north-west and north-east) of the five parcels of land was undertaken.

Photography from 2020 shows the Site currently comprises of various vegetated areas, waterways and dams, with informal vehicular and motor-cross tracks evident throughout. This contrasts with the surrounding predominately established or developing residential developments, and a variety of peri-urban land-uses to the east of the Site.

Publicly available, historical aerial photography from 1948 – 2020 (for the years 1948, 1958, 1968, 1975, 1982, 1993, 2011, 2020) is available and images showing the local context are provided for reference within **Figure 4a** to **Figure 4h**. Contemporary photography showing the present patterning of development as of **July 2022** is presented as **Figure 2**.

2.3 The Proposed Action

2.3.1 Overview

The Proposed Action involves the construction of a residential subdivision (with provision for approximately 512 residential allotments and an approximate residential population of 1,400 people) which is expected to constitute the following actions:

- removal of vegetation within the Site for development footprint[6] of the Proposed Action
- bulk earthworks and associated civil works to create appropriate levels and lot areas, and
- services, roads and other infrastructure for establishing the proposed childcare centre and ancillary infrastructure.

6: The development footprint comprises all associated earthworks and civil works for Residential, stormwater management solutions and open space areas requiring earthworks within the Site and is a total of 37.6 hectares.

The proposed plan of development and layout associated with the Proposed Action, showing areas is included as **Figure 5**. Of the Site's 47.47 ha, residential uses occupy 66.6% (31.62 ha) and open space which forms the developments linear habitat corridor comprises 33.3% (15.85 ha) of the site area. Linear habitat corridor includes areas of rehabilitated (revegetated) drainage reserve (stormwater detention basins with bioretention cells – 2.73 ha), rehabilitated waterway batters with one in four slopes (2.96 ha), and retained habitat (10.16 ha).

The Proposed Action (refer **Table 1** and **Figure 5**) will result in the delineation and establishment of two predominant land uses within the Site. These are:

- Residential Areas (31.62 ha) – the proposed location of urban development including residential dwellings, road infrastructure, services (electricity, sewer, water), neighbourhood hub (commercial) and childcare centre.
- Linear Habitat Corridor (15.85 ha) – the proposed location of all of the Site's open space and Drainage Reserve, which although dedicated as stormwater management infrastructure, can provide useful habitat (and afford a mitigatory / interface functionality between the development and the avoided habitat) as they will be rehabilitated[7]:
    - Retained vegetation comprising 10.16 ha (Avoidance Area) generally below Q100 floodline and including significant Category B (RE12.3.3). The corridor is contained within, and protected by, the Linear Park. The Linear Park contains areas of retained open forest habitat (which will be subjected to targeted ecological restoration, and ecological reconstruction within degraded areas including those affected by Urban Utilities (see **Section2.5**) and areas of rehabilitated (through ecological reconstruction) open forest on waterway batters created by civil earthworks (interface areas).
    - Interface areas comprising 2.96 ha (Temporary Impact) being batters and areas adjoining esplanade roads which will be revegetated and contain pathways (adjoining roads), informal park and community spaces, and fauna furniture (above the Q100 floodline).
    - Overland flow and drainage reserve comprising 2.73 ha (Temporary Impact) containing retained open forest, and all stormwater detention basins and water quality polishing (bio-basin) cell and overland flow paths which will be revegetated. Stormwater detention basins can be permanently revegetated with an open forest planting prescription. Bio-basin cells will require periodic maintenance to replace filter media, these areas will be planted with sedges and smaller trees allowable by water sensitive urbane design guidelines[8]; which will be replaced at the same time. The stormwater quantity and quality management structures are positioned to be above the Q100 floodline.

The Development Approval (refer **Section 6.2.1**, condition 4(f)) requires the dedication of a Linear Park to Ipswich City Council at plan sealing stage of the development. The Linear Park is comprised of the Avoidance Area and the rehabilitated waterway batters.

The combination of neighbourhood park and informal linear park, rehabilitated batters and stormwater solutions (i.e. drainage reserves) will serve to buffer between the proposed residential uses and avoided habitat within the Linear Habitat Corridor / Linear Park. The proposed action is not related to other proposed actions nor a component of a larger action.

7: Planting prescriptions have been derived from appropriate SEQ ephemeral wetland REs
8: https://waterbydesign.com.au/wsud-plant-database/bioretention-plants

2.3.2 The Linear Park and Stormwater Management Functions

Detailed botanical and ecological assessments undertaken for the Site have identified Significant Vegetation (with reference to the RVPDA Development Scheme definitions) occurring within the southern central portion of the Site associated with the central waterway corridor, which bisects the Site. The development layout has been explicitly designed to wholly locate and protect this vegetation within a Linear Park (**Figure 5**) which traverses the Site (**Appendix 4**).

The Significant Vegetation comprises the Category B *Endangered* RE 12.3.3 and is considered to provide key habitat resources for resident native fauna and to facilitate fauna movement within and through the Site. The Significant Vegetation and the balance of the proposed Linear Park will be subject to ongoing improvement through ecological restoration works. This restoration work will be undertaken with a focus on enhancing, consolidating and expanding the extent of the Significant Vegetation (as identified in the RVDS) throughout the Linear Park[9].

Upon plan sealing, the Linear Habitat Corridor encompassing entirely the avoided impact area, and the balance of the waterway batters, will be dedicated back to ICC as Linear Park. At maturity, it will represent a robust, diverse and resilient ecological community in public ownership.

The Linear Park will be further enhanced, protected and buffered by virtue of the establishment of complementary open space and recreation uses and esplanade roads as an interface to 'hard' residential areas. Drainage reserves are co-located within these interface areas and contain stormwater management infrastructure; stormwater management basins and overland flow paths, and a local park (Neighbourhood Recreation Park). In combination, these features form the Open Space and Conservation Corridor.

2.3.3 Final Form

The Proposed Action will result in direct impact to 37.31 ha (31.62 ha of permanent impact and 5.69 ha of temporary impact) and an avoidance area of 10.16 ha.

2.3.4 Layout, Lot Configuration

The layout of the Proposed Action will reflect the intent of the two land uses described in **Section 1.3** and shown in **Appendix 4**. The direct impact from the Proposed Action includes all residential uses, local parks and proposed stormwater solutions. It is also noted that local parks and stormwater solution areas will be subject to plantings of native endemic flora species, contributing to foraging habitats for common and conservation significant fauna alike.

Lot configuration will be standard and in line with requirements of the RVDS and the general requirements of the Residential Low Density Zone within the ICC Planning Scheme. The proposed staging of the Proposed Action has been illustrated within **Appendix 4**.

2.3.5 Access and Traffic

The Proposed Action represents an infill development for which all traffic requirements are internalised or conveyed to the State-controlled road network which has greater capacity (when compared with local roads) to manage the increases attributable to the Proposed Action.

The traffic investigation for the Proposed Action is considering, among other items:

9: Recreation and open space uses are not proposed within the Linear Park (i.e. local parks and associated facilities and stormwater infrastructure).

- Local road network – upgrading sections to enhance traffic capacity and safety through new or improved intersections, street lighting and pedestrian cyclist facilities where applicable.
- Public transport – the new community will provide a critical population mass and improved road network that could support an expansion of the current bus services, subject to State Government planning.
- Active transport – the proponent will provide an extensive network of pedestrian and cycle paths along roads and through the parks and bushland, ensuring a community that is connected within the Site and to the surrounding areas.

The proposed road layout is shown in **Appendix 4**.

Any roads within the Site that traverse important ecological features will be constructed in a way that promotes fauna passage across these potential barriers. These impacts can be dealt with at the latter stages of the development approval process; however, wildlife management infrastructure approaches to these matters are described in **Section 5.7**.

2.3.6 Floodplain and Stormwater Management

ICC requires the Proponent to ensure that there is no net worsening of stormwater impacts on properties adjoining the Site. The design of the Proposed Action, through Water Sensitive Urban Design (**WSUD**) principles, will achieve a better stormwater outcome (quality and quantity) through effective stormwater treatment within the Site. This has led to models showing improved flood levels to the west of the development Site boundary.

Importantly, the design of the Proposed Action includes WSUD elements within the streetscape. All areas of WSUD will be revegetated for the benefit of native wildlife but with a specific focus on habitat for MNES as described within **Section 5**.

The Proposed Action will increase impervious surfaces and introduce uses that have the potential to increase nutrient, chemical and micropollutant input to the Bundamba Creek tributary. Impacts and mitigation measures will be outlined in stormwater management plans (**SWMP**s) prepared for the various stages of the Proposed Action. A technical note from Engeny is provided in **Appendix 5** which describes the approach to dealing with water quality and quantity for stormwater in the Bundamba Creek catchment.

The SWMPs will outline how contemporary stormwater management practices will be used to polish stormwater by passing it through bioretention systems to achieve State-mandated water quality objectives. The bioretention areas will be integrated with the Linear Park and the Residential Area. Gross pollutant traps will likely be included in the treatment train to remove macro-pollutants such as plastics. Five (5) main detention basins are proposed within the Site; mostly located on the outer edges of the Linear Park (**Appendix 4**). An overland flow path is proposed to be co-located in the interface corridor along the Melrose Drive frontage to facilitate water movement from the western portion of the catchment and direct it towards the drainage basin 4 for polishing and release offsite.

Detailed SWMPs design will be submitted as part of the operational works applications. The SWMPs will be assessed against the stormwater management strategies identified as part of the ICC Integrated Design Planning Scheme Policy. Hard infrastructure (pipes and bioretention basins) will be installed and deemed to be in suitable working order before being accepted as “off maintenance”. Monitoring the effectiveness of the infrastructure will proceed as per approval conditions.

2.3.7 Erosion and Sediment Control

The construction phase of the Proposed Action requires earthworks, which if improperly managed have the potential for deposition of sediment within Bundamba Creek. However, before the commencement of construction, operational works applications will be submitted to ICC outlining proposed civil works and associated erosion and sediment control measures in accordance with accepted practice (i.e. the IECA Guidelines). The Proponent will be responsible for ensuring that the approved contractor implements the approved plans so that erosion and sediment are appropriately managed within the Site.

2.3.8 Services

Services necessary to support the Proposed Action include water, sewerage and electricity. These services will be established within the Site with connection to existing reticulated service networks. These services will be undergrounded and will not require additional removal of vegetation outside of that already envisaged within the development footprint. Where services traverse retained vegetation within the Linear Park, this may necessitate the removal of a small number of trees/shrubs to facilitate service connections. These areas are shown within the Vegetation Management Plan that has been prepared for the Proposed Action (see **Appendix 6**).

2.3.9 Restoration and Land Dedication

The Proposed Action will involve three main types of land restoration as outlined within the conceptual Rehabilitation Management Plan (**Concept RMP**) included in **Appendix 7**:

- Within the Linear Park where a connected canopy is already present, assisted natural restoration will be undertaken which will include weed removal and ongoing monitoring. This includes the Significant Vegetation that has been identified. Where adjoining the proposed road crossing centrally within the Site, fauna underpass, fauna furniture and embellishments will be established (see **Section 6.2.2**). Pursuant to MEDQ Approval 10529/2019/PDA (the **MEDQ Approval**), Local Linear Park (referred to as POS018 on Parks and Open Space Map of Ripley Valley PDA Infrastructure Charging Offset Plan – June 2020 and as Lot 907 – Linear Park on the approval plan), constitutes Trunk Infrastructure, and in accordance with Condition 4(f), is to be dedicated for Linear Park. In accordance with Part 15- Ripley Valley Master Planned Area Structure Plan of the *Ipswich Planning Scheme 2006,* Local Linear Park is identified as Open Space. *Notwithstanding, Condition 28 (a) of the MEDQ Approval requires the Applicant to rehabilitate the entirety of the Waterway Corridor/ Linear Park as shown on the approved plans* of the Development Approval, to a stable natural bushland setting consistent with the regional ecosystems mapped on site an in accordance with an approved Rehabilitation Management Plan. The Linear Park will be dedicated to Ipswich City Council for management in perpetuity.
- The Local Park will be subject to sensitive and thoughtful landscape and revegetation to complement the adjoining stormwater management areas and Linear Park. Landscaping will incorporate locally endemic flora species from the pre-clear landscaping RE and will be integrated with the proposed recreational facilities and infrastructure. Pursuant to MEDQ Approval (1059/2019/PDA), One (1) Local Recreation Park (referred to as Lot 906 – Neighbourhood Recreation Park (Local Park) on the approved plan), constitutes Trunk Infrastructure, and in accordance with Condition 4(e), is to be dedicated for Local Recreation Park. In accordance with Part 15- Ripley Valley Master Planned Area Structure Plan of the *Ipswich Planning Scheme 2006,* Local Park is identified as Open Space. The Local Park will be dedicated to Ipswich City Council for management in perpetuity.
- Earthworks for bioretention basins and stormwater drains will be undertaken, then fully revegetated with a vegetation species mix selected from an appropriate RE (areas of greater inundation within RE 12.3.3 – obligate and facultative wetland species) that can adapt to ponding depths and times

associated with the planned inundation. Full reconstruction will occur in these locations. Pursuant to MEDQ Approval (1059/2019/PDA) Condition 4(d), land required for detention basins and bio-retention basins or equivalent must be dedicated as drainage reserve in favour of Council. In accordance with Part 15- Ripley Valley Master Planned Area Structure Plan of the *Ipswich Planning Scheme 2006,* the detention basins bio-retention basins are located on land identified as Open Space. Notwithstanding, the drainage reserve will be dedicated to Council for management in perpetuity.

The pre-clear RE mapping will represent the most appropriate vegetation community to guide the land restoration activities. Further information on the proposed land restoration is included in Concept RMP (**Appendix 7**).

This restoration work will follow the South-East Queensland Ecological Restoration guideline with the tiered response comprising increasing intensity of effort being:

- ***Natural Regeneration*** - resilience is intact and recovery is automatic with the removal of the cause of the damage *e.g. removal of stock and erection of exclusion fencing.*
- ***Assisted Natural Regeneration*** - Where degrees of resilience exist and "triggering" interventions, either disturbance or resource provision can affect recovery by natural regeneration *e.g. removal of weeds to remove competition and facilitate recovery of recruitment.*
- ***Ecological Reconstruction*** – where resilience is depleted, and abiotic or biotic elements need wholesale importation or major amendment before recovery can commence *e.g. where native vegetation has been removed and is not naturally recruiting, but site topography remains unchanged.*
- ***Fabrication*** – where conditions are permanently changed and better-adapted local systems can be regenerated or constructed to restore integrity to the landscape *e.g. Where topography has changed so drastically, that the original ecosystem can no longer be re-established on the site.*

2.4 Amendments Since Submission of the CAR

2.4.1 Amendments to the Proposed Action

The Proposed Action has evolved substantially since the CAR was submitted to DEECCW; in response to ICC concerns regarding the interface between existing residents along Melrose Drive and the proposed development (refer **Appendix 4**). The northern interface Corridor is designated drainage reserve and traverses the northern boundary of the site between the development and Melrose Drive. It includes the Cunningham Highway frontage and extends in an eastward direction intersecting with from Basin 4 adjoining the Linear Park (see **Figure 5**). This addition of the northern interface corridor recognises the existing overland flow path function in this portion of the Site and will facilitate the west to east movement of fauna across the Site to the Linear Park.

As such, the proposed area for the linear habitat corridor is 15.85 ha (of which 2.73 ha is drainage reserve, the balance being Linear Park, see **Figure 5**):

- 10.16 ha of retained open forest habitat (9.69 ha being riparian forest along the unnamed tributary and 0.48 ha of open forest habitat along the northern boundary of the Site fronting Melrose Drive). This area consists of the Proposed Actions' Avoided Impact Area.
- 5.69 ha of rehabilitated drainage reserve (2.73 ha) and waterway batters (2.96 ha). As the landform will be modified, rehabilitation (i.e. ecological restoration) through Ecological Fabrication will focus on selecting specifies relevant to ephemeral wetland regional ecosystems and the environmental purpose of the drainage reserve. This area consists of the Proposed Actions' temporary impact area and ecological restoration with open forest species forms part of the Sites impact mitigation.

The Linear Habitat Corridor will be protected as Drainage Reserve and Linear Park in part and will provide on-Site mitigation measures (rehabilitated and revegetated interface) for the development and to provide a south to north ecological corridor through the Site.

The previous plan of development included as part of the CAR has been provided for comparative purposes in **Appendix 8**.

Boyland Way (which frames the southern boundary of the Site) will not be fully constructed, as such avoiding further road crossings by fauna from the retained Linear Habitat Corridor through and off the Site. This reduces the potential interaction of fauna and vehicles within areas dedicated for retention and protection.

The north-east component of the Site (Stage 9 of **Appendix 4**) will have a significantly reduced development density, with larger traditional sized allotments proposed to deal with historical underground mining subsidence/fault lines. This will also reduce the volume of traffic in these areas as well as increase the potential for tree retention within those allotments.

These changes have been made through consultation with the ICC with a series of discussions regarding the northern interface and the overall environmental design considerations the Proposed Action has included.

2.5 Actions Undertaken by Others on the Site

During July / August 2022, the Central SEQ Distributor Retailer Authority, trading as Urban Utilities ("Urban Utilities"), carried out sewer pipeline works and associate vegetation clearing, on the land. As discussed in more detail in the letter from the solicitor for Arxhe in **Appendix 9**:

- Urban Utilities is a statutory, distributor-retailer entity, in which its participating local governments (including the Ipswich City Council) are shareholders, and which performs various water and wastewater functions, including the provision of wastewater services and the construction and maintenance of trunk wastewater infrastructure, that were previously performed individually by the participating local Governments.
- the works were carried by Urban Utilities as part of its planned augmentation of its wider trunk wastewater infrastructure network and do not form a part of, and are unrelated to, Arxhe's development of the land/the Controlled Action.
- the works were carried out pursuant to access agreements in place which pre-dated either Arxhe's or CLAG's ownership of the land.
- the vegetation disturbance caused by Urban Utilities in carrying out the works extended beyond the areas authorised by those agreements, without the knowledge or consent of CLAG.
- neither Arxhe nor CLAG had any involvement in the works.
- Urban Utilities advised Arxhe/CLAG that it did not consider that referral of the works under the EPBC Act was required and that it had obtained various ecological reports in that respect.
- any responsibility for the works and associated vegetation loss lies with Urban Utilities and not Arxhe nor CLAG.

Analysis of site disturbance undertaken by Urban Utilities, shows the construction resulted in the clearing of native vegetation affording habitat critical to the koala, grey-headed flying-fox and greater glider. The features of the clearing included a corridor width of 18-22 m with a total length of 693 m and the removal of ~149 trees. The total area of the disturbance is 2.34 ha, with the disturbance footprint overlaying 0.61 ha of the Avoidance Area outlined herein. The remaining 1.73 ha overlays areas identified by the Proposed Action as impact area. Relevant tree removal mapping and imagery showing the extent of this clearing is contained in **Appendix 10**.

Consequently, the action by Urban Utilities has resulted in the removal of 0.61 ha of vegetation that would not have arisen as a result of the development (i.e. it occurred within the designated avoidance area).

2.6 Change to the Entity

On the 21st of July 2023, a letter outlining a change of person and proponent proposing to take action referral variation request signed by all relevant stakeholders was lodged to the Commonwealth. The request to change the Person Proposing to take the Action, and Proposed Designated Proponent was accepted/signed by the delegate of the Minister was endorsed 4 August 2023.

This action represented a formalisation of The Trustee for Arxhe Ripley View Investment Trust taking primary responsibility for the Ripley View Residential Development and associated Controlled Action Referral from CLAG.

2.7 Additional Surveys

Since the submission of the CAR (January 2020), the Proponent has commissioned further ecological surveys within the Site, in order to gain a greater appreciation of the existing environmental values.

These have included:

- Targeted terrestrial vertebrate surveys to provide greater clarity on the presence of species not recorded within the Site, but recognised as having a 'possible' or higher probability of occurring (including MNES species and specifically koala, grey-headed flying-fox, swift parrot and greater glider):
    - surveys undertaken by EcoSmart Ecology (2020) and led by Mark Sanders on 16-20th March 2020 (inclusive):
        - These surveys involved the use of spotlighting, camera traps, Anabat™ deployment, targeted frog surveys and opportunistic observations. MNES-related findings from these surveys have informed this PD Report (see **Section 4**).
    - The methodology and results of these targeted surveys are contained in the Terrestrial Vertebrate Survey Report (**Appendix 11**).
    - Drone flight campaigns investigating linkages and potential barriers to movement for greater glider, April 2023.
    - Site inspections of the impact site for hollows and spotlighting for greater glider, May 2023.
    - Reprocessing of tree data collected in 2020 to identify greater glider forage (<300 mm diameter at breast height (DBH)), and potential denning trees (>500 mm DBH) in accordance with guidelines for determining greater glider habitat prepared by Eyre (2022).
- Modified Habitat Quality Assessments (utilising the Queensland BioCondition framework) in August 2020 to determine Site Condition and Context:
    - Site Condition was assessed by the collection of data for 17 definable ecological attributes within an Assessment Unit (with a total of 4 Assessment Sites across the Site) and comparing this data to the known parameters of the pre-clearing Regional Ecosystem attributes outlined within the *BioCondition Benchmarks for Regional Ecosystem Condition Assessment* documentation prepared by the Queensland Herbarium (refer **Attachment 12**).
    - Site Context was assessed via a spatial assessment of each Assessment Unit relative to four attributes being: Patch Size, Connectedness, Context and Ecological Corridor. Each attribute was spatially reviewed and weighted to standardise relative importance.
- Additional BioCondition plots assessments (Impact Site) at an additional three sites in March 2023.

3 Description of the Environment

3.1 Landscape Context and Connectivity of the Impact Site

Biodiversity context mapping (**Figure 6**) representing Regulated (Remnant and High Value Regrowth) Vegetation shows the contiguous landscape, connectedness and patch features of the landscape within 25 km of the Proposed Action. Presently there is 44.7% regulated vegetation cover (39.3% remnant, 5.5% regrowth) within 20 km of the site. The balance (55.3%) comprises modified or cleared vegetation types. The majority of this vegetation is situated to the south-east and is associated with the State Significant Karawatha- Greenbank-Flinders Peak ecological corridor which frames the RVPDA to the east and south.

Connectedness of vegetation coverage at the impact site is best represented in **Figure 7**. This mapping also shows regulated vegetation however, at a finer scale to **Figure 6** allowing analysis of site attributes. Analysis of mapping shows that connectedness through the site and beyond is afforded by un-mapped regrowth and thinned canopy vegetation, to which it is adjoined by less than 4 ha of Remnant, High Value Regrowth, and (low value) regrowth. The single largest patch of native vegetation adjoining the Site is 3.6 ha in area.

In the context of native habitat present within the landscape, it is useful to consider that this mapping (**Figure 6**) does not take into account future development. While not an absolute indicator of absolute future clearing (owing to avoidance and mitigation), and landscape context change within Ripley Valley (a State Government Identified major growth front) for which there is an EPBC referral in place, is identified as **Figure 8**.

3.2 Site characteristics and natural values

Extensive ecological surveys of the site have been undertaken by 28 South and others over the period 2018 to 2023. The ecological surveys have included botanical and vegetation community assessments, tree surveys, specifically in relation to koala habitat trees and important winter flowering species alongside general and targeted fauna surveys and habitat assessments.

Surveys have been conducted by and under the supervision of staff recognised as suitably qualified and experienced to undertake assessments under the *Environment Protection and Biodiversity Conservation Act 1999*.

The full body of knowledge accumulated for the site has been drawn from ecological assessments conducted during:

- Baseline botanical, ecological and habitat surveys by Mitch Taylor and Rebecca Freese for a period of four (4) days on the 9 October 2018 and the 3-5 July 2019. This survey effort included assistance from Justin Armstrong on the 4 July 2019 (refer **Appendix 12** for the site flora list).
- Detailed koala habitat tree survey on various dates within all parts of the Site on the 9 October 2018 and 3-5 July 2019. This involved the identification and mapping of all koala habitat[10] trees above 200 mm diameter at breast height (**DBH**). See **Appendix 6** for the Vegetation Management Plan.
- Terrestrial Vertebrate Assessment led by Mark Sanders between 16th and the 20th of March 2020, including bird spotting and survey, vertebrate fauna spotlighting, infrared motion sensor camera

10: As per the definition within the *Planning Regulation 2017*, "koala habitat tree" means a tree of the *Corymbia, Melaleuca, Lophostemon, Eucalyptus* or *Angophora* genus. It is noted that Koala Habitat Trees which were <200mm where note surveyed; however, for the purposes of this assessment, the 200 mm threshold is considered relevant and substantial in effort.

trap survey and bat survey using an Anabat™ detector (see **Appendix 11** for the terrestrial fauna report.).

- BioCondition transect surveys were undertaken by Justin Armstrong and Amelia Spring on the 19 August 2020 to assess the indicative habitat scoring of the various vegetation communities identified within the Site (see **Appendix 13** for the raw data sheets).
- Drone flight campaigns investigating linkages and potential barriers to movement for greater glider April 2023.
- Site inspections of the impact site for hollows and spotlighting for greater glider, May 2023.
- Reprocessing of tree data collected in 2020 to identify presence of greater glider habitat; forage (<300 mm diameter at breast height (DBH)), and potential denning trees (>500 mm DBH) in accordance with guidelines for determining greater glider habitat prepared by Eyre (2022).
- Additional MHQA transect surveys (three sites) were undertaken by Justin Armstrong and Liam Harrington, 23 March 2023.

The studies have resulted in a comprehensive understanding of the site's ecological values to inform development of pertinent [11] fauna management strategies for the retention and restoration of the Sites best habitat. It is held that the design in concert with other green infrastructure measures put in place within the locality will adequately cater for the long-term sustainability of koala and other riparian / forest dependent fauna which would normally be expected to reside in retained and enhanced habitat within the riparian reserve.

3.2.1 Physical Characteristics of the Site

(a) Land Zones

With respect to the major geological structures of the Site, the Site overlays two landzones[12]:

- **Land zone 9-10**: fine / coarse grained sedimentary rocks. On-Site this geology comprises the more elevated parts of the Site.
- **Land zone 3**: recent alluvium. On the Site this is associated with waterways.

(b) Geology, Soils, Landform and Drainage

Hard surface geology of the comprises Ripley Road Sandstone of the late Triassic – early Jurassic era and comprising quartzose sandstones and minor mudstone. and occupies mor elevated landforms to the south-west and south east. This geological feature is bisected by Quaternary era alluvium associated with a south to north tending unnamed tributary of Bundamba Creek. Less elevated parts of the north-east corner, comprise Raceview Formation late Triassic sub-labile to quartzose sandstone, shale, mudstone, thin coal seams and siltstones.

The Site comprises undulating to rolling terrain with gentle to moderate slopes to the west, east and south, with floodplain of the Brisbane River further afield (ca. 4 km) to the north. Further afield to the south of the Ripley Valley the terrain associated with the White Rock, Flinders Pak and Mt Goolman areas becomes hilly with moderate to steep slopes. The Atlas of Australian Soils (Queensland 1:2,000,000) has defined the soil type as "duplex yellow-grey, hard setting A horizon, A2 horizon conspic bleached, acid pedal mottled B horizon". These are hard pedal mottled-yellow duplex soils.

Unconsolidated alluvial deposits (land zone 3) were associated with the Bundamba Creek Tributary and characterised by red sand becoming shallower on the lower and upper slopes while sandy soils derived

11: Specific, Measurable, Achievable, Relevant, and Time-Bound (**SMART**).
12: With respect to the Interim Biogeographic Regionalisation for Australia

from coarse to fine grained sedimentary parent geological (land zone 9-10) deposits were present throughout the rest of the Site.

(c) Topography and Drainage

Site topography is shown on **Figure 9** gently rises in the south-western portion of the Site (approximately 56 m AHD elevation), with a gentle fall from the south-west to north-east. Two ephemeral drainage features are present on the Site; the aforementioned south to north flowing waterway (approximately 28 m AHD elevation), which bisects the site (un-named Bundamba Creek tributary) and a smaller west to east tending gully which roughly parallels the northern boundary. The confluence of these two hydraulic features is immediately to the north of the Site.

Several agricultural dams are currently located along the mapped Bundamba Creek tributary on Site. The southern components tributary has historically largely been unaffected by agricultural or urban development; however, it exhibits signs of degradation (bed and bank instability) on account of changed hydrological function as a result of land use changes and physical bank disturbance from agistment of horses and livestock, and rural-residential recreation activities (e.g. motorbike use). The northern components have been subjected to development in-stream (farm) dams and greater grazing pressure with much of the understorey presenting as open paddocks with scattered eucalypts.

The west to east tending overland flow path has been subjected to extensive historical and contemporary clearing. The construction of an on-line dam in the north-west portion of the Site has resulted in significant degradation of this waterways ecological values. A combination of highly dispersive soils and agricultural and urban clearing practices has resulted in an eroded high bank with no associated riparian community and an altered hydrological regime.

As part of the development application under the provisions of the RVPDA, a waterway assessment has been undertaken over the northern most drainage feature (and dam). This assessment was undertaken by a reputable aquatic expert[13] to determine the current aquatic viability of the dam and associated drainage feature. As part of this assessment, it was determined that the drainage feature, which did not support any clearly defined beds or high banks, is highly degraded and is considered to be a broad overland flow path during high rainfall events. This assessment concluded that the drainage feature and dam does not support any significant aquatic ecological features or values.

3.2.2 Bioregional Characteristics of the Site

(a) Bioregional Context

The Site falls outside of mapped Regional Biodiversity Corridors and recognised bioregional corridors of Regional and State significance (**Figure 6**), as defined within the Queensland Government's Biodiversity Planning Assessment (**BPA**) mapping.

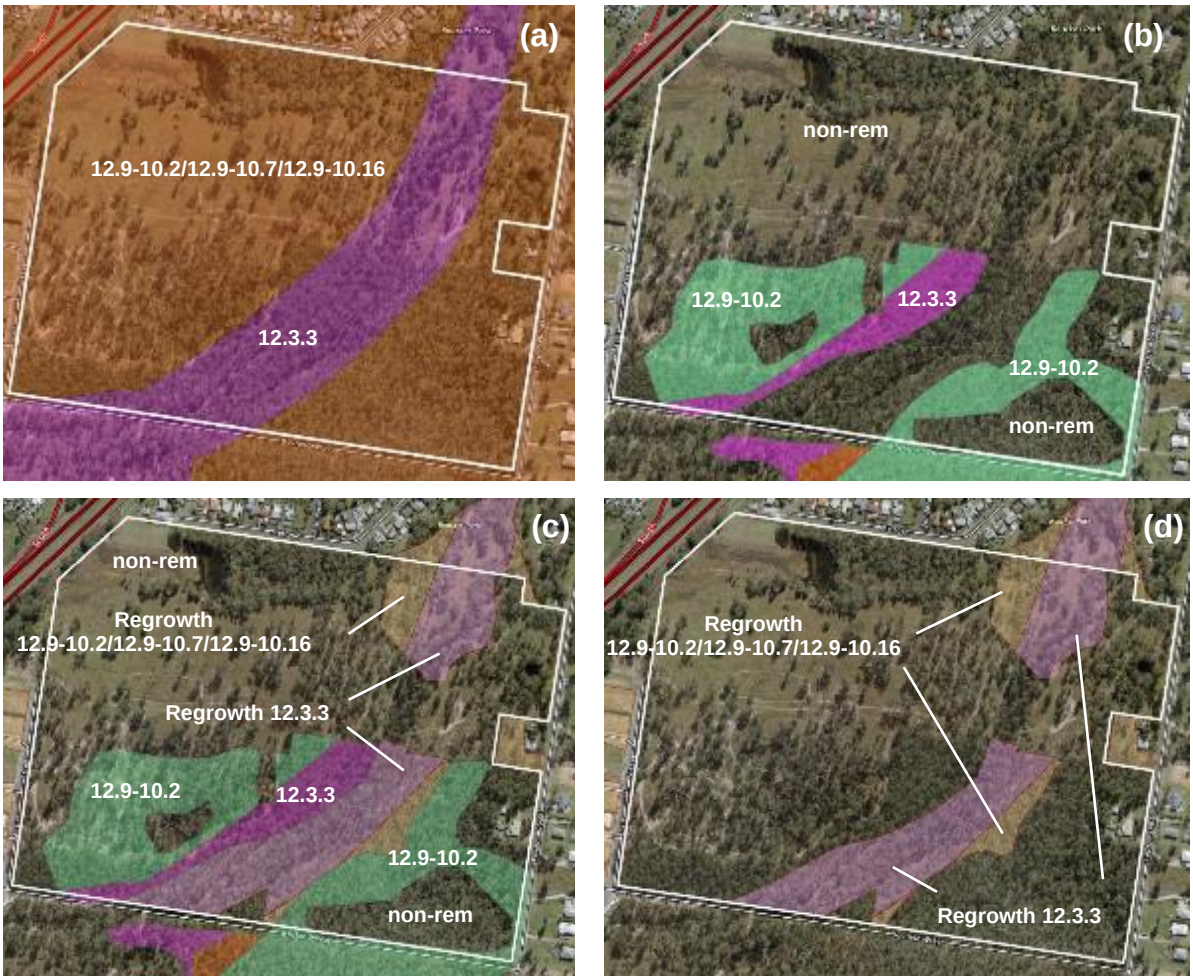
A review of the Site's regional context has been undertaken through the use of aerial photography interpretation coupled with Remnant Vegetation[14] mapping as an aid to assist in identifying more intact, higher quality habitats (**Figure 6**). In a regional context, this mapping illustrates Regional Biodiversity Corridors (ShapingSEQ) associated with the vast tracts of remnant vegetation in the Flinders – Karawatha Corridor approximately 10 km south of the Site. Other State and Regionally Significant corridors have also

13: Aquatic surveys were undertaken by Lauren Thorburn, BSc (Hons), CEnvP of Ecological Service Professionals Pty Ltd.
14: A presumed likelihood of higher quality vegetation and habitat is expected. These areas also form components of more well connected intact native vegetation communities.

been illustrated within **Figure 6**. Remnant Vegetation is largely associated with these mapped corridors and is significantly more intact where associated with the Flinders – Karawatha Corridor.

(b) Regulated and pre-Clearing Vegetation

The extent and status of the current areas of mapped Regulated Vegetation are illustrated in **Inset 1**, with Queensland Government Vegetation Management Reports appended as **Appendix 14**. Queensland Herbarium pre-clear RE mapping[15] (see **Inset 1**) shows that the majority of the Bundamba Creek Tributary areas within the Site supports RE 12.3.3. All other areas on the Site historically supported a mixed complex of RE 12.9-10.2/12.9-10.7/12.9-10.16[16].



Inset 1: Preclear Regional ecosystems, top left (a); Category B (Remnant) regional Ecosystems, top right (b); Composite Category B (remnant) and Category R (High Value Regrowth) vegetation, bottom left (c); Category R (High Value Regrowth) vegetation, bottom right (d). NB.: Non-remnant areas are considered regulated Category X.

15: Sourced from the pre-clear dataset within Queensland Globe.
16: At a ratio of 70/25/5 respectively.

A summary of both pre-clearing and current Regional Ecosystems (**RE**s) mapped over the Site is provided in **Table 4**. The full description for these communities can be found in the Regional Ecosystem Description Database (**REDD**) prepared by the Queensland Herbarium[17].

Table 4: Regulated Vegetation

Re Type	VMA* Class	Short Description	Pre-clear RE Map	Current RE Map
12.3.3[18]	Endangered	*Eucalyptus tereticornis woodland on Quaternary alluvium*	Yes	Yes
12.9-10.2[19]	Least Concern	*Corymbia citriodora subsp. variegata +/- Eucalyptus crebra* open forest on sedimentary rocks	Yes	Yes
12.9-10.7[20]	Of concern	*Eucalyptus crebra +/- E. tereticornis, Corymbia mlaris, Angophora spp., E. melanophloia* woodland on sedimentary rocks	Yes	No
12.9-10.16[21]	Of Concern	*Araucarian microphyll to notophyll* vine forest on Cainozoic and Mesozoic sediments	Yes	No

** Vegetation Management Act 1999* (Qld) (**VMA**)

(c) Ground-truthed Vegetation Communities

The vegetation supported by the Site has been subjected to historic broad-scale and selective clearing and indicates vegetation communities of various age cohorts including scattered remnant canopy retained in open paddocks, advanced regrowth and regrowth areas.

The surveys generally found that the most complex and valuable habitat within the Site is associated with the riparian habitats supported along main (south-west to north-east), unnamed Bundamba Creek Tributary. These supported large, scattered, mature trees, including *Eucalyptus tereticornis* (Queensland blue gum) with suppressed *Corymbia intermedia* (pink bloodwood) and *Angophora leiocarpa* (smooth-barked apple). This canopy habitat supports hollows of various sizes and types throughout and provides roosting opportunities for arboreal fauna that utilise these features. These habitat features, along with the Queensland blue gum, provide a more stable and abundant supply of fruiting and flowering resources and is subsequently of greatest benefit to koala, grey-headed flying-fox and greater glider.

3.2.3 Threatened Flora and Vegetation Community Searches

Targeted botanical surveys undertaken failed to record any species listed as MNES species or Threatened Ecological Communities (**TECs**) under the EPBC Act, or any state listed **CREVNT**[22] species listed under the *Nature Conservation Act 1992* (**NC Act**). Surveys have found that tree species supported on Site are generally consistent with the State Mapping.

17: https://apps.des.qld.gov.au/regional-ecosystems/
18: https://apps.des.qld.gov.au/regional-ecosystems/details/?re=12.3.3
19: https://apps.des.qld.gov.au/regional-ecosystems/details/?re=12.9-10.2
20: https://apps.des.qld.gov.au/regional-ecosystems/details/?re=12.9-10.7
21: https://apps.des.qld.gov.au/regional-ecosystems/details/?re=12.9-10.16
22: Critically Endangered (CR), Endangered (E), Vulnerable (V), Near Threatened (NT), with respect to the *Nature Conservation Act* (Qld) 1992 and the *Nature Conservation (Animal) Regulation* (Qld) *2020.*

3.2.4 Tree Survey

A tree survey utilising differential Global Positioning System (**GPS**) to pick up native tree species greater than 200 mm Diameter at Breast Height (DBH)[23]. The location of trees in relation to the Project Footprint have been plotted and are shown in and a detailed plan and tree schedule of tree details is presented as **Appendix 6**.

Tree survey data has been processed and analysed to identify all trees, koala habitat trees, winter flowering trees of importance to grey-headed flying-fox and greater glider habitat trees.

3.3 MNES of Interest to the PD and Technical Details of the Species

3.3.1 Habitats for Threatened Species

For the purpose of conducting habitat quality assessments, the site can be broadly separated into three (3) distinct habitat Assessment Units based upon vegetation and vegetation communities present (as influenced by present and historic land uses), land zones and pre-clear REs.

These vegetation communities and land zones / pre-clear REs have been used to identify the Modified Habitat Quality (**MHQA**) Assessment Units (**AUs**) outlined in below. Within each of these areas there remain sub-areas and ecotonal changes which alter the balance of features based on factors including topography, drainage, aspect, level of ongoing maintenance, grazing by horses, weeds and weed distribution vectors.

The habitat quality at the Impact Site has been assessed using a modified version of the Queensland Government's *Guide to Determining Terrestrial Habitat Quality: A toolkit or assessing land-based offsets under the Queensland Environmental Offsets Policy (Version 1.2)*. The relationship between Regional Ecosystems, Assessment Units, Vegetation Communities and The Modified Habitat Quality Assessment (**MHQA**) sites is outlined in **Table 5** with sampling effort compliance against the requirements of HQA version 1.2 shown in **Table 6**. MHQA assessment sites and Assessment units are presented as **Figure 8**.

Table 5: Relationship between Regional Ecosystems, Assessment Units, Vegetation Communities and MHQA Assessment Sites – Impact Area (IA)

Descriptor	Site		
Preclear Regional Ecosystem (RE)	12.9-10.2		12.3.3
Current regulated vegetation status*	Category X	Category B, X and R	Category R, X and B
Impact Area Assessment Unit (IA AU)	IA AU1 Open Paddocks with Scattered Native Trees	IA AU2 - Regrowth Open Forest	IA AU3 Remnant Qld blue gum Open Forest
MHQA Site	4, 5 and 6	1 and 3	2 and 7

* Described in order of relative abundance within each Assessment Unit

23: Diameter at breast height (DBH), measure at a point 1.3 m above natural ground

Table 6: MHQA Sampling for Each AU Expressed as Total Area of Assessment Units Sampled

IA AU	Total Area (ha)	Number of plots	Total plot area (ha)	Percentage of AU Sampled (%)	HQA version 1.2 Notes
1	21.75	3	1.5	6.9	Suggested minimum number of sampling sites for units of 0-50 ha is 'at least 2. This may be streamlined if it can be demonstrated a polygon is uniform in condition
2	13.97	2	1.0	7.2	
3	11.75	2	1.0	8.5	

(a) Assessment Unit 1 – Open paddocks with scattered native trees on former RE12.9-10.2

Assessment Unit 1 (**AU1**) (21.75 ha) occupies 45.8% of the western and northern less elevated parts of the site and is dominated by exotic pastural grasses and scattered mature canopy trees (paddock trees) characteristic of the pre-disturbance community (refer **Plates 1a, 1b** and **2**). Structurally RE12.9-10.2 is typically an open forest.

Historically, AU1 underwent clearing, selective logging and or canopy thinning (refer **Section 2.2** and **Figure 4a-h**), such that today it is largely mapped under State regulated vegetation mapping as Category X (non-remnant) vegetation (refer **Inset 1**). AU1 does include a small component (ca. <5% of the total AU area) of Category R (High Value Regrowth) vegetation. Structurally the community is described as a sparse woodland with an exotic dominated grassy understorey.

Canopy species include *Eucalyptus tereitcornis* (Queensland blue gum) dominating on the lower slopes with *Corymbia citriodora subsp. variegata* (spotted gum) dominant on the upper slopes. Associated species included *Corymbia* intermedia (pink bloodwood), *Angophora leiocarpa* (smooth-barked apple) and *Eucalyptus siderophloia* (northern grey ironbark) in the western extent of the AU.

Plate 1a: Representative habitat condition of Assessment Unit 1 (Assessment Site 4)

Plate 1b: Representative habitat condition of Assessment Unit 1 (Assessment Site 6)

Plate 2: Representative habitat condition of Assessment Unit 1 (Assessment Site 5)

(b) Assessment Unit 2 - Regrowth Open Forest on former RE12.9-10.2

Assessment Unit 2 (**AU2**) (13.97 ha) occupies 29.4% of the southern upper slopes of the Impact Site, straddling the unnamed waterway. AU2 consists of community with a moderately intact canopy, sub canopy and understorey layers, although exotic pasture grasses, forbs and shrubs are present.

Historically, AU2 has undergone clearing, selective logging and or canopy thinning (refer **Section 2.2** and **Figure 4a-h**), such that today it is largely mapped under State regulated vegetation mapping as Category B (Remnant) (ca. 62% of total AU) with Category R (High Value Regrowth) (ca. 33% of total AU) with some Category X (non-remnant) (ca. 5% of total AU) vegetation (refer **Inset 1**). The AU consists of advanced regrowth RE12.9-10.2 and structurally this RE typically presents as an open forest in eastern parts of the SEQ bioregion within the 800-1,000 mm per annum **isohyet**.

The canopy is characterised by mature native species with *Corymbia citriodora subsp. variegata* (spotted gum) dominant on the upper slopes and *Eucalyptus tereitcornis* (Queensland blue gum) dominating the lower slopes. Associated species included *Corymbia intermedia* (pink bloodwood), *Angophora leiocarpa* (smooth-barked apple) and *Eucalyptus siderophloia* (northern grey ironbark).

Plate 3: Representative habitat condition of Assessment Unit 2 (Assessment Site 3)

Plate 4: Representative habitat condition of Assessment Unit 2 (Assessment Site 1)

(c) Assessment Unit 3 – Regrowth and Remnant Queensland Blue gum open forest RE12.3.3

Assessment Unit 3 (**AU3**) comprising 24.8% of the Site, occupies the 11.75 ha flattened floodplain of the southern tending unnamed tributary of Bundamba Creek. The waterway is a braided, meandering system that opens into an alluvial floodplain in the northern extent of the Site. The AU consists of regrowth and remnant RE12.3.3, structurally a woodland in northern parts of the Site, and an open forest in southern parts. The AU is characterised by Category R (High Value Regrowth) comprising ca. 56% of the AU, Category B (Remnant) comprising ca. 27% of the AU, with some Category X (non-remnant) comprising ca. 17% of the AU.

Historically, AU3 has undergone clearing, selective logging and or canopy thinning (refer **Section 2.2** and **Figure 4a-h**). In northern parts of the Site, to the north of the proposed waterway crossing (represented by MHQA Assessment Site 2, **Figure 8**), AU3 is represented by Category R (High Value Regrowth) with some Category X (non-remnant) vegetation (refer **Inset 1**). To the south of this proposed waterway crossing, it is represented by Category B (Remnant), Category R (High Value Regrowth) with some Category X (non-remnant) vegetation at the point of the proposed waterway crossing (refer **Inset 1**).

The vegetation forms a mix of remnant and regrowth open forest with a canopy dominated by *Eucalyptus tereticornis* (Queensland blue gum), with associated *Angophora leiocarpa* (smooth-barked apple), *Corymbia intermedia* (pink bloodwood) and the occasional *Corymbia tessellaris* (Moreton Bay ash).

In contrast with the disturbed / modified nature of the lower strata of AUs 1 and 2, the mid-storey is dominated by *Lophostemon suaveolens* (swamp box) in dense stands adjoining the creek banks and the lower alluvial terrace*. Acacia disparrima* (hickory wattle) and *Alphitonia excelsa* (red ash) are also present throughout the mid-storey.

The shrub layer is sparse and contained regenerating mid-storey and canopy species as well as *Alstonia constricta* (quinine bush), *Breynia oblongifolia* (coffee bush), *Glochidion ferdinandi* (cheese tree) and patch infestations of *Lantana camara** (lantana). The understorey contained a variety of native grasses and herbs including various *Lomandra* species, *Leersia hexandra* (swamp rice grass), *Ottochloa gracillima* (graceful grass), *Imperata cylindrica* (blady grass) and *Cynodon dactylon** (couch grass).

Semi-aquatic and macrophytes of the waterway include *Philydrum lanuginosum* (woolly frog's mouth), a number of *Juncus* species and *Nymphoides indica* (water snowflake).

AU3 becomes variable the northern where the Site has been subject to greater historical disturbance and modification. Similarly, the extent of exotic pest plants increased towards the northern extent of the Site, with dense patches of lantana present. The southern extent of the community was generally intact and contained mature remnant canopy and scattered relict trees (refer **Plates 5** and **6**).

Plate 5: Representative habitat condition of Assessment Unit 3 (Assessment Site 7)

Plate 6: Representative habitat condition of Assessment Unit 3 (Assessment Site 2)

3.3.2 Koala

(a) Abundance, Distribution, Ecology and Habitat Preferences

The koala is known to occur over much of eastern and central Queensland, New South Wales, Victoria and some areas of South Australia. Whilst the overall extent of koala distribution has remained largely unchanged, over the past 200 years populations have declined and local extinctions, largely due to clearing and fragmentation of eucalypt woodland and forest (McAlpine *et al.* 2015), have occurred. Koalas occur across much of Queensland including its islands and, the south-east corner of the state, has historically housed populations of the highest density.

Koalas live in a range of open forest and woodland communities; however, their habitat is determined by the presence of their preferred food trees (*Eucalyptus, Corymbia, Angophora, Lophostemon* and *Melaleuca*). Koalas can occur in higher population densities in environments where these food trees grow on more fertile soils and within riparian areas; however, they are also found within partially cleared habitat, utilising scattered paddock trees and roadside vegetation and in urban areas where suitable food trees are present (Barth *et al.* In Press).

Home range size varies across mainland Queensland, with reported ranges exceeding 100 ha in central Queensland (Ellis *et al.* 2002) and less than 8 ha in the south-east (Dique 2004). Although koalas are known to be highly selective in their diet (Moore & Foley 2000), recent work suggests that they have adapted to regional food sources over time (Kjeldsen *et al.* 2019).

Contemporary (post 1990) koala records within 25 km of the Site (**Figure 12**) show close to 4000 records within close proximity to urban development associated with the expanding urban fringe. Comparatively there are fewer records within the larger blocks of contiguous vegetation to the south (White Rock / Flinders Peak conservation areas). This should not be viewed as an indicator habitat preferences, rather it is a function of observer numbers and searching / encounter rates.

(b) Extent of Habitat Within and Surrounding the Site

The koala is listed as an 'endangered' species under the EPBC Act. A significant proportion of Queensland's native vegetation, especially in South East Queensland, can be under the *National Recovery Plan for the Koala Phascolarctos cinereus (combined populations of Queensland, New South Wales and the Australian Capital Territory)* (DAWE 2022b) as critical habitat for koala. The Site is considered habitat critical to the survival as it is likely:

- that the site provides habitat during periods of stress
- habitat present can be considered to be used by koala to meet essential life cycle requirements and it contains known forage habitat
- the habitat forms a corridor necessary for the movement of koala.

Koala habitat comprising Remnant and High Value Regrowth Regional Ecosystems comprised of known koala habitat and forage trees, within 25 km of the Site has been derived from Queensland RE datasets and is mapped as **Figure 13**. Within this area there is 68,463 ha of remnant and regrowth vegetation (34.9% of the total area). The mapping shows extensive habitat to the south (White Rock / Flinders Peak conservation areas) with less extensive but important habitat associated with *Eucalyptus terticortnis* (Queensland blue gum) dominated open forests and woodlands associated with the extensive alluvial plains on Warrill Creek to the south-west of the Site. The Cunninham Highway, urban development associated with Ipswich City and the Brisbane River functionally prevent movement north – south.

Considering koala habitat within the context of the immediate locality, the Site is located within the northern reaches of the RVPDA and is enveloped on three (southern, northern, and western), of its four sides by existing high density urban infrastructure or future urban development (**Figure 6**) and to the east by low density residential development.

To the north of the Site occurs low-density residential development off Melrose Drive, which is bound to the north by Cunningham Highway. To the west of the Site occurs a contemporary low-density residential development, Cunningham Highway and a recent residential development further west of the Highway. The parcel of land to the south has recently been approved and is under construction establishing of a low-density residential development including an educational facility for Goldfield Northern Pty Ltd (EPBC Ref: 2017/8095). This development has commenced clearing and construction work. The approved development layout includes the retention of lower alluvial areas as an open space and recreation corridor with immediate connectivity to the Sites Open Space and Conservation Corridor. Finally, larger rural residential allotments supporting various levels of vegetation cover exist to the east of Fischer Road and the Site. The Swanbank – New Chum Industrial precinct exists further to the east.

Outside of the Open Space and Recreation Corridors that will be established as part of the approved development to the south, suitable koala habitat and movement opportunities exist on the balance of the large rural residential allotments to the east of the Site[24] and limited areas of open space in Rourkes Park to the north of the Site (off Melrose Drive). The Cunningham Highway to the north and west of the Site forms a significant ecological impediment for koala and no areas of suitable habitat are present further west of this feature.

At a Site level, significant levels of in-field assessment have been undertaken to determine the quality of the vegetation communities present within the Site and suitability as habitat for koala. As part of initial ecological investigations undertaken in 2018[25], four Spot Assessment Technique (**SAT**)[26] surveys (see **Text Box 1**) (**Figure 11**) found low levels of scat evidence in areas of remnant open forest and none in eucalypt-dominated regrowth areas or open paddocks.

Text Box 1: SAT method

The Spot Assessment Technique (SAT) method (Phillips and Callaghan (2011) is an assessment of koala activity involving a search for any Koalas and signs of koala usage. The SAT involves identifying a focal tree where a koala or scats are found. The next closest habitat tree to the first tree is then assessed and so on until the 30 closest trees to the original focal tree have been recorded. The number of trees showing evidence of Koalas is expressed as a percentage of the total number of trees sampled to indicate the frequency of koala usage. Assessment of each tree involves a systematic search for koala scats beneath the tree within a 1 m radius of the trunk. After approximately two minutes of searching for scats, the base of the trunk is observed for scratches and the crown for potential koala presence. A koala scat meander is a method used to identify a koala habitat focal tree for use in a SAT survey.

Each scat meander consists of searching for koala scats under tree species likely to be utilised by Koalas. A search for koala scats at the base of the tree is undertaken and where none are found the trunk is observed for scratches and the crown of the tree for potential Koalas present. If no scats, indicators of presence/utilisation or Koalas are observed, another nearby tree is chosen and the search is repeated. The process continues until a scat, indicator or koala is found or 30-minutes has expired.

24: It is reasonable to assume that this vegetation will be maintained by virtue of these properties planning designation outside of the RVPDA and within the Rural Constrained Zone under the ICC Planning Scheme.
25: 9 October 2018
26: Phillips, S & Callaghan, J (2011). 'The Spot Assessment Technique: a tool for determining localised levels of habitat use by Koalas Phascolarctos cinereus'. Australian Zoologist Volume 25 (3).

These surveys indicated a very low density of koala usage across the Site (**Table 7**). The areas where evidence of koala presence was identified were connective with offsite habitats to the south, being comprised of the Queensland blue gum on alluvial flats. More detailed surveys undertaken by Mark Sanders in 2020 (**Appendix 11**) did not detect the presence or evidence of koala despite four nights of spotlighting and significant efforts searching for scat and scratch evidence[27]. It is worth noting that studies undertaken for the adjoining EPBC Approved (2017/8095) Residential Development to the south also similarly identified very low levels of koala evidence, limited to the lower alluvial areas of this adjoining property.

Table 7: Summary of SAT Results

SAT Site Number	Evidence of Koala Use (%)	Koala Use (High/Medium/Low)[1]
S1	26.6	Medium
S2	13.3	Low
S3	13.3	Low
S4	13.3	Low

1. Wither reference to Phillips and Callagham (2011)

Vegetation outside of the Bundamba Creek tributary corridor has been subject to ongoing modification and disturbance. The western and north-western open paddock areas in particular supported a range of suitable koala habitat trees; however, the nature of these areas means that the distance between trees for koala is substantially increased. This provides lower habitat amenity for koala and increases the risk to koala of dog attacks when compared to the high-quality and more intact areas in the central/east of the Site.

Notwithstanding, detailed tree survey assessment indicated a variety of koala food tree species present within the Site including the preferred Queensland blue gum and other species such as smooth-barked apple, *Eucalyptus siderophloia* (grey ironbark), *Corymbia intermedia* (pink bloodwood), *Eucalyptus moluccana* (gum-topped box), *Corymbia citriodora* subsp*. variegata* (spotted gum), *Corymbia tessellaris* (Moreton Bay ash) and *Eucalyptus fibrosa* (large-leaved red ironbark). Habitat assessments over the Site for the Proposed Action determined the Site is considered suitable koala habitat despite the identified lack of usage.

(c) Quality and Importance of Habitat Within and Surrounding the Site

To determine the quality and importance of habitat for koala, it is necessary to understand a habitat's role within the broader landscape and its connectivity to other areas that are likely to support and convey movement of koala. The Site has been subject to broad-scale, selective thinning and other disturbance events since the 1940s which are considered highly likely to have caused disruption to koala numbers which may have been present within the Site and locality at those times. The riparian habitats associated with tributaries of Bundamba Creek within the lower components of the Site (and locality), have historically been subjected to lesser disturbance (clearing/thinning) than more fertile areas to the west and forested areas to the east and south and have been a consistent habitat feature available to koala within the broader landscape.

27: Sanders, Mark EcoSmart Ecology Ripley Gateway North Terrestrial Vertebrate Survey April 2020

As highlighted in **Figure 5**, the Site and its immediate locality have been subjected to reduction in habitat quantity and quality a result of historical land use. This process of habitat degradation increased as a result of the gazettal of the RVPDA and will continue as a result of recent, and future development approvals.

When reviewing relevant development approvals and their constituent Context Plans, most notably the adjoining Context Plan to the south, there is clearly a clear intent to define and retain in south to north tending Ecological Corridor. By virtue of the Proposed Action's development layout, a designated biodiversity corridor, complementing and adjoining a corridor to the south has been established with immediate connectivity into the open space areas of Rourkes Park (north of Melrose Drive) through alluvial open forest habitats of the Site and those similar habitats proposed for retention within the approved development to the south. These are the designated open space and Linear Habitat Corridor identified in **Figure 5.**

This corridor represents opportunities for on-going koala movement within the locality, and for residency. This area of linear habitat will provide abundant, higher-quality dietary resources given its context within the landscape (e.g. for productive alluvial flats supporting a known high-quality feed species- Queensland blue gum). The width of this corridor area also provides opportunity for koala dispersal past any individual resident koala (e.g. males dispersing through other koala home ranges).

Separately, the vegetated balance of the rural allotments located east of Fischer Road also form a north – south movement corridor. This area of habitat will remain connective with that proposed for retention within the Proposed Action through Rourkes Park. The areas of habitat within the rural properties to the east are expected to be retained within the landscape by virtue of these properties being situated outside of the RVPDA, zoned rural and subject to numerous legislative environmental constraints.

(d) Known Populations or Records

More broadly, a search of the Wildlife Online database (**Appendix 15**) indicates 192 records within a 5 km radius of the Proposed Action area (an average of 1 record per 40.9 ha). This search area encompasses large expanses of well-vegetated, freehold properties to the south of the Site including in Ripley Valley, south Swanbank and White Rock. Within a reduced 2 km radius (the Proposed Action area and immediate surrounds), there are 44 records of koala (an average of 1 record per 28.5 ha). This is in keeping with the results of the numerous surveys undertaken over the Site and the surrounding local government area, which identify considerably low levels of koala usage (EPBC Ref: 2017/8095).

(e) Koala Records and Habitats on Site

Studies within the Site found limited to no usage of the Site by koala, with the 2018 SAT surveys only identifying very low levels of scat evidence, confined to the remnant areas; while all other detailed surveys failing to detect any evidence of koala. It is also noted that documentation submitted to the DEECCW for the adjoining EPBC Referral (EPBC 2017/8095) completed a total of 30 SAT surveys over this property by Austecology in 2014 and Saunders Havill Group in 2017. The results of these surveys identified comparatively low levels of koala activity, limited to the drainage line connective with the Site.

Given the lack of koala evidence, it is considered that the Site supports limited koala abundance, likely to be limited to individual koalas moving through the locale. The lack of records over numerous surveys also indicates that it is unlikely individual koalas were residing at the Site during the survey period. Higher quality habitats aligned with the intact remnant vegetation in the lower alluvial areas present the greatest quality foraging and dispersal habitat.

While koala records are scant over the Site and adjoining properties to the south and west, the vegetated areas of the Site remain as viable koala habitat given the presence of food and shelter trees. As such, it is

considered that the areas of the Site supporting koala habitat trees forms habitat critical to the survival of koala based on the definition under the EPBC Act Koala referral guidelines.

(f) Site Surveys undertaken and their Adequacy

As part of the ongoing ecological assessment of the Site, numerous and regular in-field assessments have been undertaken for various purposes which have required a substantial presences of ecological staff presence on the Site. These surveys have included a targeted terrestrial vertebrate survey for a total period of 5 days and 4 nights in March 2020 by the recognised zoologist, Mark Sanders (**Appendix 11**)[28]. Further, extensive tree survey effort throughout the Site (for all native trees greater than 200 mm DBH see **Appendix 6**) has clearly illustrated the presence of the arrangement of koala habitat within the Site. As part of this in-field survey effort, there was considerable opportunity for the direct and indirect observation of koala on the Site (e.g. spotlighting and SAT surveys); however, no signs of koala utilisation or direct confirmation by observation or call made by the March 2020 assessment nor was any scratch or scat evidence observed.

SAT surveys, a useful indirect[29] assessment technique for koala were undertaken in accordance with the methodology developed by Phillips & Callaghan (2011) in both 2018 and 2020. Whereas SAT surveys during 2018 were successful in identifying low levels of koala evidence within the Site, recent efforts during 16-20 March 2020 failed to identify any scats (see **Appendix 11** despite two ecologists undertaking 10 person hours (approx.) of searches around 100 eucalypts (EcoSmart Ecology 2020). The results of the initial SAT assessments recorded scat densities consistent with an 'east coast low density population' (Phillips & Callaghan 2011). This result *is consistent* with findings for the adjoining (south) Ripley Projects Pty Ltd site (2017/8095) which found only very low levels of koala use at 2 out of 30 SAT sites, limited to the lower alluvial areas connective with the Site.

The SAT methodology is considered to be an accurate technique for estimating low-density Koala populations and further, is considered to provide an accurate determination on the activity levels (Mossaz 2010). Therefore, in consideration of SAT technique accuracy, and the absence of other evidence of site utilisation or direct observation, it is considered that the field surveys undertaken to date have been sufficient in establishing a sufficient baseline of koala utilisation of the Site, the theoretical carrying capacity assumptions are sound, and therefore, no further in-depth studies are necessary.

3.3.3 Grey-headed flying-fox

(a) Abundance, Distribution, Ecology and Habitat Preferences

The grey-headed flying-fox occurs in coastal and sub-coastal areas from Rockhampton in central Queensland to Melbourne in Victoria. Within this distribution, patterns of occurrence and relative abundance fluctuate significantly across seasons and between years, as the species selectively forages where its food is available within the landscape. The cities of Brisbane, Newcastle, Sydney and Melbourne are continuously occupied by the grey-headed flying-fox, with use of roost sites varying within these locations (DAWE 2019a).

Regional grey-headed flying-fox records within 25 km of the Site (**Figure 12**) show >200 records (the majority of which) are within close proximity to urban development. Comparatively there are fewer records within the larger blocks of contiguous vegetation to the south (White Rock / Flinders Peak conservation

28: Sanders op. cit.

29: The SAT technique does not provide any information on the period of koala presence (or absence) or the level of actual site activity (abundance)

areas). This should not be viewed as an indicator habitat preferences, rather it is a function of observation rates rather than presence associated with searching effort / encounter rates.

Grey-headed flying-fox roost in temporary or permanent camps during the day and traverses up to 50 km at night in search of food. No flying-fox camps are present at the Site, although four are located within 7 km of the Site: at Woodend, Yamanto, Ipswich Nature Centre and Bundamba (**Figure 13**). These camps are frequented erratically or seasonally (winter) by grey-headed flying-fox with the greatest number, approximately between 500 and 2,499 individuals, recorded from the roost at Bundamba in February 2020 (DEECCW: "National Flying-fox monitoring viewer" Accessed http://www.environment.gov.au/webgis-framework/apps/ffc-wide/ffc-wide.jsf: 28/09/ 2021).

The species prefer to feed on eucalypt blossom, followed by the blossom of other native tree species such as *Melaleuca* and *Banksia* and native fruits. They will take exotic fruits, but these are less favoured. In south-east Queensland flowering Queensland blue gums seem to be particularly important, providing a valuable resource during periods of food scarcity (winter). The loss of large Queensland blue gum stands from low-lying flood plains have caused many camps to become temporary and transient or resulted in individuals needing to traverse larger distances to forage.

(b) Extent of Habitat Within and Surrounding the Site

Resources for the grey-headed flying-fox are most critical during two key periods within their life cycle; winter when other resources are scarce, and during the breeding season between late gestation and early lactation (DAWE 2019a). The Proposed Action will result in the removal of scattered foraging resources across the Impact Area, inclusive of winter foraging resources; with these areas of permanent loss comprising of the 31.62 ha open forest and cleared paddocks adjoining the Linear Habitat. The Linear Habitat contains a variety of winter and spring flowering resources; however, as a result of historic and ongoing modification and disturbance events within the Site, some of the largest old-growth Queensland blue gum specimens within the locality are situated within the areas of retained vegetation in the Linear Park and will provide abundant blossom during winter[30].

The extent of REs and Regrowth vegetation with Queensland blue gum as a dominant or sub-dominant canopy species within 30 km of the Site[31] has been analysed and is outlined in **Table 8** and **Table 9**. The extent of heterogenous polygons have been calculated based on their documented ratios with their sub-regional extent and location shown in **Figure 16** (remnant) and **Figure 17** (regrowth).

Table 8: Extent of REs with Queensland blue gum as a Dominant, Co-dominant or Sub-dominant Canopy Species

RE	Short description	Extent (ha)
12.3.3	*Eucalyptus tereticornis* woodland on Quaternary alluvium	1,228.16
12.3.6	*Melaleuca quinquenervia* +/- *Eucalyptus tereticornis, Lophostemon suaveolens, Corymbia intermedia* open forest on coastal alluvial plains	505.24
12.3.7	*Eucalyptus tereticornis, Casuarina cunninghamiana* subsp. *cunninghamiana* +/- *Melaleuca* spp. Fringing woodland	2,244.42
12.3.11	*Eucalyptus tereticornis* +/- *Eucalyptus siderophloia, Corymbia intermedia* open forest on alluvial plains usually near coast	1,655.27

30: As detailed in EcoSmart Ecology; Terrestrial Vertebrate Survey Ripley Gateway North (**Attachment 8**)
31: A buffer of 30 km represents a subset of the communities grey-headed flying-fox have access to noting recognized foraging ranges can be as great as 50 km.

RE	Short description	Extent (ha)
12.3.19	*Eucalyptus moluccana* and/or *Eucalyptus tereticornis* and *E. crebra* open forest to woodland, with a sparse to mid-dense understorey of Melaleuca irbyana on alluvial plains	195.46
12.3.20	*Melaleuca quinquenervia, Casuarina glauca* +/- Eucalyptus tereticornis, E. siderophloia open forest on low coastal alluvial plains	10.40
12.5.2	*Corymbia intermedia, Eucalyptus tereticornis* open forest on remnant Tertiary surfaces, usually near coast. Usually, deep red soils	47.00
12.8.14	*Eucalyptus eugenioides, E. biturbinata, E. melliodora* +/- *E. tereticornis*, Corymbia intermedia open forest on Cainozoic igneous rocks	3.27
12.8.16	*Eucalyptus crebra* +/- *E. melliodora, E. tereticornis* woodland on Cainozoic igneous rocks	263.43
12.8.17	*Eucalyptus melanophloia* +/- *E. crebra, E. tereticornis, Corymbia tessellaris* woodland on Cainozoic igneous rocks	684.77
12.9-10.27	*Corymbia citriodora* subsp. *variegata* and/or *E. moluccana, E. tereticornis, E. crebra* open forest with Melaleuca irbyana understorey on sedimentary rocks	321.57
12.9-10.7	*Eucalyptus crebra* +/- *E. tereticornis, Corymbia tessellaris, Angophora* spp., *E. melanophloia* woodland on sedimentary rocks	4,329.29
12.11.14	*Eucalyptus crebra, E. tereticornis, Corymbia intermedia* woodland on metamorphics +/- interbedded volcanics	84.60
12.11.9	*Eucalyptus tereticornis* subsp. *tereticornis* or *E. tereticornis* subsp. *basaltica* open forest on metamorphics +/- interbedded volcanics. Usually higher altitudes	40.92
12.12.12	*Eucalyptus tereticornis*, *Corymbia intermedia, E. crebra* +/- *Lophostemon suaveolens* woodland on Mesozoic to Proterozoic igneous rocks	179.25
12.12.23	*Eucalyptus tereticornis* subsp. *tereticornis* or *E. tereticornis* subsp. *basaltica* +/- *E. eugenioides* woodland to open forest on crests, upper slopes and elevated valleys and plains on Mesozoic to Proterozoic igneous rocks	344.18
	Total	**12,137.25**

Table 9: Extent of Regrowth REs with Queensland blue gum as a Dominant, Co-dominant or sub-dominant Canopy Species

RE	Short description	Extent (ha)
12.3.3	*Eucalyptus tereticornis* woodland on Quaternary alluvium	2,617.47
12.3.6	*Melaleuca quinquenervia* +/- *Eucalyptus tereticornis, Lophostemon suaveolens, Corymbia intermedia* open forest on coastal alluvial plains	0
12.3.7	*Eucalyptus tereticornis, Casuarina cunninghamiana* subsp. *cunninghamiana* +/- *Melaleuca* spp. fringing woodland	1,197.19
12.3.11	*Eucalyptus tereticornis* +/- *Eucalyptus siderophloia, Corymbia intermedia* open forest on alluvial plains usually near coast	603.36

RE	Short description	Extent (ha)
12.3.19	*Eucalyptus moluccana* and/or *Eucalyptus tereticornis* and *E. crebra* open forest to woodland, with a sparse to mid-dense understorey of Melaleuca irbyana on alluvial plains	414.16
12.3.20	*Melaleuca quinquenervia, Casuarina glauca* +/- Eucalyptus tereticornis, E. siderophloia open forest on low coastal alluvial plains	3.56
12.5.2	*Corymbia intermedia, Eucalyptus tereticornis* open forest on remnant Tertiary surfaces, usually near coast. Usually, deep red soils	29.14
12.8.14	*Eucalyptus eugenioides, E. biturbinata, E. melliodora* +/- *E. tereticornis*, Corymbia intermedia open forest on Cainozoic igneous rocks	0.40
12.8.16	*Eucalyptus crebra* +/- *E. melliodora, E. tereticornis* woodland on Cainozoic igneous rocks	164.45
12.8.17	*Eucalyptus melanophloia* +/- *E. crebra, E. tereticornis, Corymbia tessellaris* woodland on Cainozoic igneous rocks	952.73
12.9-10.27	*Corymbia citriodora* subsp. *variegata* and/or *E. moluccana, E. tereticornis, E. crebra* open forest with Melaleuca irbyana understorey on sedimentary rocks	922.31
12.9-10.7	*Eucalyptus crebra* +/- *E. tereticornis, Corymbia tessellaris, Angophora* spp., *E. melanophloia* woodland on sedimentary rocks	5,273.75
12.11.14	*Eucalyptus crebra, E. tereticornis, Corymbia intermedia* woodland on metamorphics +/- interbedded volcanics	72.93
12.11.9	*Eucalyptus tereticornis* subsp. *tereticornis* or *E. tereticornis* subsp. *basaltica* open forest on metamorphics +/- interbedded volcanics. Usually higher altitudes	1.79
12.12.12	*Eucalyptus tereticornis*, *Corymbia intermedia, E. crebra* +/- *Lophostemon suaveolens* woodland on Mesozoic to Proterozoic igneous rocks	198.87
12.12.23	*Eucalyptus tereticornis* subsp. *tereticornis* or *E. tereticornis* subsp. *basaltica* +/- *E. eugenioides* woodland to open forest on crests, upper slopes and elevated valleys and plains on Mesozoic to Proterozoic igneous rocks	61.94
Total		**12,514.04**

The Proposed Action will result in the removal of scattered foraging resources across the Impact Area; however, retains the most important component of foraging habitat within the Site, being the intact remnants of winter flowering Queensland blue gum within the Linear Park. Queensland blue gum supplementary planting will also occur throughout the Linear Park as part of restoration works as well as within the drainage reserves and local park spaces, although it is acknowledged these trees will take decades to achieve a size where abundant foraging resources are provided.

For comparison, approximately 12,137 ha of remnant and 12,514 ha of regrowth vegetation (representing winter forage habitat) where Queensland blue gum is listed as a dominant, co-dominant or sub-dominant canopy species occurs within 30 km of the Site (**Table 8** and **Table 9**, and **Figure 16** (remnant) and **Figure 17** (regrowth)). The extent of lost habitat as part of the Proposed Action therefore represents <0.0014% of similar resources within a 30 km range. It is also noted that the components of Queensland blue gum open forest being retained within the Proposed Action support the highest abundance of large,

mature specimens, which provide a more significant foraging resource due to their prolific flowering when compared to the regrowth areas on Site.

(c) Quality and Importance of Habitat Within and Surrounding the Site

As outlined, the Site's most significant habitat for the grey-headed flying-fox occurs within the unnamed tributary of Bundamba Creek corridor centrally through the Site (within the Linear Park). With its dense provision of mature winter-flowering Eucalypts, this corridor is likely to play a role in supporting the fluctuating local population of grey-headed flying-fox within local roost sites)

Further, grey-headed flying-fox are known to traverse up to 50 km a night in search for foraging resources and readily forage within peri-urban and urban environments as indicated by **Figure 14**. As such, the foraging resources on Site are of high quality given the maturity and abundance of winter blossoming resources, particularly those to be retained within the Linear Habitat Corridor. Important winter flowering canopy species on the site are shown on **Figure 18**.

Park. In accord with the National Recovery Plan for the grey-headed flying-fox, where the existence of these important winter and spring flowering vegetation communities is field verified, they are considered habitat critical to the survival of the grey-headed flying-fox. These resources will become increasingly important in a landscape that is experiencing expanding urban development. Habitat on-site affording winter-flowering resources is considered critical habitat.

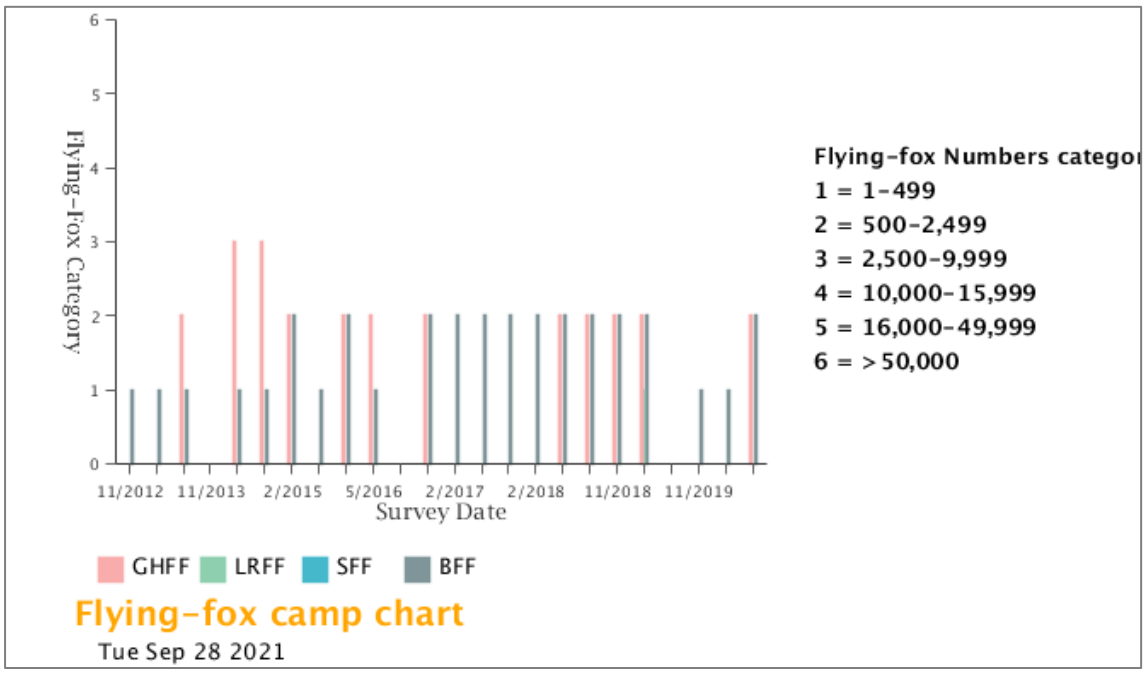
(d) Known Populations or Records

No grey-headed flying-fox are known to camp within the Site or its immediate locality. The closest known camp is identified as the Yamanto Roost off Deebing Creek, approximately 3 km to the west (**Figure 15**).

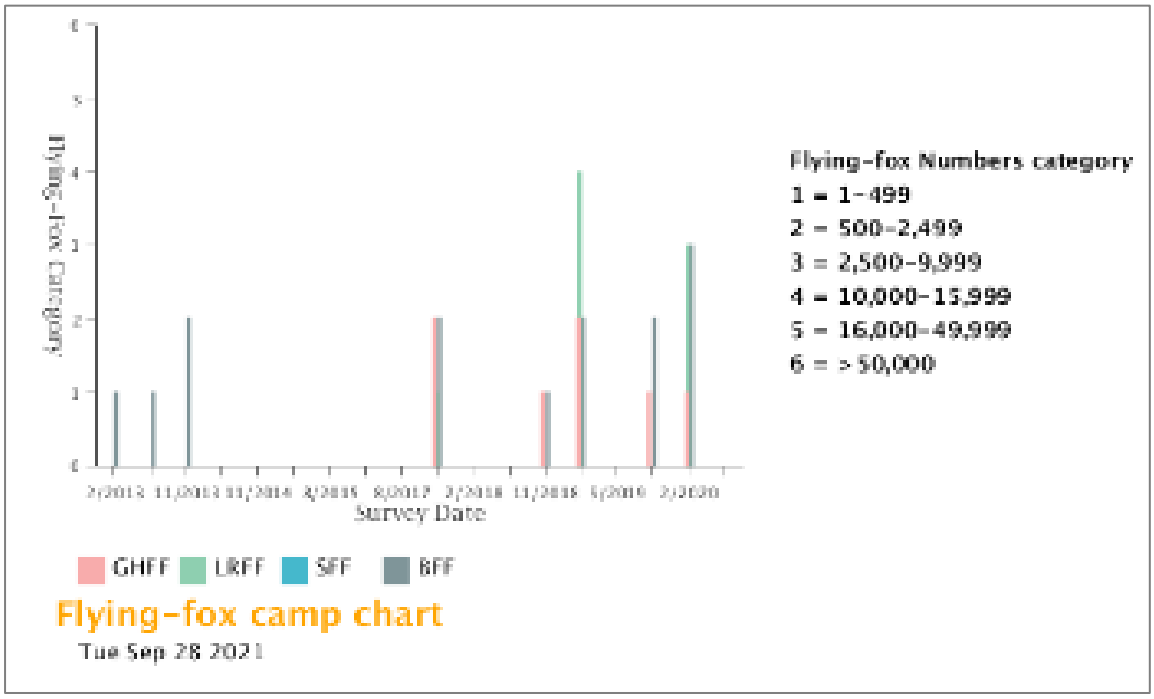
The Yamanto flying-fox camp has been monitored through the national flying fox monitoring program since 2012, and while there is minimal year-to-year variation in the maximum number of grey-headed flying-foxs counted, it appears use of the camp has generally remained steady (**Inset 2**). It is not possible from the data to determine if these trends are due to foraging resource availability, or yearly movement patterns; however, the steady numbers of the camp and its proximity to significant land development projects across the RVPDA suggests good resilience, it also suggests sufficient resources are likely to be available in the locality without those lost through these development areas.

A second flying-fox roost is known to occur approximately 3.8 km north-west at Ipswich Nature Centre, Queens Park, Goleby Ave (**Figure 15**). This roost has been monitored through the National flying fox monitoring program since 2012, and there is substantial year-to-year variation in the maximum number of grey-headed flying-fox counted, with some years resulting in a zero count (**Inset 3**). It is not possible from the data to determine if these trends are due to foraging resource availability, or yearly movement patterns.

Several other Flying-fox Camps are known to occur within 7 km of the Site. Most are used periodically by the grey-headed flying-foxes, and other monitored species.



Inset 2: Yearly maximum counts of grey-headed flying-foxnumbers at the Yamanto camp on Deebing Creek between November 2012 and August 2020. (Source: Commonwealth of Australia (Geoscience Australia) 2015: National Flying Fox monitoring viewer: accessed: 28/09/2021



Inset 3: Yearly maximum counts of grey-headed flying-fox numbers at the Ipswich Nature Centre, Queens Park, Goleby Ave between February 2013 and February 2020. (Source: Commonwealth of Australia (Geoscience Australia) 2015: National Flying Fox monitoring viewer: - http://www.environment.gov.au/webgis-framework/apps/ffc-wide/ffc-wide.jsf). Accessed: 28/09/2021

A search of the Wildlife Online database (**Appendix 15**) indicates 21 records of this species within a 5 km radius of the Proposed Action area and within a reduced 2 km radius (the Proposed Action area and immediate surrounds), there is a single (1) record of this species. This is in keeping with the known roost locations within the broader locality.

(e) Surveys and their Adequacy

Publicly available databases were inspected prior to field survey for records of the species within the local area. This included inspection of the National Flying-fox Camp online resource (DAWE 2019b) and extensive traverses across the Site to confirm flying-fox camps were not present.

Spotlighting surveys were conducted over three nights (17-19 inclusive) in March by two observers aided by high-powered headtorches, spotlights and binoculars. Three (3) hours of spotlighting was conducted each night for a total of 17 spotlight person hours. These survey efforts are consistent with or exceed those recommended for the grey-headed flying-fox in the 'Survey Guidelines for Australia's Threatened Bats' (Reardon 2010).

Whilst the species was not observed within the Site during the various infield survey efforts including the targeted fauna surveys, the species is considered likely to utilise the Site. Survey efforts have further highlighted the abundance and availability of suitable foraging resources within the Site.

3.3.4 Swift parrot

(a) Abundance, Distribution, Ecology and Habitat Preference

The swift parrot breeds in Tasmania during the austral summer and the entire population migrates north to mainland Australia for the austral winter where it feeds on nectar from flowering eucalypts and on lerp (sapsucking insects) on eucalypt leaves. The swift parrot uses habitats across all tenures, with the majority of habitats occurring outside formal conservation reserves. Whilst on the mainland the swift parrot disperses widely, foraging on flowers and lerps in *Eucalyptus* spp. mainly in Victoria and New South Wales. In south-east Queensland only small numbers (usually between 1-5 or sometimes up to 12) of migrating swift parrot infrequently reach the northern extremity of their range, every few years. Swift parrot presence in south-east Queensland is related to a paucity of the species' preferred wintering forage habitat further south is in drought (Saunders *et al.* 2016, Debus 2021).

Research within the Australian mainland over-wintering habitats has identified key foraging habitat types. In south-east Queensland these habitats include the following key species: *Eucalyptus microcarpa* (grey box), *Eucalyptus melliodora* (yellow box), *Eucalyptus robusta* (swamp mahogany) and *Eucalyptus tereticornis* (Queensland blue gum) (Saunders & Tzaros 2011). Within these habitats and their greater breeding and wintering ranges, the swift parrot has been found to preferentially forage in large, mature trees that provide more reliable foraging resources (i.e. more intense and frequent flowering) than smaller, younger trees (Brereton *et al*. 2004; Kennedy & Tzaros 2005; Saunders & Tzaros 2011).

Although they are also known to use a wider range of habitat types, they are thought to do so opportunistically as these do not provide the quality and quantity of resources upon which the species can depend. Due to the presence of aggressive competitors, disturbed areas are thought to provide sub-optimal habitat for the swift parrot (Saunders & Tzaros 2011). Conversely, the presence of non-aggressive competitor species, as well as increasing frequency of lerp and nectar-producing flowers, are all positively correlated with the occurrence of swift parrots at foraging sites (Saunders & Heinsohn 2008).

The swift parrot only nests in Tasmania but relies on mainland regions for over-wintering, mostly in the southern areas of south-east Australia (Victoria and NSW). Roost-tree requirements in mainland Australia are likely similar to those of nest-tree requirements in Tasmania. Nest-tree suitability has been shown to increase with increasing height, diameter at breast height, degree of senescence, and number of hollows (Webb *et al*. 2012). Ecosystems with significant numbers of trees matching these requirements will likely provide important potential habitat for swift parrots in south-east Queensland.

(b) Extent of Habitat Within and Surrounding the Site

In south-east Queensland winter flowering eucalypts, especially Queensland blue gum are important forage resources. Large winter flowering trees (which might attract swift parrot), especially Queensland blue gum are present within the Site, particularly within the unnamed tributary of Bundamba Creek. These will be preserved within the Linear Habitat Corridor as part of the Proposed Action (see **Figure 8**).

However, the disturbed nature of the Site and its history of broad-scale clearing, selective thinning and other disturbance events is likely to reduce the value of the Site for this species. The proximity of the Site to existing dense, urban residential development also reduces the likely value of the Site for swift parrot. The targeted fauna surveys indicated that the Site is widely used by a variety of common peri-urban and edge specialist bird species, many of which are aggressive competitors for the swift parrot.

Further, it is considered that the extent of remnant and regrowth REs within 30 km of the Site which include the favoured forage species Queensland blue gum is provided in **Table 8** and **Table 9.**

Such remnant areas, particularly those located further south of the Site and towards the Flinders – Karawatha Corridor and those large alluvial tracts of Queensland blue gum dominated/co-dominated open forest in Regional Biodiversity Corridors along the Brisbane River (to the north) and Bremer River (to the east) are considered to support higher quality habitats and resources that are more attractive to the species (see distribution of REs whether *Eucalyptus tereticornis* is a dominant, co-dominant or subdominant species within remnant and regrowth Regional Ecosystems within 25 km of the Site; **Figure 16** and **Figure 17**).

(c) Quality and Importance of Habitat Within and Surrounding the Site

The Site's most important habitat for the swift parrot is restricted to the unnamed tributary of Bundamba Creek corridor which has experienced less in the way of historic disturbance events and modification. Whilst these habitats are generally suitable for the swift parrot in terms of the provision of key foraging resources, they are considered to be marginal and may attract only transient individuals of the species on very rare occasion. Further, these areas will be retained and enhanced through the Action.

(d) Known Populations or Records

In south-east Queensland, reported occurrences of Swift Parrots usually involve 1–5 or sometimes up to 12 birds in the outer Brisbane and Ipswich areas, and occasionally Warwick, Toowoomba and Bundaberg areas (Debus 2021).

Records for the swift parrot within 25 km of the Site (**Figure 19**) are located well to the north-east of the Site; largely in the western suburbs of Brisbane. The Brisbane suburb of Kenmore (approximately 20 km north-east of the Site) contains one recent record of the swift parrot (June 2017), as does Logan Reserve (January 1988), approximately 30 km to the east of the Site. The 'cluster of birds' from Springfield Lakes in 2019 represents a small party recorded feeding blossoming eucalypts. The databases consulted showed multiple non-unique records over a number of days.

The lack of records near the Flinders View Site and the infrequency of records in south-east Queensland suggests the species is highly unlikely to occur at the Site; and if visiting, to be highly transient through the locality.

(e) Surveys and their Adequacy

Detailed fauna surveys for onsite bird utilisation were completed during early Autumn, however, detailed mapping and generally ecological surveys were undertaken over the early July period when the onsite

Queensland blue gum were in flower. These detailed tree and generally ecological surveys also coincided with a period where winter swift parrot are potentially present within south-east Queensland. Further, the detailed BioCondition surveys were also undertaken during August in 2020 when Queensland blue gum was also in flower.

Additionally, the species is considered unlikely to occur and possible impacts associated with the minor loss of vegetation from the Impact Area will be mitigated by virtue of the retention of the intact mature Queensland blue gum communities within the Linear Park, coupled with the future values gained by onsite ecological restoration, reconstruction and fabrication. These factors suggest additional targeted surveys for this species are unnecessary.

3.3.5 Greater glider

(a) Abundance, distribution, ecology and habitat preferences

The Greater Glider is an arboreal folivore dependent on large tree hollows (Foley 1987; Kavanagh and Lambert 1990; Comport et al. 1996; Eyre 2006; Smith et al. 2007; Jensen et al. 2015; DCCEEW 2022; Hofman et al. 2022). Larger trees within a forest stand are favoured for both foraging (>30 cm DBH) and denning (>50 cm DBH) (Eyre et al. 2022). Thus, Greater Gliders are more likely to occur and reach higher densities where larger trees are more common.

Greater Gliders prefer to eat young leaves as they have a higher nutrient status and lower toxin levels compared to mature leaves, resulting in seasonal changes in tree species selection and habitat use due to asynchronies in new leaf production (Kavanagh 1984, 1990). Other studies have also demonstrated an effect of leaf nutrient and toxin status and leaf phenology on the species' diet (e.g. Moore et al. 2004; Jensen et al. 2015). This results in preferential use of some tree species within a forest stand (Comport et al. 1996; Kavanagh and Lambert 1990; Eyre et al. 2022) and a patchy distribution through a forested area (Kavanagh and Bamkin 1995; Kavanagh et al. 1995; Wintle et al. 2005; Eyre 2006). In Queensland, Greater Gliders are more common in moist Eucalypt-forest compared to drier forest types, which may be due to higher site productivity, higher leaf nutrient status and lower foliar toxin concentrations (Eyre 2006).

The availability of tree hollows is considered a key limiting resource for the Greater Glider (DCCEEW 2022). Number of hollow-bearing trees varies with forest type (Eyre 2006). It requires at least 2-4 hollows per 2 ha (Eyre 2002). Greater Glider abundance is positively related to the number of live hollow-bearing trees, from 0.7 gliders predicted per 3 ha with one hollow-bearing tree ha-1 to 2.3 gliders with 8 hollow-bearing trees ha-1 (Eyre 2006). Individual Greater Gliders tend to use multiple tree hollows, with a range of 1 – 20 den trees reported (Kavanagh and Wheeler 2004; Lindenmayer et al. 2004; Smith et al. 2007) and they are generally located in the core areas of the home-range (Comport et al. 1996). Greater Gliders occupy hollows with a mean entrance diameter of 18.1 ± 0.6 cm (range 8 – 35 cm) (Hofman et al. 2022).

Home ranges are usually 1-4 ha in size (Henry 1984; Kehl and Borsboom 1984; Comport et al. 1996; Gibbons and Lindenmayer 2002; Pope et al. 2005); however, in lower productivity forest and more open woodland habitats home ranges can be up to 16 ha (Eyre 2004; Smith et al. 2007). Male home-ranges are larger than for females. There is a high degree of home-range overlap between the sexes but not within the sexes, particularly for males (Comport et al. 1996; Kavanagh and Wheeler 2004; Pope et al. 2005). Reported population densities range from 0.35 ha-1 to 2.3 ha-1 (Kehl and Borsboom 1984; Comport et al. 1996; Smith and Smith 2018). Larger home-ranges are associated with lower population density (Pope et al. 2005).

The number of greater gliders declines with increase in percentage of cleared area within 1 km. The smallest forest patch in southern Queensland in which the Greater Glider has been found is 160 ha (Eyre 2006). Due to its patchy use of habitat and limited dispersal ability the Greater Glider may have difficulty

persisting in smaller, isolated forest stands. The Greater Glider is negatively affected by forestry activities (Kavanagh and Bamkin 1995; Kavanagh et al. 1995; Eyre 2006; Maclean et al. 2018). It has long recovery times from fire (20 – 30 years for severe fire) due to mortality and low reproductive output but may persist in unburnt areas (van der Ree and Lyon 2002; Lindenmayer et al. 2013; Berry et al. 2015). The Greater Glider is also threatened by climate change. It appears to poorly tolerate nocturnal temperatures over 20ºC, which may have caused it to decline at low elevations in the southern part of its range (Smith and Smith 2018, 2020; Wagner et al. 2020). Habitat critical to the survival of the Greater Glider is defined as (DCCEEW 2022):

- Large contiguous areas of eucalypt forest, which contain mature hollow-bearing trees and a diverse range of the species' preferred food species in a particular region.
- Smaller or fragmented habitat patches connected to larger patches of habitat, that can facilitate dispersal of the species and/or that enable recolonization.
- Cool microclimate forest/woodland areas (e.g. protected gullies, sheltered high elevation areas, coastal lowland areas, southern slopes).
- Areas identified as refuges under future climate changes scenarios.
- Short-term or long-term post-fire refuges (i.e. unburnt habitat within or adjacent to recently burnt landscapes) that allow the species to persist, recover and recolonise burnt areas.
- Habitat meeting any one of the criteria above is considered critical irrespective of the current abundance or density of greater gliders or the perceived quality of the site as currently unoccupied habitat may be colonized in the future as hollow-bearing trees become more common as the forest matures (DCCEEW 2022). Given its Endangered status, all populations of the Greater Glider are important for its conservation (DCCEEW 2022).

The characteristics of Greater Glider habitat in Queensland is described by Eyre et al. (2022). A reliance on habitat characteristics to define potential Greater Glider habitat was adopted due to uncertainty regarding the detection of the Greater Glider and the difficulty of assessing suitable tree hollows from the ground. The report of Eyre et al. (2022) describes the Queensland Regional Ecosystems known or likely to support the Greater Glider, the species and size of foraging trees, and the species and size of hollow-bearing trees used for denning.

Eyre et al. (2022) defined Greater Glider habitat as:

- A Regional ecosystem with confirmed species records.
- An area that contains important habitat attributes (live or dead hollow-bearing trees, feed trees, large trees, landscape habitat connectivity).
- Eyre et al. (2022), summarising other studies (Comport et al. 1996; Wormington 2003; Smith et al. 2007; Starr et al. 2021), suggest that trees >30 cm DBH are preferred for foraging and trees >50 cm DBH are preferred for denning.

Contemporary (post 1990) greater records within 25 km of the Site (**Figure 20**) shows 23 records to the south and south-east associated with bushland interface associated with the expanding urban development front.

(b) Extent, quality and Importance of known potential habitat

(i) Presence

Spotlighting survey has been undertaken over four nights in April 2020 and two nights in May 2023[32]. Greater glider has not been detected during these surveys, nor has it been detected by ecological survey on adjoining development sites (refer **Figure 8**), including the Hayfields development site to the immediate south[33]. Greater glider is a readily detected species in occupied habitat[34], and repeated failure to record it using contemporary survey methods suggests to us that it is absent rather than elusive and undetected.

Further, given the Site's position in an emerging development area, opportunities for immigration to (and occupation of) the Site will continue to diminish over time. This issue is dealt with in the accompanying *Technical Note on Corridors and Habitat Connectivity* (**Appendix 39**).

Notwithstanding, DCCEEW's policy position is that offsets must be provided for impacts to Habitat Critical to the Survival of Greater glider irrespective of the habitat being unoccupied and potentially 'unoccupiable' in the future. To progress negotiations on this project with DCCEEW, the Proponent accepts this position.

(ii) Habitat

Broad habitat review and regional occurrence

Greater glider require large, mature, hollow-bearing eucalypts for shelter, breeding, and foraging habitat and are most strongly associated with *Eucalyptus latisinensis* (white stringybark)*, Corymbia intermedia* (pink bloodwood)*, Eucalyptus crebra* (narrow-leaved ironbark), *Corymbia citriodora subsp variegata* (spotted gum) and *Melaleuca quinquenervia* (broad leaved paperbark) in south-east Queensland (Eyre et al. 2022).

There is no way to include hollow-presence in this mapping; a precautionary approach has been applied by assuming all remnant vegetation has suitable hollows. With this assumption, the total extent of Remnant and High Value Regrowth REs comprising key greater glider tree species (after Eyre et al. 2022) within 25 km of the site has been assessed (**Figure 21**).

Whilst Greater glider are reliant on remnant habitat to persist in the landscape, High Value Regrowth and to a lesser extent young regrowth are considered 'future habitat' (after Eyre et al. 2022). The extent of high and moderate amenity remnant REs is 65,273 ha (33.5%) and low amenity (emerging habitat) High Value Regrowth (future potential) is 2,745 ha (1.4%) of the area. The vast majority of this habitat is associated with large block of habitat to the south and south-east of the Site, associated with the White Rock – Flinders Peak areas.

Although greater glider may occur in home ranges as little as 1-4 ha, viable populations require a minimum of 160 ha of contiguous vegetation. Contiguous forests of this size within the local landscape are at least 5 km from the Site, most noticeably to the west associated with Spring Mountain, White Rock and the Greenbank Army Reserve. This area is separated by a mosaic of remnant vegetation and urban/semi-urban development or areas of cleared land. Movement through such a variegated landscape will be hindered and likely sporadic, if at all.

32: Six nights of spotlighting effort in which complete site coverage was achieved on each night of survey.
33: Referral 2021/9070
34: 28 South unpublished data. See also: (i) Smith, P. and Smith, J. (2018) Decline of the greater glider (*Petauroides volans*) in the lower Blue Mountains, New South Wales. Australian Journal of Zoology 66, 103-14; and (ii) Gracanin A., Pearce A., Hofman M., Knipler M. and Mikac K.M. (2022) Greater glider (*Petauroides volans*) live capture methods. Australian Mammalogy 44, 280-6.

Site

The pre-clearance regional ecosystems represented on the site are considered to be regional ecosystems identified by Eyre et al. (2022) to be known habitat for greater glider. Site based assessment has not identified greater glider within or immediately adjacent to the Site, although it is recorded more broadly in the landscape (refer **Figure 20**) associated with a large block of contiguous habitat situated to the south of White Rock Conservation Estate.

Greater glider are reliant on remnant habitat to persist in the landscape, with High Value Regrowth[35] (and to a lesser extent young regrowth are) considered 'future habitat' (after Eyre et al. 2022). In this sense, the site can be considered to be Potential Habitat with HVR and Remnant vegetation comprising 16% and 22% of the Site's Potential Habitat (47.47 ha). Remnant and HVR areas (28% of the Site) contain feed trees, potential live and dead trees for denning (including large trees >500 mm DBH) and afford habitat connectivity across the Site and externally.

The remaining 72% of the Site[36] comprising (non-remnant previously cleared vegetation), contains a sparser representation of; feed trees, potential live and dead trees for denning (including large trees >500 mm DBH), and limited connectivity across the site, on account of openness of the area (distance between trees) leading to potential increases in predation, and greater interspecific competition from sympatric arboreal mammals (after Youngentob et al, 2012).

Therefore, in terms of quality and availability of forage and denning habitat (see **(ii) Habitat - *Broad habitat review and regional occurrence*** (above) and **(iii) Tree Survey,** below), and known presence of key tree species Assessment Units with representations of Remnant and High Value Regrowth, i.e. AU2 and AU3, can be considered to represent a higher quality food and foraging, and available shelter habitat than AU1.

(iii) Tree survey

Eyre et al. (p.37, 2022) identify tree species characterising preferentially selected habitat trees for greater glider. Trees were sorted by preferred species into potential foraging habitat (>300 mm DBH) and potential denning habitat (>500 mm DBH) (after Eyre et al. 2022). The growth rate of trees and their propensity to form hollows depends on a wide range of factors, including the subject species, growing conditions, and damage. Hollow formation is described further in the Arbor Australis advice introduced the technical note *Proposed Ripley View Residential Development (EPBC Referral 2020/8615) Greater glider offset proposal* (**Appendix 40**). Growth stage assessments may provide a better surrogate than size alone for determining the number of hollow-bearing trees potentially present on a site as most Greater glider dens are in trees in the late mature and over-mature growth stages. This is recognised by Eyre et al. (2022), which, in Section 4.2, notes, "selection of some tree species over others for denning by greater gliders will foremost depend on the age and senescence stage of the tree and species' inherent propensity to form hollows."

A tree survey was undertaken to map trees > 300 mm DBH across the development site. The dataset was then sorted to identify trees >500 mm DBH. There are 456 such trees (>500 mm DBH) present. The presence of these trees or structural attributes alone are not confirmation of habitat but are indicators of

35: In this instance Eyre et al. (2022) suggests any Queensland regional ecosystem that has been identified as greater glider habitat, no matter how fragmented, will have value now….or in the future. We have interpreted 'regional ecosystem' in this instance to be a mapped entity, either Remnant (Category B), or High Value Regrowth (Category R). By extension this would imply that non-remnant (Category X) areas would not be considered habitat. Notwithstanding, we have adopted a more nuanced approach which considers relictual canopy vegetation or very young regrowth if indicative of a pre-clear regional ecosystem that is known habitat for greater glider as potential habitat at some point in the future, albeit with much reduced quality of forage and shelter habitat.
36: This 72% area is consistent with the disturbed area visible within aerial photography from 2011 (refer **Figure 4h**), comprising much of the Site comprising AU1, and parts of AU2 and AU3.

potential suitability. Tree data are spatially represented as **Figure 22a-d** and tabulated in **Table 9**. Comprehensive tree details are contained in **Schedule 1** to **Appendix 39**.

Table 9: Greater Glider Habitat Trees at Impact Site (after Eyre et al. 2022)

Species	Common name	Potential forage trees (mm DBH)	Potential habitat trees (mm DBH)		
		300-500	501-750	751-1,000	>1,001 mm
Angophora floribunda	Rough barked apple	1	0	0	0
Angophora leiocarpa	Rusty gum	355	27	0	0
Corymbia citriodora	Spotted gum	122	45	9	1
Corymbia henryi	Large leaved spotted gum	4	0	0	0
Corymbia intermedia	Pink bloodwood	166	75	9	1
Corymbia tessellaris	Moreton Bay ash	22	2	0	0
Dead tree	Dead tree	0	1	3	0
Eucalyptus crebra	Narrow-leaved ironbark	17	5	0	0
Eucalyptus fibrosa	Red ironbark	0	1	0	0
Eucalyptus grandis	Flooded gum	0	2	0	0
Eucalyptus microcorys	Tallowwood	5	0	1	0
Eucalyptus siderophloia	Grey ironbark	30	13	1	0
Eucalyptus tereticornis	Queensland blue gum	688	192	51	4
Lophostemon suaveolens	Swamp box	119	10	1	0
Total		**1,528**	**375**	**75**	**6**

There are 1,528 trees 300-500 mm DBH (refer **Figure 22a**), 375 501-750 mm DBH (refer **Figure 22b**), 75 trees 751-1,000 mm DBH (refer **Figure 22c**), and 6 Trees greater than 1,001 mm DBH (refer **Figure 22d**). This suggests that both feed trees and potential den trees are present on the Site (after Eyre et al. 2022). Regrowth and remnant Regional Ecosystems of the Site are analogous considered potential habitat.

Greater gliders have not been detected on the Site despite spotlighting in two distinct periods. Spotlighting studies reporting detection rates for the greater glider suggest that there is a very high likelihood it would have been detected on the site were it present. While tree hollows can be difficult to see from the ground, a consistent lack of observable hollows within a stand indicates at least a low abundance. Given that not all hollow-bearing trees would provide hollows suitable for the greater glider, the number of potential den trees on the Site must be low. Trees hollows appear to be currently limiting on the Site and in the locality.

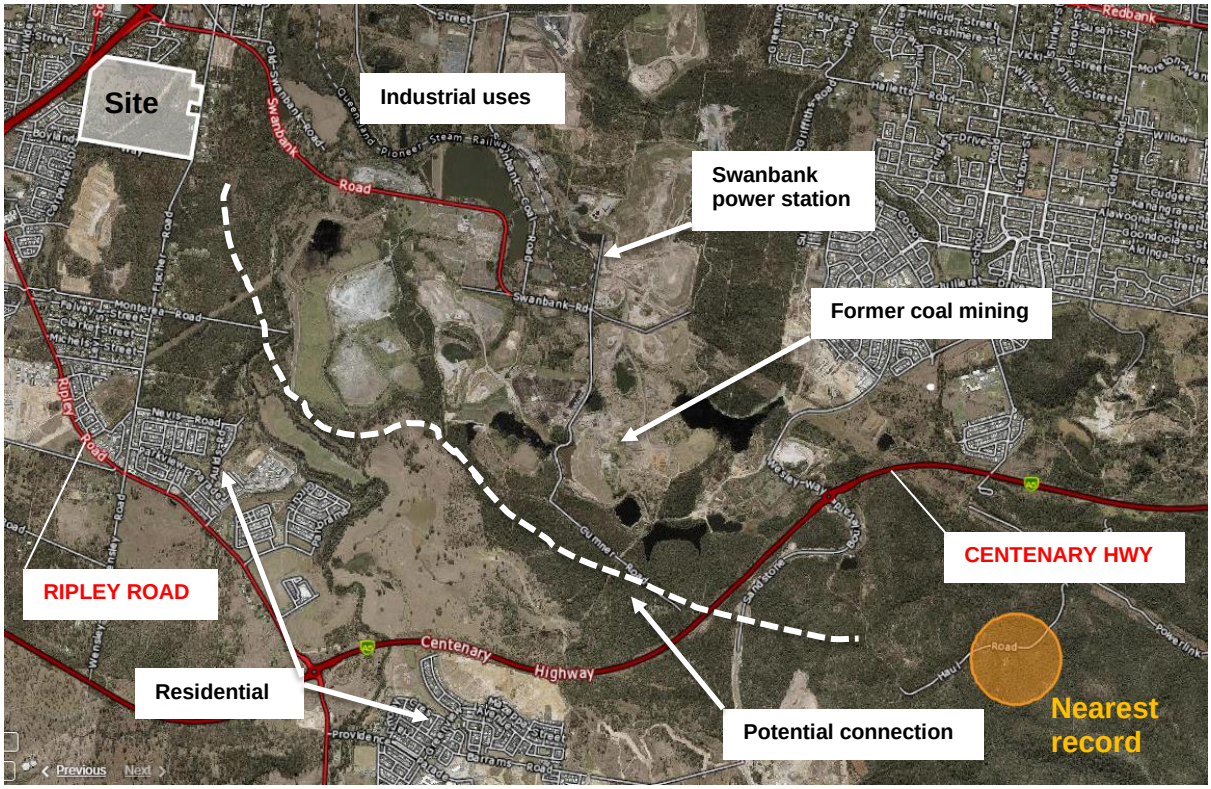
Although the patch size of vegetation mapped as RE and High-value Regrowth in the locality, including the Site, has not been determined, it is large enough to meet the patch size requirements of the greater glider given the range of patch sizes occupied (see Eyre et al. 2022, Table 6). There is no potential Greater Glider habitat to the west or north of the site on account of the Cunningham Highway (a significant movement barrier to the species) and residential development.

While current landscape connectivity to the Site is likely to be poor due to the low abundance of hollow-bearing trees in the locality, this too would improve over time provided the remaining habitat remains sufficiently intact and is allowed to mature. However, given the context of approved development surrounding the Site (refer **Figure 8**), and the designation of much of this area for residential (RVPDA) or commercial / industrial (Swanbank Industrial lands), this eventuality seems unlikely.

All contemporary (post 1990 records for greater glider within 25 km of the site) are located from large blocks of contiguous open forest habitat associated with the Greenbank-Flinders Peak Regional Corridor (23 records), see '**known records'** below. The nearest records to the Site with an albeit tenuous linkage through relict vegetation, paddock trees and riparian vegetation affected by past grazing and mining, flanked by residential development to the south and industrial land to the north, are situated 6.7 km to the south-east. A significant barrier to movement for greater glider presented by the Centenary Highway (see **Inset 4**). Future duplication of the highway will further inhibit cross highway movement. Unlike Petaurid gliders, the Greater Glider has not been recorded using crossing structures (gliding poles, rope bridges) (e.g. Goldingay et al. 2013), so it is unlikely that this impact could be adequately mitigated.

Notwithstanding, larger blocks of fragmented and disturbed vegetation do occur in rural residential lands to the east and south east of the site where there is a broader matrix of disturbed young regrowth, High Value Regrowth and Remnant vegetation which could provide habitat should suitable hollows be present.

Therefore, there is potential habitat connectivity to the east, although much of this vegetation is relatively immature and may not currently support greater gliders. Thus, colonisation of the project site is possible over the medium to long-term provided the intervening vegetation remains intact and is allowed to mature.



Inset 4: Landscape context of land between the Site and nearest greater glider records

Given the development that is occurring in the locality of the Site, there is uncertainty regarding the long-term quantity and quality of habitat in the locality and whether site colonisation would ultimately occur.

While there is future colonisation potential, it may take decades before this occurs due to the length of time generally required for tree hollows to form (Mackowski 1984; Gibbons and Lindenmayer 2002).

While the Greater Glider is not currently present on the Site, the critical habitat definition includes unoccupied habitat that may be colonized in the future as hollow-bearing trees become more common as the forest matures (DCCEEW 2022).

Our view is that this species will not be subject to impact. Notwithstanding the above points, as movement to, and therefore presence on cannot be definitively ruled out, on the basis of the presence of greater glider forage tree species habitat and vegetation analogous with Regional Ecosystems identified as habitat, the statutory documentation associated with the species requires the assessment to assess the site containing habitat critical to the survival of the greater glider is present and its removal results in a significant residual impact.

(c) Known records within 25 kilometres

Analysis of ALA records within a 25 km radius of the Impact Area has been undertaken, considering records since 1990 as contemporary. Records without a year recorded have been omitted. Since 1990, there have been 23 records of greater glider within 25km of the project Site (**Figure 20**):

- 15 records within 25 km
- 8 records within 10 km
- 0 records within 5 km
- 0 records within 2 km.

The majority of records within 10-25 km and are associated with large blocks of contiguous open forest habitat associated with the Greenbank-Flinders Peak Regional Corridor to the southeast of the Site and are suggestive of a resident population in the broader area; however, this population is separated from the project Site by a number of significant movement barriers including the dual carriage-way Centenary Highway and former mining land to the south of the Swanbank Power station. Greater glider movement through these barriers seems highly unlikely.

(d) Site Surveys undertaken and their adequacy

Targeted spotlighting for arboreal species was undertaken at the Site on the 17, 18 and 19 March 2020. 17 person hours of spotlighting with two observers traversing the entirety of the Site at night. No greater gliders were detected. Weather during this survey was conducive to spotlighting, with mild temperatures, high humidity and little to no wind. No greater gliders were detected. However, two other arboreal mammal species were found during spotlighting; *Petaurus breviceps* (sugar glider) and *Trichosurus vulpecula* (common brushtail possum). Common brushtail possums are known to compete with the greater glider for hollows.

Greater glider has not been detected from the Site nor adjoining sites despite targeted survey effort. As it is a readily detected species in occupied habitat, absence from spotlighting records suggest that it is absent rather than elusive and undetected.

It is widely understood that Greater glider occupies large hollows in large, old trees. These trees are generally at least 100 years of age. Historic photography (**Figure 4a-h**) shows that the development footprint, with the exception of riparian vegetation along the un-named tributary of Bundamba Creek (south of the proposed waterway crossing which constitutes remnant vegetation) has been largely cleared and cannot support trees of this age.

The conservation advice for Greater Glider does not assign a particular size class for trees that are thought to provide dens for Greater glider but does (uncontroversially) state that the species has a particular preference for “large hollows in large, old trees” and that “most hollow-bearing trees used for denning by arboreal and scansorial mammals are at least 100 years of age.” These observations are supported by contemporary literature (Hofman et al. 2022) identifying the mean diameter of trees supporting Greater glider dens (1,140 mm diameter).

Documentation which DEECCW relies upon (*Guide to Greater Glider Habitat in Queensland* Eyre (2022)) to determine potential den habitat states that greater glider dens can occur in trees as small as 500 mm diameter; but very few trees of this size would actually support hollows suitable for the species. There are 454 such trees at the Site, but the development footprint is positioned such that only 131 (35%) fall within the development footprint. This reflects our early development planning to ensure that impacts were avoided to the greatest extent possible. Trees within the +750 mm diameter range are likely better considered future potential habitat trees.

The Department also holds a view that while such trees may not presently support hollows, they could do so in the future We question the application of this logic to the Site because the trajectory towards hollow development will be compromised by the site’s inevitable isolation under State government supported development scenario identified for this area by the RVPDA.

Nonetheless, the Proponent is willing to accept the Department’s position that the Site could still provide potential habitat.

4 Assessment of Impacts

4.1 General Assessment of Impacts

4.1.1 Direct site-based impact

Direct impacts will arise from the loss of habitat associated with the Proposed Action.

The Proposed Action will involve direct impacts arising from the removal of 37.31 ha of mainly regrowth vegetation for the establishment of the proposed action (**Figure 3**). **Table 10** provides an analysis of habitat loss and retention by Assessment Unit.

Table 10: Impact and Environmental Protection Zone by Assessment Unit (AU)

Assessment Unit (AU)	Total area (ha)	Direct Impact Area (ha)	Proportion of total AU (%)	Proportion of total Site area (%)	Avoidance area (ha)	Proportion of total AU (%)	Proportion of total Site area (%)
1	21.75	20.53	94.4	43.2	1.22	5.6	2.6
2	13.97	12.61	90.3	26.6	1.37	9.8	2.9
3	11.75	4.17	35.5	8.8	7.10	60.4	15.0
Total	**47.47**	**37.31**	**-**		**9.69**	-	-

Direct loss of habitat will be mitigated through measures described in **Section 5**. Outside of the development footprint, the Proposed Action avoids impact to movement and habitat corridor retention of 10.16 ha of habitat (avoidance area), and restoration / regeneration of 5.69 ha of potential habitat within the Linear Park and Drainage Reserve (temporary impact area). The area of permanent impact is 31.62 ha. The Linear Park retains habitat and movement corridor for MNES and its minimum functional corridor width is 140 m.

Retention of vegetation within the Linear Habitat Corridor (**Figure 5**) avoids loss and results in the retention of the Site's greatest extent of intact remnant vegetation. This will be enhanced through targeted weeding and assisted generation and complimented by ecological restoration, reconstruction and fabrication within previously disturbed components. Restoration works will be undertaken by the proponent as part of the Sites Operational Works and will be compliant with the Concept Rehabilitation Management Plan.

4.1.2 Indirect impacts

Indirect impacts occur when project related activities affect vegetation or habitats in a manner other than a direct loss or clearing. Examples of indirect impacts include; promotion of soil erosion, sedimentation of waterways, dust inhibiting plant pollution, provision of suitable seed bed for invasive plants, altered surface and groundwater conditions effecting long term habitat change, interspecific competition on forest dwelling species from edge specialist species, light throw from urban areas, or increased noise activity within of directly adjacent to sensitive habitat areas.

The potential indirect impacts that may potentially result from pre-construction, construction activities and/or the operational phase of the project has been identified below.

(a) Pre-construction

Prior to clearing activities a suitably qualified, experienced spotter catcher, appropriately registered (in possession of a Rehabilitation Permit under the *Nature Conservation Act* 1992) will be appointed to manage fauna during pre-construction and construction phases. The Spotter Catcher will be required to prepare a Fauna Management Action Plan in accordance with the requirements of the *Nature Conservation (Koala) Conservation Plan 2017*, State and Commonwealth conditions of approval.

A key feature of fauna management during pre-construction and construction will be the installation and maintenance of temporary fauna exclusion fencing to be erected around the perimeter of Impact Areas to:

i. demarcate construction areas and habitat protection areas
ii. manage fauna displaced by habitat clearing activities
iii. management of mobile / transient fauna, to ensure encroachment into work zones does not occur.

All clearing and construction will be staged and undertaken in line with the requirements of Queensland's *Nature Conservation (Koala) Conservation Plan 2017* and the Code of Practice[37]. As such, will be completed slowly and sequentially and in a direction that directs any vacating fauna towards retained corridor areas and in the presence of a qualified fauna spotter catcher.

(b) Construction

(i) Weeds

Increased vehicle movement during the construction phase has the potential to increase the spread of weeds in the area, particularly during the vegetation clearing phase. With implementation of standard mitigation measures, the project is likely to result in a negligible impact to ecological values due to the potential introduction/spread of weeds.

(ii) Vehicle movement

During construction, a number of vehicles will be required within the Impact Area. Direct impacts from vehicle movements on threatened species and vegetation communities include:

- damage or destruction of vegetation or fauna habitat by vehicles traversing these areas
- fauna strike.

(iii) Earthworks

Construction activities have the potential to generate dust emissions. Dust emissions during construction will be temporary. The main sources of dust will be generated via:

- wheel-generated dust from the haul roads created for the construction phase
- dust lift-off from exposed surfaces (e.g. construction roads and pads)
- earthworks, including construction of the embankments, and moving, dumping and shaping material
- vegetation and soil clearing of the land.

37: Code of Practice—Care of sick, injured or orphaned protected animals in Queensland (State of Queensland 2016), https://www.qld.gov.au/__data/assets/pdf_file/0022/202198/cp-wl-rehab.pdo

Excessive deposition of dust on leaves of plants can suppress the growth and photosynthesis, resulting in reduced habitat quality for fauna. High levels of airborne dust can irritate the respiratory systems of fauna and potentially result in ingestion of dust-coated seeds and other foods. Excessive deposition of dust on open water bodies may also degrade water quality and overall habitat quality for fauna.

With implementation of standard mitigation measures, the project is likely to result in a temporary and minor impact to ecological values due to the generation of dust.

(iv) Light Emissions During Construction

Artificial light can affect both nocturnal and diurnal animals by disrupting behavioural patterns, with quality of light (e.g. wavelength, colour), intensity and duration potentially evoking different faunal responses. Impacts from increased light levels include disorientation from, or attraction toward, artificial sources of light; mortality from collisions with structures; and effects on light-sensitive cycles of species (e.g. breeding and migration for fauna and flowering in plants). An artificial increase in lighting can also affect abundance of predators.

Presence and intensity of artificial light in the Site will temporarily increase during the construction phase; however, night works will not be common. Lighting will be directed to construction areas within the Site.

Some light spillages will be inevitable and is likely to be contained. Potential impacts associated with light emissions will be temporary and unlikely to be significant.

With implementation of standard mitigation measures, the project is likely to result in a negligible impact to ecological values due to the use of light pollution during construction.

(v) Noise and Vibration

Noise levels greater than existing ambient noise levels are expected during the construction within the Site. Sources of noise are likely to consist of noise in short, intense pulses from mobile plant equipment, and more prolonged noise, with consistent vibration, pitch and volume from generators, excavators and pumps, in addition from noise from vehicles.

Both steady continuous and single noise events have the potential to lead to ecological impacts. Construction noise is expected to elicit some avoidance response from fauna using the surrounding vegetation though, with consideration of the extent of habitat available in the Site, this is likely to be a temporary and negligible to minor impact.

(vi) Increased human presence

Increased human activity during construction has the potential to disturb fauna within adjacent habitat areas.

Resulting impacts to fauna include heightened vigilance and predator avoidance, which can disrupt foraging and roosting efficiency or deter wildlife from using particular areas. Impacts essentially represent a reduction in core habitat due to edge effects. The project is likely to result in a temporary and minor impact to ecological values due to increased human presence on Site during the construction period.

(c) Post-construction

(i) Traffic

The new lots will result in a small increase in traffic however effects of this will be mitigated and ameliorated by:

- 50 km/h speed limit on internal roads.
- Construction of fauna exclusion / guide fencing around the internal Linear Park perimeter.

Fauna exclusion fencing will greatly limit fauna access to the industrial, commercial, business and warehousing zone and therefore likelihood of fauna vehicle strike of entrapped animals at this location is reduced.

(ii) Light Emissions During Operation

Artificial light can affect both nocturnal and diurnal animals by disrupting behavioural patterns, with quality of light (e.g. wavelength, colour), intensity and duration potentially evoking different faunal responses. Impacts from increased light levels include disorientation from, or attraction toward, artificial sources of light; mortality from collisions with structures; and effects on light-sensitive cycles of species (e.g. breeding and migration for fauna and flowering in plants). An artificial increase in lighting can also affect abundance of predators.

Without additional directed lighting measures and low lux lighting (whilst maintaining visibility and safety) some light spillage will be inevitable. With light shrouding and shielding / direction measures light glow and spillage can be successfully reduced.

The ecological restoration of parts of the site within the Linear Park (batters, and drainage infrastructure) will result in a transitional / interface zone being formed between the residential components and the retained habitat within the Linear Park. As the vegetation matures it will further screen any light throw generated.

With implementation of standard mitigation measures, the project is likely to result in a negligible impact to ecological values due to the use of light pollution during operation.

(iii) Noise and Vibration

Operational noise is expected to be minor and in line with existing backgrounds noise levels and as such is unlikely to elicit avoidance responses such that habitat utility is lost. The risk of operational noise affecting night-time animal behaviour within the Linear Park is considered very low.

(iv) Waste disposal

Inappropriate disposal of non-hazardous wastes can attract vermin and other wildlife to Site. This may exacerbate potential impacts (e.g. road mortality). Litter may also enter surrounding environments. With implementation of standard mitigation measures, the project is likely to result in a negligible impact to ecological values due to the generation and handling of waste.

(v) Hazardous and Dangerous Goods

Spills and leaks from transfers (e.g. fuel and/or chemicals) and inadequate storage of dangerous goods and hazardous wastes could result in point-source contamination of surrounding land. Direct adverse impacts could include toxic impacts on vegetation (resulting in degradation or loss of vegetation and

habitats), direct toxic impacts on fauna (from contact, inhalation or ingestion) or indirect impacts on threatened and migratory species from habitat loss. Direct adverse impacts on surface and groundwater quality are also possible.

With the application of standard mitigation and management measures, impacts from liquid and solid waste disposal will be avoided or localised and small in scale. Further to this, end of train WSUD (stormwater reserve) measures are highly unlikely to result in the release of spillages. The risk is considered is considered extremely low. Therefore, the project is likely to result in a negligible impact to ecological values due to potential spills and leaks.

(vi) Increased Human Presence and Interaction With Dogs

Increased human activity after completion of construction has the potential to disturb fauna within adjacent habitat areas.

Resulting impacts to fauna include heightened vigilance and predator avoidance, which can disrupt foraging and roosting efficiency or deter wildlife from using particular areas. Impacts essentially represent a reduction in core habitat due to edge effects. The project is likely to result in a minor impact on Site and adjacent ecological values due to increased human presence. Access to the Environmental Protection Zone will be discouraged through internally facing development.

The Proposed Action has the potential to increase the occurrence of dogs at the Site, but the significance of this outcome needs to be considered in light of: (i) the existing occurrence of wild dogs in the locality; and (ii) the relative contribution made by wild and domestic dogs to koala attack, particularly in new development.

In South-East Queensland, wild dog populations exist on the outskirts of suburbs within Brisbane, Logan, Gold Coast and Sunshine Coast. These dogs often go un-noticed, and residents regularly mistake them for domestic dogs without collars. Australian Koala Foundation and Queensland Parks and Wildlife data on koala deaths from these areas show that mortality due to dog attack is far more frequent in the greater Brisbane area where wild dogs are prevalent.

In the shorter term, prior to dedication of the Linear Park to public ownership (refer to Section 2.3.9 of this report), the proponent will actively manage wild dogs. In the longer term, as the area is transferred to Council ownership, Ipswich City Council will inherit the general biosecurity obligation established by the *Biosecurity Act* (Qld) *2014*. Dedication to public ownership will therefore create focal points for the management of wild dogs in line with Ipswich City Council's established wild dog management protocols.

4.2 Koala

4.2.1 Direct Impacts

(a) Loss of Habitat

The Proposed Action will involve direct impacts to the koala through the removal of vegetation within the Proposed Action (for residential, open space and stormwater management uses). The area of retained habitat between the northern overland flow adjoining the northern site boundary, adjoining Melrose Drive

comprising 0.48 ha) is considered functionally compromised[38] and is included in the total impact area of 37.79 ha.

The direct loss of koala habitat will be mitigated through numerous measures described in **Section 5**. Outside of the development footprint, the Proposed Action will be retaining the key movement and habitat corridor for koala through the retention of mature, intact vegetation communities within the proposed Linear Park. Primarily, this includes the retention of the Sites highest quality and mature habitat, coupled with the broader Linear Parks ecological restoration, reconstruction and fabrication of key habitat which has been proposed as part of a Concept RMP (**Appendix 7**). The Proponent has also committed to undertaking an offset to acquit any remaining significant residual impact to koala outside of these mitigation measures.

4.2.2 Indirect Impacts

Potential indirect impacts on the koala associated with the Proposed Action are described below.

(a) Increased Noise, Artificial Light, Dust, Sediment Generation, Other Stressors During Construction

Construction activities have the potential to increase stress on koalas within the Site through machinery, construction noise and dust generation. These elements will be addressed within a Construction Environmental Management Plan (**Section 5.7.4**) and a specific Koala Management Plan to be prepared as part of the detailed design and operational works application for the Proposed Action. It is noted that all clearing and construction will be staged and undertaken in line with the requirements of *Nature Conservation (Koala) Conservation Plan 2017*, as such, will be completed slowly and sequentially and in a direction that directs any vacating fauna towards retained corridor areas and in the presence of a qualified fauna spotter catcher.

(b) Habitat fragmentation and barriers to dispersal (including dispersal of seeds or pollen via faunal vectors)

The Site currently comprises koala habitat characterised by vegetation of varying age and quality. Through the avoidance (**Section 6**), mitigation by virtue of the consolidation and linking of koala habitat (**Section 6.2**) and the establishment of fauna movement infrastructure and road crossings (**Section 6.2.2**), the Proposed Action will enhance, expand upon and consolidate koala habitat and reduce its fragmentation as well as any future edge effects.

As existing barriers to koala movement exist to the north-west, west and south (with the exception of retained adjoining Open Space Corridors which link into those within the Proposed Action), the Proposed Action is unlikely to create new barriers to dispersal; koalas will be freely able to reside and move within and through the retained and consolidated Linear Park. Within these areas koala habitat trees will proliferate and connect into adjoining areas of similar habitat.

(c) Increased vehicle strike (construction and operation)

During clearing and construction activities, the Proposed Action will increase the potential for machinery and vehicles to interact with koalas. These risks will be appropriately managed through standard measures to be outlined within a Construction Environmental Management Plan (**Section 5.7.4**) and a Koala Management Plan to be prepared as part of detained design and operational works stage of the Proposed Action. It is noted that since the submission of the CAR, the Proposed Action has reduced the density of

38: In accordance with the DES Guideline: State Development Provisions, literature recommends that koala movement corridors should seek to be at least 100 m wide to function effectively and to minimise edge effects.

overall development (from 18 dwellings/ha to 17.5 dwellings/ha). Both these measures will reduce the volume of cars either through or adjoining these areas.

During operation, the Proposed Action will increase traffic generation within the Site, leading to potential for increased koala collisions (a) on roads within the Site, and (b) on roads intersecting koala movement corridors beyond the Site. Barriers such as exclusion fences (around construction works (e.g. a stage of development)), fauna friendly fencing and aprons extending out from the fauna crossings at road intersections, and retaining walls will be designed to prevent koalas from entering roadways and the Residential Precinct.

(d) Increased risk of attack from domestic animals, in particular dog attack on the koala from both domestic and wild dogs

The Proposed Action will potentially increase the occurrence of domestic dogs on Site, but it is difficult to disentangle the potential impact of new domestic dogs from the likely existing impact of wild dogs and roaming domestic dogs that already occur in the landscape. The vulnerability of koalas to predation is exacerbated where portions of the Site currently contain widely-scattered trees, requiring koalas to make long movements across open ground.

Through the avoidance (**Section 6.1**) and the consolidation and linking (**Section 6.8.1**) of koala habitat, the establishment of fauna movement infrastructure and road crossings (**Section6.8.1.2**) and the installation of barriers to koala movement into the Residential Precinct, the Proposed Action will reduce the prevalence of koalas within residential areas of the Proposed Action.

The potential remains however for dogs at-large (domestic or wild) to interact with koalas in the Linear Park. Specific mitigation measures to address the potential impact of dogs on koalas within the Site are discussed in **Sections 6.2.2** and **6.3.4**.

(e) Introduction/proliferation of weeds or pathogens in habitat

Through the ecological restoration works within the Linear Park, the Proposed Action will result in a considerable reduction of weeds within retained and restored koala habitat within the Site.

Once the Linear Park reaches off-maintenance status, this land will be transferred to ICC, the crown or another suitable custodian through a statutory environmental covenant or similar. This custodian will be responsible for ensuring the provisions of the Queensland *Biosecurity Act 2014* are upheld through regular weed inspections (and removal if necessary).

The potential for the introduction of weeds within koala habitat during construction will be minimised and managed through appropriate controls within a Construction Environmental Management Plan (refer **Section 6.3**).

With respect to pathogens, it is not envisaged that the Proposed Action will in any way increase the species' exposure to *Chlamydia* or koala retrovirus (KoRV), as no additional exposure to affected populations or individuals will result from the Proposed Action.

(f) Risk of Entanglement in Wire Fencing, Electrical Wires or Other Infrastructure

All electrical services for the Proposed Action will be provided underground. Barbed wire fencing will not be used for the Proposed Action and koalas will not become entangled in any infrastructure associated with the Proposed Action. Further, the existing barbed wire structures within the Site will be removed as part of both construction works and ecological restoration efforts. Barriers to prevent koala movement into the residential areas will include retaining walls and exclusion fencing between esplanade roads and the

Linear Park where practicable and will allow for safe movement under the proposed road crossing through the use of culverts and aprons extending out from the fauna crossing.

(g) Reduction in Habitat Connectivity to Surrounding Habitats and any Potential edge effects

The Proposed Action will have a limited impact on habitat connectivity for the koala within the Site and to surrounding habitats when considering the existing barriers or future uses. Currently through the patchwork of cleared, regrowth and remnant habitats the Site provides for informal and disaggregated patterns of koala movement opportunities within and through the landscape. It does however not permit koala movement to the north-west west or south (apart from the connective corridors within the adjoining development). Connection to other areas of habitat will be retained through the Linear Park to the north through Rourkes Park and south along retained Open Space corridors.

The direct impact to 37.31 ha of koala habitat for urban residential purposes areas will alter koala movement patterns through the Site. However, the Proponent has sought to incorporate the majority of the mature, densely-vegetated and high-quality koala habitat areas within the Linear Park in order to retain and enhance a key movement corridor and habitat linkage for this species (see **Section 6.5**).

The resultant design of the Linear Park results in a more formalised and legible network of koala habitat within the Site. The location of the koala habitat, which will be subject to assisted natural regeneration efforts to enhance, expand and consolidate the available habitat (see **Section 6.8.1.1**), is such that connectivity with other habitats beyond the Site reflect a locally important biodiversity corridor (see **Section 2.2.3**).

Edge effects are currently evident within koala habitat throughout the Site, largely due to the historical degradation of the Site, a lack of coordinated land management practices, erosion of dispersive soils and a poorly-defined koala habitat network. Through the avoidance (**Section 6**) and the consolidation and linking (**Section 6.8.1.1**) of koala habitat, the establishment of fauna movement infrastructure and road crossings (**Section 6.8.1.2**) combined with the buffering function of the esplanade roads, drainage reserves and local parks to the Linear Park, the Proposed Action is expected to *decrease* edge effects on koala habitat within the Site.

4.3 Grey-headed flying-fox

4.3.1 Direct Impacts

(a) Loss of Roost Habitat

The Proposed Action will not affect any existing flying-fox camps. It will not lead to loss of roost trees or an increase in disturbance to roosting bats.

(b) Loss of Forage Habitat

The Proposed Action will involve direct impacts to the koala through the removal of vegetation within the Proposed Action (for residential, open space and stormwater management uses includes in the total impact area of 37.31 ha.

Flowering trees which provide key resources during critical times in the grey-headed flying-fox life-cycle are generally concentrated within the Linear Park occurring centrally within the Site. Throughout the Site, such areas are proposed to be retained within the Linear Park as part of the Proposed Action which, at its minimum is 120 m. This corridor is associated with the unnamed tributary of the Bundamba Creek Corridor and will be the subject to ecological restoration works to retain, enhance and expanded upon the highest quality habitats within the Site.

All native trees within the Linear Park area will be retained where practicable many of which are important blossoming resources during the winter bottlenecking period particularly as these areas support the highest abundance of mature and intact Queensland blue gums. The Linear Park will also be subject to restoration works to achieve an open forest with a canopy reflective of pre-clear REs. Whilst the drainage reserves and overland flow path will be revegetated to reflect pre-clear RE communities, with suitable foraging species to be established in these areas, the planted resources will not be of value to grey-headed flying-fox for some years. Details for these revegetation areas are described in further detail in the Concept RMP (**Appendix 7**).

Given grey-headed flying-foxes are not considered to be heavily reliant on the foraging resources present within the Site, in particular the Impact Area (see **Section 3.3.2**), and similar habitats with suitable flowering trees are widespread within the locality (see **Section 3.3.3**), impacts from the Proposed Action on this species are not expected to be severe. However, there has been considerable historical habitat loss in south-east Queensland (DAWE 2019a) and it is recognised that urban developments can contribute to cumulative habitat loss. Residual impacts, although minor, will be addressed by supplementary planting of key tree species (*E. tereticornis* and *M. quinquenervia*). These plantings will occur both within the Site and on an off-Site offset. Two documents will guide these mitigation measures and ensure trees reach maturity:

- the Concept RMP (**Appendix 7**) for actions within the Site; and
- an Offset Management Strategy for actions undertaken within the off-Site offset area (see **Section 7**).

These plans provide details regarding planting density and species, responsibilities, timelines, milestones/targets and triggers for corrective measures. Monitoring, which is also included within the above plans, will be undertaken to ensure these actions equal or exceed tree loss.

The implementation of these plans in conjunction with the off-Site offset site is expected to result in no net loss of grey-headed flying-fox foraging resources.

4.3.2 Indirect Impacts

As described below, there are no indirect impacts expected to result from the Proposed Action on grey-headed flying-foxes.

(a) Increased Noise, Artificial Light, Dust, Sediment Generation, Other Stressors During Construction

With no flying-fox camps within the immediate proximity of the Site, there is little concern for impacts from construction noise and dust generation. Further, construction and associated activities are not proposed to occur at night and foraging bats would not be affected either.

grey-headed flying-fox seem undisturbed by night lights and nocturnal movement associated with urban housing and can readily move across modified landscapes. The Proposed Action will not affect flying-fox activity or movements through the landscape.

(b) Habitat Fragmentation and Barriers to Dispersal (Including Dispersal of Seeds or Pollen via Faunal Vectors)

Considering grey-headed flying-fox do not appear to be abundant within the local area during key stages of their life-cycle (see **Section 3.3.1**), and similar habitats with flowering trees are widespread within the local area (see **Section 3.3.2**), impacts from the Proposed Action on this species are not expected to be severe. Given grey-headed flying-foxes readily reside and forage within urban areas, as exampled by the

location of the camps in the locality, it is expected that the Proposed Action will not result in significant fragmentation or barriers to dispersal of grey-headed flying-fox.

(c) Increased Vehicle Strike (Construction and Operation)

No flying-fox roosts are present within the Site; therefore, there is minimal chance of vehicle strike during construction or operation activities. Further, the foraging habitat present within the Site for grey-headed flying-fox is largely limited to winter-flowering species within the Linear Park. It is expected that the restoration of the Linear Park will further enhance and strengthen the foraging habitat for the grey-headed flying-fox potentially occurring within in the landscape. These areas will be located away from most urban activities, with only one road crossings passing through the Linear Park. This central road crossing and all other esplanade roads adjoining the broader Linear Park will be low speed environments and trees boarding these areas large in stature (meaning foraging occurs at a much higher level then vehicular traffic). The likelihood that a grey-headed flying-fox might be foraging within this area and is struck by a vehicle is very low.

(d) Introduction/proliferation of Weeds or Pathogens in Habitat

Through the ecological restoration within the Linear Park, and associated weed removal and management, the Proposed Action will result in a considerable reduction of weeds within retained and restored habitat within the Site.

Once the Linear Parks achieves off-maintenance status, this land will be transferred to ICC, the crown or another suitable custodian through a statutory environmental covenant or similar. This custodian will be responsible for ensuring the provisions of the Queensland *Biosecurity Act 2014* are upheld through regular weed inspections (and removal if necessary).

The potential for the introduction of weeds within habitat during construction will be minimised and managed through appropriate controls within a Construction Environmental Management Plan.

(e) Risk of Entanglement in Wire Fencing, Electrical Wires or Other Infrastructure

All electrical services for the Proposed Action will be located underground.

Barbed wire fencing will not be used for the Proposed Action and grey-headed flying-foxes are unlikely to become entangled in any infrastructure associated with the Proposed Action. Further, the existing barbed wire structures within the Site will be removed as part of both construction works and ecological restoration efforts.

(f) Reduction in habitat connectivity to surrounding habitats and any potential edge effects

The Proposed Action involves the avoidance of the higher quality ecological values which support suitable foraging resources for grey-headed flying-fox within the Linear Habitat Corridor (see **Section 3.4.3**) and will result in further enhancement and consolidation of this habitat (see **Appendix 7** – Concept Rehabilitation Management Plan).

Significant edge effects are currently evident within vegetation communities throughout the Site, largely due to the historical degradation of the Site and a lack of coordinated land management practices and erosion of dispersive soils. This is particularly evident in Open Forest areas where the understorey is absent due to uncontrolled motorbike riding and illegal track construction. Through the avoidance (**Section 6.1**) and the consolidation and linking (**Section 6.2**) of higher quality foraging resources for grey-headed flying-fox, combined with the buffering function of the esplanade roads, drainage reserves, overland flow path

and local parks to the Linear Park (landscaped with native species), the Proposed Action is expected to *decrease* edge effects on grey-headed flying-fox foraging resources within the Site.

4.4 Swift parrot

(a) Loss breeding habitat

Swift parrot does not breed in the mainland. No breeding habitat will be affected.

(b) Landscape considerations and loss of forage habitat

Small numbers of migrating swift parrots (usually involving 1–5 or sometimes up to 12 birds) rarely reach south-east Queensland (outer Brisbane and Ipswich areas, and occasionally Warwick, Toowoomba, Bundaberg areas), at the northern extremity of their winter range. Their occurrence in Qld is related to the availability of food (or lack thereof) farther south. In periods of drought or lower foraging resources on the tablelands of the New England region to the south and south-west, swift parrot will seek foraging and shelter resources in coastal areas, traversing the great dividing ranges escarpment to find suitable winter resources.

There are no local records for the swift parrot, despite greater habitation of the Ripley Valley in recent years with the nearest records 10 km from the Site. Sub regional and regional records have been collected from the Queensland Government's Wildlife online database[39] and the Atlas of living Australia[40]. Records for the swift parrot are located ca. 11 km to the east at Springfield Lakes, 18 km to the east at the Greenbank Military Training Area, 30 km east of the Site and ca. 30 km to the east of the Site in Logan City. North of the Brisbane River records occur at Kenmore (7 km north), Kenmore Hills and Brookfield (10 km to the north, north-west), Bardon (14 km to the north, north-east), Mt Coot-tha (12 km to the north, north-east) and Pine Mountain (23 km north-west). The greatest number of records 20 occur at 25 km from the site, 14 are recorded at 20 km and 3 at 15 km (**Figure 19**).

The patterning of records within the greater Brisbane, Logan and Ipswich Region is indicative of birds crossing the Queensland Border from the northern tablelands of NSW, traversing along the main range (State significant corridor) to Toowoomba, along the Little Liverpool Range, and along the State significant Flinders Peak Corridor that extends from Rathdowney in the South, to Greenbank in the north (and encompasses White Rock, Spring Mountain, Flinders Peak, Mount Elliott, Mount Goolman and Mount Joyce) and from the Flinders Peak Corridor along a number of regionally important corridors to the Bremer and Brisbane Rivers (**Figure 19**).

Given their wide-ranging nature and increased ecological assessment (associated with development of the RVPDA and Swanbank Industrial Areas) and the number of new residents in this area, the absence of observations nearby, and the records closer to Springfield Lakes (11 km east), suggests that the main movement pathways in the region are along the Flinders/Mt Goolman Range (the State significant Flinders Peak Corridor).

Flinders View site is not located within either a regional or state corridor, nor is it connective with these corridors (refer **Figure 3** and **Figure 7**). This lack of connectivity has been reinforced in recent years by the significant land development now surrounding the Site to the west and south inclusive of the broader Ripley Residential and Swanbank Industrial areas.

39: Post 1980, Wildlife online data was sourced at 1, 2, 5, 10, 15, 20, 25 and 30 km radii from the central point -27.6519, 152.7895 (GDA 2020)
40: Data was vetted to exclude point sources prior to 1980, or which did not have record dates attached

It is likely that small transient and highly vagile groups opportunistically exploit the winter flowering ironbark and spotted gum of the higher country in these regional corridors, before dispersing onto lower country and associated waterways and floodplains in search of winter flowering Queensland blue gum which dominate the alluvial plains and lower slopes of the higher country, throughout the region. The waterways in this sub-region are all tributaries of the Brisbane and Bremer Rivers. Dispersal, whether along the high country or through the lowland floodplains leads to the pinch point between the Teviot/Flinders Peak Range and the D'Aguilar Range where the Brisbane River is constricted. This area, which includes the suburbs of Anstead, Moggill, Pinjarra Hills, Kenmore, Kenmore Hills and Brookfield (which have some of the highest Recorded observation in the sub-region) appears to be an area where birds, in search of available flowering Queensland blue gum, are funnelled. It is therefore considered highly unlikely that the swift parrot to occurs at the Site and if visiting, to be highly transient through the locality.

Within the Site, the greatest concentration of and largest specimens of Queensland blue gum, coincide with the Linear Park (a minor tributary of the Bremer River). This area is identified as RE12.3.3 and is shown in pre-clear regional ecosystem mapping. RE12.3.3 is a Queensland blue gum dominated woodland to open forest community. The balance of the site is formerly RE12.9-10.2, which is a spotted gum and ironbark woodland to open forest community. Queensland blue gum is present, though it is a species occurring in much low densities. Much of the RE12.9-10.2 on the site was previously cleared for agricultural production and trees present within the higher slopes tend to be less mature, particularly Queensland blue gum.

This area, mapped as RE12.3.3, dominated by mature Queensland blue gum and representing the highest value (most intact) habitat on-site, will be retained and protected by virtue of the proposed Linear Park. It is also noted that the components of Queensland blue gum open forest being retained within the Proposed Action support the highest abundance of large, mature specimens, which provide a more significant foraging resource due to their prolific flowering when compared to the scattered regrowth dominated by non-winter flowering species across other areas of the Site. In the context of development surrounding the Site, open forest habitat to the south of the Site and to the north have been removed by approved residential developments.

Queensland blue gum supplementary planting will also occur throughout the Ecological Corridor as part of restoration works; as well as within the drainage reserves and local park spaces, although it is acknowledged these trees will take some years to achieve a size where abundant foraging resources are provided. For comparison, approximately 12,137 ha of remnant and 12,514 ha of regrowth vegetation (representing winter forage habitat) where Queensland blue gum listed as a dominant or co-dominant canopy species occurs within 30 km of the site (**Table 8** and **Table 9** and **Figure 16** and **Figure 17**). The extent of lost habitat as part of the Proposed Action therefore represents <0.0014% of similar resources within a 30 km range.

It is important to recognise that this assessment does not recognise the presence of Queensland blue gum within the landscape in isolated patches and copses of vegetation, not recognised as remnant vegetation, regrowth, paddock trees or areas of ecological restoration which are substantial around the lower flats adjoining the Bremer and Brisbane Rivers. Queensland blue gum supplementary planting will also occur throughout the Linear Park as part of restoration works as well as within the drainage reserves and local park spaces.

It is highly unlikely that swift parrot would occur at the site, and if visiting the region would be highly transient through the locality and utilise the larger tracts of intact remnants, particularly the larger patches with suitable foraging resources, those being Brisbane/Bremer River flood plains and the large remnant corridors. Furthermore, given the lack of records for swift parrot in the vicinity of the Site; the infrequency of records for swift parrot in south-east Queensland and the negligible impacts of the Proposed Action on

regional Queensland blue gum resources it is concluded that the Proposed Action is unlikely to have a direct or indirect impacts on this species.

On the basis of the above findings, an assessment against the Critically Endangered significant impact criteria of the *Significant Impact Guidelines 1.1*[41] has been conducted. This has been appended as **Appendix 16**.

The Assessment concluded that there was unlikely to be a Significant Impact on swift parrot arising from the proposed action. Dr Steve Debus has reviewed the impact assessment and provided written endorsement of the findings of the assessment. His endorsement is appended to the significant impact assessment.

4.5 Greater glider

4.5.1 Direct impacts

(a) Habitat loss associated with mortality and displacement

In-situ forage habitat

Habitat assessment is based upon the structural and floristic attributes attributable to Greater glider described by Eyre et al. (2022) shows that 47.47 ha of potential habitat present (area illustrated in: **Figure 10**):

- There is 10.45 ha of cleared grassland with sparse paddock trees adjoining the Cunningham Highway in the northwest corner of the Site. Similar habitat is located to the north-east. Such habitat is generally not considered to be potential habitat and habitat quality (availability of food and foraging habitat and viability of shelter has therefore been assessed by the MHQA as mostly poor). These areas primarily occupy Assessment Unit AU1;
- There are 10.56 ha of edge impacted sparse woodland (AU1 - 5.60 ha), regrowth (AU2 - 2.83 ha) and remnant (AU3 - 2.95 ha) open forest. The regrowth and remnant open forest habitat, comprising RE12.9-10.2 and RE12.3.3, are the ecosystems that support greater glider. These areas are impacted by lighting and noise impacts from surrounding development (refer section 2.2.2 of **Appendix 40**). The quality of food, foraging and shelter habitat is poor to moderate.
- There is 26.46 ha of sparse woodland (AU1 – 7.73 ha), regrowth (AU2 – 10.63 ha) and remnant (AU3 – 8.10 ha) open forest potential habitat comprised of Greater glider habitat REs 12.9-10.2 and 12.3.3. The development would directly / indirectly impact these. These areas have the highest quality and availability of food, foraging and shelter habitat.

A total of 37.78 ha of vegetation with characteristics consistent with statutory definitions of critical greater glider habitat will be directly impacted by the project. Works undertaken by Urban Utilities in 2022 accounts for 0.61 ha of habitat impact within the area of retained vegetation of the linear corridor.

In-situ denning habitat

Eyre *et al*. (2022)[42] identify that trees > 500 mm DBH are preferred for denning. However, the growth rate of trees and their propensity to form hollows depends on a wide range of factors, including the subject

41: Commonwealth of Australia (2013) Significant Impact Guidelines 1.1 - Matters of National Environmental Significance. Department of Environment, Energy, Climate Change and Water. Canberra.

42: Eyre TJ, Smith GC, Venz MF, Mathieson MT, Hogan LD, Starr, C, Winter, J and McDonald, K (2022) *Guide to greater glider habitat in Queensland*. report prepared for the Department of Agriculture, Water and the Environment, Canberra. Department of Environment and Science, Queensland Government, Brisbane. CC BY 4.0.

species, growing conditions, and damage. Growth stage assessments may provide a better surrogate than size alone for determining the number of hollow-bearing trees potentially present on a site as most Greater glider dens are in trees in the late mature and over-mature growth stages. This is recognised by Eyre et al. (2022), which, in Section 4.2, notes, "*selection of some tree species over others for denning by greater gliders will foremost depend on the age and senescence stage of the tree and species' inherent propensity to form hollows*."

The tree survey data set collected was then sorted to identify trees > 500 mm DBH. There are 456 potential denning trees greater than 500 mm DBH present at the development site (375 trees in the 501-750 mm DBH class (refer **Figure 22b**), 75 trees in the 751-1,000 mm DBH class (refer **Figure 22c**), and 6 trees greater than 1,001 mm DBH (refer **Figure 22d**).

A hollow occurrence factor[43] was applied to predict potential suitable occurrence based upon a sample data set (refer Section 2.2.4 of **Appendix 40**). The number of potentially suitable denning hollows across the development site is assessed as 93.

Ex-situ habitat

Greater glider has low persistence in fragmented landscapes and modelling suggests viable populations need patches of at least 160 km^2 (TSSC 2016). The largest extent of suitable vegetation in the local landscape is associated with large blocks of open forest habitat associated with the White Rock and Flinders Peak areas ~5 km to the south and south-east.

The Site is separated from this area by large canopy gaps; thinned canopy and regrowth in all directions. Cunningham Highway (east), Centenary Highway (south and south-east) and Ripley Road (south) are all significant linear barriers, fragmenting habitat and impeding movement.

If extirpated from the site and immediate surrounds, the ability for movement of greater glider from areas of known occupied habitat to the south of the Centenary Habitat (if a source population) is a key consideration. There are many potential barriers to movement here. These are discussed in **Section 3.4.5** ((b) Extent, quality and Importance of known potential habitat). Movement through this area, although it cannot be definitively ruled out, is tenuous on account of historical disturbance, vegetation thinning and clearing and transitioning landuses away from rural residential developments.

Movement of greater glider beyond the Impact Site is not possible owing to significant landscape barriers (Cunningham Highway). Potential movement through the site, and north through Roarke's Park and beyond into riparian corridor of Bundamba Creek although unlikely, will remain.

4.5.2 Indirect Impacts

Potential indirect impacts on greater glider associated with the Proposed Action are described below.

(a) Habitat fragmentation

The Impact Site is located within a landscape that is already highly fragmented. This context is identified by **Inset 4** of **Section 3.4.5**. No greater glider have been found on the Impact Site. The greater glider statutory documentation considers that potential habitat, even if greater glider is absent as considered critical habitat as greater gliders could colonise in the future.

43: i.e. the rate at which hollows occur in the various tree size classes

If extirpated from the site and immediate surrounds, the ability for movement of greater glider from areas of known occupied habitat to the south of the Centenary Highway (if a source population) is a key consideration. There are many potential barriers to movement here. These are discussed in **Section 3.4.5** ((b) Extent, quality and importance of known potential habitat). Movement through this area, although it cannot be definitively ruled out, is tenuous on account of historical disturbance, vegetation thinning and clearing, and transitioning land uses away from rural residential developments.

Movement of greater glider beyond the Impact Site is not possible owing to significant landscape barriers (Cunningham Highway). Potential movement through the site, and north through Roarke's Park and beyond into riparian corridor of Bundamba Creek although unlikely, will remain.

(b) In-situ habitat loss arising from edge effects and interspecific competitions for hollows

The Department considers and assesses edge-effects[44] on a case-by-case basis relying on site specific contextual data to support conclusions regarding species' habitat quality.

Edge effects (deleterious impacts), experienced along the edges of habitat patches describe the biotic and abiotic interaction between habitat patches and the surrounding landscape matrix. In the case of Greater Glider, Youngentob et al. (2012) identify noise and light and interspecific competition for forage resources and denning-hollows along forest edges as key factors diminishing the availability and quality of forage and shelter habitat for greater glider[45]. Such impacted areas may be considered 'compromised'[46].

In consideration of edge effects, the Department believes the proposed Linear Habitat Corridor would be compromised habitat for greater glider as a result of undertaking the Proposed Action. This position is accepted by the proponent. However, it is the authors assertion that assessment of edge effected habitat, should equally apply to existing development. That is, if new residential development causes such impact (as is accepted), then so too must that same impact, arising from existing development and other 'avoided edges' (e.g., open paddock) be considered. Such existing development lies in an arc along the northern boundary (west of the waterway) extending around the western boundary to the south-western corner of the Impact Area (see **Figure 10**). On account of habitat values being compromised, extant habitat quality assessment for greater glider on the Impact Area, assesses these areas as being compromised by existing edge effects (as described by Youngentob et al. (2012)). This is further discussed in **Section 5.4**.

(c) Hyper-predation by native owls

Greater gliders are a favoured food item of powerful owl (*Ninox strenua*). The proposed actions will not increase powerful owl foraging resources (arboreal mammals, occasionally flying-fox) and, hence, no increased risk of predation by native owls will occur.

(e) Significant impact assessment

Assessment of impacts against the Matters of National Environmental Significance Significant Impact Guidelines 1.1 (DoE 2013) is presented in **Table 11**. This assessment concluded that the Proposed Action would adversely affect habitat critical to the survival of the greater glider (given the reference to the statutory documentation directs consideration of the habitat present as habitat critical to the survival, on account of

---

44: Based on the findings of Youngentob, K.N. Hwan-Jin Yoon, Coogan, N and Lindenmayer, D.B. 2012. Edge effects influence competition dynamics: A case study of four sympatric arboreal marsupials. Biological Conservation (155), referenced in the third-round adequacy review.
45: Competition for hollows with other hollow-denning species is likely to already be present in the Impact Area; species such as common brushtail possum (competition for hollows) and common ringtail possum (competition for forage resources – both are folivores) were observed during field surveys.
46: 'Compromised' in the sense that habitat utility is suppressed, not functionally lost as a result of edge effects.

habitat features alone) and identifies that the project may interfere with its recovery by preventing future colonisation of potential habitat.

Table 11: EPBC Significant Impact Assessment for greater glider

Guideline	Justification
Lead to a long-term decrease in the size of a population	The Site does not currently appear to support the greater glider. Although there is future colonisation potential, the current and emerging land-uses within proximity of the Site, implies that the proposal would not lead to a long-term decrease in the size of a greater glider population.
Reduce the area of occupancy of the species	The Site does not currently appear to support the greater glider. Although there is future colonisation potential, the current situation implies that the proposal would not reduce the area of occupancy of the greater glider.
Fragment an existing important population into two or more populations	The Cunningham Highway forms the western boundary of the Site. Residential land lies to the north and rural residential land the east. Land to the south of the Site was recently cleared and there is reduced limited habitat to the south. The main potential habitat connection is therefore to the east through fragmented regrowth associated with rural residential properties, former mining lands and industrial precincts. Habitat along the central waterway will be retained and this would afford habitat connectivity to the south and north. Thus, the proposal would not fragment an existing greater glider population.
Adversely affect habitat critical to the survival of a species	Despite the apparent absence of the greater glider from the Site, it was determined that habitat critical to its survival is present as: 1) the habitat characteristics suggest that potential habitat is present; and 2) there is future colonisation potential provided adequate connectivity to the Site is maintained. The proposal would remove 37.78 ha of potential habitat and further compromise 9.69 ha through edge effects. This constitutes an adverse impact to critical habitat for the greater glider.
Disrupt the breeding cycle of a population	The Site does not currently appear to support the Greater Glider. Thus, the proposal would not disrupt the breeding cycle of a greater glider population.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	The proposal would not modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the greater glider is likely to decline.
Result in invasive species that are harmful to an endangered or critically endangered species becoming established in the endangered or critically endangered species' habitat	The proposal is unlikely to introduce or exacerbate invasive species that are harmful to the greater glider or its habitat.

Guideline	Justification
Introduce disease that may cause the species to decline	The proposal is unlikely to introduce disease that is harmful to the greater glider.
Interfere with the recovery of the species	Recovery of the greater glider will include the ecological restoration of potential habitat that will enable colonisation to expand populations. This will be particularly important in fragmented habitat, such as the Site locality. By removing potential greater glider habitat, which would prevent future colonisation, the proposal may interfere with the recovery of the greater glider.

5 Residual Impacts

5.1 Methodologies for Habitat and Foraging Quality Assessment Scoring

As requested within the Information Request (item 4.4), the Proponent is required to confirm the quality of habitat to be impacted within the development footprint (Impact Area). To ensure that the Proponent can adequately address this, in a consistent manner to which habitat quality will be assessed at a suitable offset site, 28 South has utilised the: *Queensland Government Guide to Determining Terrestrial Habitat Quality: A toolkit for assessing land based offsets under the Queensland Environmental Offsets Policy (Version 1.2 2017)*[47] (**HQA Guide**) (DES, 2020) as a basis to determine habitat quality scoring over the impacted areas of the Site (i.e. the Residential Precinct, Local Parks and Stormwater Management Areas). This methodology is well recognised, robust, repeatable and a standard by which most large-scale assessments are measured.

This methodology collects relevant ecological data and reviews it against known benchmarks for remnant (or pre-clearing) data for the individual Regional Ecosystem and produces a weighted score for each "Assessment Unit". Assessment Units (**AUs**) are derived from areas of similar habitat types (e.g. Regional Ecosystems, cleared paddocks, stands of weed, regrowth vegetation etc.).

The Site has been divided into three (3) Assessment Units to reflect the different states of the vegetation on-Site (refer **Figure 10**). For the purpose of quantifying impacts, contiguous habitat associate with the development is presented as **Figure 23a**; landscape connectedness is shown as **Figure 24**.

In relation to the Site Context assessment outlined in the HQA Guide, Patch Size, Connectedness and Context mapping, illustrative of the relevant calculations and scoring are identified by **Figure 23b**, **Figure 23c** and **Figure 23d**, respectively. The results for the Site Context assessment are:

- Patch size – 92ha (MHQA Score of '5')
- Connectedness – 38% (MHQA Score of '2')
- Context – 20.2% (MHQA Score of '2').

The Controlled Action decision for the Ripley View Residential Subdivision under Section 75 EPBC Act was made 2 June 2020. This was prior to the uplifting of koala and greater glider from Vulnerable to Endangered. The koala was uplifted to Endangered 12 February 2022 and the greater glider 5 July 2022.

Section 158A of the EPBC Act provides that approval process decisions under Parts 7 – 9 of the EPBC Act will not be affected by an uplisting event made after the determination. On this basis, offset calculations for koala and greater glider are assessed as both species being vulnerable.

5.2 Koala

5.2.1 Direct Impact

The Residual Significant Impact on koala is 37.79 ha of impact arising from the Proposed Action. A further 0.61 ha of impact arising from Urban Utilities trunk sewer main upgrades unrelated to the Proposed action occurs at the Site within parts of the site proposed for avoidance. The disturbance by Urban Utilities will be mitigated through restoration of the disturbance footprint within the vegetation retained within the Linear Habitat Corridor (designated Avoidance Area) (see **Section 2.3.1**, **Figure 5** and the Concept Rehabilitation

47: https://environment.des.qld.gov.au/__data/assets/pdf_file/0015/90312/habitat-quality-assessment-guide.pdf

Plan - **Appendix 7**). The loss of foraging habitat on the site, that is the with Significant Residual Impacts of 38.40 ha will offset through the provisions described in **Section 7**.

Taking into consideration the avoidance measures in **Section 6.1** and the mitigation measures in **Section 6.2**, and referencing the Koala Referral Guidelines, the Proposed Action will have a residual impact on the koala. This residual impact is quantified as the removal of no more than 37.31 ha of habitat for urban purposes, even though much of this land presently exists as historically cleared paddocks. 5.69 ha of this disturbance area ((comprising stormwater management infrastructure (2.73 ha) and batters to the waterway (2.96 ha)) will be restored with open forest habitat to form an interface between residential development areas and retained open forest habitat within the Linear Park avoided by the Proposed Action. The Linear Park will be enhanced through assisted natural regeneration and restoration measure to maintain and expand the area of useful high-quality habitat for koala.

Some residual impacts are likely to be attributable to koala interaction with people, dogs and vehicles associated with the Proposed Action. However, it is considered that the measures outlined in **Sections 6.3** will effectively reduce these residual impacts to a level that is as low as practicable within an urban environment.

5.2.2 Quantum of Impacts

the Proposed Action only results in a Significant Residual Impact of 37.31 ha to koala (see **Section 4.2.1**). However, for the purposes of the offset area calculation, the additional 0.61 ha of Urban Utilities disturbance is included in the calculation. The total quantum of impact to be offset is therefore calculated as 38.4 ha.

(a) Methodology

In order to determine the quantum and quality of the habitat suitable for koala on-Site, vegetation/habitat quality was derived from the Modified Habitat Quality Assessment tool. This assessment approach utilises the Queensland BioCondition Assessment method combined with Site context and species stocking rate assessments to determine the habitat quality of the referral area.

(i) Modified Habitat Quality Assessment

The traditional terrestrial habitat quality assessment assesses three (3) core indicators—Site condition, Site context and species habitat index.

The modified habitat quality assessment combines the three (3) core indicators into two (2) (Site condition and Site context) with each Site Condition being weighted 30% of the final score and Site Context being weighted 30% of the final score. The balance of the weighting (40 %) has been attributed to the third indicator which is independent of the traditional habitat quality assessment, being species stocking rate.

The species stocking rate has been added to the MHQA to better incorporate MNES, and for the purpose of this preliminary documentation, the endangered-listed koala MNES. The following section details the methodology utilised to assess the Site condition, Site context and species stocking rate under the MHQA.

(ii) Site condition (30%)

Assessing Site condition is an integral step in determining specific quantification of impacts, while also determining whether an offset Site is suitable to establish a desired capacity to support the prescribed environmental matters being offset. The on-Site condition is a key element of habitat quality and has a direct influence on the biodiversity it supports. Site condition is assessed using a suite of attributes to describe the structure and function of the vegetation community and is benchmarked against the expected range for a relatively undisturbed community.

The Site condition assessment under the MHQA is assessed using fifteen (15) condition characteristics being:

- recruitment of woody perennial species in the ecologically dominant layer (EDL)
- native plant species richness – trees
- native plant species richness – shrubs
- native plant species richness – grasses
- native plant species richness – forbs
- tree canopy height
- sub-canopy cover
- tree canopy cover
- native grass cover
- organic litter
- large trees
- coarse woody debris
- non-native plant cover
- quality and availability of food and foraging habitat
- quality and availability of shelters.

(iii) Site context (30%)

The Site context assessment deals with the Site and its adjacent surroundings. Site context is measured using a suite of attributes to describe the location of the habitat within the surrounding landscape and the influence of its associated threats. This assessment also considers the influence of adjacent vegetated areas and ecological corridors. Under the MHQA, Site context is measured using the following seven (7) characteristics:

- size of patch
- context (refer **Figure 23**)
- connectedness (refer **Figure 24**)
- ecological corridors (Biodiversity Corridor) (refer **Figure 24**)
- role of Site location to species overall population in the state
- threats to the species
- species mobility capacity.

Unlike the traditional habitat quality assessment methodology where Site connectedness is assessed against the surrounding remnant vegetation only, the MHQA Site connectedness is assessed against the surrounding MNES habitat, in this instance, Koala Habitat. Whilst remnant eucalypt forest vegetation is critical habitat for koala, equally Koalas can utilise areas of non-remnant vegetation or high value regrowth vegetation that does not yet achieve remnant status. Therefore, Site context under the MHQA accounts for surrounding species habitat rather than remnant vegetation. In developing the MHQA, three (3) species habitat index characteristics were nominated; role of Site location to overall species population in the state, threats to the species and species mobility capacity.

(iv) Species stocking rate (40%)

The MHQA incorporates species stocking rate as an attribute not discussed under the traditional terrestrial habitat assessment methodology. Species stocking rates are estimates of the koala carrying capacity of the Site at the time of undertaking the survey. Given the discreet nature of the koala and limited to no published literature on habitat carrying capacity of the species, the species stocking rate scoring methodology has been derived through the collation of site-specific surveys and surrounding contextual habitat analysis. **Table 12** outlines the attributes utilised to assess species stocking rate.

Table 12: Species Stocking Rate Scoring – koala

Attribute	Possible maximum score
Species stocking rate table	
Presence detected on or adjacent to Site (neighbouring property with connecting habitat)	Score out of 10
Species usage of the Site (habitat type and evidenced usage)	Score out of 15
Approximate density (per ha)	Score out of 30
Species stocking rate supplementary table	
Key source population for breeding (/10)	
Key source population for dispersal (/5)	
Necessary for maintaining genetic diversity (/15)	
Near the limit of the species range (/15)	
SSR[48] Supplementary Table Score (from the four features above)	Score out of 15
Total Species Stocking Rate Score	Score out of 70
Species stocking rate	**Score out of 4**

(b) Findings

Three assessment units, reflective of historic Site disturbance have been identified. Their extent, typology and extent are:

- Impact Assessment Site, Assessment Unit 1 (IA AU1 – 3 BioCondition plots) – open paddock, pre-clear RE 12.9-10.2 *Corymbia citriodora subsp. variegata* (spotted gum) open forest or woodland usually with *Eucalyptus crebra* (narrow leaved ironbark). Other species such as *Eucalyptus tereticornis* (Queensland blue gum), *E. moluccana* (grey box), *E. acmenoides* (white stringybark) and *E. siderophloia* (northern grey ironbark) may be present in scattered patches or in low densities.
    - Total AU area – 21.75 ha (45.8% of Site)

48: Species Stocking Rate

- Total disturbance area 20.53 ha (94.5% of AU).

- Impact Assessment Site, Assessment Unit 2 (IA AU2 – 2 BioCondition plots) – regrowth open forest with *Corymbia citriodora subsp. variegata* (spotted gum) open forest or woodland usually with *Eucalyptus crebra* (narrow leaved ironbark). Other species such as *Eucalyptus tereticornis* (Queensland blue gum), *E. moluccana* (grey box) and an exotic grassy understorey, pre-clear RE 12.9-10.2.

    - Total AU area – 13.97 ha (29.4% of Site)
    - Total disturbance footprint – 12.61 ha (90.2% of AU).

- Impact Assessment Site, Assessment Unit 3 (IA AU3 – 2 plots) – *Eucalyptus tereticornis* (Queensland blue gum), with *Corymbia tessellaris* (Moreton Bay ash), *Corymbia intermedia (*pink bloodwood*) and Lophostemon suaveolens* (swamp box), with a grassy understorey. Contains areas of regrowth and remnant RE12.3.3.

    - Total AU area - 11.75 ha (31.4% of Site)
    - Total disturbance footprint – 5.26 ha (44.8% of AU).

Refer to **Section 3.4.1** for a description of the habitats present.

Determination of the AUs were informed by inspection and interrogation of State Government vegetation and pre-clear mapping and data sets, and review of vegetation mapping conducted for the project. In order to determine Site condition, appropriate 'benchmarks' are required to score residual habitats quality against. No mapped 'remnant' or regulated regrowth' is mapped over the Site. Pre-clear Regional Ecosystem mapping coupled with assessment of relict tree data collected in the field was used to delineate appropriate AUs and benchmarks.

The habitat quality scores for each assessment unit, combining Site Condition, Site Context and Species Stocking Rate are reported in **Appendix 17** with a summary presented as **Table 13.** The scores for Site Condition are derived directly from the MHQA Tool data. These scores are then used to determine the scores for Quality and Availability of Food and Foraging Habitat, and Quality and Availability of Shelter.

This score is calculated based on the combined weighted habitat quality scores for each assessment unit:

- Site condition
- Site context
    - Size of patch
    - Connectedness
    - Context
    - Ecological corridors
    - Role of the Site in terms of the overall population in the state
    - Threats to the species
    - Species mobility capacity
- Species stocking rate.

Table 13: Koala Modified Habitat Quality Assessment – Impact Site

Habitat quality score weighted	AU1	AU2	AU3	Total
Site condition score (out of 3)	1.53	1.80	1.98	1.77
Site context score (out of 3)	1.50	1.66	1.66	1.61
Species Stocking Rate Score (out of 4)	2.29	2.29	2.29	2.29
Habitat Quality score (out of 10)	5.12	5.75	5.93	5.66
Assessment Unit area (ha) in disturbance footprint	20.53	12.61	5.26	38.40
Total Impact Area (ha) for this MNES	38.40	38.40	38.40	38.40
Size Weighting	0.53	0.33	0.14	1.00
Total Weighted Habitat Quality Score	**5.54**			

The Site was given an overall weighted habitat quality score of 5.54 out of the total of 10 which rounds to a score of 6 out of 10. This is considered a moderate habitat quality score.

(c) Impact site area and EPBC impact calculator

To define a '*total quantum of impact*', it is necessary to achieve a koala habitat quality score out of 10. As such, the above provides a measurable method for arriving at a qualified score to input into the EPBC Offset Calculator. The final score assigned to the Impact Area has been determined through the HQA as it provides a scientifically robust and accepted scoring method for habitat and ecological qualities of an area. This supports the original ecological assessments conclusion that habitats within the Impact Areas were of relatively low ecological quality.

The total defined Residual Significant Impact Area equates to 38.40 ha with a total weighted MHQA adjusted to 6[49]. The EPBC Calculator then adjusts the 'total quantum of impact' based on an internal equation which defines the Impact Areas of the Site as having a 23.04 ha 'total quantum of impact' as shown in **Inset 5**. The Offsets Assessment Guide 'EPBC Act status' for koala is that applicable at the time the CAR was lodged[50].

49: Actual MHQA score of 5.54 which is rounded to 6

50: The Controlled Action decision for the Ripley View Residential Subdivision under Section 75 EPBC Act was made 2 June 2020. This was prior to the uplifting of koala and greater glider from Vulnerable to Endangered. The koala was uplifted to Endangered, 12 February 2022 and the greater glider, 5 July 2022. Section 158A of the EPBC Act provides that approval process decisions under Parts 7 – 9 of the EPBC Act will not be affected by an uplisting event made after the determination. On this basis, offset calculations for koala and greater glider are assessed as both species being vulnerable.

Matter of National Environmental Significance	
Name	Koala
EPBC Act status	Vulnerable
Annual probability of extinction Based on IUCN category definitions	**0.2%**

Impact calculator						
	Protected matter attributes	**Attribute relevant to case?**	**Description**	**Quantum of impact**	**Units**	**Information source**
	Ecological communities					
	ommunity Clear row	No		**Area**		
				Quality		
				Total quantum of impact 0.00		
	Threatened species habitat					
	habitat Clear row	Yes	Koala	**Area** 38.4	Hectares	PD Report
				Quality 6	Scale 0-10	
				Total quantum of impact 23.04	Adjusted hectares	

Inset 5: Impact Calculator Inputs for Koala

5.3 Grey-headed flying-fox

5.3.1 Direct Impact

The Residual Significant Impact on grey-headed flying-fox is 37.31 ha of impact arising from the Proposed Action. A further 0.61 ha of impact arising from Urban Utilities trunk sewer main upgrades unrelated to the Proposed action occurs at the Site within parts of the site proposed for avoidance.. The disturbance by Urban Utilities will be mitigated through restoration of the disturbance footprint within the vegetation retained within the Linear Habitat Corridor (designated Avoidance Area) (see (see **Section 2.3.1**, **Figure 5** and the Concept Rehabilitation Plan - **Appendix 7**).

The loss of important winter foraging habitat comprising Habitat Critical to the Survival of grey-headed flying-fox, that is comprising a Significant Residual Impacts of 37.92 ha, will offset through the provisions described in **Section 7**.

Taking into consideration the avoidance measures in **Section 6.1** and the mitigation measures in **Section 6.2** and referencing the grey-headed flying-fox statutory documentation, the Proposed Action will have a residual impact on the grey-headed flying-fox. This residual impact is quantified as the removal of no more than 37.31 ha of habitat for urban purposes, even though much of this land presently exists as historically cleared paddocks. 5.69 ha of this disturbance area (comprising stormwater management

infrastructure (2.73 ha) and batters to the waterway (2.96 ha)) will be restored with open forest habitat to form an interface between residential development areas and retained open forest habitat within the Linear Park avoided by the Proposed Action. The Linear Park, comprising high-quality winter blossoming forage resource for grey-headed flying-fox will be enhanced through assisted natural regeneration and restoration measure to maintain and expand the area of useful high-quality habitat for grey-headed flying fox.

Some residual impacts are likely to be attributable to grey-headed flying fox interaction with people, dogs and vehicles associated with the Proposed Action. However, it is considered that the measures outlined in **Sections 6.3** will effectively reduce these residual impacts to a level that is as low as practicable within an urban environment.

5.3.2 Quantum of Impact

the Proposed Action only results in a Significant Residual Impact of 37.31 ha to grey-headed flying-fox (see **Section 4.3.1**). However, for the purposes of the offset area calculation, the additional 0.61 ha of Urban Utilities disturbance is included in the calculation. The total quantum of impact to be offset is therefore calculated as 37.92 ha.

The Site has been divided into three (3) Assessment Units to reflect the different states of the vegetation on-Site (refer **Figure 8**).

(a) Methodology

In order to determine the quantum and quality of the habitat suitable for Grey-headed flying fox on-Site, vegetation/habitat quality was derived from the Modified Habitat Quality Assessment (**MHQA**) tool. This assessment approach utilises the Queensland BioCondition Assessment method combined with Site context and species stocking rate assessments to determine the habitat quality of the referral area.

While it is acknowledged that BioCondition surveys capture important on-ground metrics of an Assessment Unit holistically, some metrics are not entirely relevant to certain matters while equally other metrics are more relevant in their significance. For example, and of relevance to this Project, the Grey-headed flying-fox has markedly different habitat and resource requirements to small terrestrial species (e.g. fossorial skinks or *Dasyurids*). This is exemplified in the published literature prepare by Eby and Law (2008) which focuses on how important the flowering efficacy, production and biological timing of flowering are critical for the persistence of Grey-headed flying-foxes along the eastern coast of Australia; while the National Recovery Plan further highlights roosts and foraging resources within 20 km of them are critical. It is also important to note, this species forages across all landscape typologies relative to the proportion of the habitat type (Westcott et al. 2015).

As such, consideration of specific metrics being assigned an alternate scoring application (higher or lower score in the overall attributes) or weighting within the MHQA must be considered (e.g. increased or decreased in their line itemised score within the MHQA). Alternate scoring methodologies or amendments to the weighting should be in line with the DCCEEW's 'How to use the Offset Assessment Guide' and 'Environmental Offsets Policy' while utilising key elements of the relevant matters SPRAT, Conservation Advice/ Recovery Plan and published scientific literature.

A detailed outline of the devised alternate scoring is contained in **Appendix 18**.

(i) *Site Condition (40%)*

Assessing Site condition is an integral step in determining specific quantification of impacts, while also determining whether an offset Site is suitable to establish a desired capacity to support the prescribed environmental matters being offset. The on-Site condition is a key element of habitat quality and has a

direct influence on the biodiversity it supports. Site condition is assessed using a suite of attributes to describe the structure and function of the vegetation community and is benchmarked against the expected range for a relatively undisturbed community.

The Site condition assessment under the grey-headed flying-fox alternate method habitat quality assessment is assessed against using fifteen (15) condition characteristics being:

- recruitment of woody perennial species in the ecologically dominant layer (EDL)
- native plant species richness – trees
- native plant species richness – shrubs
- native plant species richness – grasses
- native plant species richness – forbs
- tree canopy height
- sub-canopy cover
- tree canopy cover
- native grass cover
- organic litter
- large trees
- coarse woody debris
- non-native plant cover
- quality and availability of food and foraging habitat – Alternative Scoring Method
- quality and availability of shelters – Alternative Scoring Method.

The total Site Condition Score is measured out of 180 to accommodate the alternate quality and availability of food and foraging and availability of shelter scores.

To better reflect attributes that are of greater significance to the Grey-headed flying-fox, it is important understand what is key elements for habitat that are critical to the survival of the Grey-headed flying-fox. The National Recovery Plan defines this as:

Where the existence of these important winter and spring flowering vegetation communities[51] is verified in the field, they are considered habitat critical to the survival of the Grey-headed Flying-fox. Back yard fruit trees, orchards or non-native trees that may be used for foraging are not considered to be habitat critical to the survival of the Grey- Headed Flying-Fox.

Alternate quality and availability of food and foraging habitat metrics (scored out of 80 whereas traditional MHQA is 10), is based upon the quality of flowering resources at the site contain native species that are known to be productive as foraging habitat during resource bottlenecking (i.e. winter) and the final weeks of gestation, and during the weeks of birth, lactation and conception (August to May). Quality and availability of shelter is determined by presence of known camps within 25 km.

Total weighting is 40% in contrast to the Traditional MHQA (which is 30%).

(ii) *Site Context (30%)*

The Site context assessment deals with the Site and its adjacent surroundings. Site context is measured using a suite of attributes to describe the location of the habitat within the surrounding landscape and the influence of its associated threats. This assessment also considers the influence of adjacent vegetated

51: Refer species lists of important flowering trees in: Eby and Law (2008); Eby 2016; Eby *et al*. (2019)

areas and ecological corridors. Under the MHQA, Site context is measured using the following seven (7) characteristics:

- size of patch (refer **Figure 44** with annotations showing analysis)
- connectedness (refer **Figure 45** with annotations showing analysis)
- context (refer **Figure 46** with annotations showing analysis)
- ecological corridors (Biodiversity Corridor) (refer **Figure 30**)
- role of Site location to species overall population in the state
- threats to the species
- species mobility capacity.

Unlike the traditional habitat quality assessment methodology where Site connectedness is assessed against the surrounding remnant vegetation only, the MHQA Site connectedness is assessed against the surrounding MNES habitat, in this instance, grey-headed flying-fox Habitat. Whilst remnant eucalypt forest vegetation with winter flowering resources is critical habitat for Grey-headed flying-foxes, equally they can utilise areas of non-remnant vegetation or high value regrowth vegetation that does not yet achieve remnant status. Therefore, Site context under the MHQA accounts for surrounding species habitat rather than remnant vegetation. In developing the MHQA, three (3) species habitat index characteristics were nominated; role of Site location to overall species population in the state, threats to the species and species mobility capacity.

Alternative methods for assessing the attributes *role of site to species overall population in the state* and *threats to the species* have been modified to reflect their importance to Grey-headed flying-fox and its biological/ ecological values. These are discussed in detail in **Appendix 18**.

(iii) *Species stocking rate (30%)*

The MHQA incorporates species stocking rate as an attribute not discussed under the traditional terrestrial habitat assessment methodology. Species stocking rates are estimates of grey-headed flying-fox carrying capacity of the Site at the time of undertaking the survey. Given the discreet nature of the grey-headed flying-fox and limited to no published literature on habitat carrying capacity of the species, the species stocking rate scoring methodology has been derived through the collation of site-specific surveys and surrounding contextual habitat analysis. **Table 14** outlines the attributes utilised to assess species stocking rate.

Table 14: Species Stocking Rate Scoring - Grey-headed Flying-fox

Attribute	Possible maximum score
Species stocking rate table	
Presence detected on or adjacent to Site (neighbouring property with connecting habitat)	Score out of 10
Species usage of the Site (habitat type and evidenced usage)	Score out of 15
Approximate density (per ha)	Score out of 30
known nationally important / camps within 25 km – *subscore out of 15*	
presence of foraging habitat (state mapped) within the site - *subscore out o 15*	
Species stocking rate supplementary table	

Attribute	Possible maximum score
Key source population for breeding (/10)	
Key source population for dispersal (/5)	
Necessary for maintaining genetic diversity (/15)	
Near the limit of the species range (/15)	
SSR[52] Supplementary Table Score (from the four features above)	Score out of
Total Species Stocking Rate Score	Score out of 70
Species stocking rate	**Score out of 3**

Total Species Stocking Rate weighting is 30% in contrast to the Traditional MHQA (which is 40%).

(b) Findings

Three assessment units, reflective of historic Site disturbance have been identified. Their extent, typology and extent are:

- Impact Assessment Site, Assessment Unit 1 (IA AU1 – 3 BioCondition plots) – open paddock, pre-clear RE 12.9-10.2 *Corymbia citriodora subsp. variegata* (spotted gum) open forest or woodland usually with *Eucalyptus crebra* (narrow leaved ironbark). Other species such as *Eucalyptus tereticornis* (Queensland blue gum), *E. moluccana* (grey box), *E. acmenoides* (white stringybark) and *E. siderophloia* (northern grey ironbark) may be present in scattered patches or in low densities.
    - Total AU area – 21.75 ha (45.8% of Site)
    - Total disturbance area 20.53 ha (94.5% of AU).
- Impact Assessment Site, Assessment Unit 2 (IA AU2 – 2 BioCondition plots) – regrowth open forest with *Corymbia citriodora subsp. variegata* (spotted gum) open forest or woodland usually with *Eucalyptus crebra* (narrow leaved ironbark). Other species such as *Eucalyptus tereticornis* (Queensland blue gum), *Eucalyptus moluccana* (grey box) and an exotic grassy understorey, pre-clear RE 12.9-10.2.
    - Total AU area – 13.97 ha (29.4% of Site)
    - Total disturbance footprint – 12.61 ha (90.2% of AU).
- Impact Assessment Site, Assessment Unit 3 (IA AU3 – 2 plots) – *Eucalyptus tereicornis* (Queensland blue gum), with *Corymbia tessellaris* (Moreton Bay ash), *Corymbia intermedia* (pink bloodwood*) and Lophostemon suaveolens* (swamp box), with a grassy understorey. Contains areas of regrowth and remnant RE12.3.3.
    - Total AU area - 11.75 ha (31.4% of Site)
    - Total disturbance footprint – 4.78 ha (40.7% of AU).

52: Species Stocking Rate

Refer to **Section 3.4.1** for a description of the habitats present.

Determination of the AUs were informed by inspection and interrogation of State Government vegetation and pre-clear mapping and data sets, and review of vegetation mapping conducted for the project 2015 to present. In order to determine Site condition, appropriate 'benchmarks' are required to score residual habitats quality against. No mapped 'remnant' or regulated regrowth' is mapped over the Site. Pre-clear Regional Ecosystem mapping coupled with assessment of relict tree data collected in the field was used to delineate appropriate AUs and benchmarks.

The habitat quality scores for each assessment unit, combining Site Condition, Site Context and Species Stocking Rate are reported in **Appendix 19** with a summary presented as **Table 15**. The scores for Site Condition are derived directly from the MHQA Tool data. These scores are then used to determine the scores for Quality and Availability of Food and Foraging Habitat, and Quality and Availability of Shelter.

This score is calculated based on the combined weighted habitat quality scores for each assessment unit:

- Site condition
- Site context
    - Size of patch
    - Connectedness
    - Context
    - Ecological corridors
    - Role of the Site in terms of the overall population in the state
    - Threats to the species
    - Species mobility capacity
- Species stocking rate.

Table 15: Grey-headed Flying-fox Modified Habitat Quality Assessment – Impact Site

Habitat quality score weighted	AU1	AU2	AU3	Total
Site condition score (out of 3)	1.67	1.61	1.66	1.65
Site context score (out of 3)	1.09	1.19	1.19	1.16
Species Stocking Rate Score (out of 4)	2.14	2.14	2.14	2.14
Habitat Quality score (out of 10)	4.91	4.94	4.99	4.95
Assessment Unit area (ha) in disturbance footprint	20.53	12.61	4.78	37.92
Total Impact Area (ha) for this MNES	37.92	37.92	37.92	37.92
Size Weighting	0.54	0.33	0.13	1.00
Total Weighted Habitat Quality Score	**4.93**			

The Site was given an overall weighted habitat quality score of 4.93 out of the total of 10 which rounds to a score of 5 out of 10. This is considered a moderate habitat quality score.

(c) Impact site area and EPBC impact calculator

To define a '*total quantum of impact*', it is necessary to achieve a grey-headed flying-fox foraging resource score out of 10. As such, the above provides a measurable method for arriving at a qualified score to input into the EPBC Offset Calculator. The final score assigned to the Impact Area has been determined through the MHQA and Foraging Scoring methodologies as it provides a scientifically robust and accepted scoring method for habitat and ecological qualities of an area. This supports the original ecological assessments conclusion that habitats within the Impact Areas were of relatively low ecological quality.

The total defined Residual Significant Impact Area equates to 37.92 ha with a total weighted MHQA score of 5[53]. The EPBC Calculator then adjusts the 'total quantum of impact' based on an internal equation which defines the Impact Areas of the Site as having a 18.96 ha 'total quantum of impact' as shown in **Inset 6**.

Matter of National Environmental Significance	
Name	GHFF
EPBC Act status	Vulnerable
Annual probability of extinction Based on IUCN category definitions	**0.2%**

Impact calculator

Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Ecological communities						
Clear row	No		**Area**			
			Quality			
			Total quantum of impact	0.00		
Threatened species habitat						
Clear row habitat	Yes	Grey-headed flying-fox	**Area**	37.92	Hectares	PD Report
			Quality	**5**	Scale 0-10	
			Total quantum of impact	18.96	Adjusted hectares	

Inset 6: Impact Calculator Inputs for Grey-headed flying-fox

53: Actual MHQA score of 4.93 which is rounded to 5

5.4 Greater Glider

5.4.1 Direct and Indirect Impact

The Greater glider, has not been recorded from the Subject Site, nor from adjoining development sites, and on account of fragmented habitat, expansion and intensification of urban (residential, commercial and industrial) development within 5 km of the Site, in concert with landscape scale impediment to movement arising from linear infrastructure (Cunningham and Centenary Highways) it an unlikely that the greater glider is present on the Site, though it cannot be definitively ruled out. Our view is that this species will not be subject to an impact. Regardless, we anticipate (but disagree), that DCCEEW will consider the Greater Glider to be significantly impacted by the proposed action.

The Residual Significant Impact on greater glider is 47.47 ha of impact arising from the Proposed Action (this includes 0.61 ha of impact arising from Urban Utilities trunk sewer main upgrades unrelated to the Proposed action occurs at the Site within parts of the site proposed for avoidance). The disturbance by Urban Utilities will be mitigated through restoration of the disturbance footprint within the vegetation retained within the Linear Habitat Corridor (designated Avoidance Area) (see (see **Section 2.3.1**, **Figure 5** and the Concept Rehabilitation Plan - **Appendix 7**).

Taking into consideration the avoidance measures in **Section 6.1** and the mitigation measures in **Section 6.2**, and referencing the greater glider statutory documentation, the Proposed Action will have a residual impact on the greater glider. This residual impact is quantified as the removal of no more than 47.47 ha of low to high quality habitat for urban purposes, even though much of this land presently exists as historically cleared paddocks.

5.4.2 Quantum of Impacts

The Proposed Action requires clearing 47.47 ha[54] of vegetation identified as providing critical habitat for the greater glider (see **Section 4.1.1**). The clearing already undertaken by Urban Utilities is factored into this assessment. The total quantum of impact to be offset is therefore calculated as 47.47 ha.

The Site has been divided into three (3) Assessment Units to reflect the different states of the vegetation on-Site.

(a) Methodology

In order to determine the quantum and quality of the habitat suitable for greater glider on-Site, vegetation/habitat quality was derived from the Modified Habitat Quality Assessment tool. This assessment approach utilises the Queensland BioCondition Assessment method combined with Site context and species stocking rate assessments to determine the habitat quality of the referral area.

(i) Modified Habitat Quality Assessment

The traditional terrestrial habitat quality assessment assesses three (3) core indicators—Site condition, Site context and species habitat index.

The modified habitat quality assessment combines the three (3) core indicators into two (2) (Site condition and Site context) with each Site Condition being weighted 30% of the final score and Site Context being weighted 30% of the final score. The balance of the weighting (40 %) has been attributed to the third indicator which is independent of the traditional habitat quality assessment, being species stocking rate.

54: Provisional only

The species stocking rate has been added to the MHQA to better incorporate MNES, and for the purpose of this preliminary documentation, the listed endangered greater glider MNES. The following section details the methodology utilised to assess the Site condition, Site context and species stocking rate under the MHQA.

(ii) Site condition (30%)

Assessing Site condition is an integral step in determining specific quantification of impacts, while also determining whether an offset Site is suitable to establish a desired capacity to support the prescribed environmental matters being offset. The on-Site condition is a key element of habitat quality and has a direct influence on the biodiversity it supports. Site condition is assessed using a suite of attributes to describe the structure and function of the vegetation community and is benchmarked against the expected range for a relatively undisturbed community.

The Site condition assessment under the MHQA is assessed using fifteen (15) condition characteristics, being:

- recruitment of woody perennial species in the ecologically dominant layer (EDL)
- native plant species richness – trees
- native plant species richness – shrubs
- native plant species richness – grasses
- native plant species richness – forbs
- tree canopy height
- sub-canopy cover
- tree canopy cover
- native grass cover
- organic litter
- large trees
- coarse woody debris
- non-native plant cover
- quality and availability of food and foraging habitat
- quality and availability of shelter.

Dot points 1-13 are quantitative measures for each biocondition plot (i.e. MHQA Assessment Sites 1-7, refer **Figure 10**), based on collected field data referenced against appropriate RE benchmarks sourced from Qld Government (DES) data[55].

Dot point 14 quality and availability of food and foraging habitat and dot point 15 quality and availability of shelter are supplementary semi-quantitative assessments of utility of habitat for the particular MNES (in this case greater glider), unrelated to benchmarked metrics of 1-13, and take into account the spatial arrangement and presence of habitat and extant direct and indirect impacts.

The MHQA scoring allows for each AU to be assessed and scored against the metrics: poor – 1, moderate – 5, high – 10. The following describes the scoring applied to each of the MHQA Assessment Sites within each Assessment Unit (refer **Table 5**).

55: https://www.qld.gov.au/environment/plants-animals/biodiversity/benchmarks (Version 3.4).

Assessment Unit 1 (MHQA Sites 4, 5 and 6)

Assessment Unit 1, overlies the extent of site clearing / thinning obvious in historical aerial 2011 photography (refer **Figure 4h** and **Figure 10**). Significantly, this area is identified by state datasets as non-remnant vegetation (Section 3.3.1(a) and **Section 3.2.2**). On account of this historical clearing, the canopy is sparse and there area fewer greater glider forage and habitat trees. The Site is surrounded by a number of development fronts resulting in residential and infrastructure development along the western and northern boundaries. This has resulted in concommitant indirect edge effects (discussed in **Section 4.5.2**) affecting habitat quality (*viz-a-viz* compromised habitat).

All MHQA Assessment Sites are affected by lower habitat quality associated with past clearing and additionally, MHQA Assessment Site 4 is also affected by edge effects and all have been scored as low quality habitat (score = 1). See **Table 16**. The averaged score for quality and availability of food and foraging habitat and quality and availability of shelter is 1.0 for both.

Table 16: Availability and Quality of Habitat (Greater Glider) - Assessment Unit 1

Quality Metric	MHQA Assessment Site (refer Figure 10)			AU1 (ave. score)
	4	5	6	
Quality and availability of food and foraging habitat	1.0	1.0	1.0	1.0
Quality and availability of shelter	1.0	1.0	1.0	1.0

Assessment Unit 2 (MHQA Sites 1 and 3)

Assessment Unit 2, despite comprising mainly intact remnant vegetation (**section 3.3.1 (b)**) does contain areas of high value and young regrowth. On account of this, MHQA Assessment Sites (which overlap integral and regrowth vegetation have been scored as moderate quality habitat (score = 5). See **Table 17**. The averaged score for quality and availability of food and foraging habitat and quality and availability of shelter is 5.0 for both.

Table 17: Availability and Quality of Habitat (Greater Glider) - Assessment Unit 2

Quality Metric	MHQA Assessment Site		AU2 (ave. score)
	1	3	
Quality and availability of food and foraging habitat	5.0	5.0	5.0
Quality and availability of shelter	5.0	5.0	5.0

Assessment Unit 3 (MHQA Sites 2 and 7)

Assessment Unit 3, despite comprising mainly intact (remnant) and high value regrowth vegetation (**section 3.3.1 (c)**) does contain areas of young regrowth. To the north of the proposed crossing of the waterway (refer **Figure 10**), Assessment Unit 3 (represented MHQA Assessment Site 2) consists of previously cleared and thinned areas, young regrowth, high value regrowth and areas of compromised habitat affected by edge impacts associated with residential and urban development. This (MHQA) Assessment Site has been assigned a moderate habitat quality (score = 5.0). A high habitat quality (score

= 10.0) has been assigned to the areas to the south of the proposed crossing (represented by MHQA Assessment Unit 7) on account of the integral and advanced regrowth nature of the habitat at this point. See **Table 18**. The averaged score for quality and availability of food and foraging habitat and quality and availability of shelter is 7.5 for both.

Table 18: Availability and Quality of Habitat (Greater Glider) - Assessment Unit 3

Quality Metric	MHQA Assessment Site		AU3 (ave. score)
	2	7	
Quality and availability of food and foraging habitat	5.0	10.0	7.5
Quality and availability of shelter	5.0	10.0	7.5

(iii) Site context (30%)

The Site context assessment deals with the Site and its adjacent surroundings. Site context is measured using a suite of attributes to describe the location of the habitat within the surrounding landscape and the influence of its associated threats. This assessment also considers the influence of adjacent vegetated areas and ecological corridors. Under the MHQA, Site context is measured using the following seven (7) characteristics:

- size of patch
- context (refer **Figure 22**)
- connectedness (refer **Figure 23**)
- ecological corridors (Biodiversity Corridor) (refer **Figure 23**)
- role of Site location to species overall population in the state
- threats to the species
- species mobility capacity.

Unlike the traditional habitat quality assessment methodology where Site connectedness is assessed against the surrounding remnant vegetation only, the MHQA Site connectedness is assessed against the surrounding MNES habitat, in this instance, greater glider habitat. Whilst remnant eucalypt forest vegetation is critical habitat for greater glider, equally greater glider can utilise areas of non-remnant vegetation or high value regrowth vegetation that does not yet achieve remnant status. Therefore, Site context under the MHQA accounts for surrounding species habitat rather than remnant vegetation. In developing the MHQA, three (3) species habitat index characteristics were nominated; role of Site location to overall species population in the state, threats to the species and species mobility capacity.

(iv) Species stocking rate (40%)

The MHQA incorporates species stocking rate as an attribute not discussed under the traditional terrestrial habitat assessment methodology. Species stocking rates are estimates of the greater glider carrying capacity of the Site at the time of undertaking the survey. Given the discreet nature of the greater glider and limited to no published literature on habitat carrying capacity of the species, the species stocking rate scoring methodology has been derived through the collation of site-specific surveys and surrounding contextual habitat analysis. **Table 19** outlines the attributes utilised to assess species stocking rate.

Table 19: Species Stocking Rate Scoring - Greater Glider

Attribute	Possible maximum score
Species stocking rate table	
Presence detected on or adjacent to Site (neighbouring property with connecting habitat)	Score out of 10
Species usage of the Site (habitat type and evidenced usage)	Score out of 15
Approximate density (per ha)	Score out of 30
Species stocking rate supplementary table	
Key source population for breeding (/10)	
Key source population for dispersal (/5)	
Necessary for maintaining genetic diversity (/15)	
Near the limit of the species range (/15)	
SSR[56] Supplementary Table Score (from the four features above)	Score out of 15
Total Species Stocking Rate Score	Score out of 70
Species stocking rate	**Score out of 4**

(b) Findings – foraging habitat

Three assessment units, reflective of historic Site disturbance have been identified. Their extent, typology and extent are:

Impact Assessment Site, Assessment Unit 1 (IA AU1)

IA AU1 (3 BioCondition plots) comprised open paddock, pre-clear RE 12.9-10.2 *Corymbia citriodora subsp. variegata* (spotted gum) open forest or woodland usually with *Eucalyptus crebra* (narrow leaved ironbark). Other species such as *Eucalyptus tereticornis* (Queensland blue gum), *E. moluccana* (grey box), *E. acmenoides* (white stringybark) and *E. siderophloia* (northern grey ironbark) may be present in scattered patches or in low densities.

- Total AU area – 21.75 ha (45.8% of Site)
- Total disturbance area 21.75 ha (100.00% of AU).

This AU consists of a sparse open woodland with spattered trees (refer **Figure 10**) and comprise (edge affected) habitat (after Youngentob *et al.* (2012)). Therefore to account for extant effects, quality and availability of food and foraging habitat and quality and availability of shelter habitat scores have been scored as ‘1’for MHQA Assessment Sites 4, 5 and 6.

On account of compromised mobility capacity to the west on account of historic thinning and adjoining development, mobility capacity has been assessed at ‘4’ (highly restricted) for MHQA Assessment Site 5, and ‘7’ (moderately restricted) for MHQA Assessment Sites 4 and 6.

56: Species Stocking Rate

Impact Assessment Site, Assessment Unit 2 (IA AU2)

IA AU2 (2 BioCondition plots), comprised of regrowth open forest with *Corymbia citriodora subsp. variegata* (spotted gum) open forest or woodland usually with *Eucalyptus crebra* (narrow leaved ironbark). Other species such as *Eucalyptus tereticornis* (Queensland blue gum), *E. moluccana* (grey box) and an exotic grassy understorey, pre-clear RE 12.9-10.2.

- Total AU area – 13.97 ha (29.4% of Site)
- Total disturbance footprint – 13.97 ha (100.00% of AU).

Impact Assessment Site, Assessment Unit 3 (IA AU3)

Impact Assessment Site, Assessment Unit 3 (IA AU3 – 2 plots) – *Eucalyptus tereticornis* (Queensland blue gum), with *Corymbia tessellaris* (Moreton Bay ash), *Corymbia intermedia (*pink bloodwood*) and Lophostemon suaveolens* (swamp box), with a grassy understorey. Contains areas of regrowth and remnant RE12.3.3.

- Total AU area - 11.75 ha (31.4% of Site)
- Total disturbance footprint – 11.75 ha (100.00% of AU).

This AU consists of a sparse open forest (refer **Figure 10**) habitat with an area of this AU adjoining the northern boundary (Melrose Drive) of the site comprising compromised (edge affected) habitat (after Youngentob *et al.* (2012)). Therefore to account for extant effects, quality and availability of food and foraging habitat and quality and availability of shelter habitat scores have been scored as '5' for MHQA Assessment Site 2 and '10' for MHQA Assessment Site 7.

On account of compromised mobility capacity to the north on account of historic thinning and adjoining development, mobility capacity has been assessed at '7' (moderately restricted) for MHQA Assessment Site 2. MHQA Assessment Site 7 is assessed as '10' (minor restriction).

Determination of the AUs were informed by inspection and interrogation of State Government vegetation and pre-clear mapping and data sets, and review of vegetation mapping conducted for the project. In order to determine Site condition, appropriate 'benchmarks' are required to score residual habitats quality against. No mapped 'remnant' or regulated regrowth' is mapped over the Site. Pre-clear Regional Ecosystem mapping coupled with assessment of relict tree data collected in the field was used to delineate appropriate AUs and benchmarks.

The habitat quality scores for each assessment unit, combining Site Condition, Site Context and Species Stocking Rate are reported in **Appendix 20** with a summary presented as **Table 20.** The scores for Site Condition are derived directly from the MHQA Tool data. These scores are then used to determine the scores for Quality and Availability of Food and Foraging Habitat, and Quality and Availability of Shelter.

This score is calculated based on the combined weighted habitat quality scores for each assessment unit:

- Site condition
- Site context
  - Size of patch
  - Connectedness
  - Context
  - Ecological corridors
  - Role of the Site in terms of the overall population in the state
  - Threats to the species
  - Species mobility capacity

- Species stocking rate.

Table20: Greater glider Modified Habitat Quality Assessment – Impact Site

Habitat quality score weighted	AU1	AU2	AU3	Total
Site condition score (out of 3)	1.09	1.50	1.83	1.47
Site context score (out of 3)	1.45	1.66	1.58	1.56
Species Stocking Rate Score (out of 4)	2.29	2.29	2.29	2.29
Habitat Quality score (out of 10)	4.82	5.45	5.70	5.32
Assessment Unit area (ha) in disturbance footprint	21.75	13.97	11.75	47.47
Total Impact Area (ha) for this MNES	47.47	47.47	47.47	47.47
Size Weighting	0.46	0.29	0.25	1.00
Total Weighted Habitat Quality Score	**5.22**			

The Site was given an overall weighted habitat quality score of 5.22 out of the total of 10 which rounds to a score of 5 out of 10. This is considered a moderate habitat quality score.

(c) Impact site forage habitat impacts and EPBC impact calculator

To define a '*total quantum of impact*', it is necessary to achieve a greater glider habitat quality score out of 10. As such, the above provides a measurable method for arriving at a qualified score to input into the EPBC Offset Calculator. The final score assigned to the Impact Area has been determined through the HQA as it provides a scientifically robust and accepted scoring method for habitat and ecological qualities of an area. This supports the original ecological assessments conclusion that habitats within the Impact Areas were of relatively low ecological quality.

The total defined Residual Significant Impact Area equates to 47.47 ha with a total weighted MHQA adjusted to 5[57]. The EPBC Calculator then adjusts the 'total quantum of impact' based on an internal equation which defines the Impact Areas of the Site as having a 23.74 ha 'total quantum of impact' as shown in **Inset 7**. The Offsets Assessment Guide 'EPBC Act status' for greater glider is that applicable at the time the CAR was lodged[58].

57: Actual MHQA score of 5.22 which is rounded to 5

58: The Controlled Action decision for the Ripley View Residential Subdivision under Section 75 EPBC Act was made 2 June 2020. This was prior to the uplifting of koala and greater glider from Vulnerable to Endangered. The koala was uplifted to Endangered, 12 February 2022 and the greater glider, 5 July 2022. Section 158A of the EPBC Act provides that approval process decisions under Parts 7 – 9 of the EPBC Act will not be affected by an uplisting event made after the determination. On this basis, offset calculations for koala and greater glider are assessed as both species being vulnerable.

Matter of National Environmental Significance	
Name	Greater Glider
EPBC Act status	Vulnerable
Annual probability of extinction Based on IUCN category definitions	**0.2%**

Impact calculator

Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Ecological communities						
Clear row ommunity	No		**Area**			
			Quality			
			Total quantum of impact	0.00		
Threatened species habitat						
Clear row habitat	Yes	Greater glider	**Area**	47.47	Hectares	PD Report
			Quality	**5**	Scale 0-10	
			Total quantum of impact	23.74	Adjusted hectares	

pact calculator

Inset 7: Impact Calculator Inputs for Greater Glider

(d) Habitat trees hollows

The impact site has been identified as containing 456 trees greater than 500 mm DBH (late mature/over-mature/senescent development stages) providing potential future hollows. A hollow occurrence factor applied to predict potential suitable occurrence based upon a reference sample data set (refer Section 2.2.4 of **Appendix 40**) identifies that 93 hollows would be lost.

6 Avoidance and Mitigation Measures

The mitigation hierarchy is a tool that is used to limit the amount of damage an action, such as a development, will have on the environment. There are three steps, and each step must be followed in order and to the greatest extent possible before moving on to the next. These steps are:

1. Avoid
2. Mitigate
3. Offset.

This section provides discussion on the measures that have been adopted to avoid, in the first instance, then minimise potential impacts to MNES and their habitat. Discussion of offsets is provided separately in **Section 7**.

6.1 Impact Avoidance

Avoidance of impacts to environmental values has been a central element to the Proposed Action in both the initial planning process and the refined design process. The ways through which the Proposed Action demonstrates adoption of such avoidance measures are further described in the following sections.

6.1.1 Site Identification

The Site's location within the RVPDA and its strategic location for the sequential expansion of existing urban development (recognised at both local and regional levels) is described within **Section 2.1**. Within the RVPDA, the Proponent defined the Site through (a) involvement of receptive landowners, and (b) identification of those parts of the RVPDA with fewer constraints. The Proponent has designed the Proposed Action in consideration with its mapped ecological values highlighted as part of the RVPDA Development Scheme (**Appendix 3**), specifically the Significant Vegetation. Major considerations for the Proponent were targeting those locations within the RVPDA that were subject to historic urban and agricultural degradation and achieving a consolidated collection of properties in an appropriate and logical location.

This initial Site identification process has achieved significant avoidance of ecological values that are present within the RVPDA and broader locality.

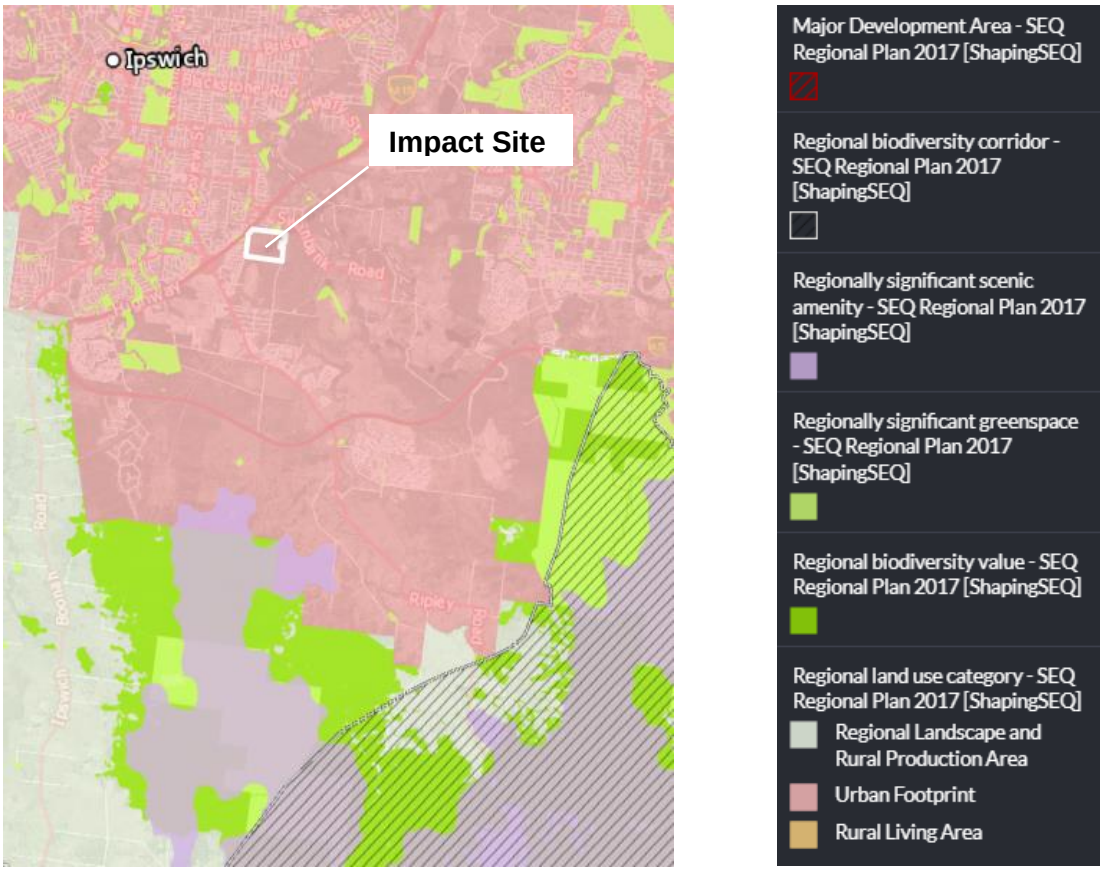
(a) Regional Scale

The State's Department of State Development, Infrastructure, Local Government and Planning administers *Shaping SEQ* – South East Queensland Regional Plan 2017 (**Regional Plan**)[59]. Under the Regional Plan, the Site is within the urban footprint, as are surrounding sites and the emerging suburb of Flagstone and Flinders to the west. Regionally significant greenspace, and biodiversity values are avoided (**Inset 8**).

The Regional Plan notes that "*Through ShapingSEQ, we are encouraging growth within the current urban footprint"* as this will *"help reduce our impact on the environment, reduce urban sprawl and our carbon footprint."*[60] While the Regional Plan notes that the urban footprint is *"not an urban zone and does not imply*

59: https://dsdmipprd.blob.core.windows.net/general/shapingseq.pdf
60: Page 4.

that all land can be developed for urban purposes", [61] other more refined land use planning in this locality has established the Site's suitability for the intended development.



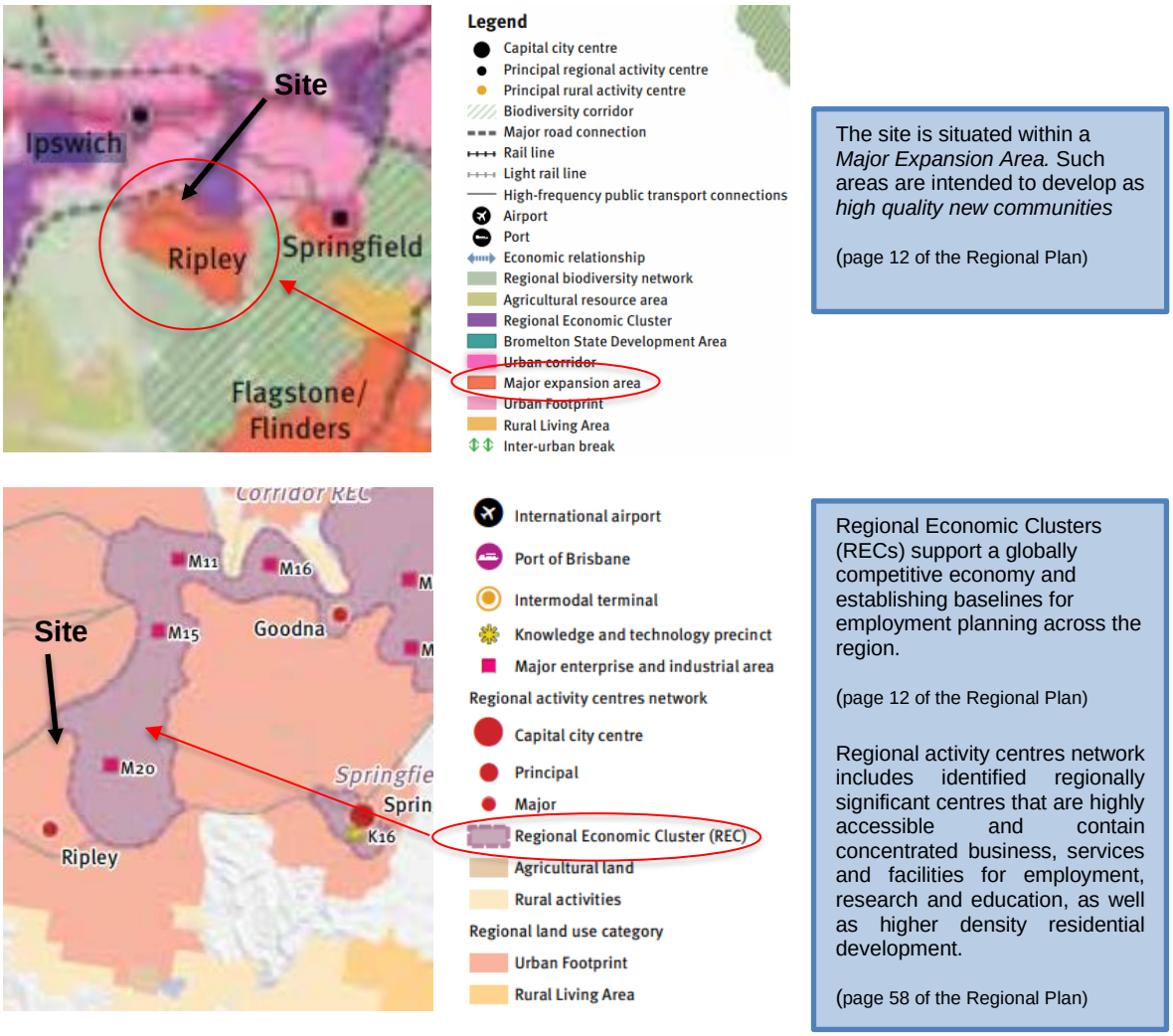
Inset 8: Shaping SEQ – Regional Plan Designations

At a closer scale, this development intent is further delineated in the Regional Plan which identifies the expansion area and its interdependencies with sources of employment (**Inset 9**). This precinct continues beyond the Site and south into the Ripley Valley.

(b) Sub-regional Scale

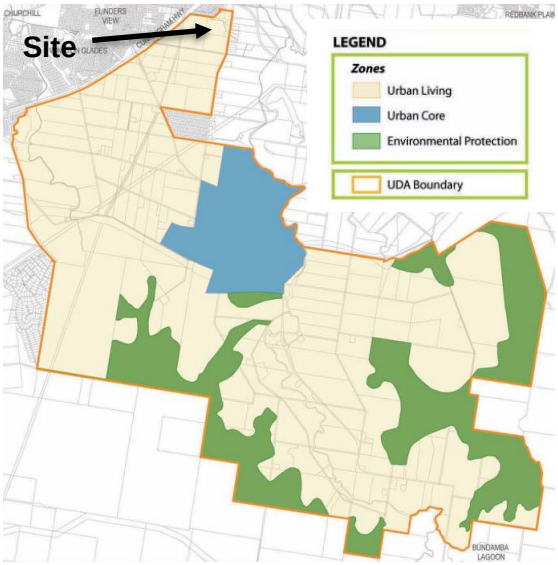
At a sub-regional scale, EDQ-approved the Site's landuse planning intent is governed by the Ripley Valley Urban Development Area Development Scheme (**Development Scheme**). The Development Scheme identifies the Subject Site as part of a Proposed Urban Development Area, and more specifically as an area of residential development (the Urban Living area under the scheme). Areas of environmental protection and significant riparian vegetation under the Planning Scheme are identified (Map 4 and Map 2, respectively). See **Inset 10**.

61: Page 101.

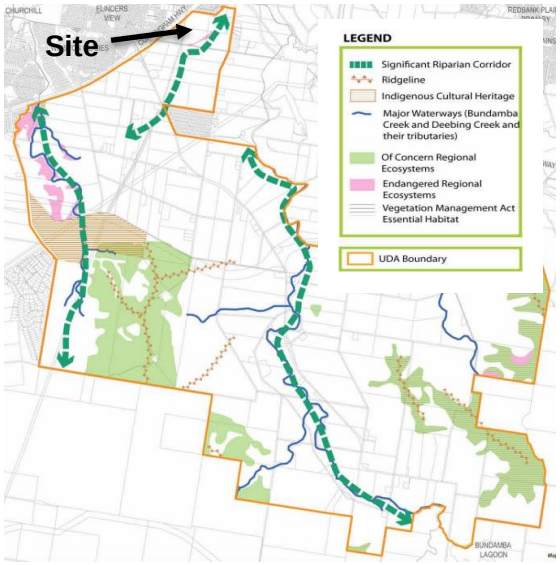


Inset 9: Designation of the Site within the Regional Plan

The intent of the EDQ designation is that the Ripley Valley will provide a development area to accommodate projected population growth and provide important dormitory and employment source for emerging Regional Economic Clusters (RECs). The local authority, Ipswich City Council, is upgrading local infrastructure (roads and some stormwater), Urban Utilities is upgrading sewer and water, and Department of Main Roads and Transport is upgrading capacity and access to and from State Controlled Roads in the broader locality to meet the demands of this planned future development. The Council is supportive of the development in this area.



Map 4 - Zones



Map 2 - Values

Inset 10: Ripley Valley Priority Development Area Planning Scheme Zones

Section 3.3.8 of the **Development Scheme** identifies expectations for protection of natural and cultural values. Requirements relevant to this PD Report are identified by **Inset 11**.

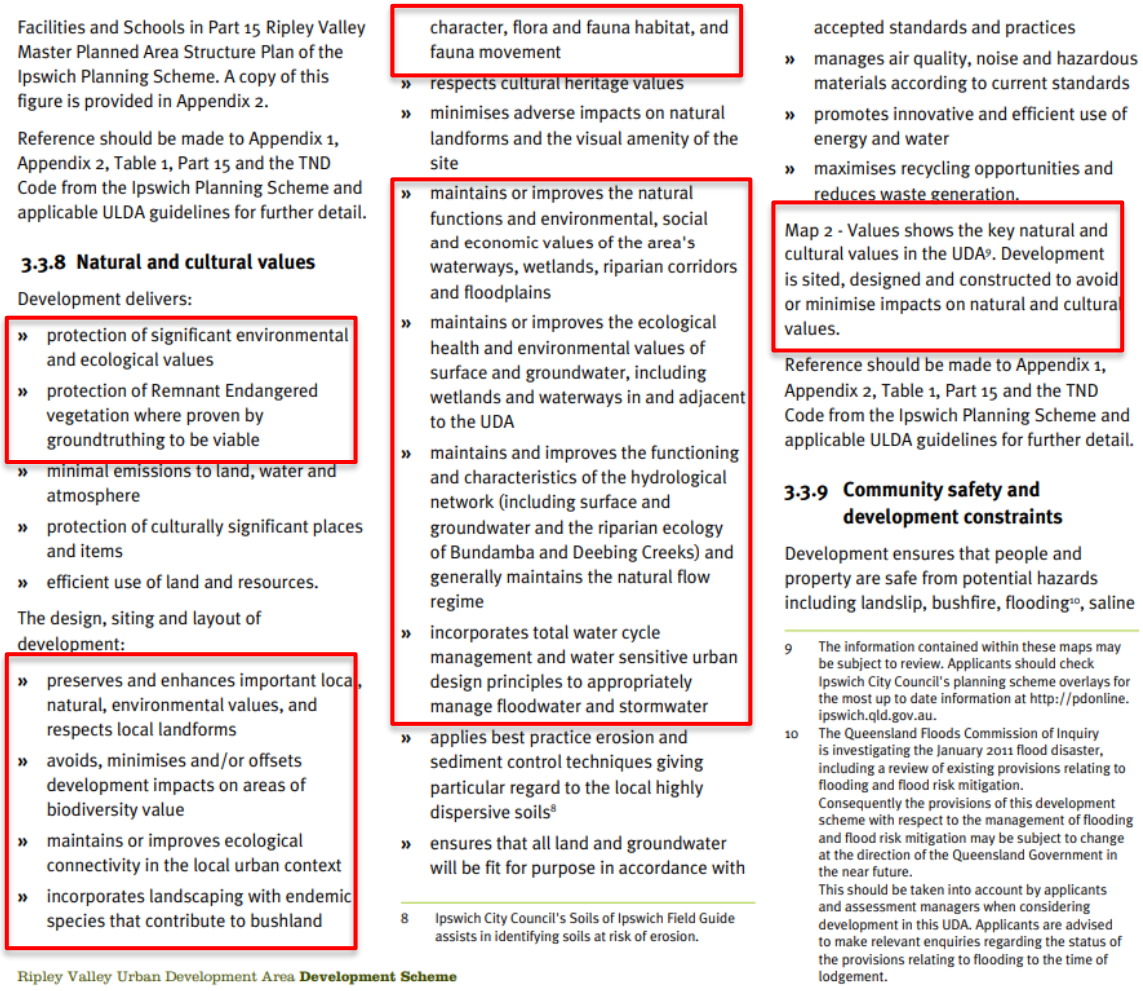
The development footprint of the Proposed Action falls within the defined development area identified and retains, enhances and restores important local environmental values (riparian corridor, and remnant endangered Regional Ecosystem), maintains and improves connectivity in the local context, maintains and improves ecological health and environmental values of waterways in the Site and protects these water corridors and important biodiversity areas through dedication to ICC as linear park (refer to Section 2.3.9 of this report).

(c) EDQ conditions of approval

ICC as delegate to EDQ issued approval for the Proposed Action on 11 August 2021 (**Appendix 21**) for:

- Reconfiguration of a Lot (**RoL**) for Five (5) Lots into Five Hundred and Twenty (520) Lots (consisting of 512 Residential lots, 1 future Child Care Centre lot, 1 Neighbourhood Recreation Park lot, 1 Linear Park Lot, 6 Drainage Reserve lots) and New Roads.
- Material Change of Use (**MCU**) (Plan of Development) for a House over Four Hundred and Seventy-Seven (477) Residential Lots and Multiple Residential over Thirty–Four (34) Residential Lots.

Of key relevance to the Proposed Action is the MEDQ Delegate's Conditions (10529/2019/PDA) key relevant to the approval are contained in Attachment A, Condition 4(d) and 4(e) requiring the proponent dedicate the Linear Park and Drainage Reserve in favour of Council.



Facilities and Schools in Part 15 Ripley Valley Master Planned Area Structure Plan of the Ipswich Planning Scheme. A copy of this figure is provided in Appendix 2.

Reference should be made to Appendix 1, Appendix 2, Table 1, Part 15 and the TND Code from the Ipswich Planning Scheme and applicable ULDA guidelines for further detail.

3.3.8 Natural and cultural values

Development delivers:

- protection of significant environmental and ecological values
- protection of Remnant Endangered vegetation where proven by groundtruthing to be viable
- minimal emissions to land, water and atmosphere
- protection of culturally significant places and items
- efficient use of land and resources.

The design, siting and layout of development:

- preserves and enhances important local, natural, environmental values, and respects local landforms
- avoids, minimises and/or offsets development impacts on areas of biodiversity value
- maintains or improves ecological connectivity in the local urban context
- incorporates landscaping with endemic species that contribute to bushland character, flora and fauna habitat, and fauna movement
- respects cultural heritage values
- minimises adverse impacts on natural landforms and the visual amenity of the site
- maintains or improves the natural functions and environmental, social and economic values of the area's waterways, wetlands, riparian corridors and floodplains
- maintains or improves the ecological health and environmental values of surface and groundwater, including wetlands and waterways in and adjacent to the UDA
- maintains and improves the functioning and characteristics of the hydrological network (including surface and groundwater and the riparian ecology of Bundamba and Deebing Creeks) and generally maintains the natural flow regime
- incorporates total water cycle management and water sensitive urban design principles to appropriately manage floodwater and stormwater
- applies best practice erosion and sediment control techniques giving particular regard to the local highly dispersive soils[8]
- ensures that all land and groundwater will be fit for purpose in accordance with accepted standards and practices
- manages air quality, noise and hazardous materials according to current standards
- promotes innovative and efficient use of energy and water
- maximises recycling opportunities and reduces waste generation.

Map 2 - Values shows the key natural and cultural values in the UDA[9]. Development is sited, designed and constructed to avoid or minimise impacts on natural and cultural values.

Reference should be made to Appendix 1, Appendix 2, Table 1, Part 15 and the TND Code from the Ipswich Planning Scheme and applicable ULDA guidelines for further detail.

3.3.9 Community safety and development constraints

Development ensures that people and property are safe from potential hazards including landslip, bushfire, flooding[10], saline

8 Ipswich City Council's Soils of Ipswich Field Guide assists in identifying soils at risk of erosion.

9 The information contained within these maps may be subject to review. Applicants should check Ipswich City Council's planning scheme overlays for the most up to date information at http://pdonline.ipswich.qld.gov.au.

10 The Queensland Floods Commission of Inquiry is investigating the January 2011 flood disaster, including a review of existing provisions relating to flooding and flood risk mitigation. Consequently the provisions of this development scheme with respect to the management of flooding and flood risk mitigation may be subject to change at the direction of the Queensland Government in the near future. This should be taken into account by applicants and assessment managers when considering development in this UDA. Applicants are advised to make relevant enquiries regarding the status of the provisions relating to flooding to the time of lodgement.

Ripley Valley Urban Development Area **Development Scheme**

Inset 11: Relevant extracts from the Greater Flagstone Development Scheme

(d) Alternative Sites

The preceding discussion demonstrates that the Proposed Action is appropriately positioned in regard to the land use planning intent for the region, locality, and site. Therefore, it is an appropriately positioned development and the Proponent need not seek alternative sites. The EDQ approval confers this suitability. Nonetheless, further information on why this particular site has been chosen for the proposed action rather than other sites that might be available in the region follows:

> *In assessing the viability of this site, we considered many other sites across South East Queensland however the factors noted below outweighed the potential of other options.*
>
> *The site is located within the Ripley Valley PDA which has been identified as a major development front. The assessing authority for development applications within this PDA is Economic Development Queensland (EDQ). EDQ designated this site and surrounding land specifically for redevelopment to facilitate residential development activities which provide dormitory residences for emerging employment opportunities locally (specifically with the ICC LGA. Further, the Ripley Valley is strategically well positioned to leverage existing and proposed infrastructure and services within the Ipswich region, and development within proximity to established urban development makes logical and sequential sense. The Site is well positioned to take advantage of tertiary and secondary public hospital facilities and tertiary education and training facilities in Ipswich CBD and Springfield. Key transport routes and public transport service the area facilitating easy local and*

intraregional movement. Construction of the site will also create immediate employment opportunities during delivery of the project.

The site is strategically located with immediate access to the Centenary Highway and the Cunnigham Highway both major transport routes which provide direct access to all major road networks leading in and out of Brisbane and interstate. It is ideally located with direct routes to other major industry and business hubs located in Ipswich, Logan, Brisbane and the Gold Coast. The service road which is being brought down in front of this site will provide access to the adjoining land and the sites to the south.

It is essential large strategic land holdings such as this are delivered in accordance with the use they have been identified for. There are limited opportunities to create major residential/service/employment hubs so close to existing and emerging communities which is why the delivery of this site is extremely important. Redevelopment of this site is fully supported by all levels of Government.

28 South also notes that, while other recently developed industrial sites might be available to accommodate the Proposed Action (subject to the Proponent's locational imperatives) these have (in most cases) also required clearing of native vegetation providing habitat for MNES; see also **Figure 6** for a location of approvals relevant to the site.

(e) Mitigating Development Impacts through Site Scale Planning

The following matters have guided positioning of the development footprint in a way that mitigates large-scale development impacts. Residual impacts and their management are then discussed for each of the subject MNES below.

(i) Historic Disturbance

As identified in **Section 2.2** the Site's disturbance history are illustrated in **Figure 4a-h**. Historically, land use within the Site and the broader RVPDA has been influenced by agricultural pursuits; broadscale clearing for intensive cropping, selective clearing and rural residential development. Agricultural activity influenced the locality until the late 1970's when more intensive forms of urban residential development commenced to the north, north-west and west. In ca.1982, construction on the Ipswich bypass on the Cunningham Highway commenced. Within the site at this time (ca.1982), much of the north-west quadrant of the site had been cleared with degradation along the central waterway. The period 1982 to present has seen further intensification of urban residential development to the north, north-west and west, and rural residential development to the east. By 1993, the Site, had been subdivided into the five properties forming the Site, and from 1993 to present extensive clearing of three (south-west, north-west and north-east) of the four parcels of land was undertaken. Contemporary photography shows extensive clearing and residential development to the south of the Site.

The impact of historic clearing remains evident on-ground today, most notably in the form of even-aged regrowth and a lack of mature and hollow-bearing trees (a function of vegetation age) within the areas of proposed permanent impact associated with the development. This lack of tree hollows has an implication for conservation-significant species that might otherwise be expected to occur (e.g., Greater glider). The proposed development is focused on the historically disturbed areas.

(ii) Positioning in Relation to Adjoining Development

When considered in context of approved and likely development on adjoining sites, there is a clear logic to positioning development in this location. Here, there is ready access to the Cunningham Highway, Centenary Highway and Ripley Road.

Development in the east also aligns to approved developments to the south and to disturbed land to the north.

(iii) Development Form

Residential development has been maximised in parts of the site with lower ecological values (as identified by MHQA Site Condition Scores – **Appendices 17, 19** and **20**) with higher values retained within the Site's Linear Parkland; an area of biodiversity protection and connectivity. Vehicular connectivity across the waterway has been minimised to a single raised crossing which will feature a dedicated dry fauna underpass (one of) and a wet culvert (one of) for natural stream flow.

6.1.2 Single Proponent Coordination

The coordinated establishment of the Proposed Action over the collection of properties that make up the Site has significant advantage over a piecemeal development approach for the individual lots. Development of individual properties, by different proponents, is unlikely to involve a coordinated consideration of ecological and environmental impacts across the broader RVPDA. A piecemeal approach may result in the cumulative impact of the developments being at least the same as (and most likely greater) the Proposed Action; however, this would result in there being a limited requirement for assessment and approval of the individual projects under the EPBC Act. Differing interests of the various landowners could create greater constraint or opportunity over individual sites (e.g. location of retained fauna movement corridors would be disaggregated and potentially ineffective at a broader scale if established individually for each property).

In comparison, the Proposed Action will be subject to holistic (landscape-scale) impact assessment and consideration of the measures needed to avoid, minimise and mitigate any identified impacts. The Proponent, through the Proposed Action, can also achieve:

- a coordinated conservation outcome (e.g. through the establishment of the Linear Park)
- coordinated sequential clearing to minimise impacts on fauna (to encourage them to retreat to the identified and protected Linear Park)
- delivery of critical infrastructure such as underpasses to retain and enhance corridor functionality, and
- coordinated delivery of development infrastructure such as water and sewer infrastructure.

Furthermore, the Proponent will be the sole entity responsible for delivering the development on these parcels. In this way, the Proposed Action avoids some of the RVPDA-wide impacts that may otherwise result in an uncoordinated approach to the future development of this land if undertaken for each individual property.

6.1.3 Iterative Design Based on Ground-truthed Ecological Values

The iterative design process has been an important process for the consideration and review of constraints and opportunities available over the Site to accurately capture and protect the Site's environmental values where practicable. The design process was iterative by nature and was informed by ongoing accumulation of desktop and Site-based data. This iterative process of informing design has occurred through:

i. Desktop assessments
ii. Site-based surveys
iii. Review and workshop of Site-based survey results
iv. Review and testing of Proposed Action design
v. Review of the RVPDA Development Scheme
vi. Review of ICC Planning Scheme and Codes
vii. Refinement of the Proposed Action.

The aspects of the Site that were determined to provide critical ecological functions have been retained and enhanced through the design of the Proposed Action.

6.1.4 Determination and Delineation of Proposed Action Precincts

The guiding principles for the location of the overarching land uses in the Proposed Action are to:

- Avoid impacts on areas with higher ecological values by locating the residential uses outside of the mapped and identified higher ecological values.
- Minimise/mitigate impacts by limiting the type and scale of uses that can occur in areas adjoining components of the Site with higher ecological importance. The Open Space and Conservation Corridor will be permitted to contain stormwater infrastructure, minor parkland embellishments such as adjoining/fringing footpaths and landscaping that will function as an interface buffer to the internal Linear Park.
- Protect, enhance and expand areas with higher ecological value (i.e. the identified Significant Vegetation and higher ecological and habitat values within the Bundamba Creek Tributary that has been wholly contained within Linear Park).

The establishment of these key elements within the Linear Park will result in the Proposed Action avoiding impacts to the Significant Vegetation and the most important habitats within the Site. The iterative design process allowed for the establishment of an exclusion zone for the Significant Vegetation and other mature vegetation within the corridor. Further, the Proposed Action will provide opportunity for these higher values to be enhanced and expanded upon through the Linear Park corridor.

The proposed Linear Park is comprised of various Local Parks, Linear Parks and Drainage Reserves as shown by **Figure 5**.

The enveloping nature of the drainage reserves/basins and local park form a soft buffer between residential areas and the Linear Park. This design allows for a transition from layered forest environments in the Linear Park to open space parkland with varying levels of vegetation before transitioning to hard-scaped esplanade road and residential uses. The combination of these parkland designations results in an internal corridor dedicated to ecological functions of a minimum of 120 m, to a maximum of 250 m in width.

As part of the Proposed Action's mitigation strategies, sensitive landscaping, revegetation and ecological restoration works are proposed within the Open Space and Conservation Corridor. These works will aim at enhancing, expanding upon and consolidating the identified Significant Vegetation, while components of the balance of the Linear Park will be subject to the revegetation to establish open forests outside of areas critical for stormwater management. The drainage reserves and overland flow path will be revegetated with native vegetation endemic to the locality, with a focus on including koala habitat tree/grey-headed flying-fox forage target species from pre-clearing vegetation communities whilst also meeting the requirements for suitable water conveyance. The active open space areas will be subject to sensitive landscaping embellishments in accordance with the requirements of the RVPDA Development Scheme and ICC Planning Scheme Policy for establishing such uses. Such efforts will specifically focus on utilising and

establishing species a locally endemic flora species from the preclear landscape, many of which are koala, grey-headed flying-fox and greater glider habitat / feed tree species.

6.1.5 Retaining Higher Quality Bushland Habitat

Baseline ecological assessment identified habitat suitable for koala throughout the Site, particularly within the mature vegetation within the riparian corridor centrally through the Site (see **Figure 5**). Koala SAT survey results noted low koala usage occurred within the Site at low densities in the mature vegetation along the unnamed tributary of Bundamba Creek. These areas are also considered to support the most mature and extensive habitats which provide a higher level of foraging resources for the grey-headed flying-fox, with notably mature, winter flowering Queensland blue gums; which are also a preferred forage species for koala and greater glider.

Retention of this habitat as part of the Linear Park provides for the retention and enhancement of the movement connections and foraging resources into other areas of habitat to the south, and to a lesser extent north, of the Site.

This feature is the primary measure of the Proposed Action to avoid impacts on better quality koala, grey-headed flying-fox and greater glider habitat.

Although considered unlikely to visit the Site, this proposed avoidance will retain the highest quality habitat components of the Site available to the swift parrot. The retention of this vegetation includes a variety of habitat and vegetation types including highly productive alluvial vegetation communities. Restoration, consolidation and linking of this retained habitat represents a mitigation measure for the Proposed Action (see **Section 6.1** and **6.2**).

6.1.6 Involvement of Subject Matter Experts

(a) Involvement of Mark Sanders

In addition to impacts on the koala, the DEECCW identified in its IR that the Proposed Action could potentially significantly impact the grey-headed flying-fox and the possibility of impacts to the swift parrot. Consequently, the Proponent engaged the services of Mark Sanders, a recognised zoologist within south-east Queensland to:

- undertake additional targeted fauna surveys within the Site in conjunction with 28 South:
  - Mr Sanders completed these surveys on 16th to the 20th of March 2020 (inclusive), and
  - these surveys involved the use of spotlighting, camera traps, Anabat™ deployment, targeted frog surveys and opportunistic observations.
- quantify potential impacts associated with the Proposed Action on the grey-headed flying-fox and the swift parrot MNES species
- identify ways through which the Proposed Action could avoid potential impacts to these MNES species, and
- provide key inputs to this PD Report in relation to the MNES species.

(b) Involvement of Dr Steve Debus

Dr Steve Debus was engaged to assist with matters related to the swift parrot. Dr Debus is a researcher and author who has a broad ornithological experience principally recognized for his work on raptors and owls. Since 2016, he has conducted quarterly surveys for the Regent Honeyeater and Swift Parrot for NSW Local Land Services (North West) in the Barraba region, and biannually (spring and summer) for BirdLife Australia's National Regent Honeyeater Monitoring Program at tableland sites, as well as for BirdLife's

voluntary biannual search days (May and August) for these species, in Bundarra-Barraba for over 10 years and has had numerous encounters with swift parrots during this time. Dr Debus maintains professional relationships with Dr Debra Saunders and Dr Laura Rayner who are well known ornithologists and ecologists with extensive swift parrot experience. Dr Debus provided advice on:

- the frequency of swift parrot visitation in southeast Queensland
- the foraging availability scenarios within the species range under which swift parrot will reach southeast Queensland
- the nature and location of the current threats within the swift parrot's range
- foraging resources in southeast Queensland
- movement pathways into southeast Queensland and mobility of visiting swift parrot when attendant in the region
- regional context and significance of the impact at the site.

6.2 Impact Minimisation Thorough Mitigation

6.2.1 Mitigation Measures Required by EDQ Approval

The EDQ Approval (**Appendix 21**) requires the Proponent to implement a range of mitigation measures of relevance to avoiding or minimising impacts to MNES. MEDQ Delegate's Conditions (10529/2019/PDA) key relevant to the approval are contained in Attachment A.

- Condition 4(d) states '*The land required for detention basins and bioretention basins or equivalent must be dedicated as drainage reserve in favour of Council and not included within any other lot under separate ownership'*.

- Condition 4(f) states '*the applicant must dedicate* [to ICC] *land for Linear Park {referred as Lot 907 - Linear Park on the approval plan} in accordance with the endorsed compliance assessment as required by Condition 21 'Linear Park (proposed Lot 907)'*.

- Condition 6 states '*The applicant must ensure all land to be dedicated to Council is not listed on either the Contaminated Land Register or the Environmental Management Register prior to dedication. In this regard the applicant is responsible for all works associated with the removal of any land to be dedicated to Council from these registers. The applicant must provide details to Council demonstrating that the requirements of this condition have been met'*.

- Condition 8 states '*Unless otherwise approved in writing by the MEDQ Delegate, construction works must only occur within the hours as defined in Planning Scheme Policy 3 – General Works Part 5, Section 5.1.3'.*

- Condition 13 states '*The applicant must dispose of cleared vegetation in accordance with Ipswich Planning Scheme Policy 3'.*

- Condition 18 (a) states *'the applicant must ensure any lighting along cycleways/pathways adjoining Linear Park/Waterway Corridor is designed to ensure no adverse impacts on local fauna.'*

- Condition 19 states '*Council is aware that vegetation clearing associated with this approval 10529/2019/PDA has been deemed a controlled action under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) EPBC reference 2020/8615. The applicant may be requested to provide to the MEDQ Delegate copies of the decision notice for the approvals prior to vegetation clearing commencing on site'.*

- Condition 27 (a) states *'The applicant must submit for compliance assessment an amended Geomorphic Assessment prepared by a Hydro-biologist that clearly details the locations and extent of works to achieve a largely soft engineered solution (minimising hardening of the waterway) to the waterway stability within the north western riparian corridor'.*

- Condition 28 (a) states *'The applicant must rehabilitate the entirety of the Waterway Corridors/Linear Park shown on the approved plans listed in Part 3 'Approved Plans Specifications and Drawings' of this Development Approval, to a stable natural bushland setting consistent with the regional ecosystems mapped on site and in accordance with the approved Rehabilitation Management Plan…'.*

- Condition 28 (b) states '*the applicant must submit for compliance assessment an amended Rehabilitation Management Plan which identifies the works within the Waterway Corridors/Linear Park that is guided by the Geomorphic Assessment required by Condition 27 'Geomorphic Assessment' of this approval and include, but not limited to the following:*

    (i) The design for all the waterway corridors must be generally in accordance with Ipswich City Council's "Riparian Corridor Revegetation Guideline" and "Waterway and Channel Rehabilitation Guideline", as well as locally relevant design guidance such as the Brisbane City Council "Natural Channel Design Guidelines".

    (ii) (ii) Stormwater outfalls location, direction and velocities from the development must be located in accordance with Condition 27 'Geomorphic Assessment' to ensure no new, or exacerbate existing, erosion or sediment movement in the waterway. Any eroded or otherwise degraded areas must be remediated and no evidence of active erosion present.

    (iii) All declared weeds, environmental weeds, exotic pests and rubbish must be removed from the site. Where appropriate a staged rehabilitation approach must be adopted to ensure that any habitat values provided by the exotic species is gradually replaced by native plants.

    (iv) *Include measurable targets and Milestones and how they will be monitored and delivered in conjunction with the stages of plan seal'*.

- Condition 29 (a) states 'The applicant must submit to the MEDQ Delegate for compliance assessment an amended Vegetation Management Plan that reassesses the retention of trees within the waterway corridors where the location of the sewer is micro sited to avoid large habitat trees.

- Condition 29 (b) states 'Unless otherwise approved in writing by the MEDQ Delegate the applicant must retain native trees within areas of Local/Linear Park and Drainage Corridor generally in accordance with the amended Vegetation Management Plan required by Condition 29(a)'.

- Condition 29 (c) states 'Trees identified to be retained by Condition 29(a) above must be appropriately protected from impact of construction works as prescribed by a Level 5 arboricultural consultant, and in accordance with AS4970:2009 *Protection of Trees on Development sites'.*

- Condition 29 (d) states '*The applicant must submit to the MEDQ Delegate a report, prepared by a Level 5 arborist required by Condition 29(c)… outlining:*

(i) The extent of arboricultural treatment undertaken on trees to be protected and retained as detailed within this approval

(ii) Confirmation that all trees to be retained have been reinspected during and following completion of the works and are considered to be safe for the surrounding use; and

(iii) *Any further necessary works required prior to dedication and acceptance of the land on which the trees are located off maintenance.*

- Condition 29 (e) states *'The applicant must submit to the MEDQ Delegate a report, prepared by a Level 5 arborist required by Condition 29(c) above, outlining the trees retained in Condition 29(a) above have been inspected and all works required identified in Condition 29(c) above have been undertaken and no further mitigation is required'.*

- Condition 38 (c) states *'The applicant must submit to the MEDQ Delegate, the detailed engineering design and construction drawings certified by an RPEQ experienced in hydrologic and hydraulic engineering, for the infrastructure proposed for stormwater quantity management generally in accordance with the Stormwater Management Plan and Flood Impact Assessment, Revision 6 prepared by Engeny, and dated 04 February 2021'.*

- Condition 38 (d) states *'The applicant must construct all stormwater quantity management infrastructure as per the approved design in accordance with Condition 38(c) above.'*

- Condition 38 (e) states *'The applicant must discharge stormwater runoff from the proposed development in accordance with the Stormwater Management Plan and Flood Impact Assessment, Revision 6 prepared by Engeny, and dated 04 February 2021'.*

- Condition 38 (f) states *'The applicant must provide any external protection or rectification works where any external stormwater impacts occur as a result of the development, unless otherwise agreed in writing by the MEDQ Delegate'.*

- Condition 39 (a) states *'The applicant must achieve the water quality objectives outlined in Table 2.3.1 of Planning Scheme Policy 3 General Works of the Ipswich Planning Scheme prior to stormwater runoff discharging from the site'.'*

- Condition 39 (b) states *'In order to comply with Condition 39(a) above the applicant must construct stormwater basins generally in accordance with the Stormwater Management Plan (SMP) in Part 3 'Approved Plans Specifications and Drawings' of this Development Approval'.*

- Condition 39 (c) states *'Unless otherwise approved in writing by the MEDQ Delegate, the applicant must construct stormwater infrastructure in conjunction with the adjoining Stages'.'*

- Condition 39 (d) states *'The applicant must submit to the MEDQ Delegate engineering design and construction drawings showing the final locations and cross-sections of stormwater infrastructure in accordance with the approved SQMP and section 2.3.5 of Planning Scheme Policy 3 General Works of the Ipswich Planning Scheme and the requirements of this Development Approval'.'*

- Condition 39 (e) states *'The drawings required by Condition 39(d) above must be certified by a Registered Professional Engineer of Queensland (RPEQ-Civil)'.*

- Condition 39 (f) states *'The maintenance period for all stormwater infrastructure (including bioretention basins, vegetated stormwater outlet areas, and works to the central drainage corridor)*

is a minimum period of 24 months post establishment. Note: Vegetation requires a minimum 12-week establishment period prior to acceptance on-maintenance'.

- Condition 40 (a) states '*The applicant must engage a spotter catcher licensed by the Department of Environment and Science under the Nature Conservation Act 1992, to assesses the site, supervise any vegetation removal and ensure that any native fauna (including native bees) has been identified, relocated and discouraged from returning prior to habitat disturbance'.*

- Condition 40 (d) states '*The applicant must submit to the MEDQ Delegate a Pre-Clearance Fauna Management Plan undertaken by the spotter catcher mentioned at Condition 40(a) above'.*

- Condition 40 (e) states '*The applicant must submit to the MEDQ Delegate a Post Vegetation Clearance Report…'.*

- Condition 45 (e) states' *The applicant must prepare a site-based construction management plan……'.*

- Condition 47 (a) states' *The applicant must provide sufficient grass (or equivalent) cover to prevent both rill and sheet erosion for all unpaved and disturbed areas'.*

- Condition 47 (b) states' *The applicant must submit a construction phase Erosion and Sediment Control Plan prepared by an RPEQ or CPESC in accordance with the International Erosion and Sediment Control (IECA) Best Practice Erosion and Sediment Control (BPESC) document. This must include the required IECA soil sampling rates/depths, associated laboratory testing and the design basis of sediment basins and other control measures. The ESCP must be prepared in accordance with the recommendations of the Dispersive Soil Management Plan (DSMP): Ripley View Estate, 39-49 Fischer Road, Flinders View, prepared by Gallagher Environmental, and dated 20 August 2019'.*

- Condition 55 (a) states' *The development must be carried out generally in accordance with the CLAG PTY LTD Ripley View Estate Stormwater Management Plan and Flood Impact Assessment prepared by Engeny Water Management dated 4 February 2021, Reference M64000_004_REP-001 Revision 6'.*

- Condition 55 (b) states '*Submit to the MEDQ delegate and EDQ Development Assessment, RPEQ certification with supporting documentation, demonstrating that the development has been designed and constructed in accordance with part (a) of this condition'.*

- Condition MDEQ 2 (d) states *'The land over which you have made a development application is within a suburb known to have Fire Ants and as such is within a "Restricted Area". The presence of Fire Ants on the site may affect the nature, form and extent of works permitted on the site. In view of this it will be necessary for you to contact the Department of Employment, Economic Development and Innovation to investigate the site and for you to implement any necessary matters required by that Department prior to the commencement of any works'.*

6.2.2 Mitigation Measures - Koala

(a) Consolidating and Linking Retained Koala Bushland Habitat

(i) Description

The retained koala bushland habitat (**Section 6.5**) will be consolidated and linked by way of:

(i) protection within the Linear Park and establishment of an exclusion zone associated with the protection of the Endangered RE12.3.3
(ii) assisted natural regeneration in areas of existing regrowth and remnant vegetation, namely weed removal, and
(iii) assisted natural regeneration/reconstruction in areas of open forest with managed understorey, largely removal of dense infestations of weed (*Lantana camara*) and infill canopy and shrub planting

These methods of ecological restoration will be in line with the ICC Implementation Guideline No. 19 - Vegetation Retention (2007) and ICC Implementation Guideline No. 28- Dispersive Soils Management (2016).

A detailed RMP will be prepared to guide compliance with the principles and intents of the of the RVPDA Development Scheme and any subsequent approval conditions from the Commonwealth, State or ICC. The Concept RMP provided in **Appendix 7** provides detail regarding the proposed rehabilitation of the Site. This represents the Proposed Action's primary mitigation measure to improve and expand upon habitat connectivity and achieve a suitable ecological outcome on the Site.

The unnamed tributary of Bundamba Creek through the Site aligns with the "Significant Riparian Corridor" identified by the RVPDA Development Scheme, Map 2 - Values (**Appendix 3**), and the proposed works will make a significant contribution to the mapped values within both the RVPDA Development Scheme, the current ICC Planning Scheme and the Draft ICC Planning Scheme[62].

The Proposed Action will result in the removal of 38.4 ha koala habitat of varying quality to facilitate residential, WSUD and active and passive open space uses (see **Appendix 4**). The impact on koala habitat will be mitigated by retaining, enhancing and consolidating koala habitat within the Linear Park which will result in a dedicated minimum ~120 m wide Linear Park for koala with immediate connectivity to habitats located to the north and south of the Site. The interface of the Linear Park will support 'soft' transition to unsuitable residential areas by establishing complimentary passive and active open spaces and WSUD uses, establishing a minimum of a ~120 m to a maximum ~250 m wide Ecological Corridor.

Overall, 9.69 ha of koala habitat will be retained and enhanced with a further 2.96 ha of batters and 2.73 ha of stormwater detention (Drainage Reserve) within the disturbance area rehabilitated within the Linear Habitat Corridor. The Linear Habitat Corridor will be retained in perpetuity is designated Linear Park. The desired minimum corridor width for koalas of 100 m is exceeded within the Linear Park (see annotated widths in **Figure 5**).

The restoration goal for the Linear Park area is the enhancement and re-establishment of pre-clearance RE vegetation communities (see Concept RMP **Appendix 7**). Using an accepted rate of ~250 koala habitat trees per hectare (DEHP 2016), the restoration works are expected to lead to the establishment of a further 870 koala habitat trees in the drainage reserves and overland flow path. Using total stem densities for benchmark REs (DES 2019c), it is expected that the Linear Park is likely to achieve over 10,900 stems within the canopy, sub-canopy and shrub strata.

(ii) Effectiveness Table

Ecological restoration in the Linear Park and the interface corridor (drainage reserves, overland flow path and local parks) and the dedication of the area to ICC will achieve a significant ecological outcome.

62: Currently under Development by ICC and in the Stage 1 – early consultation regarding the Full Draft Planning Scheme

The goal of the RMP is to reinstate the pre-clear REs which will enhance and expand on the existing Significant Vegetation within the Linear Park which can be described as Queensland blue gum woodland to open forest on Quaternary alluvium analogous with RE12.3.3 (a community with high capacity for supporting koala).

Where areas within the Linear Park are currently disturbed and devoid of any of the vegetation stratum that characterise the pre-clear RE, tubestock planting densities in the initial establishment phase of the RMP phase allow for the achievement of natural and woodland to open forest communities at maturity. Maintenance will be provided throughout the life of the Proposed Action and will continue until the targets under the RMP have been achieved; or, when it is handed to ICC or another suitable custodian for ongoing maintenance and management. Once the ecological restoration works reaches off-maintenance status, this land will be transferred to the custodian through statutory environmental covenant or similar and the custodian will be responsible for ensuring the provisions of the Queensland *Biosecurity Act 2014* are upheld through regular weed inspections (and removal if necessary).

The loss, fragmentation and degradation of habitat, including dispersal habitat as a primary threat to koala in the coastal context. Logically, a mitigation measure that retains, consolidates and links koala habitat is an effective means of reducing such a threat.

(iii) Performance and Completion Criteria

If the Proposed Action is approved under the EPBC Act, approval conditions reflective of performance and completion criteria established by this PD (**Table 21** for Construction and Operation Avoidance and Mitigation Measures, and the Conceptual Rehabilitation Management Plan (**Appendix 7**)) and the Compliance Endorsement which formalise performance and completion criteria.

The Concept Rehabilitation Management Plan is the master document informing the Compliance Plans approved by ICC (as Delegate to the Minister for EDQ) for works within drainage reserves (stormwater detention basins and bio-basins *Condition 39* of the approval (see **Section 6.2.1**)) under a Landscape Compliance Endorsement [63] and the rehabilitation of terrestrial vegetation under a Rehabilitation Compliance Endorsement[64] (Condition 28 of the approval (see **Section 6.2.1**)). The approval conditions mandate that the plans identify the mandatory removal and management of declared weeds, environmental weeds, exotic pests and rubbish which must be removed from the site and measurable targets and milestones and how they will be monitored and delivered in conjunction with project staging. These are detailed in the plans and bind the proponent.

(iv) Risks and Contingency Measures

Monitoring and adaptive maintenance of the Linear Park during the initial establishment phase[65] will ensure that there is sufficiently robust plant health and a trajectory towards the target plant community at the end of the maintenance period. There is a very low risk that the restoration works will not be provided, but as a contingency ICC retains development bonds to remedy non-compliant works.

The restored habitat in the Linear Park and the interface areas are proposed to be transferred to ICC, the crown or another appropriate entity to be held for environmental conservation purposes in perpetuity. This would allow, for example, ICC to then undertake a statutory amendment process to the RVPDA development scheme to change the zoning of that land from its current zoning to the Conservation Ripley Valley zone or the Recreation Ripley Valley zone (as applicable).

63: Pending assessment by ICC as Delgate
64: Pending assessment by ICC as Delgate
65: As per the requirements of a Council-approved Rehabilitation Management Plan.

Once the zone has been changed, the applicable provisions of the RVPDA Development scheme would apply. Any future development of that land would require either an amendment to development scheme, following the statutory process, or an approval of an impact assessable development application for a variation request under the *Planning Act 2016* and the *Economic Development Act 2012* to seek to vary the effect of RVPDA development scheme with respect to the zoning of that land. This mechanism is sufficient to ensure appropriate conservation of the land into the future; therefore, no contingency measures are proposed.

(b) Movement

(i) Corridors and Habitat Connectivity

The provision of retained vegetation along the central (south-north tending) waterway corridor (which includes underpasses and koala movement infrastructure as outlined below), is a key strategy for ensuring ongoing opportunities for exploiting open forest resources along the waterway corridor and conveying animals through the landscape. Further justification of this approach, discussing the planning and ecological contexts and evaluation of connectivity and potential 'pinch-points' is provided in **Appendix 22**.

(ii) Infrastructure and Road Treatments

Description

The Proposed Action will retain and improve key environmental values within the Open Space and Conservation Area. To assist in corridor functionality in the initial periods of the ecological restoration works and where barriers are proposed such as the central road crossing, the detailed design will be refined so that ecological restoration work and mitigation measures include as a minimum:

- functional fauna underpasses (these are to be of sufficient standard to afford koalas a safe, dry passage);
- fauna furniture within and adjoining underpasses to funnel fauna into crossing points and provide safe passage (e.g. raised walks or gantries between trees and under roads);
- restored riparian and waterway habitats.

Additional design mitigation commitments for koala are:

- Developing the Site so it is "koala permeable" by establishing:
    - A low vehicle speed where applicable and supporting this through signs incorporating radar detection technology (speed awareness monitors (**SAM**s)) to assist drivers to keep below this speed limit (refer to **Appendix 23**). Similar technology ("slow down for SAM") has been successfully trialled in Brisbane, with studies showing the technology has reduced vehicle speeds by an average of 5 km/h for all vehicles and 9.5 km/h for vehicles travelling slightly over the speed limit. The Brisbane City Council data demonstrates that the SAM is:
        - Effective at reducing speeds and increases the compliance of vehicles over the speed limit.
        - Effective at reducing speeds and increasing the number of vehicles adhering to the speed limit regardless of road hierarchy, speed limit or school zones.
        - Continually effective at reducing speeds and percentage of vehicles exceeding limits when in place for at least 23 weeks (*Pers. comm* N. Herson Brisbane City Council – refer also Burke (2015)).

- Directional street lighting to improve night-time visibility on the road surface whilst reducing light spill into the adjoining Open Space and Conservation Corridor by utilising directional lighting and/or shields.
- Landscaping to encourage koala movement towards the internal corridor and avoid movement through residential areas should a koala become present in this area of the Site. Landscaping works within the interface areas including the local park, drainage reserves and overland flow path to provide a soft transition towards the Linear Park as the internal corridor.

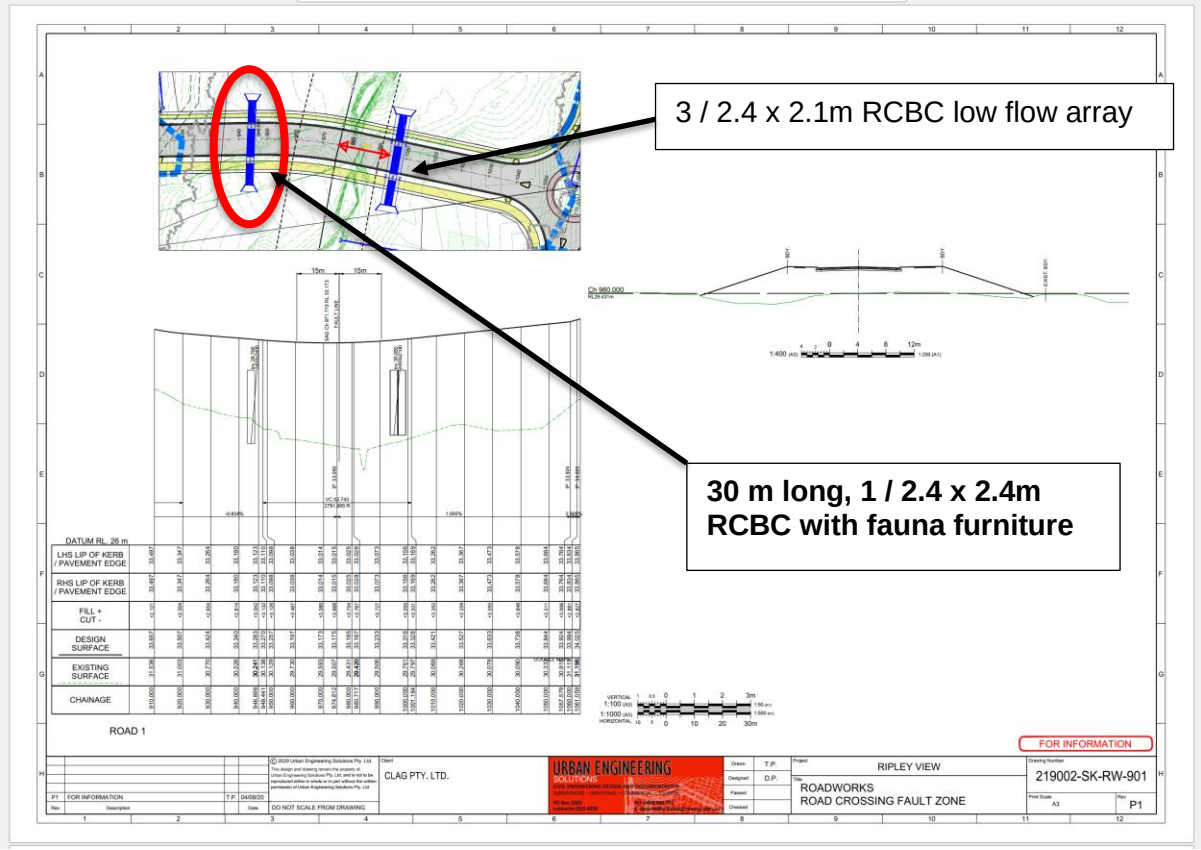
After the retention, consolidation and linking of the koala habitat through the Linear Park, the greatest potential for koala strike will occur at the internal road crossing of the Linear Park. To mitigate this potential impact, the Proponent will establish a dedicated dry passage fauna underpass (refer **Figure 5**) at the central road crossing. A second dedicated low flow culvert array for water conveyance will be constructed to the east of the dry cell. The dry cell fauna culvert will contain fauna furniture as discussed (climbing rail) and will allow movement of other terrestrial fauna. It will be positively graded to minimise settling of mud on the culvert floor (**Inset 12** below).

Inset 12: Indicative example of a fauna underpass with fauna furniture (note the Proponent's proposal will attach the poles to the wall of the culvert and will use a much smaller concrete apron to allow more planting around the portal). Further, rocks will be provided within the culvert to provide cover for small terrestrial species.

As the project is being staged, Compliance Reporting (to ICC) will be completed slightly ahead of ahead Stage commencement. As construction of internal crossing of the waterway bringing access and traffic from Fischer Road will occur in later project stages, Detailed Engineering Plans are not available. Concept plans forming a component of the Development Application Package show the location of one 30 m long, 2.4 x 2.4 m reinforced concrete box culvert dry cell underpass. The apron, climbing rail and tie into exclusion fencing will be detailed as required by Compliance Reporting. As outlined fauna exclusion fencing will be installed around the perimeter of the Linear Park tying back into the underpass to direct fauna.

The dry fauna passage layout is shown as **Inset 13** (see also **Appendix 24**).

Revegetation on either side of the culvert will be provided to establish: (i) cover from predators at the culvert portals (thereby minimising the predator funnel effect); and (ii) a canopy over the road that is sufficiently spaced to allow transit by gliders and woodland birds. The revegetation at the fauna crossings will be as the specifications of the Concept RMP (**Appendix 7**).



Inset 13: Concept engineering plans showing the location of the dry cell culvert for fauna passage, and the array designed for water conveyance

Effectiveness

The koala statutory documentation identifies underpasses as a moderately effective for mitigating vehicle strike on the koala, but experience with nearby locations shows that the combination of underpasses and exclusion fencing has been very effective for reducing vehicle strike. Other mitigation measures described above are not assigned a level of "mitigation effectiveness" by the Koala Referral Guidelines, but they will achieve a level of benefit well-above doing nothing.

The effectiveness of underpasses in facilitating koala and other fauna movement when is now well understood; rather than creating a barrier to movement these structures when combined with exclusion fencing are effective in directing fauna. In addition to the proposed dry-cell dedicated fauna underpass, fauna will be able to use the low flow array.

Presently koala occur in low numbers within the locality, and a potential vector for movement in a north-south direction is along the unnamed tributary of Bundamba Creek, through Roarke's Park (Ipswich City Council Park) adjoining to the north and onto the lands comprising the Bundamba Creek Floodplain. Koala movement to the south through the Goldfields Development Pty Ltd land (EPBC 2021/9070) at 352-396 Ripley Road, Ripley, is already constrained by residential development south of formed and unformed sections of Montera Road.

Development of the Ripley View Residential Subdivision, with dedicated koala underpass will maintain the status-quo and not restrict utilisation of koala habitat along the waterway.

The empirical evidence outlining the effectiveness of the SAM technology is outlined in **Appendix 23**.

(iii) Performance and Completion Criteria

Provision of underpass structures and directional fencing can be an EPBC approval condition. More detailed designs will be assessed as part of the development application to ICC, and then the detailed design as part of the operational works phase of the Proposed Action.

Performance of the underpass structures and directional fencing can be measured in two main ways:

- temporal increase in use of the underpass structures by koalas; and
- no increase in koala injury/mortality numbers within the Site.

The use of underpasses by fauna is well known and understood. Many studies undertaken within South East Queensland on behalf of Local Governments and the State have shown this. Therefore, the monitoring of culvert use at Ripley View is considered to be unnecessary. However the proponent is willing to undertake monitoring if required to satisfy approval conditions.

(iv) Risks and Contingency Measures

Risks that the infrastructure will not be maintained are low because it will become ICC infrastructure. No contingency is required.

(c) Exclusion fencing

(i) Description

The proponent proposes to retain koala habitat within the Linear Habitat Corridor the area dedicated to Council and zoned for protection under the RVPDA zoning.

Fencing of the Linear Park will be of a type typical conservation fencing to compliment the proposed offset area, to ensure a consistent conservation outcome at a landscape scale, whilst also dedicating the area in ICC ownership. The purpose of the fencing is to ensure koala do not enter areas where they may become isolated from shelter from predation and / or to exclude pets from the Linear Park.

The (exclusion / directional) fencing is to span the perimeter of the Linear Park and include Stormwater Reserve features 1.8 m high aluminium perimeter / pool fencing (which is compliant with the Koala Sensitive Design Guidelines[66] (Department of Environment and Science 2022)), with no gaps at the base. An example of the typical fencing is shown in **Plate 7**.

66. https://environment.des.qld.gov.au/__data/assets/pdf_file/0025/102859/koala-sensitive-design-guideline.pdf

Plate 7: Koala exclusion fencing similar to that proposed

(ii) Performance and completion criteria

Installation of exclusion / directional fencing can be an EPBC approval condition. More detailed designs will be assessed as part of compliance plans for parks submitted to ICC, and then the detailed design as part of the parks compliance phase of the Proposed Action.

Performance of directional fencing can be measured in one main way, no occurrence of greater glider within the Development Footprint (the area of exclusion).

(iii) Risks and contingency measures

Risks that the Linear Park will not be maintained are low because it will become ICC infrastructure. No contingency is required.

(d) Management of Domestic and Wild Dogs

(i) Description

The Proposed Action will improve opportunities for north south koala movement through and off the Site by establishing contiguous vegetation and habitat protected in the Linear Park. This contiguous vegetation and habitat will minimise the time spent on ground when koalas are moving from tree to tree within the Linear Park and will provide greater opportunity for inter-canopy movements given the current higher quality of the vegetation and the enhancement works that are proposed.

In suburban areas, the greatest morbidity and mortality of koalas due to dog attack occurs in backyards. There is also a correlation between dog size and the risk of koala injury or death (larger dogs being implicated in a greater risk of death or injury) (*Pers. comm* Dr. Frank Carrick). In this regard, it is relevant to consider the size of lots to be created by the Proposed Action, and the potential for interaction between dogs and koalas.

In rural-residential and large urban lot development, where tree retention is sometimes proposed to achieve habitat and greenspace outcomes in the balance of new lots, there is clear potential for interaction between domestic dogs and koalas. However, in more tightly-configured development (as proposed by the Proponent) (**Appendix 4**) the potential for interaction between the two species is reduced, because:

- bulk earthworks requirements have limited the ability to retain trees within the development footprint;
- the small backyards are typically landscaped with small-statured shrubs and groundcovers rather than trees and shrubs that would attract koalas;
- the small backyards reduce the likelihood of residents owning larger dogs capable of inflicting mortality; and
- the backyards are typically fenced with 1,800 mm tall fencing, which create a significant barrier to movement (and thus access by koalas).

Potential remains for dogs at-large to interact with koalas in the Open Space and Conservation Corridor, particularly the Linear Park. This will also be addressed through:

- provision of barriers around Linear Park to prevent domestic dogs from entering the Linear Park and koala accessing residential areas, consolidating koala movement through the Linear Park and minimising the area for interface between koala and dogs.
- community awareness and education programs for new residents moving into the Site. These programs will reinforce the threats that dogs present for koala populations and will outline dog owners' responsibilities for maintaining control of their dogs.

The Proponent will also rely on governance measures [67], which have been considered acceptable under Referral 2017/8095 and Referral 2016/7723. As future owner of the Open Space and Conservation Corridor, the custodian will be responsible for managing wild dogs in accordance with obligations established by the Queensland *Biosecurity Act 2014.*

(ii) Effectiveness

The Koala Referral Guidelines do not discuss the effectiveness of governance measures, but enforced local laws have a degree of efficacy that extends beyond doing nothing. This is implicit in the DEECCW decision regarding the suitability of governance measures under Referral 2016/7723 and Referral 2017/8095. It is also relevant to consider the benefit of ecological restoration and enhancement of the Linear Park, particularly areas currently disturbed and devoid of vegetation will aid in the establishment of more closely-spaced trees that will reduce the time that koalas spend on the ground moving between trees, and thus exposure to dog attack.

(iii) Performance and Completion Criteria

ICC Animal Management subordinate local laws are already in operation and will apply to all future residential areas. The future custodian of the Open Space and Conservation Corridor will be required to manage wild dogs in accordance with obligations established by the *Queensland Biosecurity Act 2014*. The performance criterion for this mitigation measure is:

- in the unlikely event that koala mortality does occur as a result of attack by domestic dog/s a situation analysis will be conducted to discover the cause of the interaction (eg. was it; a failure of design, deliberate or accidental breach of controls; a failure of administrative controls / education) and SMART corrective measures implemented to redress the cause / causes of the incident.

(iv) Risks and Contingency Measures

The structure and configuration of the residential areas in the Proposed Action (as discussed in **Section 2.3**) will be set by ICC development approval conditions. Both ICC and the Proponent seek to

67: ICC Local Laws which govern control of roaming dogs

establish this form of development at the Site. It is highly unlikely that the development layout would be amended to a large-lot style of development.

There is very little risk that ICC domestic animal local laws will change in a way that reduces controls on wandering domestic dogs. There is also little risk that the custodian will abandon its legal obligation to manage wild dogs in accordance with the *Biosecurity Act 2014*. Therefore, no contingency measures are proposed.

(e) Construction Management Plan

(i) Description

The DEECCW Information Request (**Appendix 1**) indicates that construction activities may result in direct mortality to koalas. However, it is common practice for ICC to require the submission of a Vegetation Clearing and Fauna Management Plan prior to commencement of construction works for development projects affecting koala habitat. The fauna management plans that will subsequently be prepared as part of operational works phase of the Proposed Action will identify measures that reduce the risk of death or injury during the clearing and construction works to establish the Proposed Action (e.g. pre-clearance surveys; use of spotter-catchers; identification of relocation habitat; and stop-work procedures).

(ii) Effectiveness

The development of fauna management plans including koala management requirements aligns with the State's requirements under the *Planning Regulation 2017* and the NC Act. Such measures are considered effective in minimising the risk of death or injury resulting from construction activity (primarily removal of habitat).

Fauna management plans (including plans to deal with potential impacts on specific listed species) prepared for various controlled actions in south-east Queensland have proven to be effective at managing impacts during construction. It is expected that a fauna management plan will be similarly effective for the Proposed Action. Key features of the plan will be:

- Clearing procedures that avoid the fragmentation of vegetation will be adopted within the SBMPs and informed by the Fauna Spotter Catcher a condition of the [68].
- Clearing will be undertaken in a way that flushes fauna into connected areas of habitat and will avoid flushing fauna into fragmented or hostile areas. Specifically:
    - Koala are not required to cross roads or move through developed or disturbed areas, such as residential areas of areas that require movement greater than 100 m over cleared ground to reach suitable habitat;
    - Fauna are not left occupying an 'island' of habitat between hostile environments, such as road and cleared areas;
    - Fauna can safely leave the site of clearing and relocate to adjacent habitat;
    - Demarcation fencing will be fauna friendly to ensure fauna are not trapped within the proposed cleared extent; and
    - Cleared vegetation is to be stockpiled as to not impede fauna movement

---

68: Condition 40 of the EDQ Approval (**Appendix 21**) (refer **Section 6.2.1**) makes the presence of a Spotter Catcher mandatory at any time vegetation is being removed. Specific relevant conditions include *40(a) 'The applicant must engage a spotter catcher licensed by the Department of Environment and Science under the Nature Conservation Act 1992, to assesses the site, supervise any vegetation removal and ensure that any native fauna (including native bees) has been identified, relocated and discouraged from returning prior to habitat disturbance'* and 40(d) *'The applicant must submit to the MEDQ Delegate a Pre-Clearance Fauna Management Plan undertaken by the spotter catcher mentioned at Condition 40(a) above'.* This approval is further reflected by Compliance Endorsement (by ICC as Delegate to the MDEQ) 11983/2022/PDAEE, Compliance Assessment – Condition 29(a) Vegetation Retention – Riparian Corridor of 2 September 2023, which further references Spotter Catcher Requirements.

- Additionally, proposed construction roads will be subject to design treatments to ensure safe fauna crossing opportunities are maintained to vegetated areas and impose low vehicle speeds within construction areas.

(iii) Performance and Completion Criteria

A fauna management plan (including koala management requirements) will be prepared for submission to ICC as part of the operational works phase of the Proposed Action. Requirements for the plan's implementation will be identified as a condition of development approval.

The performance criterion related to this mitigation measure is:

- No koala mortality attributable to the construction of the Proposed Action.
- Clearing to be undertake in compliance with the *Nature Conservation (Koala) Conservation Plan 2017*, as such, will be completed slowly and sequentially and in a direction that directs any vacating fauna towards retained corridor areas.

A dedicated monitoring program will be implemented by the Proponent to enable the tracking of this performance criterion.

(iv) Risks and Contingency Measures

The requirement to prepare a construction environmental management plan incorporating koala management measures (spotter-catchers, etc.) is a commonly-applied condition of development consent within the RVPDA and ICC, and readily accepted by contractors. There is a very small risk that a condition will not be applied by ICC. As such, an acceptable contingency measure could be that a fauna management plan (MNES) is required as a condition of approval by the DEECCW.

6.2.3 Mitigation Measures - Grey-headed flying-fox

(a) Retaining, Consolidating and Linking Grey-headed Flying-fox Resources

(i) Description

Section 3.3.3 identifies that the Site's most significant habitat for the grey-headed flying-fox occurs within the Linear Park. This area supports a relatively large area of intact, mature/relict habitats dominated dense and mature provision of winter-flowering *Eucalypts*. Clearing of winter forage is a particular key threat for the species with foraging resource reliability during the critical reproductive periods (e.g. mating (March-April), birth and gestation (Oct-Nov)) especially during spring of key importance to the species (Commonwealth of Australia 2021, p18)[69]. The National Recovery Plan (*ibid*), identifies few foraging resources that flower in winter and those that do flower reliably occur on coastal lowlands in northern New South Wales and southern Queensland. Queensland blue gum is a key winter flowering species on site and the identification and retention of this large area of winter flowering resource is a key mitigation measure of the Proposed Action.

Given its intact, mature and connective nature, this area represents the highest quality habitat within the Site and immediate area, theoretically requiring a lower energy output for the purposes of grey-headed flying-fox foraging purposes than the smaller regrowth (lower flower levels) in the Site's south-east/south-west and more widely-scattered paddock trees (more energy to move for lower resources/higher

69: *National Recovery Plan for the Grey-headed Flying-fox 'Pteropus poliocephalus',* Department of Agriculture, Water and the Environment, Canberra, March. https://www.dcceew.gov.au/sites/default/files/documents/recovery-plan-grey-headed-flying-fox.pdf

competition). As such, this corridor is likely to play a minor role in supporting the fluctuating local population of grey-headed flying-fox (see **Section 3.4.3**).

As described in **Section 4**, the Proposed Action will impact some lower-quality scattered woodland foraging habitat for the grey-headed flying-fox; however, these scattered trees occur largely as regrowth specimens in the south-east of the Site or as scattered individuals throughout paddock areas. As such, theoretically performing a lower ecological function than those mature trees within the intact conservation areas.

Similar to the consolidation and linkage of koala habitat values, the retained habitat will be consolidated and linked as component of the Proposed Action. These methods of ecological restoration are described within the Concept RMP (**Appendix 7**). It is important to note that the restoration of habitat for the koala will be of direct benefit to the grey-headed flying-fox due to the overlap of key feed tree species.

(ii) Effectiveness

The *National Recovery Plan for Grey-headed Flying-fox* (DAWE 2021) notes that habitat loss and degradation pose the most significant threat to the grey-headed flying-fox. Reduction of winter foraging habitat is of particular concern. Evidence of repeated food shortages during winter and spring indicates that inadequate productive foraging habitat exists in these seasons to sustain the current grey-headed flying-fox population (p. 18). DAWE (2021) goes on to note under Recovery Objective 1 (action 1.4) that increasing the extent and viability of forage habitat for the grey-headed flying-fox that is productive during winter and spring is an important conservation outcome for this species (p. 21). Therefore, the protection and retention of productive foraging habitat in the Linear Park can be reasonably identified as an effective mitigation measure.

(iii) Performance and Completion Criteria

If the Proposed Action is approved under the EPBC Act, approval conditions reflective of performance and completion criteria established by this PD (**Table 21** for Construction and Operation Avoidance and Mitigation Measures, and the Conceptual Rehabilitation Management Plan (**Appendix 7**)) and the Compliance Endorsement which formalise performance and completion criteria.

The Concept Rehabilitation Management Plan is the master document informing the Compliance Plans approved by ICC (as Delegate to the Minister for EDQ) for works within drainage reserves (stormwater detention basins and bio-basins *Condition 39* of the approval (see **Section 6.2.1**)) under a Landscape Compliance Endorsement [70] and the rehabilitation of terrestrial vegetation under a Rehabilitation Compliance Endorsement[71] (Condition 28 of the approval (see **Section 6.2.1**)). The approval conditions mandate that the plans identify the mandatory removal and management of declared weeds, environmental weeds, exotic pests and rubbish which must be removed from the site and measurable targets and milestones and how they will be monitored and delivered in conjunction with project staging. These are detailed in the plans and bind the proponent.

(iv) Risks and Contingency Measures

Monitoring and adaptive maintenance of the ecological restoration area during the initial establishment phase[72] will ensure that there is sufficiently robust plant health and a trajectory towards the target plant community at the end of the maintenance period. Development bonds are taken by ICC to ensure that

70: Pending assessment by ICC as Delgate
71: Pending assessment by ICC as Delgate
72: As per the requirements of the Council-approved Rehabilitation Management Plan.

revegetation works achieve acceptable standards. There is a very low risk that the restoration works will not be provided, but as a contingency ICC retains development bonds to remedy non-compliant works.

The enhanced habitat in the Ecological Corridor and established future foraging opportunities within the drainage reserves and overland flow path will be transferred to ICC, the crown or another suitable custodian to be held for environmental conservation purposes in perpetuity. This would allow, for example, ICC to then undertake a statutory amendment process to the RVPDA development scheme to change the zoning of that land from its current zoning to the Conservation Ripley Valley Zone or the Recreation Ripley Valley Zone (as applicable).

Once the zone has been changed, the provisions of the RVPDA Development scheme will apply. Any future development of that land would require either an amendment to RVPDA Development Scheme, following the statutory process, or the approval of an impact assessable development application for a variation request under the *Queensland Planning Act 2016* and the *Queensland Economic Development Act 2012* to seek to vary the effect of development scheme with respect to the zoning of that land. This mechanism is sufficient to ensure appropriate conservation of the land into the future; therefore, no contingency measures are proposed.

(b) Clearing and Construction Environmental Management

(i) Description

The DEECCW Information Request (**Appendix 1**) indicates that construction activities may result in direct mortality to grey-headed flying-fox. However, it is common practice for ICC to require the submission of a Vegetation Clearing and Fauna Management Plan prior to commencement of construction works for development projects affecting grey-headed flying-fox habitat. The fauna management plans that will subsequently be prepared as part of operational works phase of the Proposed Action will identify measures that reduce the risk of death or injury during the clearing and construction works to establish the Proposed Action (e.g. pre-clearance surveys; use of spotter-catchers; identification of relocation habitat; and stop-work procedures).

Reliability of foraging resource, particularly during critical reproductive periods is of importance to grey-headed flying-fox (Commonwealth of Australia 2021, p18). Vegetation will be cleared sequentially to avoid, minimise and mitigate risk of disturbance to grey-headed flying-fox when foraging in habitat during construction, specifically conducting clearing and construction during daylight hours between 7am - 6pm. The timing of vegetation clearing will minimise impacts (direct or indirect) during optimum breeding periods (e.g. mating (March-April), birth (Oct-Nov)).

The sequential clearing of vegetation will allow for the gradual loss of vegetation, giving fauna time to naturally disperse away from the disturbance. The use of fauna exclusion fencing around construction areas will ensure fauna do not disperse into unsafe, hostile areas, again minimising the risk of injury of death.

Each of these measures will ensure that the risk of injury or death to grey-headed flying-fox as a result of construction are avoided and mitigated. The aim of these procedures is to support zero injuries or death to grey-headed flying-fox as a result of construction.

(ii) Effectiveness

The development of fauna management plans including grey-headed flying-fox management requirements align with the State's requirements under the *Planning Regulation 2017* and the NC Act. Such measures are considered effective in minimising the risk of death or injury resulting from construction activity (primarily removal of habitat).

Fauna management plans (including plans to deal with potential impacts on specific listed species) prepared for various controlled actions in south-east Queensland have proven to be effective at managing impacts during construction. It is expected that a fauna management plan will be similarly effective for the Proposed Action.

The Fauna Management Plan will also include provisions for the proponent to appoint a suitably qualified, experienced Fauna Spotter Catcher, licenced under the NC Act. Fauna Spotter Catchers have a primary role to ensure no fauna are in vegetation before it is cleared. Given Grey-headed Flying-foxes are nocturnal, there is minimal risk of mortality from vehicle collision. Restricted operation hours (i.e. daylight hours) is considered an effective mitigation measure to minimise this risk and allows a 13-hour period for safe dispersal and foraging to occur.

Working hours on construction sites for the types of machinery used for construction purposes are regulated by the environmental noise provisions of the *Environmental Protection Act* (Qld) *1992*. A site-based construction environmental management plan will be a condition of development. The plan will outline working hours, clearing sequencing plan, upholding fauna management measures outlined in the fauna management plan.

Ecological restoration measure to be employed within Ecological Corridor will enhance the quality of the remaining habitat on the Site.

(iii) Performance and Completion Criteria

A fauna management plan (including koala management requirements) will be prepared for submission to ICC as part of the operational works phase of the Proposed Action. Requirements for the plan's implementation will be identified as a condition of development approval.

The performance criterion related to this mitigation measure is:

- no koala mortality attributable to the construction of the Proposed Action.
- clearing to be undertake in compliance with the *Nature Conservation (Koala) Conservation Plan 2017*, as such, will be completed slowly and sequentially and in a direction that directs any vacating fauna towards retained corridor areas.

A dedicated monitoring program will be implemented by the Proponent to enable the tracking of this performance criterion.

(iv) Risks and Contingency Measures

The requirement to prepare a construction environmental management plan incorporating koala management measures (spotter-catchers, etc.) is a condition of approval. As such, an acceptable contingency measure could be that a fauna management plan (MNES) is required as a condition of approval by the DEECCW. With appropriate monitoring of observed feed trees by the Fauna Spotter Catcher[73] no residual impacts are expected to occur.

73: Condition 40 of the EDQ Approval (**Appendix 21**) (refer **Section 6.2.1**) makes the presence of a Spotter Catcher mandatory at any time vegetation is being removed. Specific relevant conditions include *40(a) 'The applicant must engage a spotter catcher licensed by the Department of Environment and Science under the Nature Conservation Act 1992, to assesses the site, supervise any vegetation removal and ensure that any native fauna (including native bees) has been identified, relocated and discouraged from returning prior to habitat disturbance'* and 40(d) *'The applicant must submit to the MEDQ Delegate a Pre-Clearance Fauna Management Plan undertaken by the spotter catcher mentioned at Condition 40(a) above'.* This approval is further reflected by Compliance Endorsement (by ICC as Delegate to the MDEQ) 11983/2022/PDAEE, Compliance Assessment – Condition 29(a) Vegetation Retention – Riparian Corridor of 2 September 2023, which further references Spotter Catcher Requirements.

(c) Operational Aspects

(i) Electrocution on Overhead Wires

Description

Electrocution on powerlines, particularly in urban areas and as a result of increasing urbanisation is a known threat for the grey-headed flying-fox (Commonwealth of Australia 2021, p24). The Proposed Action will supply power to all households via an underground service and will not bring any new overhead cables into the locality.

Effectiveness

Although the impacts of electrocution are as of yet unquantified (Commonwealth of Australia 2021, p6), reducing electrocution on powerlines is identified as a recovery objective (Recovery Objective 9, Commonwealth of Australia 2021, p31) for the grey-headed flying-fox. Ensuring that all new power supply is provided by underground cable will ensure that the Proposed Action does not contribute to this threat. Therefore, the proposed measure will be highly effective.

Performance and Completion Criteria

The requirement to supply power via underground cables will be a condition of development consent. A measurable performance indicator will be no new overhead powerlines within the Site.

Risks and Contingency Measures

There is a low risk that the measure will not be implemented, and so no contingency measures are proposed.

(ii) Entanglement

Description

Entanglement on barbed wire and netting is a known threat for the grey-headed flying-fox (Commonwealth of Australia 2021, p24) with entanglement in fruit netting the most significant risk for bats (36.8%) resulting in admissions to wildlife care/veterinary facilities). Barbed wire is a major hazard for flying-foxes with thousands of animals each year facing death or permanent injury from entanglement on barbs, usually on the top strand (Commonwealth of Australia 2021, p22).

The Proposed Action will result in all barbed wire fencing already on-site being removed, and not replaced. Fruit trees do not form a component of planting prescriptions in landscaped areas and therefore netting will not be used.

Effectiveness

Although the impacts of entanglement are as of yet unquantified (Commonwealth of Australia 2021, p6), reducing opportunities for entanglement is identified as a recovery objective (Recovery Objective 9, Commonwealth of Australia 2021, p31) for grey-headed flying-fox. The recovery objective states that barbed wire and netting that does not comply with wildlife friendly netting guidelines should not be used. No barbed wire or netting will be used by the development. Any fencing used will be wildlife friendly (and this will benefit other species especially gliders).

Performance and Completion Criteria

The requirement for netting or barbed wire to not be used will be a condition of development consent. A measurable performance indicator will be no barbed wire or netting in public areas of the site.

Risks and Contingency Measures

There is a very low risk that the measure will not be implemented, and so no contingency measures are proposed.

(d) Disturbance to grey-headed flying-fox habitat in retained corridors during operation

(i) Description

Light and noise disturbance are identified as potential issues for grey-headed flying-fox. In response, the development layout has placed esplanade roads adjoining the Ecological Corridor and retained vegetation along and waterways to minimise edge effects. Rehabilitated batters adjoining the Ecological Corridor (waterway) is the primary means by which light spill is mitigated. The added distance between dwellings and corridor (buffered by esplanade roads and revegetation of batters) will assist with attenuation of residential noise. Directional street lighting on esplanade roads will be configured to ensure light throw will be away from the Ecological Corridor and shrouds will be used as necessary.

Esplanade roads to adjoin Ecological Corridors and retained vegetation along and waterways to minimise edge effects. The primary road network will be designed to support speed limits no greater than 50 kph.

Grey-headed flying-fox will undoubtably utilise the Ecological Corridor post development and possibly residential areas. This activity will inevitably result in negative attitudes and responses from some members of the community, largely as a result of perceptions of bats as sources of some diseases that can affect humans (Commonwealth of Australia 2021, p24) and a lack of understand of the important ecosystem services provided by flying foxes. Lifestyle guidelines and awareness signage with the purpose of instilling awareness of the issues and stewardship amongst residents encouraging them to actively protect native wildlife, including grey-headed flying-fox.

(ii) Effectiveness

The development, once in operation, has the potential, (although minimal compared to construction) to cause disturbance. Adopting fauna sensitive urban design principles, including esplanade roads to mitigate edge effects, will result in minimised light and noise disturbance from the proposed development relative to allotments being adjacent. Revegetation of batters formed within the Ecological Corridor will focus on restoring native species appropriate to pre-disturbance REs/post development ecological conditions.

Installing ecological stewardship are effective management measures to see long term protection of native fauna and biodiversity and such measures are consistent with Recovery Objectives 4 and 5 of the grey-headed flying-fox Recovery Plan (Commonwealth of Australia 2021).

(iii) Performance and Completion Criteria

The requirement for the Ecological Corridor and development layout will be a condition of development consent.

Ecological restoration within the Ecological Corridor will be a requirement of the Concept RMP a condition of the development consent.

Directional lighting and awareness signage will be a requirement of the Landscape Design.

Lifestyle Guidelines will be developed for distribution to potential purchasers by the time allotments come to market for sale.

(iv) Risks and Contingency Measures

There is a very low risk that the measure will not be implemented, on account of the vegetation management controls which have been put into effect by Development Approvals and reflected in Compliance Plans (Vegetation Management Plan)[74].

The Vegetation Management Plan mandates the installation of temporary arboriculture exclusion fencing around areas of retention, demarcating these areas as 'tree protection – no go' areas and the subsequent timely monitoring of exclusion areas by the Project Arborist during vegetation clearing and construction.

Any breaches would be the subject of stop-work orders and investigation of the reasons behind and implementation of corrective actions; further and better controls, tool-box talks, further training of work-force. Breaches of the VMP resulting in clearing (of retained grey-headed flying-fox habitat) are subjected to mandatory reporting to ICC and this will also apply to reporting of non-conformance with EPBC Approvals to DCCEEW.

(e) Risk of injury of death from vehicle strike

(i) Description

Vehicle strike is a risk for grey-headed flying-fox during operation. Although the risk to vehicle strike is low, a number of measures will be imposed to avoid and mitigate the risk of grey-headed flying-fox being struck by vehicles.

Grey-headed Flying-fox food trees will not form part of the primary landscaping of the development footprint so that grey-headed flying-fox are not enticed to enter residential areas. Imposition of low vehicle speeds to reduce the risk of collisions. Vehicle speed limits are restricted to 50km/h on built up residential roads.

(ii) Effectiveness

The purpose of these measures is to enable the objective of no injury or death to grey-headed flying-fox as result of vehicle strike. Overall, these tools are considered to be effective measures to reduce the risk of injury or death.

(iii) Performance and Completion Criteria

The purpose of these avoidance and mitigation measures is to minimise the risk of injury or death to grey-headed flying-fox from vehicle strike. To achieve this the incentive, for grey-headed flying-fox to enter residential areas will be achieved by restricting the availability of habitat in these areas.

As such, street scaping will not be planted with suitable grey-headed flying-fox habitat, which will in turn encourage grey-headed flying-fox to stay away from the development area. Importantly, low vehicle speeds will be imposed along residential roads, minimising the risk of high-speed vehicle strikes which were identified in the literature review as accounting for a large proportion of vehicle related deaths.

(iv) Risks and Contingency Measures

Risks include vehicle speeding and forage trees included in primary landscaping. With low imposed vehicle speeds will be signed and enforced as for public roads and residential development landscape plans

74: Specifically Compliance Endorsement (by ICC as Delegate to the MDEQ) 11983/2022/PDAEE, Compliance Assessment – Condition 29(a) Vegetation Retention – Riparian Corridor of 2 September 2023.

ensuring tall statured prolifically blossoming species or fruit trees are not used, it is considered that there is no residual risk. No contingency measures are proposed.

6.2.4 Mitigation Measures - Swift parrot

As described in **Section 4.4**, the Proposed Action will have no direct or indirect impacts on this species. The retention, and restoration of important habitat supporting mature intact winter-flowering species in the Linear Park, can be reasonably identified as a measure that will ultimately improve the Site's provision of habitat for the swift parrot.

6.2.5 Mitigation Measures – Greater Glider

(a) Protecting and Enhancing Retained Habitat

(i) Description

The Proposed Action will result in the clearing of 47.47 ha of greater glider habitat associated with the Proposed Action (including 0.61 ha affected by works already undertaken by Urban Utilities for trunk sewer upgrades unrelated to the project). The 9.69 ha of open forest will be retained (avoided) and restored and drainage reserve and which will be rehabilitated, is considered compromised (edge affected) habitat with respect to the conservation advice for greater glider.

The principal objectives of the ecological restoration is to establish and maintain high quality open forest habitat affording ecological functionality affording uninterrupted habitat and movement opportunities for greater glider.

Methods of ecological restoration are in accordance with the Concept RMP (**Appendix 7**), which has been prepared to be generally in accordance with South East Queensland Ecological Restoration Framework (SEQRF) and guideline. The Conceptual Rehabilitation Management Plan provides detail regarding the proposed ecological restoration of the Site. This represents the Proposed Action's primary mitigation measure to improve and expand upon habitat connectivity and achieve a suitable ecological outcome on the Site.

The primary goals and performance criteria for ecological restoration of the Linear Parkland are:

- retention and protection of all native trees
- retention and enhancement of existing native fauna habitat
- removal of extensive weed infestations and review regenerating species with a view to promoting native regeneration and removal of exotic regrowth
- plant-out within areas which do not support native regeneration with native endemic tube stock to increase the extent of native vegetation cover both initially and over time
- expansion of the existing mature habitat and remnant vegetation to increase density within the restored / rehabilitated Linear Parkland and Drainage Reserve
- improvement in ecological connectivity within and beyond the site (along the riparian corridor of the unnamed tributary
- ensure that Weeds of National Significance (**WoNS**), weed species listed under the *Biodiversity Act 2014* and environmental weeds are not present within Linear Parkland or Drainage Reserve
- observe evidence of significant reductions in the presence of other exotic species
- Undertake weed treatment in a manner that does not promote erosion
- Routinely monitor Management Units to identify and rectify the following impacts:
  - litter and/or rubbish dumping

- plant theft
- fauna impacts
- soil compaction
- erosion.
- overgrowth.

(ii) Effectiveness

Where areas within the Linear Park are currently disturbed and devoid of any of the vegetation stratum that characterise the pre-clear RE, tubestock planting densities in the initial establishment phase of the RMP phase will allow for the achievement of natural and woodland to open forest communities at maturity. Maintenance will be provided throughout the life of the Proposed Action and will continue until the targets under the Concept RMP (**Appendix 7**) have been achieved. Once the ecological restoration works reaches off-maintenance status, this land will be transferred to the custodian through statutory environmental covenant or similar and the custodian will be responsible for ensuring the provisions of the Queensland *Biosecurity Act 2014* are upheld through regular weed inspections (and removal if necessary).

Both the national Conservation Advice for *Petauroides volans* (DCCEEW 2022) identifies habitat clearing and fragmentation as a primary threat to greater glider. Logically, a mitigation measure that retains, consolidates and links greater glider habitat is an effective means of reducing such a threat.

(iii) Performance and Completion Criteria

If the Proposed Action is approved under the EPBC Act, approval conditions reflective of performance and completion criteria established by this PD (**Table 21** for Construction and Operation Avoidance and Mitigation Measures, and the Conceptual Rehabilitation Management Plan (**Appendix 7**)) and the Compliance Endorsement which formalise performance and completion criteria.

The Concept Rehabilitation Management Plan is the master document informing the Compliance Plans approved by ICC (as Delegate to the Minister for EDQ) for works within drainage reserves (stormwater detention basins and bio-basins *Condition 39* of the approval (see **Section 6.2.1**)) under a Landscape Compliance Endorsement [75] and the rehabilitation of terrestrial vegetation under a Rehabilitation Compliance Endorsement[76] (Condition 28 of the approval (see **Section 6.2.1**)). The approval conditions mandate that the plans identify the mandatory removal and management of declared weeds, environmental weeds, exotic pests and rubbish which must be removed from the site and measurable targets and milestones and how they will be monitored and delivered in conjunction with project staging. These are detailed in the plans and bind the proponent.

(iv) Risks and Contingency Measures

Monitoring and adaptive maintenance of the Linear Park and rehabilitated components of the Drainage Reserve during the initial establishment phase will ensure that there is sufficiently robust plant health and a trajectory towards the target plant community at the end of the maintenance period. There is a very low risk that the restoration works will not be provided, but as a contingency LCC retains development bonds to remedy non-compliant works.

The restored habitat in the Linear Park and Drainage Reserve are proposed to be transferred to ICC, the crown or another appropriate entity to be held for environmental conservation purposes in perpetuity. This

75: Pending assessment by ICC as Delgate
76: Pending assessment by ICC as Delgate

would allow, for example, ICC to then undertake a statutory amendment process change the present zoning of that land from its current zoning to Environmental Protection zone.

Once the zone has been changed, the applicable provisions of the Planning Scheme would apply. Any future development of that land would require either an amendment to development scheme, following the statutory process, or an approval of an impact assessable development application for a variation request under the *Planning Act 2016* to seek to vary the effect of development scheme with respect to the zoning of that land. This mechanism is sufficient to ensure appropriate conservation of the land into the future; therefore, no contingency measures are proposed.

(b) Entanglement

(i) Description

Entanglement on barbed wire is a known threat for the greater glider (DCCEEW, 2022; van der Ree 1999), albeit recognised as a low risk.

The Proposed Action will result in all barbed wire fencing already on-Site being removed, and not replaced.

(ii) Effectiveness

The effectiveness of replacing/avoiding use of barbed wire as a conservation measure for greater glider has not been studied. Regardless, the conservation and management priorities for the species includes that the use of barbed wire should be avoided, and replaced the top strands of existing barbed wire with single-strand wire in habitat known to be occupied by greater gliders. No barbed wire will be used by the development. Any fencing used will be wildlife friendly (and this will benefit other species).

(iii) Performance and Completion Criteria

The requirement for netting to not be used will be a condition of development consent. A measurable performance indicator will be no barbed wire on the Site.

(iv) Risks and Contingency Measures

There is a very low risk that the measure will not be implemented, and so no contingency measures are proposed.

(c) Clearing and Construction

(i) Description

The EDQ approval (**Appendix 21**) requires the submission of a Vegetation Clearing and Fauna Management Plan prior to commencement of construction works. The fauna management plans that will subsequently be prepared as part of works will identify measures that reduce the risk of death or injury during the clearing and construction works to establish the Proposed Action (e.g. pre-clearance surveys; use of spotter-catchers; identification of relocation habitat; and stop-work procedures).

(ii) Effectiveness

The development of fauna management plans aligns with the State's requirements under the *Nature Conservation Act 1992*. Such measures are considered effective in minimising the risk of death or injury resulting from construction activity (primarily removal of habitat).

Fauna management plans (including plans to deal with potential impacts on specific listed species) prepared for various controlled actions in South East Queensland have proven to be effective at managing impacts during construction. It is expected that a fauna management plan will be similarly effective for the Proposed Action. Key features of the plan will be:

- Clearing procedures that avoid the fragmentation of vegetation will be adopted within the Action Management Plans (AMPs) and informed by the Fauna Spotter Catcher.
- Clearing will be undertaken in a way that flushes fauna into connected areas of habitat and will avoid flushing fauna into fragmented or hostile areas. Specifically:
    - fauna are not required to cross roads or move through developed or disturbed areas, such as areas that require movement over cleared ground to reach suitable habitat;
    - Fauna are not left occupying an 'island' of habitat between hostile environments, such as road and cleared areas;
    - Fauna can safely leave the Site of clearing and relocate to adjacent habitat;
    - Demarcation fencing will be fauna friendly to ensure fauna are not trapped within the proposed cleared extent; and
    - Cleared vegetation is to be stockpiled as to not impede fauna movement.

Additionally, proposed construction roads will be subject to design treatments to ensure safe fauna crossing opportunities are maintained to vegetated areas and impose low vehicle speeds within construction areas.

(iii) Performance and Completion Criteria

A fauna management plan will be prepared as part of the operational works phase of the Proposed Action. Requirements for the plan's implementation is required as a condition of EDQ approval (**Appendix 21**).

The performance criterion related to this mitigation measure is no greater glider mortality attributable to the construction of the Proposed Action.

A dedicated monitoring program will be implemented by the Proponent to enable the tracking of this performance criterion.

(iv) Risks and Contingency Measures

The requirement to prepare a construction environmental management plan and fauna management plan has already been conditioned on the Proposed Action (refer approval conditions package – **Appendix 23**). As such, an acceptable contingency measure could be that a fauna management plan (MNES) is required as a condition of approval by the DCCEEW.

(d) Operational Lighting

(i) Description

Excessive light throw and dislocation of habitat is a known secondary threat for the greater glider (DCCEEW, 2022).

The Proposed Action will result in an increase in lighting associated with residential developments. Lighting will be installed along cycleways/pathways adjoining Linear Park/Waterway Corridor and esplanade roads. Lighting will be deigned to ensure there is limited light throw into bushland area. This can be achieved through a combination of installing lighting along the outside edge of the Linear Park and directing light through away from habitat using innovative LED lighting, focused beams and shrouds. It is a requirement

of the MEDQ Approval (condition 18a) that lighting of public spaces must cause no adverse impacts on local fauna. This measure is equally applicable to koala[77] and grey-headed flying-fox.

(ii) Effectiveness

The effectiveness of directional lighting, lower lux lighting, shrouding and zonal lighting have all proven effective in reducing light pollution and are well known / understood, by designers, contractors and regulators. The ecological restoration of waterway batters will form an interface between residential areas and better quality retained habitat within the Linear Park an also provide additional light screening function.

(iii) Performance and Completion Criteria

A measurable performance indicator will be no light throw into or glow from lighting in public spaces affecting retained habitat.

(iv) Risks and Contingency Measures

There is a very low risk that the measure will not be implemented (it is a condition of approval, and so no contingency measures are proposed.

6.3 Action Management Plan

In addition to mitigation outcomes incorporated in the design process, a number of management measures are proposed to ensure impacts are avoided and or minimised through the construction and operational phases.

To avoid and mitigate the direct and indirect impact from the proposed action on the koala, grey-headed flying-fox and greater glider, an **AMP** will be prepared. The AMP will act as the master Environmental Management Plan (**EMP**) for the project (with respect to MNES) and will inform the Contractor's Construction Environmental Management Plan. In relation to MNES, key outcomes within the Project Specific Environmental Management Plan include:

- Koala, grey-headed flying-fox and greater glider are protected on Site.
- The abilities for koalas, grey-headed flying-fox and greater glider to move into, within and out of the Environmental Protection Zone is maintained.
- Potential risks to koala, grey-headed flying-fox and greater glider (e.g. vehicle strike, entanglement, fragmentation of habitat / becoming stranded, noise/light pollution etc.) are identified and appropriately managed.
- All persons involved in construction and operation of the development are aware of the Site's values, their potential to impact on koala, grey-headed flying-fox and greater glider and their habitats, and their responsibilities in regard to procedures and strategies with the contractors Construction Environmental Management Plan / Project Management Plan.
- The AMP will outline construction measures to manage and mitigate impacts on native flora, and fauna, specifically the koala, grey-headed flying-fox and greater glider and will include details on:
- Project Description, Site design and identification of conservation areas.
- Ecological Values of the Site, including:
    - Existing flora and fauna values on the subject Site and in surrounding areas

77: Queensland Government (2002). *Koala-Sensitive Design Guideline A Guide to Koala-Sensitive Design Measures For Planning And Development Activities.* Department of Environment and Science. https://environment.des.qld.gov.au/__data/assets/pdf_file/0025/102859/koala-sensitive-design-guideline.pdf

    - Key results from survey data, including koala and Grey-headed flying fox occurrence and the availability and quality of habitat.
- Environmental Objectives
    - Quantification of objectives
    - Identification of key environmental strategies
- Assessment of Risks
    - Risks to achieving objectives
    - Risk management
- Environmental Management, including:
    - Identification of key personnel
    - Roles and Responsibilities
    - Environmental awareness and compliance training for all contractors and sub-contractors
    - Adaptive management
    - Statutory requirements.
- Pre-Clearance Requirements – Fauna Management, including:
    - Pegging of approved clearing areas
    - Vegetation management (clearing and protection),
    - Protection of MNES Fauna (koala, grey-headed flying-fox and greater glider) and Native Wildlife, including:
        - Specifications for and Installation of Temporary Fauna Exclusion Fencing
        - Installation of no-go signage
        - Engagement of a suitably qualified, experienced and permitted DES approved Fauna Spotter/Catcher
        - Impacts in pre-clearance surveys, reporting and monitoring
        - Staged sequential clearing plan and clearing restrictions
- Maintenance of Safe Wildlife Movement Opportunities (during Construction) including:
    - Objectives
    - Management Strategy:
        - Loss of habitat and its avoidance
        - Mortality due to Clearing by Machinery or Tree Felling and its Avoidance
        - Increased vehicle strike during clearing and construction
        - Risk of entanglement
        - Dog Management
        - Temporary fencing
        - Hours of operation
        - Fauna awareness signage
        - Vehicle movement controls.
    - Performance Indicators and Environmental Outcomes
- Riparian Reserve Rehabilitation, including:
    - Planting and rehabilitation
    - Reporting and Monitoring
- Education and Awareness, including distribution of Lifestyle Guidelines
- Monitoring and Adaptive Management.

6.3.1 Pre-clearance Actions

Each clearing phase will be subject to issue of an Environmental Pre-Clearance Checklist and Environmental Pre-Clearance Package to ensure all approval requirements are met prior to vegetation clearing.

Environmental Pre-Clearance Checklists are designed to easily show compliance for approval requirements, including EPBC approval requirements, in a format where they can be 'ticked off' prior to vegetation clearing.

All relevant parties (e.g. civil contractor, clearing contractor, Fauna Spotter Catcher, environmental coordinator, superintendent and client) must sign the checklist prior to clearing, acknowledging that they have reviewed all, and will undertake the works in accordance with, approved procedures and reporting.

As way of acknowledgement, the Environmental Pre-Clearance Checklist will be run through at a project pre-start meeting with all personnel and relevant parties required to sign the checklist. No clearing can commence for a specific phase of works until the checklist has been completed and signed off by the Environmental Coordinator.

6.3.2 Pre-construction Actions

The Proponent / Proponents Representative must ensure adequate mitigation measures are put in place during the clearing and construction phases of the Project to avoid the loss of Koala Habitat beyond that which is approved under the PVRM EPBC approval.

The key risk management measures and strategies to avoid the risk of death or injury to koala due to loss of Koala Habitat include:

a. pegging out of the approved clearing areas by a registered surveyor to accurately demarcate the approval footprint
b. installation of highly visible fencing and no-go signage along the demarcated boundary to the approved clearing and construction areas
c. implementation of the slow, sequential clearing methods
d. implementation of Clearing and Construction Environmental Management Plans to deal with secondary impacts to Koala Habitat (e.g. dust, hydrology, bushfire).

Land management activities will be undertaken in a gradual and sequential manner and are underpinned by:

a. slow, incremental reduction of koala foraging resources from the peripheries of the development footprint in a staged manner reflective of the staged development sequencing
b. fencing lands off once the staged augmentation and removal of habitat amenity has been completed to minimise the opportunity for koala to move through cleared land prior to, and during civil activities
staged development.

Work to remove vegetation will be undertaken slowly, and prior to commencement of clearing. The initial works will be undertaken by a small team of tree loppers and DES Permitted Spotter Catchers. Tree removal will occur sequentially in discrete areas and will be confined to the initial stages of the development.

Temporary koala exclusion fencing (e.g. construction exclusion fencing with hoarding – refer **Plate 8**) will be formed around any area of construction works. Temporary koala exclusion fencing must be installed immediately after completion of habitat augmentation and prior to the commencement of construction, so

as to prevent koalas entering any construction areas. Temporary koala exclusion fencing must remain in place around any construction area until all construction activities within that fenced area are completed.

Plate 8: Temporary fauna exclusion fencing installed on an active construction Site

6.3.3 Fauna Management Roles and Responsibilities

As will be required by the Project Specific Environmental Management Plan, a DES registered Fauna Spotter Catcher must be appointed to ensure fauna management, specifically koala, Grey-headed flying fox and greater glider management, prior to, during and post clearing (this is also a condition of the MEDQ Approval – condition 40). This role is mandated for any clearing of native vegetation in Queensland. The role of the Fauna Spotter Catcher is to complete an assessment of the works area no more than 2 weeks prior to clearing and present a short report to the proponent on the findings and how the proposed clearing is to be managed.

The spotter catcher will undertake pre-clearing inspections and supervise all vegetation clearing works in line with the following:

a. No vegetation clearing is to commence or continue without the presence of a person licenced under the Queensland *Nature Conservation Act 1992* (Qld) to detect, capture, care for, assess, and release wildlife disturbed by vegetation clearance activities who has at least three years' experience undertaking this work with Koalas (Fauna Spotter Catcher).

b. Undertaking wildlife load reduction measures through the pre-clearing trapping and relocation of wildlife within 1-2 weeks prior to the approved clearing being conducted. Sequential clearing cannot be used as a primary fauna management measure.

c. All trees scheduled for removal will be checked on the day of their removal (prior to the start of operations) for the presence of Koalas by the appointed Fauna Spotter Catcher.

d. Clearly marking (flag) vegetation found to contain fauna or fauna habitat (such as tree hollows, arboreal termite mounds, stick nests or possum drays with flagging tape) and visually and verbally communicate this information to the tree feller to ensure flagged trees are not felled until authorised by the fauna manager.

e. Manage any Koalas identified on Site in accordance with the *Nature Conservation (Koala) Conservation Plan 2017* and manage any Grey-headed flying fox and greater glider identified on Site in accordance with the protocols discussed in **Table 21**.

f. The appointed Spotter Catcher is responsible for ensuring, throughout the duration of the clearing operations, that no tree in which a koala is present, or a tree with a crown overlapping a tree in which a koala is present, or a tree identified as being a risk to Koalas, should not be felled, damaged or interfered with until the koala has moved from the clearing zone or its own volition.

g. Where a koala is present within a clearing zone, the tree will be marked with distinctive flagging (and other advisory means as required) and chainsaw or machinery operators will be briefed on the location of the area. No clearing works can occur within 20 m of the tree retaining a koala until the animal has moved on of its own volition (where the strategy is to allow the koala to move of its own accord, overnight). On the following day, the tree and retained area, are to be checked again prior to their removal. If necessary, the procedure is repeated until the koala has moved.

h. In the event that a koala or other fauna is sick or injured and needs medical attention, DES will be contacted and trapping by the koala Spotter Catcher may be required to allow the koala to receive medical attention.

i. Ensuring vegetation and rubbish piles are not left to serve as refuge for displaced or roaming wildlife through the implementation of the following measures:

    i. immediately (within 12 hours) remove or destroy such material
    ii. erect wildlife proof barriers. Fencing surrounding stockpiles to prevent wildlife use
    iii. ensure old (>12 hours) piles of felled vegetation are treated as potential wildlife habitat and inspected by a wildlife spotter/catcher prior to removal or destruction.

j. Limiting the felling of habitat and hollow bearing trees to the following methods:

    i. Segmental removal of tree, with hollow bearing limbs being checked by the Fauna Spotter Catcher and cleared of fauna using a cherry picker or suitable means determined by the Fauna Spotter Catcher.
    ii. Segmental removal of the tree, with hollow bearing limbs plugged and lowered to the ground for inspection by wildlife spotter.
    iii. Use of an excavator with vertical grab to lower the main trunk (only after the removal of lateral limbs).
    iv. A combination of the above methods.

6.3.4 Proposed Koala Exclusion Fencing - Operation

The proponent proposes to retain koala and potential grey-headed flying fox and greater glider habitat along Linear Corridor and restore / rehabilitate impacted parts Linear Reserve (batters) and Drainage Reserve infrastructure with species appropriate to the site context, and canopy species suitable as forage habitat for all species. With time as this vegetation matures int will become increasingly useful as habitat. Koala exclusion fencing will be installed around the perimeter of the Linear Corridor.

The purpose of the fencing is to compliment Linear Park, and to ensure a consistent conservation outcome at a landscape scale through risk reduction; fencing will ensure koala do not enter areas where they would be prone to vehicle strike or attack by dogs. Similarly, fencing is to keep domestic and wild dogs straying into the Linear Park. This is further discussed above.

Fencing is to span the perimeter of the Linear Park within the Site[78] with 1.8 m high aluminium perimeter / pool fencing with no gaps at the base useful for this purpose. Timber posts are used to allow animals to climb the posts and escape back into the Linear Park in the unlikely instance they enter the residential area, and aluminium sleaves on the Linear Park side of the fence prevent animals moving out of the Linear Park. An example of the typical conservation area fencing which is both effective and aesthetically pleasing, and therefore useful in urban setting is shown in **Plate 7**.

6.3.5 Weed Management in the Environmental Protection Zone

Within the Environmental protection Zone, WoNS and other environmental weeds will be treated in accordance with the control methods provided in *South East Queensland Restoration Framework (2012) – Manual – Appendix C* unless it can be demonstrated that there is an overriding need to utilise another method which deviates from the recommended methods (e.g. if a woody weed is specifically left in-situ but killed and planted into with native figs for soil retention and visual amenity). The Offset Provider will undertake detailed site inspections prior to works commencing to identify target weed species, their location and extent for treatment.

Herbicides must be applied by appropriately qualified/supervised persons in accordance with the *Agricultural Chemicals and Distribution Control Act 1966* at rates identified on registered product labels, or on an Australian Pesticides and Veterinary Medicines Authority (APVMA) issued off-label permit where applicable. Refer to South East Queensland Ecological Restoration Framework for additional guidance.

The Offset Provider is to ensure herbicides are applied under appropriate environmental conditions to minimise the likelihood of spray drift and damage to native vegetation outside of the treatment area.

6.3.6 Rehabilitation Measures

Ecological restoration of the Linear Park and Drainage Reserve will be carried out with the aim of improving habitat and ecological values were all native fauna and flora within this area, with a particular focus on improving habitat values for the koala and grey-headed flying-fox and greater glider. These efforts will focus on the removal of introduced flora and fauna species from the retained conservation area and infill planting of bare and denuded areas to ensure the conservation area meets the pre-clear regional ecosystem mosaic vegetation community structure. A Rehabilitation Management Plan will form part of the broader management document submitted as part of supporting documentation for the Compliance Reporting will be broadly in accord with the Concept RMP contained within **Appendix 7**. The final document submitted to Council reflective of specific Compliance Reporting requirements with respect to Ecological restoration areas within the Linear Parkland and the specific requirements for the Drainage Reserve[79].

6.3.7 Effectiveness of Measures to be Implemented

21 details the avoidance and mitigation measures and their effectiveness that will be documented by the AMP, and which will be implemented by the Proposed Action through the Civil Contractors Construction Environmental Management Plan (or equivalent).

78: The external property boundary where it crosses the Linear Park (i.e. the northern and southern boundaries will not be fenced.
79: Compliance Plans responding to Condition 28 of the MEDQ Approval; Rehabilitation, relate to restored and rehabilitated components of the Linear Park (retained areas and waterway batters). The condition does not include stormwater quantity and bioretention pods and other infrastructure associated within the Drainage Reserve, as these works must be documented by Landscape Plans. However, to ensure those plans by others are consistent with the objectives of the rehabilitation to provide interface zones and mitigate some of the projects secondary impacts, and provide useful habitat in the middle – long term, landscape plans will be developed with reliance on the planting palettes identified within the Concept RMP.

Table 21: Construction and Operation Avoidance and Mitigation Measures for Koala, Grey-headed Flying fox and Greater Glider

Avoidance and Mitigation Measures	Impact	Evaluation of the Effectiveness of Measures	Mitigation	Timeline	Risk Assessment	Milestone	Residual Impact
Habitat to be cleared on Site is largely non-remnant and regrowth vegetation, disturbed and degraded through historical land uses. The residual of the Site along the unnamed tributary of Bundamba Creek will be retained and rehabilitated within the Linear Park which upon plan sealing, will be dedicated to LCC and held in Public Ownership. No more than 38.4 ha of vegetation identified as habitat critical to the survival of the koala, 37.92 ha of vegetation identified as habitat critical to the survival of the grey-headed flying-fox and 47.47 ha of vegetation identified as habitat critical to the survival of the greater glider will be removed to facilitate the development and removal is considered unavoidable. This includes 0.61 ha of open forest habitat has been affected by works undertaken by Urban Utilities for trunk sewer upgrade (unrelated to this proposed action). Clearance limits will be demarcated prior to the commencement of works to ensure "No Go" areas are recognised and protected.	Pre-construction and Construction Impacts	Ecological surveys and habitat assessment conducted across the Site led to the precise spatial analysis of vegetation and habitat qualities. The Proposed Action will result in the unavoidable loss of 37.31 ha ha of critical habitat for the Koala, Grey-headed flying fox and Greater glider.	Avoiding high value areas at development.	Works complete.	The field survey applied has accurately mapped the features that are to be avoided and retained within the Environmental Protection Zone. The development area is largely contained within non-remnant vegetation.	The Linear Parkis intact at the completion of work, with restoration work complete with mitigating factors outlined below effectively applied. At plan sealing it will be dedicated as Environmental Management and Conservation Zone, and transferred to public ownership. The development area is cleared and developed.	Loss of 37.31 ha of critical habitat for the koala, grey-headed flying fox and greater glider. Urban Utilities Actions have resulted in the additional residual impact to 0.61 ha of grey-headed flying fox and greater glider habitat.
All clearing will be undertaken in accordance with a stage specific Construction Environmental Management Plan. This will include: • Provisions for the proponent to engage a qualified Fauna Spotter Catcher to participate in all stages of vegetation clearing. The role of the Fauna Spotter Catcher is to ensure that no injury or deaths occur to Koalas or other fauna species. • Vegetation will be cleared sequentially in accordance with the *Nature Conservation (Koala) Conservation Plan 2017* requirements. Clearing will be conducted so that fauna are flushed into safe, vegetated areas and will avoid pushing fauna into fragmented areas. • Temporary fauna friendly fencing will allow fauna to safely disperse	Loss of approximately 37.31 ha of habitat for the koala, the grey-headed flying-fox and greater glider Risk of injury or mortality to Koala, Grey-headed flying fox and Greater glider from vegetation clearing and construction	The use of a Fauna Spotter Catcher throughout clearing is an effective tool to: i. Identify they types of species on Site prior to clearing; and ii. Identify and flag habitat features that require thorough examination before clearing. Fauna Spotter Catchers have a primary role to ensure no fauna are in vegetation before it is cleared. Given the size of Koalas and their utilisation of tree branches, they can quite easily be observed from the ground. As such, it is extremely unlikely that a koala will be killed or injured during vegetation clearing, particularly given the onerous and thorough procedures set out The Draft Code. Given grey-headed flying-fox and greater glider are nocturnal, there is minimal risk of mortality from vehicle	Fauna Spotter	Present at all times during clearing works	Fauna Spotter not present and koala injured or killed.	No injury or death to Koalas during clearing.	The use of a Fauna Spotter is mandated; **No residual impact**
			Sequential clearing	At all times during construction.	Sequential clearing not undertaken, and fragmentation induced.	Clearing completed as per sequential clearing	Sequential clearing is mandated and guided by Construction Environmental Management Plans (**CEMP**)s and pre-clearance checklists and pre-starts **No residual Impact**
			Temporary fauna fencing	At all times during construction.	Temporary fencing not applied, and koala are injured or killed.	Temporary fencing utilised at all times during the clearing process	Temporary Fencing is mandated, installed and guided by the CEMP **No residual impact**
			Restricted construction hours	At all times during construction.	Works outside of hours.	Works area completed within mandated hours	Speed limits are mandated and guided by the CEMP **No residual impact**

Avoidance and Mitigation Measures	Impact	Evaluation of the Effectiveness of Measures	Mitigation	Timeline	Risk Assessment	Milestone	Residual Impact
into vegetated areas away from construction, • Temporary fauna exclusion fencing will then be erected to prevent fauna dispersing into construction areas. • Restricted construction hours (i.e. daylight 6am -6pm) • Prohibition of companion/security animals (e.g. dogs). • Restricted vehicle speeds (e.g. max 40km) within construction areas. In addition to this, all construction personnel shall attend environmental training as part of the Site induction process prior to entering the work Site. As part of this training all personnel will be instructed on their obligations in regard to vehicle movement and construction speed limits.		collision. Restricted operation hours (i.e. daylight hours) is considered an effective mitigation measure to minimise this risk. The sequential clearing of vegetation will allow for the gradual loss of vegetation, giving fauna time to naturally disperse away from the disturbance. The use of fauna exclusion fencing around construction areas will ensure fauna do not disperse into unsafe, hostile areas, again minimising the risk of injury of death. Each of these measures will ensure that the risk of injury or death to Koalas or Grey-headed flying fox as a result of construction are avoided and mitigated. The aim of these procedures is to support zero injuries or death to Koalas or grey- headed Flying-foxes as a result of construction.	Dog prohibitions	At all times during construction.	No companion and security dogs on-Site	Construction completed without dogs on-Site	Dog controls are mandated and guided by the CEMP **No residual impact**
			Low vehicle speeds	At all times during construction	Speeds are exceeded resulting in fauna strike.	Construction completed without vehicle strike	Speed limits are mandated and guided by the CEMP **No residual impact**
			Site inductions	At all times during construction	Inductions avoided	Construction completed without inductions being breached	Inductions are mandated and guided by the CEMP **No residual impact**
The CEMP will include controls to avoid, minimise and mitigate risk of disturbance to Grey-headed flying fox when foraging in habitat during construction, specifically: • Avoiding clearing between 6am-6pm • Monitoring of foraging trees by the fauna Spotter Catcher and including appropriate clearing controls/management where required to minimise disturbance. • Staged clearing of vegetation will allow for the gradual loss of vegetation, giving fauna time to naturally disperse away from the disturbance.		Construction management and clearing controls implemented through the contractor CEMP are considered to be able to effectively avoid, minimise and mitigate risk of disturbance to grey-headed flying-fox and greater glider foraging regimes during construction, and allow for adaptive management where required. Limiting hours of construction and clearing to daylight hours only (e.g. 6am-6pm), allows a 12-hour period for safe dispersal and foraging to occur. With appropriate monitoring of observed feed trees by the Fauna Spotter Catcher, no residual impact is expected to occur.					No residual impact
Vegetation clearing has the risk of fragmenting habitat areas during the construction phase. To avoid this impact, vegetation will be undertaken sequentially to allow fauna to disperse from construction areas.	Risk of injury or mortality to koalas, grey-headed flying-fox and greater glider from vegetation clearing and construction	Habitat isolation and fragmentation is a primary concern due to its impacts on fauna. Koalas, grey-headed flying-fox and greater glider are able to disperse through a variety of environs,	Fauna not fragmented from adjoining habitat during clearing	Fauna are not fragmented from habitat during clearing with sequential clearing undertaken at all	Fauna are fragmented by clearing activities	Clearing completed without fauna being fragmented.	Sequential clearing is mandated and guided by CEMP and pre-clearance checklists and pre-starts No residual impact

Avoidance and Mitigation Measures	Impact	Evaluation of the Effectiveness of Measures	Mitigation	Timeline	Risk Assessment	Milestone	Residual Impact
Clearing procedures that avoid the fragmentation of vegetation will be adopted within the Site Based Management Plans and informed by the Fauna Spotter Cather. Clearing will be undertaken in a way that flushes fauna into connected areas of habitat and will avoid flushing fauna into fragmented or hostile areas. Specifically: • Fauna are not required to cross roads or move through developed or disturbed areas, such as areas that require movement greater than 100 metres over cleared ground to reach suitable habitat • Fauna are not left occupying an 'island' of habitat between hostile environments, such as road and cleared areas; • Fauna can safely leave the Site of clearing and relocate to adjacent habitat; • Demarcation fencing will be fauna friendly to ensure fauna are not trapped within the proposed cleared extent; and • Cleared vegetation is to be stockpiled as to not impede fauna movement. Additionally, proposed construction roads will be subject to design treatments to ensure safe fauna crossing opportunities are maintained to vegetated areas and impose low vehicle speeds within construction areas.		including bushland and cleared areas. The direction of clearing of vegetation in accordance with the contractors CEMP (informed by the Action Management Plan) will ensure that clearing does not create fragmented habitat islands that could trap fauna. Procedures will be in place to ensure clearing flushes fauna away from construction areas into the Riparian Reserve that is connected to the wider landscape. The designated Linear Park will accommodate fauna habitat into the future, and thus will not be subject to fragmentation in the future. As such. No residual impacts are anticipated.		times during clearing			
	Fragmentation of habitat for koala and Grey-headed flying fox during construction		Temporary fauna fencing	At all times during construction	Temporary fences are not applied.	Temporary fencing utilised at all times during construction	Temporary fauna fencing is mandated and guided by CEMP and pre-clearance checklists and pre-starts No residual impact
			Stockpiling of cleared vegetation ensures safe fauna movement	At all times during construction	Stockpiling creates a barrier to fauna	Stockpiling is undertaken as guided by civil contractors CEMP	Safe stockpiling is mandated and guided by CEMP and pre-clearance checklists and pre-starts No residual impact
			Safe fauna crossings during construction	At all times during construction	Fauna strike occurs at crossing location	No fauna strikes during construction.	Fauna go slow andfencing measures are applied at corridor crossings as per the CEMP and pre-clearance checklists and pre-starts. No residual impact
			Low vehicle speeds	At all times during construction	Speed limits are breached resulting in fauna strike	No speed limit breaches during construction	Speed limits are mandated and guided by the CEMP. No residual impact.
The CEMP will include controls to avoid, minimise and mitigate risk of disturbance to koala and Grey-headed flying fox habitat during construction, specifically light and noise disturbance. Construction of the project will result in increased noise and light disturbance. These impacts may disturb fauna and disrupt foraging, reproduction or movement behaviours. Restricted construction hours (e.g. 6am-6pm) will limit disruption from light and	Disturbance to koala and grey-headed flying-fox and greater glider during construction	Construction management and clearing controls implemented by the CEMP are considered to be able to effectively avoid, minimise and mitigate risk of disturbance to koala activities during construction, and allow for adaptive management where required. Limiting hours of construction and clearing to daylight hours, allows a 12-hour period for safe dispersal. With appropriate monitoring, pre, during and post construction by the	Minimising light and noise disturbance.	At all times during construction	Light and noise impacts on fauna	Light and noise disturbance is limited to daylight hours	Light and noise restrictions mandate works between 7am and 6pm Monday to Saturday in the CEMP. No residual impact
			The risk of contamination and exacerbating weeds and pathogens is minimised.	At all times during construction	Contamination, weed and pathogen incursion	Contamination, weed and pathogen incursions do not occur.	The CEMP will mitigate the risk of contamination and weed, pathogen incursion. No residual impact

Avoidance and Mitigation Measures	Impact	Evaluation of the Effectiveness of Measures	Mitigation	Timeline	Risk Assessment	Milestone	Residual Impact
noise impacts, as well as allow a 12-hour period for fauna to disperse and forage. Contamination, weeds and pathogens Construction activities increase the risk of weeds, pathogens and contamination into the Site. To manage these impacts, a Weed and Pathogen Management Plan will be prepared to identify potential weed species, and include appropriate controls for weed and pathogen management, disposal and monitoring. Weeds will be actively managed within the construction footprint and disposed of appropriately. No companion animals (e.g. dogs) will be allowed within construction areas. Vehicle disturbance Reduced vehicle speeds will be implemented throughout the construction area to minimise vehicle disturbances. Further, proposed construction roads will be subject to design treatments to ensure safe fauna crossing opportunities are maintained to vegetated areas and impose low vehicle speeds within construction areas. Barriers to dispersal Vegetation will be cleared sequentially. Clearing will be conducted so that fauna are flushed into safe, vegetated areas and it will avoid pushing fauna into fragmented areas. Temporary fauna friendly fencing will allow fauna to safely disperse into vegetated areas while clearing. Temporary fauna exclusion fencing will then be erected to prevent fauna dispersing into construction areas. Contractor management All construction personnel shall attend environmental training as part of the Site induction process prior to entering the work Site. As part of this training, all personnel will be instructed on their obligations in regard to vegetation clearing protocols and to protect native fauna. Additional controls for koala and Grey-headed flying fox will be presented in a toolbox talk.		Fauna Spotter Catcher, no residual impacts area expected to occur.	Vehicle disturbance is minimised	At all times during construction	As above	As above	As above No residual impact
			Barrier's dispersal not created.	At all times during construction	As above	As above	As above No residual impact
			Temporary fauna exclusion fencing	At all times during construction	As above	As above	As above No residual impact
			Inductions and training	At all times during construction	As above	As above	As above No residual impact
			Adaptive management	At all times during construction	Adaptive management not applied	Adaptive management utlised if required.	The CEMP will include adaptive management strategies to avoid recurrence of adverse incidents should they occur. No residual impact

Avoidance and Mitigation Measures	Impact	Evaluation of the Effectiveness of Measures	Mitigation	Timeline	Risk Assessment	Milestone	Residual Impact
Stormwater detention technologies will be utilised to minimise the effects of excess rainwater flowing into catchments caused by the creation of hardstand areas. All work will be undertaken in accordance with appropriate management plans to ensure the hydrological changes the Site do not impact on surrounding vegetation.		The implementation of a project wide Stormwater Management Plan as designed by certified engineers ensures that hydrological change area appropriately accounted for and managed. These management measures will reduce impacts from higher levels of surface water flow caused by hardstand areas and ensures natural drainage lines continue to function as they naturally would have. Stormwater detention basins prevent localised flooding of drainage lines and waterways caused by increased runoff over hardstand areas and also contribute to maintaining water quality levels.	Hydraulic and Stormwater Management Plan.	To be approved prior to works.	Unforeseen hydrological changes	No worsening of hydrological impacts as a result of the development	A Hydraulic and Stormwater Management Plan is prepared by Hydraulic Engineers and Approved by **EDQ.** No residual Impact.
A number of measures will be imposed to avoid and mitigate the risk of koalas being hit by vehicles. Although the risk to vehicle strike is low, these measures will be concurrent for grey-headed flying-fox and greater glider. These measures include: • No koala, grey-headed flying-fox or greater glider food trees will form part of the primary landscaping of the development footprint so that Koalas/Grey-headed flying fox are not enticed to enter the industrial precinct. • Owing to the presence of exclusion fencing along the Linear Parkit is unlikely that koala will enter higher density industrial areas. Imposition of low vehicle speeds to reduce the risk of collisions. Vehicle speed limits are restricted to 20 km/hon internal driveways. • Erection of koala and grey-headed flying fox awareness signage in parks and pedestrian links along the verge of the Linear Parkto raise awareness of the species' presence in the area. • New tenants and owners will be issued with a “Operational Guideline” to raise awareness about local wildlife and to educate workers about the protection of	Hydrological changes	The purpose of these avoidance and mitigation measures is to minimise the risk of injury or death to koala from vehicle strike. These measures will also mitigate risks for Grey-headed flying fox. It will be important to minimise the incentive for Koalas and Grey-headed flying fox to enter industrial areas by restricting the availability of habitat in these areas. As such, landscaping will not be planted with suitable koala/Grey-headed flying fox habitat, which will in turn encourage Koalas to stay away from the development area. Importantly, low vehicle speeds will be imposed within the industrial estate, minimising the risk of high-speed vehicle strikes which were identified in the literature review as accounting for a large proportion of vehicle related deaths. In addition, awareness signage will ensure motorists are aware that Koalas have potential to occur in the area, making them more conscious of potentially dispersing Koalas and encouraging them to maintain a low vehicle speed. The implementation and distribution of “Operational Guidelines” has the	Open space buffer (bioretention basins) between industrial development and Environmental Protection Area	To be delivered with adjoining development	Open space buffer not delivered	Open space buffers delivered	No residual impact
	Operational Impacts		Landscaping does not include forage species	On construction of roads	Habitat / forage trees used in high density industrial areas	Urban landscaping delivered with non-koala native species	No residual impact
	Risk of injury of death to koala, grey-headed flying-fox and greater glider from vehicle strike.		Installation of exclusion fencing	Prior to on-maintenance	Exclusion fencing not installed	Exclusion fencing installed	No residual impact
			Low vehicle speeds	On construction of roads	Vehicles speeding	No koala deaths from vehicle strikes in industrial areas	Low vehicle speeds will be signed and enforced as for internal driveways No residual impact
			Educational guidelines/ markings	On creating internal driveways	Signage not installed	Upon completion of driveway construction	Vehicle speeds will be signed and enforced as for internal driveways Minor residual impact
			Signage.	Prior to on-maintenance	Signs not installed	Signs installed	No residual impact

Avoidance and Mitigation Measures	Impact	Evaluation of the Effectiveness of Measures	Mitigation	Timeline	Risk Assessment	Milestone	Residual Impact
Koalas and Grey-headed flying fox in the area.		purpose of instilling stewardship of the issue amongst workers, encouraging them to actively protect native wildlife and making them aware of the types of fauna that could disperse onto roads. In essence, wildlife crossings will include the following elements: • Reduced vehicle speed limits on roads internal to the development (≤20 km/h) • Demarcated driveway treatment surface and signage to raise driver awareness.	Operational guidelines.	On purchase / commencement of tenancy.	Operational guidelines not delivered	Operational guidelines in purchase package	No residual impact
			Escape measure incorporated into exclusion fencing installed	Prior to on-maintenance	Escape measures not installed	Escape posts installed	No residual impact
In peri-urban development, where tree retention is sometimes proposed to achieve habitat and greenspace outcomes, there is clear potential for interaction between domestic dogs and Koalas. However, for industrial development (as proposed by the Proponent), the potential for interaction between the two species is reduced, because: (i) bulk earthworks requirements have limited the ability to retain trees within the development footprint; (ii) small garden areas incorporated into the industrial precinct will be landscaped with small-statured shrubs and groundcovers rather than trees and shrubs that would attract Koalas; (iii) the industrial nature of the land use reduces the likelihood of occupants owning larger dogs capable of inflicting mortality; and (iv) commercial operations in industrial precincts are typically fenced with 1,800 mm tall fencing, or greater, which create a significant barrier to movement (and thus access by Koalas). This will also be addressed through: • Provision of barriers around the Linear Park to prevent domestic dogs from entering the Linear Park and koala accessing developed areas, consolidating koala movement through the Linear Parkand minimising the area for interface between koala and dogs.		The koala recovery plan (DAWE 2022b) does not discuss the effectiveness of governance measures, but enforced local laws have a degree of efficacy that extends beyond doing nothing. This is implicit in the DCCEEW decision regarding the suitability of governance measures under Referral 2016/7723 and Referral 2017/8095. It is also relevant to consider the benefit of rehabilitation and enhancement of the Environmental Protection Zone, and thus exposure to dog attack.	Dog restrictions	At delivery of open space areas	Dogs are not managed	Dog signage delivered. Council controls on dog ownership imposed	Dogs will be managed to Council specifications. No residual impact.
			Absence of habitat trees in the development footprint.	As above	Koala are incentivised to enter the residential precinct	Koala are not incentivised to enter the residential precint	No residual impact

Avoidance and Mitigation Measures	Impact	Evaluation of the Effectiveness of Measures	Mitigation	Timeline	Risk Assessment	Milestone	Residual Impact
• Community awareness and education programs for new commercial tenants moving into the Site. These programs will reinforce the threats that dogs present for koala populations and will outline dog owners' responsibilities for maintaining control of their dogs. Additional appropriate solutions may include but not be limited to awareness and dog on-leash signage and passive educational documentation.							
To mitigate this associated development, habitats within the Environmental Protection Area will be retained and enhanced through restoration. The construction of exclusion fencing along interface areas of the Environmental Protection Area which maintains connectivity with other habitats beyond the Site. The location of the koala Habitat, will be subject to assisted natural regeneration efforts to enhance, expand and consolidate the available habitat and fabrication within previously cleared components.	Risk of injury or death from dog attack	The development of the industrial areas across the estate will accommodate and facilitate fauna movement. The extent of establishment of fauna movement infrastructure, construction of exclusion fencing along interface areas of the Environmental Protection Area and retention of same maintains connectivity with other habitats beyond the Site. The location of the Koala Habitat, will be subject to assisted natural regeneration efforts to enhance, expand and consolidate the available habitat and fabrication within previously cleared components.	Provision of Open Space area and Environmental and Conservation Precinct	As above	As above	No fauna stuck in industrial area	No residual impact
The Proposed Action has designed controls to avoid, minimise and mitigate risk of disturbance to koala and Grey-headed flying fox habitat during operation, specifically: Light and noise disturbance • Detailed layout will adopt fauna sensitive design measures, specifically adjoining Environmental Protection Area including, avoiding open parking and open space areas backing on to Environmental Protection Area. Contamination, weeds and pathogens	Creation of barriers to dispersal/fragmentation of habitat	The development, once in operation, has the potential, (although minimal compared to construction) to cause disturbance to koala, grey-headed flying fox or greater glider habitat. Adopting fauna sensitive design, including lot design to avoid and minimise light and noise disturbance from the proposed development relative to allotments being adjacent (e.g. rear of large buildings facing Environmental Protection Area. Landscaping within the development will include a primary mix of native species and be subject to a Council on/off maintenance period. In addition to this, the Operational Guidelines will	No open space / car parking facing Environmental Protection Area Open space and appropriate landscaping to buffer Environmental Protection Area with no open space/ lighting facing into this area.	On construction On construction	Directional lighting not delivered Landscaping and revegetation of bioretention basins not delivered	Directional lighting installed Landscaping to be delivered	Directional lighting to minimise light impacts on the Environmental Protection Area will be a requirement of the Landscape Design. No residual impacts No residual impacts

Avoidance and Mitigation Measures	Impact	Evaluation of the Effectiveness of Measures	Mitigation	Timeline	Risk Assessment	Milestone	Residual Impact
• Landscaping mix to be primarily native species • Lifestyle guidelines to include information on suggested planting mix and weed management • Increased risk of pathogens to koala arising from development	Disturbance to koala, grey-headed flying fox or greater glider habitat in retained Environmental Protection Area during operation	include information on suggested planting mixes for tenants to encourage the use of native species, as well as appropriate controls for weed management. These measures are effective in discouraging Koalas and Grey-headed flying fox to enter the development. The distribution of "Operational Guidelines" has the purpose of instilling stewardship of the issue amongst tenants, encouraging them to actively protect native wildlife, including koala and Grey-headed flying fox, raising awareness of the types of fauna that could disperse onto roads, suggested landscaping tree types to discourage Koalas and grey-headed flying-foxes into industrial areas or the spread of weeds and how to appropriately manage domestic pets. Education of the community and installing ecological stewardship are effective management measures to see long term protection of native fauna and biodiversity. Diseases such as Chlamydia and KoRV are considered inherent in South-east Queensland koala populations. With the restoration of the Environmental Protection Area to improve habitat and refugia quality, addition of exclusion fencing, landscaping within parks and bio-basins alongside of the reserve to buffer industrial development, and tying of connectivity of the Environmental Protection Area into adjoining habitats. As the Impact Area will be surrounded either by fauna exclusion fencing or existing/approve industrial development, disturbance to koala and Grey-headed flying fox habitat is limited to direct impacts from clearing, with indirect impacts considered to be appropriately managed. No residual impacts are anticipated outside the development footprint.	Operational guidance to recommend appropriate species	On purchase of property	Operational guidelines not delivered	Operational guidelines in purchase package	No residual impact

7 Offsets

7.1 Significant Residual Impacts

Despite the avoidance, and proposed mitigation (restoration of habitat utility) measures the Proposed Action will result in a Significant Residual Impact of 38.4 ha to koala, 37.92 ha grey-headed flying-fox and 47.47 ha of greater glider arising from direct impacts associated with Proposed Action undertaken by the proponent (for the purposes of the offset area calculation, the additional 0.61 ha of Urban Utilities disturbance for regional trunk sewer main upgrade unrelated to the development of the site for the Proposed Action has been included in the calculation). The proponent proposes an environmental, Direct Offset to acquit the residual impact.

An Offset Area Management Plan has been prepared for proposed offset (**Appendix 25**).

7.2 Offset Receiving Site

The Offset Receiving Site (ORS) is situated 65.5 km to the north-west of the Impact Site (**Figure 25**) and 11 km to the north-west of Esk on a single 813.6 ha property held by KoalaFund Little Kipper Creek Road Biarra 4013 (**Figure 26**). The property of situated within the Somerset Regional Council (SRC) LGA and likes within the rural zone of the Somerset Region Planning Scheme 2016. The lot on plans relevant to the property are formally described as:

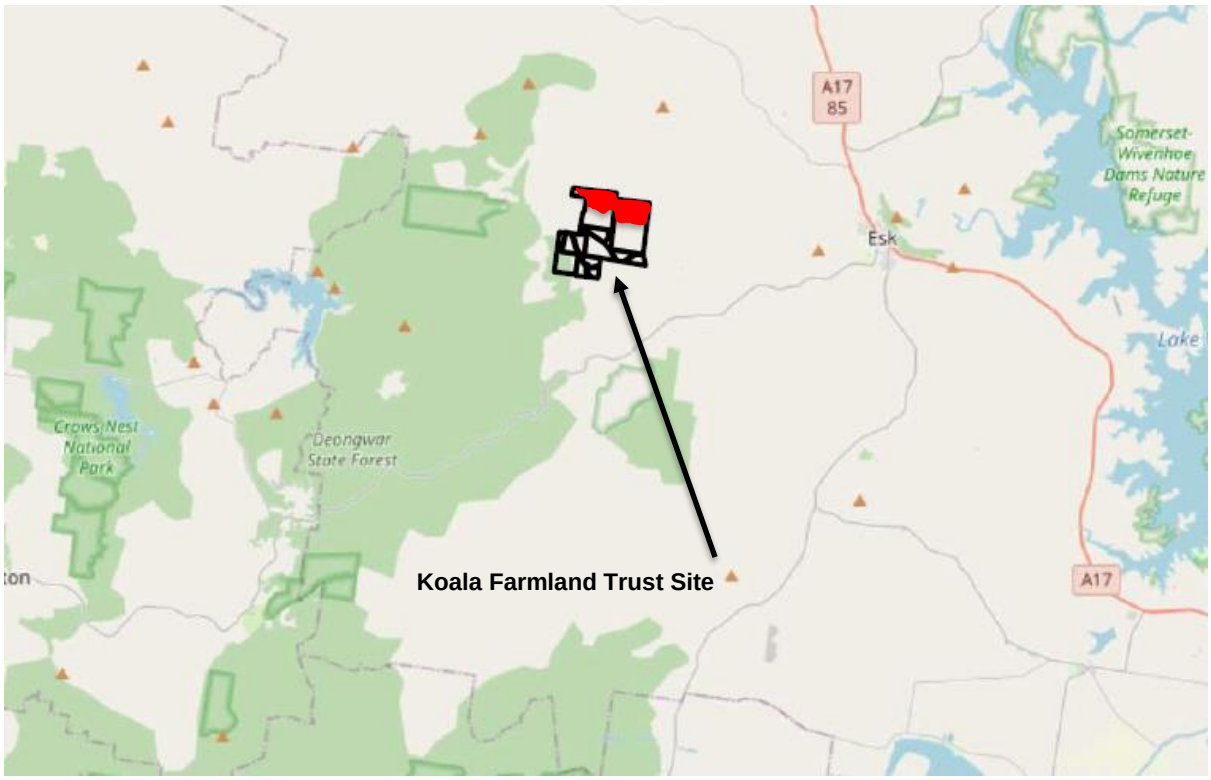
- Lot 271 on CA311037
- Lot 127 on CA31414
- 273 on CA311588
- Lot 272 on CA311095
- Lot 11 on CA31764
- Lot 10 on CA31764
- Lot 34 on CSH106

All lots are held in freehold title**. Inset 14** shows the configuration of these parcels.

Arxhe is negotiating with Koala Farmland Trust for the use of 184.3 ha (refer **Figure 26**) to deliver its offset obligation arising as a result of the Proposed Action. The ORS occupies two parcels:

- Lot 271 on CA311037 = 88.2 ha (47.8% of property). Where reference is made within Section 7 to the ‘western parcel’, it should be considered to be referencing this lot.
- Lot 127 on CA31414 = 96.2 ha (52.2% of property). Where reference is made within Section 7 to the ‘eastern parcel’, it should be considered to be referencing this lot.

The ORS is in the rural zone, outside of the SEQ Urban Footprint; the State Government’s South East Queensland Regional Plan 2009-2031 imposes restrictions on development in the Rural zone.



Inset 14: KoalaFund holdings (black wire frame, indicated) and location of the Ripley View Residential Subdivision Offset Receiving Site indicated by red shading (approximate only). NB: Triangles are localised topographic high points

7.2.1 Topography, Terrain and Aspect

The ORS is situated in the eastern foothills of the Great Dividing Range as it extends through Deongwar State Forest. The ORS itself consists of an undulating series of valleys (200 m AHD) and ridgelines (310 m AHD) with steep to moderately steep slopes associated with headwater tributaries of Little Kipper Creek on Lot 271, running in an east to west direction, and Gallanani Creek North Branch on Lot 127, running in a west to east direction, as shown on **Figure 27**.

7.2.2 Geology and Soils

The 1:100,000 detailed surface geology across both lots is dominated by late Triassic to early Jurassic sedimentary rocks of the Woogaroo Subgroup (formerly Helidon Sandstone). Lithology includes sublabile to quartzose sandstone, siltstone, quartz-rich granule to cobble conglomerate and coal. *Corymbia citriodora* subsp *variegata* (spotted gum) is strongly associated with the deeper loamy soils of the Woogaroo Subgroup (Harms, 1999).

The floodplain of the Little Kipper Creek tributary, which flows across Lot 271, is mapped as later Tertiary-Quaternary colluvium comprising clay, silt, sand, gravel and soil; colluvial and residual deposits.

The floodplain of the Gallanani Creek North Branch tributary, which flows across Lot 127, is mapped as Quaternary alluvium comprising clay, silt, sand and gravel.

1:50,000 soils mapping from the Land Resource Assessment of the Brisbane Valley (Harms, 1999) indicates that most of the Lot 271 and the southern half of Lot 127 is dominated by the Hibiscus (Hb) Soil Profile Class (SPC) which is a red loamy soil (Red Kandosol). This soil type is associated with undulating to rolling rises and low hills.

The northeastern corner of Lot 271 and southern half of Lot 127 is mapped as being dominated by the Yellowbank (Yb) SPC which is a yellow or brown loamy soil (Brown or Yellow Kandosols). This soil type is associated with undulating to rolling low hills. Predominantly lower slopes and drainage depressions.

7.2.3 Land Patterning Change

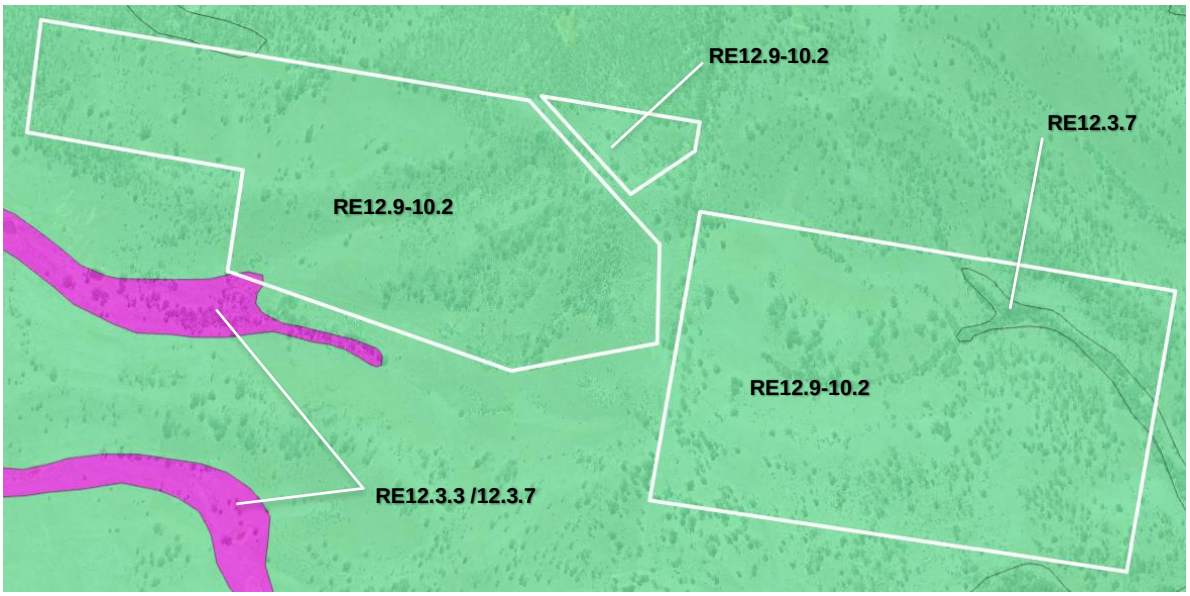
Historical aerial photography from 1992 (**Figure 28**) shows that the predominantly cleared. Discussions with KoalaFund revealed that the former vendor indicated that the Offset Site was cleared for native pasture improvement to facilitate grazing. Recent photography from 2023 (**Figure 29**), shows the unassisted progression of woody vegetation thickening over a ca. 30year period, primarily associated with the radial expansion around relict trees and patches observable in 1992 photography.

7.2.4 Regional Ecosystems

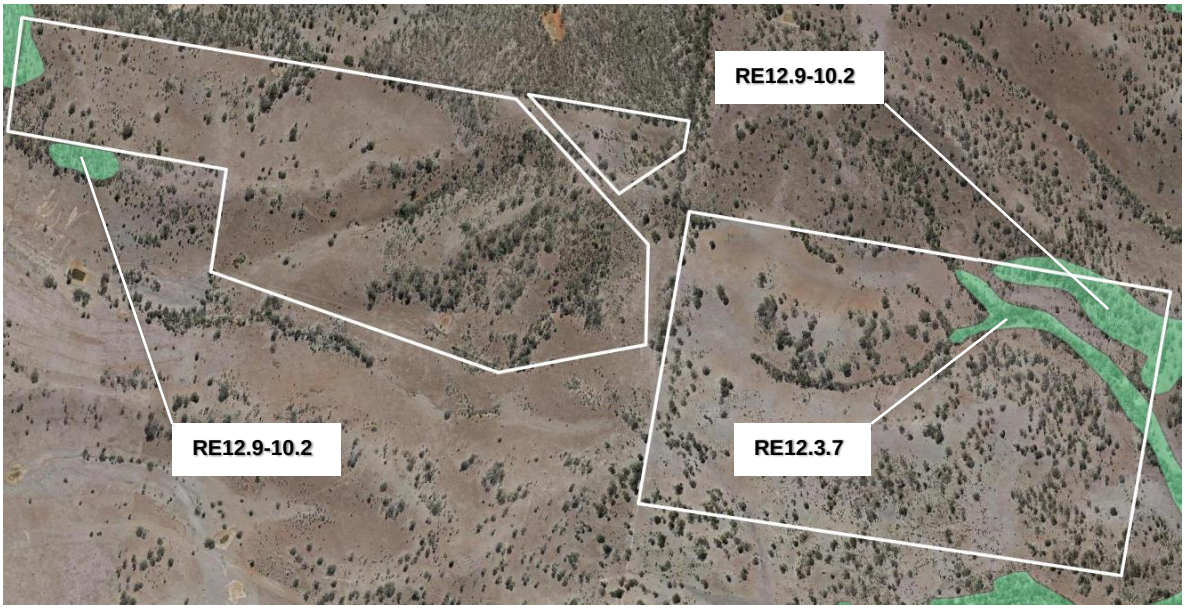
Mapped pre-clear Regional Ecosystems (**Inset 15**) comprised RE12.3.7 – Narrow fringing woodland of *Eucalyptus tereticornis* (Queensland blue gum)*, Casuarina cunninghamiana subsp. cunninghamiana* (river oak) +/- *Melaleuca viminalis* (weeping bottlebrush) and RE12.9-10.2 – *Corymbia citriodora* subsp *variegata* (spotted gum) woodland or open forest with *Eucalyptus crebra* (narrow-leaved ironbark) on rolling terrain. Other species such as *Eucalyptus tereticornis* (Queensland blue gum) are present. The understorey is grassy.

Historically, the ORS partially thinned and or cleared for the creation of pasture and grazed by beef cattle. Light grazing occurs to this day. Since clearing, woody vegetation has thickened and encroached eastward such that presently, regulated High Value Regrowth (**HVR**) and young regrowth (Category X regulated vegetation), 92.28 ha (50.1%) of the ORS area (see **Inset 15**). Remnant vegetation accounts 7.11 ha (3.9%) of the ORS and the remainder 84.93 ha (46.1%) is characterised by pastoral grassland (Category X regulated vegetation), with scattered trees of varying age.

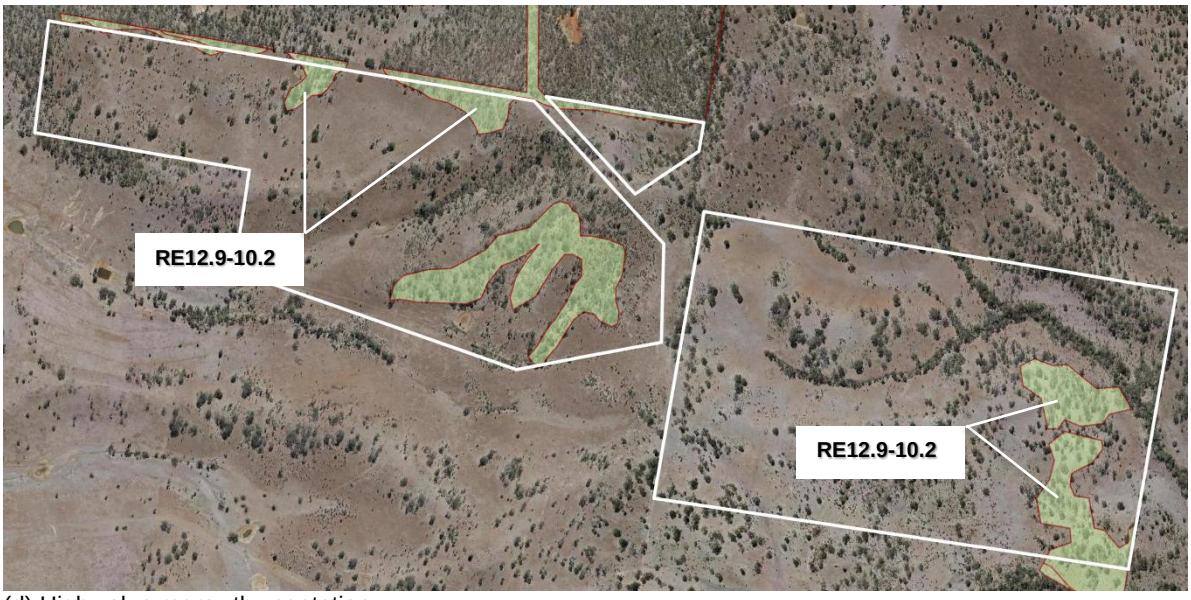
(a) Context (current aerial photography)



(b) Pre-clearance regional ecosystem mapping - predicted



(c) Remnant vegetation



(d) High value regrowth vegetation

Inset 15: Offset Site State Vegetation Context (Regulated Vegetation Management Map (RVMM)

Note: - Site denoted by white wire frame
Source Qld Globe https://qldglobe.information.qld.gov.au/ accessed 24 February 2023, Queensland Herbarium Regional Ecosystem Mapping version 12.2.

7.2.5 Biodiversity Planning Context

(a) Regional

Under the Southeast Queensland Regional Plan, the offset site is located in the Regional Landscape and Rural Production Area but is closely adjoined by corridors and habitats of regional biodiversity value (**Figure 30**). As shown, the offset site is at the nexus of two regional biodiversity corridors and will make a notable contribution to these links.

Similarly, the Somerset Planning Scheme Strategic Framework Map 2 (Natural Environment)[80] shows the offset site at the nexus of important ecological corridors and providing a connection between areas identified as Significant Vegetation (**Figure 31**).

Figure 26 shows the offset site at closer scale, and in relation to existing or planned conservation estate. While Deongwar State Forest is currently under a forestry tenure, in November 2019, the Queensland Government announced that:

> *Hardwood forestry harvesting will end in the South East Queensland Regional Plan area (south of Noosa) in 2024 as originally envisioned by the 1999 South East Queensland Forests Agreement and a commitment has been made to progressively hand back up to 20,000 hectares* of land to become conservation estate before 2024[81].

80: The offset site is located in the west of the Somerset Regional Council local government area.
81: *Palaszczuk Government takes action to support timber industry jobs* Joint Press Release The Honourable Annastacia Palaszuzuk and the Honourable Mark Furner 04/11/2019 https://statements.qld.gov.au/statements/88797

DES has identified Deongwar State Forest as a very high priority for transfer to protected areas estate[82].

For reference the contiguous landscape comprising mapped Remnant and High Value Regrowth vegetation is identified as **Figure 32**. This identifies the continuous habitat connectivity between the site, through the proposed offset land to the south and into Deongwar State Forest top the west.

(b) Local

Figure 33 shows the offset site at a locality scale and illustrates the position of other offsets being assessed by DCCEWW in the south of the KoalaFund landholding. These offsets consolidate remnant, regrowth and regenerating vegetation in these parts of the landholding[83]. The proposed offset the subject of this current PD Report has been positioned to consolidate patches of regrowth vegetation in the north of the KoalaFund landholding, and to complete a north-south connection to a large area of vegetation north of the westernmost offset parcel[84].

7.3 Statutory Measures

The Approval Holder will place a covenant under the *Land Title Act 1994* or *Land Act 1994* over the Offset Site. Covenants afford the same protection level as National Park in Queensland and provide the Department (DCCEEW) with a higher level of confidence that the offset will be protected for the duration of the impacts associated with the proposed action.

The Approval Holder or their engaged provider, will be responsible for the delivery and management of offset works during the establishment and through the 20-year maintenance period and per any other Conditions of Approval. Upon the completion of works the offset will be retained in perpetuity; or, if desired by the Queensland Government or SRC the land will be gifted back for protection and environmental conservation purposes upon successful completion of relevant offset goals and requirements outline.

7.4 Offset Area Management Plan

The Proponent will contract a third-party entity to manage the ORS in perpetuity.

The Proponent proposes to deliver its offset obligations for Residual Impacts to MNES arising through a Direct Offset by way of rehabilitation contractor. The governing mechanism / methods as to how the Direct Offset will be established, managed and maintained are detailed within the attached Offset Area Management Plan (see **Appendix 25**). Primary means of establishing and maintaining the ecological restoration will be:

- The component of the Offset Receiving Site (ORS) which will be subject to active restoration (reconstruction[85]) in cleared parts of the ORS characterised by pastural grassland
- Assisted regeneration comprising weeding and infill planting where parts of the ORS currently support HVR and Remnant vegetation.

The ORS will be subject to detailed offset delivery works, which will fully revegetate the existing cleared paddocks and regrowth areas. Works will be in-line within the South East Queensland Ecological

---

82: Protected Area Solutions. 2021. Proposed State Forest Transfers – SEQ Regional Planning Region 2021. Report to Queensland Conservation Council.
83: Referral details are commercial in confidence and were not shared with 28 South.
84: In May 2022, the Wildlife Preservation Society conducted an education event and spotlighting tour for Greater glider in Crows Nest. In 2015, the Toowoomba Field Naturalists Club also reports of Greater glider in the Crows Nest area.
85: Natural Regeneration, Assisted Natural Regeneration and Reconstruction are classed as 'restoration' and Fabrication (or Type Conversion) is considered to be 'rehabilitation' (after Chenoweth EPLA and Bushland Restoration Services, 2012)

Restoration Framework[86]. Revegetation works will achieve a diverse vegetative structure in line with the pre-clearing REs and meet the BioCondition metrics outlined in the Offset Area Management Plan and completion criteria outlined in the concept Offset Rehabilitation Plan (**Appendix 25**).

7.5 Policy Principles

The EPBC Act Environmental Offsets Policy details a number of principles that a suitable offset will achieve. The Offset Area Management Plan demonstrates how the ORS meets and exceeds the Policy Principles; a synopsis is outlined by **Table 22**.

Table 22: Response to Suitability of Offset Site Against Offset Criteria

EPBC Offset Suitability Criteria	Response
1. Suitable offsets must deliver an overall conservation outcome that improves or maintains the viability of the protected matter	The proposed management measures will deliver a significant upswing in vegetation quality and cover within the ORS (and immediate surrounds). Further, the ORS will ultimately increase both the extent and volume of foraging resources for koala, grey-headed flying-fox and greater glider, with a particular focus on establishing a self-sustaining open forest of RE12.9-10.2 containing *Corymbia citriodora subsp variegata* (spotted gum) and *Eucalyptus crebra* (narrow leaved ironbark) open forest with *Eucalyptus tereticornis* (Queensland blue gum) either as a subdominant or dominant canopy species on lower-slopes, and achieving remnant status within 20 years (time to acquittal of the matter). The total offset area will be 184.31 ha. When considered in the context of the ORS directly combining with additional offset lands owned by Koala Farmland Trust to the south, existing Queensland blue gum dominated vegetation along Kipper Creek west and higher order waterways surrounding the Site, a consolidated regionally significantly area of important foraging habitat will be established. The offset will be maintained in perpetuity as habitat protected by Covenant. The cumulative mass of 184.31 ha of remnant status vegetation with scattered veteran trees flowing in unison will provide a significant beacon of intact foraging resources with low edge to volume ratio. **Suitability for Koala** Youngentob et al. (2021) identified locally important food trees for koala by geography. Two tree species recognised as important food trees for koala in south-east Queensland are present within the ORS, being *Eucalyptus crebra* (narrow-leaved ironbark) and *Eucalyptus tereticornis* (Queensland blue gum). These species will also be included in the planting palette for revegetation across the ORS. In order to ascertain current utilisation, spotlighting was conducted over two evenings in May 2023. Two koala were observed on contiguous habitat immediately to the south of the offset (on the Koala Farmland Trust land). Scat surveys identify utilisation on the Offset Site. It is clear that koala would benefit significantly from the increase in habitat quality and quantity over the ORS, particularly considering the wider linkages it would provide for koala, providing significant corridors for individual home ranges and the ability for uninterrupted dispersal (particularly younger males moving to new ranges attempting to avoid older established males). **Suitability for Grey-headed flying fox** Important winter flowering species (with high productivity and reliability scores) in the blossom diet of grey headed flying foxes include *Eucalyptus crebra* (narrow-leaved ironbark), *Eucalyptus tereticornis* (Queensland blue gum), *Corymbia citriodors supsp variegata* (spotted gum), *Corymbia intermedia* (pink bloodwood) and *Eucalyptus*

86: Chenoweth EPLA and Bushland Restoration Services (2012) *South East Queensland Ecological Restoration Framework: Manual.* Prepared on behalf of SEQ Catchments and South East Queensland Local Governments, Brisbane

EPBC Offset Suitability Criteria	Response
	microcorys (tallowwood)[87]. All species are present within AU1 and AU2 with Queensland blue gum a dominant / co-dominant species on lower slopes. Within the Site there are ca. 199 Queensland blue gum, 172 narrow-leaved ironbark, 1,162 spotted gum, 135 pink bloodwood and 1 tallowwood >300 mm DBH present. **<u>Suitability for greater glider</u>** Regional ecosystem 12.9-10.2 contains canopy species that are dominant, codominant, subdominant and associated that represent greater glider habitat (Eyre 2022). Tree cover occurs mainly occurs in AU1, patchy cover in AU2 and sparse paddock trees in AU3. Tree species of known value to the greater glider present at the Offset Site are: • *Angophora subvelutina* (broad leaved apple) • *Corymbia citriodora subsp variegata* (spotted gum) • *Corymbia clarksoniana* (long fruited bloodwood) • *Corymbia intermedia* (pink bloodwood) • *Corymbia trachyphoia* (brown bloodwood) • *Corymbia tessellaris* (Moreton Bay ash) • *Eucalyptus carnea* (bread-leaved stringybark) • *Eucalyptus crebra* (narrow leaved ironbark) • *Eucalyptus microcorys* (tallowwood) • *Eucalyptus tereticornis* (Queensland blue gum) • *Lophostemon suaveolens* (swamp box). There are also a large number of large trees (1,963 >300 mm DBH, including 976 >500 mm. There are a number of potential habitat trees within parts of the site converted to improved pasture viz-a-viz AU2 and AU3 without ecological context, that is although present they are not accessible by greater glider. Under a status quo scenario in which the site continues to be managed as a grazing property, these trees would be lost or remain unengaged / unavailable to greater glider. Ecological restoration will result in the establishment of forage habitat which will provide context to these trees. The offset site therefore has a significant capacity to improve habitat quality for the greater glider over time by revegetation of cleared areas and the maturity of existing and future vegetation. Importantly, the Offset Site retains ecological connectivity with large areas of remnant and regrowth forest within the KoalaFund site (where two greater gliders were observed in May 2023) and with a broader block of State biodiversity significance on the eastern slopes of the Great Dividing Range where numerous National Praks and State Forests are present. Multiple contemporary records for greater glider are found in this area.
2. Suitable offsets must be built around direct offsets but may include other compensatory measures	The ORS can accommodate up to 184.31 ha of direct offset for koala, grey-headed flying-fox and greater glider with the express aim of achieving an increase in the quality and cover of habitat for these species with a 20 year time to ecological benefit. The ORS will however, have tangible ecological benefits to many other species. The proposed intensive management measures will also aim at creating/ fabricating other habitat features such as course woody debris. Beyond this, the Direct Offset will have beneficial outcomes to other MNES. The Offset will result in the expansion of habitat at the footslopes of Deongwar State Forest (Deongwar

87: Main flowering in spring and autumn (Stanley and Ross 2022)

EPBC Offset Suitability Criteria	Response
	Range – eastern slopes of the Great Dividing Range to the east of the town Crows Nest) a noted ecological corridor. All three MNES are found within this area. Five farm dams present on the Offset Site will be modified for irrigation during restoration, firefighting and will remain in perpetuity as watering points for local wildlife.
3. Suitable offsets must be in proportion to the level of statutory protection that applies to the protected matter	The ORS is in proportion to the level of statutory protection because the offset assessment guide requires that the user selects the appropriate conservation status or extinction rate. The ORS will be the subject to a Statutory Environmental Covenant under the *Land Title Act 1994*, ensuring protection in perpetuity. Beyond this, the ORS will also be subject to a Covenant under the *Land Title Act 1994* (Qld) or *Land Act 1994* (Qld). Covenants afford the same protection level as National Park in Queensland and provide the Department (DCCEEW) with a higher level of confidence that the offset will be protected for the duration of the impacts associated with the proposed action.
4. Suitable offsets must be of a size and scale proportionate to the residual impacts on the protected matter	The ORS (184.31 ha) will be subject to ecological restoration works, eventually creating an open forest of *Corymbia citriodors supsp variegata* (spotted gum) and *Eucalyptus crebra* (narrow-leaved ironbark) with *Eucalyptus tereticornis* (Queensland blue gum) and *Corymbia intermedia* (pink bloodwood) all significant resource for koala, grey-headed flying-fox and greater glider, and numerous other species and communities of conservation significance) within c 50 km of the ORS. The proposed offset of 184.32 ha represents a net gain of habitat of 4.86 times the significant residual impact (9.72 times the total quantum impact of 18.96 ha) at the impact site (koala and greater glider) and achieves >100% offset result for all species.
5. Suitable offsets must effectively account for and manage the risks of the offset not succeeding	All works will be actively managed by a dedicated, experienced, proven and reputable offset provider (to be confirmed). The ORS will be subject to a detailed a management program to govern and guide success parameters. Only contractors with an established track record for establishing and managing offsets for similar periods of time to establish an offset (20 years) will be considered. The Proponent has contracted is in advanced negotiations with the KoalaFund to acquire 182 ha of their larger South Kipper offset site as offset for residual impacts arising from the Ripley Valley Residential development. The level of protection this ORS will be afforded on top of this intensive management will ensure that the ORS is managed and retained as a significant area of conservation in perpetuity. The direct offset will be delivered under the framework of an Offset Area Management Plan. The documents sets a framework of actions including implementation, management, risk evaluation and management, monitoring, reporting, review and corrective actions. It clearly identifies: • The environmental offset required to be delivered by the Proponent as a consequence of anticipated residual significant impacts of the Proposed Action. • The nature of the conservation gain, including completion criteria, to be achieved over the nominated offset period for relevant MNES on the proposed ORS. • Land management actions required over the offset period to support progress towards achieving the completion criteria. • A monitoring program required to measure progress towards achieving the completion criteria, including corrective actions. • Adaptive management, including corrective actions, and reporting requirements for the duration of the offset period. The Offset Area Management Plan (**Appendix 25**) outlines a number of triggers and corrective actions which are to be implemented in instances of non-compliance or the lack of success toward the gradual achievement of the completion criteria identified during annual monitoring, as reported in the Annual Compliance Reports, and major milestone monitoring events (every 5 years).

EPBC Offset Suitability Criteria	Response
6. Suitable offsets must be additional to what is already required, determined by law or planning regulations, or agreed to under other schemes or programs	The proposed ORS is specifically to acquit offset requirements under the EPBC Act and not any other law or planning regulation. The ORS is ideal for the Proponent to deliver an offset which meets the requirements of the EPBC Act Offset Policy and DCCEEW Approval Conditions. With respect to the Impact Area, the ORS represents an outstanding opportunity to deliver a high-quality offset and meet community expectations of this being locally sourced. The ORS will protect large area of land that provides some value to MNES, on account of past clearing of the Offset Site and the locality more broadly. Despite the continued growth of the South East Queensland region the ORS is considered at low risk of threat from urban development; the locality in which the ORS is outside of the South East Queensland urban footprint and is part of the Rural Landscape. The ORS will be managed under an intensive works program and be subject to consistent and constant monitoring through transparent, reliable and trusted BioCondition and tertiary Site monitoring assessments. It is important to note that the site owner KoalaFund has purchased the Site, formerly managed as a cattle grazing property (and permitted under the agricultural planning designation of the locality) with the intent of establishing offsets. Therefore, existing management involves fencline management, pest reduction and light grazing to reduce grass biomass (and reduce grassfire fuel loads), in line with present planning / rural land management principles and obligations for a pastural landscape. Without the offset the site would continue to be managemed for light agricultural activity. The success of the Offset *is not* dependent upon the implementation of other proposed offsets to the south, but rather is complimentary to these; the offset in their absence (of adjoining offsets) remains connected to broader areas of habitat and conservation estate through its position in the landscape existing linkages (as demonstrated by its site context (patch size, connectedness and context) identified through MHQA assessment) and adjoining, nearby conservation estate. The ORS will be managed under an intensive works program implemented with reference to the Offset Area Management Plan and will be subject to consistent and constant monitoring through transparent, reliable and trusted bio-condition and tertiary site monitoring assessments. The Offset Area Management Plan identifies the nature of the conservation gain, including completion criteria, to be achieved over the nominated offset period for relevant MNES on the proposed ORS. It has undertaken a risk assessment specifically focussed on identifying and managing risks which would threaten the offset's conservation gain; the management of these threats eg. fire management, pest management, dealing with the consequence of stochastic threats is focussed on returning the site to a functioning ecosystem within 20 years. The management measures required to achieve the stated conservation gain (reinstatement of former open forest habitat) are over and above what is required to maintain the site as a pastural landscape.
7. Suitable offsets must be efficient, effective, timely, transparent, scientifically robust and reasonable	The ORS is effective in that it is mapped as it is mapped as proximally close (has canopy connectivity with) a State and Regionally significant area of vegetation containing important biodiversity corridors and therefore is efficient in contributing, at scale, the realization of regional landscape ecological outcomes. Advanced restoration works and regrowth existing on the ORS will mean that the offset is timely in relation to the residual impacts of a Proposed Action. Beyond the regrowth areas being protected by the ORS, a component of the offset will result in a significant up-swing in habitat availability for MNES as these areas will be transitioning from completely cleared paddocks to remnant vegetation over the period they will be protected. By using the DCCEEW impact and offset calculators, the offset is transparent, scientifically robust and reasonable.
8. Suitable offsets must have transparent governance arrangements including being able to be readily	These Offset Area Management Plan (**Appendix 25**) provides clarity around the environmental objectives proposed, risks and risk management in achieving these goals and corrective actions identified should works not meet their envisaged target. This can be achieved through a) intensive ecological restoration works (i.e. full augmentation of habitats through intervention); b) intensive restoration and forestry management practices for the ORS; c) Yearly tertiary monitoring for the life of the ORS compliance (to 2053); d)

EPBC Offset Suitability Criteria	Response
measured, monitored, audited and enforced	detailed monitoring at years 1, 2, 3, 5, 7, 10, 15, 20; and e) Major Monitoring and Auditing events at years 5, 10, 15 and 20. The Offset Area Management Plan will be the responsibility of, managed and delivered by experts in offset delivery to ensure works meet this policy item and regulators will be informed of ongoing progress in relation to the approved Offset Area Management Plan. The rehabilitation contractor will be responsible for the development and completion of compliance reporting. This reporting will clearly outline how reporting requirements defined in the Offset Area Management Plan (**Appendix 25**) such as the qualifications and experience of monitoring and reporting staff have been met. It will be the contractor's responsibility to ensure that reporting is sent to DCCEEW, published on the Project's website and maintained in a safe, secure file for auditing purposes. the Proponent will ultimately remain responsible for the approval, regardless of the proposed delivery mechanism.

7.5.1 Offset Provider

The Proponent has an in-principal agreement with the offset provider KoalaFund[88] an unlisted managed investment fund and the owner of the site to manage the ORS in perpetuity. Commercial terms are yet to be finalised. A holding fee for the 182 ha proposed offset has been paid to KoalaFund.

7.5.2 Koala

As described in **Section 5.2**, the Proposed Action is expected to have a residual impact on the koala. The Proponent proposes to deliver a direct offset and provide other mitigation measures to achieve its offset obligations under the EPBC Act. This is extensively detailed in the Offset Area Management Plan (**Appendix 25**).

While this PD Report deals exclusively with offsets for koalas under the EPBC Act, it should be noted that the offset package to be delivered by the Proponent in order to meet its obligations for koalas under the EPBC Act, will also be sufficient to meet any potential offset obligation at the State and Local Government levels.

(a) Landscape Records

In order to determine that the proposed offset is suitable to maintain the viability of the protected matter, the presence of koala records and habitat within 25 km of the Site was assessed through desktop analysis of available databases and reports, supplemented with nocturnal spotlighting both on the Offset Site and on lands adjoining the ORS (**Figure 34**).

Mapping of koala habitat based upon State identified koala habitat, shows that within 25 km of the site, there is 54,000 ha of remnant and 14,781 ha of regrowth habitat covering 35% of the search area (**Figure 35**).

The ALA database was inspected to determine regional records. What contemporary records (post 1990) reveal is that records are clustered along points of the landscape (roads and settlements where their presence is note by casual observation. Queensland Department of Environment and Science (**DES**) data

88: http://www.koalafarmlandfund.com.au/

(*DES generated generilsed distribution and densities of Queensland wildlife*) identifies good coverage of koala records within the Landscape.

The *Generalised Distribution and Densities of Queensland Wildlife* dataset was interrogated to determine the occurrence of Koala in the broader locality (**Figure 34**). As shown, there are a considerable number of records from the grid squares containing settlements (Toogoolawah, Esk, Coominya and Churchable) but fewer from the sparsely settled rural grid squares (including the offset site). This is an artefact of the number of observers and observer effort/motivation, rather than any real difference in habitat values or suitability between settlements and rural areas.[89]

Targeted spotlighting assessments of the ORS and the landscape within the KoalaFund holding contributed records of an additional 3 observations to the records. These were within 2.5-3 km to the south of the offset site. On 19-20 May 2023, spotlighting survey work being undertaken for Greater glider in the southern portions of the KoalaFund landholdings (Lot 1 on AP21313 and Lot 77 on CA322588) identified koala. Koala was observed at three locations during this survey, and then closer to the offset site on the traverse back to Little Kipper Creek Road (**Figure 34**)[90].

(b) Site Records

No koala were observed on the ORS. To determine the occurrence of koala on the offset site, Spot Assessment Technique[91] (see **Text Box 1**) was and undertaken found low levels of scat evidence in areas of regrowth and remnant open forest. in eucalypt-dominated regrowth areas or open paddocks. Surveys were undertaken at nine (8) BioCondition sites and three (3) 50x50 plot sites indicated a very low density of koala usage across the Site. Derived results are shown in **Table 23**.

Table 23: Summary of SAT Results

SAT Site Number	Evidence of Koala Use (%)	Koala Use (High/Medium/Low)[1]
BioCondition 1	-	-
BioCondition 2	6.6 (two scats)	Low
BioCondition 3	-	-
BioCondition 5	-	
BioCondition 11	-	
BioCondition 13	3.3 (one scat)	Low
BioCondition 15	3.3 (one scat)	Low
BioCondition 18	-	-
Plot 63	-	-
Plot 603	-	
Plot 1019	-	-
Plot 1103	3.3 (one scat)	Low

1. Wither reference to Phillips and Callagham (2011)

89: i.e., there are few observers to make observations of threatened species, and it is not unreasonable to expect a lack of motivation to report the occurrence of such species.
90: i.e., there are few observers to make observations of threatened species, and it is not unreasonable to expect a lack of motivation to report the occurrence of such species.
91: Phillips, S & Callaghan, J (2011). 'The Spot Assessment Technique: a tool for determining localised levels of habitat use by Koalas Phascolarctos cinereus'. Australian Zoologist Volume 25 (3).

Derived Data suggests that the offset site supports a low-density koala population. This finding does not indicate that the offset site is unsuitable or of low value as a koala offset, but rather that (in its present rural condition) does not have capacity to support any greater koala density. However, DES spatial modelling[92] identifies that the habitat to be created (RE 12.9-10.2) is (in a Southeast Queensland Bioregion context) of medium value for koala[93]. Further, there are considerable areas of colluvium in the east of the offset site that already support the primary koala habitat tree, Queensland blue gum (*Eucalyptus tereticornis*) (Figure 40) and further emerging individuals. At a site-scale, these areas represent a transition from RE 12.9-10.2 to RE 12.9-10.7[94].

7.5.3 Grey-headed Flying-fox

As described in **Section 5.3**, the Proposed Action will have a residual impact on grey-headed flying-fox. The Proponent proposes to deliver a direct offset and provide other mitigation measures to achieve its offset obligations under the EPBC Act. This is extensively detailed in the Offset Area Management Plan (**Appendix 25**).

While this PD Report deals exclusively with offsets for koalas under the EPBC Act, it should be noted that the offset package to be delivered by the Proponent in order to meet its obligations for koalas under the EPBC Act, will also be sufficient to meet any potential offset obligation at the State and Local Government levels.

(a) Landscape and Site Records

In order to determine that the proposed offset is suitable to maintain the viability of the protected matter, the presence of grey-headed flying-fox records and camps within 25 km of the Site (see **Figure 36**).

The Generalised Distribution and Densities of Queensland Wildlife dataset was interrogated to determine the occurrence of grey-headed flying-fox in the broader locality (**Figure 36**). The somewhat limited number of records (restricted to two locations) is unlikely to reflect this species use of the landscape:

(i) firstly, because the 34 records near Esk correlate with a known Grey-headed flying fox roost[95] supporting 500-2,500 individuals. The Esk roost is ~10km from the offset site. Based on telemetry data, Westcott et al (2015)[96] reported the mean distance of a grey-headed flying-fox foraging site from the camp in which the animal had roosted and to which it returned was 10.9 km (quartile range from 6.2 - 27.9 km). The offset site is located at the mean forage distance; and

(ii) secondly, because it is not unusual for there to be an absence of fauna records in a sparsely settled rural landscape[97]. However, in our experience, grey-headed flying-fox is almost invariable recorded from these areas when adequate survey is undertaken. In May 2023, the offset site and

92: Department of Environment and Science (DES) 7 September 2022. Spatial modelling for koalas in South East Queensland: Report version 3.0. Koala Habitat Areas (KHA) v3.0, Locally Refined Koala Habitat Areas (LRKHA) v3.0, Koala Priority Areas (KPA) v1.0, Koala Habitat Restoration Areas (KHRA) v1.0. Brisbane: Department of Environment and Science, Queensland Government.
93: Refer ranking in Appendix 2 (p. 61).
94: RE 12.9-10.2 grades to RE 12.9-10.7 on lower slopes. RE 12.9-10.7 tends to be co-dominated by Queensland blue gum.
95 : identified by the DCCEEW National Flying Fox Monitoring Viewer https://www.qld.gov.au/environment/plants-animals/animals/living-with/bats/flying-foxes/roost-monitoring-locations/flying-fox-roost-monitoring-and-locations
96: Westcott, DA, Heersink, DK, McKeown, A, Caley P. 2015. The status and trends of Australia's EPBC-Listed flying-foxes. CSIRO, Australia in DAWE 2021, National Recovery Plan for the Grey-headed Flying-fox 'Pteropus poliocephalus', Department of Agriculture, Water and the Environment, Canberra, March. CC BY 4.0.
97: i.e., there are few observers to make observations of threatened species, and it is not unreasonable to expect a lack of motivation to report the occurrence of such species. This phenomenon is usefully illustrated in the koala database records (Figure 34), where there are considerable more records of koala in grid squares containing the settlements of Toogoolawah, Esk, Crows Nest, Coominya and Churchable.

adjoining areas were inspected to determine the occurrence of blossoming Queensland blue gum (*Eucalyptus tereticornis*), an important winter blossom resource for grey-headed flying-fox[98].

Blossom productivity was found to be poor, and no further spotlighting was conducted for the species at this time. The offset site was reinspected on 9 June 2023, at which time much greater Queensland blue gum blossom was evident. Spotlighting survey for Grey-headed flying fox then commenced at approximately 30 minutes after dusk (6:15pm) and continued for three hours. During this inspection, 10 observations of Grey-headed flying fox were made (see **Figure 37**).

(b) Landscape Resources

Resources for the grey-headed flying-fox are most critical during two key periods within their life cycle; winter when other resources are scarce, and during the breeding season between late gestation and early lactation over the period September to November (DAWE 2019a).

The extent of state mapped Remnant and High Value Regrowth Regional Ecosystems where two key significant South-east Queensland winter and spring flowering species; *Melaleuca quinquenervia* (broad-leaved paperbark) and *Eucalyptus tereticornis* (Queensland blue gum) are Dominant, Co-dominant, Subdominant and Associated canopy species within 25 km of the Site have been mapped as **Figure 36** (Dominant and Co-dominant) and **Figure 37** (Subdominant and Associated REs).

(c) Site Resources

The spatial distribution and abundance of important winter forage species identified by tree surveys has been assessed and plotted as **Figure 39**. In identifying suitable species, reference was made to DAWE (2021) and Eby and Law (2008) to identify important forage candidates. This revealed nine species considered as important flowering forage species (ibid) are present on Site.

DAWE (p.15, 2021) states the 'where the existence of these important winter and spring flowering vegetation communities is verified in the field, they are considered habitat critical to the survival of grey-headed flying-fox'. Reference was then made to Stanley and Ross (2002) to identify winter and spring flowering species important as foraging resources. This delineated *Euclayptus tereticornis* (Queensland blue gum), *Corymbia citriodora* (spotted gum), *Corymbia intermedia* (pink bloodwood), *Eucalyptus crebra* (narrow-leaved ironbark), *Eucalyptus microcorys* (tallowwood) as important winter-spring flowering forage resources important to seasonal resource bottlenecking and gestational periods which are present on the ORS. The distribution and abundance of mature trees >300 mm DBH are shown as **Figure 40**.

7.5.4 Greater Glider

As described in **Section 5.4**, the Proposed Action is expected to have a residual impact on the greater glider. The Proponent proposes to deliver a direct offset and provide other mitigation measures to achieve its offset obligations under the EPBC Act. This is extensively detailed in the Offset Area Management Plan (**Appendix 25**).

While this PD Report deals exclusively with offsets for koalas under the EPBC Act, it should be noted that the offset package to be delivered by the Proponent in order to meet its obligations for koalas under the EPBC Act, will also be sufficient to meet any potential offset obligation at the State and Local Government levels.

98: Page 14 of the DAWE 2021, National Recovery Plan for the Grey-headed Flying-fox 'Pteropus poliocephalus', Department of Agriculture, Water and the Environment, Canberra, March. CC BY 4.0.

(a) Landscape Records

In order to determine that the proposed offset is suitable to maintain the viability of the protected matter, the presence of greater glider records within 25 km of the Site (see **Figure 43**). Searches of more conventional data sources, eg. ALA revealed very few contemporary records. Knowledge of the broader locality and anecdotal reports of greater glider presence led to an expansion in data searches and information of presence outside of readily available data sources.

The Queensland Department of Environment and Science (DES) Generalised Distribution and Densities of Queensland Wildlife dataset was interrogated to determine the occurrence of Greater glider in the broader locality. The data is arranged in a way that shows the number of records of a target species (in this case, Greater glider) within 10 km grid squares. As expected, the data revealed a significant number of Greater glider records in the ranges to the west and southwest of the proposed offset site (**Figure 40**). While the records are dated, other contemporary DES data (**Figure 31**) and grey literature[99] confirm that Greater glider persists in these areas. While the Generalised Distribution and Densities of Queensland Wildlife dataset does not show Greater Glider records closer to the offset site, other sources confirm such occurrence, namely:

1. Baseline ecological assessment for the Big T Pumped Hydro project at Lake Cressbrook (DPM Envirosciences 2021)[100] recorded Greater glider scat at the eastern end of the project area, approximately 11km southwest of the proposed offset site (**Figure 40**). The spatial arrangement of Greater glider records in relation to the project area is shown in (**Appendix 26.1** – Big T Pumped Hydro Records). The study identified 1,198 hectares of potential habitat within the project area[101], and suitable habitat in the adjoining Deongwar State Forest[102].

2. A DES Matters of State Environmental Significance (MSES) search for the primary lot comprising Deongwar State Forest (Lot 528 on FTY1889) revealed confirmed records of Greater glider (**Appendix 26.2** and **Appendix 26.3** – DES SEARCH). While currently in State Forest tenure, in November 2019, the Queensland Government announced that:

   > *Hardwood forestry harvesting will end in the South East Queensland Regional Plan area (south of Noosa) in 2024 as originally envisioned by the 1999 South East Queensland Forests Agreement and a commitment has been made to progressively hand back up to 20,000 hectares of land to become conservation estate before 2024.*

   DES has identified Deongwar State Forest as a very high priority for transfer to protected areas estate[103].

3. **Figure 49** shows a continuum of Greater glider habitat[104] between the Greater glider record at Cressbrook Dam and the offset site. A tenuous secondary connection (which could be improved through revegetation) extends to the northeast of the Cressbrook Greater glider record; and

---

99: In May 2022, the Wildlife Preservation Society conducted an education event and spotlighting tour for Greater glider in Crows Nest. In 2015, the Toowoomba Field Naturalists Club also reports of Greater glider in the Crows Nest area.
100: DPM Envirosciences Pty Ltd. 2021. Big T Pumped Hydropower Energy Storage – Baseline Ecological Surveys: Prepared for Complex Infrastructure Services Pty Ltd (BE Power).
101: Refer p. 130 of the DPM Report.
102: Refer p. 142 of the DPM Report.
103: Media release 4 November 2019 (Palaszczuk Government takes action to support timber industry jobs) https://statements.qld.gov.au/statements/88797#:~:text=Hardwood%20forestry%20harvesting%20will%20end,become%20conservation%20estate%20before%202024.
104: As defined by Eyre et al. 2022. The movement pathway is circuitous because it avoids the unsuitable dry rainforest regional ecosystems at the base of the range.

4. At a closer scale, **Figure 50** shows there to be a contiguous (~1,563 hectare) patch of suitable Greater glider habitat to the south of the offset site. To the south of the broader KoalaFund landholding (Lot 1 / AP21313), a review of contemporary and historic aerial photography identified potentially suitable habitat for Greater glider. Ground truthing and spotlighting survey of this land was undertaken over 19-20 May 2023.

   The ground truthing survey found that the specifically targeted Greater glider habitat (a protected south-facing gully) had been affected by the 2020 bushfires. Hence, attention turned to the remaining parts of this site. On 19 May, spotlighting survey commenced at approximately 5:45 pm (dusk) and continued via vehicle and walking transects until 11 pm. Two koalas, a Brushtail possum, a ringtail possum and the conservation-significant (Qld) Powerful owl were detected during this survey. Spotlighting surveys recommenced at 5:45 pm on May 20th. Greater glider was recorded at approximately 8:40 pm, and a further koala was recorded at approximately 9 pm. Surveys ceased at approximately 9:30 pm.

   The Greater Glider record is significant because, while not located on the offset site or the broader KoalaFund landholdings, it is in contiguous habitat. **Figure 50** shows there to be a continuum of Remnant Vegetation and HVR extending north from the 28 South Greater glider record towards the offset site. Much of this area is identified as an EPBC Act offset under Referral No. 2021/9065[105] (refer **Appendix 40**). Offset provider (KoalaFund) further advises that land between the 2021/9065 offset and the Proponent's offset has also been secured for offsets (i.e., there will be a complete, well-vegetated and protected link between the Proponent's offset and the Greater glider record). The Proponent's offset then creates a connection through to a ~760 ha patch to the north, which has otherwise tenuous landscape connections for the Greater glider (**Figure 51**).

(b) Landscape resources

Greater glider require large, mature, hollow-bearing eucalypts for shelter, breeding, and foraging habitat and are most strongly associated with *Eucalyptus latisinensis* white stringybark), *Corymbia intermedia* (pink bloodwood), *Eucalyptus crebra* (narrow-leaved ironbark), *Corymbia citriodora subsp variegata* (spotted gum) and *Melaleuca quinquenervia* (broad leaved paperbark) in south-east Queensland (Eyre et al. 2022). However, this list is not exclusive and the document (*ibid*) lists a number of other species.

Only remnant vegetation and to a lesser extent HVR should be considered suitable habitat as regrowth vegetation generally has not reached the structural maturity required to support greater glider. However, it may do so in the future.

There is no way to include hollow-presence in this mapping; a precautionary approach has been applied by assuming all remnant vegetation has suitable hollows. With this assumption, the total extent of Remnant and High Value Regrowth REs containing favoured tree species within 25 km of the site has been assessed (**Figure 41**). The extent of high and moderate amenity remnant REs is 53,998 ha (27.5%) and low amenity (emerging habitat) High Value Regrowth (future potential) is 14,781 ha (7.5%) of the search area.

Although greater glider may occur in home ranges as little as 1-4 ha, viable populations require a minimum of 160 ha of contiguous vegetation. Contiguous forests of this size within the local landscape are represented to the west and south of the ORS, but not on the Offset Site.

105: in early November 2023, the PD Report for this referral was substantially advanced and on public advertising (1 November – 15 November).

(c) Site resources

The offset site is located on a sandstone ridge supporting the same pre-clear regional ecosystem as the development site (RE12.9-10.2). The offset site has had a substantial disturbance history and is now largely mapped as 'Category X' on the Regulated Vegetation Management Map (**RVMM**) (see **Inset 15**). Clearing of Category X areas is not regulated by the VMA, which is illustrated by selective timber harvesting and clearing for pasture maintenance on nearby land (see Attachment 4 of **Appendix 40**).

Some parts of the offset site have regenerated to the extent that they are now defined as HVR on the RVMM. Clearing of these areas is regulated under the VMA, but this does not prohibit continued grazing. Further, the patches are small, and, adopting the edge effect impact identified by Youngentob et al (2012), would not provide suitable habitat for Greater glider. Even though these patches will continue to mature under the protections of the VMA, maintenance of the surrounding KoalaFund lands for grazing (and potentially timber harvesting) will see the HVR patches forever functionally isolated as Greater glider habitat. The hollows in these trees will only provide denning habitat for Greater glider under the Proponent's offset proposal. Therefore, they are included in the offset calculations.

A tree survey was undertaken to map all trees > 300 mm DBH across the offset site The data were sorted in GIS to identify trees > 500mm DBH. Foraging habitat (>300 mm DBH) and potential denning habitat (>500 mm DBH) after Eyre et al. 2022. Presence of these trees or structural attributes are not confirmation of habitat but are indicators of potential suitability. Tree data are spatially represented as **Figure 43a-d** and tabulated in **Table 24**.

Table 24: Greater Glider Habitat Trees at Impact Site (after Eyre et al. 2022)

Species	Common name	Potential forage trees (mm DBH)	Potential habitat trees (mm DBH)		
		300-500	501-750	751-1,000	>1,001 mm
Angophora subvelutina	Broad-leaved apple	102	31	3	1
Corymbia citriodora	Spotted gum	536	511	82	18
Corymbia clarksoniana	Long-fruited bloodwood	0	1		
Corymbia intermedia	Pink bloodwood	74	43	14	1
Corymbia tessellaris	Moreton Bay ash	58	25	2	
Corymbia trachyphloia	Brown bloodwood	1			
Eucalyptus carnea	Broad-leaved mahogany	6	13	2	
Eucalyptus crebra	Narrow-leaved ironbark	71	71	24	4
Eucalyptus sp.	An unidentified eucalypt	0	1		
Eucalyptus microcorys	Tallowwood	0	1		
Eucalyptus tereticornis	Queensland blue gum	95	76	21	1
Lophostemon suaveolens	Swamp box	38	11	3	
Dead tree		0	6	5	5

Species	Common name	Potential forage trees (mm DBH)	Potential habitat trees (mm DBH)		
		300-500	501-750	751-1,000	>1,001 mm
Total		981	790	156	30

There are 981 trees 300-500 mm DBH (refer **Figure 43a**), 790 trees 501-750 mm DBH (refer **Figure 43b**), 156 trees 751-1,000 mm DBH (refer **Figure 43c**), and 30 Trees greater than 1,001 mm DBH (refer **Figure 43d**).

While not part of the formal conservation advice for Greater glider, DEECCW also relies on the document *Guide to Greater Glider Habitat in Queensland*. This document states that "on average, trees greater than 500 mm DBH appear to be important for use by Greater glider as den trees". There are 976 such trees at the Site. It is important to note that 500 mm is the lower limit of trees that are typically starting to develop hollows. It does not necessarily mean that all such trees actually support such hollows.

Site analysis shows that there are many large trees surrounded by scattered young regrowth, or which are isolated paddock trees. While these trees support large hollows suitable for greater glider, the lack of adjoining feed trees of suitable size (>300mm DBH) means that they have supressed 'ecological context'. Under a status quo scenario in which the site continues to be managed as a grazing property, these trees would be lost or remain unengaged / unavailable to greater glider. The offset will conserve these trees and, through the restoration works, provide them with ecological context for Greater glider, and an ecologically meaningful outcome established.

Facilitating the recovery of connective habitat is critical as this will provide forage habitat and bring 'ecological context' to the otherwise isolated denning habitat trees. During the inspection of the offset site with DCCEEW, concern was expressed that some areas were not exhibiting strong regrowth. This issue is dealt with in the accompanying 'Technical Note on Natural Regeneration in 'Gaps' at the Offset Site' (17 November 2023). This document contains an analysis of the offset site's disturbance history and the capacity of the gaps to support tubestock planting. Elsewhere, the offset will primarily rely on managed natural regeneration. The natural regenerative capacity of the offset site under an unregulated grazing regime and challenging climatic conditions (2016-2021) is illustrated by historical aerial phoitographic analysis (Attachment 5 to **Appendix 40**) and natural regeneration counts (**Appendix 28**), and it is likely, that with the exclusion of grazing on the ORS, the trajectory of recovery will continue. The offset management plan describes works proposed to facilitate the regeneration. Regeneration sufficient to create connective habitat is expected to take ~20 years.

(d) Denning habitat investigations

To determine the occurrence of hollows with the requisite entrance size, all trees > 700 mm DBH (n = 240) were inspected by climbing arborists. Imagery of this effort is provided as Attachment 6 to **Appendix 40**.

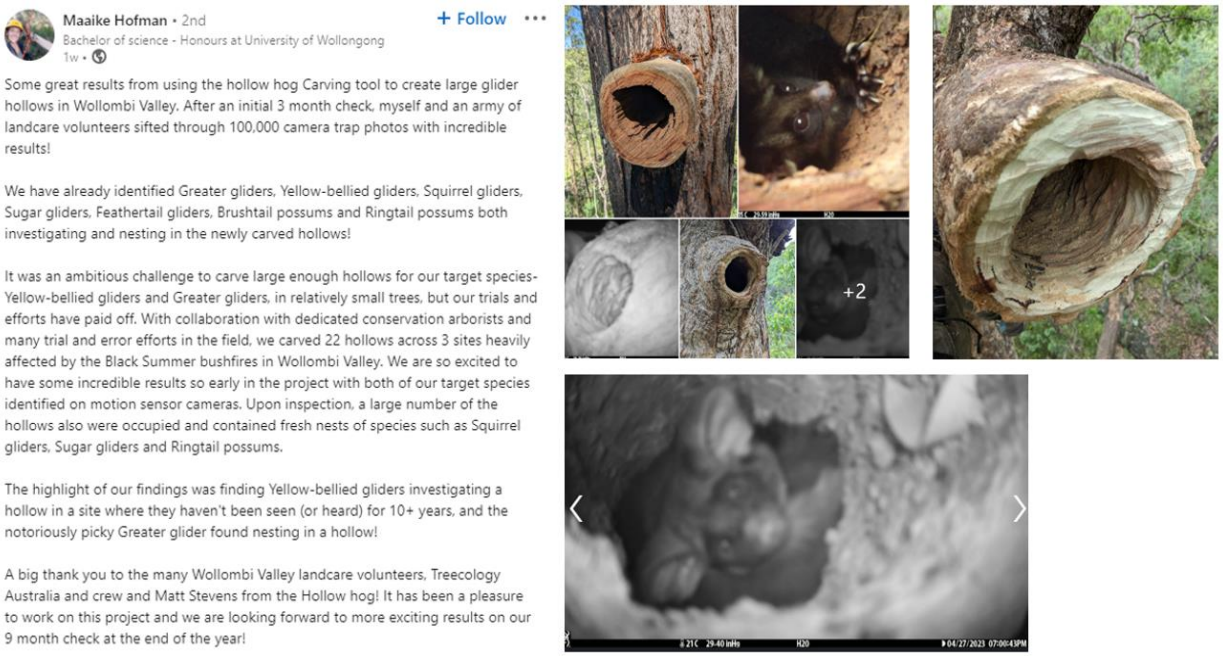
For the smaller 500 mm – 700 mm DBH size class, where experience shows there to be a lesser degree of hollow formation, a drone was used to conduct initial hollow inspections. 34% of trees in this size class were assessed before the drone was attacked (and destroyed) by a raptor. Notwithstanding, the sample

size achieved to that point is similar to that accepted by DCCEEW elsewhere. The investigation yielded 17 trees for closer assessment by the climbing arborists.

Survey data was sorted to identify suitable hollows (as defined above, and with upright hollows excluded) (**Suitable Hollows**) (n = 94) (**Figure 52,** and Schedule 2 to **Appendix 40**). Some hollows were found to fail the suitable hollow dimensions only marginally. The entrance dimensions were frequently suitable, but the depth was insufficient (often < 200 mm shorter than the minimum chamber depth). These hollows can be deepened by using the hollow hog tool, or chainsaw cut hollow techniques (refer to Arbor Australis advice in Attachment 7 of **Appendix 40**) (Amendably Suitable Hollows) (n = 38) (**Figure 53** and Schedule 5 to **Appendix 40**).

Arbor Australis was engaged to assess the suitability of trees to accommodate newly constructed hollows, these being: cut and drilled branch end hollows; exposure of expected internal hollows indicated by swollen unions; and constructed trunk hollows. The methods and findings of the Arbor Australis assessment are provided in Attachment 7 to **Appendix 40**. **Figure 54** shows the identified opportunities (n = 73). Recent grey literature identifies the successful establishment of greater glider denning habitat using the Hollow hog carving tool (**Inset 16**), providing evidence that artificial hollow creation benefits this species.

While the remaining trees do not presently support suitable denning hollows, many are late mature or over-mature trees with a strong propensity to produce future hollows. There are 134 such trees in the > 700 mm DBH size classes (**Figure 55**). The occurrence of these trees provides a benefit that supplements the formal offset and further underpins the offset site's 'suitability'.



Inset 16: Recent grey literature on greater glider use of artificial habitat

(c) Facilitating the recovery of foraging and connective habitat

Facilitating the recovery of connective habitat is critical as it is this that will provide forage habitat and bring 'ecological context' to the otherwise isolated denning habitat trees. During the inspection of the offset site with DCCEEW, concern was expressed that some areas that were not exhibiting strong regrowth. This issue is dealt with in the 'Technical Note on Natural Regeneration in 'Gaps' at the Offset Site' (**Appendix 39**). This document contains an analysis of the offset site's disturbance history and the capacity

of the gaps to support tubestock planting. Elsewhere, the offset will primarily rely on managed natural regeneration. The natural regenerative capacity of the offset site under an unregulated grazing regime and challenging climatic conditions (2016-2021) is illustrated by Attachment 5 to **Appendix 40**. The offset management plan describes works proposed to facilitate the regeneration. Regeneration sufficient to create connective and foraging habitat is expected to take 20 years.

(c) Provision of denning habitat

Synopsis

Due to the different forms of management proposed, there is a requirement to populate the Offsets assessment guide with three 'offset components'. While the amendably suitable branch hollows and other constructed hollows can be established in Year 1 of the offset, benefits will not arise until near the end of the management program (year 20) because there will be insufficient connective habitat to access the hollows. As described in **Section 7.5.4 (d)**, it is expected that the connective habitat required for occupation will take ~ 20 years to develop. The cumulative benefit of offset Components A-C achieves 148.25% of the Offsets Assessment Guide offset requirement.

Component A

Component A comprises 94 Suitable branch hollows (**Figure 52**) that will be protected and provided with ecological context.

Component B

Component B comprises 38 Amendably suitable branch hollows (**Figure 53**) that will be protected and provided with ecological context.

Component C

Component C comprises 73 constructed hollows (refer Arbor Australis report – Attachment 7 of **Appendix 40**) that will be constructed and provided with 'ecological context' (**Figure 54**). ORS Habitat Quality.

7.5.5 Modified Habitat Quality Assessment Tool

The offset Site has been assessed using a modified version Queensland Government Guide to Determining Terrestrial Habitat Quality: A toolkit or assessing land-based offsets under the Queensland Environmental Offsets Policy (Version 1.2).

The MHQA assessment methodology used to assess habitat quality for the Offset Site is identical to that used for the Impact Site, as described in **Section 5.2.2** for koala, **Section 5.3.2** for grey-headed flying-fox and **Section 5.4.2** for greater glider.

Landscape context showing the extent of Remnant and High Value Regrowth within the region is presented as **Figure 44**.

For the purpose of determining Site Context scoring within the MHQA framework, GIS analysis of Patch Size (**Figure 45**), Connectedness (**Figure 46**) and Context (**Figure 47**), was undertaken.

7.5.6 ORS Assessment Units

(a) BioCondition Assessments

Determination of the ORS AUs was informed by inspection and interrogation of State Government remnant vegetation and pre-clear mapping data sets, project specific drone photography, pre-BioCondition orientation site inspection 7 April 2023 and BioCondition survey work conducted over the period 2-20 May 2023.

At the Offset Site 19 MHQA transects (the Assessment Site's) were applied across three (3) Assessment Units the offset site to determine the starting quality of habitat on the offset site. Units and Assessment Site's are shown in **Figure 48**. The three assessment units reflective of historic site disturbance have been identified.

The relationship between Regional Ecosystems, Assessment Units, Vegetation Communities and The Modified Habitat Quality Assessment (**MHQA**) sites is outlined in **Table 25** with sampling effort compliance against the requirements of HQA version 1.2 shown in **Table 26**. MHQA assessment sites and Assessment units are presented as **Figure 48**.

Table 25: Relationship between Regional Ecosystems, Assessment Units, Vegetation Communities and MHQA Assessment Sites – Offset Receiving Site (ORS)

AU	Description	Reg Veg Status	Pre-clear RE	Biocon-Sites	
				East	West
1a	Remnant 12.9-10.2	Cat B	12.9-10.2	3, 4	n/a
1b	Regrowth 12.9-10.2	Cat R	12.9-10.2	1, 2	11, 12, 13
2	Young regrowth 12.9-10.2	Cat X	12.9-10.2	14, 15, 18	5, 7, 9
3	Pastural grassland	Cat X	12.9-10.2	16, 17, 19	6, 8, 10

Table 26: MHQA Sampling for Each AU Expressed as Total Area of Assessment Units Sampled

ORS AU	Total Area (ha)	Number of plots	Total plot area (ha)	Percentage of AU Sampled (%)	HQA version 1.2 Notes
1a	7.11	2	1.0	14.1	Suggested minimum number of sampling sites for units of 0-50 ha is 'at least 2. This may be streamlined if it can be demonstrated a polygon is uniform in condition
1b	21.07	5	2.5	11.9	
2	71.21	6	3.0	4.2	
3	84.93	6	3.0	3.5	

The sampling undertaken meets the recommended requirements for sampling sites identified by the HQA version 1.2.

(b) Baseline Weed and Canopy Species Recruitment Survey

In addition to the data collected by the standard BioCondition assessment, field data collection at BioCondition sites was modified (added to) to include measures of weed abundance and quantification of recruitment (stems less than 50 mm DBH).

Additionally, baseline recruitment and weed data was collected over the period 2-20 May 2023 from twenty-nine (29) 50 x50 m assessment plots deployed within young regrowth (AU2 – twelve plots) and pastural grassland (AU3 – 17 plots). In the field, all recruitment was identified to species level and enumerated. All weed species were identified and qualitative abundance measures applied. The plots locations are identified by **Figure 43**.

Data are discussed in the Assessment Units, with synthesised field data is contained in **Appendix 27** (BioCondition data sheets), **Appendix 28** (Canopy Recruitment) and **Appendix 29** (Baseline Weeds).

The purpose of this data collection was to establish an understanding of management actions necessary for the purpose of activating the offset.

(i) Canopy Recruitment

Weed assessment was assessed over 48 unique assessment locations (refer **Figure 43**). On account of the comparatively small size of patches comprising AU1 and observed variability of regrowth within AU2 and 3, quadrats were only deployed in areas of young regrowth / pastural grassland.

Unsurprisingly, recruitment levels were greatest in proximity to well established mature canopy trees. Standardised recruitment in the vicinity of AU1 (Remnant and High Value Regrowth RE12.9-10.2) ranged 1,330-1,373 stems / ha (ave. 1,324), with very little variation between the eastern and western offset locations.

AU2 comprising young regrowth RE12.9-10.2 showed variability between eastern and western patches; 647 stems / ha ion the east and 900 stems / ha in the west (ave. 773). This discrepancy in the east is believed to be an artifact of quadrat location with most being placed to the west of patches (i.e. up wind of prevailing westerly winds).

The least recruitment occurred (unsurprisingly) in cleared pastural grasslands. These results have practical implications for the ecological restoration on the site, indicating that greatest intervention (with respect to direct seeding and planting) needs to occur within AU3.

These matters are further explored in the Offset Area Management Plan (**Appendix 25**).

(ii) Weeds

Weed assessment was assessed over 48 unique assessment locations (refer **Figure 43**). On account of the comparatively small size of patches comprising AU1 and observed variability of regrowth within AU2 and 3, quadrats were only deployed in areas of young regrowth / pastural grassland.

In the field, three qualitative measures of abundance were applied, being (rankled from lowest to highest); occasionally found (O), commonly found (C) and abundant (A).

Three WoNS are present on site:

- *Lantana camara* (lantana) occurring as isolated individual and thickets in all Assessment Units (AU1-3). Abundance measures range from common to abundant, with highest densities in AU3, found in 46 locations (96% of sample sites).

- *Opuntia stricta* (prickly pear) occurs as isolated individuals, occasionally encountered in AU1b, and occasionally to commonly found in AU3, found in 9 location (19% of sample plots).
- *Senecio madagascariensis* (fire weed) which is sparsely distributed and occasionally encountered four locations within the Eastern portion of the offset area (AU1a, AU2 and AU3) (8% of sample sites).
- *Opuntia tomentosa* (velvety tree pear) was found at one location (occasional) in AU2, found at 1 location (2% of sample sites).

These matters are further explored in the Offset Area Management Plan (**Appendix 25**).

(c) Tree Survey

Detailed habitat tree survey was undertaken over the period 2-20 May 2023. This involved the identification and mapping of all trees above 300 mm diameter at breast height (**DBH**).

(d) Baseline Camera Trapping

Terrestrial / arboreal (non-avian) fauna species data presented herein was collated from site observation and camera trapping at 25 locations on the site (see attached **Figure**). Camera traps distributed throughout both the eastern and western portions of the ORS from the 19th of June to the 5th of July (375 trap nights). Weather during this period was fine and mild with temperatures ranging ~5ºC (overnight) to low 20's during daytime. With respect to exotic species:

- *Bos taurus* (cattle) were observed in cameras at 48% of the trap sites. These pose a threat to ecological restoration success.
- *Rattus rattus* (black rat) were observed at 20% of the trap sites. These pose a threat to ecological restoration success.
- *Canis lupis familaris* (wild dogs) were observed at 16% of the trap sites. These pose a predator threat.
- *Vulpes vulpes* (European fox) were observed at 16% of the trap sites. These pose a predator threat.
- *Lepus capensis* (European hare) were observed at 16% of the trap sites. These pose a browsing threat.
- *Cervus timorensis* (rusa deer) were observed at 8% of the trap sites. These pose a browing and trampling threat to ecological restoration success.

Additionally, *Felis catus* (feral cat) which pose a predator and disease threat, *Cervus elaphus* (red deer) which pose a browsing and trampling threat to revegetation, *Sus scrofa* (pig) and, *Rhinella marina* (cane toad) were observed.

The predators are of consideration when calculating MHQA scores, particularly the site context measures). These matters are further explored in the Offset Area Management Plan (**Appendix 25**).

Baseline camera trapping also identified useful information to native fauna presence, with a number of species observed being those that require specific habitat features or good habitat structural diversity. Such species include *Aepyprymnus rufescens* (rufouis bettong), *Antechinus flavipes flavipes* (yelloy footed antechinus), *Perameles nasuta* (long nesed bandicoot), *Phascogale tapoatafa* (brush tailed phascogale) and *Tachyglossus aculeatus* (short beaked echidna). Their presence indicates high residual naturalness measure which would only be enhanced through strategic restoration and ecological restoration of the site. These are identified in **Appendix 30**.

(e) Assessment Units

(i) Offset Receiving Site - Assessment Unit 1

ORS AU1 consists of Remnant (AU1a – 7.11 ha) and High Value Regrowth (AU1b – 21.07 ha) RE12.9-10.2 occurring on a variety of topographic positions and aspects from ridge crests, upper slopes, lower slopes and along incised order 1 eroding stream channels on sedimentary geology (Land Zone 9-10). Canopy species include C*orymbia citriodora subsp. variegata* (spotted gum) and *Eucalyptus crebra* (narrow-leaved ironbark). Other species may include *Eucalyptus tereticornis* (Queensland blue gum), *Corymbia intermedia* (pink bloodwood), *Corymbia tessellaris* (Moreton Bay ash), *Angophora subvelutina* (broad-leaved apple) with *Lophostemon suaveolens* (swamp box) present along waterways. Canopy species on crests and upper slopes tends to be dominated by spotted gum and narrow-leaved ironbark, with Queensland blue gum and broad-leaved apple more prevalent on lower slopes and along waterways.

The subcanopy species includes regenerating canopy species and *Allocasuarina torulosa* (rose oak) and the groundlayer is significantly comprised on native graminoides and forbs (RE12.9-10.2). This AU comprises 28.18 ha or 13.5% of the proposed offset area.

The canopy and sub-canopy layer is well established, though cover is patchy on account of past thinning / clearing. Large (eucalypt) trees range 28-38 trees/ha in the east and 14-22 trees/ha in the west.

Tree canopy species, shrub, graminoid and forb richness are high, as is native grass and shrub cover. Non-native plant coverage ranges 25-70%, with higher levels reflective patchiness in canopy coverage and associated with exotic pasture grasses and woody weeds.

*Lantana camara** (lantana) a WoNS can be common and thicket forming. The exotic pasture grass is abundant. *Opuntia stricta** (prickly pear) and *Senecio madagascariensis** (fireweed) both WoNS and *Lantana modividensis** (creeping lantana) which is a State restricted pest are occasionally present.

Canopy species recruitment within AU1 is in the order of 1300-1400 stems/ha.

Photographic images representing AU1 are presented in **Plates 9** and **10** (below).

Plate 9 ORS AU1, Assessment Site 3 (view to north)

Plate 10: ORS AU1, Assessment Site 2 (view to south)

(ii) Offset Receiving Site – Assessment Unit 2

ORS AU2 consists of young RE12.9-10.2 regrowth similarly occurring on a variety of topographic positions and aspects from ridge crests, upper slopes, lower slopes and along incised order 1 eroding stream channels on sedimentary geology (Land Zone 9-10).

The canopy consists of C*orymbia citriodora subsp. variegata* (spotted gum) and *Eucalyptus crebra* (narrow-leaved ironbark). Other species may include *Eucalyptus tereticornis* (Queensland blue gum), *Corymbia intermedia* (pink bloodwood), *Corymbia tessellaris* (Moreton Bay ash) and very occasionally *Angophora subvelutina* (broad-leaved apple) and *Allocasuarina torulosa* (rose oak) open forest 4-8 m height. Subcanopy and shrublayer species include regenerating canopy species and the groundlayer is variable ranging from areas dominated by native graminoides and forbs to exotic pasture grasses (analogous with RE12.9-10.2). AU2 comprises 71.21 ha and 38.6% of the proposed offset site area.

The canopy and sub-canopy layer is very sparse with canopy cover very patchy on account of past thinning / clearing. Large (eucalypt) trees range 10-16 trees/ha in the east and 0-4 trees/ha in the west.

The number of tree canopy and shrub species present, and native grass and shrub cover is suppressed on account of past clearing, however conversely, graminoid and forb species richness is high. Non-native plant coverage ranges 10-60%, with higher levels reflective of a sparse canopy coverage (low levels of ground strata shading) resulting in high levels of exotic pasture grasses. *Lantana camara** (lantana) can forms thickets.

*Lantana camara** (lantana) a WoNS can be common and thicket forming. The exotic pasture grass is abundant. *Opuntia stricta** (prickly pear)*, Opuntia tomentosa* (velvety tree pear) and *Senecio madagascariensis** (fireweed) all WoNS and *Lantana modividensis** (creeping lantana) and *Sporobolus natalensis** (giant rat's tail grass) both State restricted pests are occasionally present. Canopy species recruitment within AU2 is in the order of 585-625 stems/ha.

Photographic images representing AU2 are presented in **Plates 11-12** (below).

Plate 11: ORS AU2, Assessment Site 7 (view to north-west)

Plate 12: ORS AU2, Assessment Site 9 (view to north-east from centre of plot).

(iii) Offset Receiving Site - Assessment Unit 3

ORS AU3 consists of derived pastural grassland of exotic and native species occurring on a variety of topographic positions across the site on sedimentary geology (Land Zone 9-10). The pre-clear regional ecosystem is RE12.9-10.2 and relict paddock trees, canopy recruitment and groundcover species are reflective of this. AU3 comprises 84.93 ha and 46.1% of the proposed offset site area.

The canopy and sub-canopy layer is mostly absent on account of past thinning / clearing. Large (eucalypt) trees are absent. The number of canopy and shrub species present, and native grass and shrub cover is suppressed on account of past clearing. There is high variability in native grass species richness and native species richness is consistently high. Non-native plant coverage ranges 55-65%, with high levels of exotic pasture grasses.

*Lantana camara** (lantana) a WoNS can be common and thicket forming. The exotic pasture grass is abundant. *Opuntia stricta** (prickly pear), *Opuntia tomentosa* (velvety tree pear) and *Senecio madagascariensis** (fireweed) all WoNS and *Lantana modividensis** (creeping lantana) and *Sporobolus natalensis** (giant rat's tail grass) both State restricted pests are occasionally present. Canopy species recruitment within AU3 is in the order of 89-309 stems/ha. Photographic images representing AU3 are presented in **Plates 13-14** (below).

Plate 13: ORS AU3, Assessment Site 6 (view to north-west from start of transect)

Plate 14: ORS AU1, Assessment Site 10 (view west from centre of transect)

7.5.7 Results

(a) Koala

(i) Methodology

In order to determine the quantum and quality of the habitat suitable for koala at the Offset Site, vegetation/habitat quality was derived from the Modified Habitat Quality Assessment tool. This assessment approach utilises the Queensland BioCondition Assessment method combined with Site context and species stocking rate assessments to determine the habitat quality of the referral area.

Modified Habitat Quality Assessment

The traditional terrestrial habitat quality assessment assesses three (3) core indicators—Site condition, Site context and species habitat index.

The modified habitat quality assessment combines the three (3) core indicators into two (2) (Site condition and Site context) with each Site Condition being weighted 30% of the final score and Site Context being weighted 30% of the final score. The balance of the weighting (40%) has been attributed to the third indicator which is independent of the traditional habitat quality assessment, being species stocking rate.

The species stocking rate has been added to the MHQA to better incorporate MNES, and for the purpose of this preliminary documentation, the endangered-listed koala MNES. The following section details the methodology utilised to assess the Site condition, Site context and species stocking rate under the MHQA.

Site Condition (30%)

Assessing Site condition is an integral step in determining specific quantification of impacts, while also determining whether an offset Site is suitable to establish a desired capacity to support the prescribed environmental matters being offset. The on-Site condition is a key element of habitat quality and has a direct influence on the biodiversity it supports. Site condition is assessed using a suite of attributes to describe the structure and function of the vegetation community and is benchmarked against the expected range for a relatively undisturbed community. The Site condition assessment under the MHQA is assessed using fifteen (15) condition characteristics being:

- recruitment of woody perennial species in the ecologically dominant layer (EDL)
- native plant species richness – trees
- native plant species richness – shrubs
- native plant species richness – grasses
- native plant species richness – forbs
- tree canopy height
- sub-canopy cover
- tree canopy cover
- native grass cover
- organic litter
- large trees
- coarse woody debris
- non-native plant cover
- quality and availability of food and foraging habitat
- quality and availability of shelters.

Site Context (30%)

The Site context assessment deals with the Site and its adjacent surroundings. Site context is measured using a suite of attributes to describe the location of the habitat within the surrounding landscape and the influence of its associated threats. This assessment also considers the influence of adjacent vegetated areas and ecological corridors. Under the MHQA, Site context is measured using the following seven (7) characteristics:

- size of patch (refer **Figure 44** with annotations showing analysis)
- connectedness (refer **Figure 45** with annotations showing analysis)
- context (refer **Figure 46** with annotations showing analysis)
- ecological corridors (Biodiversity Corridor) (refer **Figure 30**)
- role of Site location to species overall population in the state
- threats to the species
- species mobility capacity.

Unlike the traditional habitat quality assessment methodology where Site connectedness is assessed against the surrounding remnant vegetation only, the MHQA Site connectedness is assessed against the surrounding MNES habitat, in this instance, Koala Habitat. Whilst remnant eucalypt forest vegetation is critical habitat for koala, equally Koalas can utilise areas of non-remnant vegetation or high value regrowth vegetation that does not yet achieve remnant status. Therefore, Site context under the MHQA accounts for surrounding species habitat rather than remnant vegetation. In developing the MHQA, three (3) species

habitat index characteristics were nominated, role of Site location to overall species population in the state, threats to the species and species mobility capacity.

Species Stocking Rate (40%)

The MHQA incorporates species stocking rate as an attribute not discussed under the traditional terrestrial habitat assessment methodology. Species stocking rates are estimates of the koala carrying capacity of the Site at the time of undertaking the survey. Given the discreet nature of the koala and limited to no published literature on habitat carrying capacity of the species, the species stocking rate scoring methodology has been derived through the collation of site-specific surveys and surrounding contextual habitat analysis. **Table 27** outlines the attributes utilised to assess species stocking rate.

Table 27: Species Stocking Rate Scoring - Koala

Attribute	Possible maximum score
Species stocking rate table	
Presence detected on or adjacent to Site (neighbouring property with connecting habitat)	Score out of 10
Species usage of the Site (habitat type and evidenced usage)	Score out of 15
Approximate density (per ha)	Score out of 30
Species stocking rate supplementary table	
Key source population for breeding (/10)	
Key source population for dispersal (/5)	
Necessary for maintaining genetic diversity (/15)	
Near the limit of the species range (/15)	
SSR[106] Supplementary Table Score (from the four features above)	Score out of 15
Total Species Stocking Rate Score	Score out of 70
Species stocking rate	**Score out of 4**

(ii) Findings

Given the discreet nature of the koala and limited to no published literature on habitat carrying capacity of the species, the species stocking rate scoring methodology has been derived through the collation of site-specific surveys and surrounding contextual habitat analysis. As outlined in Section 6.5.1, koala utilisation of the locality was directly observed by spotlighting efforts in high value regrowth associated with the western precincts of the ORS.

The starting habitat quality scores for each assessment unit, combining Site Condition, Site Context and Species Stocking Rate are reported in **Appendix 31**. A summary of the scores is presented as **Table 28.** The scores for Site Condition are derived directly from the MHQA Tool data. These scores are then used

106: Species Stocking Rate

to determine the scores for Quality and Availability of Food and Foraging Habitat, and Quality and Availability of Shelter.

This score is calculated based on the combined weighted habitat quality scores for each assessment unit. **Appendix 31.1** provides annotated justification for scoring against.

Table 28: Koala Modified Habitat Quality Assessment – Offset Receiving Site

Habitat quality score weighted	ORS AU1	ORS AU2	ORS AU3	Total
Site condition score (out of 3)	2.33	1.62	0.67	1.54
Site context score (out of 3)	1.65	1.43	0.86	1.31
Species Stocking Rate Score (out of 4)	2.29	2.29	2.29	2.29
Habitat Quality score (out of 10)	6.27	5.33	3.81	5.10
Assessment Unit area (ha)	28.18	71.21	84.93	184.32
Total Impact Area (ha) for this MNES	184.31	184.31	184.31	184.32
Size Weighting	0.15	0.39	0.46	1.00
Total Weighted Habitat Quality Score	**4.77**			

The Site was given an overall weighted habitat quality score of 4.77 out of the total of 10 which rounds to 5 out of 10 which is considered a moderate habitat quality score. This score is calculated based on the combined weighted habitat quality scores for each assessment unit.

(b) Grey-headed flying-fox

(i) Methodology

Modified Habitat Quality Assessment

In order to determine the quantum and quality of the habitat suitable for Grey-headed flying fox on-Site, vegetation/habitat quality was derived from the Modified Habitat Quality Assessment (**MHQA**) tool. This assessment approach utilises the Queensland BioCondition Assessment method combined with Site context and species stocking rate assessments to determine the habitat quality of the referral area.

While it is acknowledged that BioCondition surveys capture important on-ground metrics of an Assessment Unit holistically, some metrics are not entirely relevant to certain matters while equally other metrics are more relevant in their significance. For example, and of relevance to this Project, the grey-headed flying-fox has markedly different habitat and resource requirements to small terrestrial species (e.g. fossorial skinks or *Dasyurids*). This is exemplified in the published literature prepare by Eby and Law (2008) which focuses on how important the flowering efficacy, production and biological timing of flowering are critical for the persistence of Grey-headed flying-foxes along the eastern coast of Australia; while the National Recovery Plan further highlights roosts and foraging resources within 20 km of them are critical. It is also important to note, this species forages across all landscape typologies relative to the proportion of the habitat type (Westcott et al. 2015).

As such, consideration of specific metrics being assigned an alternate scoring application (higher or lower score in the overall attributes) or weighting within the MHQA must be considered (e.g. increased or decreased in their line itemised score within the MHQA). Alternate scoring methodologies or amendments to the weighting should be in line with the DCCEEW's 'How to use the Offset Assessment Guide' and 'Environmental Offsets Policy' while utilising key elements of the relevant matters SPRAT, Conservation Advice/ Recovery Plan and published scientific literature.

A detailed outline of the devised alternate scoring is contained in **Appendix 18.**

Site Condition (40%)

Assessing Site condition is an integral step in determining specific quantification of impacts, while also determining whether an offset Site is suitable to establish a desired capacity to support the prescribed environmental matters being offset. The on-Site condition is a key element of habitat quality and has a direct influence on the biodiversity it supports. Site condition is assessed using a suite of attributes to describe the structure and function of the vegetation community and is benchmarked against the expected range for a relatively undisturbed community.

The Site condition assessment under the grey-headed flying-fox alternate method habitat quality assessment is assessed against using fifteen (15) condition characteristics being:

- recruitment of woody perennial species in the ecologically dominant layer (EDL)
- native plant species richness – trees
- native plant species richness – shrubs
- native plant species richness – grasses
- native plant species richness – forbs
- tree canopy height
- sub-canopy cover
- tree canopy cover
- native grass cover
- organic litter
- large trees
- coarse woody debris
- non-native plant cover
- quality and availability of food and foraging habitat – Alternative Scoring Method
- quality and availability of shelters – Alternative Scoring Method.

The total Site Condition Score is measured out of 180 to accommodate the alternate quality and availability of food and foraging and availability of shelter scores.

To better reflect attributes that are of greater significance to the Grey-headed flying-fox, it is important understand what is key elements for habitat that are critical to the survival of the Grey-headed flying-fox. The National Recovery Plan defines this as:

Where the existence of these important winter and spring flowering vegetation communities[107] is verified in the field, they are considered habitat critical to the survival of the Grey-headed Flying-fox. Back yard fruit trees, orchards or non-native trees that may be used for foraging are not considered to be habitat critical to the survival of the Grey- Headed Flying-Fox.

Alternate quality and availability of food and foraging habitat metrics (scored out of 80 whereas traditional MHQA is 10), is based upon the quality of flowering resources at the site contain native species that are known to be productive as foraging habitat during resource bottlenecking (i.e. winter) and the final weeks of gestation, and during the weeks of birth, lactation and conception (August to May). Quality and availability of shelter is determined by presence of known camps within 25 km.

Total weighting is 40% in contrast to the Traditional MHQA (which is 30%).

107: Refer species lists of important flowering trees in: Eby and Law (2008); Eby 2016; Eby *et al*. (2019)

Site Context (30%)

The Site context assessment deals with the Site and its adjacent surroundings. Site context is measured using a suite of attributes to describe the location of the habitat within the surrounding landscape and the influence of its associated threats. This assessment also considers the influence of adjacent vegetated areas and ecological corridors. Under the MHQA, Site context is measured using the following seven (7) characteristics:

- size of patch (refer **Figure 44** with annotations showing analysis)
- connectedness (refer **Figure 45** with annotations showing analysis)
- context (refer **Figure 46** with annotations showing analysis)
- ecological corridors (Biodiversity Corridor) (refer **Figure 30**)
- role of Site location to species overall population in the state
- threats to the species
- species mobility capacity.

Unlike the traditional habitat quality assessment methodology where Site connectedness is assessed against the surrounding remnant vegetation only, the MHQA Site connectedness is assessed against the surrounding MNES habitat, in this instance, grey-headed flying-fox Habitat. Whilst remnant eucalypt forest vegetation with winter flowering resources is critical habitat for Grey-headed flying-foxes, equally they can utilise areas of non-remnant vegetation or high value regrowth vegetation that does not yet achieve remnant status. Therefore, Site context under the MHQA accounts for surrounding species habitat rather than remnant vegetation. In developing the MHQA, three (3) species habitat index characteristics were nominated; role of Site location to overall species population in the state, threats to the species and species mobility capacity.

Alternative methods for assessing the attributes *role of site to species overall population in the state* and *threats to the species* have been modified to reflect their importance to Grey-headed flying-fox and its biological/ ecological values. These are discussed in detail in **Appendix 18**.

Species stocking rate (30%)

The MHQA incorporates species stocking rate as an attribute not discussed under the traditional terrestrial habitat assessment methodology. Species stocking rates are estimates of grey-headed flying-fox carrying capacity of the Site at the time of undertaking the survey. Given the discreet nature of the grey-headed flying-fox and limited to no published literature on habitat carrying capacity of the species, the species stocking rate scoring methodology has been derived through the collation of site-specific surveys and surrounding contextual habitat analysis. **Table 29** outlines the attributes utilised to assess species stocking rate.

Table 29: Species Stocking Rate scoring - Grey-headed flying-fox

Attribute	Possible maximum score
Species stocking rate table	
Presence detected on or adjacent to Site (neighbouring property with connecting habitat)	Score out of 10
Species usage of the Site (habitat type and evidenced usage)	Score out of 15
Approximate density (per ha)	Score out of 30
known nationally important / camps within 25 km *– subscore out of 15*	

Attribute	Possible maximum score
presence of foraging habitat (state mapped) within the site *- subscore out o 15*	
Species stocking rate supplementary table	
Key source population for breeding (/10)	
Key source population for dispersal (/5)	
Necessary for maintaining genetic diversity (/15)	
Near the limit of the species range (/15)	
SSR[108] Supplementary Table Score (from the four features above)	Score out of
Total Species Stocking Rate Score	Score out of 70
Species stocking rate	**Score out of 3**

Total Species Stocking Rate weighting is 30% in contrast to the Traditional MHQA (which is 40%).

(ii) Findings

The starting habitat quality scores for each assessment unit, combining Site Condition, Site Context and Species Stocking Rate are reported in **Appendix 32**.1. A summary of the scores is presented as **Table 30**. The scores for Site Condition are derived directly from the MHQA Tool data. These scores are then used to determine the scores for Quality and Availability of Food and Foraging Habitat, and Quality and Availability of Shelter.

This score is calculated based on the combined weighted habitat quality scores for each assessment unit. **Appendix 32.2** provides a annotated justification for scoring against:

Table 30: Grey-headed Flying-fox Modified Habitat Quality Assessment – Offset Receiving Site

Habitat quality score weighted	ORS AU1	ORS AU2	ORS AU3	Total
Site condition score (out of 3)	2.28	1.84	0.57	1.57
Site context score (out of 3)	1.03	0.99	0.88	0.96
Species Stocking Rate Score (out of 4)	1.71	1.71	1.71	1.71
Habitat Quality score (out of 10)	5.02	4.55	3.16	4.24
Assessment Unit area (ha)	28.18	71.21	84.93	184.32
Total Impact Area (ha) for this MNES	184.31	184.31	184.31	184.32
Size Weighting	0.15	0.39	0.46	1.00
Total Weighted Habitat Quality Score	**3.98**			

108: Species Stocking Rate

The Site was given an overall weighted habitat quality score of 3.98 out of the total of 10 which rounds to 4 out of 10 which is considered a moderate habitat quality score. This score is calculated based on the combined weighted habitat quality scores for each assessment unit.

(c) Greater glider

(i) Foraging habitat

Modified Habitat Quality Assessment

The traditional terrestrial habitat quality assessment assesses three (3) core indicators—Site condition, Site context and species habitat index.

The modified habitat quality assessment combines the three (3) core indicators into two (2) (Site condition and Site context) with each Site Condition being weighted 30% of the final score and Site Context being weighted 30% of the final score. The balance of the weighting (40%) has been attributed to the third indicator which is independent of the traditional habitat quality assessment, being species stocking rate.

The species stocking rate has been added to the MHQA to better incorporate MNES, and for the purpose of this preliminary documentation, the endangered-listed greater glider MNES. The following section details the methodology utilised to assess the Site condition, Site context and species stocking rate under the MHQA.

Site Condition (30%)

Assessing Site condition is an integral step in determining specific quantification of impacts, while also determining whether an offset Site is suitable to establish a desired capacity to support the prescribed environmental matters being offset. The on-Site condition is a key element of habitat quality and has a direct influence on the biodiversity it supports. Site condition is assessed using a suite of attributes to describe the structure and function of the vegetation community and is benchmarked against the expected range for a relatively undisturbed community.

The Site condition assessment under the MHQA is assessed using fifteen (15) condition characteristics being:

- recruitment of woody perennial species in the ecologically dominant layer (EDL)
- native plant species richness – trees
- native plant species richness – shrubs
- native plant species richness – grasses
- native plant species richness – forbs
- tree canopy height
- sub-canopy cover
- tree canopy cover
- native grass cover
- organic litter
- large trees
- coarse woody debris
- non-native plant cover
- quality and availability of food and foraging habitat
- quality and availability of shelters.

Site Context (30%)

The Site context assessment deals with the Site and its adjacent surroundings. Site context is measured using a suite of attributes to describe the location of the habitat within the surrounding landscape and the influence of its associated threats. This assessment also considers the influence of adjacent vegetated areas and ecological corridors. Under the MHQA, Site context is measured using the following seven (7) characteristics:

- size of patch (refer **Figure 44** with annotations showing analysis)
- connectedness (refer **Figure 45** with annotations showing analysis)
- context (refer **Figure 46** with annotations showing analysis)
- ecological corridors (Biodiversity Corridor) (refer **Figure 30**)
- role of Site location to species overall population in the state
- threats to the species
- species mobility capacity.

Unlike the traditional habitat quality assessment methodology where Site connectedness is assessed against the surrounding remnant vegetation only, the MHQA Site connectedness is assessed against the surrounding MNES habitat, in this instance, greater glider habitat. Whilst remnant eucalypt forest vegetation is critical habitat for greater glider, equally greater glider can utilise areas of non-remnant vegetation or high value regrowth vegetation that does not yet achieve remnant status. Therefore, Site context under the MHQA accounts for surrounding species habitat rather than remnant vegetation. In developing the MHQA, three (3) species habitat index characteristics were nominated, role of Site location to overall species population in the state, threats to the species and species mobility capacity.

Species stocking rate (40%)

The MHQA incorporates species stocking rate as an attribute not discussed under the traditional terrestrial habitat assessment methodology. Species stocking rates are estimates of the greater glider carrying capacity of the Site at the time of undertaking the survey. Given the discreet nature of the greater glider and limited to no published literature on habitat carrying capacity of the species, the species stocking rate scoring methodology has been derived through the collation of site-specific surveys and surrounding contextual habitat analysis. **Table 31** outlines the attributes utilised to assess species stocking rate.

Table 31: Species Stocking Rate scoring – Greater glider

Attribute	Possible maximum score
Species stocking rate table	
Presence detected on or adjacent to Site (neighbouring property with connecting habitat)	Score out of 10
Species usage of the Site (habitat type and evidenced usage)	Score out of 15
Approximate density (per ha)	Score out of 30
Species stocking rate supplementary table	
Key source population for breeding (/10)	
Key source population for dispersal (/5)	
Necessary for maintaining genetic diversity (/15)	
Near the limit of the species range (/15)	

Attribute	Possible maximum score
SSR[109] Supplementary Table Score (from the four features above)	Score out of 15
Total Species Stocking Rate Score	Score out of 70
Species stocking rate	**Score out of 4**

Findings

The starting habitat quality scores for each assessment unit, combining Site Condition, Site Context and Species Stocking Rate are reported in **Appendix 33.1**. A summary of the scores is presented as **Table 32** The scores for Site Condition are derived directly from the MHQA Tool data. These scores are then used to determine the scores for Quality and Availability of Food and Foraging Habitat, and Quality and Availability of Shelter.

This score is calculated based on the combined weighted habitat quality scores for each assessment unit. **Appendix 33.2** provides an annotated justification for scoring.

Table 32: Greater Glider Modified Habitat Quality Assessment – Offset Receiving Site

Habitat quality score weighted	ORS AU1	ORS AU2	ORS AU3	Total
Site condition score (out of 3)	2.03	1.62	0.67	1.44
Site context score (out of 3)	1.33	1.11	0.70	1.05
Species Stocking Rate Score (out of 4)	2.29	2.29	2.29	2.29
Habitat Quality score (out of 10)	5.65	5.01	3.65	4.77
Assessment Unit area (ha)	28.18	71.21	84.93	184.32
Total Impact Area (ha) for this MNES	184.32	184.32	184.32	184.32
Size Weighting	0.15	0.39	0.46	1.00
Total Weighted Habitat Quality Score	**4.48**			

The Site was given an overall weighted habitat quality score of 4.48 out of the total of 10 which rounds to 4 out of 10 which is considered a moderate habitat quality score. This score is calculated based on the combined weighted habitat quality scores for each assessment unit.

7.6 Offset Calculation

7.6.1 Summary of Impact and Offset Results - Habitat

The Offset will be delivered into areas of cleared open paddocks comprising 184.32 ha. Through consideration of the MHQA scoring undertaken on the Impact Site (**Section 5**), and the Offset Receiving Site (**Section 7.7**) the proposed ORS and OMP can be assessed using the EPBC Act Offset Calculator. **Table 33** summarises the existing MHQA Scores for koala, grey-headed flying-fox and greater glider at the Impact Site and the starting quality of habitats (MHQA scores) for the Offset Receiving Site.

109: Species Stocking Rate

Table 33: Summary of Current On-ground MHQA Scores (Rounded to Whole Number)

Species	Residual Impact Area (ha)	Baseline Impact Site Score (/10)	Baseline ORS Score (/10)	20 Year ORS Score out of 10 with offset (/10)	20 Year ORS Score out of 10 without offset (/10)
Koala	38.40	5.54	4.77	7.32	4.96
Grey-headed flying-fox	37.92	4.93	3.98	5.89	4.06
Greater glider	47.47	5.22	4.48	7.42	4.71

7.6.2 Offset Assessment Guide Input Values - Habitat

Table 34 provides justification for the values used in compiling the offset calculation.

Table 34: Justification of Values Used for Offset Assessment Guide

Attribute	Value	Justification
Time of which loss is averted	20 years	The highest protection category under the VM Act will legally secure the land and is proposed to be in place for a minimum of twenty (20) years. A twenty-year period is sufficient time for the large majority of the offset land to return to a self-sustaining Koala habitat area (with assistance).
Time until ecological benefit	20 years	The ORS has been derived from the clearing of native canopy trees and shrubs with the resultant grasslands displaying a high degree of naturalness with respect to the biodiversity of endemic graminoids and forbs. Extensive and well development recruitment of tree and shrub species is displayed and in the absence of grazing assisted natural regeneration (supplemented by more intensive measures if determined by adaptive management principles) should result in habitat suitable to support koala being achieved in 15-20 years.
Start quality	Koala: 5 GHFF: 4 GG: 4	Despite the site condition having been affected by overstorey removal, the understorey displays a high native biodiversity and recruitment of native trees and shrubs. site context and species stocking rates are high given the proximity of the site to contiguous blocks of native vegetation and koala and grey-headed flying fox records within the landscape adjoining.
Future quality without offset	Koala: 5 GHFF: 4 GG: 5	The property containing ORS is a working cattle property. Without the offset this area will continue to be grazed.
Future quality with offset	Koala: 7 GHFF: 6 GG: 7	Achievement of an upswing in (future) quality of '2' for grey-headed flying-fox and '2' for koala and Greater Glider is a modest assessment and demonstrably achieved by practical implementation of cattle exclusion, assisted regeneration and habitat fabrication if informed by adaptive management and implementation of covenants to protect the offset area. Justification of the upswing in habitat value is presented by projected 5, 10, 15 and 20 year completion criteria of the Offset Rehabilitation Plan for each species (**Appendices 30.2** (koala), **31.2** (grey-headed flying-fox) and **32.2** (greater glider). This provides a details line itemised illustrate of the scoring for each attribute of the MHQA, and its individual predicted upswing in value through the restoration works proposed.

<table>
<tr><th>Attribute</th><th>Value</th><th>Justification</th></tr>
<tr><td>Risk of loss without offset</td><td>0%</td><td>The ORS lies within the Rural Landscape of South East Queensland. As the property is zoned Rural under the ICC Planning Scheme there are few opportunities to advance land uses other than rural activity.</td></tr>
<tr><td>Risk of loss with offset</td><td>0%</td><td>The offset land will be legally secured using a Covenant under the Land Title Act 1994 or Land Act 1994. This legislative instrument regulates new controls on the land as stipulated in the offset management plan and is attached to the land title. Regardless of owner or zoning, a covenant will legally ensure regenerating and reinstated values are protected and provides the Department (viz. DCCEEW) with a higher level of confidence that the offset will be protected for the duration of the impacts associated with the proposed action.</td></tr>
<tr><td>Confidence in the result (averted loss to species or matter)</td><td>71%</td><td>This attribute relates to the confidence associated with whether the offset will avert the loss of habitat for the matter or species at the impact site by way of an offset, and the longevity and permanence of the offset to continue providing habitat.

Statutory Covenants are routinely used for the securement of environmental offsets and are approved all over Queensland representing a combination of both State and Commonwealth Government approvals. There is high confidence that the Covenant and resulting restriction placed on title will bring necessary regulation to protect MNES for the duration of the impacts associated with the proposed action.

The offset site consists of areas of advanced regrowth with koala confirmed present through direct observation and known winter flowering forage trees for grey-headed flying fox confirmed. Remnant vegetation is associate with AU1a, HVR is associated with AU1b. AU2 consists of young regrowth and AU3 pastural grassland with isolated mature copses and individual (ie. canopy ‘paddock’) trees. Such trees afford regular and reliable blossoming habitat utilised during the winter / spring resource bottleneck period. As grey-headed flying-fox is a highly vagile species and known camps and records are present within 25 km, it can be reliably derived that the species will utilise the ORS.

Noting that the risk of loss attribute focusses on the probability the offset achieving a real and tangible benefit to the species or matter, it seems reasonable to take the position that owing to the landscape context and connectivity of the ORS, known presence of koala and high value mature habitat already present, that the risk of loss is lower than would be the case for a fabricated offset. With weed management and assisted regeneration of AUs1-3 it is logical to assume that with increased quality and availability of habitat, koala (and to a similar extent grey-headed flying-fox will increase occupancy and utilisation. On this basis a confidence of 71% (AUs1-3) could be applied. Noting that by far the greatest area of the ORS (AU3) requires intensive ecological restoration, (confidence in averting loss here could reasonably be considered lower) a weighted confidence score has been applied, thus:
<table>
<tr><th>Unit</th><th>Area (ha)</th><th>% Site</th><th>Confidence Score</th><th>Weighted Score</th></tr>
<tr><td>AU1a</td><td>7.11</td><td>3.86%</td><td>0.85</td><td>0.03</td></tr>
<tr><td>AU1b</td><td>21.07</td><td>11.43</td><td>0.80</td><td>0.09</td></tr>
<tr><td>AU2</td><td>71.21</td><td>38.63%</td><td>0.75</td><td>0.29</td></tr>
<tr><td>AU3</td><td>84.93</td><td>46.05%</td><td>0.75</td><td>0.30</td></tr>
</table>
</td></tr>
</table>

Attribute	Value	Justification
		184.32 100.0% Weighted Confidence Score 0.71
Confidence in the result (quality)	90%	Implementation of all management actions within the non-remnant area will be documented by the engaged offset provider. Employing a suitably qualified ecologist, zoologist or environmental scientist to complete this work has a positive impact on the confidence in result however this type of work has inherent risks. The non-remnant areas require mass areas of revegetation and is at potential risk of plant mortality or absence of maintenance resulting in limited tree strike. This has a negative effect on the confidence in result compared to other management areas. Additionally, these areas will result in the largest increase in quality which warrants additional caution.

7.6.3 Offset Assessment Guide Input Values – Features (denning habitat)

Synopsis

Due to the different forms of management proposed, there is a requirement to populate the Offsets assessment guide with three 'offset components'. While the amendably suitable branch hollows and other constructed hollows can be established in Year 1 of the offset, benefits will not arise until near the end of the management program (year 20) because there will be insufficient connective habitat to access the hollows. As described in **Section 7.5.4 (d)**, it is expected that the connective habitat required for occupation will take ~ 20 years to develop. The cumulative benefit of offset Components A-C achieves 148.25% of the Offsets Assessment Guide offset requirement.

Component A

Component A comprises 94 Suitable branch hollows that will be protected and provided with ecological context:

i. a time horizon of 20 years for ecological benefit - representing 94 existing suitable hollows provided with ecological context after 20 years of regeneration in adjoining areas of the KoalaFund site.
ii. a start value of 0 - while suitable hollows occur, the landscape is too fragmented for Greater glider to occupy. The offset brings 'ecological context' to these suitable hollows, allowing future occupation (20 years).
iii. a future value with the offset of 94 - representing 94 existing hollows provided with future ecological context.
iv. confidence in the result of 70% - the hollows already provide suitable denning habitat for Greater glider and are not utilised only because of their functional isolation. Some hollows may fail/become unsuitable over the 20-year management timeframe. The allowed failure rate of 30% is conservative.

Component B

Component B comprises 38 Amendably suitable branch hollows that will be protected and provided with ecological context:

i. a time horizon of 20 years for ecological benefit - representing Amendably suitable branch hollows provided with ecological context after 20 years of regeneration in adjoining areas of the KoalaFund site.

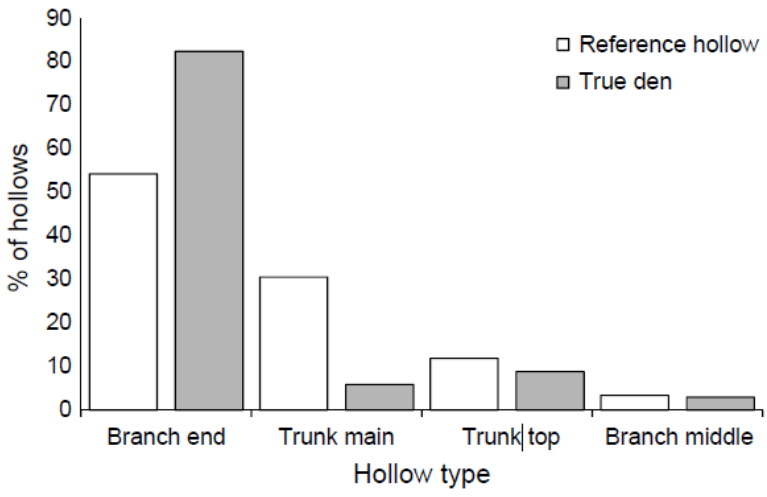
ii. a start value of 94 – insofar as 94 suitable hollows are already present (refer Component A).
iii. a future value with the offset of 132 – equating to 94 Suitable hollows + 38 Amendably suitable hollows.
iv. confidence in the result of 70% - the hollow hog and chainsaw cut hollow techniques can establish chambers of the required dimension with precision. If these features are established in year 1 of management, there is some prospect of failure over the 20-year management timeframe. The allowed failure rate of 30% is conservative. Failure rates would be significantly reduced if the hollows were established at year 20 of the program, but to establish certainty that the works will be undertaken, they will be commissioned and reported on in year 1 of management.

Component C

Component C comprises 73 constructed hollows (refer Arbor Australis report – Attachment 7 of **Appendix 40**) that will be constructed and provided with 'ecological context':

i. establishing some 'high in the canopy' trunk hollows on the premise of **Inset 17**.
ii. a time horizon of 20 years for ecological benefit - representing constructed hollows provided with ecological context after 20 years of regeneration in adjoining areas of the KoalaFund site.
iii. a start value of 132 – insofar as 94 suitable hollows + 38 Amendably suitable hollows are already present;
iv. a future value with the offset of 205 – equating to 94 Suitable hollows + 38 Amendably suitable hollows + 73 Constructed hollows.
v. confidence in the result of 70% - the hollow hog and chainsaw cut hollow techniques can establish chambers of the required dimension with precision. If these features are established in year 1 of management, there is some prospect of failure over the 20-year management timeframe. The allowed failure rate of 30% is conservative. Failure rates would be significantly reduced if the hollows were established at year 20 of the program, but to establish certainty that the works will be undertaken, they will be commissioned and reported on in year 1 of management.

While Greater glider is known to prefer branch end hollows, it will also use trunk hollows. Analysis by Hofman et al. 2022 is useful in regard to determining the utility of trunk hollows. As shown, trunk hollows set higher in the tree (trunk top) are used at a considerably greater rate than those in the main stem and comparable rates (in terms of availability) to branch middle hollows.



Inset 17: 'High in the canopy' trunk hollows

7.6.4 Offset Assessment Guide Results - Habitat

The proportional acquittal for MNES is outlined in **Table 35**. The completed EPBC Offset Calculators for koala, grey-headed flying-fox and greater glider have been included in **Appendix 34** (koala), **Appendix 35** (grey-headed flying-fox), and **Appendix 36** (greater glider).

The Controlled Action decision for the Ripley View Residential Subdivision under Section 75 EPBC Act was made 2 June 2020. This was prior to the uplifting of koala and greater glider from Vulnerable to Endangered. The koala was uplifted to Endangered 12 February 2022 and the greater glider 5 July 2022.

Section 158A of the EPBC Act provides that approval process decisions under Parts 7 – 9 of the EPBC Act will not be affected by an uplisting event made after the determination. On this basis, offset calculations for koala and greater glider are assessed as both species being vulnerable.

Table 35: Summary of acquitted habitat impact to MNES

Species	Total Acquittal
Koala	109.14%
Grey-headed flying-fox	265.25%
Greater glider	105.94%

7.6.5 Offset Assessment Guide Results – Features (denning habitat)

Synopsis

Due to the different forms of management proposed, there is a requirement to populate the Offsets assessment guide with three 'offset components'. While the amendably suitable branch hollows and other constructed hollows can be established in Year 1 of the offset, benefits will not arise until near the end of the management program (year 20) because there will be insufficient connective habitat to access the hollows. As described in **Section 7.5.4 (d)**, it is expected that the connective habitat required for occupation will take ~ 20 years to develop. The cumulative benefit of offset Components A-C achieves 118.55% of the Offsets Assessment Guide offset requirement.

Component A

Component A comprises 94 Suitable branch hollows that will be protected and provided with ecological context. Under the following assumptions, 67.98% of the impact is acquitted. The corresponding Offsets Assessment Guide is provided in **Appendix 36.2**.

Component B

Component B comprises 38 Amendably suitable branch hollows that will be protected and provided with ecological context. Under the following assumptions, 27.48% of the impact is acquitted. The corresponding Offsets Assessment Guide is provided in **Appendix 36.3**.

Component C

Component C comprises 73 constructed hollows (refer Arbor Australis report – Attachment 7 of **Appendix 40**) that will be constructed and provided with 'ecological context'. Under the following assumptions, 52.79% of the impact is acquitted. The corresponding Offsets Assessment Guide is provided in **Appendix 36.4**.

Expanded time to ecological benefit

Even if it is conservatively assumed that the 20-year management period will only put the offset on a strong trajectory towards achieving the ecological benefit (i.e., occupation by Greater glider), and it, in fact, take 30 years for that occupation to occur, the Offsets Assessment Guide is still satisfied (108.35% of the requirement being acquitted). The corresponding Offsets Assessment Guide (which otherwise adopts the same assumptions as Components A-C) is provided in **Appendix 36.5**.

8 Social and Economic Impacts of the Proposed Action

8.1 Community Needs Analysis

Located within the ShapingSEQ Urban Footprint, the Proposed Action is consistent with the growth strategy for south-east Queensland; a region that is anticipated to grow in population by approximately 75,000 new residents each year, resulting in the need for 30,000 new dwellings each year. The Proposed Action represents a well-integrated and balanced development that responds to the region's growth pressures, the Queensland Government's growth strategy and ICC's land use planning vision.

The Proposed Action is anticipated to bring about a number of social benefits associated with a diversity of housing choice, local and locally-resourced construction work, long-term benefits for fauna movement corridors, and equity (community access, participation and inclusion). While it is acknowledged that there may be potential adverse impacts associated with loss of locally important green space and character of the Site, this will be offset through the creation of a master-planned integrated residential community and short-term impacts on the loss of marginal fauna habitat will be mitigated through the approaches outlined within this PD Report (e.g. **Appendix 4** and **Appendix 25** (Offset Area Management Plan).

8.2 Employment Generation

The construction phase of the Proposed Action is expected to generate over 11,000 person-years of construction employment, much of which will be within the local area.

Once constructed, the Flinders View community is anticipated to host the following full-time equivalent (**FTE**) employment:

- 200 FTE generated by people working from home;
- 20 FTE created by a child care centre; and
- 70 FTE within the activity centre (small supermarket, food services, convenience retail, personal/professional services, etc.)[110].

8.3 Community and Stakeholder Involvement

In order to fully consider potential social impacts of the Proposed Action, it is critical to proactively engage with the local community regarding the proposed activities and to ensure that any concerns are appropriately addressed and any queries are diligently followed-up.

8.3.1 Community Information Sessions

The Proponent will undertake all statutorily required public notification in accordance with the requirements of the *Planning Act 2016* and the *Planning Regulation 2017*.

8.3.2 Indigenous Engagement

The Proponent has undertaken extensive engagement with the Yuggera Ugarapul People (YUP). Formal engagement was undertaken between the YUP to understand any concerns or questions the

110: Estimates are based on an employment assessment prepared by RPS for the Proponent.

representatives from YUP have and discuss the key features of the proposed development. The formal consultation events covered a range of topics, including the proposed development, previous site uses and retention and protection of protected koala habitat.

The agreed YUP Cultural Heritage Management Plan (Dated 12/12/2019) and details how the proposed works are to manage and avoid harm to Aboriginal cultural heritage and to the extent that harm cannot reasonably be avoided, to minimise harm to Aboriginal cultural heritage. This Management Plan can be found in **Appendix 37**.

8.4 The Proponent's Environmental Record, and Capacity to Deliver on the Mitigation and Offset Commitments

During this application process, the Ripley View project underwent a change in ownership. The new entity taking control is the Trustee for ARHXE Ripley View Investment Trust, which acquired the project from the previous holder, CLAG Pty Ltd, in October 2022. Since then, the Trustee for ARHXE Ripley View Investment Trust become the new proponent and recently, have completed the formal change to the registered proponent (refer approval letter from Declan O'Connor-Cox on the 4th August 2023).

Given the Trustee for ARHXE Ripley View Investment Trust is a newly created entity setup for the delivery of this project, it naturally doesn't have any track record. However, the shareholders, all run independent businesses within the property development sector. These businesses all have a comprehensive and diverse track record of delivering successful development projects. This includes large land subdivisions, which have created thriving communities and delivered positive environmental and conservation outcomes.

It is worth noting, collectively the proponent possesses a strong financial capability, business acumen and a holistic, and diversified skillset. This will facilitate the successful delivery of the project at this scale and environment and conservative significance.

While most developers would see environmental approvals as simply a box ticking exercise, the team understands that this is a long-term commitment that needs to be managed over a 20-year period to ensure the environmental and conservation outcomes are achieved. For this reason, not only has experts such as 28South have been engaged to run this application process, but additional resources have been engaged via an independent advisor (EarthTrade) to provide advice to the project team on how to structure the governance and ongoing management of the offset site to ensure the obligations under this application is achieved.

The Proponent, and any associated entities, have not been subject to any environmental compliance proceedings under Commonwealth, State or Territory law for the protection of the environment or the conservation and sustainable use of natural resources.

Below, are some of the key team members and short introductions. A full profile has been provided in **Appendix 38**.

Lei Feng is the director of Preer Pty Ltd, which is based in Victoria but is active across several States. Preer is a multi-disciplinary practice across residential, commercial developments and funds management. The organisation runs several in-house projects, including large land subdivisions, but also has a comprehensive development management capability that is utilised by several developers in the land subdivision sectors.

Alec Woolley is the director of Napoleon Energy. A business that was created to combine a 20-year background in sustainability and renewables with property development. Napoleon Energy is an advisory business, consulting to several residential, commercial, and industrial property development projects on sustainability. The firm has advised on hundreds of projects on environmentally sustainable design (ESD) strategy and compliance initiatives.

Alan Key is an established figure in the offset sector, Alan has held the role of Managing Director at Earthtrade Group since its founding in 2007. With more than 16 years of experience aiding clients on offset solutions in corporate settings, he also maintains strong connections with landholders in agriculture, resources, development sectors, and Indigenous communities. Alan actively participates in industry associations, frequently presenting at conferences, events hosted by industry, law firms, and academia.

More broadly, the Proponent relies on an experienced consultancy team to advise on compliance with environmental planning legislation relevant to its projects, and contemporary environmental management solutions. The Proponent has not been subject to any environmental compliance proceedings under Commonwealth, State or Territory law for the protection of the environment or the conservation and sustainable use of natural resources.

9 The Proposed Action Achieves ESD

Section 3A of the EPBC Act sets out the principles of ESD. The Proposed Action achieves these principles as follows:

(a) decision-making processes should effectively integrate both long and short-term economic, environmental, social and equitable considerations

Environmental considerations have been set out within the main body of this PD Report. The Proposed Action will achieve positive social and economic outcomes. Environmental impacts will occur, but these will be mitigated by the provision of compensatory habitat and habitat corridors, and other contemporary environmental management measures. In this light, the Proposed Action achieves an appropriate balance of environmental, social and economic needs.

(b) if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation

The ecological assessment supporting this application provides adequate information for decision making. Where knowledge gaps exist, the precautionary principle has been adopted. Third party peer review has been undertaken to confirm values and impact assessment, and the adequacy impact mitigation measures. Mark Sanders has been involved in the iterative design process to ensure that the Proposed Action avoids, minimises and mitigates potential impacts to mapped and identified MNES fauna in an appropriate manner.

(c) the principles of inter-generational equity – that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations

The Proposed Action will contribute to the provision of sustainable population growth and affordable housing in south-east Queensland, while maintaining environmental values through the avoidance, mitigation and offset measures described in this PD Report.

(d) the conservation of biological diversity and ecological integrity should be a fundamental consideration in decision making

Biological diversity and ecological integrity will be maintained via the avoidance, mitigation and offset measures proposed in this PD Report. The conservation of biological diversity and ecological integrity was a major consideration in the design evolution for the Proposed Action.

(e) improved valuation, pricing and incentive mechanisms should be promoted.

Not relevant to the Proposed Action.

10 Conclusion

This PD Report has presented an assessment of the Proposed Action in response to the DEECCW's Information Request under the EPBC Act (**Appendix 1**). Specifically, this PD Report has examined the potential impacts of the Proposed Action on three (3) MNES species.

The Proposed Action represents a contemporary residential development located within a strategic growth corridor of south-east Queensland. The Site has been subjected to significant broad-scale and selective clearing events since the 1940s and has been used primarily for rural purposes and subject to disturbance and degradation since this period. Consequently, the ecological value of the Site has been considerably compromised.

Nevertheless, the Site does play some role in the provision of habitat for a variety of species, including the koala and grey-headed flying-fox; as some areas of mature vegetation do provide habitat and foraging resources for both species. However, the primary function of the Site within the landscape is the facilitation of movement for koalas and other species along the locally-significant Ecological Corridor in a north - south direction towards more intact remnant areas such as the Flinders – Karawatha Corridor.

Since the submission of the CAR, the Proponent has overseen a number of amendments and refinements to the Proposed Action. These have stemmed from various stimuli, including stakeholder and Council engagement, further studies on the Site (including the finalisation of the tree survey and targeted fauna survey), the involvement of recognised experts in the MNES of interest, and various inputs from other technical disciplines. The current plan of development has been designed to achieve significant dedication of land for open space and conservation purposes – this represents a significant commitment to the retention and restoration of the local environment and its values for MNES. Importantly, the design and location of the Linear Park is such that the highest-quality mature vegetation is preserved and key movement corridors within the Site have been retained and proposed for enhancement works as part of the Proposed Action.

This PD Report has demonstrated that the Site provides a minor role in habitat provision for two (2) MNES of interest. Of the MNES species (koala and grey-headed-flying-fox):

- the koala is known to exist within the Site at low densities. Through a careful and considered approach to the Proposed Action design (retention, consolidation and restoration of the Linear Park and its buffering by 'soft' complimentary open space and recreation uses), and directional and supervised clearing and construction works (the removal of vegetation to occur under the supervision of a Koala Spotter Catcher), the Proposed Action will mitigate some of the impacts on koala.

- While there are no mapped or identified flying fox roosts over the Site, or within 3 km of the Site, the Site may be utilised in an ad-hoc or transient fashion by local grey-headed flying-foxes. The retention, protection and enhancement of the existing mature winter blossoming resources within the Ecological Corridor by virtue of the Linear Park will continue to offer ad-hoc utilisation of the site by any transient individuals.

- A third MNES, the Greater glider, has not been recorded from the Subject Site, nor from adjoining development sites. The greater glider is listed as an 'endangered' species under the

EPBC Act. *The Conservation Advice for Petauroides volans (greater glider (southern and central))* (DEECCW 2022) identifies that where potential habitat as defined by Eyre et al. 2022) is present, a precautionary approach is adopted and identified habitat is considered to be habitat critical for the survival of the species, as there is opportunity for greater glider to exploit this habitat at some point in the future. Reference the *Guide to greater glider habitat in Queensland* (ibid) identifies that the regrowth and remnant vegetation present (comprising RE12.9-10.2) is considered to be a habitat utilised by greater glider, and the species mix of canopy trees including within cleared and modified areas is identified as forage species for the trees. On this basis, the Conservation Advice identifies critical habitat is present. However, our view is that this species will not be subject to impact. Regardless, we anticipate (but disagree), that DCCEEW will consider the Greater Glider to be significantly impacted by the proposed action.

- Notwithstanding, the establishment of residential development over 37.31 ha of land within the Site will lead to a residual impact on these identified species, despite the avoidance, minimisation and mitigation measures proposed by the Proponent. This residual impact will be offset through a combination of off-site offset delivery (the Offset Area Management Plan is provided in **Appendix 25**) and other measures, including utilisation of fauna movement infrastructure throughout the site.

The Proponent is highly motivated to achieve ESD through the delivery of the Proposed Action. This PD Report concludes that such an outcome is likely to occur through the approval of the Proposed Action with appropriate conditions that capture the commitments made within this assessment.

11 References

Atlas of Living Australia (2019). Spatial Portal – *Lathamus discolor*. Accessed online at https://spatial.ala.org.au/#

Australian Government, Department of Climate Change, Energy, the Environment and Water (2022). Conservation Advice for *Petauroides volans* (greater glider (southern and central)).

Australian Government, Department of the Environment (2015). Referral guideline for management actions in grey-headed and spectacled flying-fox camps (EPBC Act Policy Statement).

Barth, B, FitzGibbon, S, Gillett, A, Wilson, R, Moffitt, B, Pye, G, Adam, D, Preece, H & Ellis, W. (In Press). 'Scattered paddock trees and road-side vegetation can provide important habitat for koalas (Phascolarctos cinereus) in an agricultural landscape', *Australian Journal of Mammalogy*.

Brereton R., Mallick S.A. and Kennedy S.J. (2004). Foraging preferences of Swift Parrots on Tasmanian Blue-gum: tree size, flowering frequency and flowering intensity. *Emu*, 104, 377-383.

Commonwealth of Australia (2013) Significant Impact Guidelines 1.1 - Matters of National Environmental Significance. Department of Environment, Energy, Climate Change and Water. Canberra. https://www.dcceew.gov.au/environment/epbc/publications/significant-impact-guidelines-11-matters-national-environmental-significance

Commonwealth of Australia (2021) *National Recovery Plan for the Grey-headed Flying-fox 'Pteropus poliocephalus',* Department of Agriculture, Water and the Environment, Canberra, March. https://www.dcceew.gov.au/sites/default/files/documents/recovery-plan-grey-headed-flying-fox.pdf

Commonwealth of Australia (2022) *National Recovery plan for the Koala: Phascolarctos cinereus (combined populations of Queensland, New South Wales and the Australian Capital Territory).* Department of Agriculture, Water and the Environment, Canberra. March 2022. https://www.dcceew.gov.au/sites/default/files/documents/recovery-plan-koala-2022.pdf

Comport, S. S., Ward, S. J., & Foley, W. J. (1996). Home ranges, time budgets and food tree use in a high density tropical population of Greater Gliders, *Petauroides volans* minor (Pseudocheiridae: Marsupialia). Wildlife Research 23, 401-419.

Department of the Environment (2014). *EPBC Act referral guidelines for the vulnerable koala (combined populations of Queensland, New South Wales and the Australian Capital Territory)*, Commonwealth of Australia.

Department of the Environment and Energy (2019a). *Species Profile and Threats Database* – Pteropus poliocephalus – Grey-headed Flying-fox. Accessed online at http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=186, Date Accessed: 21 June 2019.

Department of the Environment and Energy (2019b). *Monitoring flying-fox populations*. Accessed online at www.environment.gov.au/biodiversity/threatened/species/flying-fox-monitoring, Date accessed: 14 June 2019.

Department of the Environment and Energy (2019c). *Species Profile and Threats Database* – Phascolarctos cinereus *(combined populations of Qld, NSW and the ACT) – koala*, Accessed online at http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=85104, Date Accessed: 21 June 2019.

Department of the Environment and Energy (2017). Draft National Recovery Plan for the grey-headed flying-fox(*Pteropus policephalus*). Commonwealth of Australia.

Department of Environment and Heritage Protection (2016). *Queensland Environmental Offsets Policy (Version 1.2)*, June 2016, The State of Queensland.

Department of Environment and Science (2022). Koala-sensitive Design Guideline: A guide to koala-sensitive design measures for planning and development activities. Koala Policy and Oversight Team, Department of Environment and Science, Queensland Government.

Department of Environment and Science (2019a). *Koala facts*, Accessed online at https://environment.des.qld.gov.au/wildlife/koalas/koala-ecology.html, Date Accessed: 21 June 2019.

Department of Environment and Science (2019b). *Flying-fox roost monitoring and locations*. Accessed online at www.environment.des.qld.gov.au/wildlife/livingwith/flyingfoxes/roost-locations.html, Date accessed: 14 June 2019.

Department of Environment and Science (2019c). *BioCondition Benchmarks for Regional Ecosystem Condition Assessment*, Accessed online at https://www.qld.gov.au/__data/assets/pdf_file/0026/67382/seq-benchmarks.pdf, Date Accessed: 23 August 2019.

Department of Infrastructure Local Government and Planning (2017). ShapingSEQ – South East Queensland Regional Plan 2017. Queensland Government

Department of Science, Information Technology, Innovation and the Arts (2018). Regional Ecosystem Technical Descriptions. Queensland Government.

Department of Sustainability, Environment, Water, Population and Communities (2012). *Environment Protection and Biodiversity Conservation Act 1999* Environmental Offsets Policy. Commonwealth of Australia.

Department of Agriculture, Water and Environment (2020). *Additional information required for preliminary documentation Ripley View Residential Subdivision, Flinders View, Ipswich, Queensland (EPBC 2020/8615).* DAWE, Canberra, 6 August 2020.

Dique, DS (2004). 'The distribution, abundance and dynamics of a regional koala population in south east Queensland', Ph.D thesis, PhD thesis, University of Queensland.

Eby P. (1991). Seasonal movements of Grey-headed Flying-foxes, *Pteropus poliocephalus* (Chiroptera: Pteropodidae), from two maternity camps in northern New South Wales. *Wildlife Research*, 18, 547-559.

EcoSmart Ecology (2020). Ripley Valley Terrestrial Vertebrate Survey and Assessment.

Ellis, W, Melzer, A, Carrick, FN & Hasegawa, M. (2002). 'Tree use, diet and home range of the koala (*Phascolarctos cinereus*) at Blair Athol, central Queensland', *Wildlife Research*, vol. 29, no. 3, pp. 303-11.

Engeny (2020). Ripley Valley Stormwater Quantity and Flood Report (Draft), February 2021

Eyre, T.J. (2006) Distribution and conservation status of the possums and gliders of southern Queensland. In: The Biology of Australian Possums and Gliders. (Eds Goldingay, R.L. & Jackson, S.M.), Surrey Beatty and Sons: Chipping Norton, NSW. pp. 1-25.

Eyre TJ (2002) *Habitat preferences and management of large gliding possums in southern Queensland. Ph.D. thesis,* Southern Cross University, Lismore

Eyre, T.J., Smith, G., Venz, M.F., Mathieson, M.T., Hogan, L.D., Starr, Corymbia, Winter, J. & McDonald, K. (2022). Guide to greater glider habitat in Queensland. Report prepared for the Department of Agriculture, Water and the Environment, Canberra. Department of Environment and Science, Brisbane.

Gibbons, P. and Lindenmayer, D. (2002) *Tree Hollows and Wildlife Conservation in Australia*. CSIRO, Melbourne.

Hall L. and Richards G. (2000). *Flying Foxes: Fruit and Blossom Bats of Australia*. UNSW Press, Sydney. 135 pp.

Harris, J. M., & Maloney, S. (2010). *Petauroides volans* (Diprodontia:Pseudocheiridae). Mammalian Species 42, 207-219.

Henry, S. R. (1984). Social organisation of the Greater Glider (*Petauroides volans*) in Victoria. In Possums and Gliders (eds A. P. Smith & I. D. Hume), pp. 221-228. Surrey Beatty and Sons, Chipping Norton.

Hofman. M., Gracanin. A., and Mikac. K. (2022) *Greater Glider (Petauroides volans) den tree and hollow characteristics*. Australian Mammology 45(2).

Kavanagh, R. P., & Lambert, M. (1990). Food selection by the Greater Glider: is foliar nitrogen a determinant of habitat quality? Australian Wildlife Research 17, 285-299.

Kehl, J., & Borsboom, A. (1984). Home range, den tree use and activity patterns in the Greater Glider (*Petauroides volans*). In Possums and Gliders (eds. A. P. Smith & I. D. Hume), pp. 229-236. Surrey Beatty and Sons, Chipping Norton.

Kennedy S.J. and Tzaros C.L. (2005). Foraging ecology of the Swift Parrot *Lathamus discolour* in the box-ironbark forests and woodlands of Victoria. *Pacific Conservation Biology*, 11, 158-173.

Kjeldsen, SR, Raadsma, HW, Leigh, KA, Tobey, JR, Phalen, D, Krockenberger, A, Ellis, WA, Hynes, E, Higgins, DP & Zenger, KR (2019). 'Genomic comparisons reveal biogeographic and anthropogenic impacts in the koala (Phascolarctos cinereus): a dietary-specialist species distributed across heterogeneous environments', *Heredity*, vol. 122, no. 5, pp. 525-44.

Mackowski, C.M. (1984) *The ontogeny of hollows in blackbutt (Eucalyptus pilularis) and its relevance to the management of forests for possums, gliders and timber*. In: Possums and Gliders (eds Smith, A.P., Hume and I.D.) pp. 553-67. Surrey Betty & Sons, Sydney.

McAlpine, C, Lunney, D, Melzer, A, Menkhorst, P, Phillips, S, Phalen, D, Ellis, W, Foley, W, Baxter, G, de Villiers, D, Kavanagh, R, Adams-Hosking, C, Todd, C, Whisson, D, Molsher, R, Walter, M, Lawler, I & Close, R. (2015). 'Conserving koalas: A review of the contrasting regional trends, outlooks and policy challenges', *Biological Conservation*, vol. 192, pp. 226-36.

Mifsud, G. (2013). Wild dogs and their impact on Koalas a very real threat – a submission to a Senate Committee Enquiry into the Status, Heath and Sustainability of Australis's Koala Population: National Wild Dog Facilitator, Invasive Animals CRC.

Moore, BD & Foley, WJ. (2000). 'A review of feeding and diet selection in koalas (*Phascolarctos cinereus*)', *Australian Journal of Zoology*, vol. 48, no. 3, pp. 317-33.

Mossaz, A., (2010), 'Estimating Low-Density Koala Populations in Southeast Queensland: Comparing the Spot Assessment Technique and Distance Sampling'. Bachelor of Science (Honours), Griffith University.

Ipswich City Council (2018). Flying fox monitoring – results. Accessed on 21 August 2020 at https://environment.des.qld.gov.au/__data/assets/pdf_file/0022/88510/map-03.pdf

Ipswich City Council (2006). Ipswich City Plan 2006.

Nelson, J.E. (1965). Movements of Australian Flying Foxes (Pteropodidae: Megachiroptera). *Australian Journal of Zoology* 13, 53-73.

Parry-Jones K. and Augee M.L. (1991). Food selection by Grey-headed Flying-foxes (*Pteropus poliocephalus*) occupying a summer colony site near Gosford, New South Wales. *Wildlife Research*, 18, 111-124.

Pers coms Dr Stephen Debus October 2021.

Phillips, S and Callaghan, J. (2011). The Spot Assessment Technique: a tool for determining localised levels of habitat use by Koalas, *Phascolarctos cinereus*. Australian Zoologist 35(3)

Podberscek, M. (1991). Field Guide to the Eucalypts of the Gympie, Imbil and Maryborough Forestry Districts. Queensland Department of Primary Industries.

Reardon, T. (2010). Survey Guidelines for Australia's Threatened Bats. Guidelines for detecting bats listed as threatened under the *Environment Protection and Biodiversity Conservation Act 1999.* Prepared for the Commonwealth of Australia, 2010 and available at:

http://www.environment.gov.au/system/files/resources/2f420bf1-d9e4-44ec-a69c-07316cb81086/files/survey-guidelines-bats.pdf.

Sattler, P and Williams, R. (eds) (1999). *The conservation status of Queensland's Bioregional Ecosystems*. Environmental Protection Agency, Queensland Government, Brisbane.

Stanley, T.D and Ross, E.M. (2002). Flora of South eastern Queensland. Queensland Department of Primary Industries.

Saunders D.L. and Heinsohn R. (2008). Winter habitat use by the endangered, migratory Swift Parrot (*Lathamus discolour*) in New South Wales. *Emu*, 108, 81-89.

Saunders D. and Tzaros C. (2011). *National Recovery Plan for the Swift Parrot Lathamus discolor*. Birds Australia, Melbourne.

Saunders D.L., Cunningham R., Wood J., and Heinsohn R. (2016). Responses of critically endangered migratory Swift Parrots to variable winter drought. *Emu*, 118, 1-6.

Webb M.H., Holdsworth M.C. and Webb J. (2012). Nesting requirements of the endangered Swift Parrot (*Lathamus discolor*). *Emu*, 112, 181-188.

Youngentob, K.N. Hwan-Jin Yoon, Coogan, N and Lindenmayer, D.B. (2012). *Edge effects influence competition dynamics: A case study of four sympatric arboreal marsupials*. Biological Conservation (**155**)