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NEOEN

NARROGIN WIND FARM

Assessment of Impacts to Matters of National Environmental Significance

FINAL

September 2024

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FINAL

Prepared by
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on behalf of
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Environmental & Social Consultants

This report was prepared using Umwelt's ISO 9001 certified Quality Management System.

Acknowledgement of Country

Umwelt would like to acknowledge the traditional custodians of the country on which we work and pay respect to their cultural heritage, beliefs, and continuing relationship with the land. We pay our respect to the Elders – past, present, and future.

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Abbreviations

Abbreviation	Definition
AGL	Above Ground Level
AHD	Australian Height Datum
AVW	Avon-Wheatbelt Bioregion
BAM Act	*Biosecurity and Agriculture Management Act 2007* (WA)
BBUS	Bird and Bat Utilisation Survey
BC Act	*Biodiversity Conservation Act 2016* (WA)
BESS	Battery Energy Storage System
DBCA	Department of Biodiversity, Conservation and Attractions
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DPLH	Department of Planning, Lands and Heritage
DWER	Department of Water and Environment Regulation
EP Act	*Environmental Protection Act 1986* (WA)
EPA	Environmental Protection Authority
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cth)
GIS	Geographic Information Systems
IBRA	Interim Bio-Regionalisation of Australia Version 7
JAF	Jarrah-Forest Bioregion
kV	Kilovolt
MNES	Matters of National Environmental Significance
MWh	Megawatt hour
MW	Megawatt
NVIS	National vegetation Information System
O&M	Operations and Maintenance
PD Act	*Planning and Development Act 2005* (WA)
PMST	Protected Matters Search Tool
RSA	Rotor Swept Area
SM4	Songmeter 4
SWIS	Southwest Interconnected System
TEC	Threatened Ecological Community
VSA	Vegetation System Association
VT	Vegetation Type
WAPC	Western Australian Planning Commission
WoNS	Weeds of National Significance
WTG	Wind Turbine Generator

Executive Summary

Neoen Australia Pty Ltd (Neoen) is proposing the construction and operation of up to 25 wind turbines, a battery energy storage system (BESS), transmission network connection, and associated infrastructure approximately 160 km south-east of Perth, in the Wheatbelt South subregion of Western Australia. The Narrogin Wind Farm (the Project), is currently undergoing referral under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act), and this report is intended to support this submission by:

- detailing the proposed action which has been referred to the Department of Climate Change, Energy, the Environment, and Water
- identifying Matters of National Environmental Significance (MNES) which may be impacted by the proposed action
- providing information on the survey effort undertaken to date to verify the presence and extent of MNES
- summarising the proposed mitigation and management actions to address potential impacts to MNES
- undertaking an assessment of significant impacts, in accordance with EPBC Act guidelines, for those MNES that have a potential to be impacted.

Field surveys undertaken within the Project Area (Study Area) have identified a total of six MNES which are considered Known or otherwise likely to occur. These include:

- Forest Red-tailed Black-Cockatoo (*Calyptorhynchus banksii naso*) – Vulnerable
- Baudin's Black-Cockatoo (*Zanda baudinii*) – Endangered
- Carnaby's Black-Cockatoo (*Zanda latirostris*) – Endangered
- Chuditch (*Dasyurus geoffroii*) – Vulnerable
- Red-tailed Phascogale (*Phascogale calura*) – Vulnerable
- Fork-tailed Swift – Migratory.

Suitable habitat for all five MNES species (excluding the Fork-tailed Swift) was mapped across the Study Area and used to inform subsequent impact assessments.

Neoen has undertaken a reiterative design review process to apply the avoidance and minimisation principles of the mitigation hierarchy to mitigate impacts to MNES as far as practicable. Following this, a residual impact consisting of the permanent removal of up to 7.41 ha of remnant native vegetation and 0.98 ha of planted native vegetation comprising suitable habitats for five of the MNES remains.

This residual impact has been assessed against EPBC Act guidelines for its significance, and it was determined that the impact is unlikely to be significant for the following reasons:

- No more than 7.41 ha of native remnant vegetation and 0.98 ha of planted native vegetation will be cleared
- No Threatened Ecological Communities will be cleared.
- No vegetation in Good condition or better will be cleared.
- The 8.39 ha of fauna habitat loss is distributed across over 20 patches of vegetation in the Study Area and consists of degraded and highly fragmented vegetation at the perimeter of existing patches, with approximately 85% of clearing areas being less than 0.5 ha.
- The fauna habitat loss will result in the total removal of 1.64–2.06% of black-cockatoo foraging habitat and approximately 0.67% of other fauna habitat types across the entire Study Area, with extensive, better-quality habitats of similar suitability present in the region immediately surrounding the Study Area, including areas protected for conservation.
- No Rank 1 (trees with activity at hollow observed) and Rank 2 (trees with hollows of suitable size with chew marks visible) black-cockatoo nesting trees will be removed.
- Providing a minimum turbine tip height of 49 m above ground level minimises risk of turbine strike for black-cockatoo species which typically fly at canopy height and along areas of remnant vegetation in areas of lower topographic relief.
- A preliminary Bird and Bat Management Plan specific to the Project has been developed and includes specific measures to mitigate potential operational impacts. These measures include monitoring during potentially higher activity periods and responding to any incidents of mortality including consultation with the Department of Biodiversity, Conservation and Attractions.

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1.0 Introduction

Umwelt has been commissioned by Neoen Australia Pty Ltd (Neoen) to undertake ecological surveys and an impact assessment for the Narrogin Wind Farm (the Project) with particular focus on Matters of National Environmental Significance (MNES) protected under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act).

The Project will involve the construction and operation of up to 25 wind turbines, a battery energy storage system (BESS), and associated infrastructure. The transmission line and terminal required to connect the Project to the electricity network have also been included in this assessment. This infrastructure will likely be constructed by the network operator Western Power but has been included to ensure the cumulative impacts are captured.

1.1 Project Locality

The Project is located approximately 160 km south-east of Perth, Western Australia, in the Wheatbelt South subregion spanning across the Shires of Williams and Narrogin (**Figure 1.1**). The Project is located across numerous freehold properties approximately 7 km east of the township of Williams and 9 km west of the township of Narrogin. A 220 kV line intersects the southern boundary of the proposed site that the Project will connect to.

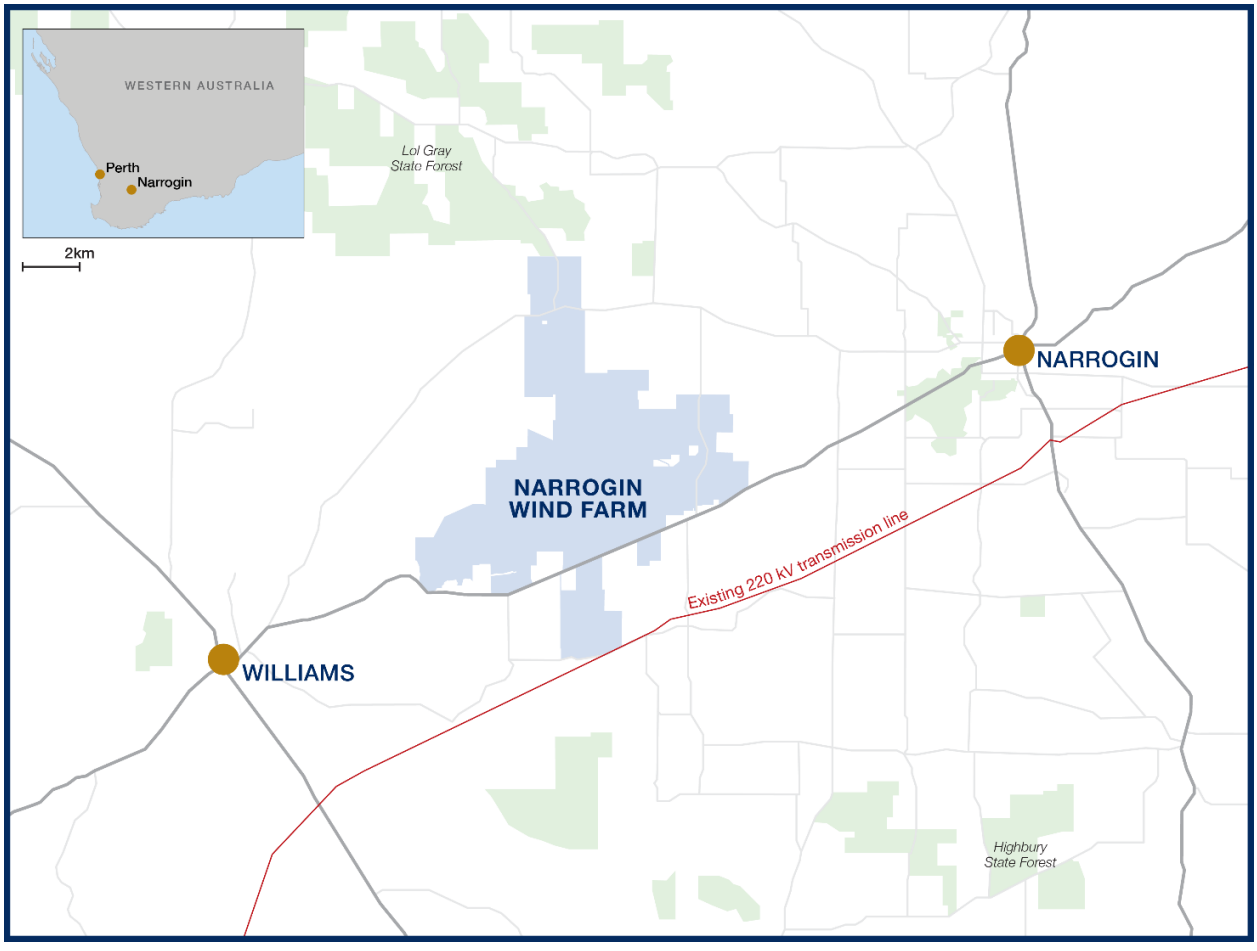


Figure 1.1 Project Locality

1.2 Project Transport Route

A Traffic Impact Assessment (TIA) has identified a feasible route for transport of large Project infrastructure (e.g. turbine blades, BESS, transformer) from the Port of Bunbury via road to the Project site. The TIA has identified approximately five areas where minor clearing of roadside vegetation may be required for the transportation of the turbine blades, however further detailed design work is required to delineate the transport route.

The potential clearing includes 0.2 ha of a degraded perimeter patch of an area identified as potentially Threatened Ecological Community (TEC), being the Eucalypt Woodlands of the Western Australian Wheatbelt ecological community. A self-assessment has determined that this is not likely to have a significant impact on MNES and instead the minor clearing of vegetation from Port to site can be managed via the WA State approval process. Furthermore, the Lot in which the potential TEC is located is under the ownership of Main Roads WA and appears to have been used as a gravel storage area. Due to the need for detailed planning to finalise the route, the low likelihood of significant impact to the TEC, and mechanisms under WA legislation to manage potential impacts, the clearing of vegetation from port to site is not discussed any further in this report and will not form part of the EPBC submission.

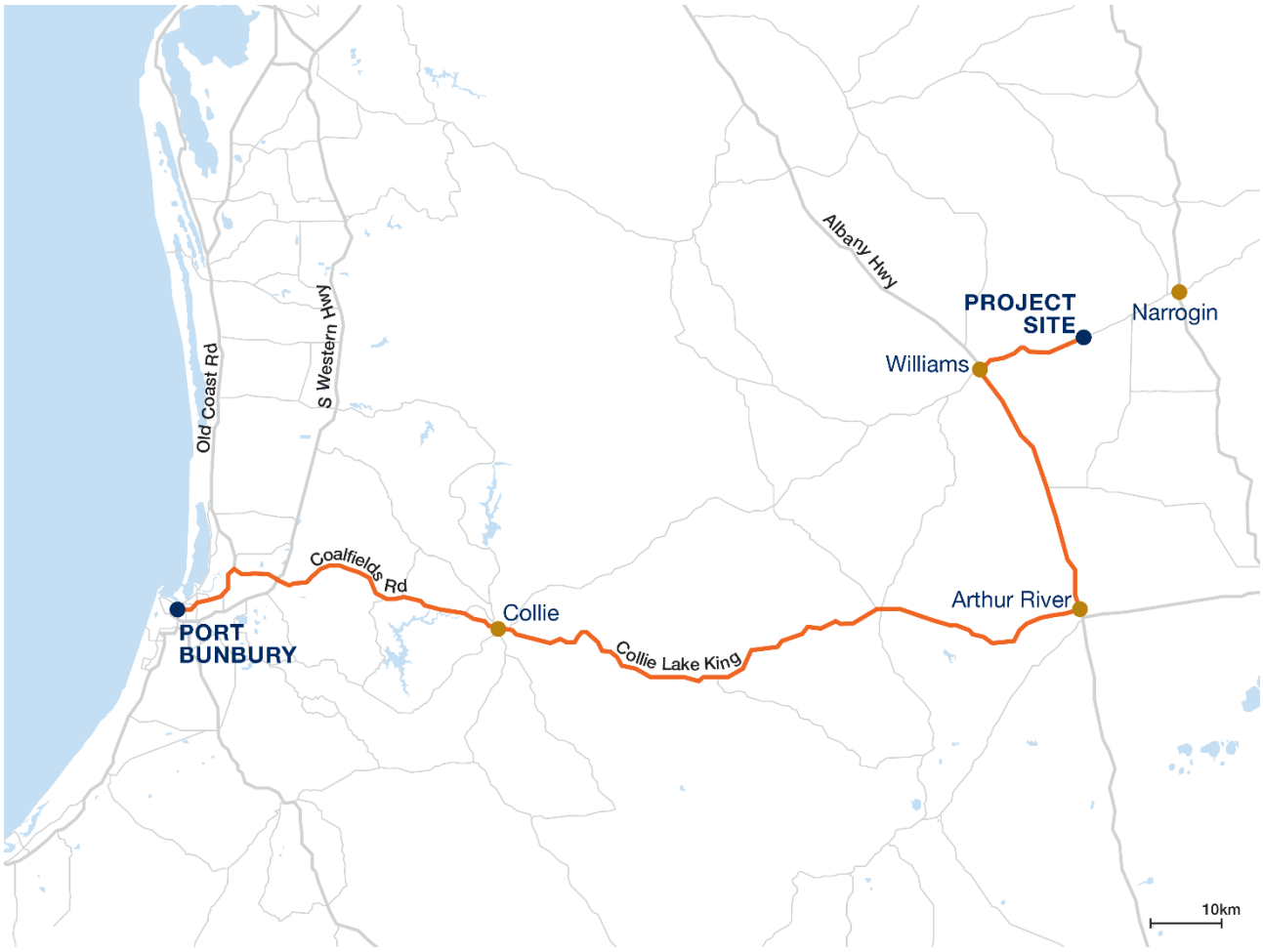


Figure 1.2 Project Transport Route

1.3 Ecological Assessment Boundaries

For the purposes of this report and ecological assessment, the following distinct boundaries are presented:

- **Study Area**: refers to the boundaries of all involved land parcels where consent has been granted for development of the Project. This is synonymous to the 'Project Area' as referenced throughout the EPBC referral for the Project (**Section 1.3.1.1**). The Study Area is 6,344 ha.
- **Indicative Project Footprint**: refers to the maximum area of land that will be cleared for installation of all Project infrastructure. It is based on the largest possible conceptual layout and has been used to calculate the maximum area of native vegetation clearing (7.41 ha of remnant native vegetation and 0.98 ha planted native vegetation). Impact assessments within this document are based on the entire Indicative Project Footprint being cleared. The Indicative Project Footprint is 192 ha.
- **Development Corridor**: refers to the area within which all Project works and infrastructure will be confined. It encompasses the entire Indicative Project Footprint with buffers applied to provide the Project with a reasonable level of flexibility as it progresses into the detailed design phase. The Development Corridor is 671 ha.
- **Additional Survey Area**: refers to an earlier much larger study area boundary which encompassed early conceptual layouts of the Project. This boundary is discussed where appropriate in context of the survey effort applied to the Project's ecological assessments and to demonstrate application of the mitigation hierarchy in the design phase (specifically avoidance). No Project activities will be undertaken in the Additional Survey Area. The Additional Survey Area is 2,830 ha.

These boundaries are illustrated on **Figure 1.3** and further detailed below.

1.3.1.1 Study Area

The Study Area is located across numerous freehold land parcels and local road reserves, totalling approximately 6,344 ha at elevations between approximately 274 m and 386 m Australian Height Datum (AHD). The majority of the Study Area is located primarily in the Shire of Narrogin, with four land parcels located in the adjacent Shire of Williams.

1.3.1.2 Development Corridor

The Development Corridor (671 ha) refers to the area within which all Project works and infrastructure will be situated, and includes a variable width buffer on Project infrastructure. This has been done to afford the Project the most flexibility as it progresses into the detailed design phase. Incorporating this level of flexibility in the Development Corridor allows for further avoidance and management of specific on-ground constraints, including civil design constraints and ecological constraints.

The Development Corridor has been defined through an iterative design process, informed by a range of ecological, heritage, noise, landscape and visual, hydrological, aviation, and wind generation optimisation modelling studies. These studies have informed avoidance and mitigation of impacts to key ecological values through the iterative design process.

The Project will undergo a detailed design phase following a competitive tender and contract award for equipment supply and construction. The detailed design process will rely on future technical assessments, including geotechnical investigations, on-ground cultural heritage surveys, and additional targeted ecological surveys. This process will define the final positioning of Project infrastructure as well as the Final Project Footprint.

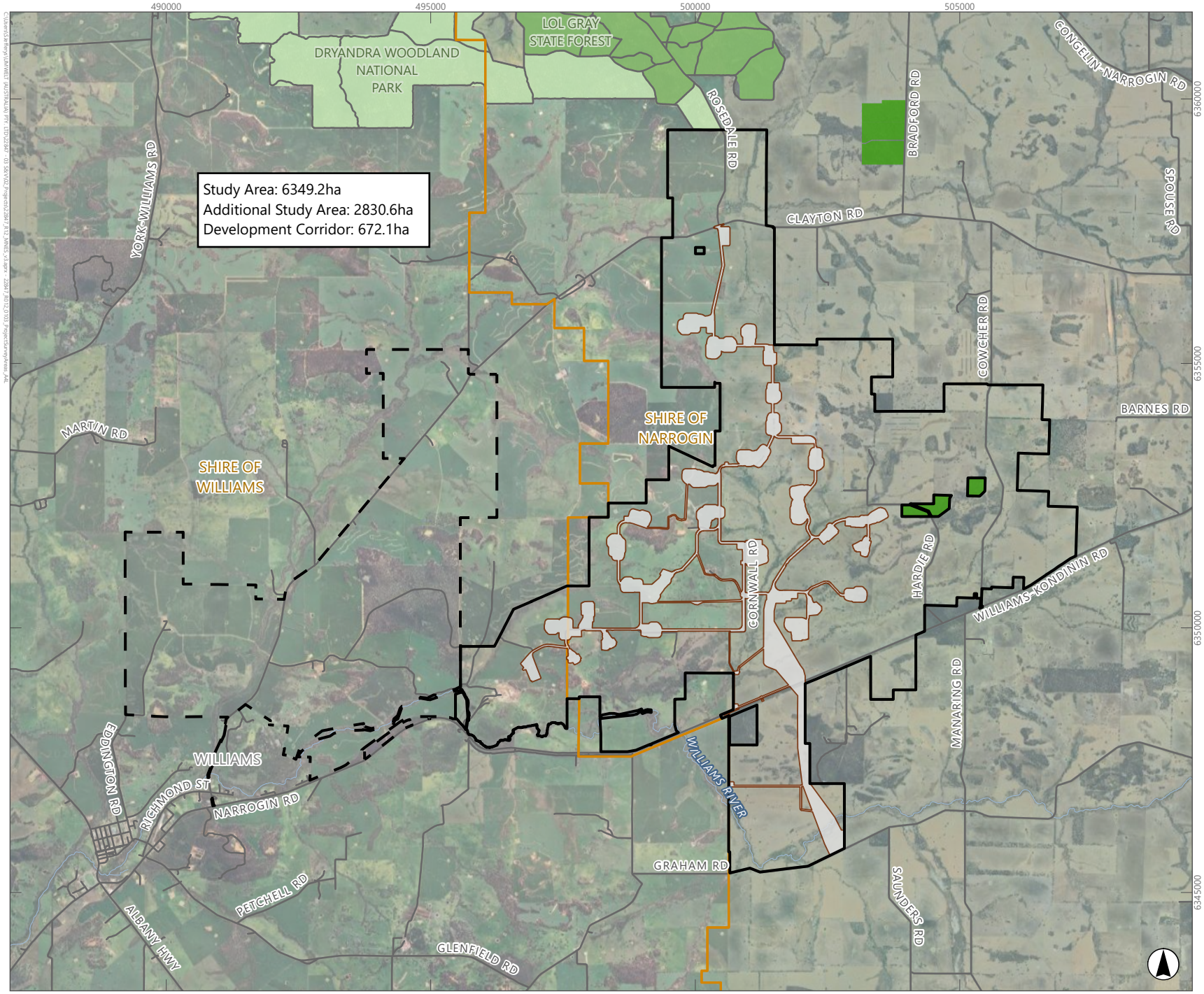
Clearing within the Development Corridor will not exceed 7.41 ha of remnant native vegetation and 0.98 ha of planted native vegetation.

1.3.1.3 Additional Survey Area

The Additional Survey Area was originally developed in 2023 and included a study area of approximately 2,830 ha which extended further into the Shire of Williams (**Figure 1.3**).

Following initial surveys and preliminary assessments of ecological values and sensitive receptors, the Additional Survey Area was excluded from the Project Area boundary and resulted in avoidance of impacts to high ecological values identified through ecological surveys such as Threatened Ecological Communities (TEC), good to very good condition native vegetation and fauna habitats. This amounted to a total reduction of 30% reduction in the Project Area. Additionally, the total number of wind turbines was reduced from 44 to 25. Data gathered from surveys undertaken within the Additional Survey Area have been utilised where possible to inform the potential occurrence of conservation significant species, characterise the utilisation of the Study Area by bird and bat species, and to understand fauna assemblages in the wider region.

FIGURE 1.3
Project Survey Areas



Legend

- Study Area
- Additional Survey Area
- Development Corridor
- Local Government Area Boundary
- Road
- Major Watercourse
- Nature Reserve
- National Park
- State Forest

0 2 4

Kilometres

Scale 1:100,000 at A4
GDA2020 MGA Zone 50

Image Source: ESRI Basemap (2023) | **Data Source:** Landgate (2023), Umwelt (2023), DBCA (2023)

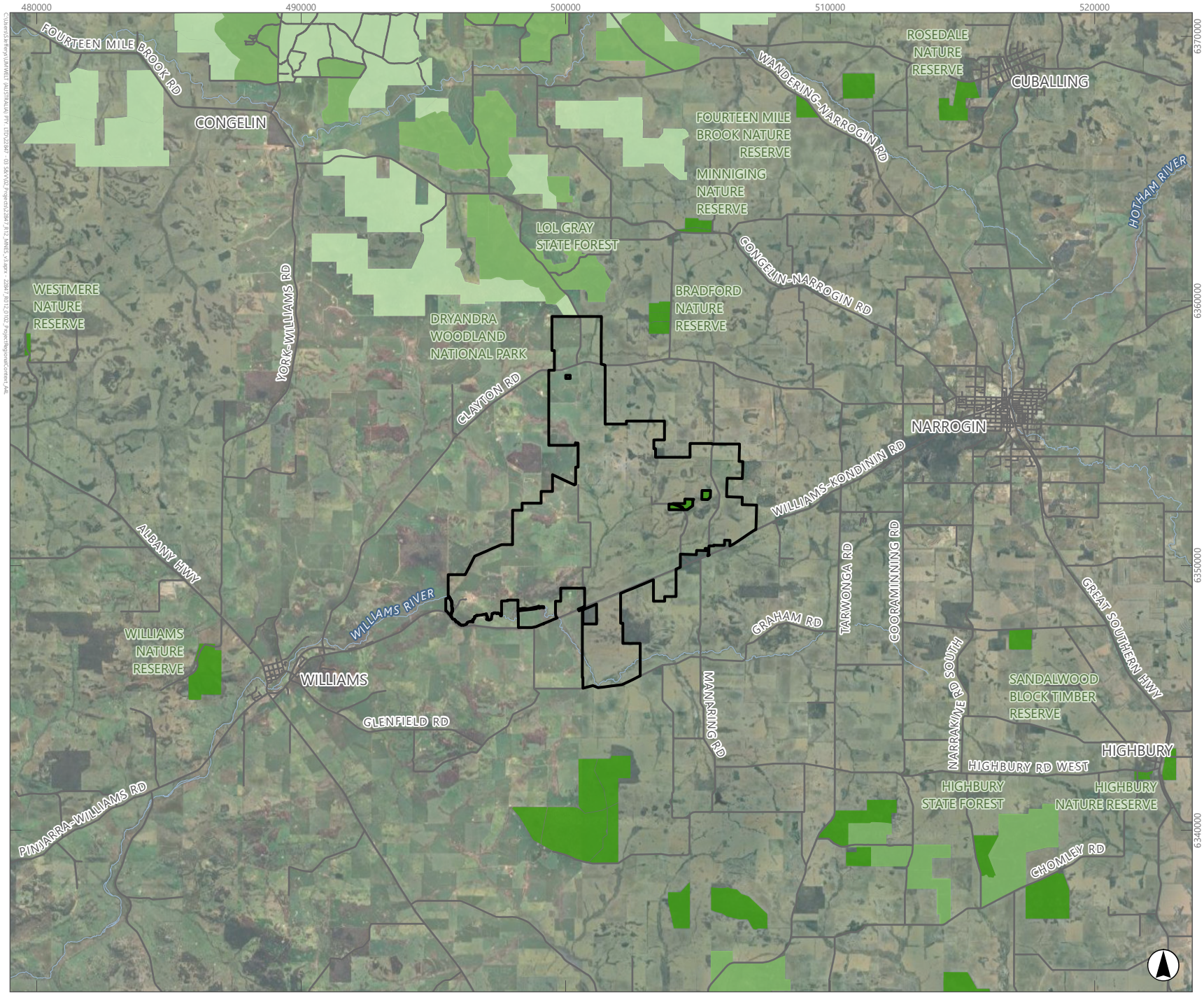
1.4 Existing Land Uses and Tenure

The Study Area predominantly consists of land cleared for agriculture and livestock grazing, with interspersed patches of remnant and regrowth woodland that is generally associated with hills, slopes, and creeklines. Key environmental and social receptors in proximity to the Study Area include (**Figure 1.4**):

- Dryandra Woodland National Park, located directly adjacent to the northern boundary of the Study Area
- Lol Gray State Forest, located 500 m north of the Study Area which forms a mosaic of protected areas along with Dryandra Woodland National Park north of the Study Area
- Bradford Nature Reserve, located 1.8 km east of the northern boundary of the Study Area
- three unnamed Nature Reserves which are surrounded by Study Area land parcels in the east of the Study Area
- an unnamed Nature Reserve for the purposes of conservation of flora and fauna, located approximately 1.7 km south of the Study Area
- numerous other Nature Reserves and State Forests located to the south of the Study Area within a 20 km buffer
- watercourses located in the north (Mujiting Brook and Minniging Brook) and south (Geeralying Brook and Williams River) of the Study Area and numerous other non-perennial drainage lines located throughout the Study Area
- registered Aboriginal Heritage Sites such as a modified tree and camp site (Geeralying, Site ID 15139), a modified tree and food resource site (Manaring Road, Site ID 5826) and a burial site (Geeralying, Site ID 5888)
- the town of Williams, located approximately 7 km west of the Study Area
- the town of Narrogin, located approximately 9 km east of the Study Area.

A 220 kV transmission line owned and operated by Western Power intersects the southern boundary of the Study Area and forms part of the South West Interconnected System (SWIS). This transmission line connects from the Narrogin South Substation, approximately 18 km to the east of the Study Area, to Muja Terminal, approximately 80 km to the west.

FIGURE 1.4
Project Regional Context



Legend

- Study Area
- Road
- Major Watercourse
- Nature Reserve
- National Park
- State Forest

0 4 8

Kilometres

Scale 1:200,000 at A4
GDA2020 MGA Zone 50

Image Source: ESRI Basemap (2023) | **Data Source:** Landgate (2023), Umwelt (2023), DBCA (2023)

1.5 Justification, Site Selection, and Alternatives

The Project will utilise wind energy resources in the Wheatbelt region to support State and national decarbonisation targets.

The Study Area was selected for siting of the Project for the following key reasons:

- The presence of a Western Power 220 kV transmission line in the south of the Study Area providing suitable network access with sufficient capacity to accommodate the Project and minimal additional infrastructure required such as long-distance transmission corridors and lines. The cost of minimal amount of infrastructure required can therefore be borne by the proponent and does not rely on government funding to be able to connect.
- The Study Area contains 5,098.9 ha (80.4%) of cleared land which provides options for the siting of Project infrastructure in areas that minimise the clearing and disturbance of native vegetation.
- The Study Area provides good access to existing road networks, including major roads and highways allowing Project infrastructure, plant and equipment to be transported to site without significant upgrades outside of the existing road network.
- The Study Area is primarily used for agricultural activities such as cropping which can be continued without significant loss of suitable land to Project infrastructure due to its relatively minor footprint, making both land uses compatible and maximising use of existing disturbed areas for economic activities.
- There is a sufficiently large area of land to host a financially viable wind farm in an area with relatively low density of dwellings, allowing for adequate setbacks between turbines and existing neighbouring dwellings to meet noise compliance criteria.
- The availability of a good wind resource that is diversified from those used by established wind farms in the State (i.e. peak wind production at different times of the day) which also reduces the need for energy storage to smooth transitions between energy sources.
- Availability of water for construction from the WA Water Corporation pipeline that runs through the Project area, avoiding the need to abstract significant quantities of water from a water scarce area.
- Topology and geology of the site, means that the amount of fill material to be imported and cut material to be exported is minimal. There is sand and aggregate material on site and nearby reducing the vehicle movements required to deliver the construction material to site and associated carbon emissions.

Alternatives for the Project included locating it in a different area, or a “do nothing” alternative.

Alternative areas for large-scale wind farms in the Wheatbelt in the short-term are limited due to the location of suitable transmission infrastructure that do not require significant upgrades or new long-distance transmission corridors to provide network access. A demand assessment undertaken for the SWIS found from initial modelling that the level of electricity required by 2042 could grow to five times that of 2022. This would necessitate almost ten times the amount of current generation capacity in the SWIS if electricity is to be generated primarily from renewable sources (DEMIRS, 2023). Therefore, it is critical that progress towards the transition is commenced as soon as possible to allow demand to be met.

The existing 220 kV transmission line in the south of the Study Area connects to the major load centres via Muja terminal and utilises the existing infrastructure for generation from the coal power plants thereby replacing existing generation sources known to be retiring within the same transmission network. At 80 km from Muja terminal, the Project is also relatively close to a major distribution substation when compared with other eastern wind farm projects, resulting in lower electricity losses.

The "do nothing" alternative for the Project would further delay the clean energy transition and decarbonisation of energy networks in Western Australia which have been identified as key goals for the Western Australian government (Energy Policy WA, 2021; Energy Transformation Taskforce, 2020; Western Australian Planning Commission (WAPC), 2021). Climate change is a key threat for many ecosystems and species, but particularly those MNES considered as part of this assessment such as black-cockatoo species and the Red-tailed Phascogale (see **Section 9.2.2** and **Section 9.3.2)**. Changes to rainfall, temperature extremes, and bushfires may accelerate the decline of these species through a combination of range contractions in response to changing climatic conditions, impacts to suitable habitat from more intense and frequent bushfires, and effects on factors influencing breeding success and timing. Renewable energy projects are critical in addressing these challenges in the long-term by directly reducing emissions from energy production.

Further, in constructing the Narrogin Wind Farm, Neoen will implement their "above and beyond" initiative. This initiative is separate and additional to any regulatory requirement and provides funding for programs that aim to improve conservation outcomes for key biodiversity values. The value of this initiative has been demonstrated in South Australia with the purchase and donation of a new National Park as part of the Goyder Wind Farm (Creating a new - National Parks and Wildlife Service South Australia).

1.6 Report Purpose

The purpose of this report is to:

- detail the proposed action which has been referred to DCCEEW
- identify MNES which may be impacted by the proposed action
- provide information on the survey effort undertaken to date to verify the presence and extent of MNES
- summarise the proposed mitigation and management actions to address potential impacts to MNES
- undertake an assessment of significant impacts, in accordance with EPBC guidelines, for those MNES that have a potential to be impacted.

1.7 Report Contents

The structure and content of this report which has been designed to address the purpose outlined above is summarised in **Table 1.1**.

Table 1.1 Report Structure and Content

Report Section	Information/Description
Section 1.0	Provides an introduction and background to the Project.
Section 2.0	Provides a description of the Project (proposed action) and those components relevant to the EPBC referral.
Section 3.0	Summarises the legislative frameworks relevant to the EPBC referral and assessment of Project impacts.
Section 4.0	Provides a description of the methodology used to identify and characterise MNES that may be potentially impacted by the Project, and the methodology used to assess the extent and significance of these impacts.
Section 5.0	Summarises the results of desktop searches undertaken using the DCCEEW Protected Matters Search Tool database.
Section 6.0	Describes the ecological values of the Study Area and broader region as determined through Project specific studies undertaken in the Study Area and Additional Survey Area, particularly those relevant to MNES.
Section 7.0	Details the potential impacts from the Project to MNES, including both at the construction and operational phases.
Section 8.0	Provides a description of the avoidance, mitigation, and management measures proposed to address any potential impacts to MNES from the Project.
Section 9.0	Details the results of significant impact assessments undertaken for MNES within the Study Area in accordance with the *EPBC Significant Impact Guidelines 1.1.*
Section 10.0	Discusses assessment of offset requirements and potential requirements.
Section 11.0	Summarises the outcomes of this report.
Section 12.0	Provides references for all citations included in this report.
Appendix A	Provides the Reconnaissance and Targeted Flora and Vegetation Assessment for the Project
Appendix B	Provides the Vertebrate Fauna Survey report for the Project
Appendix C	Provides the Targeted Fauna Habitat Assessment for a previous Project layout
Appendix D	Provides the Preliminary Bird and Bat Adaptive Management Plan for the Project
Appendix E	Provides the Protected Matters Search Tool results for the Study Area and a 20 km boundary around it
Appendix F	Details the likelihood of occurrence assessment results for all conservation significant species that may occur within the Study Area
Appendix G	Provides the Preliminary Construction Environmental Management Plan for the Project
Appendix H	Details all species recorded within the Study Area during the field survey program

2.0 Project Description

This section describes the key infrastructure elements that will make up the Project. The Project has been through an iterative design process which was influenced by a combination of wind resource, economic, constructability, environmental, heritage, social, landowner, and network capacity considerations. The Project will include the following key infrastructure elements:

- turbines
- turbine foundations
- hardstands
- electrical connections, substations and grid connection
- BESS
- operational and maintenance facility
- construction compound, concrete batching plant and laydown areas
- borrow pits/quarries
- temporary workers accommodation
- permanent meteorological masts
- communication towers
- external site access
- internal access roads
- utilities.

The total area of ground disturbance for the above infrastructure is expected to be approximately 200 ha, within the proposed Development Corridor of 671.6 ha.

These elements are detailed in the sections below, with the Development Corridor depicted in **Figure 2.1.**

2.1 Turbines

Up to 25 wind turbines are proposed, with a maximum overall height (tip height) of 291 m above ground level (AGL). Turbines will have a horizontal axis, with a rotor consisting of three blades with a maximum blade length of up to 91 m and a maximum hub height of up to 200 m. The selected blade length and hub height will be configured so that the tip height does not exceed 291 m. These maximum specifications are summarised in **Table 2.1**.

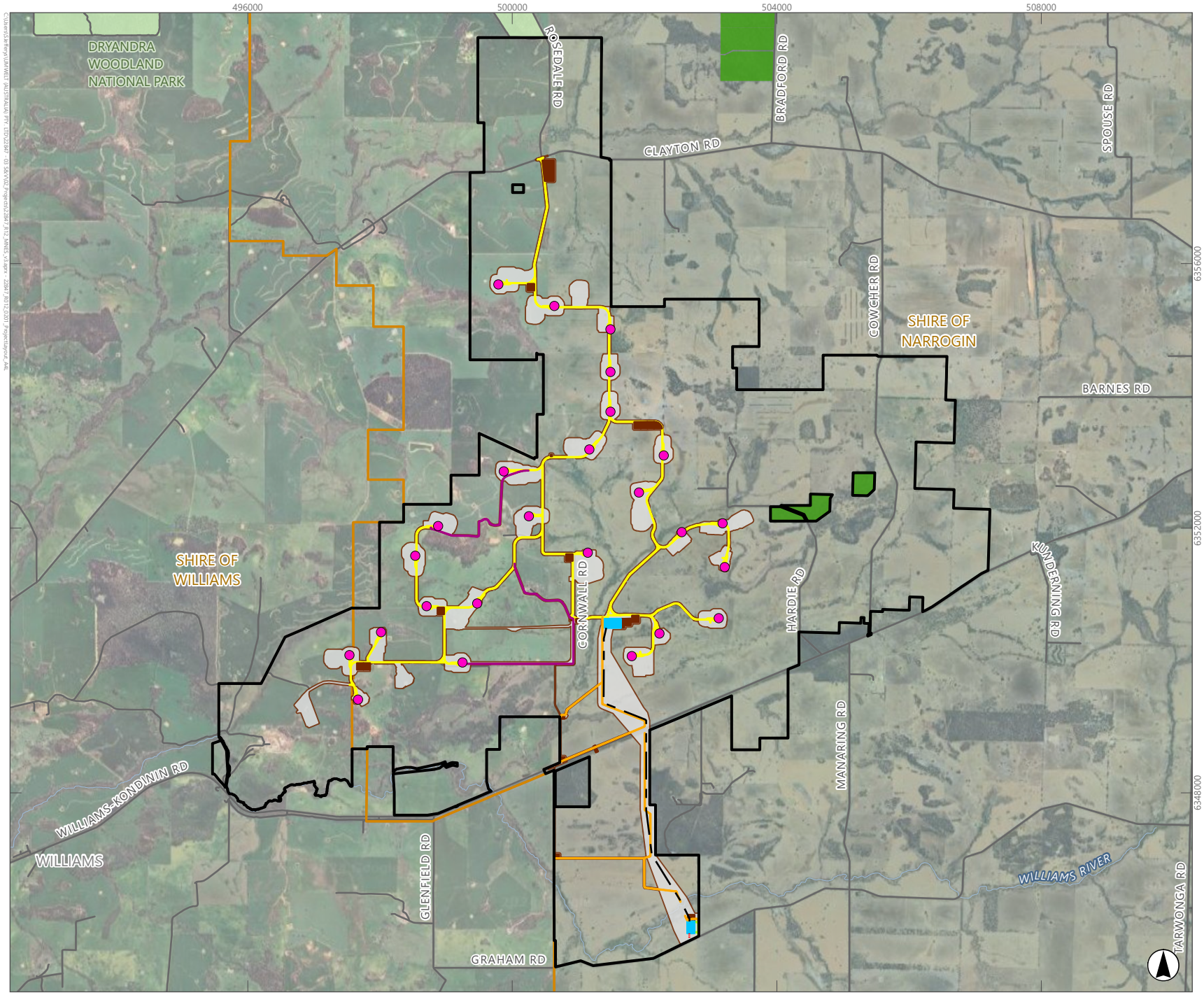
Table 2.1 Turbine Specifications

Feature	Maximum Specifications
Project generation capacity	Up to 200 MW
Maximum number of turbines	25
Hub Height	Up to 200 m
Tip Height	Up to 291 m
Blade Length	Up to 91 m

* The specifications listed in the table are considered to be an upper limit and are intended to provide flexibility for any innovation in turbine design between now and the time of detailed design and construction.

The rotor swept area (RSA) refers to the physical area swept by the rotating blades during operation. For the purposes of this assessment, an inclusive "worst-case" RSA of 49 m AGL to 291 m AGL was considered to account for wind turbine models with hub heights as low as 140 m. Final turbine selection is subject to procurement and the ability to satisfy the environmental constraints and approval conditions.

FIGURE 2.1
Project Layout



Legend

- Study Area
- Development Corridor
- Local Government Area Boundary
- Road
- Major Watercourse
- Nature Reserve
- National Park
- WTG Location
- Transmission Line WP
- Transmission Line Route
- Primary Road
- WP Terminal Road
- Access Track – Transmission Line
- Access Track – Windfarm
- Permanent Infrastructure
- Temporary Works

0 1.6 3.2

Kilometres

Scale 1:80,000 at A4
GDA2020 MGA Zone 50

Image Source: ESRI Basemap (2023) | **Data Source:** Landgate (2023), Neoen (2024), DBCA (2023)

2.2 Turbine Foundations

Each turbine foundation will comprise a reinforced concrete slab. The size of the turbine foundations may vary depending on imposed loadings, ground conditions, construction methodology and the drainage design. Final design will account for geotechnical conditions identified through a detailed investigation.

Construction of the turbine foundations will require the excavation of surface organic soil/sub-soil and other soft overburden until either rock, or a firm stratum is found, with the excavation sides battered back to ensure stability. The excavated soil/sub-soil would be separated and stored safely near to the excavation in stockpiles. The surrounding ground around the turbine base would be restored to tie in with the original and existing surface levels by using the previously stored overburden. Any surplus material would be used for additional landscaping, concrete and surfacing reinstatement.

Concrete for the foundations will be mixed at concrete batching plants which are proposed to be part of the laydown areas within the Project site. Concrete batching material may be sourced off-site.

2.3 Hardstands

Each wind turbine requires areas of hardstand to be constructed adjacent to the actual turbine foundation area. These provide stable and suitable areas for the turbine components to be stored and lifted into position by the required cranes.

The construction of each turbine will require a primary large sized crane and a secondary small sized crane. These cranes will require gravel capped hardstands to provide a stable and firm base during the installation of the turbines. The crane hardstands will remain in-situ for the lifetime of the wind farm, in case any cranes are required during the operational phase e.g., to change a blade, undertake any repairs. The pad for the primary crane is typically 100 m x 50 m and the turbine foundation falls within this area, while there can be up to an additional four secondary crane hardstands of 25 m x 15 m each. The area of the permanent handstands in total is approximately 0.65 ha per turbine

In addition to the permanent hardstands there will be two temporary cleared and graded areas during the construction phase to support the construction of the crane boom and for the laydown of the blades prior to lifting into place. The area for the crane boom is 150 m x 15 m, while the laydown area is 95 m x 20 m. The temporary works areas will be reinstated following construction.

As with the turbine foundations there will be a requirement for the excavation surface organic soil/sub-soil and other soft overburden. This material will be treated like the material from the turbine foundations and reused where possible.

2.4 Substations and Operations and Maintenance Facilities

The Project includes one substation and an operations and maintenance (O&M) facility. The proposed area for the substation and O&M facility will also include vehicle parking spaces, septic ablutions and wash down areas as appropriate.

- Power and communication cables will be installed underground between the turbines and will connect back to the substation and the O&M facility. These cables will be laid in cable trenches to allow for continued agricultural activities. The route of the underground cables will typically be adjacent to the internal access roads where available to follow.

- The total length of cable reticulation required is estimated to be 250 km but will depend on the final layout of the substation, turbines and O&M facility. Once the trenched areas have been backfilled, the disturbed area will be reinstated.
- A Western Power Terminal is proposed at the southern boundary of the Study Area where the Project ties-in to the existing network. This includes the construction of 5 km of overhead line to connect the substation in the centre of the site to the existing Western Power 220 kV line located at the southern boundary of the site. The overhead line will be supported on lattice tower structures up to 60 m tall at 250 m to 400 m intervals. Reduced spans between towers may be required near crossings of rivers and roads, or where there is a change in direction.
- The overhead line corridor of up to 70 m wide will require any vegetation that can grow above 3 m to be cleared and has been sited to avoid native vegetation as far as practicable.

2.5 Battery

The BESS will be adjacent to the proposed substation area. The specific BESS technology has yet to be selected, however, it will likely be made of lithium-ion and will have capacity to deliver up to 100 MW / 200 MWh of power that can be dispatched to the grid as required. The BESS will include battery containers, inverters, medium-voltage transformers as well as modular electrical buildings containing switchgear and control cabinets. All of the equipment in the BESS area will be installed on a permanent hardstand with appropriate drainage and stormwater management. Underground cables will connect the BESS to the substation and export power to the SWIS utilising the same transmission lines as the wind farm.

The BESS area will also include balance of plant including firewater tanks, a separate O&M building from the wind farm, a stores and security.

2.6 Construction Compound and Laydown Areas

The construction compound areas will be used to manage construction activities. These compounds will likely include: portacabins (site offices, first aid facilities, canteen facilities, waste disposal and toilets); storage containers for tools and equipment; storage areas for plant, fuel storage, material and components; wash down facilities; and sufficient parking for the workforce, deliveries and visitors. Temporary offices, lunchrooms, and ablutions may also be established on turbine hardstands during the construction period.

These areas will also accommodate temporary storage of construction plant equipment, wind farm components and construction materials prior to moving to their ultimate destination. The areas may also be used for rock crushing and stockpiles, and concrete batching equipment.

The temporary construction compounds and laydown areas will be formed into hardstand. Prior to forming the hardstand area, the topsoil will be removed and stockpiled adjacent to the hardstand area. The exact locations, nature and number of the temporary construction compounds and laydown areas will be established in consultation with the relevant landowners when a full construction methodology is determined.

Following the completion of the construction phase, these areas may be reinstated using the stockpiled topsoil depending on the landowner's requirements.

2.7 Meteorological Masts

Meteorological masts may be installed to monitor the climatic conditions and wind speed throughout the life of the Project. The masts would be of triangular steel lattice construction, approximately 160 m in height and will be guy wired in three equilateral directions. The mast will be equipped with wind and weather sensors at various heights, allowing for the measurement of wind speed, wind direction, wind shear, wind turbulence and air density.

2.8 Communication Towers

Communication towers may be required adjacent to both the substation and Western Power terminal. These towers will provide a secure and robust high-speed microwave radio link extending the existing Telco services. These towers will be up to 60 m tall, with microwave dishes installed between 40 m and 60 m above ground level. Power for the towers will be supplied by primarily from the adjacent facility, however, may also include a tower mounted solar panel and battery system as back-up.

2.9 External Site Access

The main access to the Project is proposed from Clayton Road. As shown in **Figure 2.1**, it is currently proposed that the main access for traffic to the Project site will be via the upgrade of an existing farm access road opposite Rosedale Road. From this site access point, it is proposed that Project traffic will travel south along internal project access roads. Most roads are yet to be constructed however they are proposed to be located along existing farm tracks as much as possible. All primary infrastructure, plant and equipment will be delivered to site via this access point.

Cornwall Road will be used as a secondary access to the electrical ancillary infrastructure/battery storage/substation area (**Figure 2.1**). Access to the southern portion of the site, where overhead lines and the Western Power tie in are to be constructed, will be from existing local roads managed by the Local Government Authority, most likely Hancock Road and Glenfield Rd.

Appropriate signage will be installed on relevant roads during the construction period to comply with necessary health and safety requirements.

2.10 Internal Access Roads

Design criteria and mitigation measures were applied to the access track layout to mitigate potential impacts, such as:

- Access tracks will be up to 10 m wide (widths will vary depending on various construction requirements [e.g. Reinforcement batters] topography and cabling requirements).
- Locating tracks on existing farm tracks where possible.
- Regular passing places and turning areas will be instated.
- Watercourse crossings will be minimised.
- Tracks will not be sealed.

- Tracks will be constructed from locally sourced aggregate where available.
- Clearing of native vegetation has been avoided as far as practicable.

The construction of access tracks will vary depending on localised ground conditions. Conditions impacting construction include the existing vegetation, nature of the topsoil, level of moisture in the ground, geotechnical base and localised topography.

Post construction, roads will be maintained as they need to remain passable for oversize over mass loads in the event of a blade replacement during operation.

2.11 Construction Workforce

It is estimated that the peak construction workforce will comprise of up to 250 staff during a 33-month construction period. Neoen focuses first on hiring local people for projects. It is expected that some of the workforce will commute from the wider local areas and will not require additional accommodation. Other workers may be accommodated in a temporary workers accommodation facility, local rental houses, hotels and motels, and/or Shire owned infrastructure in the surrounding localities and towns.

2.12 Operational Workforce

During operations, the Project will be managed by both on-site and off-site personnel, employed by, or contracted to Neoen. It is expected that the Project will generate approximately ten permanent, full-time jobs throughout its operational life. Neoen will focus first on hiring local people for the Project.

Aspects of the Project operation dealt with by on-site personnel include:

- maintenance of wind turbines and associated infrastructure
- safety management
- implementation of environmental conditions
- landowner liaison.

2.13 Maintenance

The chosen turbine manufacturer will be responsible for maintaining the wind turbines for a defined period of time following commissioning. Once the manufacturer's obligation expires, a suitably qualified contractor will be employed to visit the site and undertake regular inspection and maintenance activities. Ongoing maintenance of the access tracks will generally be undertaken to ensure safe access to all components requiring maintenance throughout the year.

In addition to regular maintenance activities there will be a need for unscheduled maintenance. Unscheduled maintenance is more likely to be required at the Project start up and towards the end of the operational period as the end of the design life is reached.

2.14 Decommissioning and Rehabilitation

The proposed technology is expected to have an economic life of approximately 25–30 years. The landowner agreements make provision for an initial lease term of 30 years as well as an additional term of 30 years. At the end of the current lease term, a decision would be made whether to either:

- decommission the project permanently; or
- remove the old turbines and seek to replace them with new, upgraded models.

In the event that the project is permanently decommissioned, Neoen would take full responsibility for decommissioning and rehabilitation works. A decommissioning plan would be prepared and submitted to the relevant authority.

Decommissioning would include the following:

- de-energising plant and equipment
- dismantling and removing wind turbines and transmission lines, as well as all other aboveground buildings, foundations and equipment
- rehabilitation of disturbed land
- recycling of recyclable materials (including batteries).

Decommissioning of some elements may be subject to the landowner's discretion (such as access tracks).

As per accepted industry practice, decommissioning does not include the removal of infrastructure that is located more than 600 mm below the surface, as the earthworks required cause considerable and unnecessary vegetation and soil disturbance, and this infrastructure, if left in place, causes no harm to the environment or disruption to agricultural practices.

3.0 Legislative and Regulatory Context

3.1 Commonwealth

3.1.1 Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) is administered by the Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW). Under the EPBC Act, if the Minister for the Environment determines that an action is a "controlled action" which would have or is likely to have a significant impact on Matters of National Environmental Significance (MNES) or Commonwealth land, then the action may not be undertaken without prior approval from the Minister. The EPBC Act identifies nine MNES:

- world heritage properties
- national heritage places
- Ramsar Wetlands of International Significance
- Threatened species and ecological communities
- Migratory species
- Commonwealth marine areas
- the Great Barrier Reef Marine Park
- nuclear actions (including uranium mining)
- water resources (in relation to coal seam gas development and large coal mining development).

Under the EPBC Act, any action that is likely to have a significant impact on these matters may be deemed a controlled action.

3.1.1.1 Significant Impact Guidelines 1.1 – Matters of National Environmental Significance

The MNES Guidelines (Department of the Environment, 2013) provide overarching guidance on determining whether an action is likely to have a significant impact on a matter protected under the EPBC Act.

The significance of the proposed action on MNES can be determined through a self-assessment. The significant impact criteria set out in the guideline for each MNES are to assist in determining whether the impacts of the proposed action on any MNES are likely to be significant (e.g. as being important, notable or of consequence, or having regard to its context or intensity).

If after undertaking a self-assessment it is concluded that the action is likely to have a significant impact on any MNES, or if unsure, the action should be referred to the Minster. If the Minister decides that the action is likely to have a significant impact, then the action will be determined as a controlled action requiring approval under the EPBC Act.

3.1.1.2 Referral Guidelines for 3 WA Threatened Black Cockatoo Species

The Guidelines for 3 WA Threatened Black Cockatoo Species (Department of Agriculture, Water and the Environment (DAWE), 2022) adheres to the EPBC Act and is regulated by DCCEEW. The referral guidelines provide guidance to proponents on the need to refer an action that has the potential to affect any of the three species:

- Carnaby's Cockatoo (*Zanda latirostris*)
- Baudin's Cockatoo (*Zanda baudinii*)
- Forest Red-tailed Black-cockatoo (*Calyptorhynchus banksii naso*).

This document distinguishes what actions are deemed likely (or unlikely) to require a referral to the Minister based on whether the action will have a significant impact on the species. Information on habitat quality, survey expectations, mitigation standards, as well as the aspects needing to be considered to determine whether referral is necessary, are also detailed in this document.

3.1.1.3 EPBC Act Biodiversity Offsets Policy

The EPBC Act Environmental Offsets Policy (EPBC Offset Policy) (DSEWPaC, 2012) outlines the approach for the use of environmental offsets under the EPBC Act.

Offsets are measures that compensate for the significant residual impacts of an action on the environment, after avoidance and mitigation measures are taken. Where appropriate, offsets are considered during the assessment phase of an environmental impact assessment under the EPBC Act. The suitability of a proposed offset is considered as part of the decision to approve or not approve a proposed action. The EPBC Offset Policy provides guidance on how suitable offsets are determined while the quantum of impact and quantum of offset required to counterbalance this impact are calculated using the Commonwealth Offset Assessment Guide and corresponding guidance.

3.1.2 Weeds of National Significance

Under the Australian Weeds Strategy 2017–2027 (Invasive Plants and Animals Committee (IPAC), 2017) 32 introduced plants are identified as Weeds of National Significance (WoNS). This list of species was developed with reference to several key criteria: invasive tendencies, impacts, potential for spread, and socioeconomic and environmental values. National management strategies and manuals have been published for all of these species. The strategies aim to:

- improve prevention, detection and early intervention
- minimise the impact of established weeds
- enhance capacity and commitment to weed management.

3.2 Relevant WA Legislation

3.2.1 Biodiversity Conservation Act 2016

The *Biodiversity Conservation Act 2016* (WA) (BC Act) seeks to 'conserve and protect biodiversity and biodiversity components in the State' and 'to promote the ecologically sustainable use of biodiversity components in the State'.

It not only provides for the formal listing of native flora, fauna, and ecological communities that are under threat and in need of protection but also regulates the taking, disturbing, supplying, possessing, processing, dealing, importing, and exporting of all native flora and fauna.

Activities that involve the taking, disturbing, supplying, possessing, dealing, importing, or exporting of any native flora and fauna will require an appropriate licence issued by DBCA under the BC Act.

3.2.2 Environmental Protection Act 1986

The *Environmental Protection Act 1986* (WA) (EP Act) provides the legal framework to prevent, control and abate pollution and environmental harm in WA, as well as the legal basis to conserve, preserve, protect, enhance, and manage the environment.

The Environmental Protection Authority (EPA), the Department of Water and Environmental Regulation (DWER), and the Office of the Appeals Convenor are the government agencies that administer and have responsibilities under the EP Act.

The EPA undertakes environmental impact assessments, develops environmental protection policy, prepares guidelines for managing environmental impacts, and provides strategic advice to the Minister for Environment.

Part IV of the EP Act requires projects that are likely to have a significant effect on the environment to be referred to the EPA to decide if an environmental impact assessment is required.

The EPA considers significant impacts to fourteen environmental factors grouped under five themes. The commonly understood, everyday meaning of 'significant' impact or effect apply as these terms are not defined in the legislation. The EPA list the range of matters that may be included when considering the significance of proposed activities.

Part V of the EP Act regulates emissions and discharges to the environment through a works approval and licensing process and regulates the clearing of native vegetation through clearing permit applications. DWER is responsible for administering Part V of the EP Act. Applications to clear native vegetation are assessed and decided in accordance with the EP Act, in particular the Clearing Principles (under Schedule 5 of the EP Act).

The Project is being referred to the EPA under Part IV of the EP Act to determine whether formal assessment is required. Should the Project not require formal assessment under Part IV, a native vegetation clearing permit will be applied for under Part V of the EP Act.

3.2.3 Environmental Offset Policy (2011) and Guidelines (2014)

The 2011 Environmental Offset Policy and 2014 Guidelines provides the overarching framework for offset design, quantification, and implementation in Western Australia. Offsets are required to address residual significant impacts to protected State matters and may be implemented under the BC Act, or Part IV or V of the EP Act. Depending on the legislation under which the offsets are implemented, the regulating agency may be the EPA, DWER or the Department of Biodiversity, Conservation and Attractions (DBCA). It is expected that offsets will be required to be implemented under the EP Act.

3.2.4 Planning and Development Act 2005

The WA *Planning and Development Act 2005* (PD Act) is the primary legislation under which development in WA is regulated. Under this Act, any development requires approval unless a range of exemptions apply. Decision makers for development applications under the PD Act are required to consider a range of factors, including potential environmental impacts. Specifically, decision makers under the PD Act need to consider relevant planning policies and guidelines which include:

- WAPC Position Statement for Renewable Energy Projects (WAPC, 2020), which requires proponents to manage environmental impacts, including to biodiversity.
- State Planning Policy 2.0 (WAPC, 2003) Environment and natural resources policy: which has the objective to integrate environment and natural resource management with broader land use planning and decision-making, and to protect, conserve and enhance the natural environment.
- State Planning Policy 2.5 (Department of Planning, Land and Heritage, 2016): Rural Planning, which is intended to guide the protection and preservation of the State's rural land assets for their economic, natural resource, food production, environmental, and landscape values.
- Guidance Statement 33 (Environmental Protection Authority (EPA), 2008): Environmental Guidance for Planning and Development, which provides information to assist decision makers in the planning and development process to protect, conserve, and enhance the environment. Specifically this guideline discusses the importance of biodiversity conservation consideration during planning, and notes that decision-making on land use and development should reflect strategies that address biodiversity protection and avoid unacceptable impacts to biodiversity.

In the context of the Narrogin Wind Farm, approval of a development application will likely include a condition to develop and implement a management plan to mitigate potential impacts to bird and bat species.

3.2.5 Biosecurity and Agriculture Management Act 2007

The *Biosecurity and Agriculture Management Act 2007* (WA) (BAM Act) provides the legal framework to:

- Address invasive, weeds and diseases ('biosecurity').
- Ensure agricultural and veterinary chemicals are used safely.
- Establish standards for safe and quality agricultural products.
- Raise funds for biosecurity-related purposes.

The BAM Act also supports biosecurity activities to detect, contain, manage or eradicate prohibited organisms/declared pests that enter the state. This can include the reporting of declared pests, restrictions on the rights to keep or breed pests, register the movement of pests, or assisting in efforts to aid in the containment, management, or eradication of pests.

4.0 Methodology to Assess Impacts to MNES

4.1 Desktop Assessment

A review of available ecological data and literature was first undertaken to characterise the ecological values and identify the potential presence of threatened species and vegetation communities within the Study Area. The objectives of this desktop assessment included:

- a review of relevant biodiversity databases, government publications and published literature relevant to the Study Area
- an assessment of the broad conservation values of vegetation communities and habitat present in the Study Area
- identification of the potential presence of conservation significant species and habitat in the Study Area.

The desktop assessment included searches of the following databases:

- DCCEEW EPBC Protected Matters Search Tool (PMST) database (Department of Climate Change, Energy, the Environment and Water (DCCEEW), 2024f)
- DBCA Threatened and Priority flora database (Department of Biodiversity, Conservation and Attractions (DBCA), 2023b)
- DBCA Threatened and Priority ecological communities database (DBCA, 2023b)
- DBCA Threatened and Priority fauna database (DBCA, 2023a).

Database searches undertaken by Umwelt as part of the desktop assessment utilised a designated "Search Area" that included at least a 20 km buffer around both the Study Area and Additional Survey Area boundary.

Desktop assessments are described in detail in the following reports:

- Phase 1 Reconnaissance Flora and Vegetation and Fauna Habitat Assessment (Umwelt, 2023)
- Phase 2 Reconnaissance and Targeted Flora and Vegetation Assessment (Umwelt, 2024d) (Provided in **Appendix A**)
- Phase 2 Vertebrate Fauna Survey Report (Western Wildlife, 2024) (Provided in **Appendix B**)
- Bird and Bat Utilisation Survey Summary Report (Umwelt, 2024c) (provided as part of **Appendix D**)
- Bird and Bat Utilisation Survey Risk Assessment Report (Umwelt, 2024b) (provided as part of **Appendix D**).

4.2 Field Surveys

The data presented herein has been collected within the Study Area across numerous field surveys from May 2023 to August 2024 (referred to as the survey program). A list of the field surveys completed to date and associated climatic conditions is provided in **Table 4.1**. The survey methodology employed for each survey effort and assessment of ecological data is then detailed in the following sections.

Table 4.1 Field Surveys Undertaken for the Project

Field Survey	Survey Dates	Survey Length (Days)	Rainfall (mm)	Temperature (°C)	
				Min	Max
Flora and Vegetation Reconnaissance Survey and Fauna Habitat Assessment (Phase 1 survey)	1–3 May 2023	4	0	12.8	34.2
Flora and Vegetation Reconnaissance and Targeted Survey (Phase 2 – central Study Area)	26–29 September 2023	4	0	4	31
Flora and Vegetation Reconnaissance and Targeted Survey (Phase 2 – additional Survey Area)	4–6 November 2023	3	0.2	13.8	35.5
Flora and Vegetation Reconnaissance and Targeted Survey (Phase 2 – northeastern portion of Study Area)	19 April 2024	1	0	10.9	27.5
Vertebrate Fauna Survey (Phase 2)^	23–27 October 2023	5	0	5	29.9
Spring Bird and Bat Utilisation Survey	23–28 October 2023	6	0	5	29.9
Summer Bird and Bat Utilisation Survey	5–9 February 2024	5	0	8.6	40
Targeted Fauna Habitat Assessment	10–11 June 2024	2	5.4	10.3	16.5

Note. ^Some remote sensing equipment (camera traps and passive acoustic recorders) remained in the field until retrieval on 24 and 25 November 2023.

4.2.1 Terrestrial Flora and Vegetation

4.2.1.1 Vegetation Communities

Floristic and vegetation structural data recorded as vegetation mapping notes and relevés at waypoints across the Study Area were examined to define discrete Vegetation Types (VTs) of the Study Area. Locations of vegetation mapping notes and relevés were used in conjunction with aerial photograph interpretation, digital elevation models, and soil mapping units to generate discrete VT polygons in a Geographic Information Systems (GIS) environment. Mapping boundaries were developed using aerial photography on a scale of 1:5,000 and reflected changes in vegetation patterns visible at this scale. The scale of mapping was refined within the Development Corridor once established. The full survey effort for flora and vegetation is provided in **Figure 4.1**.

VT descriptions have been adapted from the National Vegetation Information System (NVIS) Australian Vegetation Attribute Manual Version 6.0 (ESCAVI, 2003). This model follows nationally agreed guidelines to describe and represent VTs and produces data that is comparable and consistent nation-wide. VTs were defined and described using the structural vegetation classification technique as outlined in EPA Technical Guidance (Environmental Protection Authority (EPA), 2016). This technique uses vegetation structure and dominant species to describe VTs with information provided on the height of strata, foliage cover, and dominant species, as well as substrate and landscape factors.

Vegetation condition was described using the vegetation condition scale presented by EPA (2016) for the South West and Interzone Botanical Provinces (**Table 4.2**). Notes on vegetation condition were taken during the reconnaissance survey at all vegetation mapping note locations. Vegetation condition classifications were applied to the mapped VTs by either categorising whole polygons where the condition was uniform throughout, or dividing existing VT polygons where a change in condition was observed.

Table 4.2 Vegetation Condition Scale as described in EPA (2016)

Vegetation Condition	South West and Interzone Botanical Provinces
Pristine	Pristine or nearly so, no obvious signs of disturbance or damage caused by human activities since European settlement.
Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species. Damage to trees caused by fire, the presence of non-aggressive weeds and occasional vehicle tracks.
Very Good	Vegetation structure altered, obvious signs of disturbance. Disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds at high density, partial clearing, dieback and grazing.
Completely Degraded	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees and shrubs.

4.2.1.2 Threatened Ecological Communities

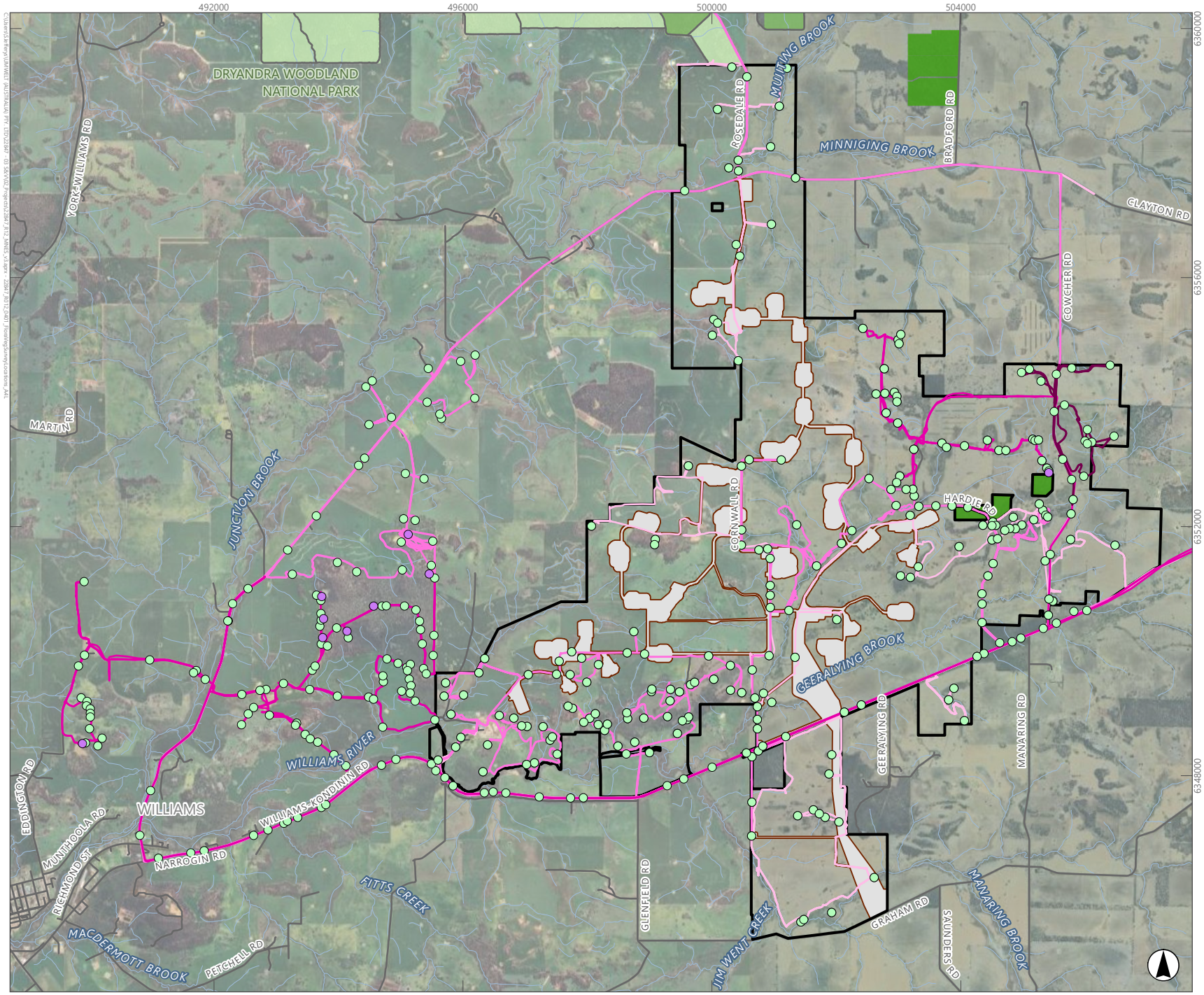
The vegetation of the Study Area was manually compared to descriptions for those TECs returned by the desktop assessment or otherwise relevant to the region, to determine whether any vegetation may represent a TEC. Specifically, comparisons of dominant species, soils, topography, and geographical distribution of VTs were made to the applicable diagnostic criteria as per the approved listing or conservation advice for those TECs potentially occurring in the Study Area.

4.2.1.3 Threatened Flora

Targeted surveys were undertaken in accordance with the EPA (2016) *Technical Guidance—Flora and Vegetation Surveys for Environmental Impact Assessment*. The extent of targeted survey was assessed at the time of the fieldwork, dependent on environmental conditions and the environmental factors encountered.

Targeted survey was conducted for significant flora in areas of Good or better vegetation condition and to verify the condition of two areas in the northeast of the Study Area previously assessed as 'Good' condition by the Phase 1 survey. Likewise, an area in the west was also subject to Targeted survey for significant flora and to confirm vegetation condition. Areas subject to Targeted flora survey were searched at 20 m spacing for significant flora. An additional three transects were conducted along the major drainage line in the central property to search for significant flora to confirm the original assertation that the vegetation condition would not support significant flora. Areas of Degraded or Completely Degraded condition were regarded as having very low likelihood of presence of significant flora taxa due to the disturbed nature of the vegetation (generally consisting of a tree layer over pasture weeds, with impacting processes present such as historical clearing and livestock in combination with lack of fences protecting remnant vegetation, as observed during the Phase 1 May 2023 field survey).

FIGURE 4.1
Flora and Vegetation Survey Locations



Legend

- Study Area
- Development Corridor
- Road
- Watercourse
- Nature Reserve
- National Park
- State Forest
- Relevé
- Vegetation Mapping Note

Track Logs

- Trip 4 – April 2024
- Trip 3 – November 2023
- Trip 2 – September 2023
- Trip 1 – May 2023

0 1.7 3.4

Kilometres

Scale 1:85,000 at A4
GDA2020 MGA Zone 50

Image Source: ESRI Basemap (2023) | **Data Source:** Landgate (2023), Umwelt (2024), DBCA (2023)

4.2.2 Terrestrial Fauna

Survey methods for terrestrial fauna were developed and undertaken in accordance with the EPA (2020) *Technical Guidance—Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment*. Additionally, for the three Threatened black-cockatoo species with a potential to occur in the Study Area, the DCCEEW (DAWE, 2022) *Referral Guideline for 3 WA Threatened Black Cockatoo Species* and Bamford Consulting Ecologists (BCE) (2020) method was utilised for mapping and characterising foraging and breeding habitat. Fauna surveys were conducted within representative locations of all fauna habitat types.

The survey effort presented in **Table 4.3** and depicted on **Figure 4.2** covers the full field survey program which was conducted across the Study Area and Additional Survey Area.

The survey approach and associated effort for Threatened fauna considered to have a potential to occur within the Study Area is outlined in **Section 4.2.2.1** and includes the following species:

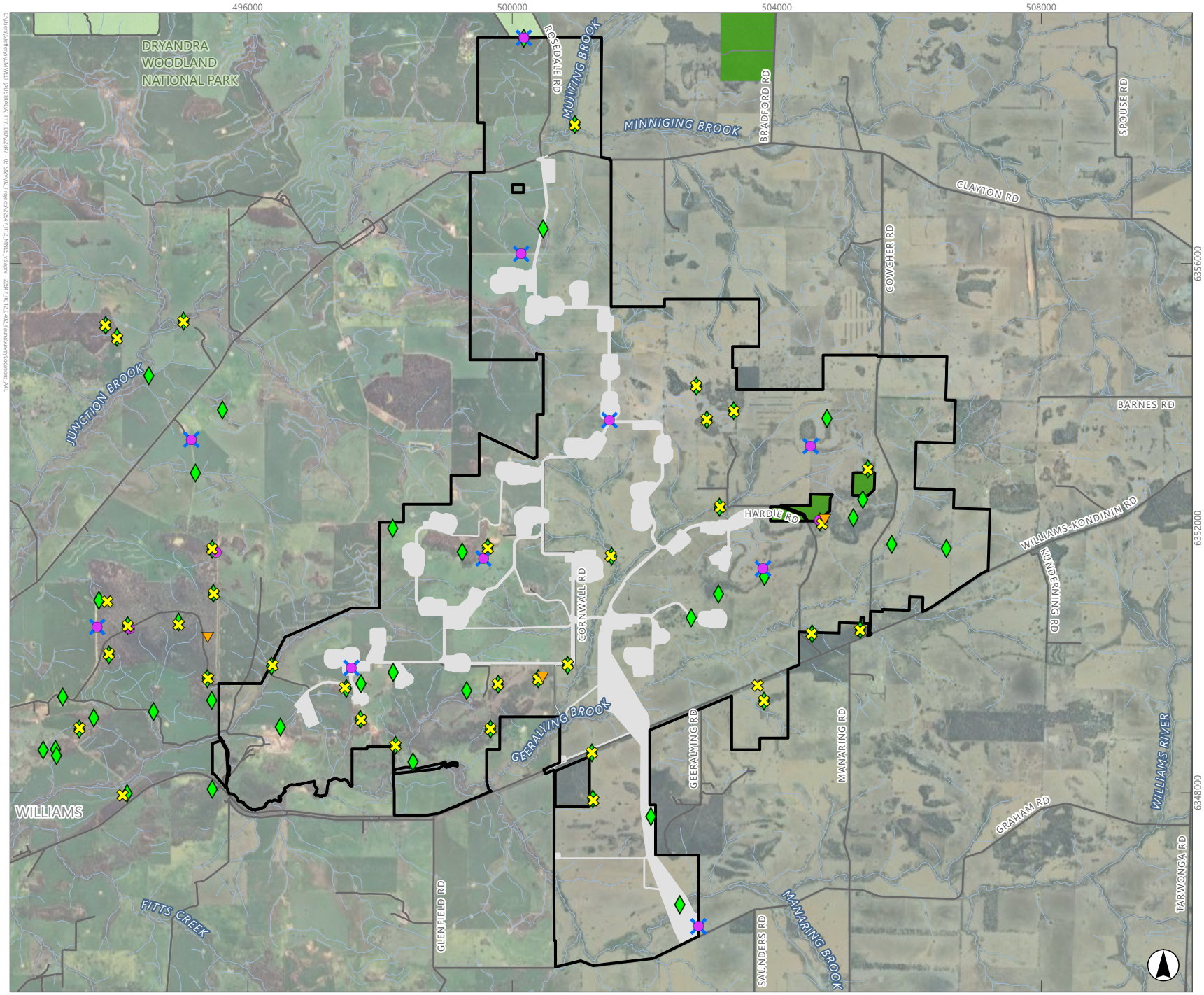
- Three black-cockatoo species (Baudin's Black-Cockatoo [*Zanda baudinii*], Carnaby's Black-Cockatoo [*Zanda latirostris*], and Forest Red-tailed Black-Cockatoo [*Calyptorhynchus banksii naso*])
- Chuditch (Dasyurus geoffroii)
- Red-tailed Phascogale (*Phascogale calura*)
- Fork-tailed Swift (*Apus pacificus*).

Table 4.3 Fauna Survey Techniques and Effort

Technique	Description	Survey Effort		
		Within Study Area	Outside Study Area	Total
Bird Survey (fixed-point)	Diurnal birds were sampled using a fixed-point count method involving timed 30-minute intervals across eight vantage points in the Study Area and three in the Additional Survey Area to assess site utilisation and flight behaviour. Vantage points were established at high points of habitat types representative of those found across the Study Area. Each vantage point was surveyed during four sampling windows per day (early morning, late morning, early afternoon, and late afternoon) to minimise sampling bias. Surveys were completed in Spring 2023 and Summer 2024.	64 cumulative hours across 8 locations	24 cumulative hours across 3 locations	88 cumulative hours
Camera Trapping	A total of 39 camera traps were deployed at strategic locations across the Study Area and Additional Survey Area to record visitation by nocturnal and diurnal fauna over a month. Each trap was deployed with a non-reward bait lure of a fish oil-soaked sponge in a perforated plastic container. The bait lure was secured to the ground and the camera secured to a stake or nearby tree. The camera images were reviewed by a qualified zoologist, and all vertebrate fauna were identified to species level where possible.	685 trap-nights across 21 locations	597 trap-nights across 18 locations	1,282 trap-nights
Acoustic Monitoring	Anabat passive bat detector devices were deployed at BBUS vantage points to record visitation by bats between dusk and dawn in vegetated areas during the basic fauna survey and BBUS. Detectors were deployed across three survey events, with two in Spring 2023 and one in Summer 2024. Songmeter 4 (SM4) passive acoustic detectors were set to record between dusk and dawn during the basic fauna survey in Spring 2023 for 18 nights across October and November. Each unit was secured to a tree, about 1.5 m off the ground. All bird species able to be identified were recorded.	Anabat: 36 trap-nights across 9 locations SM4: 36 trap-nights across 2 locations	Anabat: 21 trap-nights across 6 locations SM4: 36 trap-nights across 2 locations	Anabat: 57 trap-nights SM4: 72 trap-nights

Technique	Description	Survey Effort		
		Within Study Area	Outside Study Area	Total
Fauna Habitat Assessment	Habitat assessments were undertaken across the Study Area with the aim of sampling the heterogeneity present in each habitat in both large and small remnant patches. A fauna habitat assessment was initially undertaken concurrently with the reconnaissance flora and vegetation assessment during phase 1 surveys, and these were later verified and refined during the basic fauna survey undertaken during phase 2 surveys. Further targeted habitat assessments were completed in 2024 to ground-truth the presence and extent of Threatened fauna habitat for the Chuditch and Red-tailed Phascogale within areas of the Development Corridor. This targeted assessment also provided an opportunity to categorise and assess key fauna habitats for their significance to Threatened fauna species.	N/A	N/A	N/A
Black Cockatoo Habitat Assessment	The vegetation in the study area was assessed for the presence and extent of breeding, foraging, and roosting habitat, and scored using the (DAWE, 2022) referral guideline for broad-scale mapping across the Study Area. This was later refined within areas of the Development Corridor at a finer-scale using the BCE (2020) method.	N/A	N/A	N/A
Incidental Observations	At all times, observations of fauna were noted when they contributed to the accumulation of information on the fauna of the Study Area. These included casual observations of reptiles, mammals, and birds seen while travelling between sites or while undertaking other activities.	N/A	N/A	N/A

FIGURE 4.2
Fauna Survey Locations



Legend

- Study Area
- Development Corridor
- Road
- Watercourse
- Nature Reserve
- National Park

Survey Effort

- Bat Detector
- Camera Trap
- Passive Acoustic Detector
- Vantage Point
- Habitat Assessment

0 1.6 3.2

Kilometres

Scale 1:80,000 at A4
GDA2020 MGA Zone 50

Image Source: ESRI Basemap (2023) | **Data Source:** Landgate (2023), Umwelt (2024), DBCA (2023)

4.2.2.1 Threatened Fauna

The survey approaches and associated efforts for Threatened or Migratory fauna considered as part of the desktop assessment to have a moderate or greater likelihood of occurrence within the Study Area is outlined below.

Threatened black-cockatoo species

Surveys for the three Threatened black-cockatoo species expected to occur within the Study Area (Carnaby's Black-Cockatoo [*Zanda latirostris*], Baudin's Black-Cockatoo [*Zanda baudinii*] and the Forest Red-tailed Black-Cockatoo [*Calyptorhynchus banksii naso*]) were undertaken in accordance with the DCCEEW (DAWE, 2022) *Referral guideline for 3 WA threatened black cockatoo species* and the WA Environmental Protection Authority (EPA) (2020) *Technical Guidance – Terrestrial vertebrate fauna surveys for environmental impact assessment*. The alignment of survey techniques with these guidelines is described in **Table 4.4**. The system adopted for ranking of potential Black-Cockatoo trees is presented in **Table 4.5.**

Table 4.4 Black-Cockatoo Survey Methodology

Recommended methodology	Field survey alignment

Survey timing (wheatbelt) (DAWE, 2022)**:**
• Baudin's Black-Cockatoo – Breeding habitat and foraging habitat in proximity - possible presence on western margins during breeding season (October to March).
• Carnaby's Black-Cockatoo – Breeding habitat and foraging habitat in proximity - July to December; some individuals occur all year.
• Forest Red-tailed Black-Cockatoo – Breeding habitat and foraging habitat in proximity - possible presence on margins, depending upon resource availability.
Survey technique:
• Primary survey techniques for birds include observational or acoustic surveys (EPA, 2020):
  ○ these may involve fixed time and position counts, transect searches and/or area searches
  ○ should be undertaken during peak activity periods typically after dawn and before dusk, avoiding wet, windy, and extremely hot conditions
  ○ sites should be surveyed more than once in a consistent manner at different times of the day across different days.
• Habitat assessments for black-cockatoos need to be informed by field observations on the presence of breeding habitat (known, suitable or potential nesting trees), foraging habitat, or night roosting habitat (DAWE, 2022):
  ○ observations include presence and size of hollows, chewing around hollow entrances, feeding signs or feeding debris, and sightings of the birds and observations of their behaviour.
  ○ Foraging habitat assessments should be undertaken in accordance with the DCCEEW Foraging Habitat Quality Scoring Tool
	Survey timing:
	• Field surveys for black-cockatoo species were undertaken at various intervals between October 2023 and June 2024.
	Survey techniques
	• Opportunistic records – observations made opportunistically during field surveys (including visual, aural, and signs of secondary evidence) were recorded.
	• Fixed-point count method – 11 vantage points were surveyed using the fixed-point count method across four days during two separate survey phases (totalling eight days across spring and summer). Details of flight heights, general behaviour, and number of individuals were recorded and surveys were undertaken at early morning, late morning, early afternoon, and late afternoon.
	• Acoustic monitoring (Songbird meter 4) - passive acoustic detectors were set to record between dusk and dawn totalling 74 trap-nights.
	• Habitat assessments:
	  ○ Vegetation data and habitat assessments in all representative habitat types were used to assess the suitability for foraging habitat based on DAWE (2022).
	  ○ Similarly, potential breeding habitat was assessed as any vegetation containing tree species known to be used for breeding, with records of any hollows opportunistically identified also taken.
	  ○ Targeted breeding and foraging habitat of ~60% of the Indicative Project Footprint were also assessed using the BCE (2020) method. The BCE (2020) method is adapted from the DAWE (2022) scoring method with a more detailed approach that is also aligned with the Commonwealth offset guidelines for habitat scoring. Breeding tree ranking is described in **Table 4.5** and the targeted survey is summarised in **Appendix C**. Note that the total areas of foraging habitat and number of trees shown in **Appendix C** do not match numbers in this report due to changes to the Indicative Project Footprint following completion of the targeted survey. The Project commits to undertaking targeted breeding and foraging habitat surveys of unassessed areas of the final Project footprint prior to construction.

Table 4.5 Black-Cockatoo Breeding Tree Ranking

Rank	Description of tree and hollows/activity
1	Activity at hollow observed; adult (or immature) bird seen entering or emerging from hollow. Can also be used for a known nest tree active in the previous 12 months (although this should be noted in the description). Note that activity at a hollow does not absolutely mean that breeding is occurring unless a young bird in hollow is observed.
2	Hollow of suitable size visible with chew marks around entrance. Record if chew-marks are recent or old.
3	Potentially suitable hollow visible but no chew marks present at entrance; or potentially suitable hollow suspected to be present - as suggested by structure of tree, such as large, vertical trunk broken off at a height of >8 m; but note that hollow height is contextual. Carnaby's Black-Cockatoo will nest in hollows <5 m so in a Wheatbelt breeding site a lower criterion may be more appropriate.
4	Tree with large hollows or broken branches that might contain large hollows, but hollows or potential hollows (nest chamber) are not vertical or near-vertical; thus a tree with or likely to have hollows of sufficient size but not to have hollows of the angle preferred by Black-Cockatoos. Trees with low but otherwise suitable hollows can also be assigned a rank or 4, depending on the species of black-cockatoo likely to be present.
5	Tree lacking large hollows or broken branches that might have large hollows; a tree with more or less intact branches and a spreading crown.

Chuditch (*Dasyurus geoffroii*)

Surveys for the Chuditch were undertaken in accordance with the WA EPA (2020) *Technical Guidance – Terrestrial vertebrate fauna surveys for environmental impact assessment* as outlined in **Table 4.6**.

Table 4.6 Chuditch Survey Methodology

Recommended methodology	Field survey alignment
Survey techniques Primary recommended survey techniques listed by EPA (2020) for medium-sized mammals (>30 g , <2,500 g) include: • Box traps and cage traps. • Opportunistic records via searching for tracks and other signs. • Camera traps for which baits can be used to attract targeted fauna to camera trap monitoring area.	**Survey techniques** Opportunistic records: • Observations of fauna and fauna evidence were noted when they contributed to the accumulation of information on the fauna of the site while travelling between sites or while undertaking other activities. • General location for common species, and conservation significant species were recorded with a GPS location. **Camera traps:** • Total of 39 camera traps deployed for a month with a non-reward bait lure of a fish oil-soaked sponge in a perforated plastic container giving a total of 1,276 trap-nights across the Study Area and Additional Survey Area. • Camera images were reviewed by a qualified zoologist and all vertebrate fauna were identified to species level where possible.

Red-tailed Phascogale (*Phascogale calura*)

Surveys for the Red-tailed Phascogales were undertaken in accordance with the WA EPA (2020) *Technical Guidance – Terrestrial vertebrate fauna surveys for environmental impact assessment* as outlined in **Table 4.7.**

Table 4.7 Red-tailed Phascogale survey methodology

Recommended methodology	Field survey alignment
Survey techniques Primary recommended survey techniques listed by EPA (2020) for medium-sized mammals (>30 g, <2,500 g) include: • Box traps and cage traps. • Opportunistic records via searching for tracks and other signs. • Camera traps for which baits can be used to attract targeted fauna to camera trap monitoring area.	**Survey techniques** Opportunistic records: • Observations of fauna and fauna evidence were noted when they contributed to the accumulation of information on the fauna of the site while travelling between sites or while undertaking other activities. • General location for common species, and conservation significant species were recorded with a GPS location. **Camera traps:** • Total of 39 camera traps deployed for a month with a non-reward bait lure of a fish oil-soaked sponge in a perforated plastic container giving a total of 1,276 trap-nights across the Study Area and Additional Survey Area. • Camera images were reviewed by a qualified zoologist and all vertebrate fauna were identified to species level where possible.

Fork-tailed Swift (*Apus Pacificus*)

Surveys for the Fork-tailed Swifts were undertaken in accordance with the WA EPA (2020) Technical Guidance – Terrestrial vertebrate fauna surveys for environmental impact assessment and the *Draft referral Guideline For 14 Birds Listed as Migratory Species Under the EPBC* (Department of the Environment, 2015b)as outlined in **Table 4.8.**

Table 4.8 Fork-tailed Swift survey methodology

Recommended methodology	Field survey alignment
Survey techniques The *Draft referral Guideline For 14 Birds Listed as Migratory Species Under the EPBC Act* lists the following considerations for surveying swifts (Department of Environment, 2015): • Surveying should be conducted by an experienced person from an elevated viewpoint during the Austral Summer, and prevailing weather conditions should be noted as this can greatly affect the likelihood of occurrence. • Fork-tailed Swifts high in the air have a distinctive vocalisation, recognisable to experienced observers.	**Survey techniques** Fixed-point count method • 11 vantage points at high points in the landscape were surveyed using the fixed-point count method during two separate survey phases by experienced zoologists (totalling eight days across spring and summer). Details of flight heights, general behaviour, and number of individuals were recorded, and surveys were undertaken at early morning, late morning, early afternoon, and late afternoon.

Recommended methodology	Field survey alignment
• As they are transitory at most sites, it is unlikely to record occurrences during specific surveys of short duration and records from local observers should be utilised. The WA EPA (2020) Technical Guidance – Terrestrial vertebrate fauna surveys lists the following techniques for surveying bird species which may be relevant to swifts: • Opportunistic observations: All vertebrate fauna detected while travelling from one site to another/undertaking other general tasks should be recorded. The location and habitat where the signs or species were observed should be recorded. • Acoustic surveys using audible calls: Listening to the dawn chorus at a site will give an understanding of the bird species that have roosted in the area the preceding night and may identify cryptic species that are hard to detect visually.	**Opportunistic observations:** • All observations or evidence of fauna were noted when they contributed to the accumulation of information on the fauna of the site and recorded while travelling between sites or while undertaking other activities. • General location was recorded for common species, and conservation significant species were recorded with a GPS location. **Acoustic surveys – audible calls:** • Four Songmeter 4 (SM4) passive acoustic detectors were set to record between dusk and dawn with each unit secured to a tree, about 1.5 m off the ground. • The detectors recorded until the batteries ran out, giving about 18 nights per unit, or a total of 72 trap-nights. • The SM4 data were reviewed by a qualified zoologist (Malu Fauna) and all bird species able to be identified were recorded (**Appendix B**).

4.2.2.2 Bird and Bat Utilisation Surveys

Bird and bat utilisation surveys were undertaken in October 2023 (Spring) and February 2024 (Summer). The timing of these surveys was targeted to coincide with the seasonal migration/movement of EPBC Act listed bird species that are likely to occur in the area, including Fork-tailed Swift (*Apus pacificus*) and black-cockatoo species (Forest Red-tailed Black-Cockatoo [*Calyptorhynchus banksia naso*], Baudin's Black-Cockatoo [*Zanda baudinii]* and Carnaby's Black-Cockatoo [*Z. latirostris*]). Survey timing was also aimed to coincide with peak seasonal activity for target bat species such as the State listed Western False Pipistrelle (*Falsistrellus mackenziei*). Additional surveys are also currently planned for October 2024 (Spring) and February 2025 (Summer).

A total of eight vantage points (**Figure 4.2**) were established on high points and clearings across the Study Area with best attempts made to position vantage points near proposed wind turbine locations. Three additional vantage points were also established in the Additional Survey Area. Vantage points were configured such that representativeness and coverage of the Study Area and associated fauna habitats was maximised. Each site was surveyed for a 30-minute period during four sampling windows per day:

- early morning (between 6.00 am and 10.00 am)
- late morning (between 10.00 am and 12.30 am)
- early afternoon (between 12.30 pm and 3.00 pm)
- late afternoon (between 3.00 pm and 6.00 pm).

Vantage points were visited at different times of day and across different days to allow for time-of-day differences in bird movements and activity to be recorded. A fixed-point count survey at each vantage point was completed eight times during each of the survey events. At each vantage point, a single observer recorded the following information for each observation:

- species and abundance
- observation type (visual or aural)
- distance and direction from the observer (to the nearest 10 m and 10° respectively)
- approximate height AGL of the observed bird/s (to the nearest 10 m)
- direction of flight (to the nearest 10°)
- flight pattern (i.e., not flying, local movement, directional flight, circling, swooping, varied, other)
- behaviour (i.e., flight, foraging, perching, mating, aggressive interactions, hollow inspection, nesting, on station).

In addition to observations during fixed-point count surveys, incidental bird observations were recorded at various locations throughout the Study Area during travel between vantage points. For each record the following were noted where available: species, location of the observation recorded, abundance, flight behaviour, flight height and flight direction. Emphasis was placed on observations of birds of concern (listed threatened, priority and/or migratory species and raptors) as well as birds moving through the Study Area at RSA height.

Microbat (microchiropteran) echolocation calls were sampled using Anabat Swift recording devices at 11 vantage point locations within the Study Area and Additional Survey Area. Devices were placed approximately 2 m above ground level (AGL) facing a cleared area or flyway and left for between two nights. Call data collected from each device was sent to Balance! Environmental and Bob Bullen (Bat Call WA) for identification. Due to the nature of survey methods (bat call detectors) no flight heights for bats were recorded during the field surveys. There is no publicly available information on blade strike from the majority of wind farms located in these species' range, including Western Australia. Therefore, due to data deficiency on the flight heights of microbats a precautionary principle has been applied and it is assumed that all eight species of microbat may fly at RSA at some periods during their lifecycle.

4.2.3 Survey Limitations

4.2.3.1 Flora and Vegetation

The timing of the Phase 1 Reconnaissance survey (mid-autumn) did not coincide with the recommended survey timing provided by the EPA *Technical Guidance for Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA, 2016). However, this was not considered to be a limitation of the Reconnaissance survey as the purpose of this survey was to characterise the vegetation of the Study Area (including vegetation condition) in order to inform the significant flora and vegetation likelihood of occurrence and provide potential environmental constraints for planning purposes, as opposed to being a full census of the flora of the Study Area or a targeted survey for significant flora and vegetation. Additionally, a further survey was conducted during spring 2023, which is the recommended survey timing as per the EPA (2016).

Rainfall in the two months prior to the Autumn 2023 survey was higher than average, but is unlikely to have affected flowering of any taxa to a great extent. The daily maximum temperatures in the months prior to autumn survey were also cooler on average compared to long-term data. The spring survey was preceded by less rainfall than the long-term average; however, this is not considered to have significantly affected the survey with regard to identification of flora species. There were no issues related to flora sampling and identification with both annual and perennial (including tuberous and cormous species) flora in good condition. The field team leader and plant identifications manager has had extensive (>15 years) experience in conducting similar surveys in the Jarrah Forest and Avon Wheatbelt bioregions. No recent disturbances affected the results of the survey; however, the lack of recent fire within the Study Area may mean that some short-lived disturbance opportunists are not currently present.

There were some access restrictions, including the presence of cropping which prevented some vehicle/foot access to some polygons of vegetation (primarily for surveys undertaken in Spring 2023). However, these polygons were for the most part adequately viewed from a distance to ascertain their vegetation type, condition and suitability for significant taxa and vegetation, and therefore such restrictions are not considered to have affected survey results. Not all areas of remnant vegetation were inspected; however, aerial photography interpretation, and digital elevation models and contour information, supported by site vegetation mapping notes or observations, assisted in determining VTs for those areas not inspected on foot.

One small area of VT12 was mapped in Good condition (0.4 ha; 0.006% of the Study Area), located near the eastern boundary of the Study Area. Targeted searching at 20 m spacing was not undertaken, due to the small size of this VT; one relevé was conducted and wandering transects to record flora taxa of the VT was undertaken. It was therefore concluded that adequate sampling was undertaken in this area.

Additional targeted searching was undertaken in some remnant vegetation (assessed to be in Degraded condition) to confirm vegetation condition and the presence/absence of significant flora and vegetation, however in general no targeted flora survey was undertaken in areas assessed as being in Degraded or Completely Degraded condition due to very low likelihood of significant flora persisting in these areas.

No other survey limitations were present.

4.2.3.2 Fauna

Exact counts of birds are limited to visual observations. As such and for the purposes of this report and data analyses, all aural observations were assigned a count of one individual. There were access limitations to some of the vantage point locations originally selected via aerial imagery for the 2023 Spring survey. These were relocated once on-site to suitable locations nearby with sufficient visual coverage of the surrounding landscape. The same locations were then utilised for the 2024 Summer survey.

Temperatures reached 40°C on the final day (February 9th) of the summer BBUS. This may have led to a decrease in bird activity across the site during the hottest part of the day.

Bat surveys were limited to use of stationary bat-detector devices recording calls of bat species. No active trapping was undertaken. Bat species density is impossible to estimate from echolocation records. Bat presence at a series of sites is therefore substituted as an approximate guide to the relative numbers of each species using the Study Area (Bat Call WA, 2024).

No other survey limitations were present.

4.3 Likelihood of Occurrence Assessment

The likelihood of occurrence of threatened species was assessed based on results of field surveys, a review of previous occurrence records, a review of known habitat preferences and the broad habitats provided by verified vegetation communities mapped across the Study Area.

4.3.1 Fauna Likelihood of Occurrence

Based on the analysis of habitats, records and known species habitat preferences, fauna species were assigned to one of the categories outlined in **Table 4.9**.

Table 4.9 Likelihood of Occurrence Assessment Criteria

Category	Description
Known	The species has been recorded in the Study Area during the past decade (or during the Project-specific survey period).
High	Suitable habitat is present in the Study Area. Given the extent, quality and suitability of habitat in the Study Area, the location of the Study Area relative to existing contemporary records (past 20 years) of the species (with consideration of sampling effort in the region and the species' detectability) it is highly likely that the species occurs in the Study Area. Also includes species likely to regularly occur in the Study Area during migratory, short-distance seasonal or nomadic movements (including cases for which likelihood of occurrence is high regardless of the nature of habitat present in the Study Area).
Moderate	Potential or suitable habitat is present in the Study Area though given the species' status/the distribution of records in the surrounding region a moderate rating for likelihood of occurrence is deemed more appropriate than a low or high rating. Includes species that may be present or may occasionally utilise the Study Area but for which there may be little information or those that are either cryptic or occur at low densities. Also includes species that may occasionally occur in the Study Area during migratory, short-distance seasonal or nomadic movements.
Low	The Study Area either contains no suitable habitat or potential/marginal habitat. The species is either very scarce or absent in the surrounding region in habitat similar to that present in the Study Area in the region. The species is deemed unlikely to occur in the Study Area based on the aforementioned factors. The species may disperse through or near the Study Area infrequently.
Unlikely	The Study Area offers limited to no potential habitat for the species, is outside its known range and/or is lacking broader habitat requirements.

4.3.2 Flora Likelihood of Occurrence

The likelihood of occurrence for Threatened flora species in the Study Area was categorised as either "Unlikely" or "Potential" based on the following:

- **Unlikely**: Species classified as unlikely to occur in the Study Area are based on the assessment that no potential habitat is present within the Study Area (due to lack of required substrate, soil or water conditions, or due to degraded nature of the remnant vegetation present), or the Study Area is outside of the species' known range. It should be noted that suitable habitat has predominantly been determined utilising details recorded from known locations of specimens lodged with the WA

Herbarium (1998–). However, for many species known within the general vicinity of the Study Area, suitable habitat is difficult to define as the available information is often vague or very broad and difficult to interpret. Therefore, a precautionary approach has been adopted when assessing whether suitable habitat for the species is present in the Study Area.

- **Potential**: All remaining species identified from desktop searches that have some level of potential to occur within the Study Area. It should also be noted that the species identified as potentially occurring within the Study Area are only considered possible within the area of remnant vegetation in Good condition not subject to the targeted survey in 2023.

4.4 Significant Impact Assessment

The potential impacts associated with MNES were assessed with reference to the Significant Impact Guidelines – MNES (Department of the Environment, 2013). Specifically, the significant impact criteria were used to assess the significance of potential impacts according to each MNES' conservation status (Vulnerable, Endangered, Critically Endangered, and Migratory). Threatened species and ecological communities with a likelihood of occurrence of Moderate, High or Known were assessed.

Key terms used within significant impact criteria for listed TECs, threatened species and migratory species are defined by Department of the Environment (2013) as follows:

- **Habitat critical to the survival** of a species or ecological community refers to areas that are necessary:
    - for activities such as foraging, breeding, roosting, or dispersal
    - for the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators)
    - to maintain genetic diversity and long-term evolutionary development, or
    - for the reintroduction of populations or recovery of the species or ecological community.
- **Important population** of a species refers to a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans and/or that are:
    - key source populations either for breeding or dispersal
    - populations that are necessary for maintaining genetic diversity, and/or
    - populations that are near the limit of the species range.
- **Important habitat** for a migratory species refers to habitat that is:
    - utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species, and/or
    - of critical importance to the species at particular life-cycle stages, and/or
    - utilised by a migratory species which is at the limit of the species range, and/or
    - within an area where the species is declining.

Commonwealth or State government guidelines, recovery plans, conservation advice, and species profiles were utilised wherever relevant when undertaking these assessments and are summarised in **Table 4.10**.

Table 4.10 Government Guidelines, Recovery Plans, Conservation Advice, and Species Profiles

Matter of National Environmental Significance	Guidelines, recovery plans, conservation advice or species profile
Eucalypts of the Western Australian Wheatbelt	• Approved Conservation Advice (including listing advice) for the Eucalypt Woodlands of the Western Australian Wheatbelt (Department of the Environment, 2015a) • Eucalypt Woodlands of the Western Australian Wheatbelt SPRAT Profile (DCCEEW, 2024d)
Baudin's Black-Cockatoo	• Referral Guideline for 3 WA Threatened Black Cockatoo Species (DAWE, 2022) • Forest Black Cockatoo (Baudin's Cockatoo *Calyptorhynchus baudinii* and Forest Red-tailed Black Cockatoo *Calyptorhynchus banksii naso*) Recovery Plan (Department of Environment and Conservation (DEC), 2008) • *Zanda baudinii* — Baudin's Cockatoo, Baudin's Black-Cockatoo, Long-billed Black-cockatoo SPRAT Profile (DCCEEW, 2024g)
Forest Red-tailed Black-Cockatoo	• Referral Guideline for 3 WA Threatened Black Cockatoo Species (DAWE, 2022) • Approved Conservation Advice for *Calyptorhynchus banksii naso* (Forest Red-tailed Black Cockatoo) (Department of the Environment, Water, Heritage and the Arts (DEWHA), 2009) • Forest Black Cockatoo (Baudin's Cockatoo *Calyptorhynchus baudinii* and Forest Red-tailed Black Cockatoo *Calyptorhynchus banksii naso*) Recovery Plan (DEC, 2008) • *Calyptorhynchus banksii naso* — Forest Red-tailed Black-Cockatoo, Karrak SPRAT Profile (DCCEEW, 2024b)
Carnaby's Black-Cockatoo	• Referral Guideline for 3 WA Threatened Black Cockatoo Species (DAWE, 2022) • Carnaby's Cockatoo (*Calyptorhynchus latirostris*) Recovery Plan (Department of Parks and Wildlife (DPAW), 2013a) • EPA Advice: Carnaby's Cockatoo in Environmental Impact Assessment in the Perth and Peel Region (EPA, 2019) • *Zanda latirostris* — Carnaby's Black Cockatoo, Short-billed Black-cockatoo SPRAT Profile (DCCEEW, 2024h)
Chuditch	• Chuditch (*Dasyurus geoffroii*) National Recovery Plan (DEC, 2012) • *Dasyurus geoffroi*i — Chuditch, Western Quoll SPRAT Profile (DCCEEW, 2024c)
Red-tailed Phascogale	• Conservation Advice: *Phascogale calura* Red-tailed Phascogale (Threatened Species Scientific Committee (TSSC), 2016) • Draft Species Conservation Management Plan: Red-Tailed Phascogale (*Phascogale calura*) Conservation Plan for The Wheatbelt Populations 2009-2014 (DEC, 2013) • *Phascogale calura* — Red-tailed Phascogale, Red-tailed Wambenger, Kenngoor SPRAT Profile (DCCEEW, 2024e)
Fork-tailed Swift	• Draft Referral Guideline for 14 Birds Listed as Migratory Species Under the EPBC Act (Department of the Environment, 2015b) • *Apus pacificus* — Fork-tailed Swift SPRAT Profile (DCCEEW, 2024a)

5.0 Protected Matters Search Tool Results

Results from the Protected Matters Search Tool (PMST) database search are provided in **Appendix E**. As identified in the PMST results, 36 MNES had the potential to occur within a 20 km radius of the Study Area and Additional Survey Area which included the following:

- wetland of international importance (Ramsar wetland)
- listed Threatened Ecological Community
- listed Threatened species
- listed Migratory species.

The results of the PMST database interrogation as they related to these MNES are discussed in detail in **Section 5.1** to **Section 5.4** and the results of the interrogation provided in **Table 5.1.**

Table 5.1 PMST Database Results in the Search Area

Matter of National Environmental Significance	Potential Presence in Search Area
World Heritage Properties	Nil
National Heritage Places	Nil
Wetlands of International Importance	1
Great Barrier Reef Marine Park	Nil
Commonwealth Marine Area	Nil
Threatened Ecological Communities	1
Threatened Species	28
Migratory Species	6

5.1 Wetlands of International Importance

The PMST results have indicated that there is a wetland of international importance located within 50–100 km downstream of the Study Area, being the Peel-Yalgorup System which is a declared Ramsar site. However, a review of the Directory of Important Wetlands in Australia (DBCA, 2018b) has identified that this site is mapped approximately 116 km west of the westernmost boundary of the Study Area.
The Project is not expected to have any direct hydrological impacts which would result in offsite impacts to this Ramsar site due to the nature of Project activities and the distance from the Project.

5.2 Threatened Ecological Communities

One Threatened Ecological Community (TEC) was identified in the PMST results as 'likely to occur' in the Search Area. This TEC and the analogous State listed ecological community is detailed in **Table 5.2.**

Table 5.2 Threatened Ecological Communities Returned from the PMST Database

Threatened Ecological Community	EPBC Act Status (Cth)	Analogous State listed PEC	BC Act Status (WA)
Eucalyptus Woodlands of the Western Australian Wheatbelt	Critically Endangered	Eucalypt Woodlands of the Western Australian Wheatbelt	Priority 3

5.3 Threatened Species

A total of 15 Threatened flora species and 13 Threatened fauna species were identified in the PMST results as "likely", "may", or "known" to occur within the Search Area. These species are detailed in **Table 5.3**.

Table 5.3 Threatened Species Returned from the PMST Database

Scientific Name	Common Name	EPBC Act Status (Cth)	BC Act Status (WA)
Flora			
Acacia insolita subsp. *recurva*	Yornaning Wattle	Endangered	Critically Endangered
Andersonia gracilis	Slender Andersonia	Endangered	Endangered
Banksia cuneata	Matchstick Banksia, Quairading Banksia	Endangered	Endangered
Banksia oligantha	Wagin Banksia	Endangered	Endangered
Boronia capitata subsp. *capitata*	N/A	Endangered	Endangered
Caladenia dorrienii	Cossack Spider-orchid	Endangered	Endangered
Calectasia pignattiana	Stilted Tinsel Lily	Vulnerable	Vulnerable
Conostylis drummondii	Drummond's Conostylis	Endangered	Endangered
Darwinia carnea	Mogumber Bell, Narrogin Bell	Endangered	Endangered
Daviesia euphorbioides	Wongan Cactus	Endangered	Critically Endangered
Diuris micrantha	Dwarf Bee-orchid	Vulnerable	Vulnerable
Eleocharis keigheryi	Keighery's Eleocharis	Vulnerable	Vulnerable
Pultenaea pauciflora	Narrogin Pea	Vulnerable	Vulnerable
Roycea pycnophylloides	Saltmat	Endangered	Vulnerable
Verticordia fimbrilepis subsp. *fimbrilepis*	Shy Featherflower	Endangered	Endangered
Fauna			
Birds			
Aphelocephala leucopsis	Southern Whiteface	Vulnerable	Not listed
Calidris acuminata	Sharp-tailed Sandpiper	Vulnerable	Migratory
Calidris ferruginea	Curlew Sandpiper	Critically Endangered	Critically Endangered

Scientific Name	Common Name	EPBC Act Status (Cth)	BC Act Status (WA)
Calyptorhynchus banksii naso	Forest Red-tailed Black-Cockatoo	Vulnerable	Vulnerable
Falco hypoleucos	Grey Falcon	Vulnerable	Vulnerable
Leipoa ocellata	Malleefowl	Vulnerable	Vulnerable
Zanda baudinii (listed as *Calyptorhynchus baudinii*)	Baudin's Black-Cockatoo	Endangered	Endangered
Zanda latirostris (listed as *Calyptorhynchus latirostris*)	Carnaby's Black-Cockatoo	Endangered	Endangered
Mammals			
Bettongia penicillata ogilbyi	Woylie	Endangered	Critically Endangered
Dasyurus geoffroii	Chuditch, Western Quoll	Vulnerable	Vulnerable
Macrotis lagotis	Greater Bilby	Vulnerable	Vulnerable
Myrmecobius fasciatus	Numbat	Endangered	Endangered
Phascogale calura	Red-tailed Phascogale	Vulnerable	Conservation Dependent

5.4 Migratory Species

A total of six Migratory species were identified in the PMST results as “may” or “likely” to occur within the Search Area. These species are detailed in **Table 5.4**.

Table 5.4 Migratory Species Returned from the PMST Database

Scientific Name	Common Name	EPBC Act Status (Cth)	BC Act Status (WA)
Actitis hypoleucos	Common Sandpiper	Migratory Wetlands Species	Migratory
Apus pacificus	Fork-tailed Swift	Migratory Marine Birds	Migratory
*Calidris acuminata^*	Sharp-tailed Sandpiper	Migratory Wetlands Species	Migratory
*Calidris ferruginea^*	Curlew Sandpiper	Migratory Wetlands Species	Critically Endangered
Calidris melanotos	Pectoral Sandpiper	Migratory Wetlands Species	Migratory
Motacilla cinerea	Grey Wagtail	Migratory Terrestrial Species	Migratory

Note. ^This species is also listed as Threatened under the EPBC Act and is included in **Table 5.3.**

6.0 Description of Ecological Values

6.1 Biogeographic Description

6.1.1 Bioregion

The Study Area is located across two bioregions, being the Jarrah Forest (JAF) and Avon Wheatbelt (AVW) bioregions, as defined by the Interim Biogeographic Regionalisation for Australia (IBRA) (DCCEEW, 2022).

A majority of the Project Area is within the Katanning subregion of AVW (**Figure 6.2**) which is an area of active drainage dissecting a Tertiary plateau in Yilgarn Craton. The Katanning subregion spans 3,012,977 ha with features such as (Beecham, 2003):

- gently undulating landscapes of low relief, including gently undulating rises to low hills with abrupt breakaways
- continuous stream channels that flow in most years
- soil formed in colluvium or in-situ weathered rock
- Proteaceous shrub heaths, rich in endemics, on residual lateritic uplands and derived sandplains
- mixed eucalypt, *Allocasuarina huegeliana a*nd Jam-York Gum woodlands on Quaternary alluvials and eluvials
- dominant land uses of dry land agriculture and grazing pasture.

Some smaller components of the Project Area also intersect the Northern Jarrah Forest subregion of JAF (**Figure 6.2**) which is a lateritic duricrusted plateau of the Yilgarn Craton. The Northern Jarrah Forest subregion spans 2,255,904 ha with features such as (Beard, 2015; Williams & Mitchell, 2003):

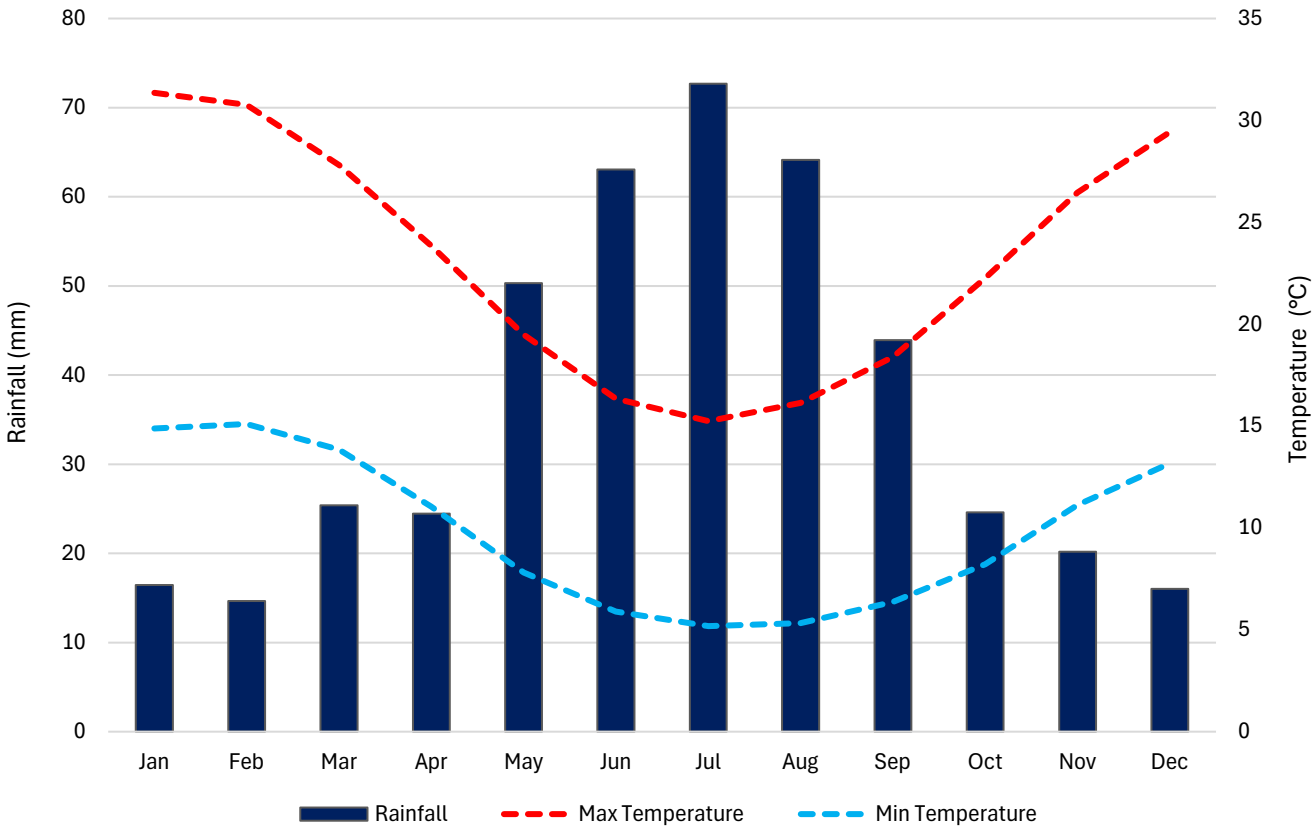
- extensive lateritic duricrust overlying Archean granite and metamorphic rocks, broken by occasional granite hills, and dissected by locally-rising streams and rivers originating from the eastern interior
- increasingly deep dissections from west to east before eventually breaking away into isolated remnants
- soils predominantly comprising lateritic gravels and related lateritic podzolic soils which frequently overlie a pallid zone of 30 m or more in thickness and “massive” ironstone pavements common along ridge tops and some slopes
- vegetation primarily comprising jarrah-marri forest in the west with bullich, blackbutt, wandoo and marri woodlands in the east and powder bark on breakaways
- dominant land uses of forestry, conservation, grazing, dry land agriculture, and mining.

6.1.2 Climate

Climate data was gathered from the Narrogin Station (010614) which is approximately 1.1 km southwest of Narrogin and is considered representative of the climatic conditions within the Study Area. Monthly averages for rainfall, minimum and maximum temperatures were obtained from 1993 to 2023 (representing a full 30-year climate cycle) and can be seen in **Graph 6.1**.

The hottest months of the year occur between December and March with an average maximum daily temperature of 31.4 °C and an average minimum of 13.2°C. The coldest months of the year occur between May and October with an average minimum daily temperature of 5.2°C and maximum of 22.3°C. (Bureau of Meteorology (BOM), 2024b)

Narrogin experiences an average annual rainfall of approximately 435.9 mm. The highest rainfall in Narrogin occurs from May to August with the maximum average monthly rainfall of 72.7 mm occurring in July (BOM, 2024a).



Graph 6.1 Narrogin Climate Statistics (BOM, 2024b; BOM, 2024a)

6.1.3 Hydrology

The Study Area is intersected by a number of watercourses and smaller ephemeral drainage lines. These drainage lines are located along the low-lying depressions in the landscape, comprising of both natural and man-made tributaries that predominantly flow in a southwestern direction and feed into the Williams River (via Geeralying Brook). Many of the larger waterways within the Study Area have riparian vegetation growing along their banks, with some sections having over 20 m of growth either side. Farm dams are also commonly found both within the Study Area and in the surrounding region. The north of the Study Area is intersected by Junction Brook. The south is intersected by Geeralying Brook which is a major tributary to the Williams River, which also intersects the south of the Study Area and is itself a major tributary of the Hotham River.

6.1.4 Land Systems

Land systems are broad descriptions of landform, geology and soils. The Study Area intersects five land systems, which are characterised as follows (Western Wildlife, 2024):

- **Marradong System**: Plateau remnants, in the central Eastern Darling Range, with sandy gravel, loamy gravel, grey deep sandy duplex and loamy duplex. Jarrah-marri wandoo forest and woodland.
- **Dryandra System**: Ridges of banded iron formation supporting dense mixed shrublands with emergent native pines, mallees and casuarinas.
- **Narrogin System**: Interfluves with significant gradient, aggressively stripped by headward incision, at the headwaters of the Hotham and Blackwood catchments. Numerous dolerite dyke swarms.
- **Dellyanine System**: Undulating rises and low hills on granite, in the southern Zone of Rejuvenated Drainage. Grey sandy duplex (shallow and deep), sandy gravel and red deep sandy duplex. Wandoo-Sheoak woodland.
- **Quindanning System**: Deep granitic valleys, in the northern and central Eastern Darling Range, with deep sandy duplex soils, shallow sand, loamy duplex and bare rock. Marri-wandoo-york gum-jam woodland.

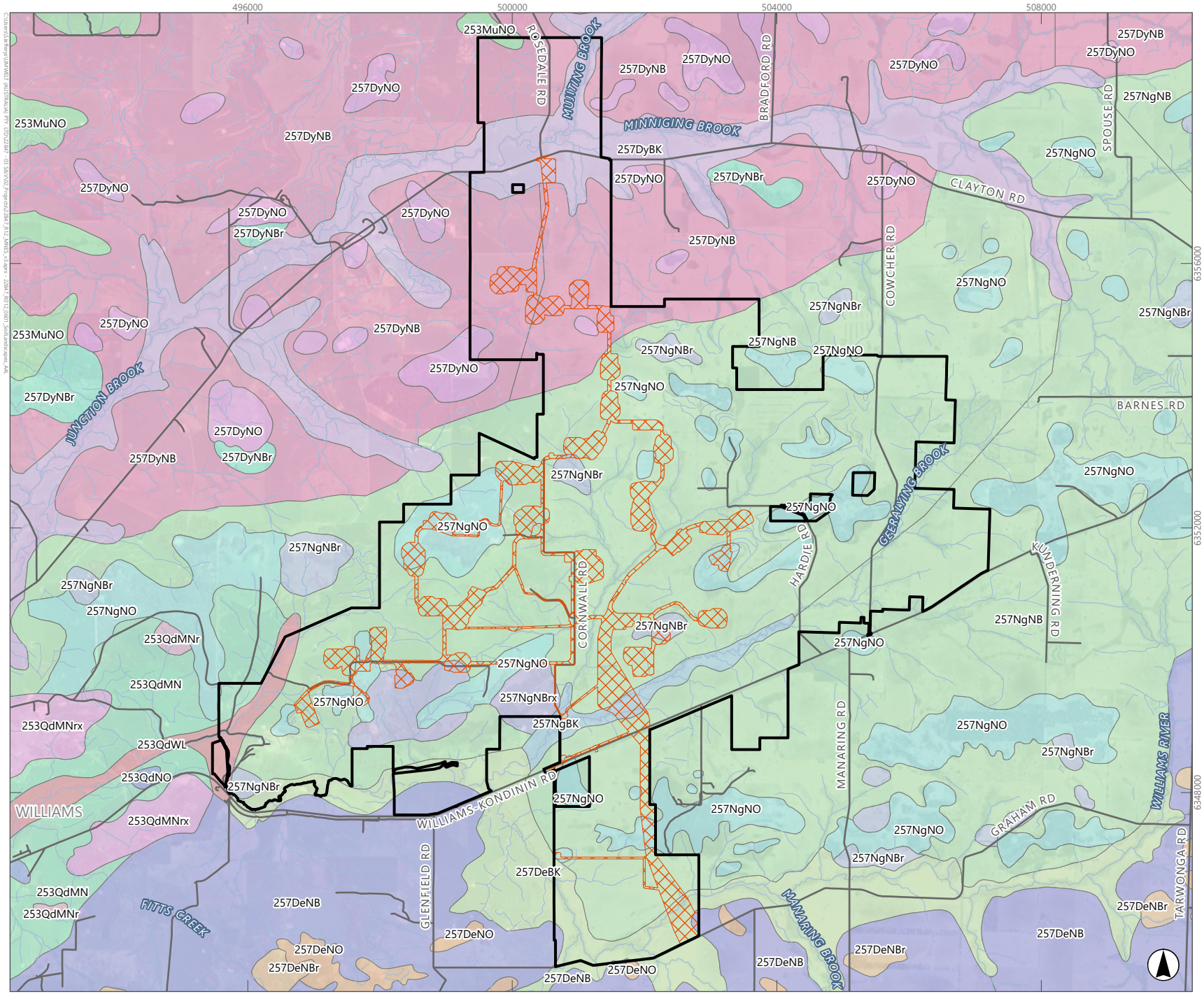
6.1.5 Soils and Geology

Soil landscape mapping of WA has been compiled from the results of various surveys across the state by the Department of Agriculture (now the Department of Primary Industries and Regional Development [DPIRD]) (DPIRD, 2022). The Study Area is located across 14 separate soil-landscape units, as summarised in **Table 6.1** and presented on **Figure 6.1**. The most commonly occurring soil-landscape units are the Noombling subsystem (Narrogin) (61.5%), Noombling subsystem (Dryandra) (12.4%), and Norrine subsystem (Narrogin) (9.6%).

Table 6.1 Soil Landscape Mapping of the Project Area

Soil Landscape Unit	Name	Description	Mapped Extent in Study Area (ha)
253MuNO	Norrine subsystem (Marradong)	A complex of lateritic residuals and associated pediment; gravely sand, sand, duplex yellow soils and duricrust.	6.4 0.1%
253QdMN	Michibin subsystem (Quindanning)	Hillslopes containing soils formed by the weathering of fresh rock. Rock outcrop is common Hillslopes containing soils formed by the weathering of fresh rock. Rock outcrop is common.	24.5 0.4%
253QdWL	Williams subsystem (Quindanning)	Valley floor subtended by the steep slopes of the Michibin unit; yellow duplex soils and a lower sandy terrace.	76.3 1.2%
257DeBK	Biberkine subsystem (Dellyanine)	Valley floors and footslopes surrounded by gently undulating rises and low hills. Alluvium & colluvium / granite etc. Yellow brown sandy duplexes (mostly deep), wet and semi-wet soils (sometimes saline). Wandoo-Flooded Gum / Jam-Sheoak-Tea.	220.0 3.5%
257DeNB	Noombling subsystem (Dellyanine)	Long gentle and undulating hillslopes and divides. Colluvium over granite, gneiss and sometimes dolerite. Grey and yellow/brown deep sandy duplexes, sandy gravels and shallow duplexes. Marri-Wandoo woodland; Jam-Sheoak understory.	54.9 0.9%
257DeNO	Norrine subsystem (Dellyanine)	A complex of lateritic residuals and associated pediment; gravely sand, sand, duplex yellow soils and duricrust.	0.1 0.0%
257DyBK	Biberkine subsystem (Dryandra)	Valley floors & footslopes with gently undulating rises & low hills. Alluvium and colluvium over granite etc. Yellow brown sandy duplexes, wet and semi-wet soils & brown deep loamy duplexes. Wandoo-Flooded Gum with Jam-Sheoak-Teatree.	257.5 4.1%
257DyNB	Noombling subsystem (Dryandra)	Long gentle and undulating hillslopes and divides. Colluvium / weathered granite, gneiss and some dolerite. Yellow/brown and grey deep sandy duplexes, brown deep loamy duplexes, sandy gravels and shallow duplexes. Marri-Wandoo / Jam-Sheoak.	785.5 12.4%
257DyNO	Norrine subsystem (Dryandra)	A complex of lateritic residuals and associated pediment; gravely sand, sand, duplex yellow soils and duricrust.	22.3 0.4%
257NgBK	Biberkine subsystem (Narrogin)	Valley floor subtended by the gentle slopes of Noombling unit; yellow sandy duplex soils and a narrow, lower, sandy terrace.	100.7 1.6%
257NgNB	Noombling subsystem (Narrogin)	Gently sloping terrain which may extend over local divides; yellow and red duplex soils and associated granite and dolerite outcrops.	3903.8 61.5%
257NgNBr	Noombling (Narrogin), rocky phase	Gently sloping terrain which may extend over local divides; yellow and red duplex soils and associated granite and dolerite outcrops Gently sloping terrain which may extend over local divides; yellow and red duplex soils and associated granite and dolerite outcrops.	83.6 1.3%
257NgNBrx	Noombling (Narrogin), very rocky phase	Gently sloping terrain which may extend over local divides; yellow and red duplex soils and associated granite and dolerite outcrops.	200.5 3.2%
257NgNO	Norrine subsystem (Narrogin)	A complex of lateritic residuals and associated pediment; gravely sand, sand, duplex yellow soils and duricrust.	608.6 9.6%
		Total	**6,344.1**

FIGURE 6.1
Soil Landscape Units of the Study Area



Legend

- Study Area
- Development Corridor
- Road
- Watercourse
- 253MuNO Norrine s/s (M)
- 253QdMN Michibin s/s (Q)
- 253QdMNr Michibin (Q), rocky
- 253QdMNrx Michibin (Q), very rocky
- 253QdNO Norrine s/s (Q)
- 253QdWL Williams s/s (Q)
- 257DeBK Biberkine s/s (De)
- 257DeNB Noombling s/s (De)
- 257DeNBr Noombling (De), rocky
- 257DeNO Norrine s/s (De)
- 257DyBK Biberkine s/s (Dr)
- 257DyNB Noombling s/s (Dr)
- 257DyNBr Noombling (Dr), rocky
- 257DyNO Norrine s/s (Dr)
- 257NgBK Biberkine s/s (N)
- 257NgNB Noombling s/s (N)
- 257NgNBr Noombling (N), rocky
- 257NgNBrx Noombling (N), very rocky
- 257NgNO Norrine s/s (N)

0 1.6 3.2

Kilometres

Scale 1:80,000 at A4
GDA2020 MGA Zone 50

Image Source: ESRI Basemap (2023) | **Data Source:** Landgate (2023), DPIRD (2022)

6.2 Flora and Vegetation

6.2.1 Regional Vegetation

The Katanning subregion ('AW02' on **Figure 6.2**) largely comprises woodlands of Wandoo, York Gum and Salmon Gum, with Jam and Casuarina also common. The subregion is located within the transitional rainfall zone known for the most species-rich areas such as the lateritic uplands of the Wheatbelt's western edge (Beecham, 2003).

The vegetation of the Northern Jarrah Forest subregion ('JAF01' on **Figure 6.2**) comprises Jarrah-Marri forest in the west, with Bullich and Blackbutt in the valleys grading to Wandoo and Marri woodlands in the east and Powder Bark on breakaways. There are extensive but localised sand sheets with Banksia low woodlands. Heath is found on granite rocks and as a common understorey of forests and woodlands in the north and east. The majority of the diversity in the communities occurs on the lower slopes or near granite soils where there are rapid changes in site conditions (Williams & Mitchell, 2003).

The vegetation of WA as it was presumed to have existed prior to European settlement has been mapped at a scale of 1:250,000 as Vegetation System Associations (VSAs), providing the Pre-European Vegetation spatial dataset (Beard et al., 2013; DPIRD, 2019).

The Study Area intersects nine VSAs as mapped by DPIRD (2019) which are presented on **Figure 6.2**. The primary VSA occurring is Dryandra_1023 (43.8%), followed by Narrogin_1023 (40.5%) and Narrogin_352 (4.6%). All nine VSAs that occur within the Project Area are summarised in **Table 6.2**, which also details the current extent of VSAs in relation to their pre-European extents and the percentage currently protected for conservation within the Northern Jarrah Forest and Katanning IBRA subregions (DPIRD, 2019). While this dataset is the most current available, it was last updated on 19 April 2019 and current extant areas should be treated with caution.

It should be noted that as per DBCA (2019), protected areas in this context are considered to be any areas listed in DBCA Legislated Lands and Waters dataset (DBCA, 2024) as either Crown reserves or lands managed under Section 8A of the *Conservation and Land Management Act 1984* (WA) that have an International Union for Conservation of Nature (IUCN) category of I to IV.

Five VSAs have less than 30% of their pre-European extent remaining as of 2019, with the remaining four having over 30% remaining (**Table 6.2**). There does not appear to be an accurate, publicly available spatial dataset that presents the current extents of VSAs; while Western Australian Local Government Association (WALGA) categorised the Pre-European Statewide vegetation mapping dataset in 2020 (WALGA, 2020), review of this dataset in the Study Area and its vicinity reveals inaccuracies and inconsistencies with the mapping. For example, some areas of vegetation that appear to be remnant have not been mapped, despite being larger than other nearby areas that have been mapped. Therefore, the Pre-European extents of each VSA in the Study Area have been presented in **Table 6.2**.

Table 6.2 Vegetation System Associations of the Project Area

VSA	Description	Extent within Northern Jarrah Forest and Katanning IBRA Subregions				Extent within Study Area	
		Pre-European Extent[1] (ha)	Current Extent[1] (ha)	Pre-European Extent Remaining[1] (%)	Current Extent Protected for Conservation[1] (%)	Pre-European Extent (ha)	Current Extent (ha)
DRYANDRA_1023	Medium woodland; York gum, wandoo & salmon gum (*Eucalyptus salmonophloia*)	10,388.10	1,505.55	14.49	0.00	2,574.1 40.5%	2,574.1 40.5%
DRYANDRA_352	Medium woodland; York gum	7,705.15	1,383.51	17.96	0.07	30.5 0.5%	30.5 0.5%
DRYANDRA_5	Medium woodland; wandoo & powderbark (*Eucalyptus accedens*)	31,817.93	15,186.21	47.73	21.84	244.2 3.8%	244.2 3.8%
DRYANDRA_946	Medium woodland; wandoo	1,681.52	874.15	51.99	0.00	11.7 0.2%	11.7 0.2%
NARROGIN_1023	Medium woodland; York gum, wandoo & salmon gum (*Eucalyptus salmonophloia*)	189,088.48	31,369.71	16.59	6.69	2,780.8 43.8%	2,780.8 43.8%
NARROGIN_1073	Medium woodland; wandoo & mallet	873.12	419.56	48.05	9.72	73.8 1.2%	73.8 1.2%
NARROGIN_352	Medium woodland; York gum	15,729.07	1,730.35	11.00	3.43	294.6 4.6%	294.6 4.6%
NARROGIN_947	Medium woodland; powderbark & mallet	19,255.57	7,726.51	40.12	14.76	194.8 3.1%	194.8 3.1%
WILLIAMS_7	Medium woodland; York gum (*Eucalyptus loxophleba*) & wandoo	11,301.70	1,990.87	17.6	4.27	139.5 2.2%	139.5 2.2%
					Total	**6,344.1**	**6,344.1**

Note.[1]DBCA Statewide Vegetation Statistics: Full Report (Department of Biodiversity Conservation and Attractions (DBCA), 2019). [2]Pre-European Vegetation spatial dataset (DPIRD-006) (DPIRD, 2019).

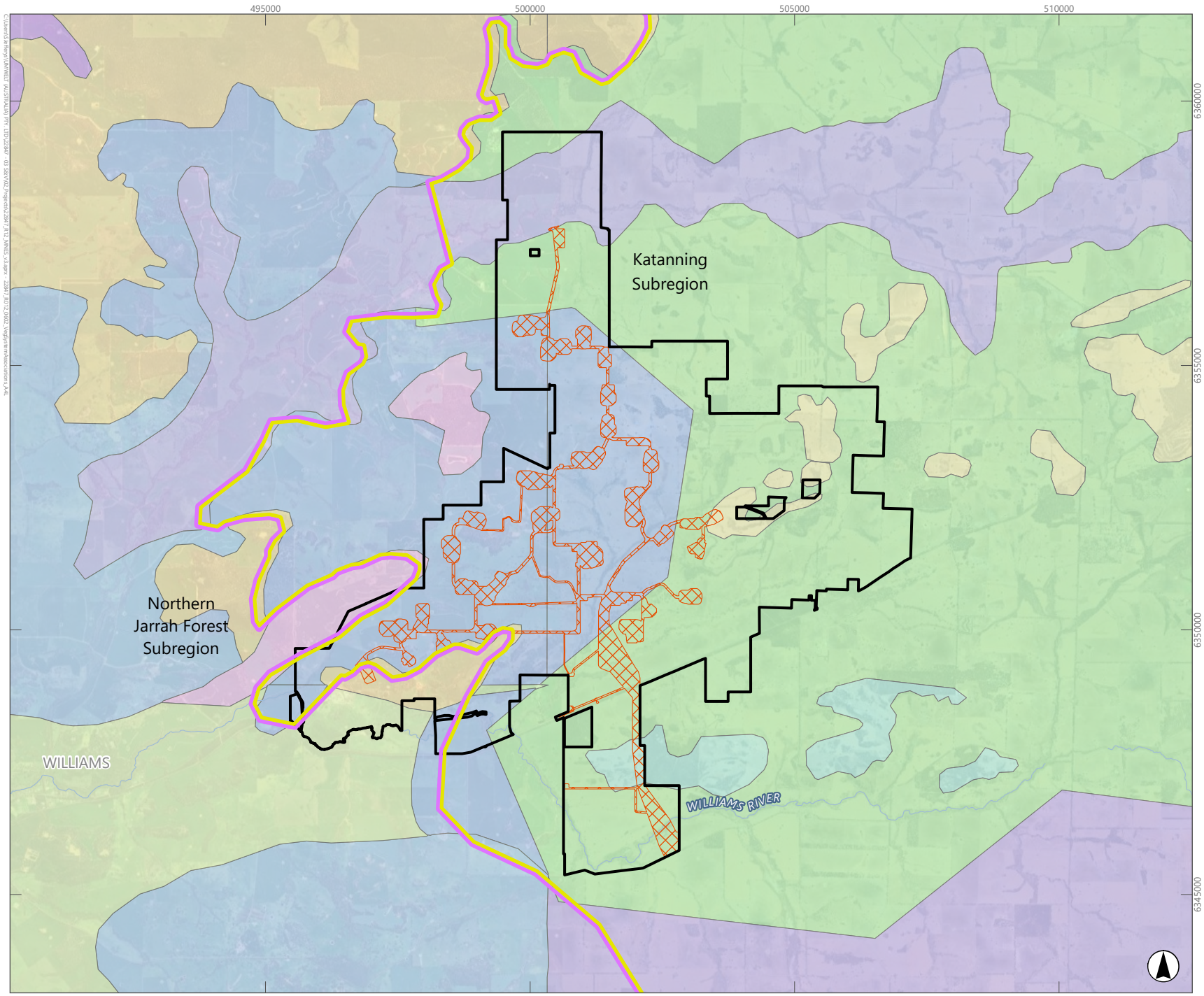


FIGURE 6.2

Vegetation System Associations of the Study Area

Legend

- Study Area
- Development Corridor
- Major Watercourse

Vegetation System Associations

- DRYANDRA_4
- DRYANDRA_5
- DRYANDRA_352
- DRYANDRA_946
- DRYANDRA_1023
- NARROGIN_352
- NARROGIN_947
- NARROGIN_1023
- NARROGIN_1073
- WAGIN_1023
- WILLIAMS_4
- WILLIAMS_7

IBRA V7 Subregions

- Katanning
- Northern Jarrah Forest

0 2 4

Kilometres

Scale 1:100,000 at A4
GDA2020 MGA Zone 50

Image Source: ESRI Basemap (2023) | **Data Source:** Landgate (2023), Umwelt (2023), DPIRD (2019)

6.2.2 Vegetation Types

A total of 22 VTs were mapped within the Study Area during field surveys, as described in **Table 6.3** and shown on **Figure 6.3**. Excluding cleared and planted vegetation, this area covers 1,146.6 ha and represents 18.1% of the Study Area.

The majority of VTs have clearly been highly modified since European settlement and are no longer considered to be intact remnant vegetation. This is a result of the long history of agricultural activities and other development in the Study Area, including direct clearing for cropping, pasture, roads and other infrastructure, and grazing by stock. These include areas with primarily only native tree species remaining, areas with only planted native trees and shrubs, and areas with almost exclusively weed or crop species. Remnant vegetation was mapped primarily as occurring either on drainage lines, or on the tops of hills influenced by either granite or laterite; these areas being the least favoured for agricultural purposes.

- VT7 represents the largest portion of the Study Area in the context of remnant vegetation (5.6%). This vegetation type is described as low to mid woodland to open woodland of *Eucalyptus rudis* subsp. *rudis* and *Eucalyptus loxophleba* subsp. *loxophleba* over low sedgeland to open sedgeland of **Juncus acutus* subsp. *acutus* over tussock grassland of pasture weeds on drainage lines.
- The second largest VT is VT6 (*Corymbia calophylla* and *Eucalyptus wandoo* subsp. *wandoo* woodland with occasional *Allocasuarina huegeliana* and *Eucalyptus astringens* subsp. *astringens*) (2.9% of the Study Area).
- The third largest is VT8 (*Eucalyptus astringens* subsp. *astringens* and *Eucalyptus gardneri* subsp. *gardneri* woodland) (1.3% of the Study Area).

Table 6.3 Vegetation Types of the Study Area

VT	Description	Sampling Effort	Extent within Study Area (ha)	Representative Photo
Native Vegetation				
VT1	Low to mid isolated trees to woodland of *Eucalyptus rudis* subsp. *rudis*, occasionally over tall isolated shrubs to tall open shrubland of *Acacia acuminata* and *Acacia saligna* over mid open sedgeland of **Juncus acutus* subsp. *acutus* over low closed tussock grassland of pasture weeds on brown sandy loam on drainage lines.	VM02, VM03, VM05, VM06, VM07, VM13, VT17, VM18, VM20, VM21, VM65, VM66, VM67, VM99, VM100, VM143, VM152, VM345	164.1 (2.6%)	
VT2	Low to mid open woodland of *Corymbia calophylla* over isolated tall shrubs of *Acacia saligna* and *Acacia microbotrya* over tall open sedgeland of **Typha orientalis* over low open sedgeland of **Juncus acutus* subsp. *acutus* over low tussock grassland of pasture weeds on brown sandy clay loam on drainage lines on slopes.	VM08	9.9 (0.2%)	

VT	Description	Sampling Effort	Extent within Study Area (ha)	Representative Photo
VT3	Low open woodland of *Allocasuarina huegeliana* over isolated tall shrubs of *Acacia saligna, Acacia microbotrya* and *Acacia acuminata* over low open sedgeland of **Juncus acutus* subsp. *acutus* over low tussock grassland of pasture weeds on brown sandy clay loam adjacent to drainage lines on slopes.	VM36	17.9 (0.2%)	
VT4	Low to mid woodland to open woodland of *Eucalyptus loxophleba* subsp. *loxophleba* over low closed tussock grassland of pasture weeds on brown-red clay loam on slopes.	VM16, VM41, VM68, VM121, VM135, VM242	63.4 (1.0%)	

VT	Description	Sampling Effort	Extent within Study Area (ha)	Representative Photo
VT5	Tall shrubland of *Acacia acuminata* with isolated low to mid scattered trees of *Eucalyptus loxophleba* subsp. *loxophleba* and *Corymbia calophylla* over low tussock grassland of pasture weeds on red-brown sandy clay loam on lower slopes with granite outcropping.	VM19, VM32	7.9 (0.1%)	
VT6	Low to mid woodland to open woodland of *Corymbia calophylla* and occasional *Eucalyptus wandoo* subsp. *wandoo*, *Eucalyptus astringens* subsp. *astringens* and/or *Allocasuarina huegeliana* over low tussock grassland to low open tussock grassland of pasture weeds on lateritic ridges and upper slopes with lateritic gravel on brown loam.	VM22, VM23, VM25, VM26, VM27, VM31, VM37, VM38, VM39, VM44, VM45, VM49, VM51, VM55, VM57, VM60, VM61, VM69, VM102, VM103, VM107, VM112, VM115, VM120, VM123, VM125, VM126, VM127, VM131, VM132, VM133, VM134, VM137, VM138, VM144, VM148, VM362, VM363, VM368	186.5 (2.9%)	

VT	Description	Sampling Effort	Extent within Study Area (ha)	Representative Photo
VT7	Low to mid woodland to open woodland of *Eucalyptus rudis* subsp. *rudis* and *Eucalyptus loxophleba* subsp. *loxophleba* over low sedgeland to open sedgeland of **Juncus acutus* subsp. *acutus* over low tussock grassland of pasture weeds on drainage lines with red-brown clay loam on gentle slopes.	VM14, VM15, VM28, VM29, VM30, VM35, VM46, VM50, VM52, VM53, VM54, VM70, VM72, VM136, VM162, VM175, VM180, VM182, VM183, VM184, VM185, VM186, VM190, VM194, VM195, VM342	360.1 (5.6%)	
VT8	Low to mid woodland of *Eucalyptus astringens* subsp. *astringens* and occasionally *Eucalyptus gardneri* subsp. *gardneri* on brown-red clay loam with some lateritic outcropping on the edge of breakaways, crests, and upper slopes.	VM33, VM34, VM40, VM47, VM48, VM56, VM58, VM64, VM105, VM114, VM118, VM124, VM130, VM146, VM147, VM261, VM262, VM263, VM265, VM267, VM268, VM373	88.5 (1.3%)	

VT	Description	Sampling Effort	Extent within Study Area (ha)	Representative Photo
VT9	Low open woodland of *Eucalyptus drummondii* over low open tussock grassland of pasture weeds on red-brown sandy loam with lateritic outcropping on edges of breakaways or crests.	VM24	0.4 (0.006%)	
VT10	Isolated trees to mid open woodland of *Eucalyptus wandoo* subsp. *wandoo* and *Corymbia calophylla* over low tussock grassland of pasture weeds on red-brown sandy loam with laterite extensions on upper slopes.	VM01, VM43, VM247, VM248, VM249, VM250, VM251, VM252, VM253, VM254, VM261, VM262, VM366	65.2 (1.0%)	

VT	Description	Sampling Effort	Extent within Study Area (ha)	Representative Photo
VT11	Low to mid open woodland of *Corymbia calophylla* and *Eucalyptus wandoo* subsp*. wandoo* and *Allocasuarina huegeliana* with occasional *Eucalyptus drummondii* over tussock grassland to open tussock grassland of pasture weeds on lateritic ridges and upper slopes with lateritic gravel on brown loam.	VM59	5.8 (0.09%)	
VT12	Mid woodland of *Allocasuarina huegeliana* and *Eucalyptus wandoo* subsp. *wandoo* over tall open shrubland of *Banksia sessilis* var. *sessilis*, sometimes with *Santalum murrayanum* over sparse sedgeland of *Gahnia aristata* on laterite hills.	NR03	0.4 (0.008%)	

VT	Description	Sampling Effort	Extent within Study Area (ha)	Representative Photo
VT13	Mid woodland of *Eucalyptus accedens* and *Eucalyptus astringens* subsp. *astringens* over isolated clumps of grasses of pasture weeds on lateritic slopes.	VM266	0.8 (0.01%)	
VT14	Mid open woodland of *Eucalyptus wandoo* subsp. *wandoo,* sometimes with *Eucalyptus marginata* subsp. *marginata* and occasional *Corymbia calophylla* over low to mid open shrubland of mixed species over low sparse tussock grassland with laterite or granite.	VM255, VM256, VM260	10.2 (0.2%)	

VT	Description	Sampling Effort	Extent within Study Area (ha)	Representative Photo
VT15	Low open woodland of *Eucalyptus dorrienii* over low open tussock grassland of pasture weeds on red-brown sandy loam with lateritic outcropping on edges of breakaways or crests.	VM264	0.1 (0.002%)	
VT16	Mid open woodland of *Allocasuarina huegeliana,* occasional *Eucalyptus wandoo* subsp. *wandoo* or *Eucalyptus loxophleba* subsp. *loxophleba*, associated with granite outcropping.	VM119, VM145, VM200, VM205, VM259	15.3 (0.2%)	

VT	Description	Sampling Effort	Extent within Study Area (ha)	Representative Photo
VT17	Mid woodland of *Casuarina obesa* over **Juncus acutus* subsp. *acutus* mid sedgeland, associated with drainage or outwash areas with brown sandy loam.	Not included within the Study Area. Note: sampling for this VT was undertaken in the Additional Survey Area, with mapping of this unit continued into the Study Area	4.1 (0.06%)	
VT18	Mid sedgeland of **Juncus acutus* subsp. *acutus*, with no overstorey, or with occasional *Eucalyptus wandoo* subsp. *wandoo* and *Allocasuarina huegeliana* in drainage lines.	VM63, VM343, VM368, VM370	10.5 (0.1%)	

VT	Description	Sampling Effort	Extent within Study Area (ha)	Representative Photo
VT19	Mosaic, disturbed. Mid open woodland of *Casuarina obesa, Eucalyptus* spp. and assorted planted species, both local and exotic over low tussock grassland of pasture weeds, with saline influences, associated with drainage and outwash areas with brown sandy loam.	VM85, VM244, VM245, VM246	14.1 (0.2%)	
VT21	Isolated trees to mid open woodland of *Eucalyptus loxophleba* subsp. *loxophleba* and *Allocasuarina huegeliana* with occasional *Corymbia calophylla* and/or *Eucalyptus rudis* subsp. *rudis*, tall isolated shrubs of *Acacia acuminata* and sometimes *Acacia microbotrya* on slopes with exposed granite and brown sandy clay loam.	VM101, VM104, VM108, VM109, VM110, VM111, VM116, VM117, VM139, VM140, VM141, VM142, VM374	74.2 (1.2%)	

VT	Description	Sampling Effort	Extent within Study Area (ha)	Representative Photo
VT22	Isolated trees to mid open woodland of *Eucalyptus wandoo* subsp. *wandoo* with *Allocasuarina huegeliana*, occasionally with *Eucalyptus loxophleba* subsp. *loxophleba* over low tussock grassland of pasture weeds on granite outcropping.	VM62, VM204	2.1 (0.03%)	
VT23	Mosaic of isolated remnant native trees, including *Eucalyptus wandoo* subsp. *wandoo, Eucalyptus loxophleba* subsp. *loxophleba, Corymbia calophylla, Eucalyptus rudis* subsp. *rudis, Eucalyptus astringens* subsp. *astringens, Allocasuarina huegeliana* and isolated mid to tall shrubs *of Acacia acuminata, Acacia microbotrya* and *Acacia saligna*, occasionally *Hakea prostrata* or *Banksia sessilis* var. *sessilis,* over low tussock grassland of pasture weeds; associated with road verges.	VM155, VM158, VM159, VM161, VM163, VM165, VM166, VM167, VM168, VM169, VM170, VM171, VM172, VM173, VM174, VM176, VM177, VM178, VM179, VM187, VM188, VM189, VM191, VM192, VM193, VM198, VM199, VM201, VM202, VM203, VM206, VM230, VM231, VM232, VM233, VM234, VM344, VM346, VM347, VM348, VM349	44.3 (0.7%)	

VT	Description	Sampling Effort	Extent within Study Area (ha)	Representative Photo
Other Areas Mapped				
Pl	Planted trees of local and other exotic species over pasture weeds on brown loam on slopes or undulating plains.	VM04, VM09, VM10, VM11, VM12, VM71, VM73, VM106, VM113, VM122, VM128, VM156, VM157, VM235, VM243, VM257, VM369, VM371, VM372	96.6 (1.5%)	
Cl	Cleared areas with occasional isolated (remnant native and exotic) trees over pasture weeds.	VM42, VM129, VM181, VM196, VM197	5098.9 (80.4%)	NA
NA	Not Assessed	NA	1.8 (0.02%)	NA

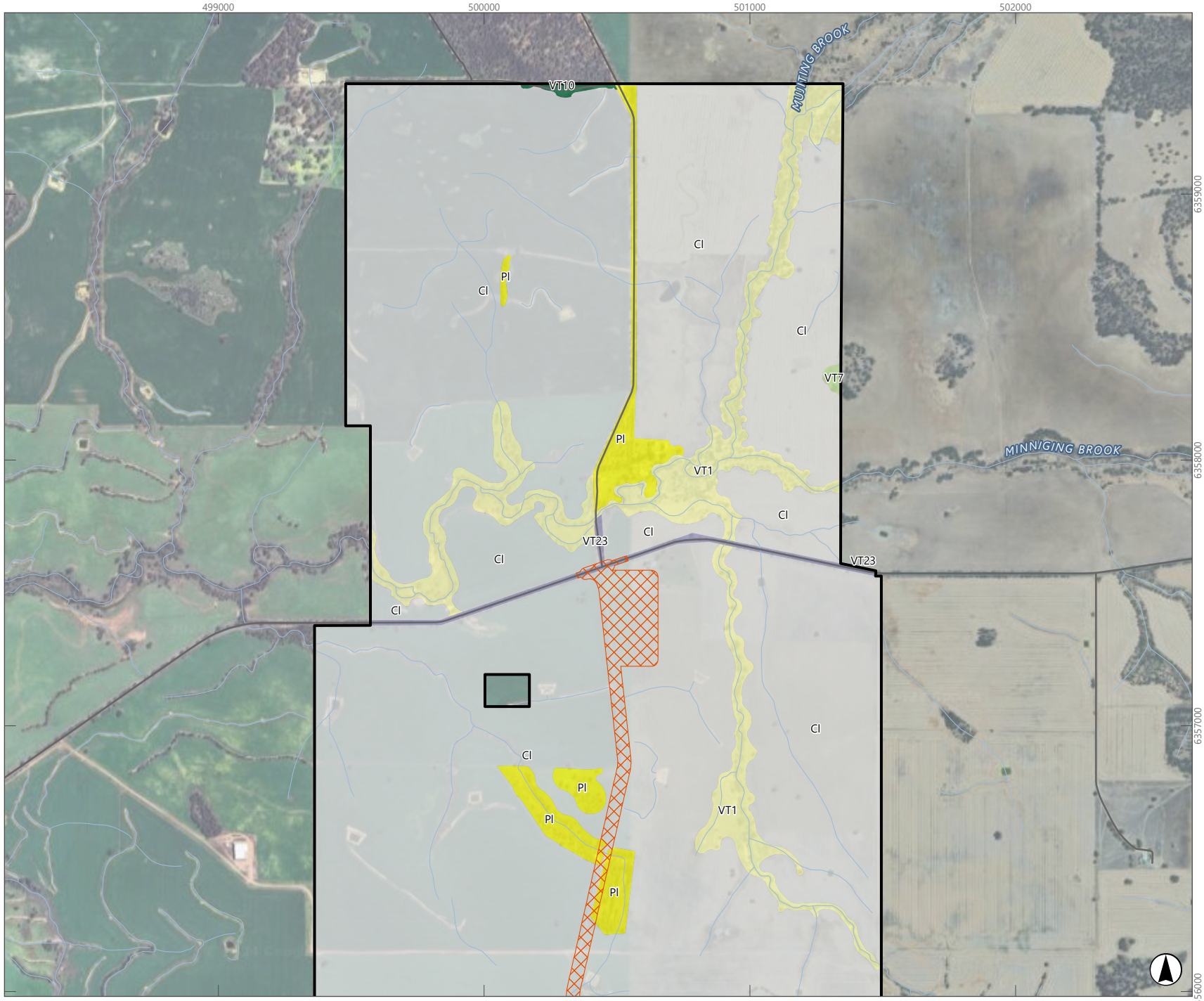


FIGURE 6.3.1
Vegetation Types of the Study Area

Legend

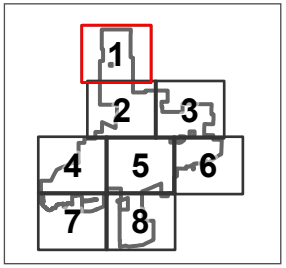
- Study Area
- Development Corridor
- Road
- Watercourse

Vegetation Type

- VT1
- VT7
- VT10
- VT23

Other Areas Mapped

- CI
- PI



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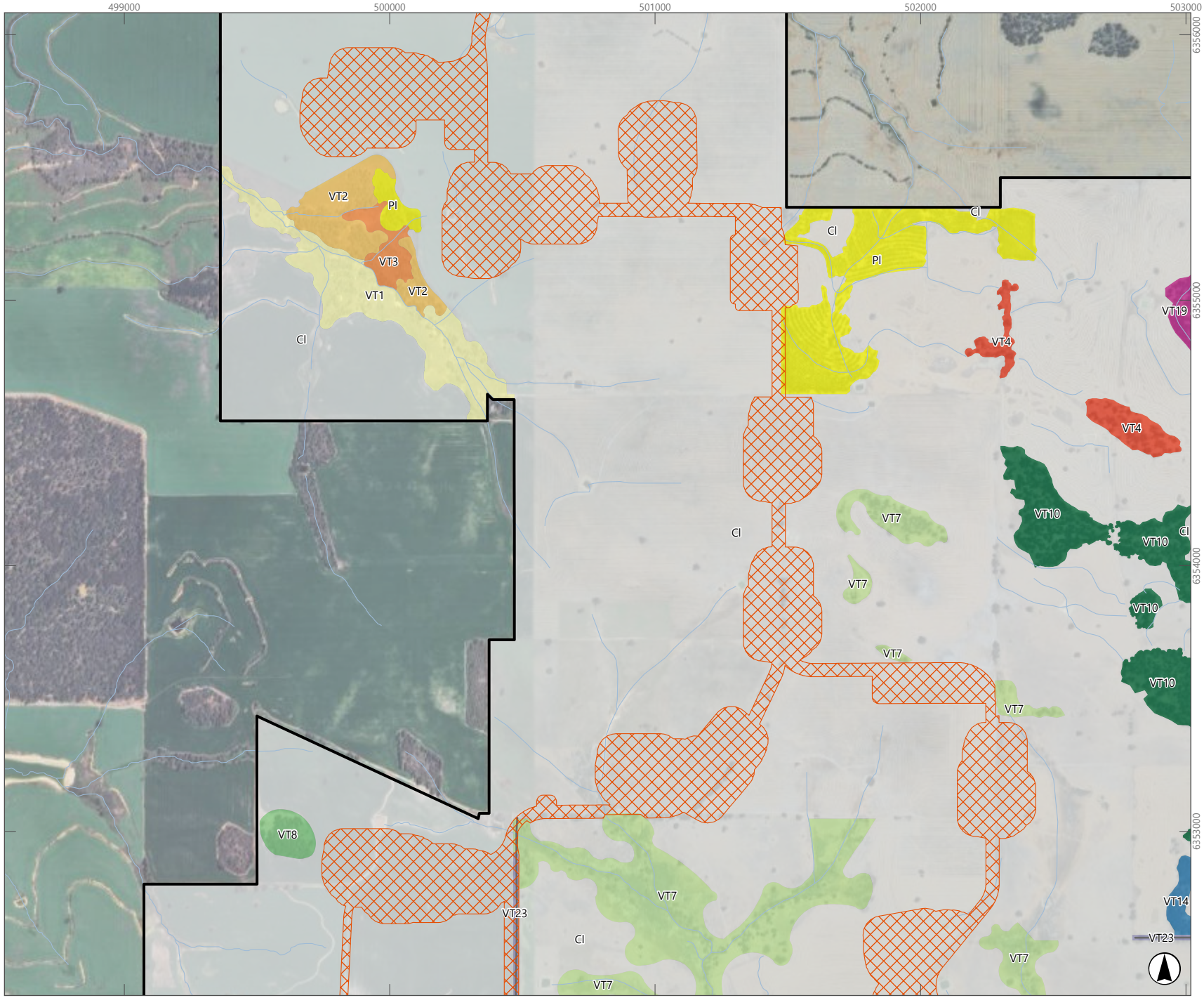
Metres

Scale: 1:20,000 at A4

GDA2020 MGA Zone 50

Image Source: ESRI Basemap (2023) | **Data Source:** Landgate (2023), Umwelt (2024)

FIGURE 6.3.2
Vegetation Types of the Study Area



Legend

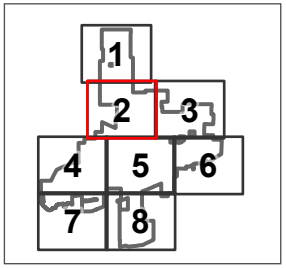
- Study Area
- Development Corridor
- Road
- Watercourse

Vegetation Type

- VT1
- VT2
- VT3
- VT4
- VT7
- VT8
- VT10
- VT14
- VT19
- VT23

Other Areas Mapped

- CI
- PI



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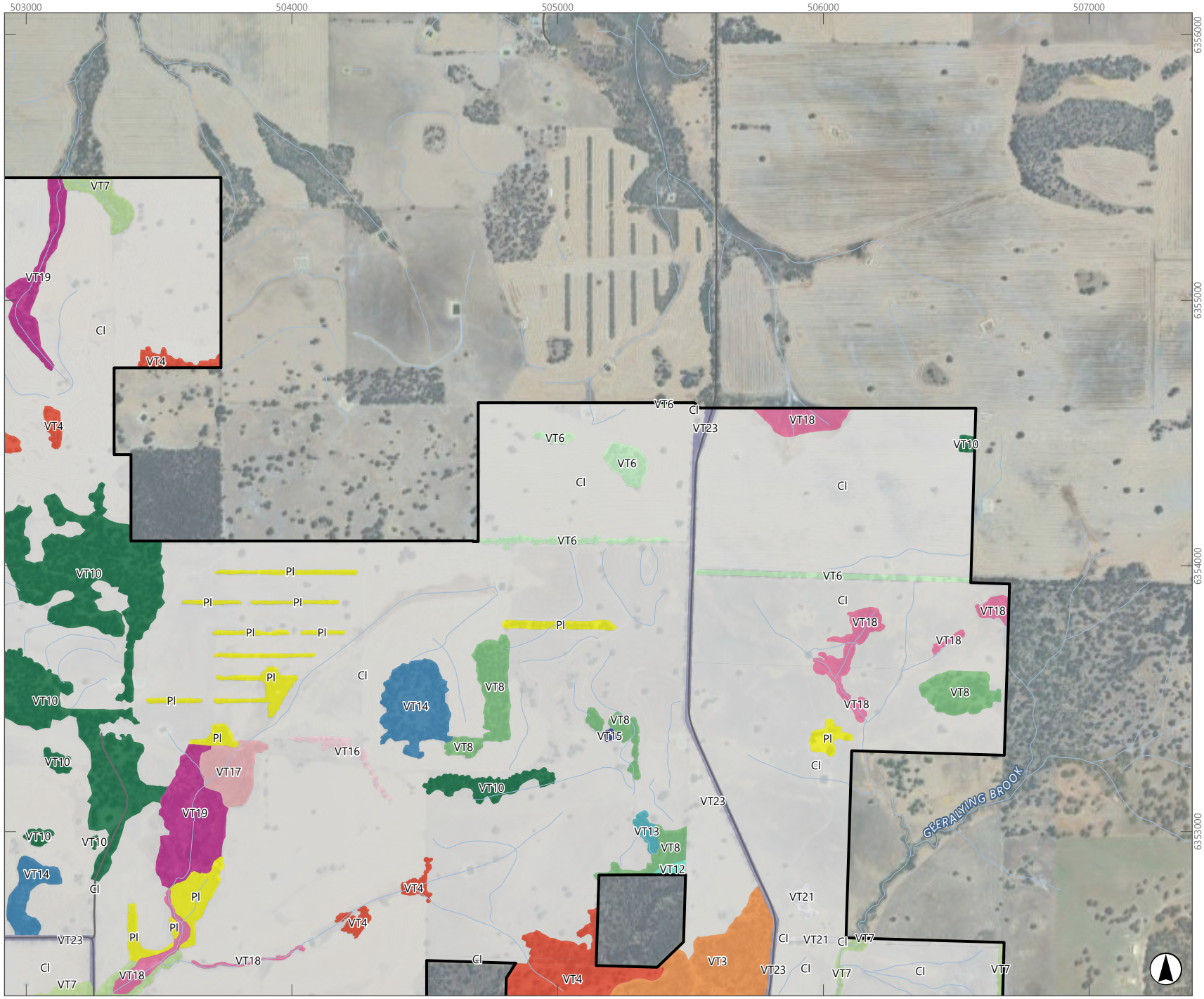
Metres

Scale: 1:20,000 at A4

GDA2020 MGA Zone 50

Image Source: ESRI Basemap (2023) | **Data Source:** Landgate (2023), Umwelt (2024)

FIGURE 6.3.3
Vegetation Types of the Study Area



Legend

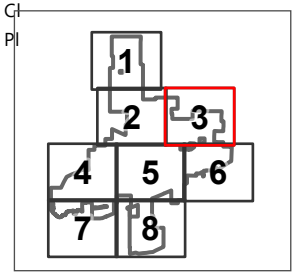
- Study Area
- Road
- Watercourse

Vegetation Type

- VT3
- VT4
- VT6
- VT7
- VT8
- VT10
- VT12
- VT13
- VT14
- VT15
- VT16
- VT17
- VT18
- VT19
- VT21
- VT23

Other Areas Mapped

- CI
- PI



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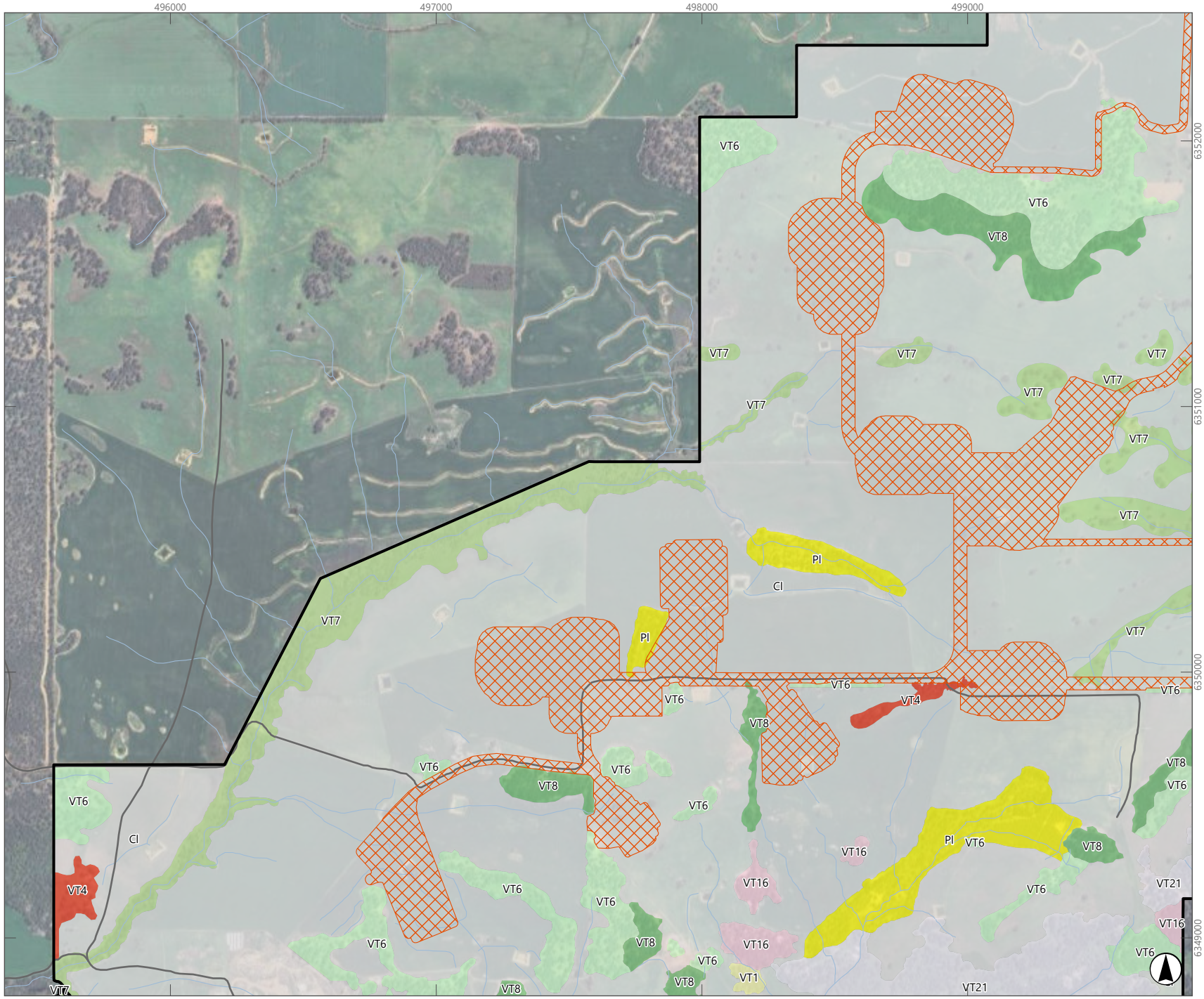
Metres

Scale: 1:20,000 at A4

GDA2020 MGA Zone 50

Image Source: ESRI Basemap (2023) | **Data Source:** Landgate (2023), Umwelt (2024)

FIGURE 6.3.4
Vegetation Types of the Study Area



Legend

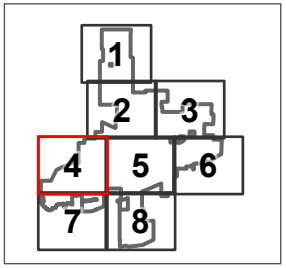
- Study Area
- Development Corridor
- Road
- Watercourse

Vegetation Type

- VT1
- VT4
- VT6
- VT7
- VT8
- VT16
- VT21

Other Areas Mapped

- CI
- PI



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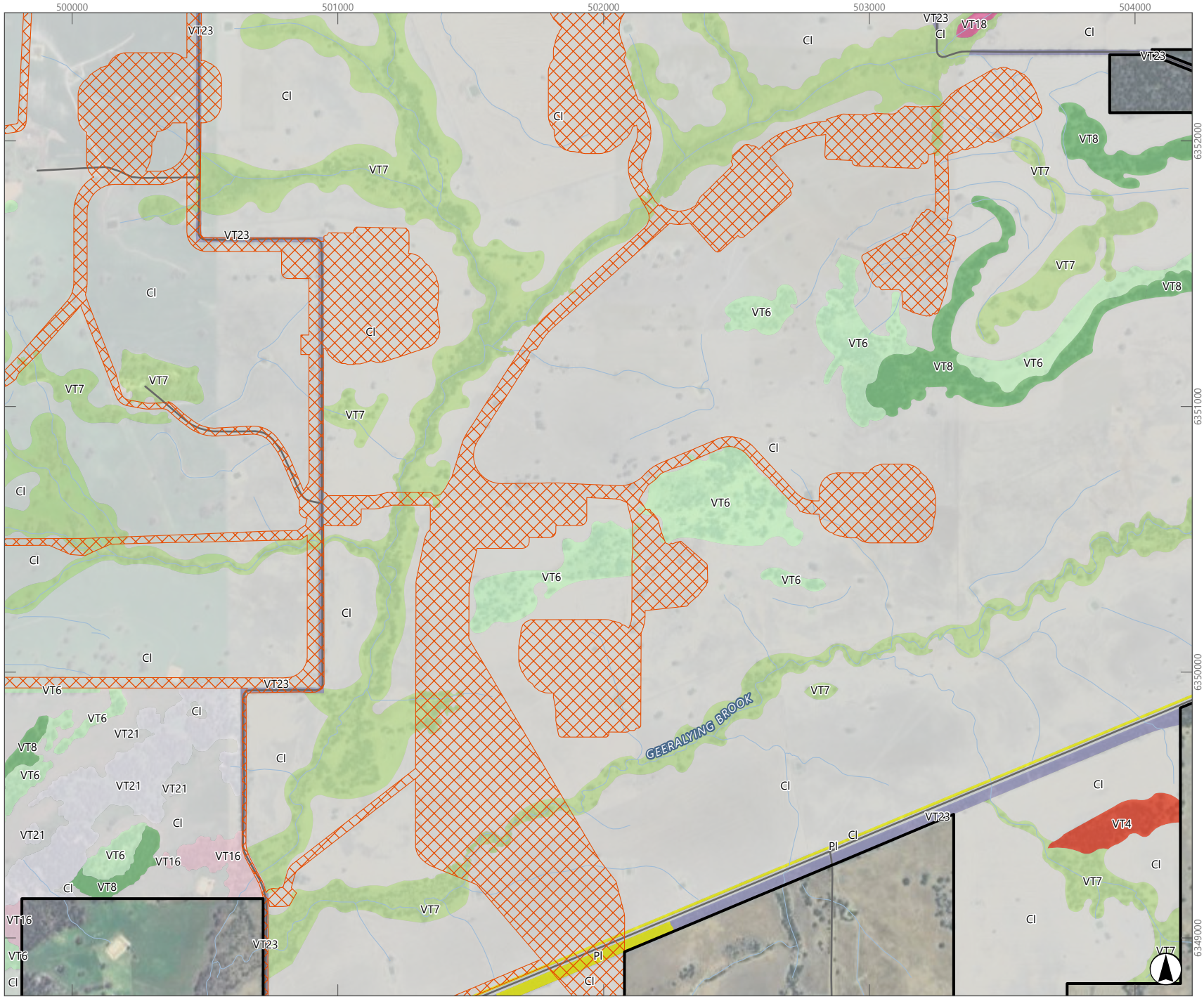
Metres

Scale: 1:20,000 at A4

GDA2020 MGA Zone 50

Image Source: ESRI Basemap (2023) | **Data Source:** Landgate (2023), Umwelt (2024)

FIGURE 6.3.5
Vegetation Types of the Study Area



Legend

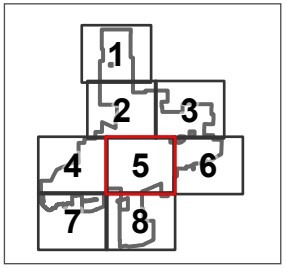
- Study Area
- Development Corridor
- Road
- Watercourse

Vegetation Type

- VT4
- VT6
- VT7
- VT8
- VT16
- VT18
- VT21
- VT23

Other Areas Mapped

- CI
- PI



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Metres

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GDA2020 MGA Zone 50

Image Source: ESRI Basemap (2023) | **Data Source:** Landgate (2023), Umwelt (2024)

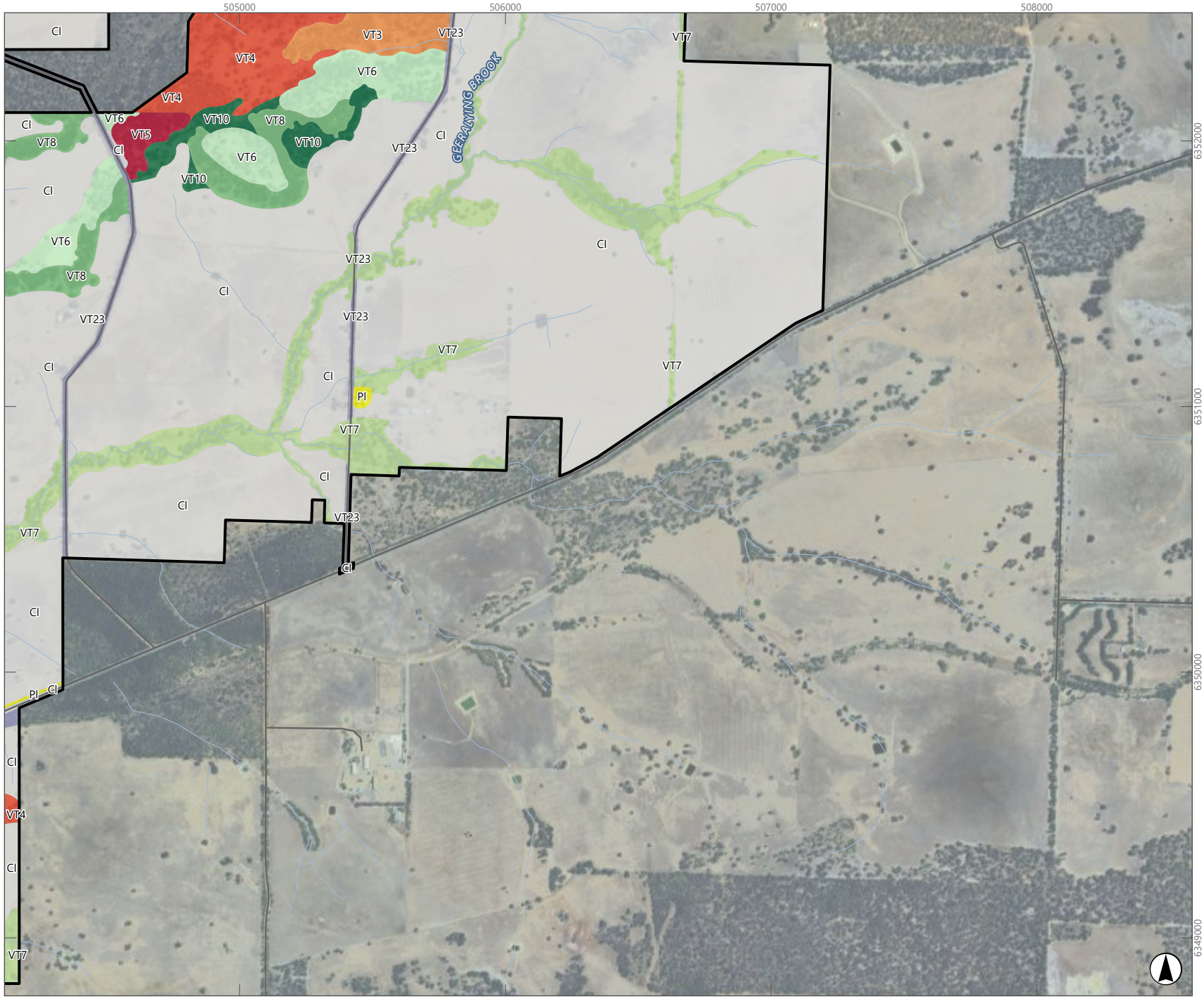


FIGURE 6.3.6
Vegetation Types of the Study Area

Legend

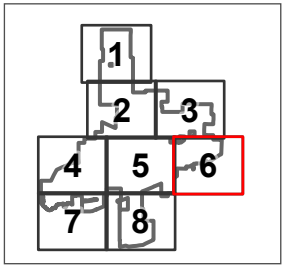
- Study Area
- Road
- Watercourse

Vegetation Type

- VT3
- VT4
- VT5
- VT6
- VT7
- VT8
- VT10
- VT23

Other Areas Mapped

- CI
- PI



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GDA2020 MGA Zone 50

Image Source: ESRI Basemap (2023) | **Data Source:** Landgate (2023), Umwelt (2024)

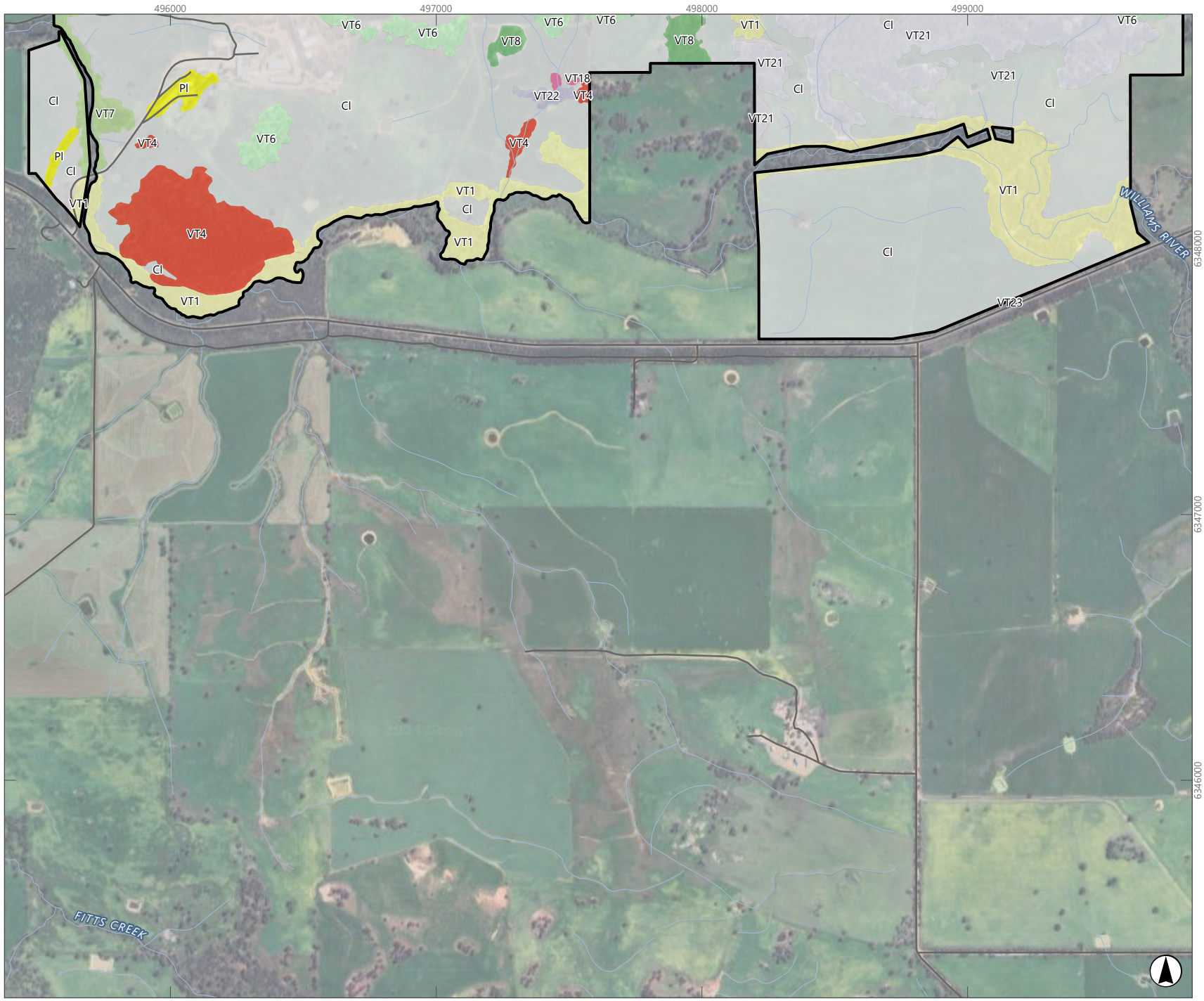


FIGURE 6.3.7
Vegetation Types of the Study Area

Legend

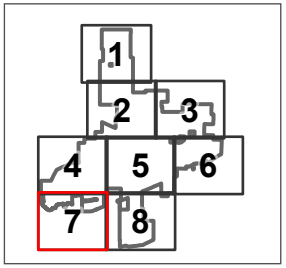
- Study Area
- Road
- Watercourse

Vegetation Type

- VT1
- VT4
- VT6
- VT7
- VT8
- VT16
- VT18
- VT21
- VT22
- VT23

Other Areas Mapped

- CI
- PI



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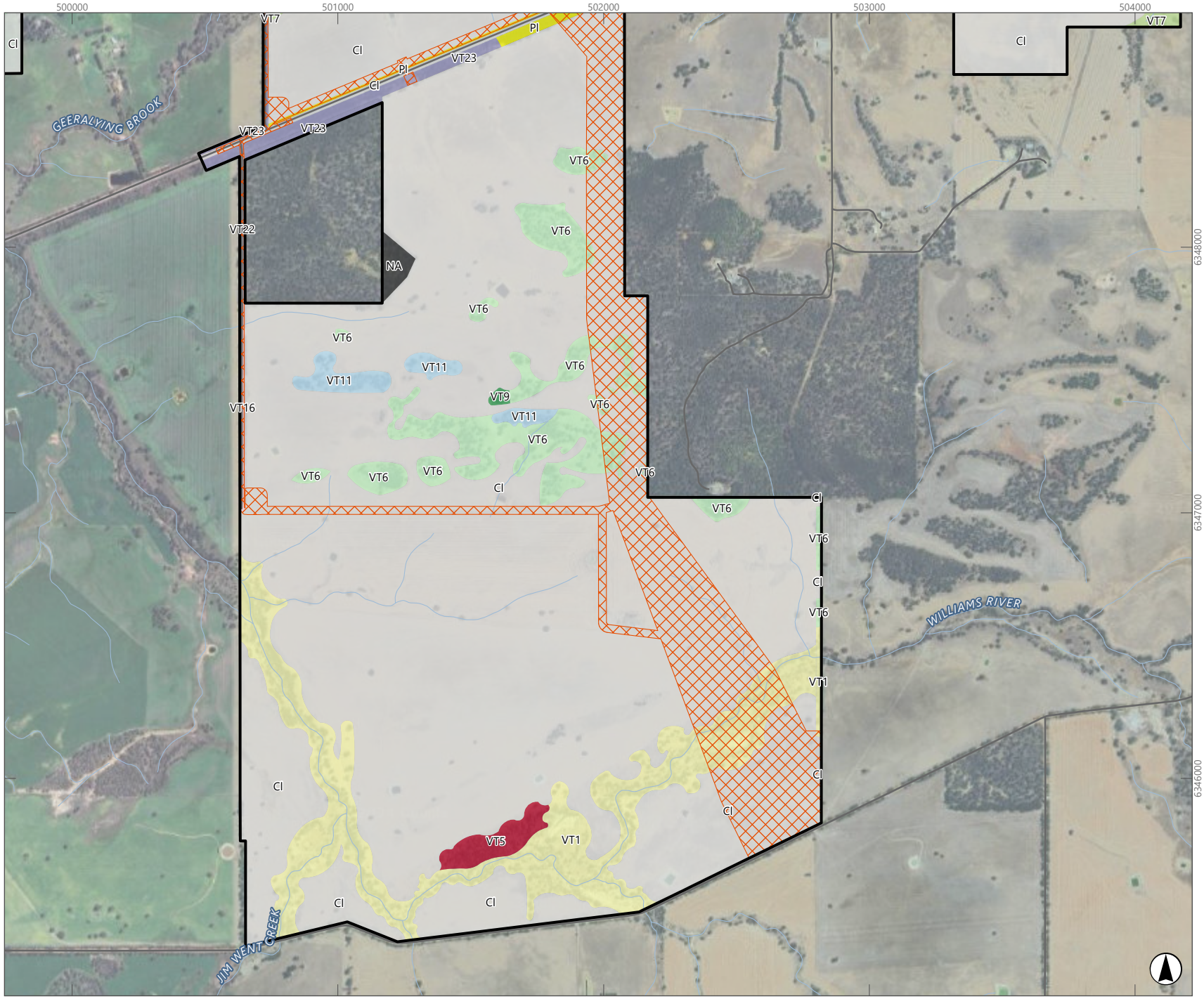
Metres

Scale: 1:20,000 at A4

GDA2020 MGA Zone 50

Image Source: ESRI Basemap (2023) | **Data Source:** Landgate (2023), Umwelt (2024)

FIGURE 6.3.8
Vegetation Types of the Study Area



Legend

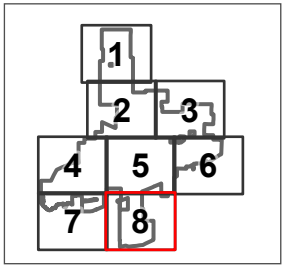
- Study Area
- Development Corridor
- Road
- Watercourse

Vegetation Type

- VT1
- VT5
- VT6
- VT7
- VT9
- VT11
- VT16
- VT22
- VT23

Other Areas Mapped

- CI
- NA
- PI



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Metres

Scale: 1:20,000 at A4

GDA2020 MGA Zone 50

Image Source: ESRI Basemap (2023) | **Data Source:** Landgate (2023), Umwelt (2024)

6.2.3 Vegetation Condition

Vegetation condition as mapped across the Study Area is presented on **Figure 6.4**. The majority of the Study Area has been mapped as 'Completely Degraded' (5,221.5 ha, 82.3%). This largely consists of areas mapped as Cleared land ('Cl') and Planted ('Pl') areas, in which the land has been cleared for pasture or cropping. Little to no native vegetation remains in these areas, although isolated remnant trees do occur. A small extent (25.9 ha) of VTs 7, 10, 18 and 19 were also mapped as Completely Degraded; in these areas, VT allocation was undertaken due to the extent of remaining tree stratum, or weed overstorey presence, allowing grouping into these VTs rather than being allocated to Cleared land.

Nearly one fifth of the Study Area was mapped as being in 'Degraded' condition (1,120.2 ha, 17.6%); these areas predominately consisted of native trees over no or very little understorey taxa, and high levels of introduced (weed) taxa. An area previously mapped as 'Good' condition in the eastern portion of the Study Area by the Phase 1 survey (Umwelt, 2023) was revisited during the spring survey and was deemed to be 'Degraded', due to historical logging, high weed cover and lack of intact native understorey.

A very small portion of the Study Area was mapped as being in 'Good' condition (0.4 ha, 0.008% of the Study Area). This condition rating was mapped across one patch of remnant vegetation, being located adjacent to an unnamed reserve (reserve number R20877), on the eastern boundary of the Study Area. This area is the only mapped location of VT12.

Due to the history of clearing, logging and grazing in the Study Area, there was no vegetation observed that was considered to be in 'Pristine', 'Excellent' or 'Very Good' condition.

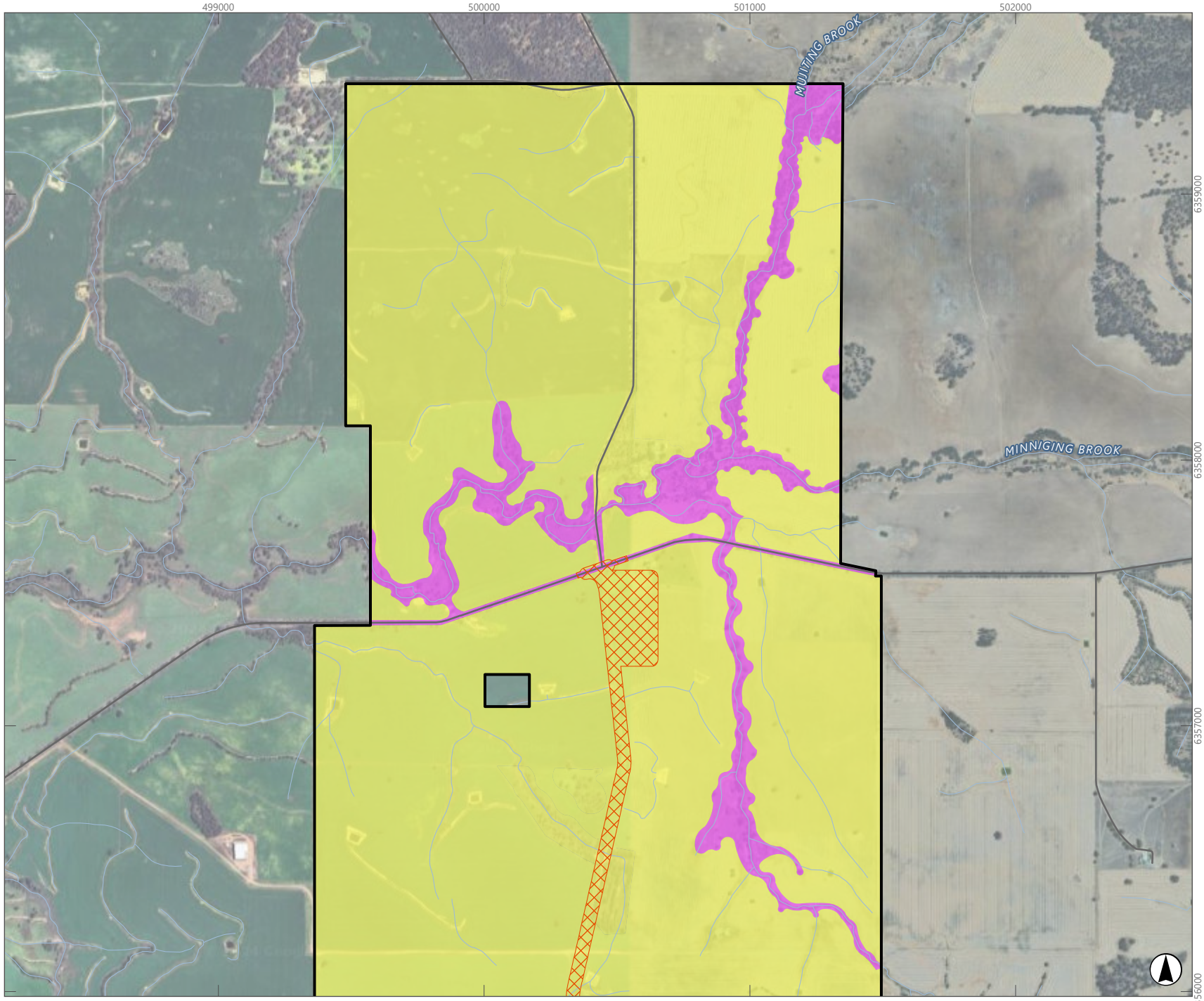


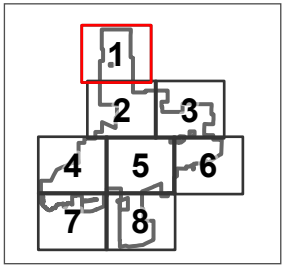
FIGURE 6.4.1
Vegetation Condition of the Study Area

Legend

- Study Area
- Development Corridor
- Road
- Watercourse

Vegetation Condition

- Degraded
- Completely Degraded



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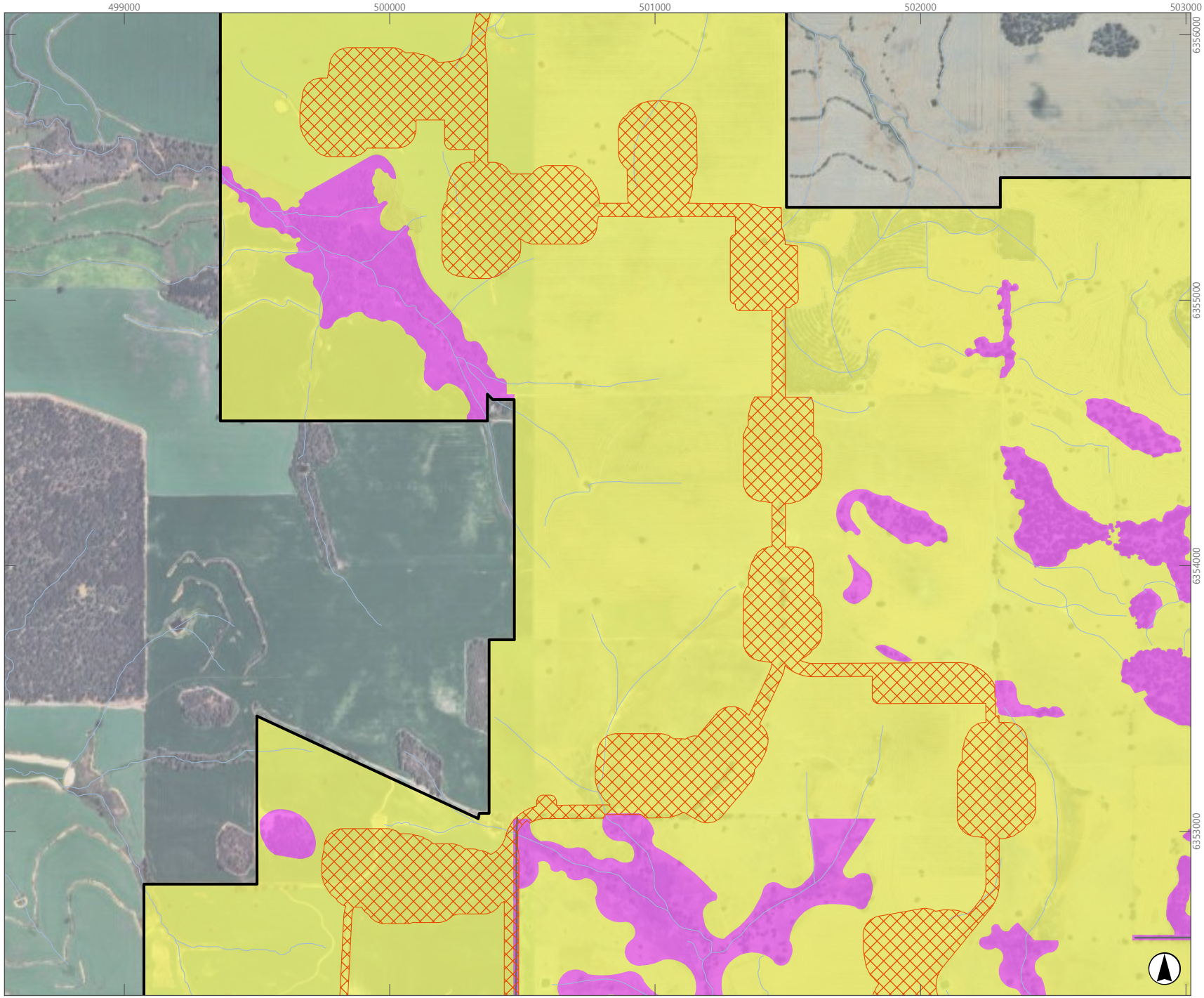
Metres

Scale: 1:20,000 at A4

GDA2020 MGA Zone 50

Image Source: ESRI Basemap (2023) | **Data Source:** Landgate (2023), Umwelt (2024)

FIGURE 6.4.2
Vegetation Condition of the Study Area

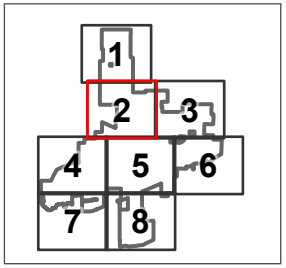


Legend

- Study Area
- Development Corridor
- Road
- Watercourse

Vegetation Condition

- Degraded
- Completely Degraded



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Metres

Scale: 1:20,000 at A4

GDA2020 MGA Zone 50

Image Source: ESRI Basemap (2023) | **Data Source:** Landgate (2023), Umwelt (2024)

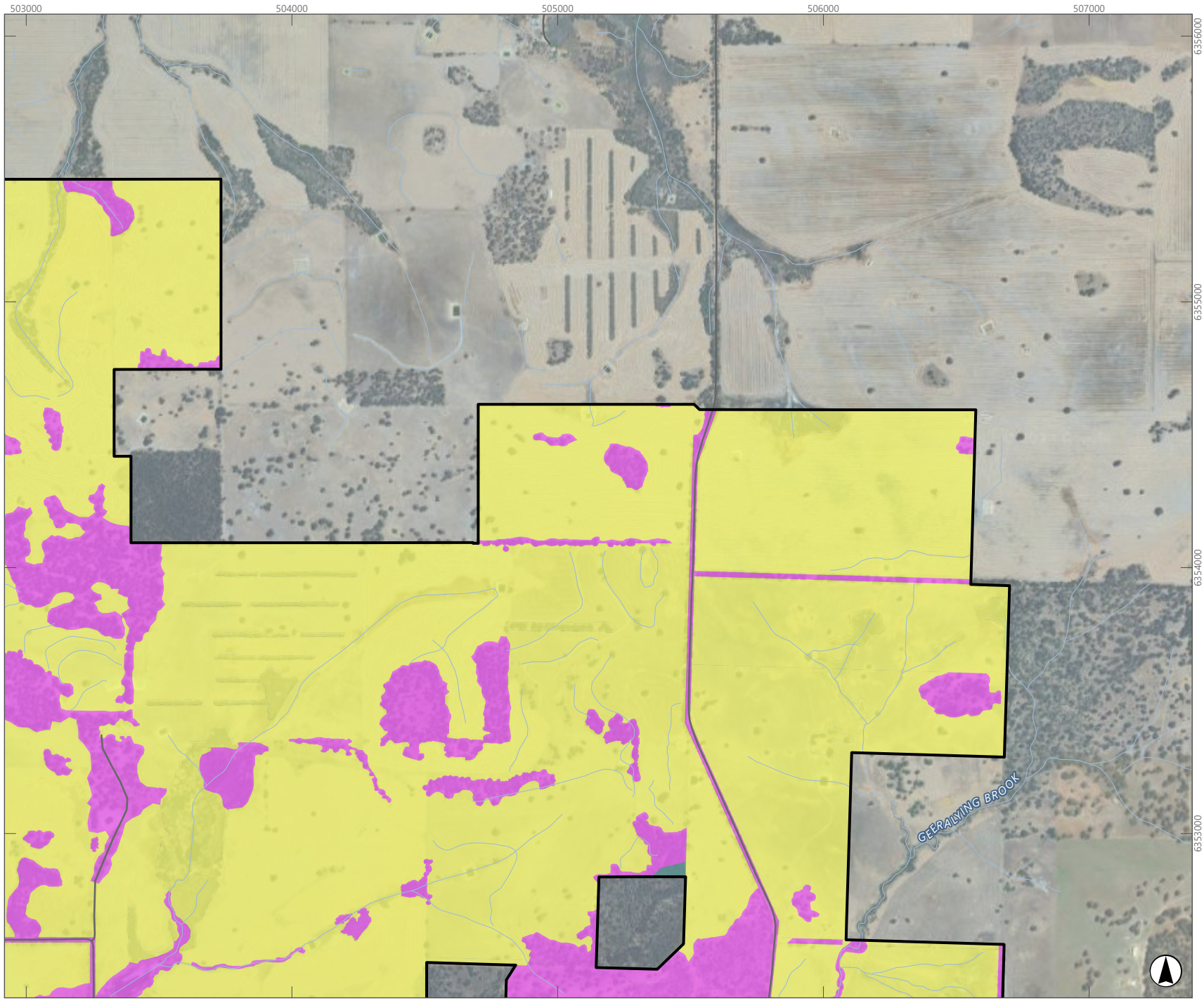


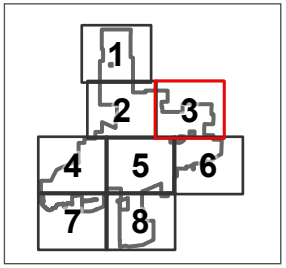
FIGURE 6.4.3
Vegetation Condition of the Study Area

Legend

- Study Area
- Road
- Watercourse

Vegetation Condition

- Good
- Degraded
- Completely Degraded



0 400 800

Metres

Scale: 1:20,000 at A4

GDA2020 MGA Zone 50

Image Source: ESRI Basemap (2023) | **Data Source:** Landgate (2023), Umwelt (2024)

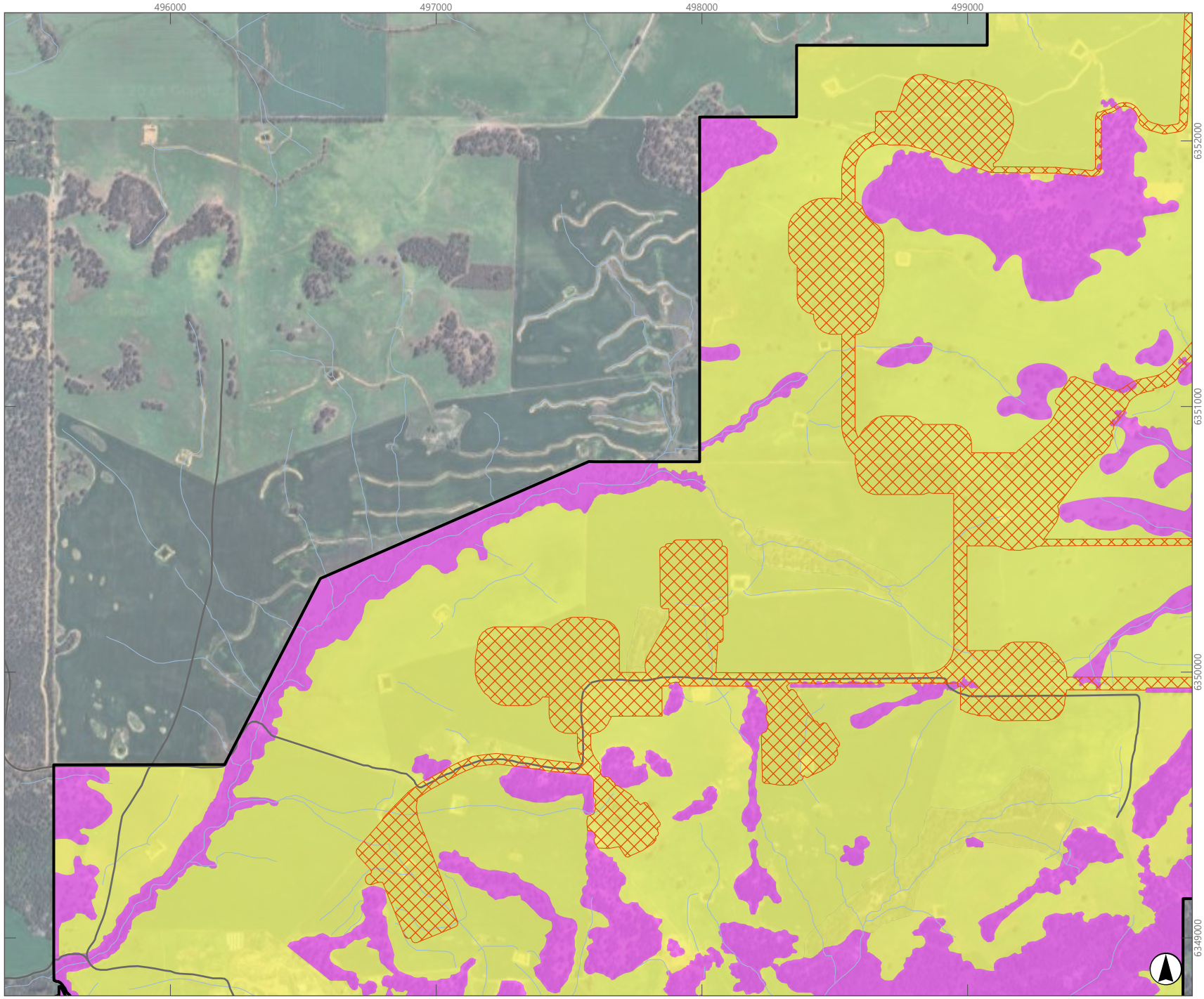


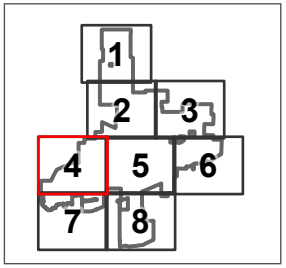
FIGURE 6.4.4
Vegetation Condition of the Study Area

Legend

- Study Area
- Development Corridor
- Road
- Watercourse

Vegetation Condition

- Degraded
- Completely Degraded



0 400 800

Metres

Scale: 1:20,000 at A4

GDA2020 MGA Zone 50

Image Source: ESRI Basemap (2023) | **Data Source:** Landgate (2023), Umwelt (2024)

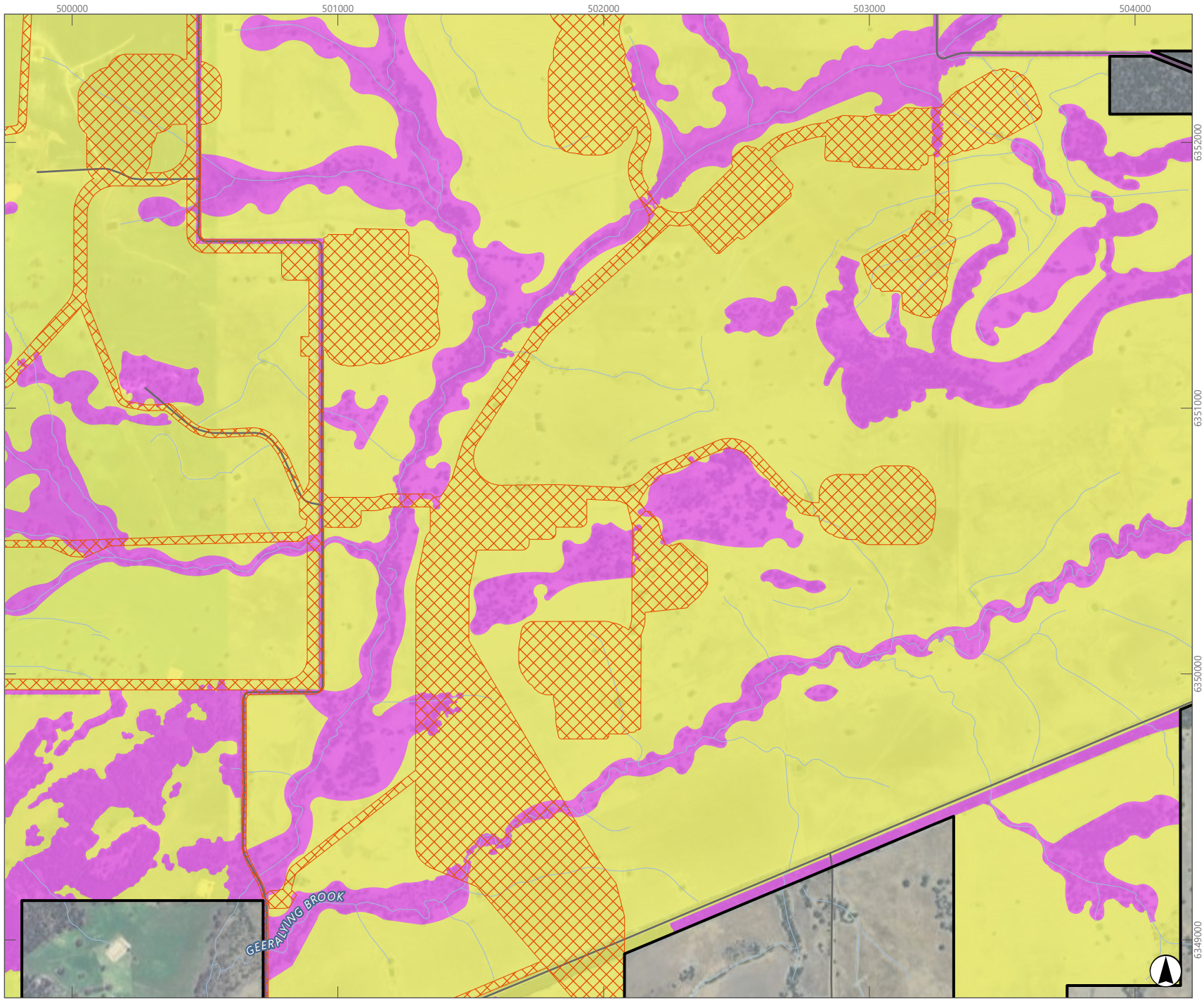


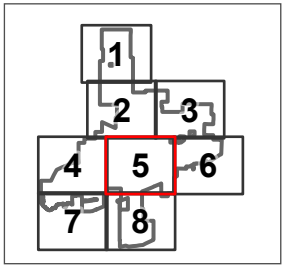
FIGURE 6.4.5
Vegetation Condition of the Study Area

Legend

- Study Area
- Development Corridor
- Road
- Watercourse

Vegetation Condition

- Degraded
- Completely Degraded



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Metres

Scale: 1:20,000 at A4

GDA2020 MGA Zone 50

Image Source: ESRI Basemap (2023) | **Data Source:** Landgate (2023), Umwelt (2024)

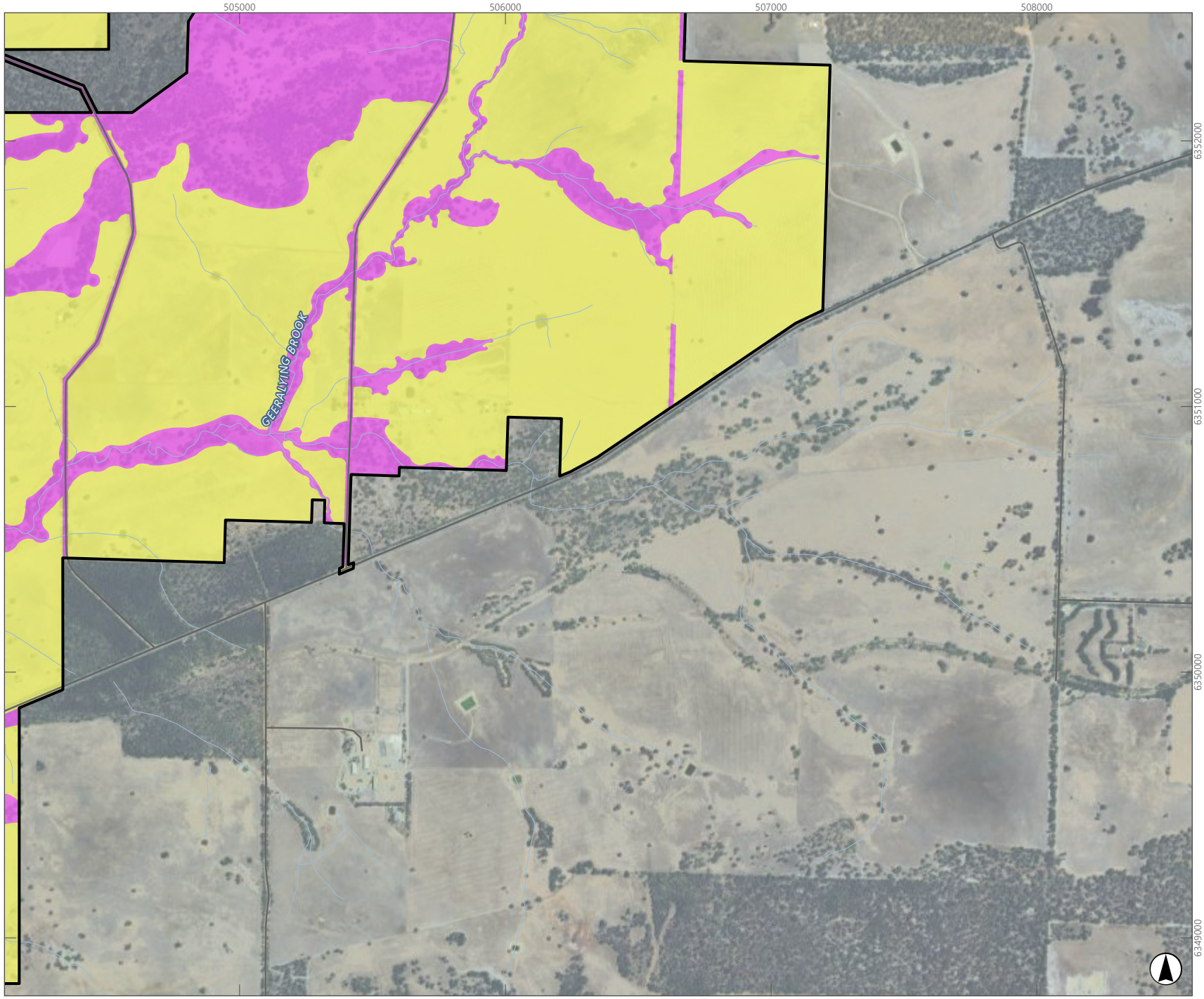


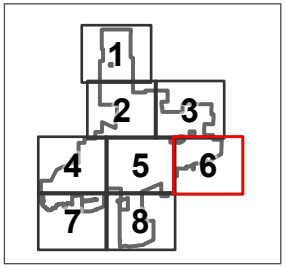
FIGURE 6.4.6
Vegetation Condition of the Study Area

Legend

- Study Area
- Road
- Watercourse

Vegetation Condition

- Degraded
- Completely Degraded



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Metres

Scale: 1:20,000 at A4

GDA2020 MGA Zone 50

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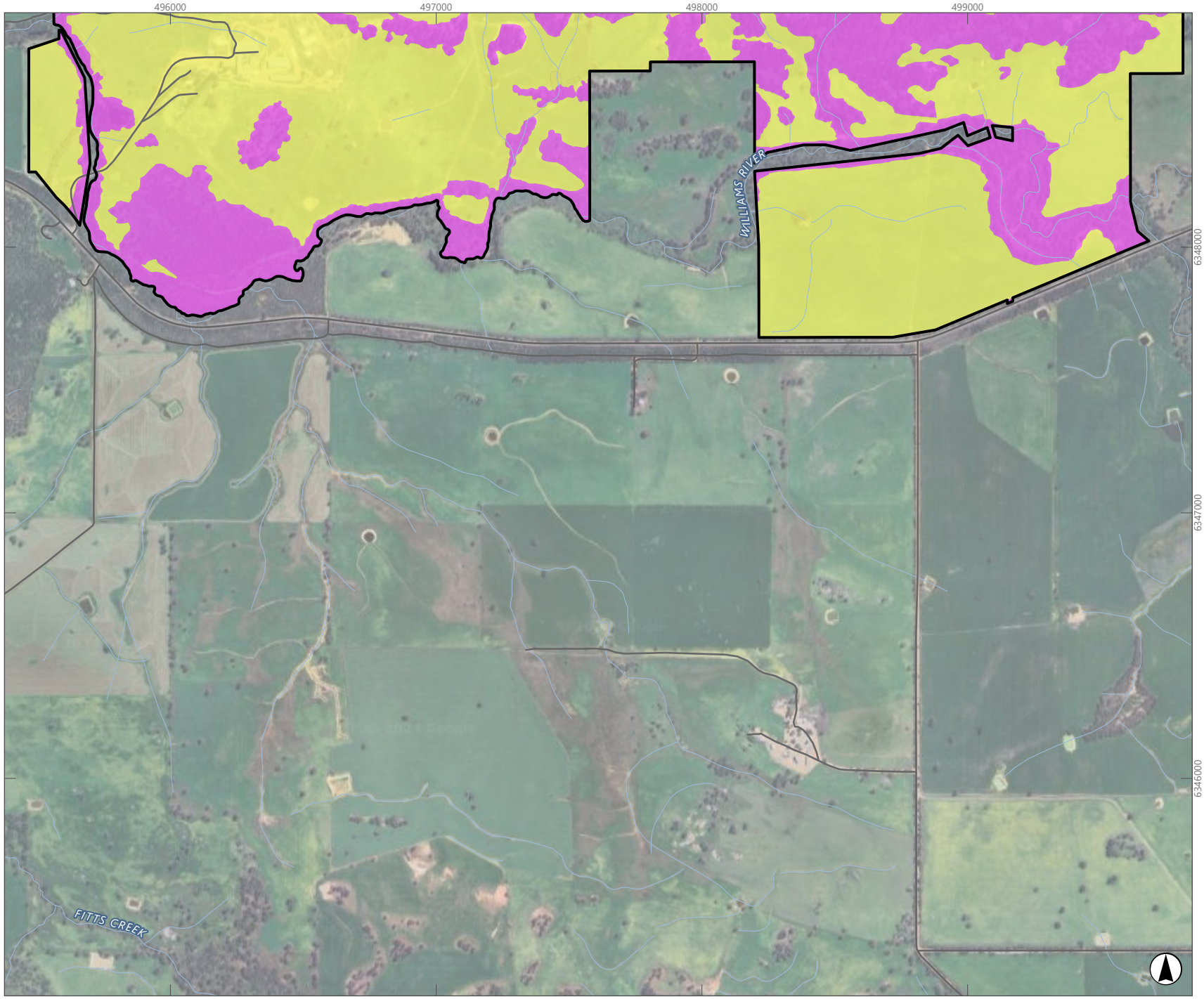


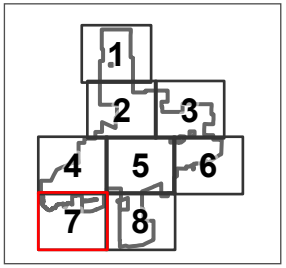
FIGURE 6.4.7
Vegetation Condition of the Study Area

Legend

- Study Area
- Road
- Watercourse

Vegetation Condition

- Degraded
- Completely Degraded



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Metres

Scale: 1:20,000 at A4

GDA2020 MGA Zone 50

Image Source: ESRI Basemap (2023) | **Data Source:** Landgate (2023), Umwelt (2024)

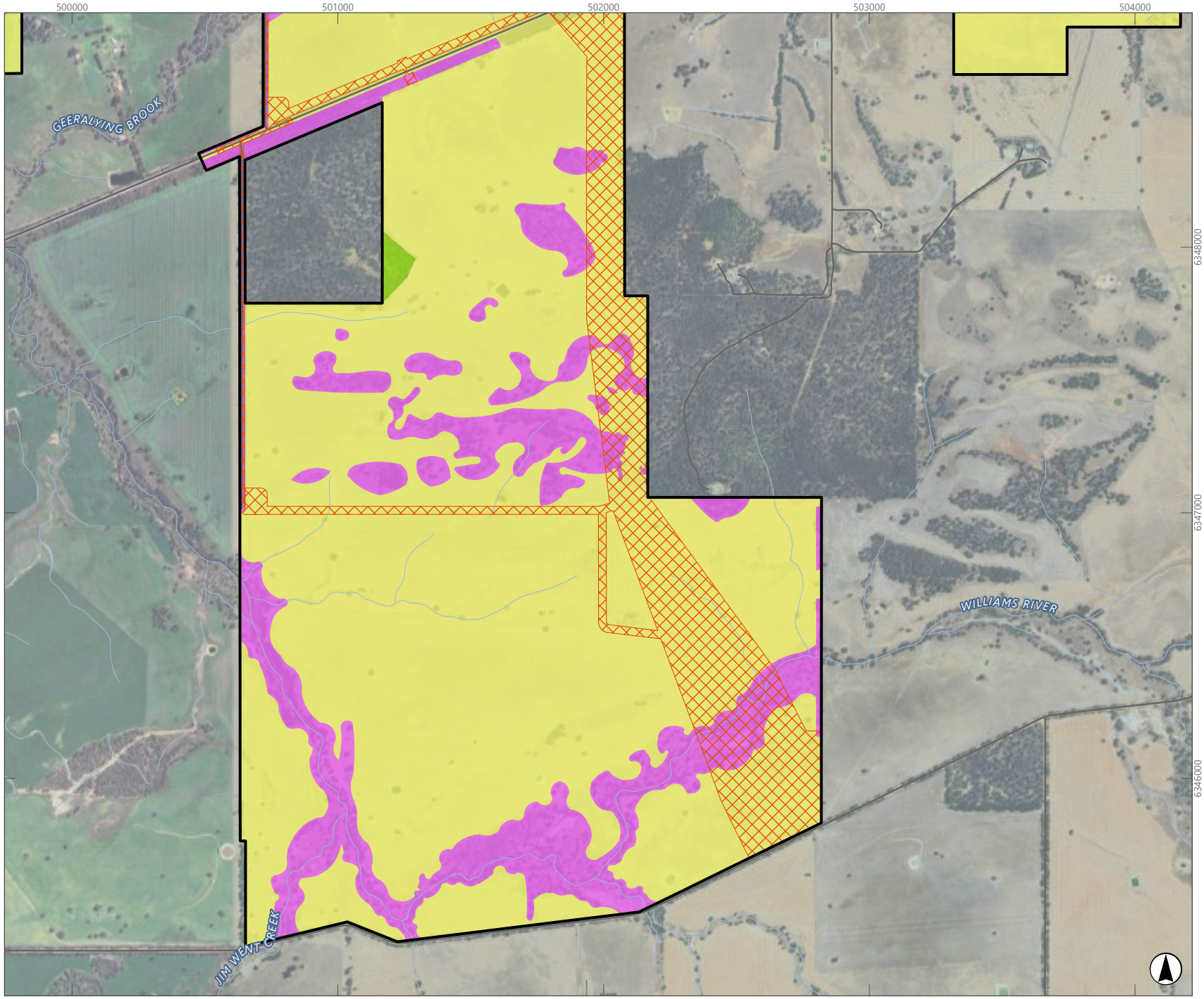


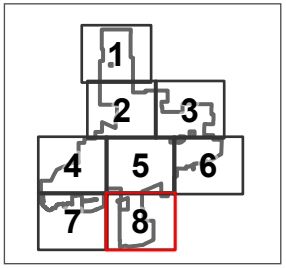
FIGURE 6.4.8
Vegetation Condition of the Study Area

Legend

- Study Area
- Development Corridor
- Road
- Watercourse

Vegetation Condition

- Degraded
- Completely Degraded
- Not Assessed



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Metres

Scale: 1:20,000 at A4

GDA2020 MGA Zone 50

Image Source: ESRI Basemap (2023) | **Data Source:** Landgate (2023), Umwelt (2024)

6.2.4 Threatened Ecological Communities

The interrogation of DCCEEW's PMST database (DCCEEW, 2024f) returned one TEC, being the Eucalypt Woodlands of the Western Australian Wheatbelt ecological community (see **Section 5.1**, for more). This community is synonymous with the State listed PEC 'Eucalyptus Woodlands of the Western Australian Wheatbelt' and is described in **Table 6.4**. No other Commonwealth-listed TECs were returned from desktop searches within the search area.

The VTs described and mapped in the Project Area were assessed against the key diagnostics in relation to characteristics 2 (Structure), 3 (Key tree species), and 4 (presence of understorey)(Department of the Environment, 2015a). Based on vegetation description and components alone, 12 of the VTs mapped within the Project Area were considered to potentially represent the Eucalyptus Woodlands of the Western Australian Wheatbelt TEC. Based on the assessment against key diagnostic criteria, a total of 41.8 ha of the Eucalyptus Woodlands of the Western Australian Wheatbelt TEC has been identified across five patches within the Study Area (**Figure 6.5**). These are represented by patches of VT8 (36.4 ha) and VT6 (5.2 ha) and are all in Degraded condition.

As part of flora and vegetation surveys within the Additional Survey Area, a patch of 163.5 ha of Very Good condition vegetation was determined to meet the diagnostic criteria of Western Australian Wheatbelt TEC (**Figure 6.5**). Impacts to this area of TEC have been avoided as part of the iterative project design by removing the Additional Survey Area from the Project. Approximately 53 ha of this TEC in Degraded condition was also avoided through removal of the Additional Survey Area from the Project.

Table 6.4 Threatened Ecological Communities within the Project Area

Community	Description	Status (WA)	Status (EPBC)	Source
Eucalypt Woodlands of the Western Australian Wheatbelt	The community occurs in the IBRA Avon Wheatbelt bioregion and Western Mallee subregion. It also includes outlying patches in the eastern parts of the Jarrah Forest bioregion adjacent to the Avon Wheatbelt bioregion that are off the Darling Range, and receive less than 600 mm mean annual rainfall. The structure of the ecological community is a woodland in which the minimum crown cover of the tree canopy in a mature woodland is 10%. The key dominant or co-dominant species of the tree canopy are species of Eucalyptus trees that typically have a single trunk. Native understorey is present but is of variable composition, being a combination of grasses, other herbs, and shrubs.	Priority 3	Critically Endangered	DCCEEW (2024f) & DBCA (2023b)

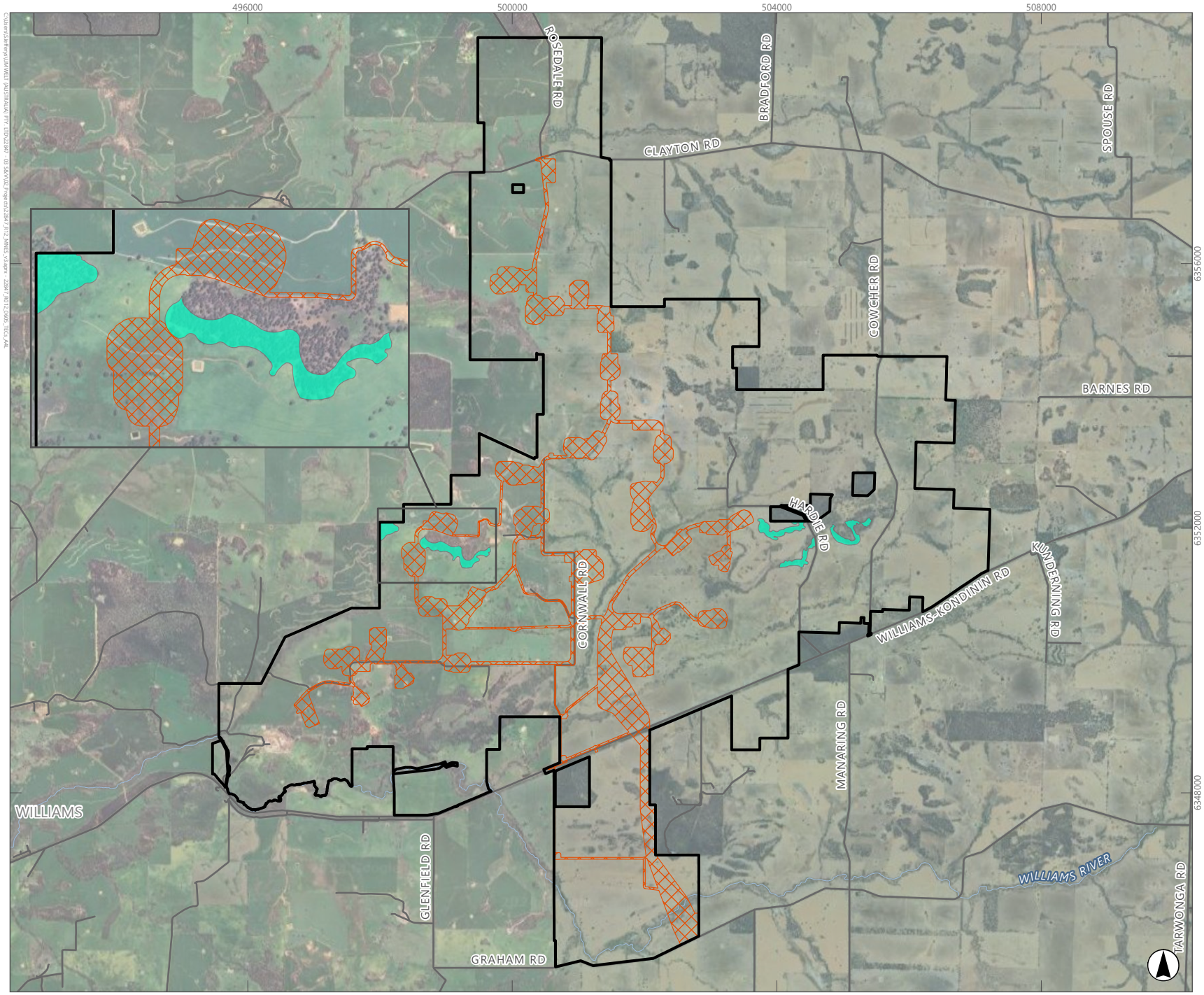


FIGURE 6.5

Threatened Ecological Communities of the Study Area

Legend

- Study Area
- Development Corridor
- Road
- Major Watercourse
- Eucalyptus Woodlands of the Western Australian Wheatbelt TEC

0 1.6 3.2

Kilometres

Scale 1:80,000 at A4
GDA2020 MGA Zone 50

Image Source: ESRI Basemap (2023) | **Data Source:** Landgate (2023), Umwelt (2024)

6.2.5 Flora Diversity

Field surveys identified a total of 149 discrete flora species from 37 families within the Study Area. The most represented plant families were the Myrtaceae (27 species), Poaceae (28 species) and Fabaceae (16 species) families. Of the species recorded, 69 are introduced, representing 46% of the total flora recorded which is indicative of the high levels of clearing for agriculture present throughout the Study Area. Of these introduced species, 10 are species native to Western Australia, but planted outside of their natural range and thus are classified as introduced in this context. It should also be noted that of the 80 species considered to be native, many of these were planted within the Study Area.

The full species list is provided in **Appendix H**, and conservation significant species are detailed further in the following section.

6.2.6 Threatened Flora

No Threatened flora species were recorded during field surveys.

6.2.7 Introduced Flora

Introduced flora comprised 46% of the total number of flora taxa recorded during the surveys, indicating the high levels of clearing for agriculture which are present throughout the Study Area. Ten of the taxa included in this list are taxa that are native to Western Australia, but planted outside of their natural range, and thus are classified as introduced in this context.

Although most introduced taxa were common pasture weeds, three are listed as Weeds of National Significance (WoNS) (Invasive Plants and Animals Committee (IPAC), 2017) and Declared Pests under the *Biosecurity and Agriculture Management Act (2007)* (WA) (BAM Act):

- Bridal creeper (Asparagus asparagoides)
- Purple viper's-bugloss (*Echium plantagineum*)
- One-leaf Cape tulip (*Moraea flaccida*).

6.3 Fauna

6.3.1 Habitat Types

Terrestrial habitats assessed through field surveys have been broadly mapped into five habitat types, as summarised in **Table 6.5** and shown on **Figure 6.6**.

Table 6.5 Terrestrial Habitat Types within the Study Area

Habitat Type	Important Habitat Elements	Area (ha)
Eucalypt woodland on laterite rise	• Laterite outcropping and surface rocks provide shelter habitat for reptiles. • Fallen timber, logs, woody debris, and leaf litter provides shelter for reptiles and small mammals. • Tree hollows provide habitat for hollow nesting birds, roosting bats, and some arboreal reptiles and mammals. • Where present, Marri (*Corymbia calophylla*), Jarrah (*Eucalyptus marginata),* and/or an understory of shrubby *Banksia* (e.g. *B. sessilis*) may provide foraging habitat for Threatened black-cockatoos. • Wandoo (*Eucalyptus wandoo*), Jarrah and Marri potentially provide breeding habitat for black-cockatoo species listed under the BC Act and EPBC Act.	404.6
Eucalypt-Sheoak woodland with granites	• Fallen timber, logs, woody debris, and leaf litter provides shelter for reptiles and small mammals. • Tree hollows provide habitat for hollow nesting birds, roosting bats and some arboreal reptiles and mammals. • Dense vegetation provides nesting habitat for birds. • Exfoliating rock on granite outcrops and granite boulders provide shelter for reptiles. • Ephemeral rock pools and seasonally wet runoff areas provide breeding habitat for frogs. • York Gum (*Eucalyptus loxophleba*) or Wandoo potentially provide breeding habitat for Threatened black-cockatoos.	181
Creekline	• Tree hollows may support breeding and roosting by birds, bats and arboreal reptiles. • Fallen timber and hollow logs may provide shelter for reptiles and mammals. • Seasonally wet areas may provide frog breeding habitat. • Linear corridors of vegetation may provide 'wildlife corridors' promoting the movement of fauna through the landscape. • Where present, Marri (*Corymbia calophylla*) may provide foraging habitat for Threatened black-cockatoos. • Where present, Marri, Flooded Gum (*Eucalyptus rudis*) and York Gum (*Eucalyptus loxophleba*) potentially provide breeding habitat for Threatened black-cockatoos.	563
Planted	• Linear corridors of vegetation may provide 'wildlife corridors' promoting the movement of fauna through the landscape.	96.7
Cleared	• Pasture may provide foraging habitat for macropods and birds that forage in open habitats. • Crops such as Canola may provide foraging habitat for birds, including Carnaby's Black-Cockatoo. • Farm dams may provide frog breeding habitat and breeding and foraging habitat for a small number of waterbirds. • Isolated paddock trees may provide foraging and/or breeding habitat for birds and roosting habitat for bats.	5,098.9

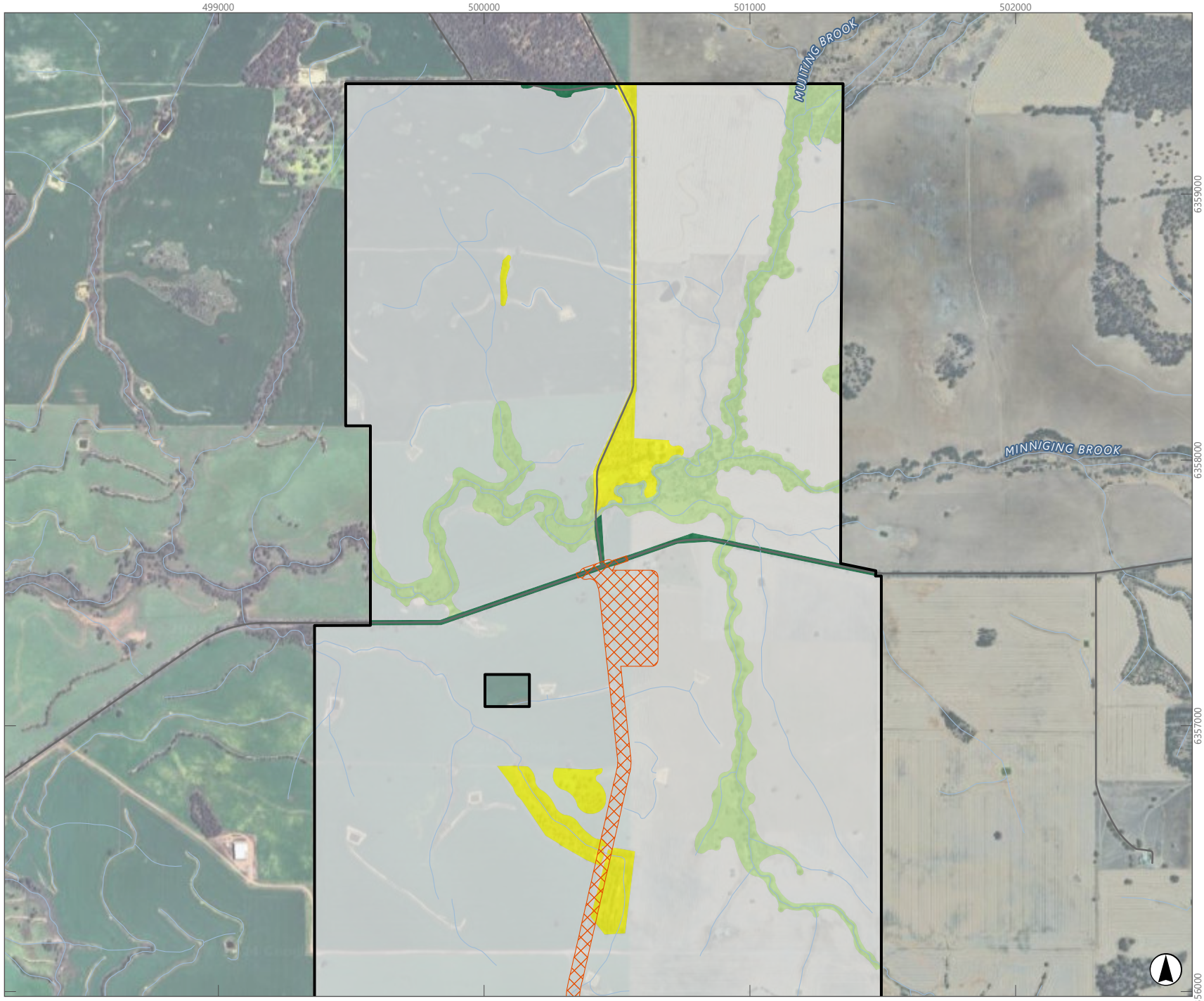


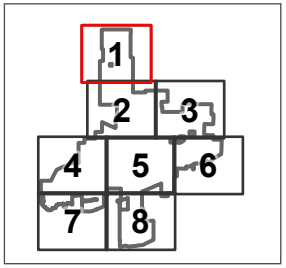
FIGURE 6.6.1
Terrestrial Habitats of the Study Area

Legend

- Study Area
- Development Corridor
- Road
- Watercourse

Fauna Habitats

- Eucalypt woodland on laterite rise
- Creekline
- Planted
- Cleared



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Metres

Scale: 1:20,000 at A4

GDA2020 MGA Zone 50

Image Source: ESRI Basemap (2023) | **Data Source:** Landgate (2023), Umwelt (2024)

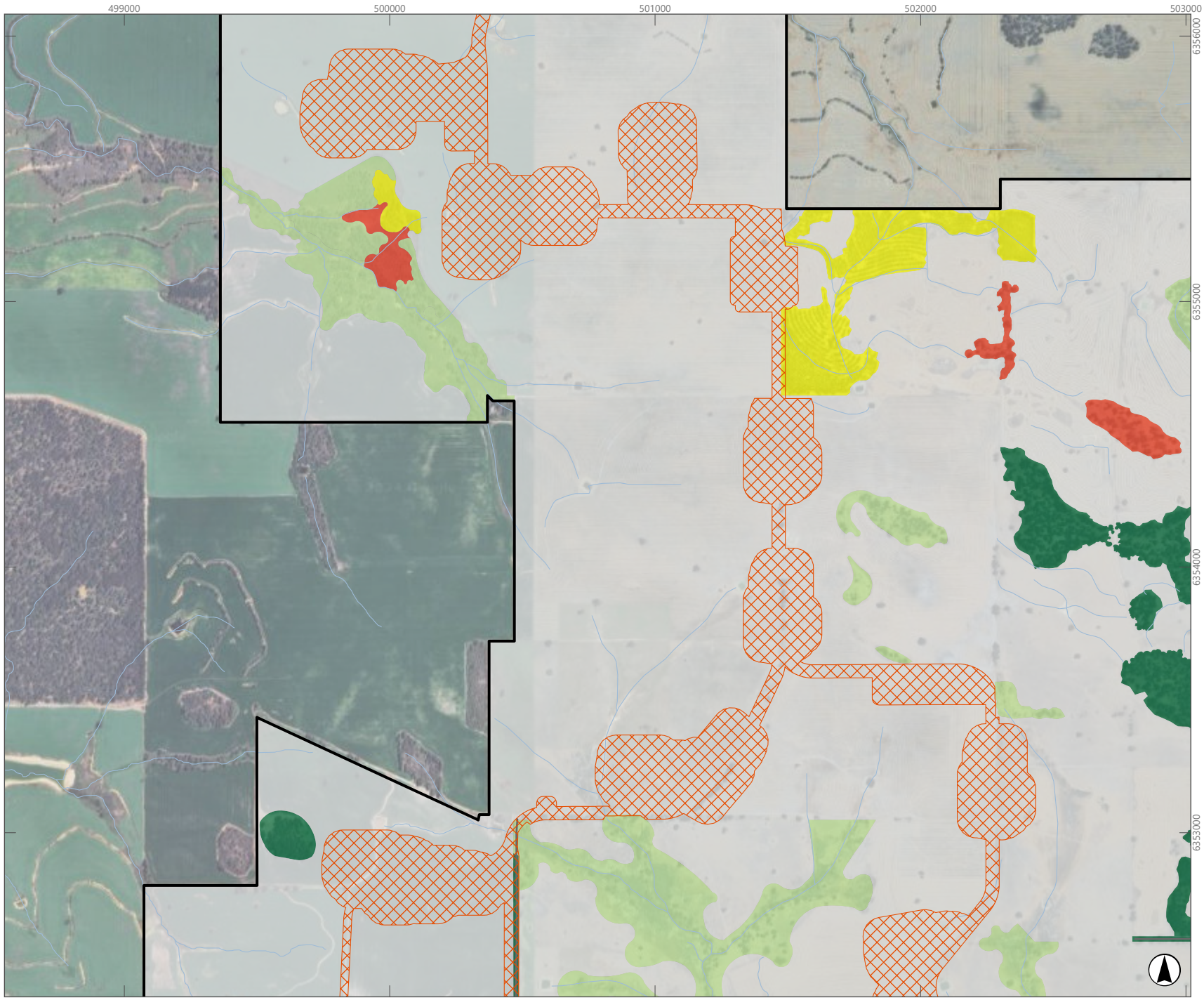


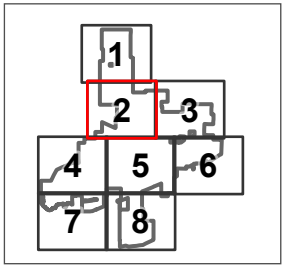
FIGURE 6.6.2
Terrestrial Habitats of the Study Area

Legend

- Study Area
- Development Corridor
- Road
- Watercourse

Fauna Habitats

- Eucalypt - Sheoak woodland with granites
- Eucalypt woodland on laterite rise
- Creekline
- Planted
- Cleared



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Metres

Scale: 1:20,000 at A4

GDA2020 MGA Zone 50

Image Source: ESRI Basemap (2023) | **Data Source:** Landgate (2023), Umwelt (2024)

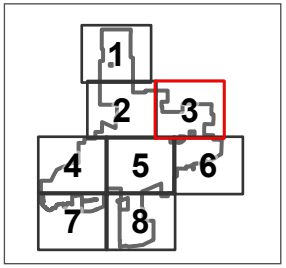
FIGURE 6.6.3
Terrestrial Habitats of the Study Area

Legend

- Study Area
- Road
- Watercourse

Fauna Habitats

- Eucalypt - Sheoak woodland with granites
- Eucalypt woodland on laterite rise
- Creekline
- Planted
- Cleared



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Metres

Scale: 1:20,000 at A4

GDA2020 MGA Zone 50

Image Source: ESRI Basemap (2023) | **Data Source:** Landgate (2023), Umwelt (2024)

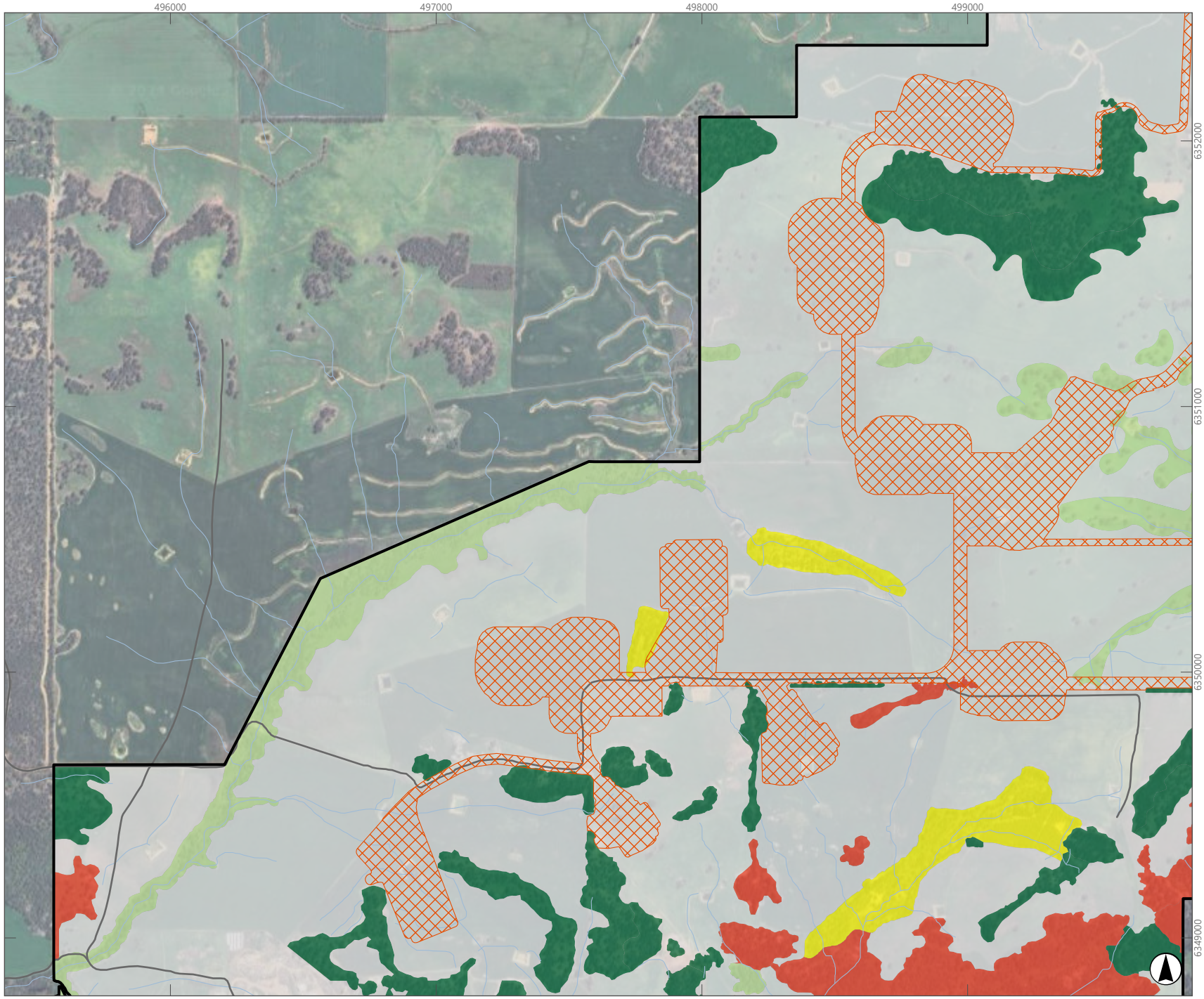


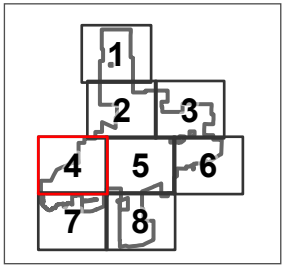
FIGURE 6.6.4
Terrestrial Habitats of the Study Area

Legend

- Study Area
- Development Corridor
- Road
- Watercourse

Fauna Habitats

- Eucalypt - Sheoak woodland with granites
- Eucalypt woodland on laterite rise
- Creekline
- Planted
- Cleared



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Metres

Scale: 1:20,000 at A4

GDA2020 MGA Zone 50

Image Source: ESRI Basemap (2023) | **Data Source:** Landgate (2023), Umwelt (2024)

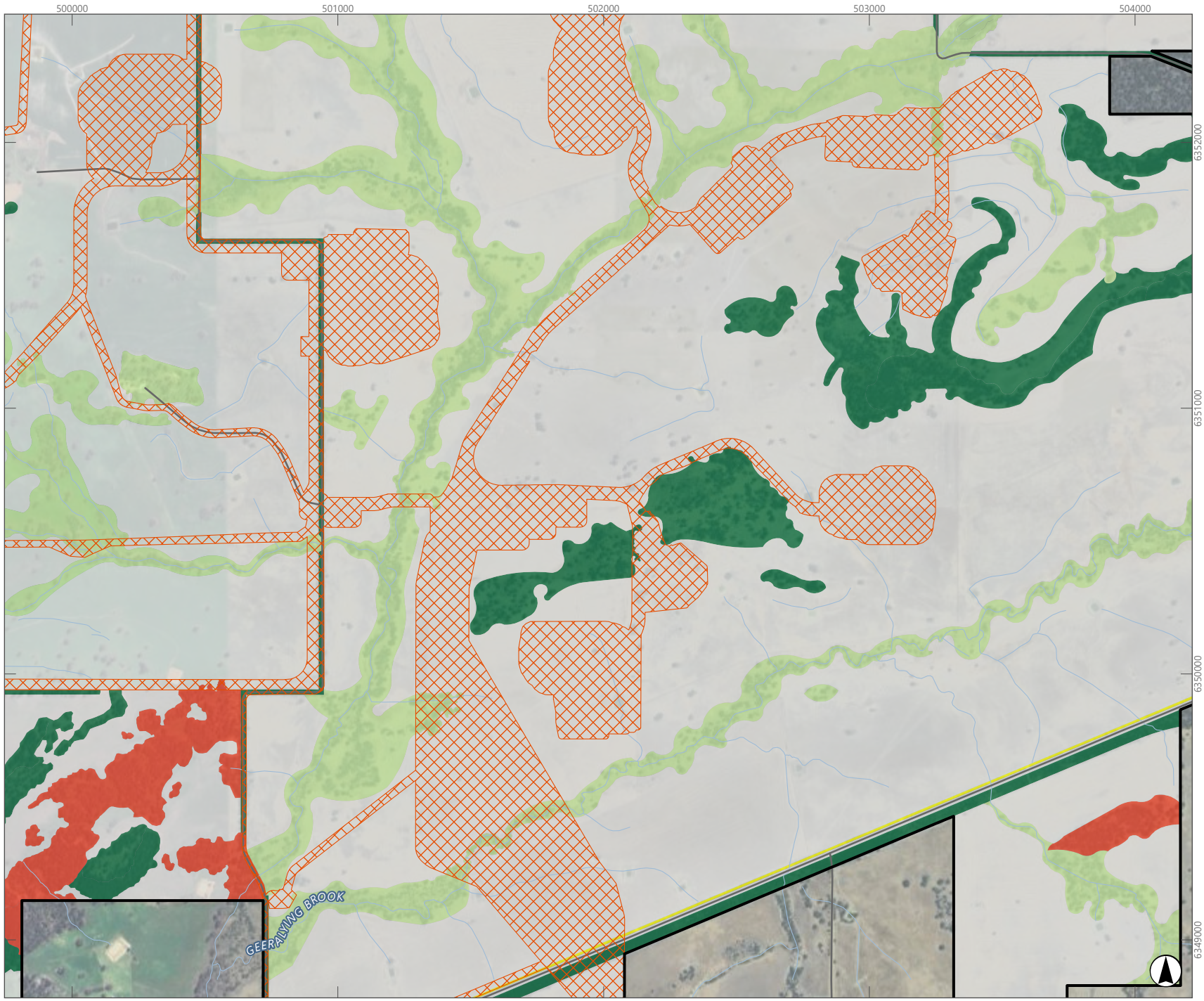


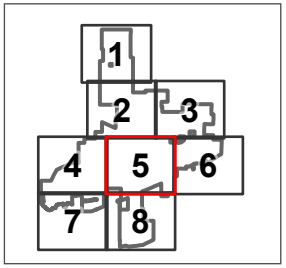
FIGURE 6.6.5
Terrestrial Habitats of the Study Area

Legend

- Study Area
- Development Corridor
- Road
- Watercourse

Fauna Habitats

- Eucalypt - Sheoak woodland with granites
- Eucalypt woodland on laterite rise
- Creekline
- Planted
- Cleared



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Metres

Scale: 1:20,000 at A4

GDA2020 MGA Zone 50

Image Source: ESRI Basemap (2023) | **Data Source:** Landgate (2023), Umwelt (2024)

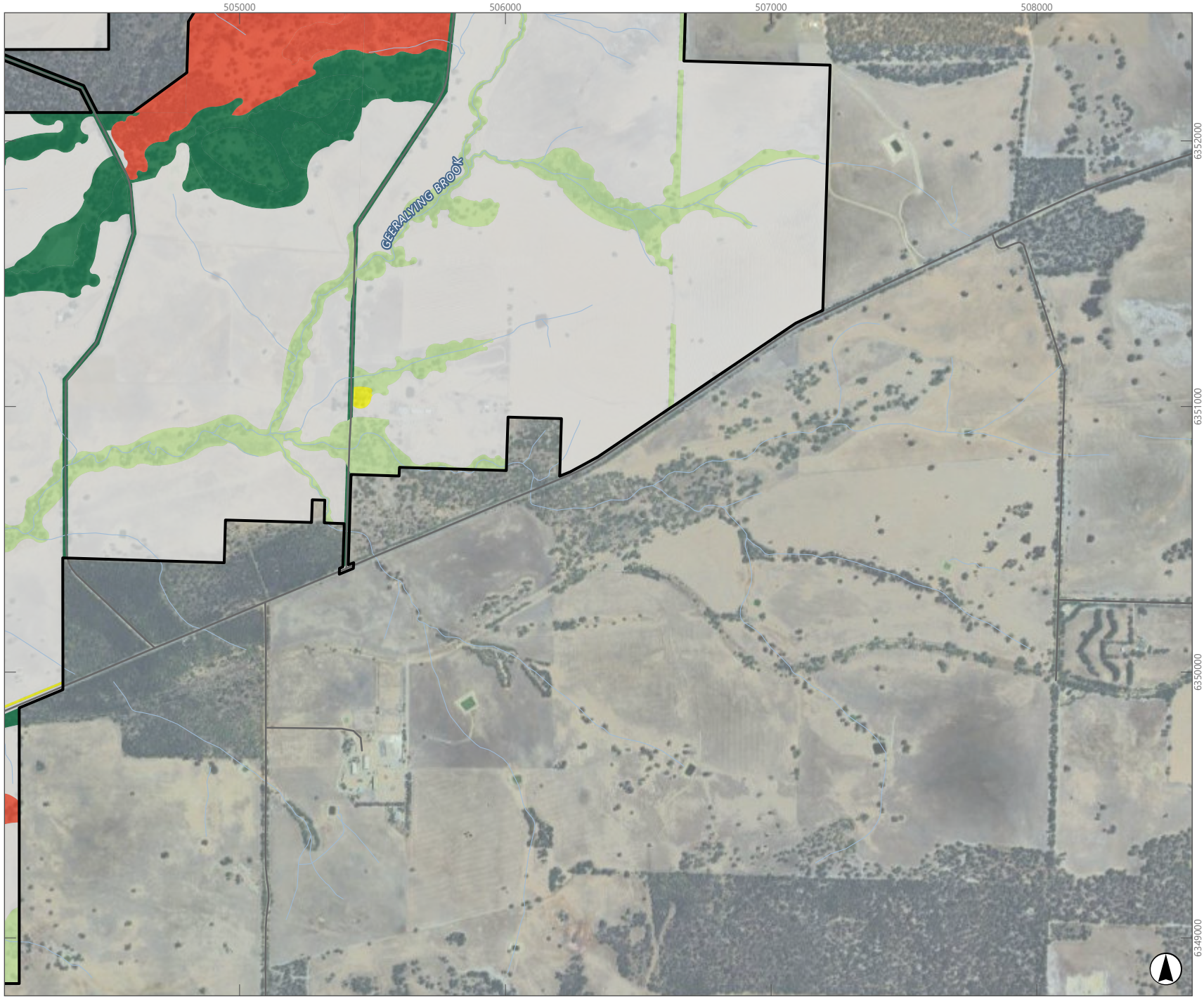


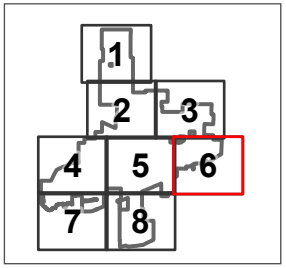
FIGURE 6.6.6
Terrestrial Habitats of the Study Area

Legend

- Study Area
- Road
- Watercourse

Fauna Habitats

- Eucalypt - Sheoak woodland with granites
- Eucalypt woodland on laterite rise
- Creekline
- Planted
- Cleared



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Metres

Scale: 1:20,000 at A4

GDA2020 MGA Zone 50

Image Source: ESRI Basemap (2023) | **Data Source:** Landgate (2023), Umwelt (2024)

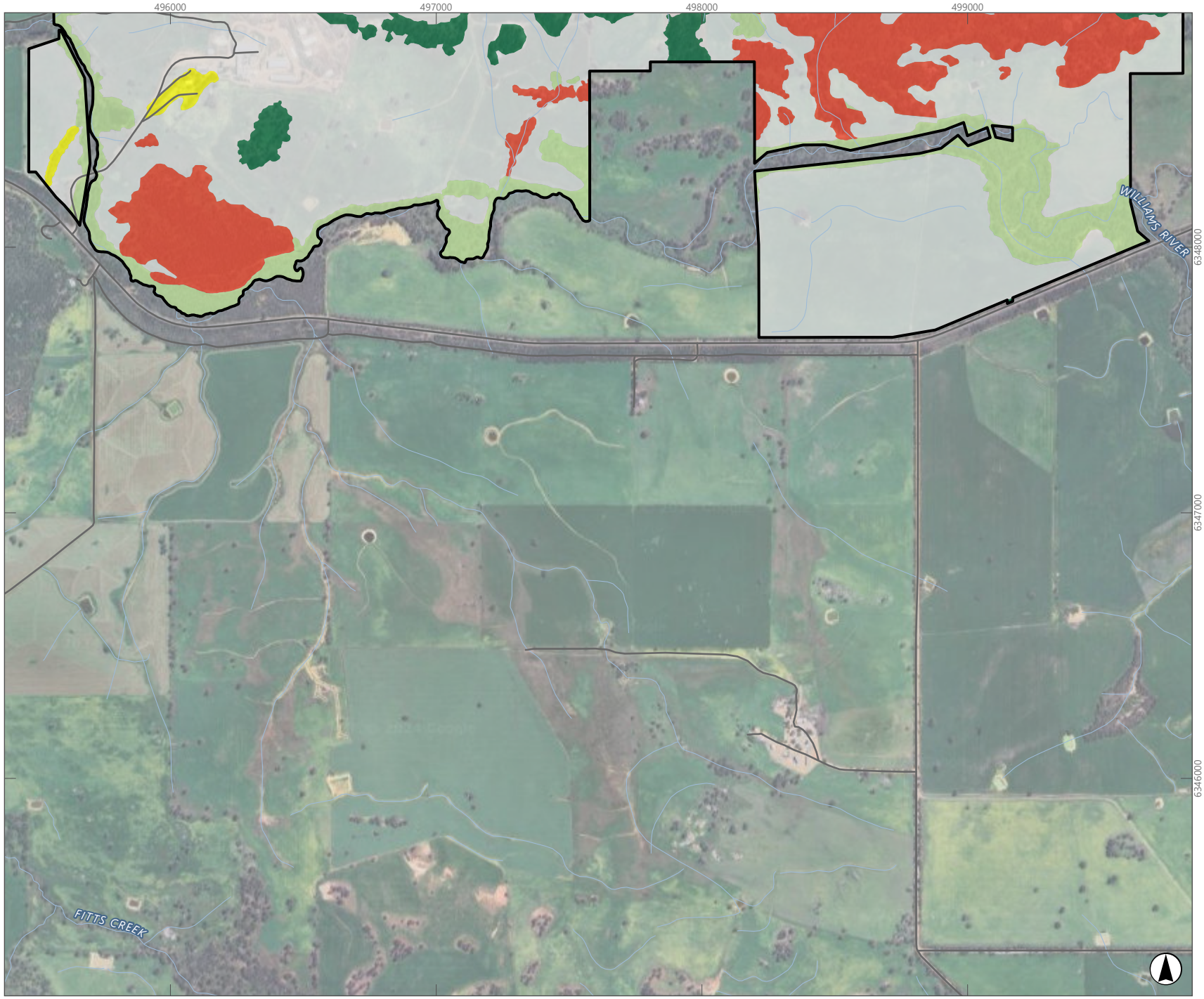


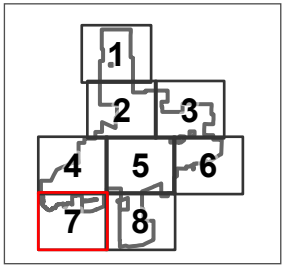
FIGURE 6.6.7
Terrestrial Habitats of the Study Area

Legend

- Study Area
- Road
- Watercourse

Fauna Habitats

- Eucalypt - Sheoak woodland with granites
- Eucalypt woodland on laterite rise
- Creekline
- Planted
- Cleared



0 400 800

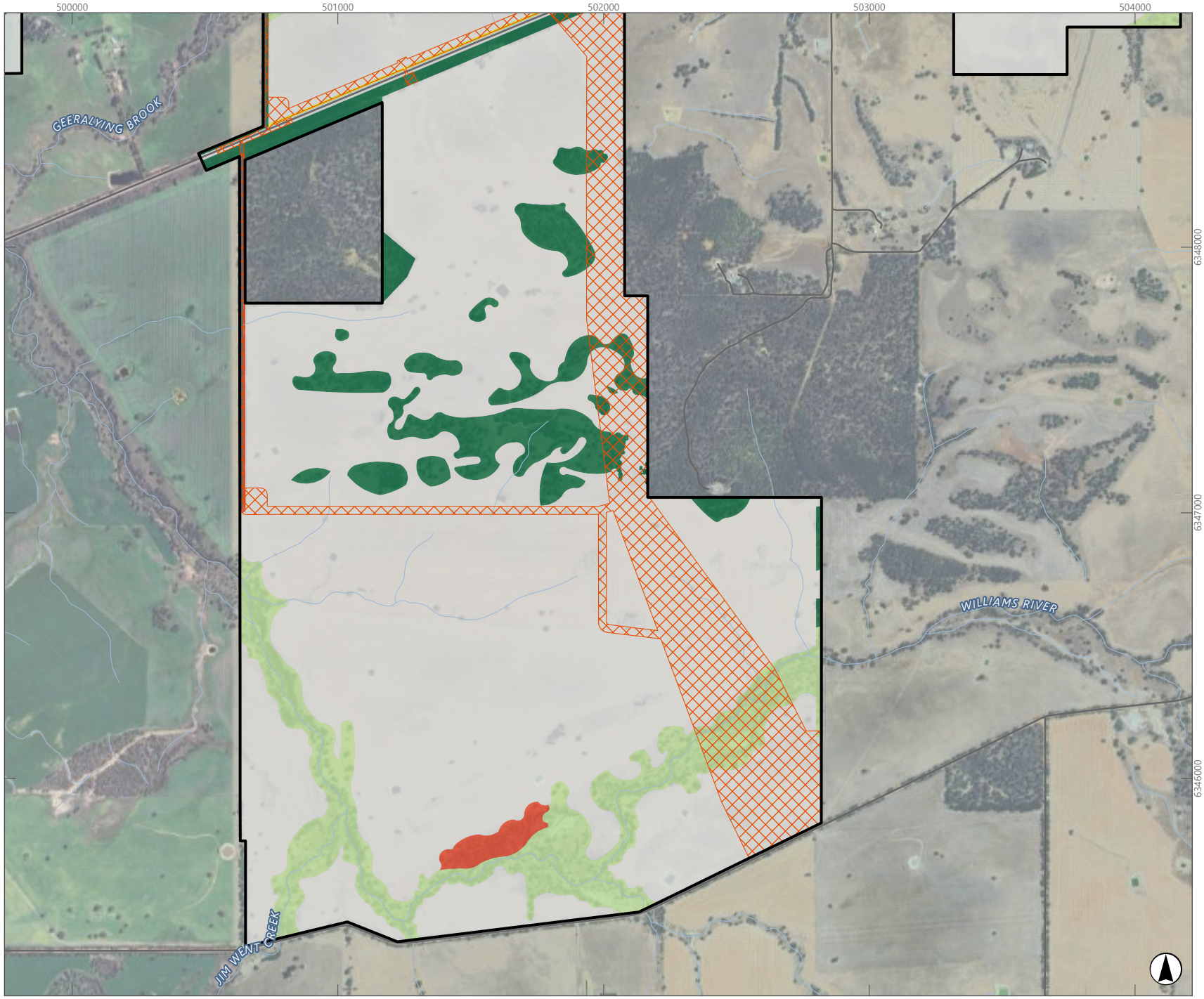
Metres

Scale: 1:20,000 at A4

GDA2020 MGA Zone 50

Image Source: ESRI Basemap (2023) | **Data Source:** Landgate (2023), Umwelt (2024)

FIGURE 6.6.8
Terrestrial Habitats of the Study Area

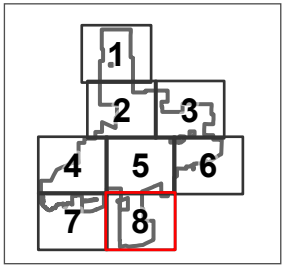


Legend

- Study Area
- Development Corridor
- Road
- Watercourse

Fauna Habitats

- Eucalypt - Sheoak woodland with granites
- Eucalypt woodland on laterite rise
- Creekline
- Planted
- Cleared



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Metres

Scale: 1:20,000 at A4

GDA2020 MGA Zone 50

Image Source: ESRI Basemap (2023) | **Data Source:** Landgate (2023), Umwelt (2024)

6.3.1.1 Threatened Fauna Habitats

Information on the extent of Black-Cockatoo foraging, roosting and breeding habitat within the Survey Area and Indicative Project Footprint is presented below. Habitat information specific to Chuditch, Red-tailed Phascogale and Fork-Tailed Swift is presented in **Sections 9.3.3, 9.4.3** and **9.5.3** respectively.

6.3.1.2 Black Cockatoos

Black-cockatoo breeding and foraging habitat has been mapped at a broad scale across the Study Area and a finer scale across approximately 60% of the Indicative Project Footprint. There was no direct or indirect evidence (e.g. guano deposits, discarded feathers) of roosting within the assessment area during targeted habitat assessments undertaken for fine-scale mapping, and therefore no roosting habitat has been mapped within the Study Area.

Foraging Habitat

Foraging habitat types for black-cockatoo species mapped across the Study Area and scored using the DAWE (2022) method are presented in **Table 6.6**.

Table 6.6 Broadscale Black-Cockatoo Foraging Habitat Mapping (Western Wildlife, 2024)

Category	Description	Extent in Study Area (ha)
Foraging habitat (shrubby *Banksia* spp. in understory)	Shrubby *Banksia* spp., such as Parrotbush (*Banksia sessilis*), are important food-plants for Carnaby's Cockatoo and a lesser extent to Baudin's Cockatoo.	0.5
Foraging habitat (woodlands containing Marri, Jarrah and shrubby *Banksia* spp.)	Marri (*Corymbia calophylla*) is an important food-plant for all three black-cockatoo species, Jarrah (Eucalyptus marginata) is important to the Forest Red-tailed Black-Cockatoo and shrubby Banksia spp. are important food-plants for Carnaby's Cockatoo and a lesser extent to Baudin's Cockatoo. Rock Sheoak (*Allocasuarina huegeliana*) also occurs, providing a less important food-plant for the Forest Red-tailed Black-Cockatoo.	57.4
Foraging habitat (woodlands containing Marri)	Marri is an important food-plant for all three black-cockatoo species and is particularly important for the Forest Red-tailed Black-cockatoo and Baudin's Cockatoo. Woodlands dominated by Marri are likely to provide a greater density of this important food plant than woodlands with a lesser density of Marri. Rock Sheoak (*Allocasuarina huegeliana*) also occurs, providing a less important food-plant for the Forest Red-tailed Black-Cockatoo.	149.3
Foraging habitat (woodlands with Marri as a dominant species)		200.7
Possible foraging habitat if food plants are present	Some eucalypt woodlands may contain a small proportion of food-plants, including occasional Marri trees or shrubby *Banksia* spp., or stands of Rock Sheoak. Planted areas often include eucalypts, including local and non-local species, some of which may provide foraging habitat. Not all planted areas are likely to provide foraging habitat.	284.3
Possible foraging habitat in isolated paddock trees.	Cleared areas contain remnant eucalypts as individual trees or small patches, some of which may be Marri or Jarrah and therefore black-cockatoo food-plants. Areas planted to Canola may also provide foraging habitat	5,015.9

Category	Description	Extent in Study Area (ha)
Unlikely to contain foraging habitat	Vegetation or cleared areas lacking food-plants for cockatoos.	553
	Total	**6,344.1**

Foraging habitat patches were refined and rescored across 60% of the Indicative Project Footprint as part of a detailed fauna habitat assessment (**Appendix C**) using the BCE (2020) method (Umwelt, 2024a). The remaining 40% of the Indicative Project Footprint was assessed and scored at a desktop level using vegetation type mapping, vegetation mapping notes, and aerial imagery. This fine-scale mapping within the Indicative Project Footprint is presented in **Table 6.7.**

It should be noted that during the targeted assessment, some broadscale foraging habitat types originally mapped as "Unlikely to contain foraging habitat" were rescored for foraging habitat (specifically creekline habitats) using the BCE (2020) method.

Table 6.7 Fine-scale Black-Cockatoo Foraging Habitat Mapping

Black-Cockatoo Species	Foraging Habitat Quality Score	Extent within Indicative Project Footprint (ha)
Forest Red-tailed Black-Cockatoo	0	1.69
	2	1.64
	3	1.74
	5	0.35
	6	2.97
	Total (excluding habitat quality scores of 0)	**6.70**
Baudin's Black-Cockatoo	0	1.66
	2	1.67
	3	1.74
	5	0.35
	6	2.97
	Total (excluding habitat quality scores of 0)	**6.73**
Carnaby's Black-Cockatoo	2	1.63
	3	3.44
	6	3.32
	Total (excluding habitat quality scores of 0)	**8.39**

Breeding Habitat

Breeding habitat types were mapped at a broad scale across the Study Area as presented in **Table 6.8**.

Table 6.8 Broadscale Black-Cockatoo Breeding Habitat Mapping (Western Wildlife, 2024)

Category	Description	Extent within Study Area (ha)
Potential breeding habitat (contains tree species known to support breeding)	Many of the woodlands in the study area include tree species known to support breeding (DAWE 2022), including Wandoo (Eucalyptus wandoo), Marri (*Corymbia calophylla*), York Gum (*Eucalyptus loxophleba*) and Jarrah (Eucalyptus marginata) and Powderbark wandoo (*Eucalyptus accedens*). Note that even within this habitat, particularly in the smaller patches, many of the trees are small (below diameter at breast height thresholds), possibly due to past logging of mature trees.	1,013.9
Potential breeding habitat in Isolated Paddock Trees	Cleared areas contain remnant eucalypts as individual trees or small patches, many of which are likely to be tree species known to support breeding.	5,035.1
Possible breeding habitat (contains eucalypts, but not species known to support breeding)	Woodlands including Brown Mallet (*Eucalyptus astringens*), Drummond's Gum (*Eucalyptus drummondii*) and/or *Eucalyptus dorrieni*i are not known to support breeding, but any suitably sized hollow may be used by cockatoos (DAWE 2022), so these areas cannot be entirely excluded.	90.8
Unlikely to be current breeding habitat, but may provide breeding habitat in the future	Planted areas often include eucalypts, including local and non-local species. Eucalypts usually take many years (200+) to form suitably-sized hollows, so planted areas are usually too young to contain breeding habitat.	107.9
Not breeding habitat	Treeless areas, or woodlands lacking eucalypts, are not breeding habitat.	96.4
	Total	**6,344.1**

Finer scale breeding habitat mapping was completed for approximately 60% of the Indicative Project Footprint during the targeted habitat assessment. This involved assessing individual trees using the BCE (2020) method. The targeted assessment recorded a total of 109 trees that met the potential black-cockatoo nest-tree criteria of DAWE (2022) which were ranked based on the categories provided in **Table 4.5**. The total number according to each rank is provided in **Table 6.9**. The remaining unassessed areas will be assessed prior to construction.

Table 6.9 Ranking of Potential and Suitable Nest-Trees Recorded

Nest-Tree Ranking	Description	Number Recorded within 60% of Indicative Project Footprint
1	Activity at hollow observed; adult (or immature) bird seen entering or emerging from hollow. Can also be used for a known nest tree active in the previous 12 months (although this should be noted in the description). Note that activity at a hollow does not absolutely mean that breeding is occurring unless a young bird in hollow is observed.	0
2	Hollow of suitable size visible with chew marks around entrance. Record if chew-marks are recent or old.	0

Nest-Tree Ranking	Description	Number Recorded within 60% of Indicative Project Footprint
3	Potentially suitable hollow visible but no chew marks present at entrance; or potentially suitable hollow suspected to be present - as suggested by structure of tree, such as large, vertical trunk broken off at a height of >8 m; but note that hollow height is contextual. Carnaby's Black-Cockatoo will nest in hollows <5 m so in a Wheatbelt breeding site a lower criterion may be more appropriate.	5
4	Tree with large hollows or broken branches that might contain large hollows, but hollows or potential hollows (nest chamber) are not vertical or near-vertical; thus a tree with or likely to have hollows of sufficient size but not to have hollows of the angle preferred by Black-Cockatoos. Trees with low but otherwise suitable hollows can also be assigned a rank or 4, depending on the species of black-cockatoo likely to be present.	1
5	Tree lacking large hollows or broken branches that might have large hollows; a tree with more or less intact branches and a spreading crown.	103
	Total	**109**

6.3.2 Fauna Diversity

Field surveys recorded 111 fauna species, comprising 90 birds, 17 mammals (including 8 bats), 3 reptiles and 1 amphibian within the Study Area. These records are unlikely to represent all the species present, as the methods used to observe fauna in this survey targeted certain fauna classes, and those such as reptiles are likely to be underrepresented in the results. Of the fauna species recorded, 5 are introduced (1 bird and 4 mammals), representing 4.5% of the total fauna recorded.

The full species list is provided in **Appendix H**, and conservation significant species are detailed further in the following sections.

6.3.3 Threatened Fauna

Four threatened fauna species were recorded within the Study Area during the fauna survey program, as outlined in **Table 6.10**. The locations of these records are shown on **Figure 6.7**.

Table 6.10 Threatened Fauna Known to Occur within the Study Area

Common Name	Scientific Name	EPBC Act Status	Notes
Carnaby's Black-Cockatoo	*Zanda latirostris*	Endangered	Foraging evidence recorded in the Study Area during field survey and recorded visually and aurally in the Additional Survey Area. A seasonal visitor, this species is likely to forage and/or roost in the Study Area and may breed in large tree hollows.

Common Name	Scientific Name	EPBC Act Status	Notes
Chuditch	*Dasyurus geoffroii*	Vulnerable	Recorded on a single camera trap on a single night within the Study Area. Resident in Dryandra Woodland National Park, this species is very mobile and likely to occur in the Study Area, at least for dispersal. Hollow logs and burrows are important for this species.
Forest Red-tailed Black-Cockatoo	*Calyptorhynchus banksii naso*	Vulnerable	Foraging evidence recorded during field surveys within the Study Area. A seasonal visitor, this species may forage and/or roost in the Study Area and may breed in large tree hollows.
Red-tailed Phascogale	*Phascogale calura*	Vulnerable	Recorded on a single camera trap within the Study Area and two camera traps within the Additional Survey Area. The Study Area is within the range of this species, there are many records in the surrounding area and there is potentially suitable habitat available in woodlands.

6.3.4 Migratory Fauna

No fauna species listed as Migratory were recorded within the Study Area during field surveys.

6.3.5 Bird and Bat Utilisation

A total of 90 bird species were recorded within the Study Area during the field survey program. Of these species, two are listed under both the EPBC Act and BC Act (Carnaby's Black-Cockatoo – Endangered and Forest Red-tailed Black-Cockatoo – Vulnerable).

A total of 8 bat species were acoustically recorded by Anabat bat detector devices within the Study Area throughout the field survey program. One of the recorded bat species is listed under the BC Act (Western False Pipistrelle – Priority 4) and none are listed under the EPBC Act.

The full list of bird and bat species identified during the field surveys are presented and discussed in detail in the BBUS, a copy of which is provided in **Appendix D**.

6.3.6 Introduced Fauna

Eight introduced fauna species were identified during the survey program:

- European red fox (*Vulpes vulpes*)
- feral cat (*Felis catus*)
- European rabbit (Oryctolagus cuniculus)
- house mouse (*Mus musculus*)
- black rat (Rattus rattus)
- Laughing Kookaburra (*Dacelo noveguineae*)

- domestic (feral) pigeon (*Columba livia*)
- Spotted Turtle Dove (*Spilopelia chinensis*).

EPBC Act 'key threatening processes' are processes which threaten the survival, abundance or evolutionary development of a native species or ecological community (Department of Agriculture, Water and the Environment (DAWE), 2021). Key threatening processes are linked to two of the above introduced species and include:

- predation by feral cats
- predation by European red fox.

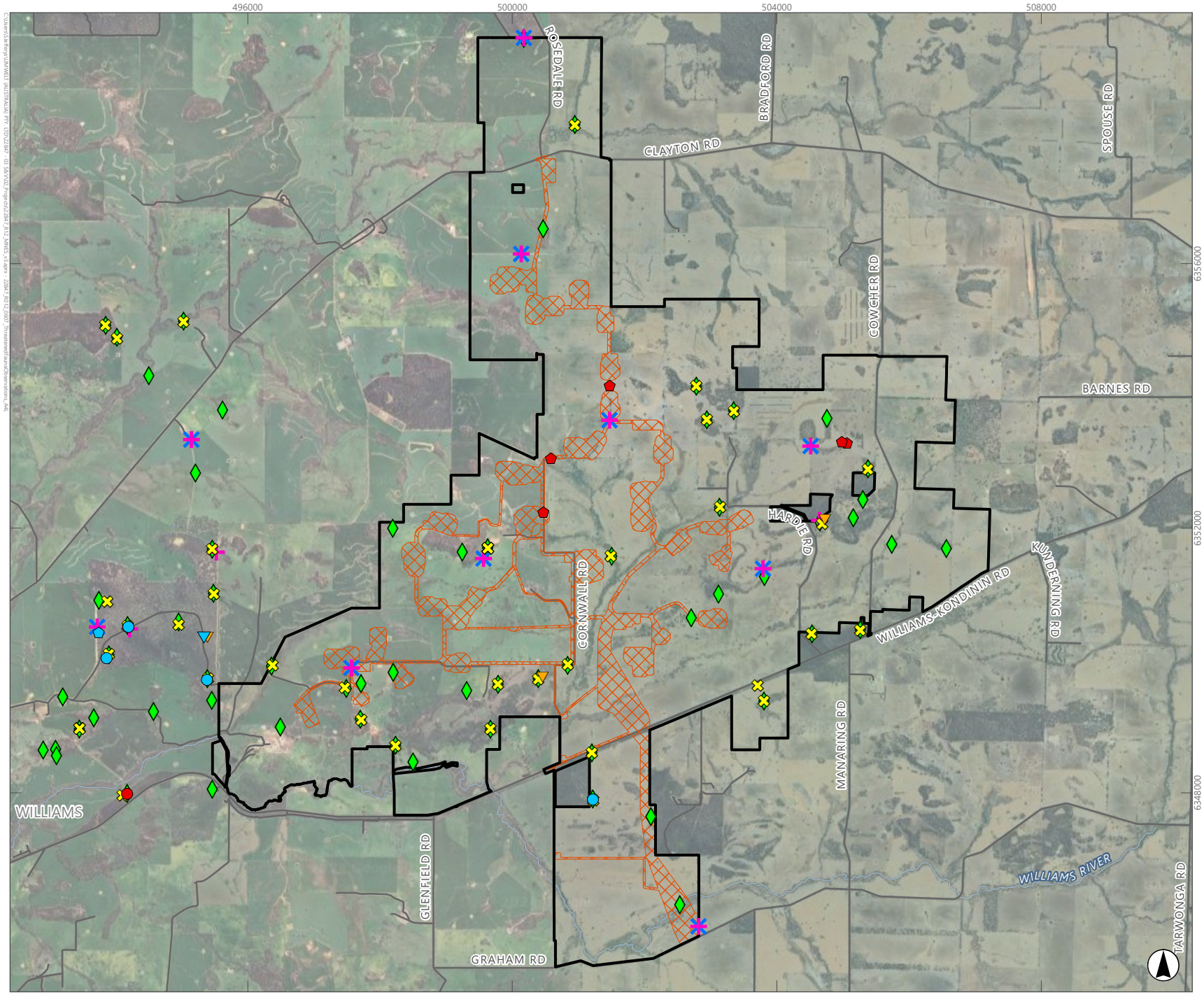


FIGURE 6.7
Threatened Fauna Observations

Legend

- Study Area
- Development Corridor
- Road
- Major Watercourse

Fauna Species

- Carnaby's Black-Cockatoo – Opportunistic
- Carnaby's Black-Cockatoo – Passive acoustic detector
- Carnaby's Black-Cockatoo – Secondary evidence (foraging)
- Chuditch – Camera trap
- Forest Red-tailed Black-Cockatoo – Opportunistic
- Forest Red-tailed Black-Cockatoo – Secondary evidence (foraging)
- Red-tailed Phascogale – Camera trap

Survey Effort

- Bat Detector
- Camera Trap
- Passive Acoustic Detector
- Vantage Point
- Habitat Assessment

0 1.6 3.2

Kilometres

Scale 1:80,000 at A4
GDA2020 MGA Zone 50

Image Source: ESRI Basemap (2023) | **Data Source:** Landgate (2023), Umwelt (2024)

6.4 Connectivity

Fauna habitat patches throughout the Study Area are generally fragmented with connectivity between them primarily afforded by creekline habitats which form linear corridors for movement. Remaining areas throughout the Study Area consist of cleared agricultural land dispersed with isolated paddock trees. Ground-dwelling fauna are more likely to be dependent on connectivity between patches to afford movement and dispersal opportunities while fauna that utilise open habitats, birds, and volant mammals such as bats are more likely to be able to disperse more readily. Utilisation of fauna habitats for connectivity according to each MNES assessed here are discussed further in **Section 9.0**.

6.5 Likelihood of Occurrence Assessment

The likelihood of occurrence was assessed for TECs, threatened species, and migratory species identified in the PMST results (**Section 5.0**). The results of this assessments are presented in **Section 6.5.1** to **Section 6.5.4**.

For the purposes of this report, results discussed in this section are presented for:

- "Known" ecological communities
- "Potential" flora species
- fauna species that have a "Moderate", "High", or "Known" likelihood of occurrence.

The complete likelihood of occurrence assessment is presented in **Appendix F**.

6.5.1 Threatened Flora

Fifteen threatened flora species were identified in the PMST results as "likely", "may", or "known" to occur within the Search Area. Of these 15 species, no Threatened flora species were recorded within the Study Area during field surveys, with two species identified as having a "Potential" likelihood of occurrence. All remaining species identified from desktop searches were considered as "Unlikely" to occur within the Study Area based on the criteria described in **Section 4.3.** The complete likelihood of occurrence for all species identified from desktop searches is presented in **Appendix F.**

As noted in **Section 4.2.1.3**, targeted surveys were conducted for Threatened flora in areas of Good or better vegetation condition with an additional three transects conducted along the major drainage line in the centre of the Study Area to confirm the original assertion that the vegetation condition would not support conservation significant flora. Areas of Degraded or Completely Degraded condition were regarded as having very low likelihood for the presence of Threatened flora due to the heavily disturbed nature of the vegetation. The only portion of Good condition vegetation within the Study Area has been avoided to minimise any potential impacts to Threatened flora with a potential to occur.

Table 6.11 Likelihood of Occurrence for Threatened Flora

Scientific Name	BC Listing^	EPBC Listing^	Flowering Period[1]	Habitat*	Likelihood of Occurrence in Study Area	Likelihood of Occurrence in Indicative Project Footprint
Darwinia carnea	CR	EN	Oct - Nov	Breakaways, brown loamy sand over laterite.	Potential	Unlikely
Pultenaea pauciflora	VU	VU	Nov - Jan	Gravelly clay loam over laterite, slopes.	Potential	Unlikely

Note. *Western Australian Herbarium (1998–). ^CR = Critically Endangered, EN = Endangered, VU = Vulnerable.

6.5.2 Threatened Fauna

Thirteen Threatened fauna species were identified in the PMST results as "likely", "may", or "known" to occur within the Search Area. Of these 13 species, four Threatened fauna species are known to occur within the Study Area due to being confirmed during field surveys (**Figure 6.7**). The assessment also determined that there is one Threatened species with a Moderate likelihood of occurrence (**Table 6.12)**.

Table 6.12 Likelihood of Occurrence for Threatened Fauna in Study Area

Scientific Name	Common Name	BC Listing*	EPBC listing
Known			
Calyptorhynchus banksii naso	Forest Red-tailed Black-Cockatoo	VU	VU
Dasyurus geoffroii	Chuditch	VU	VU
Phascogale calura	Red-tailed Phascogale	CD	VU
Zanda latirostris	Carnaby's Black-Cockatoo	EN	EN
Moderate			
Zanda baudinii	Baudin's Black-Cockatoo	EN	EN

Note. * VU = Vulnerable, EN = Endangered, CD = Conservation Dependent.

6.5.3 Migratory Species

Six Migratory species were identified in the PMST results as "may" or "likely" to occur within the Search Area. No Migratory species are known to occur within the Study Area based on the results of field surveys, with only one species assessed as having a Moderate likelihood of occurrence (**Table 6.13**).

Table 6.13 Likelihood of Occurrence for Migratory Fauna in Study Area

Scientific Name	Common Name	BC Listing*	EPBC listing*
Moderate			
Apus pacificus	Fork-tailed Swift	MI	MI

Note. *MI = Migratory.

6.5.4 Threatened Ecological Communities

Vegetation types analogous with the '*Eucalypt Woodlands of the Western Australian Wheatbelt TEC'* are known to occur within the Study Area. Five patches of the *Eucalyptus Woodlands of the Western Australian Wheatbelt TEC* were identified during the 2023-2024 survey, totalling 41.8 ha. No other Threatened Ecological Communities were identified from desktop searches or otherwise considered as having a potential to occur within the Study Area.

7.0 Potential Impacts

Potential impacts to MNES may occur during both the construction and operations/maintenance phases of the Project and may comprise either direct impacts (e.g. clearing of vegetation or blade strike) or indirect impacts (e.g. the introduction or spread of weeds).

The Development Corridor covers a total area of approximately 671.5 ha and is shown on **Figure 2.1**. The Development Corridor has been utilised as the assessment area, and impact assessments have been based on not clearing more than 7.41 ha of remnant native vegetation and 0.98 ha of planted native vegetation within the Development Corridor.

The following sections describe potential impacts to flora, vegetation and fauna. Detailed Significant Impact Assessments for MNES fauna species and ecological communities with a Moderate or higher likelihood of occurrence are provided in **Section 9.0**.

7.1 Construction Phase

The construction phase of the Project will primarily involve the installation of wind turbines, BESS, substation, access tracks, underground and some overhead cabling, and other ancillary infrastructure. Potential direct and indirect construction impacts are discussed below, however it is important to note that during the construction phase many potential impacts are likely to be short term, and concentrated in specific areas before moving progressively through the Development Corridor.

7.1.1 Direct Impacts

7.1.1.1 Vegetation Clearing

Based on the current Indicative Project Footprint within the Development Corridor, the Project may result in the disturbance of up to 7.41 ha of remnant native vegetation, 0.98 ha of planted native vegetation and isolated paddock trees in cleared agricultural land. It is expected that this area of clearing will decrease as the Project moves through detailed design stages.

Areas of vegetation that meet the diagnostic criteria for the Eucalypt Woodlands of the Western Australian Wheatbelt TEC have been avoided and will not be cleared for construction of the Project, resulting in no direct impacts.

Native vegetation clearing has been avoided and minimised as far as possible within the Development Corridor and consists primarily of vegetation at the fringes patches. While up to 7.41 ha of remnant native vegetation and 0.98 ha of planted native vegetation is proposed to be cleared, the clearing will be spread across approximately 20 patches of degraded remnant vegetation, and in the majority of cases (85%) less than 0.5 ha of native vegetation will be removed from these patches. Furthermore, no areas of vegetation in good condition or better will be cleared.

A range of mitigation measures will be implemented through the Construction Environmental Management Plan (CEMP) to manage the level of impact from clearing as discussed in **Section 8.2.1**. A copy of the CEMP is provided in **Appendix G**.

No Threatened flora species were identified during the survey and the Project is not expected to impact on any Threatened flora species as all areas of Good condition vegetation within the Study Area have been avoided by the Project. Threatened flora species are not considered to occur in lower condition vegetation (Degraded or Completely Degraded) and no areas of Very Good, Excellent, or Pristine condition vegetation occur within the Study Area (see **Section 6.2.3** and **Section 6.2.6**).

7.1.1.2 Fauna Habitat Loss

Vegetation clearing during the construction phase presents potential impacts to fauna, such as:

- direct displacement of fauna within the Development Corridor, leading to an overall reduction in fauna diversity and/or loss of local populations
- fragmentation of populations, potentially leading to reduced gene flow
- reduced availability of important habitat features (e.g. tree hollows or foraging habitat) for Threatened and Migratory species which rely on the availability of nesting, breeding, foraging, and shelter habitat for survival.

As discussed previously, the Development Corridor occupies a larger area than the Final Project Footprint. Additionally, the majority (94.6%) of the Development Corridor is located in cleared and heavily degraded agricultural land, and where vegetation clearing is proposed it primarily consists of vegetation at the fringes of generally degraded patches. Following the completion of the construction phase, existing populations are likely to continue to disperse and access resources within and beyond the Study Area, due to the limited additional habitat loss and lack of fencing that could prohibit dispersal of identified MNES species.

Vegetation clearing will result in the removal of habitat types associated with Threatened fauna that have a Moderate or known likelihood of occurrence within the Study Area (see **Section 6.4**). The potential area of habitat that may be removed compared to the total area of habitat within the Study Area is provided in **Table 7.1**. In some instances a further breakdown of habitat type is detailed based on the type of habitat.

Table 7.1 Potential Habitat Loss Impacts to Threatened Fauna

Common Name	Habitat Utilisation	Habitat Within Study Area	Maximum Removal of Habitat within Development Corridor
Black-Cockatoos	#Breeding Habitat	1,104.7 ha	No removal of Rank 1 or 2 breeding trees^ Minimise removal of Rank 3 trees^
	Foraging Habitat – DAWE (2022) method	407.9 ha	8.39 ha*
Chuditch	Dispersal Habitat	1,148.5 ha	7.41 ha
Red-tailed Phascogale	Breeding, Foraging and Dispersal Habitat	1,148.5 ha	8.39 ha*

Note. ^Trees within 60% of the current Indicative Project Footprint have been assessed. *This habitat includes planted areas.

7.1.1.3 Fauna Injury and Mortality

Activities during the construction phase of the Project that have the potential to directly cause threatened fauna injuries and mortality include:

- vegetation clearing
- vehicle and other operational equipment strike
- earthworks.

Proposed mitigation measures to address fauna injury and mortality are presented in **Section 8.2.1**.

7.1.1.4 Impacts to fauna habitat connectivity

Given the highly cleared and degraded nature of the Study Area, remnant vegetation patches may provide connectivity for the movement and dispersal of fauna between larger remnant areas. Internal dispersal opportunities are likely afforded by creekline habitats and the mosaic-like nature of smaller remnant patches throughout the Study Area.

Vegetation clearing is predominantly restricted to minor vegetation clearing at the perimeter of remnant patches, and no clearing is proposed where larger remnant patches would be bisected by Project infrastructure. All infrastructure that does bisect habitats, such as creekline habitats, has been primarily restricted to existing access tracks where vegetation is already degraded and there is little canopy connectivity or understorey present.

Given the linear nature of the Project, generally narrow width of access tracks, general lack of fauna proof fencing (most likely just around the BESS) and the nature of vegetation clearing proposed, faunal dispersal throughout the Study Area is unlikely to be materially impacted.

7.1.2 Indirect Impacts

7.1.2.1 Introduction and Spread of Weeds and Pest Fauna

The introduction and/or spread of weeds is a potential indirect impact that can compromise the integrity and condition of remnant native vegetation, increase the intensity and/or frequency of fires, as well as threaten the long-term survival of Threatened species.

Within the Study Area, weed species are common due to the long history of agricultural land use with up to 46% of all flora species recorded in survey areas being introduced species. Although most introduced species were common pasture weeds, three Declared Pests under State legislation which are also listed as WoNS were recorded (**Asparagus asparagoides*, **Echium plantagineum*, **Moraea flaccida*).

The Study Area was also found to support several introduced fauna species including European honeybees (*Apis Mellifera*), red fox (*Vulpes vulpes*), and ferals cats (*Felis catus*). These species if left unchecked may flourish in newly disturbed areas, disperse into higher quality habitat areas, and further contribute toward the degradation of fauna habitat within the Study Area. Conversely, there is the potential to better control feral animal populations in certain patches of vegetation which could provide a benefit to Threatened species.

Given the prevalence of these species within the existing landscape, it is unlikely that the proposed works will result in further introductions of feral vertebrate species. There is potential that habitat modification or degradation as a result of construction works may facilitate larger populations of certain introduced species in areas where some native species are not able to persist.

Management measures designed to address potential impacts from weeds and pest fauna are detailed in **Section 8.2**.

7.1.2.2 Edge Effects

Edge effects in ecology are identified as any difference in environment between the edge and interior of a particular vegetation patch. Environmental characteristics which differ across edges cover many components of the environment including atmosphere (e.g., microclimate), vegetation (e.g., structure, composition, functioning), fauna and their habitat, and soil (Murcia, 1995).

Edges and their effects can be created through clearing of vegetation, such as new edges created by roads. The distance the effect spreads from the edge, known as edge permeability, can be highly variable and depends upon many factors such as vulnerability of the ecosystems, degree of change in land use, intensity of this use and chance events (Murcia, 1995).

Potential environmental impacts to new edges created by the Project are considered to include:

- Modification of microclimate where new edges are created due to greater penetration of light and wind into the vegetation. Temperature extremes are greater, and humidity of air is generally less at the edge than in the interior of vegetation. This effect is known to increase in size if vegetation is dense or cover is high. Given the degraded nature of vegetation in the Study Area, this is unlikely to be a significant impact.
- Physical disturbance to vegetation at the edge. Ongoing damage to the edge of vegetation may occur due to grading and weed control of road edges and vehicle use.
- Changes to soil properties including compaction of the soil, less organic matter, and higher erodibility.
- Introduction of weeds and pathogens through mud and dirt which falls off vehicles.
- Changes to vegetation through the above listed impacts.

Many of these potential environmental impacts including introduction of weeds and physical disturbance to vegetation can be managed through good site practices, vehicle restrictions and implementation of the Project CEMP (**Appendix G**). Rehabilitation of areas no longer used for construction activities will further reduce potential impacts and given the degraded nature of the remnant vegetation patches present, any edge effects that do occur are unlikely to result in significant impacts to the integrity of these patches.

Management measures designed to address potential impacts from edge effects are detailed in **Section 8.2**.

7.1.2.3 Soil Erosion and Sedimentation

Removal of vegetation and disturbance to the soil profile through clearing and construction activities can lead to soil erosion, which in turn can lead to increased input of sediment into waterways. Increased sediment in waterways can lead to siltation of watercourses and a reduction in water quality of creeks, rivers, and other drainage lines. Through erosion, important topsoil can be lost, leading to exposure of subsoil which often has poor physical and chemical properties.

Soil erosion and sedimentation will be managed for the Project through the CEMP via measures detailed in **Section 8.2.4**.

7.1.2.4 Dust Impacts

Soil exposed through vegetation clearance can lead to dust generation, which in turn settles on adjacent vegetation. Dust impacts to vegetation are generally understudied, but can be dependent on the type of vegetation, type of dust (e.g. chemical properties or grain size), and total dust load settling on the vegetation.

Dust impacts from the Project are expected to be restricted to vegetation directly adjacent to the access tracks and in areas near stockpiles where soil is exposed and can be disturbed through vehicle movement and wind erosion. The dust will be chemically inert, and as such, any potential impacts will be physical in nature, such as blocking of plant stomata and reduction in light penetration to the leaf surface, potentially reducing photosynthetic capacity. This may lead to a reduction in the health and vigour of vegetation directly adjacent to tracks.

To reduce this impact, dust will be managed through the construction phase through dust management measures in the CEMP (**Appendix G**).

To further protect potential indirect impacts to TECs, a minimum 40 m separation buffer will be applied between the Final Project Footprint and TECs.

7.2 Operations and Maintenance Phase

Once the construction phase is complete the Project will become operational. As the Project is a wind farm development, a key risk for bird and bat MNES is collision with wind turbines. Vehicle strikes are also a risk to terrestrial fauna.

A detailed discussion on potential impacts on MNES relating to vehicle strikes, collisions, barotrauma and barrier effects is provided in **Section 7.2.1** to **Section 7.2.4**.

7.2.1 Vehicle Strikes

During operation, it is expected that some vehicle activity, including the use of light vehicles, large trucks and maintenance equipment will occur on the access tracks within the Study Area. Though the traffic is expected to be of low intensity during operations, there is some risk of vehicle strike to terrestrial fauna species including medium to large mammals, birds, and reptiles.

The new tracks will largely follow existing farm tracks that will be of much higher quality. As a result, the sight lines will be improved reducing the risk of vehicle strikes compared to those associated with the existing farming vehicles.

7.2.2 Collisions

Mortality at wind farms can result from birds or bats colliding with wind turbine blades, towers, nacelles, guy cabling, power lines, and meteorological masts. The majority of fatalities appear to result from collisions (Grodsky et al., 2011). Drewitt & Langston (2008) identified a range of factors that may influence the risk of collisions with such infrastructure, including:

- physical attributes of a wind turbine (i.e. turbine dimensions, and lighting)
- species-specific variables (i.e. abundance, flight behaviour, turbine avoidance capacity)
- biophysical attributes (i.e. landscape position, topography, vegetation type).

Factors falling under the latter two points are often interrelated and generally highly spatially and temporally variable. Proximity to roost locations, migratory flight pathways, and wetlands appear to be particularly important factors that influence bird and bat utilisation.

Data from Australia, Europe, and North America indicate that the risk of collision is likely to be highest in any given area or landscape where species most susceptible to collision (i.e., migratory species, raptors, swifts, waterbirds, high flying microbats) most frequently occur. The consequence of mortality resulting from collision for any given species is largely influenced by the species' population size and life history traits such as longevity and fecundity which combine to determine a species' capacity to replace individuals lost.

A collision risk assessment was undertaken for Threatened, Migratory and "at-risk" bird and bat species to assess the level or risk for collision with wind turbines based on their likelihood and consequence of collision (2024b). At-risk species were those birds identified as flying within RSA height during the BBUS and investigated further due to a combination of number of occurrences of observed flights within the RSA height range, total count of individuals observed, and/or their status as a listed Threatened or Migratory species. The methodology used for the risk assessment was adapted from Lumsden et al. (2019) and the full risk assessment is provided as part of **Appendix D**. Based on the risk assessment, all MNES species were found to have an overall Moderate or Minor risk rating. One group of species (microbats) ranked as a High risk, though this group does not include any MNES. No species were found to have a Very High risk of collision.

Black-cockatoo species are conservatively identified as having a "moderate" potential for impacts due to turbine collision. This risk is based on their likelihood of occurrence in the Study Area and threatened status, however they are likely to rarely fly at RSA. Black-cockatoos are considered to fly at or below canopy height (i.e. tree- or shrub-height, where applicable) when foraging, and at or just above canopy height when in longer-distance transit such as between foraging, roosting and watering areas (Umwelt, 2024c). It is considered rare that these species fly more than c. 10 m above canopy height in these instances (Umwelt, 2024c). RPS (2010) also found during field surveys that Carnaby's Black-Cockatoo tend to frequent low-lying areas of the landscape with flight movements following valleys with woodland vegetation, with 88% of species observed as flying below 40 m (n=100 observations), while Ecoscape (2019) found 80% of flocks flying <20 m AGL (n=25 observations). EPA (2019) also noted that the Carnaby's Black-Cockatoo tends to follow vegetation corridors, actively avoiding cleared and open areas, which is likely applicable to all black-cockatoo species found in southwest WA. When crossing areas of expansive open ground (or low vegetation such as heaths) black-cockatoos tend to fly close to the ground surface. In circumstances where birds are passing across less-expansive cleared areas between patches of remnant trees or isolated individual trees (as is present throughout much of the Study Area) they usually maintain a 'canopy height'

flight path (Umwelt, 2024). Instances where black-cockatoos may otherwise exceed 50 m AGL in flight height are likely restricted to evading large predatory raptors such as eagles or when congregating in large numbers. While Wedge-tailed eagles were recorded within the Study Area during the field survey program, no black-cockatoo species were directly observed within the Study Area over four separate fauna surveys and BBUS over a total of 18 survey days. Further, post-commissioning monitoring for the Carnaby's Black-Cockatoo at Badgingarra wind farm in 2019 which has a minimum tip height of 20 m AGL recorded no collisions with turbines (Ecoscape, 2019), and none were reported at the Warradarge Wind Farm Perth during monitoring from 2020 to 2022 (Bright Energy Investments, n.d.). The search method for carcasses as Warradarge Wind Farm is not publicly available and Badgingarra wind farm undertook a total of six surveys in 2019 at eight reference turbine sites and eight randomised turbine sites using a search area of 250 m x 250 m. Therefore, the likelihood of these species occurring at RSA is considered to be low.

7.2.3 Barotrauma

Barotrauma is a phenomenon in which rapid air pressure changes cause tissue damage to air-containing structures, most notably the lungs (Baerwald et al., 2009). Barotrauma can also result in non-lethal injuries such as hearing impairments and other internal injuries that may result in bats succumbing to their injuries at a later time. No published research to date has shown evidence that wind turbines cause barotrauma in bird species. Birds are considered less susceptible to barometric impacts than other volant fauna such as bats due to many having anatomical adaptations such as rigid lung structures and exceptionally strong capillaries (Lawson et al., 2020).

There is currently no published information on barotrauma in Australia. One study undertaken in Canada found that 90% of bat fatalities involved internal haemorrhaging consistent with barotrauma, and that collision with turbine blades accounted for about 50% of the fatalities (Baerwald et al., 2009). However, another study found that only 6% of bats collected at a wind farm in Illinois had lesions possibly consistent with barotrauma, leading to the conclusion that traumatic injury (i.e., collisions) is the major cause of bat mortality at wind farms (Rollins et al., 2012).

Due to the difficulty in diagnosing barotrauma unless the carcass is examined immediately after death, it is possible that cases attributed to barotrauma have been due to traumatic injury associated with direct collisions.

7.2.4 Barrier Effects

Barrier effects can be caused by wind turbines disrupting links between feeding, roosting and/or nesting areas, or diverting flights (including migratory flights) around a wind farm. The mean distance between turbines is 700 m, with the shortest distance between turbines being 558 m.

Species that pass wind farms frequently on migration appear to be of higher concern than other species (Hötker et al., 2006). However, these effects on birds, possibly resulting in higher energy consumption or injuries as a result of collision, are not yet well known (Schuster et al., 2015).

There is currently no published information on barrier effects from wind farms in Australia.

A discussion on the potential barrier effects on MNES associated with the Project is provided for each species in **Section 9.0**.

8.0 Avoidance, Mitigation, and Management

The hierarchy of avoid, minimise, and mitigate has been applied to the design process for the Project, with the field survey findings incorporated into the Development Corridor design.

These principles and the order in which they have been applied are as follows.

1. Avoid: reducing the Project Area and locating activities to avoid direct and indirect impacts on MNES
2. Minimise: minimising direct and indirect impacts where they cannot be completely avoided
3. Mitigate: implementing mitigation and management measures to reduce direct, indirect and cumulative impacts
4. Remediate and rehabilitate: actively remediate and rehabilitate temporary impacted areas to promote long-term recovery
5. Offset (where necessary): provide suitable offsets for activities that result in significant residual impacts to MNES even with the implementation of the above principles.

This section provides further details on the avoidance, mitigation and management measures that have been applied to date and that are proposed to reduce the potential Project impact on flora and fauna values. Offsets are described in **Section 10.0**.

8.1 Avoidance

8.1.1 Consideration of ecological values in determining the Project Area and Development Corridor

The Study Area and Additional Survey Area of the Project have been subject to an ecological constraints analysis, the purpose of which was to identify flora and fauna values with varying sensitivity levels and environmental significance. This early process facilitated the identification and avoidance of potentially significant flora, vegetation, and fauna habitat types during the preliminary design stage of the Project.

Numerous Project design iterations were undertaken with consideration for ecological values identified and mapped during the field survey program. As no Threatened flora species were recorded during flora and vegetation surveys, avoidance measures focused on avoiding areas of the Good or better condition native vegetation and areas mapped as Eucalypts of the Western Australian Wheatbelt TEC. The initial design required over 40 hectares of native vegetation clearing, however, through an iterative design process the total native vegetation clearing has been reduced by over 80% to 7.41 ha of native remnant vegetation and 0.98 ha of planted native vegetation.

Additionally, an area of 2,830 ha (now referred to as the Additional Survey Area) was removed from the Project Area, corresponding to a 30% overall reduction in the Study Area which resulted in the avoidance of:

- any potential impacts to a total of 216.5 ha of Eucalypts of the Western Australian Wheatbelt TEC

- 234.3 ha of native vegetation in Good to Very Good condition
- Areas where direct observations of Carnaby's Black-cockatoo individuals were recorded
- locations of most secondary evidence for conservation significant species.

Within the current Study Area, all remaining native vegetation is of Degraded condition, with only a single small patch of Good condition vegetation located in the east of the Study Area (**Figure 6.4**), which will be avoided. Areas mapped as Eucalypts of the Western Australian Wheatbelt TEC or areas with native vegetation in 'Good' condition have been wholly avoided by the Project's Development Corridor.

Design iterations incorporated avoidance mapping for potential fauna habitat considered to be of importance to conservation significant species. As a result of the reduction in Study Area, the largest and most intact remnant habitat patch consisting of Good to Very Good condition native vegetation, with the highest quality fauna habitat and direct observations of cockatoos, has been wholly avoided (approximately 229 ha). As part of further design reviews, almost all intact native vegetation representing conservation significant fauna habitats has been avoided with no trees containing hollows with active or historical evidence of black-cockatoo use being proposed for clearing and all clearing being restricted to trees or vegetation at the perimeter of existing degraded patches.

Additional aspects that have been considered as part of the Indicative Project Footprint and Development Corridor design include:

- Locating infrastructure within cleared agricultural land as much as possible.
- Avoiding areas with higher foraging value for black-cockatoos to reduce likelihood of turbine collision. This includes removing turbines from the Additional Survey Area and from the eastern part of the Study Area where there are larger areas of higher foraging habitat value. This minimises the potential that turbines in this area might reduce utilisation of this foraging habitat by black-cockatoos. It also further reduces the already low likelihood of turbine strike in this area.
- Providing a minimum turbine tip height of 49 m AGL. This minimises risk of turbine strike for black-cockatoo species which typically fly at canopy height and along areas of remnant vegetation in areas of lower topographic relief.
- Minimising creek crossings as part of the design, and where crossings are necessary utilising existing crossings so that clearing of riparian vegetation is reduced as far as possible.

8.1.2 Micro-siting

The Final Project Footprint will occupy a considerably smaller footprint than that represented by the Development Corridor (approximately 30%). Whilst the Project will seek to avoid and minimise clearing impacts to all habitat types during the detailed design phase of the Project, the infrastructure layout within the Development Corridor will be further refined to:

- Avoid clearing of Rank 1 (trees with activity at hollow observed) and Rank 2 (trees with hollows of suitable size with chew marks visible) black-cockatoo breeding trees

- Minimise disturbance of:
    - Rank 3 (Potentially suitable hollow visible but no chew marks present at entrance; or potentially suitable hollow suspected to be present) black-cockatoo breeding trees
    - higher-quality foraging habitat
    - riparian zones
    - mapped Threatened species habitat.

In addition, pre-clearing surveys will be undertaken within any areas of potential habitat that have not yet been surveyed for the Threatened fauna species known and likely to occur within the Development Corridor to inform the micro-siting process. No targeted pre-clearing surveys for threatened flora is required due to the low likelihood of occurrence in the Project Development Corridor.

8.2 Mitigation and Management

The Project will be governed by a CEMP which will include a management approach and actions to limit and reduce the potential impacts on fauna, including threatened species (**Section 8.2.3**) and is provided in (**Appendix G**). Operational impacts to birds and bats will be managed through a Bird and Bat Adaptive Management Plan (BBAMP). A preliminary BBAMP has been developed to support this referral and a copy is provided in **Appendix D**.

8.2.1 Native Vegetation and Fauna Habitat Clearing

The Project CEMP will include provisions to limit and reduce potential impacts to vegetation during clearing and other activities. Vegetation management measures will include:

- Personnel involved in native vegetation clearing activities will be required to undertake internal Project specific land clearing training which will outline regulatory requirements, management actions or controls to be implemented, and weed and pest management.
- Approved native vegetation clearing area boundaries will be demarcated prior to clearing, and clearing of remnant native vegetation will not exceed 7.41 ha of remnant native vegetation and 0.98 ha of planted native vegetation.
- Known black-cockatoo nesting trees within 50 m of clearing boundaries will be clearly tagged as “No-go zone” prior to clearing. This could be in the form of flagging or fencing.
- Areas planned for native vegetation clearing will be inspected for native fauna immediately prior to undertaking land clearing by a suitably qualified fauna spotter. This will include ensuring that no trees being removed are housing black-cockatoos, chicks, or eggs. Where conservation listed fauna are encountered, these will be reported to the Senior Environmental Advisor immediately.
- Where trees are authorised to be cleared, they will be felled away from areas of retained native vegetation as safe and practicable. Where trees unavoidably fall into retained areas, they will be left in-situ.

- Vegetation clearing will be undertaken progressively and in stages so that only a small subset of the Project footprint is impacted at any one time. The clearing will be undertaken towards adjacent native vegetation to allow fauna (such as the Chuditch and Red-tailed Phascogale) to move into adjacent native vegetation ahead of the clearing activity.
- Topsoil stockpiles will include signage that identifies the source of the stockpile, the date it was stockpiled and the volume of the stockpile.
- Topsoil stockpiles will be protected with cleared scrub, vegetation or otherwise treated as required to minimise wind erosion.
- Following the completion of each clearing event, the location and extent of areas cleared will be recorded via GPS / survey and reported within a centralised dataset.

8.2.2 Biosecurity (Weed and Disease Risk Management)

Management of the spread or introduction of weeds is an indirect potential impact of the Project, which can impact the integrity and longevity of vegetation communities, ecological communities and Threatened species. It is considered that the risk of these potential impacts can be appropriately mitigated and managed through appropriate site management practices.

Weed and disease management will be included in the CEMP and will include the following measures:

- All ground disturbing plant and equipment will enter site clean and free of weeds or dieback.
- Upon arrival to site, ground disturbing plant and equipment will be subject to a weed and seed inspection prior to entry. A record of the inspection details and whether the plant / equipment has been deemed to be weed and seed free will be retained.
- Where plant and equipment does not pass the weed and seed inspection, the plant / equipment shall be further cleaned at a dedicated wash down area and re-inspected.
- Weed infested areas that are identified will be avoided where practicable.
- Prior to leaving weed infested areas, the plant and equipment will be brushed down.
- Prior to entering the Study Area, the origin of fill material will be determined and certified where applicable. Where practicable, the fill should be from a quarry (i.e. not reused from another site) that has a Dieback Management Plan in place.

8.2.3 Fauna Management

The Project CEMP will include provisions to limit and reduce potential impacts on fauna. Primary objectives of the plan will be to:

- ensure the clearing of habitat does not exceed the approved disturbance limit of 7.41 ha of remnant native vegetation and 0.98 ha of planted native vegetation
- prevent injury or mortality to fauna during all Project phases
- maintain fauna corridors/movement through the Project

- ensure the Project does not exacerbate threats to fauna habitat including invasive weeds, pest animals and bushfire.

Dependent on the Final Project Footprint, a range of mitigation measures will be employed on the Project to limit and reduce the potential direct and indirect impacts identified in **Section 6.5.4**. These are presented below.

- The following general measures to limit and reduce habitat loss and fauna mortality will be implemented:
    - Vegetation clearance areas will be clearly demarcated to avoid over-clearing within mapped habitat.
    - No-go zones within the Study Area will be clearly documented, including threatened species habitat that is mapped within the Development Corridor and removal is not required for the Project.
    - Measures to protect and recover fauna encountered during vegetation clearing will be outlined, including the presence of qualified fauna spotters.
    - Preclearance searches of habitat will be undertaken prior to clearing by a qualified fauna spotter, with habitat features/trees clearly identified and searched for fauna.
    - Micro-siting of Project infrastructure will aim to retain habitat trees where possible.
    - Habitat trees within the Final Project Footprint that can be safely retained will be marked with flagging tape and avoided.
    - Fauna welfare procedures will be outlined, including operational and compliance reporting procedures for injured and/or dead wildlife.
    - Measures to replace/relocate habitat and resources that will be unavoidably lost will be outlined, including rehabilitation procedures for the decommissioning of temporary construction areas if those areas are not otherwise useful to the ongoing land use.
    - Training/information requirements will be in place for all personnel working on the Project, including but not limited to inductions, daily toolbox talks and/or site walk overs which discuss the management measures or risks of a particular locations.
- The following measures will be implemented to limit impacts on MNES fauna species:
    - Preclearance searches will be undertaken by a licenced fauna spotter prior to and during clearing activities within remnant vegetation types and should include denning habitat for the Chuditch and Red-tailed Phascogale.
    - Where Chuditch or Red-tailed Phascogale are found during pre-clearance surveys, a no-go zone will be established and the area avoided until the individuals have naturally dispersed.
    - Where habitat features such as existing hollow logs cannot be retained in-situ during land clearing, they will be relocated to adjacent areas of suitable habitat if safe and practicable.
    - Fauna spotters will be present during all native vegetation clearing to ensure that no trees being removed are housing black-cockatoos, chicks, or eggs.

- A targeted assessment of all unassessed potential breeding trees for black-cockatoos will be undertaken within the Final Project Footprint.
- No Rank 1 (trees with activity at hollow observed) and Rank 2 (trees with hollows of suitable size with chew marks visible) trees will be removed. If identified within 50 m of a clearing front, these trees will have a no-go zone established around their perimeter in the form of fencing or flagging.
- Disturbance of Rank 3 (potentially suitable hollow visible but no chew marks present at entrance; or potentially suitable hollow suspected to be present) trees will be minimised through micro-siting where practicable. Where it is discovered that a Rank 3 tree has been used or is in active use for nesting by black-cockatoos, a no-go zone will be established around the tree and the tree will not be cleared until the chick has naturally fledged and the breeding pair vacated.
- Vegetation clearing will be halted in areas where black-cockatoo species are located, and clearing will not resume until the species leaves the location on its own accord.
- Construction and operation personnel will be educated on the potential presence for fauna, in particular black-cockatoos, Chuditch and Red-tailed Phascogale.

- The following additional mitigation measures will be implemented to limit and reduce indirect impacts (noise, dust, light emissions and traffic) to fauna:
  - restriction of construction hours to daylight periods where possible
  - consideration of plant and equipment types, including muffler design and the use of alarms
  - dust suppression techniques to minimise generation of duct (e.g., watering access roads)
  - speed limits on access roads, informed by appropriate signage as required
  - the inclusion of points of egress in any excavation areas that are left open for more than one night
  - progressive clearing, limiting exposed areas to the immediate work zones
  - consideration to the type and use of lighting (e.g., shielded lights on buildings, directing lighting away from habitat)
  - installation of signage which includes information such as wildlife presence in TECs where a threatened species is identified
  - where encountered, personnel shall keep a distance from fauna and not harm or trap them
  - where injured fauna is encountered, the Wildcare Helpline (08 9474 9055) will be immediately contacted, and the Work Area Supervisor notified.
- The following general measures to limit and reduce the potential for introduction or spread of invasive pest species will be implemented:
  - all waste storage containing food waste will have closeable lids that can be secured shut to avoid attracting fauna
  - a carrion removal program will be implemented to minimise the attraction of scavenging fauna should any turbine collision with a bird or bat occur

- site induction training will highlight the importance of pest management
- the site will be kept in a general tidy and clean condition during construction.

8.2.3.1 Bird and Bat Adaptive Management Plan

Monitoring and management actions relating to birds and bats will be undertaken in accordance with a Project BBAMP. The strategy of the BBAMP is to monitor and mitigate the potential impacts of turbine strike on birds and bats via trigger based, adaptive management. Pre- and post-commissioning monitoring of bird and bat activity (including flight behaviours) is a key requirement of the plan, to inform a risk profile for each turbine. This strategy leads to direct and tailored management actions, applied at the appropriate locations and times.

Further detail on this plan is provided in the *Preliminary Bird and Bat Adaptive Management Plan* (**Appendix D**) which will be finalised into a Project Bird and Bat Adaptive Management prior to commissioning of the Project. It is anticipated that finalising and implementing the BBAMP in consultation with DBCA will be a condition of the development approval under the *Planning and Development Act 2005*.

8.2.4 Erosion and Sediment Control

The potential impacts of erosion and sedimentation will be mitigated and managed through the measures listed in the Project CEMP (**Appendix G**). This will include the establishment of temporary erosion and sediment control until construction is complete or exposed areas have been rehabilitated to prevent the sedimentation of waterways within the Study Area.

9.0 Significant Impact Assessments

Significant impact assessments against the criteria outlined in the Matters of National Environmental Significant: Significant Impact Guidelines 1.1 (Department of the Environment, 2013) are presented in the following sections. Significant impact criteria outlined in Department of Environment (2013) have been utilised according to the conservation status under the EPBC Act for each ecological community or species. Only ecological communities or species recorded within the Study Area or ranked as having a Moderate, High or Known likelihood of occurring have been assessed.

9.1 Eucalypt Woodlands of the Western Australian Wheatbelt TEC

The Eucalypt Woodlands of the Western Australian Wheatbelt TEC is listed as Critically Endangered under the EPBC Act.

9.1.1 Distribution and Description

The TEC is found within the Wheatbelt region of WA from the Darling Range to the Great Western Woodlands and were once extensive but now occur as mostly small remnants scattered across their former range. The Eucalypt Woodlands TEC is found on flatter landscapes and lower rises of the Wheatbelt (Department of the Environment, 2015a).

The TEC is characterised by Eucalypts as the dominant species that typically have a single trunk and occur as a complex mosaic involving approximately 30 species. Tree species present can vary from patch to patch and the native understory is diverse and highly variable, ranging from largely bare to grassy to herbs and wildflowers to shrubby. Woodlands of the Wheatbelt dominated by mallee trees, non-eucalypts, limited to granite or rock outcrops and higher elevations, sparse canopy cover under 10%, or very small remnants and patches that are degraded condition are not included in this TEC. Patches dominated by Jarrah or Marri that extend into the Wheatbelt are also not included (Department of the Environment, 2015a).

9.1.2 Threats

Known and potential threats to this TEC as outlined in the conservation advice include (Department of the Environment, 2015a):

- Clearance of native vegetation.
- Loss of habitat for key native species.
- Fragmentation into smaller, disconnected patches.
- Weed invasion.
- Impacts from pest animals.
- Inappropriate application of chemicals, including inorganic fertilisers to create improved pastures; or pesticide/herbicide spray drift from agricultural lands adjacent to a patch.

- Grazing pressure: including inappropriate grazing regimes by domestic stock and grazing of regrowth by native fauna.
- Increased salinity and waterlogging of the landscape largely due to modification of the landscape and hydrology through overclearing.
- Soil acidification.
- Altered fire regimes, notably altered fire frequency, but also changes to fire intensity and season, such as occurs during prescribed burning. This covers both wildfires and prescribed burning.
- Potential impact of plant diseases such as *Phytophthora* sp. on species diversity and structure.
- Potential impacts of climate change, including altered fire and flooding regimes, decline in tree health due to prolonged drought and heat stress, and poor regeneration and recruitment.

9.1.3 Occurrence and Potential Habitat in the Study Area

Each of the VTs described and mapped in the Project Area were assessed against the key diagnostics in relation to characteristics 2 (Structure), 3 (Key tree species), and 4 (presence of understorey) (Department of the Environment, 2015a). Based on vegetation description and components alone, 12 of the VTs mapped within the Project Area were considered to potentially represent the Eucalyptus Woodlands of the Western Australian Wheatbelt TEC. Both patch sizes and conditions (in terms of structure and species presence) for these VTs were then reviewed for a final determination on the presence and extent of the TEC.

Based on the assessment against key diagnostic criteria, a total of 41.8 ha of the Eucalyptus Woodlands of the Western Australian Wheatbelt TEC has been identified across five patches within the Study Area. These are represented by patches of VT8 (36.4 ha) and VT6 (5.2 ha) and are all in Degraded condition. The remaining VT patches within the Project Area do not meet the requirements of the TEC, mostly due to not meeting condition requirements such as a lack of native understorey and covers of introduced taxa exceeding 70% of the understorey in most cases (Umwelt, 2023).

Table 9.1 Extent of Eucalyptus Woodlands TEC

Mapped Type	Extent (ha) within Study Area	Extent (ha) within Development Corridor	Extent (ha) within Indicative Project Footprint
Confirmed	41.8	0	0
Total	**41.8**	**0**	**0**

Areas considered critical to the Survival of the Eucalypt Woodlands of the Western Australian Wheatbelt TEC includes all patches that meet the key diagnostic characteristics and condition thresholds for the ecological community, plus the buffer zones, particularly where this comprises surrounding native vegetation. Additional areas that do not meet the condition thresholds may also be important for the survival of the ecological community as they may retain some biodiversity or habitat values and it is important to consider the surrounding environment and landscape context of areas being assessed (Department of the Environment, 2015a). For the Project, this has been defined as all areas mapped as the TEC within the Study Area including a 40 m buffer zone around this area where native vegetation occurs.

9.1.4 Potential Project Impacts and Key Mitigation Measures

The Project has avoided any direct impacts to the Eucalypt Woodlands of Western Australian Wheatbelt TEC by siting all infrastructure outside of areas mapped as TEC with no proposed clearing of these patches. Project infrastructure is also located at least 40 m away from the edges of all patches.

Potential Project related indirect impacts relevant to the TEC include:

- further weed and pest incursion
- introduction or spread of plant diseases such as *Phytophthora* sp. dieback
- increased edge effects
- elevated dust.

Management measures to address the above indirect impacts are summarised in **Section 8.2**.

9.1.5 Assessment Against Significant Impact Criteria

An assessment of the significance of impacts to this TEC under the Significant Impact Guidelines 1.1 – MNES (Department of the Environment, 2013) is provided in **Table 9.2**. The assessment identified that the Project is unlikely to have a significant impact on the Eucalypt Woodlands of the Western Australian Wheatbelt TEC.

Table 9.2 Eucalypt Woodlands of the Western Australian Wheatbelt TEC Significant Impact Assessment

Significant Impact Criteria	Assessment of the Project	Outcome
1. Reduce the extent of the ecological community	The Project has avoided direct impacts to areas mapped as Eucalypts of the Western Australian Wheatbelt TEC. Indirect impacts to this TEC are expected to be negligible and will be managed through measures implemented in the Project CEMP (**Appendix G**) as outlined in **Section 8.2**. Measures related to key threats such as weed and pest incursion, introduction or spread of plant diseases such as *Phytophthora* sp. dieback, increased edge effects, elevated dust have all been incorporated.	The Project is not at variance with this criterion.
2. Fragment or increase fragmentation of the ecological community, for example by clearing vegetation for roads or transmission lines	No clearing of the Eucalypt Woodlands of the Western Australian Wheatbelt is proposed and no Project activities will result in the fragmentation of areas mapped as this TEC.	The Project is not at variance with this criterion.
3. Adversely affect habitat critical to the survival of the ecological community	Habitat critical to the survival of the Eucalypt Woodlands of the Western Australian TEC have been defined as all areas mapped as this TEC within the Study Area including a 40 buffer zone around areas where the native vegetation occurs. No vegetation clearing has been proposed within these areas and indirect impacts will be adequately managed through the measures outlined in **Section 8.2**.	The Project is not at variance with this criterion.
4. Modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for the ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns	Given the minimal extent and distributed nature of proposed vegetation clearing, impacts to soil quality (such as soil salinity) are unlikely to occur within the Study Area. No water abstraction or land use alterations related to Project activities are proposed that will modify water quality or availability, or nutrient balances necessary to the survival of this TEC in the Study Area. Surface water drainage patterns may be slightly modified in areas required for earthworks as part of Project construction, but this is not expected to impact any areas mapped as critical to the survival of this TEC.	The Project is not at variance with this criterion.
5. Cause a substantial change in the species composition of an occurrence of the ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting	No prescribed burning regimes, altered bushfire patterns, or flora or fauna harvesting is proposed as part of the Project. Additionally, given the avoidance of all areas mapped as critical to the survival of this TEC, the Project is highly unlikely to cause a substantial change to its species composition or occurrence within the Study Area.	The Project is not at variance with this criterion.

Significant Impact Criteria	Assessment of the Project	Outcome
6. Cause a substantial reduction in the quality or integrity of an occurrence of the ecological community, including, but not limited to: **a. assisting invasive species, that are harmful to the listed ecological community, to become established, or** **b. causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community**	Given that the Project does not propose any vegetation clearing in areas mapped as critical to the survival of this TEC and indirect impacts are expected to be negligible and adequately managed through measures outlined in **Section 8.2**, it is unlikely that the Project will cause a substantial reduction in the quality or integrity of the occurrence of this TEC.	The Project is not at variance with this criterion.
7. Interfere with the recovery of the ecological community	There are no direct impacts expected to occur to the Eucalypt Woodlands of the Western Australian Wheatbelt TEC as a result of the Project. Potential indirect impacts relevant to the Project include: • further weed and pest incursion • introduction or spread of plant diseases such as Phytophthora sp. dieback • increased edge effects • elevated dust. Management measures to be incorporated during construction and operations (**Section 8.2**) address the indirect impacts listed above. The Project is not expected to interfere with the recovery of the Eucalypt Woodlands of the Western Australian Wheatbelt TEC.	The Project is not at variance with this criterion.

9.2 Threatened Black-Cockatoo Species

The three species of black-cockatoo are listed under the EPBC Act as follows:

- Forest Red-tailed Black-Cockatoo (*Calyptorhynchus banksii naso*): Vulnerable
- Baudin's Black-Cockatoo (*Zanda baudinii*): Endangered
- Carnaby's Black-Cockatoo (*Zanda latirostris*): Endangered.

As well as the Matters of National Environmental Significance: Significant Impact Guidelines 1.1 (Department of the Environment, 2013), the following documents were also considered:

- Referral Guideline for 3 WA Threatened Black Cockatoo Species (DAWE, 2022),
- Relevant recovery plans for each species (DEC, 2008; DEPAW, 2013a):
    - Forest Red-tailed Black-Cockatoo and Baudin's Black-Cockatoo have similar feeding and breeding requirements and face similar threats, there is a single recovery plan for these 'Forest Black Cockatoos' (DEC, 2008).
    - A separate recovery plan was developed for Carnaby's Black-Cockatoo in 2013, with an intended 10-year period (DPAW, 2013a).
- Species Profile and Threats Database (SPRAT) database for each species.

The following sections describe the distribution and habitat requirements, threats, and occurrence and potential habitat in the Study Area and broader region. Separate significant impact assessments for each of the three species against criteria in the Significant Impact Guidelines 1.1 (Department of the Environment, 2013) is provided in **Section 9.0**.

9.2.1 Distribution and Habitat Requirements

The Forest Red-tailed Black-Cockatoo is endemic to the south-west of Western Australia, from around Gingin in the north, east to Mount Helena, North Bannister and Mount Saddleback, and south to around Albany (Johnstone & Storr, 2004). In recent years there appears to have been a distinct expansion of the range of this species on to the Swan Coastal Plain, including many suburbs within the Perth metropolitan area, as well as east into the Wheatbelt region. The species is generally restricted to areas of Jarrah-Marri forest, farmlands with remnant trees and urban landscapes.

Forest Red-tailed Black-Cockatoos are currently considered not to undergo regular migration, but may take seasonal movements in response to food resource and water availability (DCCEEW, 2024b). Larger home-ranges for the species have been associated with the flock moving between multiple smaller foraging sites, often travelling along and making use of vegetation in road verges (Rycken et al., 2022). Daily movements averaged 16.41 km for the flock with the larger home-range, with several days showing a movement of more than 20 km. A flock with a smaller home-range of 6.02 km^2, based in larger areas of remnant vegetation, travelled only 4.96 km per day on average.

Baudin's Cockatoo is endemic to the south-west of Western Australia, from around Perth to around Albany. Similar to the Forest Red-tailed Black-Cockatoo, there appears to have been an expansion of the range of this species on to the Swan Coastal Plain in recent years, including many suburbs within the Perth metropolitan area. It is generally restricted to areas of Jarrah-Marri forest and farmlands with remnant trees or pine plantations.

In a study that compared the movement ecology of Baudin's Black-Cockatoos in urban/peri-urban regions and the forest region, Rycken et al. (2021) found that flock sizes were significantly larger in forested areas. While the study did not consider movement within the agricultural matrix (such as the Study Area) it might be expected that, given the fragmentation of native vegetation, agricultural areas would more likely reflect the urban/peri-urban landscape structure and, therefore, generally support smaller black-cockatoo flock sizes than the forested areas to the west. Baudin's Black-Cockatoos in urban or peri-urban areas have smaller flock sizes (<50 birds) than in forested areas (200+ birds) and undertake smaller daily movements (3.42–6.89 km) compared with flocks in the forest (9.44 km) (Rycken et al., 2021).

The Forest Red-tailed Black-Cockatoo and Baudin's Black-Cockatoo are both diurnal granivores, feeding predominantly on the seeds of Jarrah and Marri (Johnstone et al., 2013a; Johnstone & Kirkby, 2019) though they have also adapted to foraging on urban (introduced) plant species. They are reliant on large tree-hollows in eucalypts (especially Marri) for breeding (DCCEEW 2024b, 2024g; Johnstone et al., 2013b). The Forest Red-tailed Black-Cockatoo may preferentially use hollows that are in close proximity to each other, rather than hollows throughout the landscape (Johnstone et al., 2013a).

Carnaby's Black-Cockatoo is endemic to south-western Western Australia, from Kalbarri in the north, east to Merredin and Ravensthorpe, and then further east along the south coast to the Esperance area (DCCEEW, 2024h; Johnstone & Storr, 1998). They breed (July to December) predominantly in the east of its range with a migration to coastal areas in the non-breeding period. In recent years, however, the species has expanded its breeding range westward and south into the Jarrah-Marri forests of the Darling Scarp and into the Tuart forests of the Swan Coastal Plain (DCCEEW, 2024h). Carnaby's Black-Cockatoo are heavily reliant on areas of Banksia woodland and proteaceous shrubland/heath for foraging (DCCEEW, 2024h; Johnstone & Storr, 1998).

A study of GPS-tagged Carnaby's Black-Cockatoos at Coomallo Creek (200 km north of Perth) and Borden (350 km southeast of Perth) found that breeding birds foraged over two main periods of the day: 6–9 AM and 3–6 PM, separated by a period of day roosting (Riley et al., 2023). Each day, birds travelled on average 5.98 km from the breeding site, (up to a maximum of 13.55 km) in order to forage at Borden, and 6.4 km per day (up to a maximum of 11.11 km) to forage at Coomallo Creek. Birds at Borden were noted to show clear movement paths along roads when transiting daily between patches of habitat. Similarly, birds tracked in the Pinjar Pine Plantation showed that birds avoided built-up urban areas and cleared land, preferring to move along vegetated areas, including road verges, parks and remnant patches. When travelling over cleared areas, birds flew faster and transited more quickly (Shephard & Warren, 2018). These flight path behaviours are likely to be similar for all black-cockatoo species found in southwest WA.

Carnaby's Black-Cockatoo are diurnal granivores, feeding predominantly on the seeds of the Proteaceae (especially banksias), but are also known to feed on a very wide variety of plants, including non-native ornamentals and plantation species such as pine (DCCEEW, 2024h; DPAW, 2013a; Groom, 2011; Johnston et al., 2016; Valentine & Stock, 2008). They are reliant on large tree-hollows in eucalypts (especially smooth barked species such as Wandoo and Salmon Gum) for breeding (DCCEEW, 2024h; Johnstone & Storr, 1998; Saunders, 1974).

9.2.2 Threats

Key threats to the Forest Red-tailed Black-Cockatoo and Baudin's Black-Cockatoo are habitat loss, habitat degradation, nest hollow shortage, and competition for available nest hollows from other parrots and feral honeybees (DCCEEW, 2024b, 2024g). Feral honeybees (*Apis mellifera*) pose a significant threat to the ability of black-cockatoo species to survive and breed, and hollow invasion by feral honeybees is likely to increase with the southward movement of bees in response to the predicted warmer climate in south-west WA (Department of Environment and Conservation (DEC), 2008).

Key threatening processes for Carnaby's Black-Cockatoo include habitat loss, habitat degradation, nest hollow shortage, and competition for available nest hollows from other parrots and feral honeybees, illegal shooting, and illegal trade (Burbidge, 2004; DCCEEW, 2024h). As per the species' SPRAT database, other recognised potential threats to the species include:

- Decline in tree health due to *Phytophthora cinnamomi* or 'dieback' (root rot).
- Decreasing rainfall, changes to rainfall patterns and higher temperatures in the south-west of Western Australia due to climate change.
- Fire events leading to loss of productive foraging habitat.
- Vehicle strike.
- Low rate of recruitment which is likely to limit the ability to sustain or recover numbers.

While the above threatening processes are not specified for the Forest Red-tailed Black-Cockatoos or Baudin's Black-Cockatoos, it is likely that these same processes also apply.

9.2.3 Occurrence and Potential Habitat in the Study Area and Broader Region

Within the broader region, there is approximately 27,255 ha of land managed and protected for conservation purposes within a 20 km radius of the Study Area and approximately 9,268 ha within a 12 km radius (DBCA, 2024). Much of this land consists of the Lol Gray State Forest and Dryandra Woodland National Park located to the north of the Study Area, which have a number of records for these species in the eBird (Cornell Lab of Ornithology, 2024) database and is known to contain habitat species suitable for black-cockatoo foraging, breeding, and roosting.

The WA Department of Primary Industries and Regional Development has mapped a total of 49,139 ha of native vegetation within a 20 km radius of the Study Area, and 19,934 ha within a 12 km radius (DPIRD, 2023), much of which is located within the lands managed and protected for conservation captured above but also includes remnant roadside vegetation and native vegetation occurring within freehold land.

To understand the occurrence of black-cockatoos within the Study Area, surveys were undertaken in accordance with the EPA (2020) Technical Guidance for Terrestrial Vertebrate Surveys, while ecological values were based on the definitions of breeding, foraging, and roosting habitat as per the DAWE (2022) EPBC Act referral guideline (**Appendix B**). These were later refined to targeted fine-scale mapping within areas of the Indicative Project Footprint using the BCE (2020) method which adapts and expands upon the DAWE (2022) EPBC Act referral guidelines for scoring black-cockatoo habitat (**Appendix C**). This fine-scale mapping was initially completed for a previous iteration of the Indicative Project Footprint and the assessment area now covers approximately 60% of the current Indicative Project Footprint (**Figure 4.2**).

A desktop assessment of records within the region surrounding the Project was also undertaken to understand species' utilisation and occurrence in the wider area. The outcomes of these assessments are summarised below.

9.2.3.1 Forest Red-tailed Black-Cockatoo

- The Forest Red-tailed Black-Cockatoo is known to occur within the Study Area from the presence of aged foraging material for the species found during targeted habitat assessments in 2024. Five records of foraging material were identified, with most of these aged as "very old" and likely to be greater than one or two years since foraging. Individuals were not recorded within the Study Area during four surveys over a total of 18 days.

- The Forest Red-tailed Black-Cockatoo was recorded in the Additional Survey Area outside of the Study Area during the fauna survey conducted by Western Wildlife, with a small flock of probably two birds heard in the southern part of the Additional Survey Area in Eucalypt Sheoak woodland. No evidence of foraging was recorded during this survey event despite the abundance of Marri, a favoured food-plant (Western Wildlife, 2024), and scant evidence found during the targeted habitat assessments further indicate that the species is unlikely to occur in large flocks or as a resident of the Study Area.
  The Additional Survey Area has been removed from the Project to avoid potential impacts to the area where this species was recorded.

- Approximately 60% of the Indicative Project Footprint was subjected to the detailed fauna habitat assessment (Umwelt, 2024a), in which a total of 109 trees met the suitable or potential nest tree criteria of DBH greater than 500 mm. Of these 109 trees assessed, no trees with active or historical evidence of nesting were found (Rank 1 or 2 trees), five Rank 3 trees containing potentially suitable hollows were identified, and the remaining trees did not have potentially suitable hollows (Rank 4 and 5). The remaining unassessed areas proposed for clearing will be subject to targeted survey and all Rank 1 or 2 trees will be avoided. No direct or indirect evidence of breeding was found within the Indicative Project Footprint during the targeted mapping for black-cockatoo species.

- There was no direct or indirect evidence (e.g. guano deposits or discarded feathers) of roosting found within the Indicative Project Footprint.

- The DBCA roosting sites dataset for black-cockatoos holds no records of roosting sites for the Forest Red-tailed Black-Cockatoo (DBCA, 2019b). Records of the species in the DBCA (2023a), Atlas of Living Australia (2024), and eBird (Cornell Lab of Ornithology, 2024) databases occur to the east of the Study Area in the township of Narrogin, and to the north in the Dryandra Woodland National Park and Lol Gray State Forest conservation mosaic which are dated within the last 6 years. Habitat comprising of Marri, Flooded gum and York gum woodlands occur within the Study Area, providing potential areas of breeding, roosting and refuge; however, habitats within the broader region may be more suitable than habitats within the Study Area and the species is unlikely to be concentrated in the Study Area.

- Based on the assessment, the Forest Red-tailed Black-Cockatoo is a seasonal visitor to the Study Area likely to forage and/or roost and may breed in large tree hollows, however no evidence of roosting or breeding was recorded within the Indicative Project Footprint as noted above.

The extent of native vegetation considered to be potential foraging habitat that may be cleared within the Study Area is summarised in **Table 9.3** and **Table 9.4**. Breeding trees have not been assessed for the whole Indicative Project Footprint, but based on data available the Project commits to not removing any Rank 1 or Rank 2 trees, and minimising impact to Rank 3 trees.

Table 9.3 Potential Impact to Foraging Habitat: Forest Red-tailed Black-Cockatoo

Fauna Habitat Type	Extent in Study Area	Extent in Indicative Project Footprint	
	DAWE (2022) method	DAWE (2022) method	BCE (2020) method
High-quality foraging habitat (Score >=5)	407.9 ha	4.61 ha	3.32 ha
Low-quality foraging habitat (Score <5)	0 ha	0 ha	3.38 ha

Table 9.4 Potential Impact to Roosting and Breeding Habitat: Forest Red-tailed Black-Cockatoo

Fauna Habitat Type	Extent in Study Area	Extent in Indicative Project Footprint
Roosting habitat	Unknown	0 ha
Potential breeding habitat[#]	1,013.9 ha	7.41 ha
Possible breeding habitat	90.8 ha	0.015 ha
Rank 1 or 2 trees	Unknown	0
Rank 3 trees	Unknown	5*
Rank 4 trees	Unknown	1*
Rank 5 trees	Unknown	103*

Note. [#]Excludes areas mapped as "*Potential breeding habitat in Isolated Paddock Trees*". *Trees recorded in approximately 60% of the Indicative Project Footprint.

9.2.3.2 Baudin's Black-Cockatoo

- The species was not recorded during any field surveys undertaken within the Study Area. The Study Area is also not within the known breeding range of the species (DAWE, 2022), but there is potential that it may offer potential foraging habitat during the non-breeding season. Based on this potential, and the presence of historical records within a 20 km radius of the Study Area in the DBCA (2023a), Atlas of Living Australia (2024) and eBird databases (Cornell Lab of Ornithology, 2024), with the most recent being in 2018, it has been ranked as a Moderate likelihood of occurring within the Study Area.

- Approximately 60% of the Indicative Project Footprint was subjected to the detailed fauna habitat assessment (Umwelt, 2024a), with a total of 109 trees meeting the suitable or potential nest tree criteria of DBH greater than 500 mm. Of these 109 trees assessed, no trees with active or historical evidence of nesting were found (Rank 1 or 2 trees), five Rank 3 trees containing potentially suitable hollows were identified, and the remaining trees did not have potentially suitable hollows (Rank 4 and 5). The remaining areas proposed for clearing will be subject to targeted survey and all Rank 1 or 2 trees will be avoided. No direct or indirect evidence of breeding was found within the Indicative Project Footprint during the targeted mapping for black-cockatoo species. Additionally, as the Study Area is not within the known or predicted breeding range of the species, no trees are considered potential breeding habitat.

- There was no direct or indirect evidence (e.g. guano deposits or discarded feathers) of roosting found within the Indicative Project Footprint.

- The DBCA roosting sites dataset for black-cockatoos holds no records of roosting sites for the Baudin's Black-Cockatoos (DBCA, 2019b). Habitat comprising of Marri, Flooded gum and York gum woodlands occur within the Study Area, providing potential areas of breeding, roosting and refuge; however, habitats within the broader region may be more suitable than habitats within the Study Area. The species is unlikely to be concentrated in the Study Area and may only occasionally occur when foraging.
- The recovery plan for Baudin's Black-Cockatoo (DEC, 2008) identifies critical habitat as all Marri, Karri and Jarrah forests, woodlands and remnants in the southwest of Western Australia receiving more than 600 mm of annual average rainfall, while annual average rainfall in Narrogin was approximately 442.3 mm between 1991-2020 (BOM, 2024a).
- Based on the assessment, the Baudin's Black-Cockatoo may potentially be a seasonal visitor that forages and/or roosts in the Study Area during the non-breeding season, however no evidence of either was recorded during field surveys.

The extent of native vegetation considered to be potential habitat that may be cleared within the Study Area is summarised in **Table 9.5** and **Table 9.6**.

Table 9.5 Potential Impact to Foraging Habitat: Baudin's Black-Cockatoo

Fauna Habitat Type	Extent in Study Area	Extent in Indicative Project Footprint	
	DAWE (2022) method	DAWE (2022) method	BCE (2020) method
High-quality foraging habitat (Score >=5)	407.9 ha	4.61 ha	3.32 ha
Low-quality foraging habitat (Score <5)	0 ha	0 ha	3.41 ha

Table 9.6 Potential Impact to Roosting Habitat: Baudin's Black-Cockatoo

Fauna Habitat Type	Extent in Study Area	Extent in Indicative Project Footprint
Roosting habitat	n/a	0 ha

9.2.3.3 Carnaby's Black-Cockatoo

- The Carnaby's Black-Cockatoo was recorded within the Additional Survey Area, east of the Study Area, flying through eucalypt woodland habitat with a flock of three individuals flying at a height between 20 and 40 m AGL. The Carnaby's Black-Cockatoo was also recorded during the fauna survey conducted by Western Wildlife through secondary evidence and once via calls, with the records of secondary (foraging) evidence being recorded within the Study Area and the remainder being within the Additional Survey Area. All records were within Eucalypt woodland habitat. Therefore the Carnaby's Black-Cockatoo is conservatively considered as known to occur within the Study Area. The Additional Survey Area has been removed from the Project to avoid potential impacts to the area where this species was most recorded.
- Approximately 60% of the Indicative Project Footprint was subjected to the detailed fauna habitat assessment (Umwelt, 2024a), with a total of 109 trees meeting the suitable or potential nest tree criteria of DBH greater than 500 mm. Of these 109 trees assessed, no trees with active or historical evidence of nesting were found (Rank 1 or 2 trees), five Rank 3 trees containing potentially suitable hollows were identified, and the remaining trees did not have potentially suitable hollows (Rank 4

and 5). The remaining areas proposed for clearing will be subject to targeted survey and all Rank 1 or 2 trees will be avoided. No direct or indirect evidence of breeding or roosting was found within the Indicative Project Footprint during the targeted mapping for black-cockatoo species.

- A review of the DBCA (2019b) dataset for black-cockatoo roosting sites identified that a roosting site for Carnaby's Black-Cockatoo exists approximately 8 km east of the Study Area in Narrogin and another 12.6 km north of the Study Area in Lol Gray State Forest as shown in **Figure 9.1**. The DBCA (2018a) dataset for confirmed breeding sites has also identified a breeding site approximately 12 km southeast of the Study Area likely within the Highbury State Forest as shown in **Figure 9.1**. Recent records of the species in the DBCA (2023a), Atlas of Living Australia (2024) and eBird databases (Cornell Lab of Ornithology, 2024) are also numerous in the region surrounding the Study Area, particularly to the north in the Dryandra Woodland National Park and Lol Gray State Forest conservation mosaic. Habitat comprising of Marri, Flooded gum and York gum woodlands occur within the Study Area, providing potential areas of breeding, roosting and refuge; however, habitats within the broader region may be more suitable than habitats within the Study Area and the species is unlikely to be concentrated in the Study Area.

- Based on the assessment, the Carnaby's Black-Cockatoo is a seasonal visitor likely to forage and/or roost in the Study Area and may breed in large tree hollows, however no evidence of roosting or breeding was recorded within the Indicative Project Footprint as noted above.

The extent of native vegetation considered to be potential foraging, roosting, and breeding habitat that may be cleared within the Study Area is summarised in **Table 9.7** and **Table 9.8**. Pasture and copped areas may have some opportunistic foraging value; however, the food source is available for a short period of time due to pasture being impacted by livestock and cropping being cut when ripe. Breeding trees have not been assessed for the whole Indicative Project Footprint, but based on data available the Project commits to not removing any Rank 1 or 2 trees, and minimising impact to Rank 3 trees.

Table 9.7 Potential Impact to Foraging Habitat: Carnaby's Black-Cockatoo

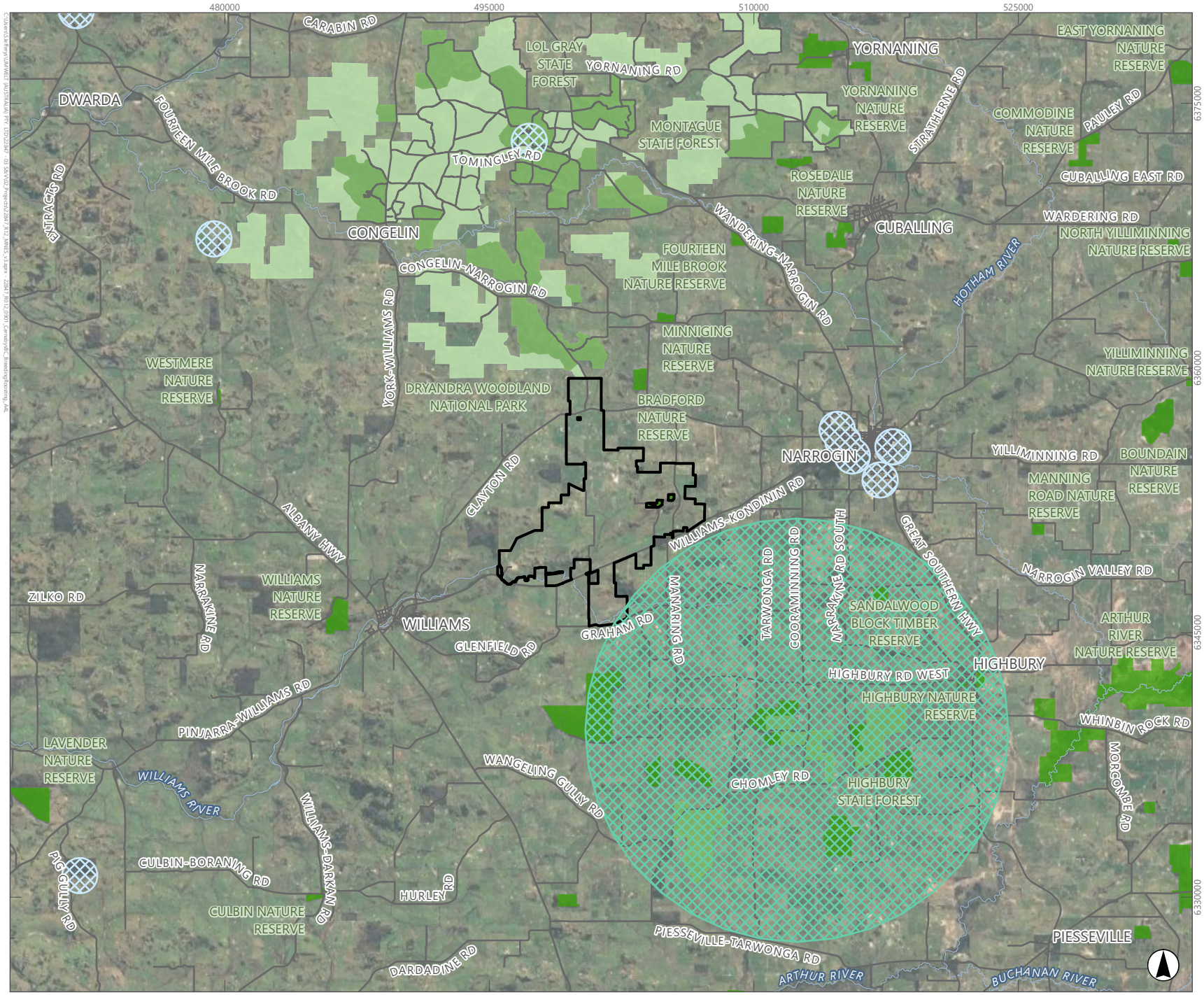
Fauna Habitat Type	Extent in Study Area	Extent in Indicative Project Footprint	
	DAWE (2022) method	DAWE (2022) method	BCE (2020) method
High-quality foraging habitat (Score >=5)	407.9 ha	4.61 ha	3.32 ha
Low-quality foraging habitat (Score <5)	0 ha	0 ha	5.07 ha

Table 9.8 Potential Impact to Roosting and Breeding Habitat: Carnaby's Black-Cockatoo

Fauna Habitat Type	Extent in Study Area	Extent in Indicative Project Footprint
Roosting habitat	n/a	0 ha
Potential breeding habitat#	1,013.9 ha	7.41 ha
Possible breeding habitat	90.8 ha	0.015 ha
Rank 1 or 2 trees	n/a	0
Rank 3 trees	n/a	5*
Rank 4 trees	n/a	1*
Rank 5 trees	n/a	103*

Note. #Excludes area mapped as "Potential breeding habitat in Isolated Paddock Trees". *Trees recorded in approximately 60% of the Indicative Project Footprint.

FIGURE 9.1
Carnaby's Black-Cockatoo Breeding and Roosting Sites



Legend

- Study Area
- Road
- Major Watercourse
- Nature Reserve
- National Park
- State Forest
- Black Cockatoo Roosting Sites - Buffered (DBCA-064)
- Carnabys Cockatoo Confirmed Breeding Areas within the Swan Coastal Plain and Jarrah Forest IBRA Regions (DBCA-054)

0 6 12

Kilometres

Scale 1:300,000 at A4
GDA2020 MGA Zone 50

Image Source: ESRI Basemap (2023) | **Data Source:** Landgate (2023), Umwelt (2023), DBCA (2018, 2019, 2023)

9.2.4 Other Impacts

The potential for turbine collision during the operational phase has also been assessed for black-cockatoos. As outlined in **Section 7.2.2**, the likelihood of turbine collision is considered to be low due to the available information on flight behaviours for the species and the results of mortality monitoring at other wind farms such as:

- Black-cockatoos are considered likely to fly at or below canopy height (i.e. tree- or shrub-height, where applicable) when foraging, and at or just above canopy height when in longer-distance transit such as between foraging, roosting and watering areas. It is considered that the flight height for these species is typically up to c. 10 m above canopy height in these instances (Umwelt, 2024c).
- RPS (2010) found that Carnaby's Black-Cockatoo tend to frequent low-lying areas of the landscape with flight movements following valleys with woodland vegetation with 88% of observations for the species as flying below 40 m (n=100 observations). EPA (2019) also noted that the Carnaby's Black-Cockatoo tends to follow vegetation corridors, actively avoiding cleared and open areas. When crossing areas of expansive open ground (or low vegetation such as heaths) black-cockatoos tend to fly close to the ground surface. This is likely applicable to all black-cockatoo species found in southwest WA.
- Instances where black-cockatoos may otherwise exceed 50 m AGL in flight height are likely restricted to evading large predatory raptors such as eagles or when congregating in large numbers. While Wedge-tailed eagles were recorded within the Study Area during the field survey program, black-cockatoos were not directly observed and only recorded via secondary and aurally records over four separate fauna surveys and BBUS over a total of 18 survey days.
- Post-commissioning monitoring for the Carnaby's Black-Cockatoo at Badgingarra wind farm in 2019 recorded no collisions with turbines (Ecoscape, 2019), and none were reported at the Warradarge Wind Farm Perth during monitoring from 2020 to 2022 (Bright Energy Investments, n.d.). For both of these projects the minimum tip height was lower than the proposed Narrogin Wind Farm so the risk of impacts from this project is relatively lower. The search method for carcasses as Warradarge Wind Farm is not publicly available and Badgingarra wind farm undertook a total of six surveys in 2019 at eight reference turbine sites and eight randomised turbine sites using a search area of 250 m x 250 m.

9.2.5 Assessment Against Significant Impact Criteria

An assessment of the significance of impacts to the three black-cockatoo species under the Significant Impact Guidelines 1.1 – MNES (Department of the Environment, 2013a) is provided in **Table 9.9**, **Table 9.10**, and **Table 9.11**. The assessment identified that the Project is unlikely to have a significant impact on any of these species.

Table 9.9 Forest Red-tailed Black-Cockatoo Significant Impact Assessment

Significant Impact Criteria	Assessment of the Project	Outcome
1. **Lead to a long-term decrease in the size of an important population of a species**	The DAWE (2022) referral guideline states that due to the mobile and wide-ranging nature of black-cockatoo species in WA, as well as the variation in flock compositions, it is considered more appropriate to assess the significance of potential impacts to individuals and/or habitat rather than distinct populations. The Forest Red-tailed Black-Cockatoo was not directly recorded within the Study Area during fauna surveys or BBUS undertaken between Spring 2023 and Summer 2024, over a total of 18 survey days. No foraging evidence was recorded during the basic fauna survey (Western Wildlife, 2024), and there was scant evidence of black-cockatoos having foraged within the area assessed during a targeted assessment of 60% of the Indicative Project Footprint (Umwelt, 2024b).. The Forest Red-tailed Black-Cockatoo was recorded once in the Additional Survey Area, with a small flock of likely two birds heard in Eucalypt – Sheoak woodland (Western Wildlife, 2024). These results suggest an absence of resident or otherwise large flocks that utilise the Study Area regularly. The Study Area is located near the eastern limit of the species range, with occurrences recorded within the township of Narrogin in DBCA (2023a) and eBird databases (Cornell Lab of Ornithology, 2024) being at the species' easternmost limit in the Wheatbelt. The species may still potentially be a seasonal visitor that forages and/or roosts in the Study Area in small numbers and may breed in large tree hollows when present, although no trees with active or historical evidence of nesting were found during either the basic fauna survey or during the targeted assessment of areas of the Disturbance Corridor. There are no mapped roosting or breeding sites held within the DBCA datasets for black-cockatoo roosting or breeding sites for the Forest Red-tailed Black-Cockatoo (DBCA 2019a, 2019b). Patches of habitat comprising of Marri, Flooded gum and York gum woodlands that occur within the Study Area potentially provide areas of breeding, roosting and refuge, and vegetation comprising Marri and Jarrah that are present may provide areas of foraging habitat. However, habitats within the broader region such as Lol Gray State Forest and Dryandra Woodland National Park located to the north of the Study Area may be more suitable than the fragmented and degraded vegetation found within the Study Area. No evidence of roosting was recorded during field surveys. It is therefore considered unlikely that the permanent removal of up to 3.32 ha of high-quality native foraging habitat and 3.38 ha of low-quality native foraging habitat distributed across 20 separate patches within the Study Area will lead to a long-term decrease in the size of an important population of Forest Red-tailed Black-Cockatoos, as populations are unlikely to be concentrated within the Study Area and there is comparatively extensive suitable habitat within the broader region that remains protected. A collision risk assessment for the Forest Red-tailed Black-Cockatoo was undertaken to assess the likelihood and consequence of turbine collision for the species (provided as part of **Appendix D**). While the species received an overall Moderate level of concern risk ranking, this was in large part due to the consequences of collision rather than their likelihood of flying at RSA height. As the Study Area is at the easterly limit of the species' range, it is unlikely the Study Area occurs within a regular movement pathway. The potential for collision with blades was considered to be low as available literature and knowledge of species' flight behaviours suggest they typically fly below the minimum RSA height of 49 m AGL (see **Section 7.2.2**). A preliminary Bird and Bat Management Plan specific to the Project has been developed, including specific measures to mitigate potential operational impacts. Based on the above, it is considered unlikely that the Project will lead to a long-term decrease in the size of an important population.	The Project is unlikely to be at variance with this criterion

Significant Impact Criteria	Assessment of the Project	Outcome
2. **Reduce the area of occupancy of an important population**	The Forest Red-tailed Black-Cockatoo has an estimated area of occupancy between 6,600 km^2 to 8,800 km^2 (Johnstone, Kirkby, Warren, Rycken, et al., 2021). The species has also shown a change in foraging ecology over the past 20 years with flocks recorded foraging further east into the Wheatbelt (Johnstone & Kirby, 1999). The Study Area is located near the eastern limit of the species range, with occurrences recorded within the township of Narrogin in DBCA (2023a) and eBird databases (Cornell Lab of Ornithology, 2024) being at the species' easternmost limit in the Wheatbelt. A univariate analysis of Carnaby's Black-Cockatoo abundance following the construction of a wind farm found that reference sites had higher counts of the species when compared to impact sites; however, the analysis also identified a large statistically significant difference between years of monitoring and concluded that the difference in abundance may not be attributable to the presence of turbines alone (Ecoscape, 2019). While the study was undertaken for Carnaby's Black-Cockatoos it is likely relevant for all black-cockatoo species assessed here. There are no mapped roosting or breeding sites recorded for the Forest Red-tailed Black-Cockatoo in the publicly available DBCA roosting or breeding site datasets (DBCA, 2019a; DBCA, 2019b). Habitat comprising of Marri, Flooded gum and York gum woodlands occur within the Study Area, potentially providing areas of breeding, roosting and refuge; however, habitats within the broader region may be more suitable than habitats within the Study Area. The Project will result in the clearing of approximately 3.32 ha of high-quality native foraging habitat and 3.38 ha of low-quality native foraging habitat distributed across 20 patches, with the majority (85%) of clearing patches being less than 0.5 ha in size. The proposed clearing primarily consists of the edges of fragmented patches and comprises 1.64% of all suitable native foraging habitat within the Study Area. Targeted mapping of 60% of the Indicative Project Footprint within the Development Corridor has assessed 109 suitable or potential nesting trees with a DBH of 500 mm or greater. Of these 109 trees assessed, no trees with active or historical evidence of nesting were found (Rank 1 or 2 trees), five Rank 3 trees containing suitable hollows were identified, and the remaining trees did not have potentially suitable hollows (Rank 1 and 2). No direct or indirect evidence of roosting was found within the Indicative Project Footprint during the targeted mapping for black-cockatoo species (Umwelt, 2024b). Within a 20 km radius of the Study Area there is approximately 27,255 ha of land managed and protected for conservation purposes and approximately 9,268 ha within a 12 km radius (DBCA, 2024) (**Figure 9.2**). Much of this land consists of the Lol Gray State Forest and Dryandra Woodland National Park located to the north of the Study Area, which have a number of records for the species in the eBird database (Cornell Lab of Ornithology, 2024) and is known to contain habitat species suitable for the foraging, breeding, and roosting of Forest Red-tailed Black-Cockatoo (commonly Marri, Jarrah, Flooded gum, York gum, Wandoo, with common but localised areas of *Allocasuarina huegliana*) (Keighery & Keighery, 2012). The removal of suitable Forest Red-tailed Black-Cockatoo foraging habitat is not considered to be unique and is comparatively minor and there is similar or better quality habitat which is protected within a 20 km radius (0.025%), and a 12 km radius (0.072%) of the Study Area. The WA Department of Primary Industries and Regional Development (DPIRD) has mapped a total of 49,139 ha of native vegetation within a 20 km radius of the Study Area, and 19,934 ha within a 12 km radius (DPIRD, 2023), much of which is located within the lands managed and protected for conservation captured above but also includes remnant roadside vegetation and native vegetation occurring within freehold land (**Figure 9.3**). The removal of fragmented Forest Red-tailed Black-Cockatoo foraging habitat within the Study Area represents 0.014% of native vegetation within a 20 km radius, and 0.034% of native vegetation within a 12 km radius.	The Project is unlikely to be at variance with this criterion

Significant Impact Criteria	Assessment of the Project	Outcome
	Therefore, it is considered unlikely that the permanent removal of up to 6.70 ha of fragmented and degraded Forest Red-tailed Black-Cockatoo habitat within the Study Area will materially reduce the area of occupancy for the species as populations are unlikely to be concentrated within the Study Area and there is comparatively extensive potential habitat within a 12 km and 20 km radius that remains protected.	
3. Fragment an existing important population into two or more populations	The species is considered unlikely to be concentrated in the Study Area. Results of field surveys suggest an absence of resident or otherwise large flocks that utilise the Study Area regularly, which is expected given the Study Area is located at the eastern limit of the species' known range and that there are relatively limited habitat values present (Umwelt, 2024b, 2024c; Western Wildlife, 2024). The species may still potentially be an occasional visitor that forages and/or roosts in the Study Area in small numbers in response to food resource or water availability and may breed in large tree hollows, noting that no evidence of hollows being used for breeding was recorded in the Disturbance Corridor. The Forest Red-tailed Black-Cockatoo is considered to rarely fly at RSA given current knowledge of black-cockatoo flight behaviours (see **Section 7.2.2**). In circumstances where birds are passing across less-expansive cleared areas between patches of remnant trees or isolated individual trees (as is present throughout much of the Study Area) they usually maintain a 'canopy height' flight path (Umwelt, 2024b) which is likely to be below the minimum RSA height for the Project (49 m AGL) given the presence of mainly isolated paddock trees at a maximum of 15–30 m AGL in height. Further, considering the spacing of turbines within the Study Area, the potential for blade strike is very low. The Project Area has been reduced to avoid the highest quality Forest-tailed Black-Cockatoo habitat and the only location where the species was directly observed during any of the fauna surveys or BBUS. By reducing the Project Area and removing turbines that would otherwise be enveloping this large patch of higher-quality habitat, the risk of turbines interrupting the regional movement of the species has been minimised. Turbines and associated infrastructure in the Study Area are unlikely to interrupt regional movement of the species such that a population is fragmented. Turbines are approximately 6 km in distance from their easternmost to westernmost points, as well as from their northernmost to southernmost points, and the distribution of native vegetation in the areas surrounding the Development Corridor will continue to provide foraging opportunities for the species if flocks were to move through the landscape between potential roosting or breeding sites to the north, east, or south. The locations of wind turbines range between 540-1,050 m in distance from their nearest neighbouring turbine which is likely to provide sufficient space for black-cockatoo species to exhibit meso-avoidance of operating turbines and continue to utilise open areas for movement where necessary. Additionally, the minimum RSA height is 49 m AGL and available information indicates these species typical fly below this height through landscapes present within the Study Area. Almost all electrical cabling associated with the Project has been located underground, with overhead cabling only proposed in the southernmost section of the Study Area over Williams-Narrogin Highway to the existing 220 kV transmission line. The maximum loss of 6.70 ha of native vegetation comprising suitable foraging habitat for the species will be distributed across the Final Project Footprint and will not substantially increase fragmentation effects. Therefore, it is considered unlikely that the Project would result in the fragmentation of populations of Forest Red-tailed Black-Cockatoo as a result of either collision risk, habitat loss, or altered movement patterns across the broader landscape.	The Project is unlikely to be at variance with this criterion

Significant Impact Criteria	Assessment of the Project	Outcome
4. **Adversely affect habitat critical to the survival of a species**	The recovery plan for Forest Red-tailed Black-Cockatoos identifies habitat critical to the survival of these species as areas (Department of Environment and Conservation (DEC), 2008): • currently occupied by the cockatoos • not currently occupied by the cockatoos due to recent fire but capable of supporting cockatoo populations when sufficiently recovered • of natural vegetation in which the cockatoos nest, feed and roost • of natural vegetation through which the cockatoos can move from one occupied area to another • of suitable vegetation within the recorded range in which undiscovered cockatoo populations may exist. The recovery plan for Forest Red-tailed Black-Cockatoos identifies critical habitat as all Marri, Karri and Jarrah forests, woodlands and remnants in the southwest of Western Australia receiving more than 600 mm of annual average rainfall. However, annual average rainfall in Narrogin was approximately 442.3 mm between 1991-2020 (Bureau of Meteorology (BOM), 2024a), and on this basis does not meet this criterion. However, given the extensive clearing of native vegetation across much of the Wheatbelt region, all breeding habitat and associated foraging habitat can be considered to be critical habitat to the Forest Red-tailed Black-Cockatoo and breeding home ranges are estimated at up to 12 km from nests for black-cockatoos (DAWE, 2022). There are no roosting or breeding sites for the Forest Red-tailed Black-Cockatoo mapped within the DBCA datasets for black-cockatoo roosting and breeding sites (DBCA, 2019a; DBCA, 2019b). Habitat comprising of Marri, Flooded gum and York gum woodlands occur within the Study Area, providing areas of potential breeding, roosting and refuge; however, habitats within the broader region may be more suitable than habitats within the Study Area. The Project will result in the clearing of approximately 3.32 ha of high-quality native foraging habitat, and 3.38 ha of low-quality native foraging habitat, which comprises 1.64% of all suitable native foraging habitat within the Study Area. Targeted mapping of 60% of the Indicative Project Footprint has assessed 109 suitable or potential nesting trees with a DBH of 500 mm or greater. Of these 109 trees assessed, no trees with active or historical evidence of nesting (Rank 1 and 2) were found and 5 trees containing suitable hollows were identified (Rank 3). No direct or indirect evidence of roosting was found within the Indicative Project Footprint during the targeted mapping for black-cockatoo species (Umwelt, 2024a). The proposed clearing comprises the edges of small, disconnected patches of remnant vegetation that are separated from large tracts of black-cockatoo habitat by cleared agricultural land. The Project has been designed to avoid the majority of black-cockatoo habitat in the Study Area and Additional Survey Area, including the highest quality native vegetation patch located outside the Western boundary of the Study Area within the Additional Survey Area. Given the quantum of habitat that will be retained in the Study Area, habitat in adjacent conservation areas that is anticipated to be preferred, no disturbance of breeding trees with active or historical evidence of use (Rank 1 and 2), disturbance of trees containing suitable hollows being minimised, and active management of indirect impacts, no adverse impacts to habitat critical to the survival of the species will occur.	The Project is unlikely to be at variance with this criterion

Significant Impact Criteria	Assessment of the Project	Outcome
5. **Disrupt the breeding cycle of an important population**	A targeted assessment of Forest Red-tailed Black-Cockatoo breeding habitat across 60% of the Indicative Project Footprint has identified no active or highly likely breeding trees (i.e. exhibiting historical evidence of breeding) with suitable hollows. A total of five Rank 3 trees were recorded with potentially suitably sized and located hollows, and one Rank 4 tree considered to have a suitably sized hollow but of unsuitable orientation and/or height. The remaining trees assessed which had a Diameter at Breast Height (DBH) of 500 mm or more contained no suitably sized hollows for nesting (Umwelt, 2024a). As the Indicative Project Footprint undergoes further refinement within the Development Corridor, the Project will ensure all trees with a DBH of 500 mm or more within the Final Project Footprint are surveyed. All breeding trees that exhibit active or historical use (Rank 1 and 2) will be identified and avoided by the Project with sufficient exclusion areas set-up around them to maintain their integrity throughout construction activities. Disturbance of Rank 3 trees will be minimised. Additionally, a Bird and Bat Management Adaptive Plan will be implemented and relevant measures incorporated into the Project's CEMP to ensure a pre-clearance survey of trees and native vegetation is undertaken by a suitably qualified fauna spotter for the presence of breeding pairs or chicks. Should an active hollow be identified, no clearing will be permitted and sufficient exclusion areas will be established. Therefore, it is considered unlikely that the Project will disrupt the breeding cycle of any Forest Red-tailed Black-Cockatoo actively breeding within the Study Area. There was no evidence of active breeding recorded during fauna surveys across the Study Area or Additional Survey Area (Umwelt, 2024a, 2024b; Western Wildlife, 2024), although there is potential that breeding occurs in the areas of suitable habitat north of the Study Area in Dryandra Woodland National Park and Lol Gray State Forest. There are no breeding sites mapped for the Forest Red-tailed Black-Cockatoo in the DBCA (2019a) dataset for known black-cockatoo breeding areas. Breeding home ranges are estimated at up to 12 km from nests for black-cockatoos, but foraging habitat in the northern region outside of the Study Area is more extensive, has better connectivity and likely to be of higher value than that within the Study Area, particularly across the Dryandra Woodland National Park and Lola Gray State Forest conservation mosaic as well as the Montague State Forest east of these areas. It is likely that the Forest Red-tailed Black-Cockatoo rarely flies at RSA, given the available information and data on flight heights and behaviours of black-cockatoo species (see **Section 7.2.2**). Considering the context of habitat in the Study Area, the management measures that will be implemented, and the flight behaviour of Forest Red-tailed Black-Cockatoo, it is considered unlikely that the Project will disrupt the breeding cycle of Forest Red-tailed Black-Cockatoo within the Study Area or surrounds.	The Project is unlikely to be at variance with this criterion

Significant Impact Criteria	Assessment of the Project	Outcome
6. **Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline**	Habitat comprising of Marri, Flooded gum and York gum woodlands occur within the Study Area, providing areas of breeding, roosting and refuge. However, foraging habitat within the Study Area is heavily fragmented and proposed clearing in these areas is primarily restricted to individual trees or 20 patches of vegetation at the perimeter of larger remnant patches which themselves are of degraded condition. Habitats within the broader region are likely to be more intact and of higher quality than habitats within the Study Area. The Project will result in the clearing of approximately 3.32 ha of high-quality but fragmented foraging habitat, and 3.38 ha of low-quality foraging habitat, which comprises 1.64% of all suitable foraging habitat within the Study Area. Proposed clearing areas are very fragmented, with approximately 85% of clearing being <0.5 ha edges of small, degraded vegetation patches. Targeted mapping of 60% of the Indicative Project Footprint has assessed 109 suitable or potential nesting trees with a DBH of 500 mm or greater. Of these 109 trees assessed, no trees with active or historical evidence of nesting (Rank 1 and 2) were found and 5 trees containing suitable hollows were identified (Rank 3). The remaining areas proposed for clearing will be subject to targeted survey. No direct or indirect evidence of roosting was found within the Indicative Project Footprint during the targeted mapping for black-cockatoo species (Umwelt, 2024a). The proposed clearing of 6.70 ha of fragmented Forest Red-tailed Black-Cockatoo habitat represents a permanent removal of 0.072% of similar or suitable habitat within the 12 km zone, and 0.025% of similar or suitable habitat within the 20 km zone. The removal of suitable Forest Red-tailed Black-Cockatoo habitat within the Study Area represents 0.014% of native vegetation within a 20 km radius, and 0.034% of native vegetation within a 12 km radius (see **Criteria 2**). This is a very low proportion of impact to habitat that is fragmented and relatively lower quality than the intact surrounding national park and state forest habitat and therefore is unlikely to result in a decline of the species. Additionally, Project infrastructure has undergone an iterative design process to consider values identified through surveys and avoid areas of native vegetation and ecological value with the majority of proposed ground disturbance (95.6%) restricted to areas of existing disturbance. Therefore, it is considered unlikely that the proposed permanent removal of vegetation or the operation of wind turbines will alter habitat to the extent where the species is likely to decline.	The Project is unlikely to be at variance with this criterion
7. **Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat**	Corellas (*Cacatua pastinator* and *C. sanguinea*) and Western Galahs (*Eolophus roseicapilla roseicapilla*) are known to be active competitors for nest hollows that are suitable for breeding by black-cockatoo species, but are native to Western Australia. The introduced Long-billed Corella (*C. tenuirostris*) is not known to occur in the Wheatbelt and is considered unlikely to be introduced or established as a result of the Project. Feral European honeybees (Apis mellifera) can also compete with black-cockatoos for suitable nest hollows. No corellas or European honeybees were recorded during the fauna survey program, including targeted habitat assessments in the Indicative Project Footprint. Western Galahs were recorded at four of the vantage points during the BBUS undertaken within the Study Area (comprising flocks of 2-4) and at one location in the Additional Survey Area (comprising a flock of 11) (Umwelt, 2024c). No activities associated with the construction or operation of the Project are considered likely to result in the introduction or expansion of these species. The highest level of activity and vehicle movement on the site will be during construction activities. During this time, vehicle hygiene measures will be implemented to reduce risk of invasive species entering the site. Therefore, the Project is considered unlikely to result in invasive species becoming established within the Study Area that pose a threat to Forest Red-tailed Black-Cockatoo.	The Project is unlikely to be at variance with this criterion

Significant Impact Criteria	Assessment of the Project	Outcome
8. **Introduce disease that may cause the species to decline**	Diseases which may pose threats to the Forest Red-tailed Black-Cockatoo includes Psittacine Beak and Feather Disease (PBFD), *Phytophthora* dieback which poses a threat to foraging and breeding species recorded within the Study Area such as Jarrah, and Marri canker disease and Marri shoot blight which pose a threat Marri. The cause of PBFD is the beak and feather disease virus (BFDV), while other infectious diseases impacting black-cockatoo species found in southwest WA include avian polyomavirus (APV) and chlamydophilosis (Department of Parks and Wildlife (DPAW), 2013a). The potential for these diseases to be spread as a result of Project activities is considered to be highly unlikely as the disease is primarily spread through transmission from infected birds or nesting material which may be exacerbated by the high concentrations of individuals congregating in areas and feeding by the public without proper sanitation of feeding areas. The nearest Forest Disease Risk Area for *Phytophthora* dieback mapped by DBCA is located approximately 50 km west of the Study Area. Areas susceptible to Phytophthora dieback are restricted to those receiving >400 mm of annual rainfall, with areas between 400-600 mm of annual rainfall that are most susceptible generally being associated with high summer rainfall averages and water gaining sites. Narrogin is located within the 400 mm isohyet and is therefore susceptible to *Phytophthora* dieback introduction or spread. Although no known Phytophthora dieback infection sites are known within or in proximity to the Study Area, the Project will implement biosecurity protocols as part of its CEMP to minimise this risk. Marri canker disease and Marri shoot blight are caused by fungal pathogens. Both diseases have been causing a decline in Marri over a number of years and due to their impact on both reproductive and vegetative tissues, affect the capacity for these trees to provide foraging and breeding habitat for black-cockatoo species. While Marri canker disease is suspected to be endemic to southwest WA, Marri shoot blight is an introduced disease and no control or management options have been developed for WA (Marbus et al., 2011; Paap et al., 2012). The Project will implement standard biosecurity management practices to minimise the risk of introduction or spread of these diseases. Biosecurity management measures to manage the diseases identified above will include: • Ensuring all ground disturbing plant and equipment enter site clean and free of weeds or dieback • Designated access tracks within site • Clean fill certificates for any imported fill used on-site Therefore, the Project is considered unlikely to result in the introduction of diseases that may cause the species to decline.	The Project is unlikely to be at variance with this criterion

Significant Impact Criteria	Assessment of the Project	Outcome
9. **Interfere substantially with the recovery of the species**	Threats identified to the recovery of the Forest Red-tailed Black-Cockatoo include nest hollow shortages, habitat clearing and degradation, and illegal shooting (DEC, 2008), although the recovery plan is noted as not current. No activities associated with the construction or operation of the Project are considered likely to result in the introduction or spread of species known to be active competitors for nest hollows that are suitable for breeding by black-cockatoo species. The permanent removal of habitat within the Study is not considered to be significant to the extent that it will result in a reduction in the area of occupancy of the species or the decline of the species given the presence of extensive, well connected, and suitable habitat in the immediate surrounds of the Study Area. Much of the suitable habitat present within the Study Area has been avoided by the Project and breeding trees that exhibit active or historical use (Rank 1 and 2) will be identified and wholly avoided by the Project with sufficient exclusion areas set-up around them to maintain their integrity throughout construction activities and clearing of Rank 3 trees will be minimised. Additionally, a Bird and Bat Adaptive Management Plan will be implemented and relevant measures incorporated into the Project's CEMP to ensure a pre-clearance survey of trees and native vegetation is undertaken by a suitably qualified fauna spotter for the presence of breeding pairs or chicks. Should an active hollow be identified, no clearing will be permitted and sufficient exclusion areas will be established. Forest Red-tailed Black-Cockatoos typically fly below RSA height, given the available information and data on flight heights and behaviours of black-cockatoo species, and thus the loss of individuals through collision with turbines is unlikely (see **Section 7.2.2**). Further, no individuals were recorded in the Study Area over four surveys, so while it is known to occur in the area the survey data suggests it will not occur in large numbers. A BBAMP will be implemented for a nominated period following commissioning of the wind farm which will monitor and manage any potential risk of collision through an adaptive management framework. The identification of a single carcass or evidence of collision will trigger a management response that would involve a re-assessment of risk and subsequent implementation of suitable mitigation measures. Therefore, the Project is not considered to substantially interfere with the recovery of the Forest Red-tailed Black-Cockatoo.	The Project is unlikely to be at variance with this criterion

Table 9.10 Baudin's Black-Cockatoo Significant Impact Assessment

Criteria	Assessment of the Project	Outcome
1. Lead to a long-term decrease in the size of a population	A 'population of a species' is defined under the EPBC Act as an occurrence of the species in a particular area. In relation to critically endangered, endangered or vulnerable threatened species, occurrences include but are not limited to: • a geographically distinct regional population, or collection of local populations, or • a population, or collection of local populations, that occurs within a particular bioregion. A population has not been defined for black-cockatoo species in Western Australia due to their mobile and widely dispersed nature as well as the variation in flock compositions. Therefore, it is considered more appropriate to consider impacts to habitats and individuals rather than a population (DAWE, 2022). The Baudin's Black-Cockatoo was not recorded during the field survey program within the Study Area or Additional Survey Area and is considered to potentially occur in the Study Area only as an occasional foraging visitor. The Study Area is located outside of the known breeding range for the species and falls on the eastern boundary of their modelled distribution (DAWE, 2022). In the non-breeding season this species ranges more widely than the breeding season, foraging primarily in habitats that contain Marri, and their distribution is probably defined by where Marri trees occur. Baudin's Cockatoos feed mainly on the seeds of eucalypts, with most of their diet consisting of Marri seeds. They also feed on seeds from other plants (e.g., Jarrah, Banksia, Hakea or commercial orchard crops such as apples and pears) and take some invertebrate material by stripping bark from trees (Johnstone & Storr, 1998). Roosting habitat is generally in the tallest trees in riparian habitats, near permanent water or in sheltered gullies (Johnstone & Kirby, 1999). Potential foraging habitat in the Study Area is present in areas with Marri, Jarrah and/or areas with shrubby *Banksia* spp. in the understorey; however, no evidence of foraging was recorded during the fauna survey program despite the abundance of Marri, a favoured food-plant. The Project will result in the clearing of approximately 3.32 ha of high-quality foraging habitat, and 3.41 ha of low-quality foraging habitat, which comprises 1.64% of all suitable foraging habitat within the Study Area. Additionally, no evidence of roosting was recorded during field surveys of portions of the Indicative Project Footprint. It is therefore considered unlikely that the permanent removal of foraging habitat within the Study Area will lead to a long-term decrease in the size of an important population of Baudin's Black-Cockatoos, as populations may only occasionally occur as a foraging visitor within the Study Area and there is comparatively extensive suitable habitat within in the broader region that remains protected. A collision risk assessment for the Baudin's Red-tailed Black-Cockatoo was undertaken to assess the likelihood and consequence of turbine collision for the species (provided as part of **Appendix D**). While the species received an overall Moderate risk ranking, this was in large part due to the consequences of collision rate than their likelihood of occurrence within the Study Area. As the Study Area is at the easterly limit of the species' range, it is unlikely the Study Area occurs within a regular movement pathway. The likelihood of the species occurring within the RSA of turbines, and thus their actual potential for collision with blades, was considered to be low as available literature and knowledge of species' flight behaviours suggest they are unlikely to fly above the minimum RSA height of 49 m AGL (see **Section 7.2.2**). A preliminary Bird and Bat Management Plan specific to the Project has been developed (**Appendix D**), including specific measures to mitigate potential operational impacts. These measures include monitoring during potentially higher activity periods and responding to any incidents of mortality including consultation with DBCA. Based on the above, it is considered unlikely that the Project will lead to a long-term decrease in the size of a population of Baudin's Black Cockatoo.	The Project is unlikely to be at variance with this criterion

Criteria	Assessment of the Project	Outcome
2. Reduce the area of occupancy of the species	The Baudin's Black-Cockatoo has an area of occupancy estimated at between 2,900 km^2 and 4,900 km^2 (Johnstone et al., 2021). A consequence of the steep population decline recorded for this species is likely to have been a contraction of their range over time. The Study Area is located outside of the known breeding range for the species and falls on the eastern boundary of their modelled distribution (DAWE, 2022). Baudin's Black-Cockatoo is considered to potentially occur in the Study Area only as an occasional foraging visitor. Potential foraging habitat is present in areas with Marri and/or areas with shrubby *Banksia* spp. in the understorey, however no evidence of foraging was recorded during the fauna survey program despite the abundance of Marri, a favoured food-plant. A univariate analysis of Carnaby's Black-Cockatoo abundance following the construction of a wind farm found that reference sites had higher counts of the species when compared to impact sites; however, the analysis also identified a large statistically significant difference between years of monitoring and concluded that the difference in abundance may not be attributable to the presence of turbines alone (Ecoscape, 2019). While the study was undertaken for Carnaby's Black-Cockatoos it is likely relevant for all black-cockatoo species assessed here. The Project will result in the clearing of approximately 3.32 ha of high-quality native foraging habitat, and 3.41 ha of low-quality native foraging habitat, which comprises 1.64% of all suitable native foraging habitat within the Study Area. No direct or indirect evidence of roosting was found within the Indicative Project Footprint during the targeted mapping for black-cockatoo species (Umwelt, 2024a). Additionally, the Study Area is located outside of the breeding range for this species. Habitat comprising of Marri, Jarrah and Wandoo woodlands with isolated shrubs to shrublands including *B. sessilis* occur within the Study Area, providing areas of foraging, roosting, and refuge; however, habitats within the broader region may be more suitable than habitats within the Study Area. Within a 20 km radius of the Study Area there is approximately 27,255 ha of land managed and protected for conservation purposes and approximately 9,268 ha within a 12 km radius (DBCA, 2024) (**Figure 9.2**). Much of this land consists of the Lol Gray State Forest and Dryandra Woodland National Park located to the north of the Study Area, which have some records for the species in the eBird database (Cornell Lab of Ornithology, 2024) and is known to contain habitat species suitable for the foraging, roosting, and refuge of Baudin's Black-Cockatoo (commonly Marri, Jarrah, Flooded gum, York gum, Wandoo, and *Banksia* spp.) (Keighery & Keighery, 2012).The removal of suitable Baudin's Black-Cockatoo foraging habitat is comparatively minor relative to the area to similar or better quality habitat which is protected within a 20 km radius (0.025%), and a 12 km radius (0.073%) of the Study Area. The WA Department of Primary Industries and Regional Development has mapped a total of 49,139 ha of native vegetation within a 20 km radius of the Study Area, and 19,934 ha within a 12 km radius (DPIRD, 2023), much of which is located within the lands managed and protected for conservation captured above but also includes remnant roadside vegetation and native vegetation occurring within freehold land (**Figure 9.3**). The removal of all fragmented Baudin's Black-Cockatoo foraging habitat within the Study Area represents 0.014% of native vegetation within a 20 km radius, and 0.034% of native vegetation within a 12 km radius. Therefore, it is considered unlikely that the permanent removal of up to 6.73 ha of fragmented and degraded Baudin's Black-Cockatoo foraging habitat within the Study Area will materially reduce the area of occupancy for the species as populations are unlikely to be concentrated within the Study Area and there is comparatively extensive potential habitat within a 12 km and 20 km radius that remains protected.	The Project is unlikely to be at variance with this criterion

Criteria	Assessment of the Project	Outcome
3. Fragment an existing population into two or more populations	The Study Area is located outside of the known breeding range for the species and falls on the eastern boundary of their modelled distribution (DAWE, 2022). Baudin's Black-Cockatoo is considered to potentially occur in the Study Area only as an occasional foraging visitor. Potential foraging habitat is present in areas with Marri and/or areas with shrubby *Banksia* spp. in the understorey, however no evidence of foraging was recorded during the fauna survey program despite the abundance of Marri, a favoured food-plant. Additionally, black-cockatoo species are highly mobile and likely undertake daily movements between roost sites in response to the spatial distribution of resources available across the landscape (Rycken, 2019). The Baudin's Black-Cockatoo is considered to typically fly below RSA given current knowledge of black-cockatoo flight behaviours. In circumstances where birds are passing across less-expansive cleared areas between patches of remnant trees or isolated individual trees (as is present throughout much of the Study Area) they usually maintain a 'canopy height' flight path (Umwelt, 2024) which is likely to be below the minimum RSA height for the Project (49 m AGL) given the presence of mainly isolated paddock trees at a maximum of 15-30 m AGL in height. The Project Area has been reduced to avoid the highest quality Baudin's Black-Cockatoo foraging habitat. By reducing the Project Area and removing turbines that would otherwise be enveloping this large patch of higher-quality habitat, the risk of turbines interrupting the regional movement of the species has been minimised. Turbines and associated infrastructure in the Study Area are unlikely to interrupt regional movement of the species such that a population is fragmented. Turbines are approximately 6 km in distance from their easternmost to westernmost points, as well as from their northernmost to southernmost points, and the distribution of native vegetation in the areas surrounding the Development Corridor will continue to provide foraging opportunities for the species if flocks were to move through the landscape between potential roosting sites to the north, east, or south to suitable foraging areas. The locations of wind turbines range between 540-1,050 m in distance from their nearest neighbouring turbine which is likely to provide sufficient space for black-cockatoo species to exhibit meso-avoidance of operating turbines and continue to utilise open areas for movement where necessary. Additionally, available information indicates these species typical flight is below the minimum RSA height of 49 m AGL in the landscapes present within the Study Area (see **Section 7.2.2**). Almost all electrical cabling associated with the Project has been located underground, with overhead cabling only proposed in the southernmost section of the Study Area over Williams-Narrogin Highway to the existing 220 kV transmission line. The maximum loss of 6.73 ha of native vegetation will be distributed across the Indicative Project Footprint and will not substantially increase fragmentation effects. Therefore, it is considered unlikely that the Project would result in the fragmentation of populations of Baudin's Black-Cockatoo as a result of either collision risk or altered movement patterns across the broader landscape.	The Project is unlikely to be at variance with this criterion
4. Adversely affect habitat critical to the survival of a species	The recovery plan for Baudin's Black-Cockatoos identifies habitat critical to the survival of these species as areas (DEC, 2008): • currently occupied by the cockatoos • not currently occupied by the cockatoos due to recent fire but capable of supporting cockatoo populations when sufficiently recovered • of natural vegetation in which the cockatoos nest, feed and roost • of natural vegetation through which the cockatoos can move from one occupied area to another	The Project is unlikely to be at variance with this criterion.

Criteria	Assessment of the Project	Outcome
	• of suitable vegetation within the recorded range in which undiscovered cockatoo populations may exist. Additionally, the recovery plan for Baudin's Black-Cockatoos identifies critical habitat as all Marri, Karri and Jarrah forests, woodlands and remnants in the southwest of Western Australia receiving more than 600 mm of annual average rainfall. However, annual average rainfall in Narrogin was approximately 442.3 mm between 1991-2020 (BOM, 2024a), and on this basis does not meet this criterion. Given the extensive clearing of native vegetation across much of the Wheatbelt region, all breeding habitat and associated foraging habitat might be considered to be critical habitat to the Baudin's Black-Cockatoo, however the Project is located outside of the known breeding range for the species (DAWE, 2022). There are no roosting or breeding sites for the Baudin's Black-Cockatoo mapped within the DBCA datasets for black-cockatoo roosting and breeding sites (DBCA, 2019a; DBCA, 2019b). Habitat comprising of Marri, Flooded gum and York gum woodlands occur within the Study Area, providing areas of potential foraging, roosting and refuge; however, habitats within the broader region may be more suitable than habitats within the Study Area. The Project will result in the clearing of approximately 3.32 ha of high-quality foraging habitat, and 3.41 ha of low-quality foraging habitat, which comprises 1.64% of all suitable foraging habitat within the Study Area. No direct or indirect evidence of roosting was found within the Indicative Project Footprint during the targeted mapping for black-cockatoo species (Umwelt, 2024a). The proposed clearing comprises the edges of small, disconnected patches of remnant vegetation that are separated from large tracts of black-cockatoo habitat by cleared agricultural land. The Project has been designed to avoid the majority of foraging habitat in the Study Area and Additional Survey Area, including the highest quality vegetation patch located outside the Western boundary of the Study Area within the Additional Survey Area. The removal of up to 6.73 ha of suitable Baudin's Black-Cockatoo foraging habitat is considered to be comparatively minor to similar or better quality habitat which is protected within a 20 km radius (0.025%), and a 12 km radius (0.073%) of the Study Area and contain a number of contemporary (<20 years old) records of occurrence. The removal of up to 6.73 ha of suitable Baudin's Black-Cockatoo habitat within the Study Area also only represents 0.014% of native vegetation within a 20 km radius, and 0.034% of native vegetation within a 12 km radius (see **Criterion 2**). Given the quantum of habitat that will be retained in the Study Area, habitat in adjacent conservation areas that is anticipated to be preferred, the Study Area being outside of the breeding range of the species, and active management of indirect impacts, no adverse impacts to habitat critical to the survival of the species will occur.	
5. Disrupt the breeding cycle of a population	The Study Area is located outside of the known breeding range for the species and falls on the eastern boundary of their modelled distribution (DAWE, 2022). Baudin's Black-Cockatoo is considered to potentially occur in the Study Area only as an occasional foraging visitor. Therefore, the Project is considered unlikely to disrupt the breeding cycle of a population of the species.	The Project is unlikely to be at variance with this criterion

Criteria	Assessment of the Project	Outcome
6. Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Habitat comprising of Marri, Flooded gum and York gum woodlands occur within the Study Area, providing areas of potential foraging, roosting and refuge. However, foraging habitat within the Study Area is heavily fragmented and proposed clearing in these areas is primarily restricted to individual trees or up to 20 patches of vegetation at the perimeter of larger remnant patches which themselves are of degraded condition. Habitats within the broader region may be more suitable than habitats within the Study Area. The Project will result in the clearing of approximately 3.32 ha of high-quality native foraging habitat, and 3.41 ha of low-quality native foraging habitat, which comprises 1.64% of all suitable foraging habitat within the Study Area. No direct or indirect evidence of roosting was found within the Indicative Project Footprint during the targeted mapping for black-cockatoo species (Umwelt, 2024a). Proposed clearing areas are very fragmented, with approximately 85% of clearing being <0.5 ha edges of degraded vegetation patches. The removal of up to 6.73 ha of suitable Baudin's Black-Cockatoo foraging habitat is considered to be comparatively minor to that which is protected within a 20 km radius (0.025%), and a 12 km radius (0.073%) of the Study Area which contain suitable habitat species for the Baudin's Black-Cockatoo and a number of contemporary (<20 years old) records of occurrence. The removal of up to 6.73 ha of suitable Baudin's Black-Cockatoo habitat within the Study Area also only represents 0.014% of native vegetation within a 20 km radius, and 0.034% of native vegetation within a 12 km radius (see **Criterion 2**). Additionally, Project infrastructure has undergone a reiterative process to avoid areas of native vegetation and ecological value with the majority of infrastructure restricted to areas of existing disturbance. Therefore, it is considered unlikely that the permanent removal of vegetation proposed will alter habitat to the extent where the species is likely to decline.	The Project is unlikely to be at variance with this criterion
7. Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat	Corellas (*Cacatua pastinator* and *C. sanguinea*) and Western Galahs (*Eolophus roseicapilla roseicapilla*) are known to be active competitors for nest hollows that are suitable for breeding by black-cockatoo species, but are native to Western Australia. The introduced Long-billed Corella (*C. tenuirostris*) is not known to occur in the Wheatbelt and is considered unlikely to be introduced or established as a result of the Project. Feral European honeybees (Apis mellifera) can also compete with black-cockatoos for suitable nest hollows. No corellas or European honeybees were recorded during the fauna survey program, including targeted habitat assessments in the Indicative Project Footprint. Western Galahs were recorded at four of the vantage points during the BBUS undertaken within the Study Area (comprising flocks of 2–4) and at one location in the Additional Survey Area (comprising a flock of 11) (Umwelt, 2024c). No activities associated with the construction or operation of the Project are considered likely to result in the introduction or expansion of these species. The highest level of activity and vehicle movement on the site will be during construction activities. During this time, vehicle hygiene measures will be implemented to reduce risk of invasive species entering the site. Therefore, the Project is considered unlikely to result in invasive species becoming established within the Study Area that pose a threat to Baudin's Black-Cockatoo.	The Project is unlikely to be at variance with this criterion

Criteria	Assessment of the Project	Outcome
8. Introduce disease that may cause the species to decline	Diseases which may pose threats to Baudin's Black-Cockatoos includes Psittacine Beak and Feather Disease (PBFD), *Phytophthora* dieback which poses a threat to foraging and breeding species recorded within the Study Area such as Jarrah, and Marri canker disease and Marri shoot blight which pose a threat Marri. The cause of PBFD is the beak and feather disease virus (BFDV), while other infectious diseases impacting black-cockatoo species found in southwest WA include avian polyomavirus (APV) and chlamydophilosis (DPAW, 2013a). The potential for these diseases to be spread as a result of Project activities is considered to be highly unlikely as the disease is primarily spread through transmission from infected birds or nesting material which may be exacerbated by the high concentrations of individuals congregating in areas and feeding by the public without proper sanitation of feeding areas. The nearest Forest Disease Risk Area for *Phytophthora* dieback mapped by DBCA is located approximately 50 km west of the Study Area. Areas susceptible to Phytophthora dieback are restricted to those receiving >400 mm of annual rainfall, with areas between 400-600 mm of annual rainfall that are most susceptible generally being associated with high summer rainfall averages and water gaining sites. Narrogin is located within the 400 mm isohyet and is therefore susceptible to *Phytophthora* dieback introduction or spread. Although no known Phytophthora dieback infection sites are known within or in proximity to the Study Area, the Project will implement biosecurity protocols as part of its CEMP to minimise this risk. Marri canker disease and Marri shoot blight are caused by fungal pathogens. Both diseases have been causing a decline in Marri over a number of years and due to their impact on both reproductive and vegetative tissues, affect the capacity for these trees to provide foraging and breeding habitat for black-cockatoo species. While Marri canker disease is suspected to be endemic to southwest WA, Marri shoot blight is an introduced disease and no control or management options have been developed for WA (Marbus et al., 2011; Paap et al., 2012). The Project will implement standard biosecurity management practices to minimise the risk of introduction or spread of these diseases. Biosecurity management measures to manage the diseases identified above will include: • Ensuring all ground disturbing plant and equipment enter site clean and free of weeds or dieback • Designated access tracks within site • Clean fill certificates for any imported fill used on-site Therefore, the Project is considered unlikely to result in the introduction of diseases that may cause the species to decline.	The Project is unlikely to be at variance with this criterion

Criteria	Assessment of the Project	Outcome
9. Interfere with the recovery of the species	Threats identified to the recovery of the Baudin's Black-Cockatoo include nest hollow shortages, habitat clearing and degradation, and illegal shooting (DEC, 2008), although the recovery plan is noted as not current. No activities associated with the construction or operation of the Project are considered likely to result in the introduction or spread of species known to be active competitors for nest hollows that are suitable for breeding by black-cockatoo species. The permanent removal of habitat within the Study is not considered to be significant to the extent that it will result in a reduction in the area of occupancy of the species or the decline of the species given the presence of extensive, well connected, and suitable habitat in the immediate surrounds of the Study Area. Much of the suitable habitat present within the Study Area has been avoided by the Project and breeding trees that exhibit active or historical use (Rank 1 and 2) will be identified and wholly avoided by the Project with sufficient exclusion areas set-up around them to maintain their integrity throughout construction activities and impacts to Rank 3 trees minimised. Additionally, an Adaptive Bird and Bat Management Plan will be implemented and relevant measures incorporated into the Project's CEMP to ensure a pre-clearance survey of trees and native vegetation is undertaken by a suitably qualified fauna spotter for the presence of breeding pairs or chicks. Should an active hollow be identified, no clearing will be permitted and sufficient exclusion areas will be established. Baudin's Black-Cockatoos typically fly below minimum RSA height, given the available information and data on flight heights and behaviours of black-cockatoo species, and thus the loss of individuals through collision with turbines is unlikely (see **Section 7.2.2**). Further, no individuals were recorded in the Study Area over four surveys, so while it is known to occur in the area the survey data suggests it will not occur in large numbers. A BBAMP will be implemented for a nominated period following commissioning of the wind farm which will monitor and manage any potential risk of collision through an adaptive management framework. The identification of a single carcass or evidence of collision will trigger a management response that would involve a re-assessment of risk and subsequent implementation of suitable mitigation measures. Therefore, the Project is not considered to substantially interfere with the recovery of the Baudin's Black-Cockatoo.	The Project is unlikely to be at variance with this criterion

Table 9.11 Carnaby's Black-Cockatoo Significant Impact Assessment

Criteria	Assessment of the Project	Outcome
1. Lead to a long-term decrease in the size of a population	A population has not been defined for black-cockatoo species in Western Australia due to their mobile and widely dispersed nature as well as the variation in flock compositions. Therefore, it is considered more appropriate to consider impacts to habitats and individuals rather than a population (DAWE, 2022). There were no direct observations of individuals in the Study Area over a total of four fauna surveys and BBUS during Spring 2023 and Summer 2024. The Carnaby's Black-Cockatoo was recorded through secondary evidence (foraging on *Banksia* spp.) within the Study Area and via visual and aural observation within the Additional Survey Area. All records were within eucalypt woodland habitat. The visual observation of the species within the Additional Survey Area consisted of three individuals flying at a height of between 20 and 40 m AGL. Typically, Carnaby's Black-Cockatoo breeds primarily in the wheatbelt region of Western Australia, nesting in large hollows in smooth-barked eucalypts such as the Salmon Gum (*Eucalyptus salmonophloia*) and Wandoo (*Eucalyptus wandoo*). However, the species has started breeding in areas further west and south from its traditional breeding range, including areas in the Darling Range and on the Swan Coastal Plain (Johnstone et al., 2013b). A review of the DBCA (2019a) Carnaby's Cockatoo confirmed breeding areas has identified a known breeding site approximately 12 km southeast of the Study Area in Highbury State Forest (**Figure 9.1**). It is also considered possible that the species is also breeding in the Dryandra Woodland National Park and Lol Gray State Forest conservation mosaic north of the Study Area based on the extensive presence of Wandoo forest, a favoured nesting tree species for Carnaby's Black-Cockatoo. The species is considered likely to be a seasonal visitor to the Study Area in response to the availability of foraging resources rather than for breeding, given the limited suitable breeding habitat in comparison to remnant vegetation in the surrounding areas. Carnaby's Cockatoos forage on the seeds of a range of plant species, but are particularly attracted to proteaceous heaths, *Banksia* and *Eucalyptus* woodlands and pine plantations (Johnstone & Storr, 1998). Important food plants have been known to include *Banksia attenuata, B. menziesii, B. grandis, B. ilicifolia, B. sessilis, B. prionotes*, Marri (*Corymbia calophylla*) and Jarrah (*Eucalyptus marginata*) (DPAW, 2013b), but the species are opportunistic feeders and will utilise a range of suitable food resources, including introduced species and other novel food sources (DCCEEW, 2024h; Finn et al., 2009; Lee et al., 2013; Saunders, 1974). Canola has also been identified previously as a suitable temporary foraging resources for the species, but their consumption has been implicated as potentially impacting nesting growth and may be the cause of the emergency of a new disease and therefore cannot be considered a reliable foraging resource (Riley et al., 2023). In breeding areas, it is important to have sufficient foraging resources in close proximity to nest hollows with black-cockatoo species generally foraging up to 12 km from nesting sites (DAWE, 2022). Carnaby's Black-Cockatoo generally roost in tall native or introduced eucalypts or pines in riparian habitats or near permanent water (Burnham et al., 2010; DCCEEW, 2024h) . A review of the DBCA (2019b) roosting habitat dataset for black-cockatoos identified that a roosting site exists 7.5 km east of the Study Area in Narrogin and another 12.6 km north of the Study Area in Lol Gray State Forest and Dryandra Woodland National Park (**Figure 9.1**). Patches of habitat comprising of Marri, Jarrah and Wandoo woodlands with isolated shrubs to shrublands including *B. sessilis* occur within the Study Area, which may provide areas suitable for potential breeding, foraging, and roosting. However, habitats within the broader region may be more suitable than habitats within the Study Area and the species is considered unlikely to be concentrated in the Study Area. This is supported by there being no evidence of roosting or nesting recorded during field surveys of portions of the Indicative Project Footprint, no	The Project is unlikely to be at variance with this criterion

Criteria	Assessment of the Project	Outcome
	direct observations of individuals in the Study Area over four separate surveys and limited secondary foraging evidence in the Study Area. It is therefore considered unlikely that the permanent removal of up to 8.39 ha of the edges of fragmented habitat across more than 20 separate patches will lead to a long-term decrease in the size of a population of Carnaby's Black-Cockatoos, as populations are unlikely to be concentrated within the Study Area and there is comparatively extensive suitable habitat within in the broader region that remains protected. A collision risk assessment for the Carnaby's Black-Cockatoo was undertaken to assess the likelihood and consequence of turbine collision for the species (provided as part of **Appendix D**). While the species received an overall Moderate level of concern rating, this was in large part due to the consequences of collision and their likelihood of occurrence within the Study Area. The likelihood of the species flying at RSA of turbines, and thus their actual potential for collision with blades, was considered to be Low as available literature and knowledge of species' flight behaviours suggest they typically fly below the minimum RSA height of 49 m AGL (see **Section 7.2.2**). A preliminary Bird and Bat Management Plan specific to the Project has been developed (**Appendix D**), including specific measures to mitigate potential operational impacts. These measures include monitoring during potentially higher activity periods and responding to any incidents of mortality including consultation with DBCA. Based on the above, it is considered unlikely that the Project will lead to a long-term decrease in the size of a population of Carnaby's Black Cockatoo.	
2. Reduce the area of occupancy of the species	The area of occupancy for the Carnaby's Black-Cockatoo is estimated at between 54,500 km^2 to 86,800 km^2 (Saunders et al., 2021). The species occupies the most extensive distribution range of the three black-cockatoo species found in southwest WA, and primarily breed in the semi-arid and sub-humid regions, before migrating back to the higher rainfall areas along the midwest coast, Swan Coastal Plain, and south coast (DEPAW, 2013b; Rycken, 2019). There have been observations of a steady shift in distribution to the south and west of their historical range over recent years. Despite the species being primarily a seasonal migrant, not all populations undertake migration and some remain as resident flocks in certain areas, for example in Badgingarra and the Stirling Range (EPA, 2019). The Project is not located at the range limit for the species. A review of DBCA roosting habitat dataset for black-cockatoos identified that a roosting site exists 7.5 km east of the Study Area in Narrogin and another 12.6 km north of the Study Area in Lol Gray State Forest (DBCA, 2019b) (**Figure 9.1**). A review of the DBCA Carnaby's Cockatoo confirmed breeding areas has also identified a known breeding site approximately 12 km southeast of the Study Area in Highbury State Forest (DBCA, 2018a) (**Figure 9.1**) and it is considered possible that the species is also breeding in the Dryandra Woodland National Park and Lol Gray State Forest conservation mosaic north of the Study Area. Throughout the full survey program (four surveys over Spring 2023 and Summer 2024) no individual Carnaby's Black-Cockatoos were recorded in the Study Area. The Carnaby's Black-Cockatoo was recorded through secondary evidence (foraging on *Banksia* spp.) within the Study Area and via visual and aural observation in Eucalypt woodland habitat within the Additional Survey Area. During the basic fauna survey undertaken in Spring, a flock of 57 birds were observed foraging in Canola and Marri approximately 13 km northwest of the Study Area.	The Project is unlikely to be at variance with this criterion

Criteria	Assessment of the Project	Outcome
	A univariate analysis of Carnaby's Black-Cockatoo abundance following the construction of Badgingarra Wind Farm found that reference sites had higher counts of the species when compared to impact sites; however, the analysis also identified a large statistically significant difference between years of monitoring and concluded that the difference in abundance may not be attributable to the presence of turbines alone (Ecoscape, 2019). The Project will result in the clearing of approximately 3.32 high-quality and 5.07 low-quality foraging habitat , which comprises 2.06% of all suitable native foraging habitat within the Study Area. Canola crops can provide a foraging resource for Carnaby's Black-Cockatoo's, however as an annual and temporary crop it is not considered a secure foraging resource. No direct or indirect evidence of roosting was found within the Indicative Project Footprint during the targeted mapping for black-cockatoo species (Umwelt, 2024b). Habitat comprising of Marri, Jarrah and Wandoo woodlands with isolated shrubs to shrublands including *B. sessilis* occur within the Study Area, providing areas of breeding, foraging, and roosting; however, habitats within the broader region may be more suitable than habitats within the Study Area. Within a 20 km radius of the Study Area there is approximately 27,255 ha of land managed and protected for conservation purposes and approximately 9,268 ha within a 12 km radius (DBCA, 2024) (**Figure 9.2**). Much of this land consists of the Lol Gray State Forest and Dryandra Woodland National Park located to the north of the Study Area, which have a number of records for the species in the eBird database (Cornell Lab of Ornithology, 2024) and is known to contain habitat species suitable for the foraging, breeding, and roosting of Carnaby's Black-Cockatoo (commonly Marri, Jarrah, Flooded gum, York gum, Wandoo, and *Banksia* spp.) (Keighery & Keighery, 2012). Habitat within the Study Area is not considered unique, and the proposed removal of fragmented Carnaby's Black-Cockatoo foraging habitat is minor relative to the abundance of similar or better quality habitat which is protected within a 20 km radius (0.031%), and a 12 km radius (0.09%) of the Study Area. The WA Department of Primary Industries and Regional Development has mapped a total of 49,139 ha of native vegetation within a 20 km radius of the Study Area, and 19,934 ha within a 12 km radius (DBCA, 2024), much of which is located within the lands managed and protected for conservation captured above but also includes remnant roadside vegetation and native vegetation occurring within freehold land (**Figure 9.3**). The removal of all suitable Carnaby's Black-Cockatoo foraging habitat within the Study Area represents 0.017% of native vegetation within a 20 km radius, and 0.042% of native vegetation within a 12 km radius. Therefore, it is considered unlikely that the permanent removal of up to 8.39 ha of native vegetation comprising suitable but fragmented and degraded Carnaby's Black-Cockatoo foraging habitat within the Study Area will materially reduce the area of occupancy for the species as populations are unlikely to be concentrated within the Study Area and there is comparatively extensive suitable potential habitat within a 12 km and 20 km radius that remains protected.	
3. Fragment an existing population into two or more populations	The Carnaby's Black-Cockatoo is likely to be a seasonal visitor which forages and/or roosts in the Study Area when present and may breed in large tree hollows, noting that no evidence of hollows being used for breeding was recorded in the areas of the Disturbance Corridor assessed. The species is considered unlikely to be concentrated or regularly breeding within the Study Area given the presence of more suitable and extensive habitats within the broader region (e.g. Dryandra Woodland National Park, Lol Gray State Forest, and Highbury State Forest), minimal evidence of foraging within the Study Area, and no record of individuals within the Study Area over four separate surveys. Additionally, black-cockatoo species are highly mobile and likely undertake daily movements between roost and breeding sites in response to the spatial distribution of resources available across the landscape (Rycken, 2019).	The Project is unlikely to be at variance with this criterion

Criteria	Assessment of the Project	Outcome
	The Project Area has been reduced to avoid the highest quality Carnaby's Cockatoo habitat and the only location where the species was directly observed during any of the fauna surveys or BBUS. Further, turbines have been removed from around the area of more intact DBCA conservation area in the eastern portion of the Project Area. By reducing the Project Area and removing turbines that would otherwise be enveloping these patches of higher-quality habitat, the risk of turbines interrupting the regional movement of the species and fragmenting the population has been greatly reduced. The Carnaby's Black-Cockatoo is considered to typically fly below RSA given current knowledge of black-cockatoo flight behaviours (see **Section 7.2.2**). In circumstances where birds are passing across less-expansive cleared areas between patches of remnant trees or isolated individual trees (as is present throughout much of the Study Area) they usually maintain a 'canopy height' flight path (Umwelt, 2024) which is likely to be below the minimum RSA height for the Project (49 m AGL) given the presence of mainly isolated paddock trees at a maximum of 15-30 m AGL in height. Further, considering the spacing of turbines within the Study Area, the potential for blade strike is very low. The Project Area has been reduced to avoid the highest quality Carnaby's Black-Cockatoo foraging habitat. By reducing the Project Area and removing turbines that would otherwise be enveloping this large patch of higher-quality habitat, the risk of turbines interrupting the regional movement of the species has been minimised. Turbines and associated infrastructure in the Study Area are unlikely to interrupt regional movement of the species such that a population is fragmented. Turbines are approximately 6 km in distance from their easternmost to westernmost points, as well as from their northernmost to southernmost points, and the distribution of native vegetation in the areas surrounding the Development Corridor will continue to provide foraging opportunities for the species if flocks were to move through the landscape between known roosting or breeding sites to the north, east, or south to suitable foraging areas and exhibit macro-avoidance of the Development Corridor. The locations of wind turbines range between 540-1,050 m in distance from their nearest neighbouring turbine which is likely to provide sufficient space for black-cockatoo species to exhibit meso-avoidance of operating turbines and continue to utilise open areas for movement where necessary. Additionally, the height of the RSA range is at least 49 m AGL and available information indicates these species typically fly below the minimum RSA height of 49 m AGL in the landscapes present within the Study Area. Almost all electrical cabling associated with the Project has been located underground, with overhead cabling only proposed in the southernmost section of the Study Area over Williams-Narrogin Highway to the existing 220 kV transmission line. The maximum loss of 8.39 ha of native vegetation will be distributed across the Indicative Project Footprint and will not substantially increase fragmentation effects. Therefore, it is considered unlikely that the Project would result in the fragmentation of populations of Carnaby's Black-Cockatoo as a result of either collision risk, habitat loss, or altered movement patterns across the broader landscape.	

4. Adversely affect habitat critical to the survival of a species	The recovery plan for Carnaby's Black-Cockatoos summarises critical habitat for the species as (DEPAW, 2013b): • The eucalypt woodlands that provide nest hollows used for breeding, together with nearby vegetation that provides feeding, roosting and watering habitat that supports successful breeding; • Woodland sites known to have supported breeding in the past and which could be used in the future, provided adequate nearby food and/or water resources are available or are re-established; • In the non-breeding season, the vegetation that provides food resources as well as the sites for nearby watering and night roosting that enable the cockatoos to effectively utilise the available food resources Given the extensive clearing of native vegetation across much of the Wheatbelt region, all breeding habitat and associated foraging habitat can be considered to be critical habitat to the Carnaby's Black-Cockatoo and breeding home ranges are estimated at up to 12 km from nests for black-cockatoos (DAWE, 2022). A review of DBCA (2019b) roosting habitat dataset for black-cockatoos identified that a roosting site exists 7.5 km east of the Study Area in Narrogin and another 12.6 km north of the Study Area in Lol Gray State Forest. A review of the DBCA (2019a) Carnaby's Black-Cockatoo confirmed breeding areas has identified a known breeding site approximately 12 km southeast of the Study Area in Highbury State Forest (**Figure 9.1**). It is also considered likely that the species is also breeding in the Dryandra Woodland National Park and Lol Gray State Forest conservation mosaic north of the Study Area based on the extensive presence of old growth Wandoo, a favoured nesting tree species for Carnaby's Black-Cockatoo. The Project will result in the clearing of approximately 3.32 ha of high-quality but fragmented foraging habitat, and 5.07 ha of low-quality and fragmented foraging habitat, which comprises 2.06% of all suitable foraging habitat within the Study Area. The proposed clearing is distributed broadly across the Study Area and consists of the edges of small, disconnected patches of remnant vegetation that are separated from large tracts of black-cockatoo habitat by cleared agricultural land. The Project has been designed to avoid the majority of critical Carnaby's Black-Cockatoo habitat in the Study Area, including the highest quality vegetation patch located outside the western boundary of the Study Area within the Additional Survey Area. Woodlands that provide nest hollows used for breeding, or woodland sites that could support breeding in future with adequate nearby food and/or water resources are considered critical habitat. Targeted mapping of 60% of the Indicative Project Footprint has assessed 109 suitable or potential nesting trees with a DBH of 500 mm or greater. Of these 109 trees assessed, no trees with active or historical evidence of nesting (Rank 1 and 2) were found and 5 trees containing suitable hollows were identified (Rank 3). No Rank 1 or 2 trees will be disturbed by the Project, and disturbance of Rank 3 trees will be minimised. No direct or indirect evidence of roosting was found within the Indicative Project Footprint during the targeted mapping for black-cockatoo species (Umwelt, 2024a). Habitat within the Study Area is not considered unique, and the removal of 8.39 ha of suitable Carnaby's Black-Cockatoo habitat is considered to be minor relative to the area of similar or better quality habitat which is protected within a 20 km radius (0.031%), and a 12 km radius (0.09%) of the Study Area and contain a number of contemporary (<20 years old) records of occurrence. The removal of 8.39 ha of fragmented Carnaby's Black-Cockatoo habitat within the Study Area also only represents 0.017% of native vegetation within a 20 km radius, and 0.042% of native vegetation within a 12 km radius (see **Criterion 2**).	The Project is unlikely to be at variance with this criterion

Criteria	Assessment of the Project	Outcome
	As part of the Project BBUA (**Appendix D**), the species received an overall Moderate risk rating. The likelihood of the species flying at RSA of turbines, and thus their actual potential for collision with blades, was considered to be Low as available literature and knowledge of species' flight behaviours suggest they typically fly below the minimum RSA height of 49 m AGL (see **Section 7.2.2**). A preliminary Bird and Bat Management Plan specific to the Project has been developed (**Appendix D**), including specific measures to mitigate potential operational impacts. These measures include monitoring during potentially higher activity periods and responding to any incidents of mortality including consultation with DBCA. Although the Project will result in the removal of suitable foraging and potential breeding habitat for the species, adverse impacts to habitat critical to the survival of the species are considered unlikely due to: • No Rank 1 or 2 trees to be disturbed by the Project, and disturbance of Rank 3 trees will be minimised. • Avoidance of larger, higher-quality patches of foraging and potential breeding habitat. • The quantum of habitat that will be retained in the Study Area. • Habitat in adjacent conservation areas that is anticipated to be preferred. • Active management of indirect impacts via the Bird and Bat Adaptive Management Plan (**Appendix D**) and Project EMP.	
5. Disrupt the breeding cycle of a population	A targeted assessment of Carnaby's Black-Cockatoo breeding habitat across 60% of the Indicative Project Footprint has identified no active or highly likely breeding trees (i.e. exhibiting historical evidence of breeding) with suitable hollows. A total of five Rank 3 trees were recorded with potentially suitably sized and located hollows, and one Rank 4 tree considered to have a suitably sized hollow but of unsuitable orientation and/or height. The remaining trees assessed which had a Diameter at Breast Height (DBH) of 500 mm or more contained no suitably sized hollows for nesting (Umwelt, 2024b). As the Indicative Project Footprint undergoes further refinement within the Development Corridor, the Project will ensure all trees with a DBH of 500 mm or more within the Final Project Footprint are surveyed. All breeding trees that exhibit active or historical use (Rank 1 and 2) will be identified and avoided by the Project with sufficient exclusion areas set-up around them to maintain their integrity throughout construction activities. Disturbance of Rank 3 trees will be minimised. Additionally, a Bird and Bat Adaptive Management Plan will be implemented, and relevant measures incorporated into the Project's CEMP to ensure a pre-clearance survey of trees and native vegetation is undertaken by a suitably qualified fauna spotter for the presence of breeding pairs or chicks. Should an active hollow be identified, no clearing will be permitted and an exclusion area will be established. Considering the site context and the measures that will be implemented, it is unlikely that the Project will disrupt the breeding cycle of any Carnaby's Black-Cockatoo actively breeding within the Study Area. A review of the DBCA (2019a) Carnaby's Black-Cockatoo confirmed breeding areas has also identified a known breeding site approximately 12 km southeast of the Study Area in Highbury State Forest (**Figure 9.1**). Breeding home ranges are estimated at up to 12 km from nests for black-cockatoos, and foraging habitat supporting these breeding areas are considered to be critical in sustaining populations during the breeding season (DAWE, 2022). The Project will result in the clearing of approximately 3.32 ha of high-quality but fragmented native foraging habitat, and 5.07 ha of low-quality but fragmented native foraging habitat, which comprises 2.06% of all suitable foraging habitat within the Study Area. Foraging habitat within the Study Area is already heavily fragmented and proposed clearing in these areas is primarily restricted to individual trees or patches of vegetation at the perimeter of larger remnant patches which themselves are of degraded condition.	The Project is unlikely to be at variance with this criterion

Criteria	Assessment of the Project	Outcome
	Additionally, the Carnaby's Black-Cockatoo is likely to rarely fly at RSA height, given the available information and data on flight heights and behaviours of black-cockatoo species (see **Section 7.2.2**). Considering the context of habitat in the Study Area, the management measures that will be implemented, and the flight behaviour of Carnaby's Black-Cockatoo it is considered unlikely that the Project would disrupt the breeding cycle of a population of Carnaby's Black-Cockatoo.	
6. Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Habitat comprising of Marri, Jarrah and Wandoo woodlands with isolated shrubs to shrublands including *B. sessilis* occur within the Study Area, providing areas of breeding, foraging, and roosting. However, foraging habitat within the Study Area is heavily fragmented and proposed clearing in these areas is primarily restricted to individual trees or patches of vegetation at the perimeter of larger remnant patches which themselves are of degraded condition. Habitats within the broader region are likely to be more intact and of higher quality than habitats within the Study Area. The Project will result in the clearing of approximately 3.32 ha of native high-quality but fragmented foraging habitat, and 5.06 ha of low-quality native foraging habitat, which comprises 2.06% of all suitable native foraging habitat within the Study Area. Proposed clearing areas are very fragmented, with approximately 85% of clearing being the edges of patches of degraded vegetation where clearing will not exceed <0.5 ha in the majority (85%) of patches. Targeted mapping of 60% of the Indicative Project Footprint has assessed 109 suitable or potential nesting trees with a DBH of 500 mm or greater. Of these 109 trees assessed, no trees with active or historical evidence of nesting (Rank 1 and 2) were found and 5 trees containing suitable hollows were identified (Rank 3). No Rank 1 or 2 tree will be removed as part of the Project, and disturbance to Rank 3 trees will be minimised. No direct or indirect evidence of roosting was found within the Indicative Project Footprint during the targeted mapping for black-cockatoo species (Umwelt, 2024a). The proposed clearing of 8.39 ha of fragmented Carnaby's Black-Cockatoo habitat represents a permanent removal of 0.031% of similar or better quality habitat within the 20 km zone and 0.091% of similar or better quality habitat within the 12 km zone. The removal of suitable Carnaby's Black-Cockatoo habitat within the Study Area also only represents 0.017% of native vegetation within a 20 km radius, and 0.042% of native vegetation within a 12 km radius (see **Criterion 2**). This is a very low proportion of impact to habitat that is not unique in the area, is fragmented, and is relatively lower quality than the intact surrounding national park and state forest habitat. Project infrastructure has undergone an iterative design process to consider values identified through surveys and avoid areas of native vegetation and ecological value with the majority of proposed ground disturbance (95.6%) restricted to areas of existing cleared land. Based on the above, it is considered unlikely that the permanent removal of vegetation or the operation of wind turbines will alter habitat to the extent where the species is likely to decline.	The Project is unlikely to be at variance with this criterion

Criteria	Assessment of the Project	Outcome
7. Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat	Corellas (*Cacatua pastinator* and *C. sanguinea*) and Western Galahs (*Eolophus roseicapilla roseicapilla*) are known to be active competitors for nest hollows that are suitable for breeding by black-cockatoo species, but are native to Western Australia. The introduced Long-billed Corella (*C. tenuirostris*) is not known to occur in the Wheatbelt and is considered unlikely to be introduced or established as a result of the Project. Feral European honeybees (*Apis mellifera*) can also compete with black-cockatoos for suitable nest hollows. No corellas or European honeybees were recorded during the fauna survey program, including targeted habitat assessments in the Indicative Project Footprint. Western Galahs were recorded at four of the vantage points during the BBUS undertaken within the Study Area (comprising flocks of 2-4) and at one location in the Additional Survey Area (comprising a flock of 11) (Umwelt, 2024c). No activities associated with the construction or operation of the Project are considered likely to result in the introduction or expansion of these species. The highest level of activity and vehicle movement on the site will be during construction activities. During this time, vehicle hygiene measures will be implemented to reduce risk of invasive species entering the site. Therefore, the Project is considered unlikely to result in invasive species becoming established within the Study Area that pose a threat to the Carnaby's Black-Cockatoo.	The Project is unlikely to be at variance with this criterion
8. Introduce disease that may cause the species to decline	Diseases which may pose threats to the Carnaby's Black-Cockatoo includes diseases such as Psittacine Beak and Feather Disease (PBFD), and Phytophthora dieback which poses a threat to foraging and breeding species recorded within the Study Area such as Jarrah and Banksia spp. The cause of PBFD is the beak and feather disease virus (BFDV), while other infectious diseases impacting black-cockatoo species found in southwest WA include avian polyomavirus (APV) and chlamydophilosis (DEPAW, 2013b). The potential for these diseases to be spread as a result of Project activities is considered to be highly unlikely as the disease is primarily spread through transmission from infected birds or nesting material which may be exacerbated by the high concentrations of individuals congregating in areas and feeding by the public without proper sanitation of feeding areas. The nearest Forest Disease Risk Area for Phytophthora dieback mapped by DBCA is located approximately 50 km west of the Study Area. Areas susceptible to Phytophthora dieback are restricted to those receiving >400 mm of annual rainfall, with areas between 400-600 mm of annual rainfall that are most susceptible generally being associated with high summer rainfall averages and water gaining sites. Narrogin is located within the 400 mm isohyet and is therefore susceptible to Phytophthora dieback introduction or spread. Although no known Phytophthora dieback infection sites are known within or in proximity to the Study Area, the Project will implement biosecurity protocols as part of its CEMP to minimise this risk. Marri canker disease and Marri shoot blight are caused by fungal pathogens. Both diseases have been causing a decline in Marri over a number of years and due to their impact on both reproductive and vegetative tissues, affect the capacity for these trees to provide foraging and breeding habitat for black-cockatoo species. While Marri canker disease is suspected to be endemic to southwest WA, Marri shoot blight is an introduced disease and no control or management options have been developed for WA (Marbus et al., 2011; Paap et al., 2012). The Project will implement standard biosecurity management practices to minimise the risk of introduction or spread of these diseases.	The Project is unlikely to be at variance with this criterion

Criteria	Assessment of the Project	Outcome
	Biosecurity management measures to manage the diseases identified above will include: • Ensuring all ground disturbing plant and equipment enter site clean and free of weeds or dieback • Designated access tracks within site • Clean fill certificates for any imported fill used on-site Therefore, the Project is considered unlikely to result in the introduction of diseases that may cause the species to decline.	
9. Interfere with the recovery of the species	Known and potential threats to the recovery of the Carnaby's Black-Cockatoo identified in the species' recovery plan include: • loss of breeding habitat • loss of non-breeding foraging and night roosting habitat • tree health • mining and extraction activities • illegal shooting and taking • climate change • collisions with other vehicles • disease. Patches of habitat comprising of Marri, Jarrah and Wandoo woodlands with isolated shrubs to shrublands including *B. sessilis* occur within the Study Area, providing areas of breeding, foraging, and roosting; however, habitats within the broader region may be more suitable than habitats within the Study Area and the species is considered unlikely to be concentrated in the Study Area. Habitat clearing within the Study Area is primarily restricted to vegetation or trees at the perimeter of existing degraded and fragmented patches and is distributed across the Study Area. It is therefore considered unlikely that the permanent removal of up to 8.39 ha of suitable native habitat within the Study Area will not interference with the recovery of the Carnaby's Black-Cockatoo. The Project does not involve any mining or extraction activities, nor is it expected to increase the occurrence of illegal shooting and taking of individuals. The Project will directly contribute to the mitigation of climate change impacts in the long-term by supporting WA's green energy transition through an increase in renewable energy sources. While increased traffic in the Study Area is likely to result from Project activities, this will primarily be temporary during the construction phase and speed limits will be sign-posted throughout the Study Area to minimise the potential for vehicle collision. Speed limits will also remain sign-posted throughout the operation of the Project.	The Project is unlikely to be at variance with this criterion

Criteria	Assessment of the Project	Outcome
	Carnaby's Black-Cockatoos typically fly below RSA height, given the available information and data on flight heights and behaviours of black-cockatoo species, and thus the loss of individuals through collision with turbines is unlikely (see **Section 7.2.2**). A BBAMP will be implemented for a nominated period following commissioning of the wind farm which will monitor and manage any potential risk of collision through an adaptive management framework. The identification of a single carcass or evidence of collision will trigger a management response that would involve a re-assessment of risk and subsequent implementation of suitable mitigation measures. Potential impacts to tree health may arise from the introduction of diseases such as *Phytophthora* dieback, Marri canker disease, and Marri shoot blight. Other diseases that may impact the species includes PBFD. While it is not expected that Project activities will result in the introduction or spread of these diseases, standard biosecurity measures will be implemented through the Project's CEMP to minimise this risk. A copy of the CEMP is provided in **Appendix G**. Performance criteria in the recovery plan for Carnaby's Cockatoo (DPAW, 2013b) relevant to this Project include: • *The species area of occupancy does not decline*. As described above, this proposal will not materially reduce the area of occupancy of Carnaby's Cockatoo • *Number of breeding pairs at pre-determined locations is stable or increasing*. The Study Area does not contain any known breeding sites. • *Estimates of number of birds and proportion of juveniles across known night roost sites remain stable or increase*. The nearest known night roost site is approximately 7.5 km east of the Study Area. • *The extent of nesting habitat (trees with nesting hollows), feeding habitat, and night roosting habitat are maintained*. No active or historically used trees with breeding hollows (i.e. Rank 1 and 2) will be cleared as a result of the Project, and disturbance of Rank 3 trees will be minimised. Implementation of the Project may promote the recovery of the species via: • Contributing to decarbonisation and mitigating the impacts of climate change, which is a significant threat to black-cockatoos. • Enabling Neoen to contribute to black-cockatoo conservation efforts via their "above and beyond" initiative. Based on the above, and noting the scale of impact, the Project is unlikely to interfere with the recovery of the species.	

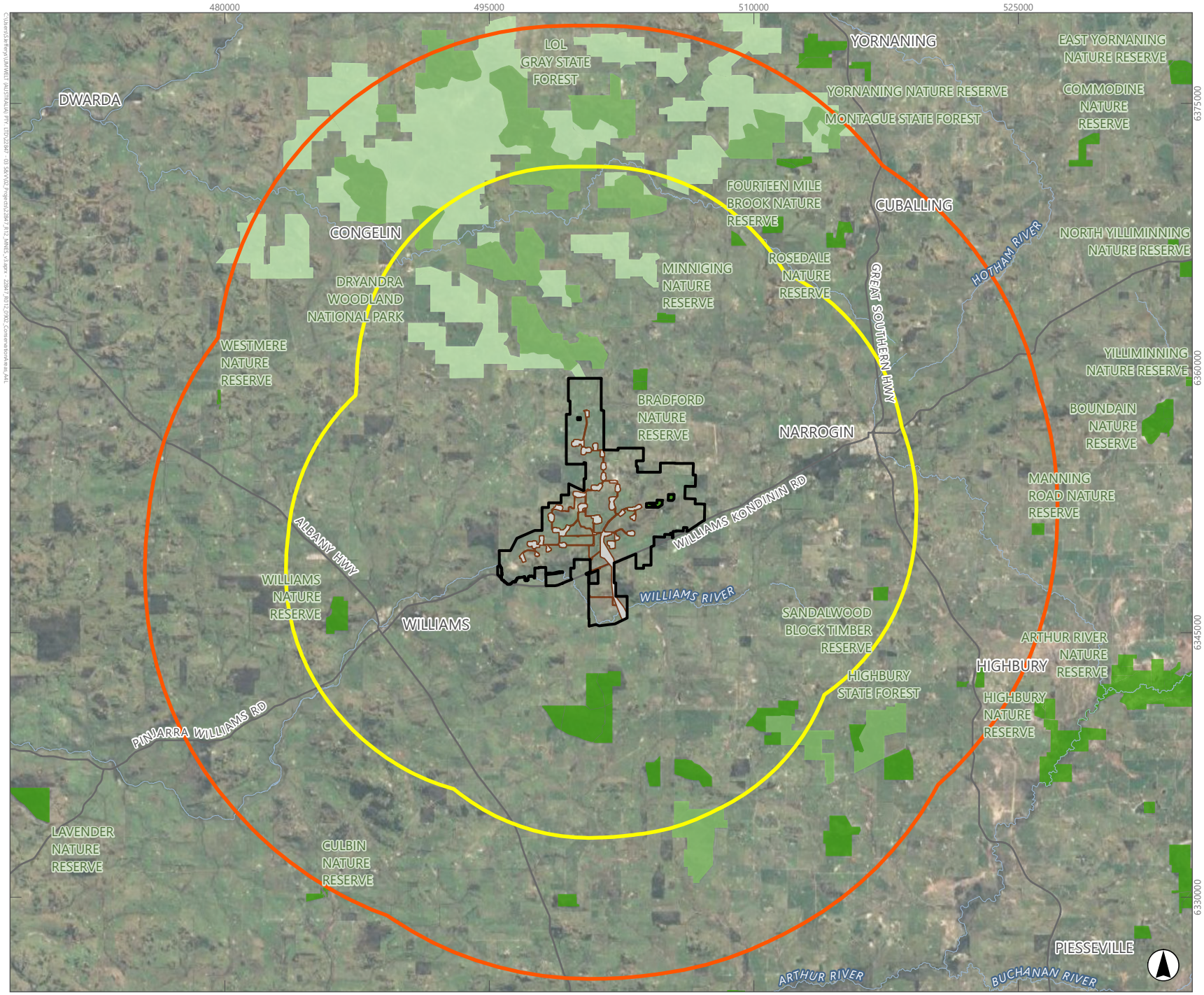


FIGURE 9.2

Conservation Areas within a 12 km and 20 km Radius of the Study Area

Legend

- Study Area
- Development Corridor
- 12 km Buffer
- 20 km Buffer
- Road
- Major Watercourse
- Nature Reserve
- National Park
- State Forest

0 6 12

Kilometres

Scale 1:300,000 at A4
GDA2020 MGA Zone 50

Image Source: ESRI Basemap (2023) | **Data Source:** Landgate (2023), Umwelt (2023), DBCA (2023)

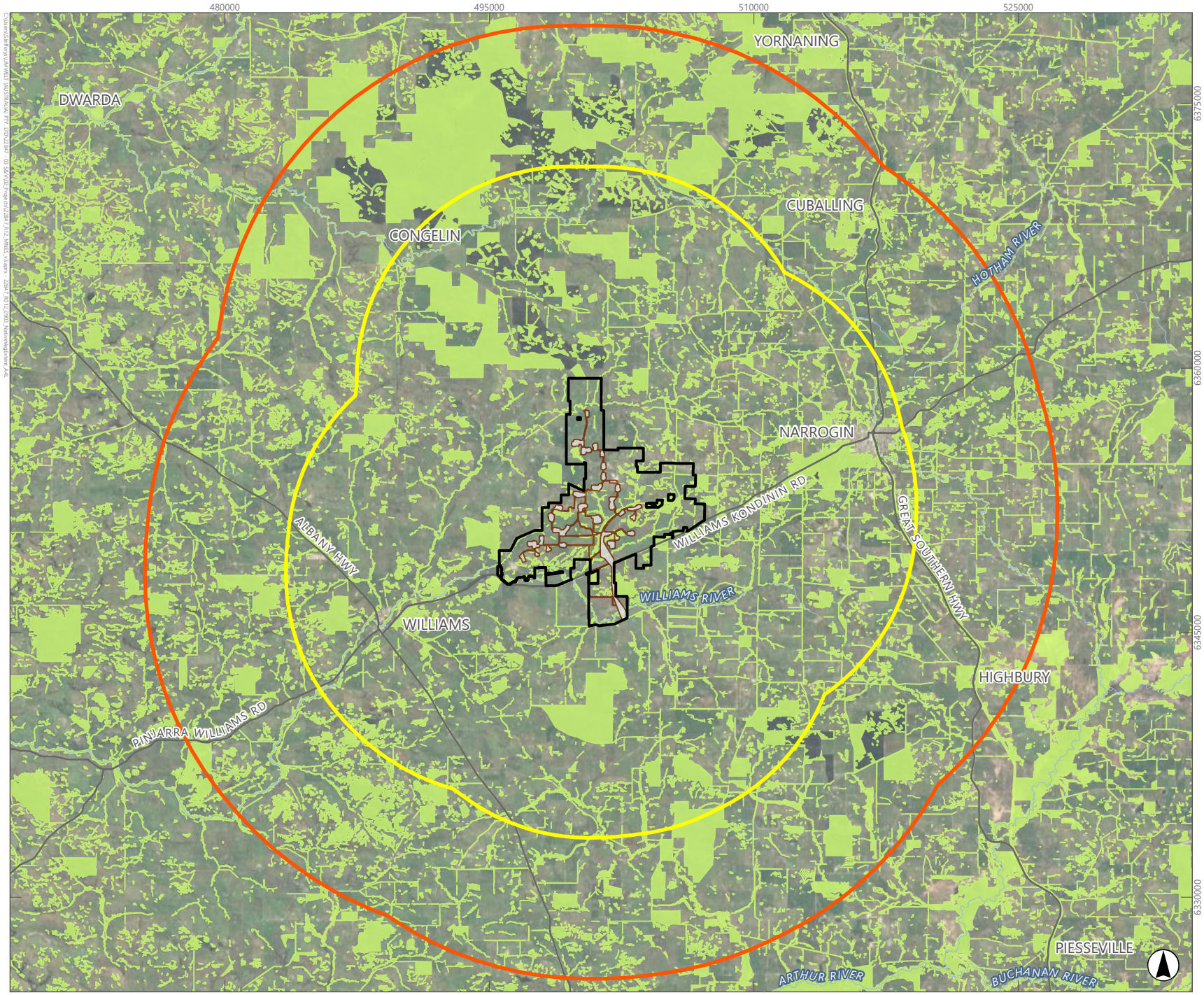


FIGURE 9.3

Native Vegetation Extent within a 12 km and 20 km Radius of the Study Area

Legend

- Study Area
- Development Corridor
- 12 km Buffer
- 20 km Buffer
- Road
- Major Watercourse
- Native Vegetation Extent (DPIRD-005)

0 6 12

Kilometres

Scale 1:300,000 at A4
GDA2020 MGA Zone 50

Image Source: ESRI Basemap (2023) | **Data Source:** Landgate (2023), Umwelt (2023), DPIRD (2023)

9.3 Chuditch

The Chuditch is listed as Vulnerable under the EPBC Act and has been assessed against the relevant Significant Impact Guidelines for Vulnerable species.

The significant impact assessment presented here considers the Significant Impact Guidelines 1.1 (Department of the Environment, 2013), the National Recovery Plan (DEC, 2012) and the SPRAT database.

The presence of suitable den and refuge sites, predators, and sufficient prey biomass are the important considerations in assessing potential impacts to the Chuditch.

The following sections describe the distribution and habitat requirements, threats, and occurrence and potential habitat in the Study Area and broader region. The significant impact assessment undertaken for the Chuditch against criteria in the Significant Impact Guidelines 1.1 (Department of the Environment, 2013) is provided in **Table 9.13**.

9.3.1 Distribution and Habitat Requirements

The Chuditch is a nocturnal, terrestrial carnivore, feeding mainly on smaller vertebrates (e.g., reptiles, birds and mammals) and large invertebrates (Burbidge, 2004; Van Dyck & Strahan, 2008). During the day, Chuditch shelter in dens; predominantly hollow logs and earth burrows (Van Dyck & Strahan, 2008).

The Chuditch is a wide-ranging resident in Marri-Jarrah forest of south-west Western Australia and also in heaths and eucalypt woodlands of the eastern wheatbelt and goldfields (Van Dyck & Strahan, 2008). This species was formerly distributed throughout much of western and inland Australia, but its range has contracted to the region approximately south-west of a line between Shark Bay and Esperance.

Chuditch use a range of habitats including forest, mallee shrublands, woodland and desert. The densest populations have been found in riparian jarrah forest. Chuditch require adequate numbers of suitable den and refuge sites (horizontal hollow logs or earth burrows) and sufficient prey biomass (large invertebrates, reptiles, and small mammals) to survive (DEC, 2012). Chuditch have a large home range, with females in the deeper south-west occupying 55–120 ha and males ranging over 400 ha or more (Van Dyck & Strahan, 2008). Further east, Rayner et al., (2012) found that Chuditch in the Forrestania area occurred at an average density of 0.039 individuals/km^2, with home ranges as small as 189 ha (a female) and as large as 2,125 ha (a male).

They are capable of travelling long distances in a short amount of time and even at their most abundant, Chuditch are generally present in low numbers. For this reason, they require habitats that are of a suitable size and not excessively fragmented (DEC, 2012).

9.3.2 Threats

DEC (2012) identified the following as being the major threats to Chuditch:

- Land clearing, particularly of riparian vegetation, and the removal of suitable den logs and den sites from Chuditch habitat.
- Predation by, and competition from, foxes and feral cats.

- Deliberate and accidental mortality from poisoning, trapping, illegal shooting, and road kills.

Factors contributing to Chuditch mortality include being hit by motor vehicles, illegal shooting near roads, predation by foxes, raptors and feral cats, injury in rabbit traps, natural accidents, and disease (DEC, 2012).

Actions that remove native vegetation (e.g., increased fire frequency, clearing for development, mineral exploration and extraction, and forestry) can result in a significant impact on the Chuditch, particularly if these actions remove habitat critical for survival, or occur within 15 km of habitat critical to survival (DEC, 2012).

9.3.3 Occurrence and Potential Habitat in the Study Area and Broader Region

The species is a known resident of Dryandra Woodland National Park north of the Study Area.

It is considered unlikely that the Chuditch breed within the Study Area given the lack of existing records and the presence of more extensive and likely suitable breeding habitat with greater connectivity to the north and west of the Study Area. Despite survey effort totalling 1,276 camera nights, only a single individual was recorded in the Eucalypt woodland habitat (see **Figure 6.7**, **Section 6.3**).

The Study Area has been considered as potential dispersal habitat due to the highly mobile nature of Chuditch and the single record captured via camera trap in the Eucalypt woodland habitat. Dispersal potentially allows gene-flow between the population in Dryandra Woodland to the north and forests to the west. Although some individuals may be lost to fox predation, the Chuditch is still likely to be able to successfully move between populations using the network of small habitat patches across the Study Area as an ecological linkage. This is due to their highly mobile nature and capability of dispersing long distances in a short span of time. Habitat patches within the Study Area are only likely to provide dispersal habitat where the species may occasionally take daytime shelter in hollow logs, rock crevices and possibly tree hollows.

The Study Area is unlikely to regularly support a population of Chuditch due to the majority of habitat patches being too small and fragmented. Also, the species is susceptible to predation by foxes which were recorded across 12 of the 21 camera traps established (Western Wildlife, 2024).

The extent of potential dispersal habitat that may be cleared within the Study Area is summarised in **Table 9.12** (excluding cleared or planted vegetation).

Table 9.12 Potential Areas of Impact to Habitat: Chuditch

Fauna Habitat Type	Impact Area (ha)
Creekline (generally degraded)	3.78
Eucalypt – Sheoak woodland with granites (generally degraded)	0.36
Eucalypt woodland on laterite rise (generally degraded)	3.27
Total	**7.41**

9.3.4 Assessment Against Significant Impact Criteria

An assessment of the significance of impacts to this species under the Significant Impact Guidelines 1.1 – MNES (Department of the Environment, 2013) is provided in **Table 9.13**. The assessment identified that the Project is unlikely to have a significant impact on the Chuditch**.**

Table 9.13 Chuditch Significant Impact Assessment

Criteria	Assessment of the Project	Outcome
1. Lead to a long-term decrease in the size of an important population of a species	An 'important population' is a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are: • key source populations either for breeding or dispersal • populations that are necessary for maintaining genetic diversity, and/or • populations that are near the limit of the species range. Important populations are not explicitly defined for the Chuditch in the current recovery plan available (DEC, 2012), but are considered to comprise: • Areas currently occupied by chuditch; • Areas of natural vegetation in which chuditch breed; • Areas of natural vegetation in which chuditch forage; • Areas of natural vegetation that chuditch use to move from one area to another; • Areas of suitable vegetation within the recorded range in which undiscovered chuditch populations may exist; • Areas not currently occupied by chuditch due to recent fire but are capable of supporting chuditch populations when sufficiently recovered; and • Areas previously occupied and that still provide suitable habitat and into which chuditch can be reintroduced. The majority of habitat patches in the Study Area are too small and fragmented to regularly support a population of the species, and the species is susceptible to predation by foxes which were recorded across 12 of the 21 camera traps established. Based on this, the Study Area is unlikely to support an 'important population' that is necessary for the species' long-term survival and recovery. The small habitat patches in the Study Area are particularly vulnerable to edge effects due to the higher ratio of edge habitat to centre habitat and subsequent exposure to weed invasion and feral predators. As the majority of habitat patches in the Study Area are unfenced, they are also heavily impacted by grazing livestock (Western Wildlife 2024). The 7.41 ha of Chuditch habitat that is proposed to be cleared is currently degraded, and the clearing will be spread across approximately 20 patches of degraded remnant vegetation where clearing in each patch is unlikely to exceed 0.5 ha. The larger more intact areas of habitat have been avoided as part of the project design. The species is a known resident of Dryandra Woodland National Park north of the Study Area, and the Chuditch was recorded on a single camera trap on a single night in Eucalypt woodland habitat, which is indicative of dispersal rather than residency in the Study Area. No breeding habitat has been mapped in the Study Area. The Chuditch may still use any habitat in the Study Area to disperse, and this can be considered critical habitat as dispersal potentially allows gene-flow between the population in Dryandra Woodland and forests to the west.	The Project is unlikely to be at variance with this criterion

Criteria	Assessment of the Project	Outcome
	Although some individuals may be lost to fox predation, the Chuditch is still likely to be able to successfully move between populations using the network of small habitat patches as an ecological linkage. This is due to their highly mobile nature and capability of dispersing long distances in a short span of time. Removal of minor portions (less than 0.5 ha in most cases) from the edges of degraded habitat patches will not reduce the ability of the species to disperse through the landscape. The Project has avoided much of the remnant native vegetation within the Study Area with a total of 7.41 ha of habitat suitable for dispersal proposed for clearing. This represents 0.65% of the total suitable habitat within the Study Area, the majority of which comprises vegetation at the perimeter of remnant patches or within heavily degraded areas, thus not materially diminishing its dispersal capacity for individuals that may use the area for dispersal. The potential for direct mortality of individuals via road kills from traffic during construction and operations is considered to be low. Suitable speed limits will be established and sign-posted across all internal access tracks constructed to minimise the risk of accidental collisions and given that the Study Area is unlikely to sustain any resident populations of the species and may only provide occasional dispersal habitat, this potential is already considered to be low. Based on the above reasons, the Project is unlikely to result in a long-term decrease in the size of an important population of the Chuditch.	
2. Reduce the area of occupancy of an important population	It is unlikely that the Study Area supports an important population of the Chuditch (see Criteria 1), however it may provide dispersal habitat. The Project has avoided much of the remnant native vegetation within the Study Area with a total of 7.41 ha of habitat suitable for dispersal proposed for clearing. This represents 0.65% of the total suitable habitat within the Study Area, the majority of which comprises of vegetation at the perimeter of remnant patches or within heavily degraded areas and thus not materially diminishing its dispersal capacity. Given the amount of potentially suitable dispersal habitat retained across the broader Study Area and present in the surrounding region, and the highly mobile nature of the species, the permanent removal of dispersal habitat within the Development Corridor is unlikely to have a material effect on the species' area of occupancy. Therefore, the Project is unlikely to result in a reduction of the area of occupancy through the permanent removal of potential dispersal habitat.	The Project is unlikely to be at variance with this criterion
3. Fragment an existing important population into two or more populations	It is unlikely that the Study Area supports an important population of the Chuditch. Existing habitat within the Study Area comprises fragmented, degraded patches of dispersal habitat. The species also has a highly mobile nature and is capable of dispersing long distances in a short span of time and thus is unlikely to be affected by the Project. There will be limited infrastructure that may pose a barrier to the dispersal of the Chuditch. Fencing will be mainly confined to the BESS and substation area and will be designed in such a way as to allow the free movement of fauna throughout the Study Area following completion of construction activities. The Project is minimising crossings through continuous creekline habitat and utilising existing creek crossings as far as possible. Therefore the Project is unlikely to fragment an existing important population into two or more populations.	The Project is unlikely to be at variance with this criterion

Criteria	Assessment of the Project	Outcome
4. Adversely affect habitat critical to the survival of a species	'Habitat critical to the survival of a species or ecological community' refers to areas that are necessary: • for activities such as foraging, breeding, roosting, or dispersal • for the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators) • to maintain genetic diversity and long term evolutionary development, or • for the reintroduction of populations or recovery of the species or ecological community. The recovery plan for Chuditch prepared by DEC (2012) identifies habitats critical to their survival and maintenance of important populations as: • Areas currently occupied by chuditch • Areas of natural vegetation in which chuditch breed • Areas of natural vegetation in which chuditch forage • Areas of natural vegetation that chuditch use to move from one area to another • Areas of suitable vegetation within the recorded range in which undiscovered chuditch populations may exist • Areas not currently occupied by chuditch due to recent fire but are capable of supporting chuditch populations when sufficiently recovered • Areas previously occupied and that still provide suitable habitat and into which chuditch can be reintroduced Based on the criteria above, all remnant native vegetation comprising dispersal habitat within the Study area is considered habitat critical to the survival of the Chuditch. The Project has avoided much of the habitat suitable for Chuditch with only 0.65% of the total suitable habitat within the Study Area proposed for clearing (excluding planted areas and existing cleared areas containing isolated paddock trees). It was identified that the Study Area was unlikely to regularly support a population of the species due to the majority of habitat patches being too small and fragmented and the species being susceptible to predation by foxes. Additionally, the quality of remnant habitat patches in the Study Area is not considered to be materially impacted by the Project given clearing will not exceed 7.41 ha and will be restricted to multiple patches of peripheral degraded vegetation with little understorey components suitable for the Chuditch. Regardless, all habitats within the Study Area are considered to have potential for providing dispersal habitat for the Chuditch (Western Wildlife, 2024) and are therefore to be considered critical habitat. In response, Neoen has rigorously applied the mitigation hierarchy by first avoiding all larger areas of more intact vegetation such that there is unlikely to be a significant reduction in dispersal habitat, despite a small direct impact to fragmented and degraded habitat patches.	The Project is unlikely to be at variance with this criterion

Criteria	Assessment of the Project	Outcome
	Indirect impacts to critical habitat for Chuditch may arise from the Project through dust impacts, edge effects, and the introduction of weeds or pests. The Project will implement management measures through its CEMP to minimise all dust impacts, edge effects, and the introduction of weeds or pests. Indirect impacts are not considered likely to materially reduce the quality or extent of critical habitat for the Chuditch or its capacity to disperse throughout the Study Area. Although the Project will result in the removal of dispersal habitat, adverse impacts to habitat critical to the survival of the species is considered unlikely as: • 99.35% of remnant native vegetation comprising dispersal habitat in the Study Area is being retained. • clearing will comprise 7.41 ha across 20 separate patches, where the majority of clearing will not exceed 0.5 ha in a patch • the species is susceptible to predation and competition by foxes which were recorded across 12 of the 21 camera traps established across the Study Area, as well as feral cats which were also recorded within the Study Area • there is habitat in nearby conservation areas that is similar or in better quality and considerably more intact than that present within the Study Area. • permanent project infrastructure will not prevent dispersal of the species across cleared areas. • the CEMP will include measures to manage indirect impacts, including dust management, edge effects and biosecurity.	
5. Disrupt the breeding cycle of an important population	The Study Area is unlikely to support an important population of Chuditch and is only likely to provide dispersal habitat where the species may occasionally take daytime shelter in hollow logs, rock crevices and possibly tree hollows (Western Wildlife, 2024). It is considered unlikely that the Chuditch breed within the Study Area given the lack of existing records and the presence of more extensive and likely suitable breeding habitat with greater connectivity to the north and west of the Study Area. The Chuditch was recorded on a single camera trap on a single night, which is indicative of dispersal behaviour rather than residency. Given the highly mobile nature and ability of the Chuditch to disperse long distances in a small amount of time and its likelihood of using any habitats in the Study Area for dispersal, Project activities are not expected to reduce the dispersal capacity of remaining habitats within the Study Area. Therefore, the Project is unlikely to disrupt the breeding cycle of an important population of Chuditch.	The Project is unlikely to be at variance with this criterion

Criteria	Assessment of the Project	Outcome
6. Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	The Project has avoided much of the habitat suitable for Chuditch with only 0.65% of the total suitable native vegetation habitat within the Study Area proposed for clearing (excluding planted areas and existing cleared areas, of which isolated paddock trees do not present a significant habitat feature for the Chuditch). Additionally, the quality of remnant habitat patches in the Study Area is not considered to be materially impacted by the Project given clearing will not exceed 7.41 ha and will be restricted to multiple patches of peripheral degraded vegetation with little understorey components suitable for the Chuditch and the presence of more extensive and likely suitable habitat with greater connectivity to the north and west of the Study Area. Given the highly mobile nature and ability of the Chuditch to disperse long distances in a small amount of time and its likelihood of using any habitats in the Study Area for dispersal, Project activities are not expected to reduce the dispersal capacity of remaining habitats within the Study Area. There will be limited infrastructure that may pose a barrier to the dispersal of the Chuditch. Fencing will be mainly confined to the BESS and substation area and will be designed in such a way as to allow the free movement of fauna throughout the Study Area following completion of construction activities. The Project is minimising crossings through continuous creekline habitat and utilising existing creek crossings as far as possible. Therefore it is considered unlikely that the Project will result in adverse impacts to the availability or quality of habitat to the extent that the Chuditch is likely to decline.	The Project is unlikely to be at variance with this criterion
7. Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	Invasive species known to be harmful to the Chuditch include foxes and feral cats. Foxes may have effects directly on the Chuditch through predation or indirectly through competition for available food resources. Foxes are known to be common in farmland areas and were recorded during field surveys across 12 of the 21 camera traps established (Western Wildlife, 2024). Feral cats were also recorded during field surveys. The CEMP will employ best practice control methods for weeds and pests and it is unlikely the Project will introduce or exacerbate weeds or pests beyond existing levels. Therefore, it is considered unlikely that the Project would result in the establishment of invasive species that are harmful to the Chuditch within the Study Area.	The Project is unlikely to be at variance with this criterion

Criteria	Assessment of the Project	Outcome
8. Introduce disease that may cause the species to decline	Diseases which may pose a threat to the Chuditch within the Study Area is *Phytophthora* dieback, Marri canker disease, and Marri shoot blight which may threaten vegetation supporting suitable habitat patches within the Study Area. Epidemic disease is also recognised as a potential or historical threat to the species, causing species decline (DEC, 2012). Such disease would typically be spread by fauna-borne parasites. As such project works are unlikely to spread disease; however, standard biosecurity management practices will be implemented to ensure equipment and vehicles entering the site are free of pathogens. The nearest Forest Disease Risk Area for *Phytophthora* dieback mapped by DBCA is located approximately 50 km west of the Study Area. Areas susceptible to Phytophthora dieback are restricted to those receiving >400 mm of annual rainfall, with areas between 400-600 mm of annual rainfall that are most susceptible generally being associated with high summer rainfall averages and water gaining sites. Narrogin is located within the 400 mm isohyet and is therefore susceptible to *Phytophthora* dieback introduction or spread. Although no known *Phytophthora* dieback infection sites are known within or in proximity to the Study Area, the Project will implement standard biosecurity measures as part of its CEMP to minimise this risk. Marri canker disease and Marri shoot blight are caused by fungal pathogens. Both diseases have been causing a decline in Marri over a number of years and due to their impact on both reproductive and vegetative tissues, affect the capacity for these trees to provide foraging and breeding habitat for black-cockatoo species. While Marri canker disease is suspected to be endemic to southwest WA, Marri shoot blight is an introduced disease and no control or management options have been developed for WA (Marbus et al., 2011; Paap et al., 2012). The Project will implement standard biosecurity management practices to minimise the risk of introduction or spread of these diseases. Biosecurity management measures to manage the diseases identified above will include: • Ensuring all ground disturbing plant and equipment enter site clean and free of weeds or dieback • Designated access tracks within site • Clean fill certificates for any imported fill used on-site Therefore, the Project is considered unlikely to result in the introduction of diseases that may cause the species to decline.	The Project is unlikely to be at variance with this criterion

Criteria	Assessment of the Project	Outcome
9. Interfere substantially with the recovery of the species	Threats identified in the (DEC, 2012) Recovery Plan for the Chuditch include: • Land clearing, particularly of riparian vegetation, and the removal of suitable den logs and den sites from chuditch habitat; • Predation by, and competition from, foxes and feral cats; and • Deliberate and accidental mortality from poisoning, trapping, illegal shooting, and road kills. Land clearing poses a particular threat to the Chuditch where: • the affected land that includes or adjoins riparian habitat (Serena & Soderquist, 1989); • it creates new gaps in otherwise homogeneous habitat; • it leads to progressive fragmentation of habitat; or • it necessitates the construction of roads (especially sealed roads) through, or adjacent to, uncleared habitat (DEC, 2012). The Project has avoided much of the remnant native vegetation within the Study Area with a total of 7.41 ha of habitat suitable for dispersal proposed for clearing. This represents 0.65% of the total suitable habitat within the Study Area (excluding existing cleared areas, of which isolated paddock trees do not present a significant habitat feature for the Chuditch, and planted areas), the majority of which comprises of vegetation at the perimeter of remnant patches or within heavily degraded areas. Some riparian habitat may be cleared (3.78 ha), however this vegetation is heavily degraded in nature and creek crossings proposed as part of the Project are to be upgrades of existing crossings. As such this does not diminish its capacity as suitable dispersal habitat given the highly mobile nature of the species and lack of suitable understorey components for regularly supporting dispersal. The Project is not expected to result in an increase in invasive species known to predate or compete with the Chuditch, and where there is capacity to occur, the Project will implement monitoring and management actions to address this through the operational EMP. The Project does not involve any deliberate poisoning, trapping, or illegal shooting of the Chuditch and is not expected to result in the introduction of such activities indirectly. Additionally, suitable speed limits will be established and sign-posted across all internal access tracks constructed to minimise the risk of road kills both during construction and operations. However, given that the Study Area is unlikely to sustain any resident populations of the species and may only provide occasional dispersal habitat, the inherent risk for road kills is considered to be low. Therefore, the Project is unlikely to interfere substantially with the recovery of the species.	The Project is unlikely to be at variance with this criterion

9.4 Red-tailed Phascogale

The Red-tailed Phascogale is listed as Vulnerable under the EPBC Act and has been assessed against the relevant Significant Impact Guidelines for Vulnerable species.

The significant impact assessment presented here considers the Significant Impact Guidelines 1.1 (Department of the Environment, 2013) and the current conservation advice for the species (TSSC, 2016).

The following sections describe the distribution and habitat requirements, threats, and occurrence and potential habitat in the Study Area and broader region. The significant impact assessment undertaken for the Red-tailed Phascogale against criteria in the Significant Impact Guidelines 1.1 (Department of the Environment, 2013) is provided in **Table 9.15**.

9.4.1 Distribution and Habitat Requirements

The Red-tailed Phascogale is a primarily nocturnal and semi-arboreal species which breeds in trees or fallen log hollows, grasstree skirts, and stumps, and are known to spend a considerable amount of time foraging on the ground (TSSC, 2016). They are opportunistic predators that feed on a wide range of invertebrates and may also consume small birds or mammals. The majority of the range of this species overlaps the southern wheatbelt and as such the population is fragmented, often occurring in isolated areas (Maxwell et al., 1996). They breed during a brief 3-week period of July each year and due to the semelparous (annual male die-off) life history, are considered more susceptible to local extinction due to stochastic events or threats (DCCEEW, 2024e).

The species is known to favour Wandoo or York Gum woodlands with Rock Sheoak but also uses other habitats including shrublands (Short et al., 2011; Woinarski et al., 2014). Specifically, they have been found to be present in upland sites dominated by Wandoo and Rock Sheoak, lowland sites such as river flats or lake fringes associated with York Gum and/or Swamp Sheoak or Swamp Sheoak and stags, as well as sites consisting of a mixture of both (Short et al., 2011). Short et al. (2011) found that canopy density in areas where the species were found tends to be higher and exhibit greater connectivity. Their home-range is from 1.5-8 ha and young will disperse once weaned to establish their own home ranges.

9.4.2 Threats

Threats to the recovery of the Red-tailed Phascogale identified in current conservation advice include (TSSC, 2016):

- Predation by feral cats
- Predation by foxes
- Habitat loss and fragmentation
- Climate change
- Frequent, intense fires.

Predation by feral cats is considered to have a severe consequence on populations of the species due to a number of specimens being retrieved from domestic cats and their overall abundance across the species range. Foxes are also abundant but considered to be of minor to moderate consequence due to the semi-arboreal nature of Red-tailed phascogales probably making them less vulnerable to predation.

Extensive land-clearing across the range of the Red-tailed Phascogale and their need for suitable canopy coverage and connectivity to minimise predation and provide dispersal capacity, as well as the presence of tree hollows, makes habitat loss and fragmentation a threat to their recovery. This threat has been ranked as of severe consequence to the species, particularly due to their susceptibility to local extinction in remnants where they do survive as a result of their semelparous breeding system and significant female die-off.

The Red-tailed Phascogale's susceptibility to drought and short-term fluctuations in climatic conditions leading to recruitment failure in any one year makes the species vulnerable to climate change impacts. In combination with the isolation of populations as a result of habitat loss and fragmentation, this presents a threat to the ability for the species to recover or recolonise sites.

Much of the suitable habitat for the species is considered to be fire prone which can destroy nesting hollows and canopy coverage. Where whole remnant patches are burnt, this can result in the species becoming locally extinct.

9.4.3 Occurrence and Potential Habitat in the Study Area and Broader Region

There are many records of this species within 20 km on DBCA's Threatened and Priority Fauna Database, including several in native vegetation immediately adjacent to the Study Area. The Study Area is within the core range of this species, and it is known to survive in relatively small habitat patches. The Red-tailed Phascogale was recorded on one camera trap in the Study Area and two camera traps in the Additional Survey Area over a total of 1,276 camera trap nights, all in the Eucalypt woodland on laterite rise habitat.

The Eucalypt – Sheoak woodland with granites and Eucalypt woodland on laterite rise habitats are likely to provide critical habitat for this species, and it may also disperse through creekline or planted habitats. Woodland patches that are small and degraded may not support the species due to a lack of shelter and foraging opportunities, but it would require further survey to exclude these areas as potential critical habitat. Cleared areas and isolated paddock trees are not likely to be used by this species. The extent of potential habitat that may be cleared within the Study Area is summarised in **Table 9.14**.

Table 9.14 Potential Areas of Impact to Habitat: Red-tailed Phascogale

Fauna Habitat Type	Impact Area (ha)
Creekline	3.78
Eucalypt – Sheoak woodland with granites	0.36
Eucalypt woodland on laterite rise	3.27
Planted	0.98
Total	**8.39**

9.4.4 Assessment Against Significant Impact Criteria

An assessment of the significance of impacts to this species under the Significant Impact Guidelines 1.1 – MNES (Department of the Environment, 2013) is provided in **Table 9.15**. The assessment identified that the Project is unlikely to have a significant impact on the Red-tailed Phascogale**.**

Table 9.15 Red-tailed Phascogale Significant Impact Assessment

Criteria	Assessment of the Project	Outcome
1. Lead to a long-term decrease in the size of an important population of a species	An 'important population' is a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are: • key source populations either for breeding or dispersal • populations that are necessary for maintaining genetic diversity, and/or • populations that are near the limit of the species range. There is currently no recovery plan in place for the Red-tailed Phascogale and management actions are defined under the approved conservation advice only (Threatened Species Scientific Committee (TSSC), 2016). Due to the semelparous (male die-off) life history of this species, it is considered more susceptible to local extinction due to stochastic events or threats and all known populations are considered essential for the species recovery and long-term survival (DCCEEW, 2024e). Therefore, potential impacts to individuals and/or habitats rather than distinct populations have been utilised to assess the significant of impacts. The species is known to favour Wandoo or York Gum woodlands with Rock Sheoak but also uses other habitats including shrublands (Short et al., 2011; Woinarski et al., 2014). The home-range is from 1.5–8 ha and this species uses a range of nesting sites including tree hollows, grasstree skirts and stumps (Woinarski et al., 2014). The majority of the range of this species overlaps the southern wheatbelt and as such the population is fragmented, often occurring in isolated reserves (Maxwell et al., 1996). The Study Area is not located near the limit of this species range and there are numerous contemporary records (<20 years) in the DBCA (DBCA, 2023a) database within the surrounding region, particularly in areas protected for conservation, such as Dryandra Woodland National Park and Lol Gray State Forest to the north, and Highbury State Forest to the south. The Eucalypt – Sheoak woodland with granites and Eucalypt woodland on laterite rise habitats are likely to provide critical habitat for this species, and it may also disperse through creekline or planted habitats. Some woodland patches that are small and degraded may not support the species due to a lack of shelter and foraging opportunities, with cleared areas and isolated paddock trees not likely to be used by this species. Short et al. (2011) found that canopy density in areas where the species were found tends to be higher and exhibit greater connectivity. This may be due to the semi-arboreal nature of the species, and the presence of key threats such as foxes and feral cats where individuals are required to use the ground more often for dispersal. Both foxes and feral cats were recorded within the Study Area during the field survey program further reducing the suitability of fragmented and degraded woodland patches. The Red-tailed Phascogale was recorded on one camera trap in the Study Area and two camera traps in the Additional Survey Area, all in the Eucalypt woodland on laterite rise habitat of degraded condition. The Project will result in the permanent removal of a total of 8.39 ha of Eucalypt-Sheoak woodland with granites, Eucalypt woodland on laterite rise, creekline, and planted habitats which represents 0.67% of these habitats within the Study Area. Additionally, the one habitat patch within the Study Area where this species was recorded via camera trap has been almost wholly avoided with clearing restricted to individual trees on the perimeter of the habitat patch and adjacent to an existing access track. Therefore, given the comparatively minimal extent of clearing of critical habitat for the species and the unsuitability of much of the habitat patches present, the Project is considered unlikely to result in a long-term decrease in the size of an important population of this species.	The Project is unlikely to be at variance with this criterion

Criteria	Assessment of the Project	Outcome
2. Reduce the area of occupancy of an important population	The area of occupancy for the Red-tailed Phascogale has been estimated at between 244 km^2 and 2,000 km^2 (TSSC, 2016). This large range is indicative of the limited sampling across their occupied range. The Project will result in a comparatively minor amount of clearing of multiple fragmented habitat patches within the Study Area, and the Study Area is not located near the range limit for the species. Suitable habitat that is present within the Study Area and proposed for clearing primarily consists of trees or vegetation at the perimeter of remnant vegetation patches which have all been rated as degraded in condition. Therefore, it is considered unlikely that the Project would result in a reduction in the area of occupancy for the species.	The Project is unlikely to be at variance with this criterion
3. Fragment an existing important population into two or more populations	Red-tailed phascogale populations are known to occur in *allocasuarina* and eucalypt woodland habitats (DCCEEW, 2024e). Specifically, they have been found to be present in upland sites dominated by Wandoo and Rock Sheoak, lowland sites such as river flats or lake fringes associated with York Gum and/or Swamp Sheoak or Swamp Sheaok and stags, as well as sites consisting of a mixture of both (Short et al., 2011). Short et al. (2011) found that canopy density in areas where the species were found tends to be higher and exhibit greater connectivity. The Red-tailed Phascogale are a semi- arboreal species which breeds in tree or fallen log hollows, grasstree skirts, and stumps, and are known to spend a considerable amount of time foraging on the ground (TSSC, 2016). The Project will result in the permanent removal of up to of 8.39 ha of Eucalypt-Sheoak woodland with granites, Eucalypt woodland on laterite rise, creekline, and planted habitats which represents 0.67% of these habitats within the Study Area. Additionally, clearing of the one habitat patch within the Study Area where this species was recorded via camera trap has been almost wholly avoided and is restricted to individual trees on the perimeter of the habitat patch and adjacent to an existing access track. These trees do not provide canopy connectivity to any nearby habitat patches on the opposite side of this track. Clearing in other suitable habitat patches within the Study Area is almost entirely restricted to trees or vegetation at their perimeter, with any clearing bisecting the patches being centred around existing access tracks and surrounded by degraded vegetation with sparse canopy cover. Access tracks that do bisect habitat patches will also not be fenced and therefore are not expected to present an obstruction to dispersal opportunities between patches via the ground. Therefore, the Project is not expected to result in the fragmentation of an existing population into two or more populations.	The Project is unlikely to be at variance with this criterion
4. Adversely affect habitat critical to the survival of a species	'Habitat critical to the survival of a species or ecological community' refers to areas that are necessary: • for activities such as foraging, breeding, roosting, or dispersal • for the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators) • to maintain genetic diversity and long term evolutionary development, or • for the reintroduction of populations or recovery of the species or ecological community.	The Project is unlikely to be at variance with this criterion

Criteria	Assessment of the Project	Outcome
	The Eucalypt – Sheoak woodland with granites and Eucalypt woodland on laterite rise habitats are likely to provide foraging, breeding, and dispersal habitat and it may also disperse through creekline or planted habitats. These habitat types comprise vegetation species or structural components that are considered suitable to the foraging, breeding, and dispersal of the Red-tailed Phascogale. Some woodland patches that are small and degraded may not support the species due to a lack of shelter and foraging opportunities, and cleared areas and isolated paddock trees are not likely to be used by this species. Therefore Eucalypt – Sheoak woodland with granites, Eucalypt woodland on laterite rise, creekline, and planted habitats within the Study Area are considered critical habitat to the survival of the Red-tailed Phascogale. The Project will result in the permanent removal of a total of 8.39 ha of Eucalypt-Sheoak woodland with granites, Eucalypt woodland on laterite rise, and creekline and planted habitats which represents 0.67% of these habitats within the Study Area. Habitat removal however will be primarily confined to the perimeters of approximately 20 patches of fragmented degraded vegetation which provide limited to no breeding habitat and are not important for the long-term maintenance of the species or to maintain genetic diversity. Given these factors and its minor extent in comparison to the remaining suitable habitat within the Study Area and surrounding more intact habitat is considered unlikely to be significant.	
5. Disrupt the breeding cycle of an important population	The Red-tailed Phascogale are a semi-arboreal species which breeds in tree or fallen log hollows, grasstree skirts, and stumps. The species is primarily nocturnal and breed only during a 3-week period in July of each year. Fauna habitats in the Study Area which potentially provide breeding habitat for the species include Eucalypt – Sheoak woodland with granites and Eucalypt woodland on laterite rise habitats. creekline and planted habitats are considered to be too degraded, with sparse canopy coverage or lacking structural components to regularly sustain the species and provide suitable breeding habitat and are therefore considered likely to only provide dispersal habitat. Clearing of Eucalypt – Sheoak woodland with granites and Eucalypt woodland on laterite rise habitats consists primarily of individual trees and vegetation at the perimeter of these habitat patches with any clearing bisecting patches being centred around existing access tracks where vegetation is already degraded and sparse. Additionally, measures to retain felled trees in-situ and relocate existing felled logs where possible during vegetation clearance will be incorporated into the Project's CEMP (**Appendix G**). Pre-clearance surveys will be undertaken by a licenced fauna spotter with any pre-clearance surveys undertaken during the Red-tailed Phascogale's breeding season targeting potential breeding habitat features such as tree or fallen log hollows, grasstree skirts, and stumps. Where individuals are identified, a no-go zone will be established, and no clearing will be undertaken until individuals have naturally dispersed and left the area. Therefore, it is considered unlikely that the Project will disrupt the breeding cycle of a population of the Red-tailed Phascogale.	The Project is unlikely to be at variance with this criterion

Criteria	Assessment of the Project	Outcome
6. Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	The Eucalypt – Sheoak woodland with granites and Eucalypt woodland on laterite rise habitats are likely to provide foraging and dispersal habitat for this species, and it may also disperse through creekline or planted habitats. Habitat is degraded and unlikely to provide breeding value at the edges. Some woodland patches that are small and degraded may not support the species due to a lack of shelter and foraging opportunities, and cleared areas and isolated paddock trees are not likely to be used by this species. The Project has avoided much of the habitat suitable for the species and will result in the permanent removal of a total of 8.39 ha of Eucalypt-Sheoak woodland with granites, Eucalypt woodland on laterite rise, creekline, and planted habitats which represents 0.67% of these habitats within the Study Area. The extent of clearing proposed in comparison to remaining suitable habitat within the Study Area is considerably small and is primarily restricted to trees or vegetation at the perimeter of approximately 20 remnant degraded vegetation patches, with any clearing bisecting the patches being centred around existing access tracks and surrounded by degraded vegetation with sparse canopy cover. Access tracks that do bisect habitat patches will also not be fenced and therefore are not expected to present an obstruction to dispersal opportunities between patches via the ground. Therefore, it is considered unlikely that the Project will result in the impacts to the availability or quality of habitat to the extent that the Red-tailed Phascogale is likely to decline.	The Project is unlikely to be at variance with this criterion
7. Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	Invasive species known to be harmful to the Red-tailed phascogale are primarily feral cats but may also include foxes (TSSC, 2016). Feral cats were recorded during field surveys, but it is not expected that the Project or Project activities would result in an increased presence of feral cats within the Study Area. Foxes may have effects directly on the species through predation and are known to be common in farmland areas. Foxes were recorded during field surveys across 12 of the 21 camera traps established (Western Wildlife, 2024). The Project Environmental Management Plan will employ best practice control methods for weeds and pests and it is unlikely the Project will introduce or exacerbate weeds or pests beyond existing levels. Therefore, it is considered unlikely that the Project would result in the establishment of invasive species that are harmful to the Red-tailed Phascogale within the Study Area.	The Project is unlikely to be at variance with this criterion
8. Introduce disease that may cause the species to decline	Diseases which may pose a threat to the Red-tailed Phascogale within the Study Area is *Phytophthora* dieback, Marri canker disease, and Marri shoot blight which may threaten vegetation supporting suitable habitat patches within the Study Area. The nearest Forest Disease Risk Area for *Phytophthora* dieback mapped by DBCA is located approximately 50 km west of the Study Area. Areas susceptible to Phytophthora dieback are restricted to those receiving >400 mm of annual rainfall, with areas between 400-600 mm of annual rainfall that are most susceptible generally being associated with high summer rainfall averages and water gaining sites. Narrogin is located within the 400 mm isohyet and is therefore susceptible to *Phytophthora* dieback introduction or spread. Although no known *Phytophthora* dieback infection sites are known within or in proximity to the Study Area, the Project will implement standard biosecurity measures as part of its CEMP to minimise this risk.	The Project is unlikely to be at variance with this criterion

Criteria	Assessment of the Project	Outcome
	Marri canker disease and Marri shoot blight are caused by fungal pathogens. Both diseases have been causing a decline in Marri over a number of years and due to their impact on both reproductive and vegetative tissues, affect the capacity for these trees to provide foraging and breeding habitat for black-cockatoo species. While Marri canker disease is suspected to be endemic to southwest WA, Marri shoot blight is an introduced disease and no control or management options have been developed for WA (CECC, 2011; CECC, 2012). The Project will implement standard biosecurity management practices to minimise the risk of introduction or spread of these diseases. Biosecurity management measures to manage the diseases identified above will include: • Ensuring all ground disturbing plant and equipment enter site clean and free of weeds or dieback • Designated access tracks within site • Clean fill certificates for any imported fill used on-site Therefore, the Project is considered unlikely to result in the introduction of diseases that may cause the species to decline.	
9. Interfere substantially with the recovery of the species	There is no recovery plan currently in place for the Red-tailed Phascogale, however threats to the recovery of the species identified in current conservation advice include (TSSC, 2016): • Predation by feral cats • Predation by foxes • Habitat loss and fragmentation • Climate change • Frequent, intense fires The Project Environmental Management Plan will employ best practice control methods for weeds and pests and it is unlikely the Project will introduce or exacerbate weeds or pests beyond existing levels The Project has avoided much of the habitat suitable for the species and will result in the permanent removal of a total of 8.39 ha of Eucalypt-Sheoak woodland with granites, Eucalypt woodland on laterite rise, and creekline, and planted habitats which represents 0.67% of these habitats within the Study Area, respectively. The extent of clearing proposed in comparison to remaining suitable habitat within the Study Area is considerably small and is primarily restricted to trees or vegetation at the perimeter of remnant degraded vegetation patches, with any clearing bisecting the patches being centred around existing access tracks and surrounded by degraded vegetation with sparse canopy cover. Access tracks that do bisect habitat patches will also not be fenced and therefore are not expected to present an obstruction to dispersal opportunities between patches via the ground. The Project will directly address the impacts of climate change over the long-term by supporting Western Australia's clean energy transition. Project activities during construction or operations are not considered likely to increase the frequency or intensity of fires within the Study Area. The Project EMP will include management measures relating to fire risk from construction activities, including adequate fire-fighting provisions and risk management procedures. Therefore, the Project is considered unlikely to interfere substantially with the recovery of the Red-tailed Phascogale.	The Project is unlikely to be at variance with this criterion

9.5 Fork-tailed Swift

9.5.1 Distribution and Habitat Requirements

The Fork-tailed Swift is a non-breeding migrant to Australia between September and April (Boehm, 1962). While it can be common further north, in southwest Australia this species is generally scarce (Johnstone & Storr, 1998). The species is known as a high-flying almost exclusively aerial species that spends much of its life "on-the-wing", only grounding for breeding (Melville, 2013). It is usually seen foraging in flocks, often 100s of metres AGL but may fly closer to the ground in response to prey and is considered to be found most abundantly over inland plains, but can occur over any terrestrial habitat and sometimes the sea (Menkhorst et al., 2019). The Fork-tailed Swift has a large range as a result of its flight behaviours and wide-ranging suitable habitat, with much of Australia mapped as within its modelled distribution by DCCEEW (2024a). The R*eferral Guideline for 14 Birds Listed as Migratory Species Under the EPBC Act* lists important habitat for the species as non-breeding habitat only which includes a range of habitats from inland open plains to wooded areas where it is exclusively aerial (Department of the Environment, 2015b).

9.5.2 Threats

There are no invasive species harmful to the Fork-tailed Swift or significant threats that have been currently identified in Australia (Department of the Environment, 2015b). Potential threats may include habitat destruction and predation by feral animals, however due to the wide range of the species, these are considered to be negligible. The species is estimated to have a large population that appears to be stable (BirdLife International, 2024).

9.5.3 Occurrence and Potential Habitat in the Study Area and Broader Region

There are no records of this species within a 20 km radius of the Study Area in the DBCA's Threatened and Priority Fauna Database (DBCA, 2023a); however, the species is considered to potentially occur on occasion given the modelled distribution by DCCEEW (2024a) and its wide-ranging nature. The nearest record found for the species in the eBird (Cornell Lab of Ornithology, 2024) database is approximately 30 km south of the Study Area in Arthur River from 2018. Although, this record cannot be verified and the species can often be difficult to identify for inexperienced observers. The Fork-tailed Swift is only likely to forage above the Study Area and surrounding region given its typical flight behaviours during the non-breeding season when it may occur.

No records of the Fork-tailed Swift were identified during the surveys.

9.5.4 Assessment Against Significant Impact Criteria

The assessment against significant impact criteria for the Fork-tailed Swift is provided in **Table 9.16**. The assessment identified that the Project is unlikely to have a significant impact on the Fork-tailed Swift.

Table 9.16 Fork-tailed Swift Significant Impact Assessment

Criteria	Assessment of the Project	Outcome
1. Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species	The Draft R*eferral Guideline for 14 Birds Listed as Migratory Species Under the EPBC Act* lists important habitat for the species as non-breeding habitat only which includes a range of habitats from inland open plains to wooded areas where it is exclusively aerial. A site is deemed internationally important if it regularly supports 1% of the population (1,000 birds) or nationally important if it regularly supports 0.1% of the population (100 birds) (Department of the Environment, 2015b). Although the Fork-tailed Swift potentially occurs, the Study Area is not likely to regularly support the species and nationally or internationally important numbers of birds are unlikely to ever occur. The Fork-tailed swift is unlikely to be concentrated within the Study Area and may only very occasionally occur as a foraging visitor indicating the Study Area does not present important habitat that is regularly utilised. As the Fork-tailed Swift is likely to be exclusively aerial on occasions where it may occur within the Study Area, it is unlikely to be affected by the relatively limited levels of on-ground clearing within the Indicative Project Footprint compared to the broader Study Area. Additionally, the species is highly mobile and agile when in-flight and is likely able to avoid turbines through macro- or meso-avoidance when it may transit through the area or forage in the surrounding region. Therefore, it is considered unlikely that the Project will substantially modify, destroy, or isolate an area of important habitat for the species.	The Project is unlikely to be at variance with this criterion.
2. Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species	The Draft R*eferral Guideline for 14 Birds Listed as Migratory Species Under the EPBC Act* indicates there are no invasive species harmful to the Fork-tailed Swift that have been currently identified in Australia (Department of the Environment, 2015b). The only invasive fauna that were recorded during the fauna survey program include feral cats and foxes; however, these species are highly unlikely to have the opportunity to directly predate on Fork-tailed Swifts. No invasive fauna that may compete with food resources with the Fork-tailed Swift have been identified. Therefore, it is considered unlikely that the Project would result in invasive species harmful to the Fork-tailed Swift becoming established in the Study Area.	The Project is unlikely to be at variance with this criterion.

Criteria	Assessment of the Project	Outcome
3. Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species	Actions which constitute serious disruption to an ecologically significant proportion of a population are those that are predicted to have annual mortality rates or affect breeding cycles of individuals meeting or exceeding the upper threshold (1%) of the species' population. The Fork-tailed Swift only occurs in Australia as a non-breeding migrant where it is exclusively aerial. The Fork-tailed swift is unlikely to be concentrated within the Study Area and may only very occasionally occur as a foraging visitor. Given the lack of existing records in the surrounding region and its general scarcity in the south of Australia, the Study Area is unlikely to be within the path of a significant or regular flyway for the species. The lower limit for an ecologically significant proportion of the species' population would be 0.1% of the overall population which is 100 individuals (Department of the Environment, 2015b). Therefore, it is considered unlikely that the Project would seriously disrupt the lifecycle of an ecologically significant proportion of the Fork-tailed Swift population.	The Project is unlikely to be at variance with this criterion.

10.0 Environmental Offsets

Residual impacts remain after the application of the mitigation hierarchy as outlined in **Section 8.0**. However, when assessing these impacts against criteria in the *Significant Impact Guidelines 1.1,* these are unlikely to be considered significant due to the extent, fragmentation and quality of native vegetation proposed for clearing.

An environmental offset is still likely to be required under the Part V EP Act Native Vegetation Clearing Permit process and will be prepared in accordance with the WA Environmental Offset Policy 2011 and Environment Offset Guidelines 2014. Further to the Part V offset, Neoen is investigating the potential to contribute funds to initiatives to further improve conservation outcomes for black-cockatoos under their "above and beyond" initiative. A prior example of where this initiative has gone beyond regulatory requirements to achieve conservation outcomes is the purchase and donation of land as part of the Goyder Wind Farm in South Australia.

11.0 Conclusions

This report identified MNES protected under the EPBC Act relevant to the Project and completed an assessment of Project activities against the Significant Impact Guidelines 1.1 – MNES (Department of the Environment, 2013). MNES identified and assessed in this report included:

- EPBC Act listed ecological communities
- EPBC Act listed Threatened fauna species
- EPBC Act listed Migratory fauna species.

Desktop and field assessments of the Study Area identified several MNES as being known to occur or expected to occur within the Study Area. A total of one Threatened Ecological Community and four Threatened fauna species were confirmed as present within the Study Area during field surveys:

- Eucalypt Woodlands of the Western Australian Wheatbelt
- Carnaby's Black-Cockatoo
- Forest Red-tailed Black-Cockatoo
- Chuditch
- Red-tailed Phascogale.

An additional one Threatened fauna species and one Migratory fauna species were identified as having a Moderate likelihood of occurrence in the Study Area:

- Baudin's Black-Cockatoo
- Fork-tailed Swift.

Two Threatened flora species were also identified as Potentially occurring within the Study Area but only within vegetation mapped as Good or better. These areas have been avoided from direct impacts by the Project and the species were therefore not included in the assessment of significant impact.
These included:

- *Darwinia carnea*
- *Pultenaea pauciflora.*

The assessment has identified a number of potential impacts on MNES, most notably the clearing of native vegetation comprising Threatened fauna species' habitat and potential for wind turbine collision.

The Project has employed an iterative design process with a strong focus on the avoidance of key environmental and ecological values to result in Project impacts reduced to as low as possible, followed by minimisation and mitigation of impacts wherever possible. The Project will be governed by several management plans to assist in the minimisation and mitigation of potential impacts such as a CEMP (**Appendix G**) and a BBAMP (**Appendix D**). These management plans will outline specific measures and procedures to minimise and mitigate against potential impacts through both the construction and operational phases of the Project.

With consideration for Project mitigation measures, significant impact assessments were conducted for the residual impacts to relevant MNES in accordance with the Significant Impact Guidelines 1.1 – MNES (Department of the Environment, 2013).

The assessment identified that while the Project will have residual impacts on the habitats of 5 MNES species, the impacts are unlikely to be considered significant. The permanent removal of native vegetation comprising these habitats is distributed across the Study Area and consists of degraded and highly fragmented vegetation at the perimeter of existing patches. It will amount to the total removal of 1.64–2.06% of black-cockatoo foraging habitat and approximately 0.67% of other fauna habitat types across the entire Study Area, with extensive, better-quality habitats of similar suitability present in the region immediately surrounding the Study Area, including areas protected for conservation.

While these residual impacts are not considered to be significant, they are still expected to be offset under the State approvals process for native vegetation clearing. As all MNES assessed here with residual impacts are also protected under State legislation, their associated habitats will be captured within the proposed offset. An offset proposal has been provided to summarise the proposed offset mechanism and impact quantum requiring an offset which will be further refined and finalised into an offset strategy during the State approvals process.

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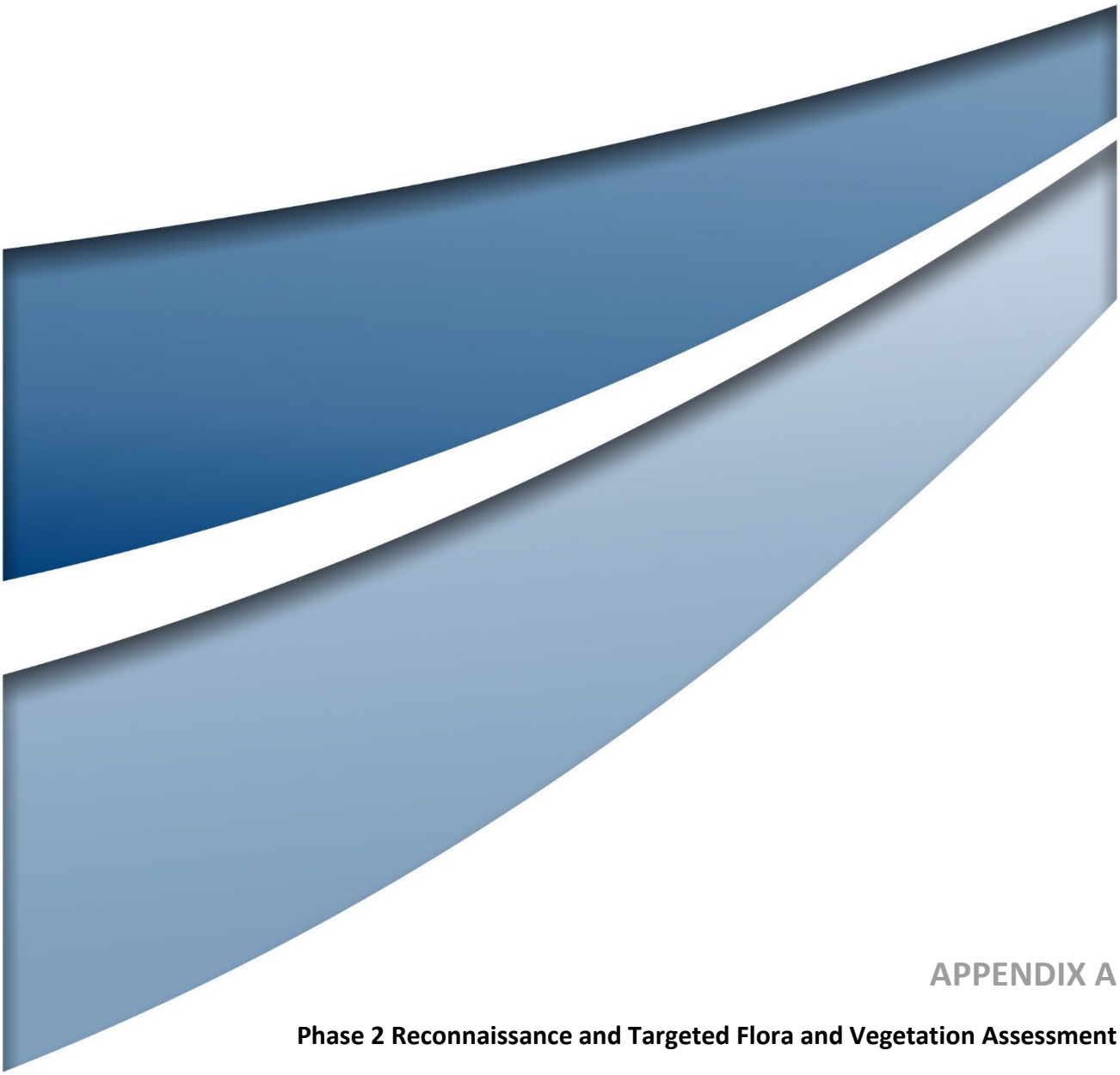
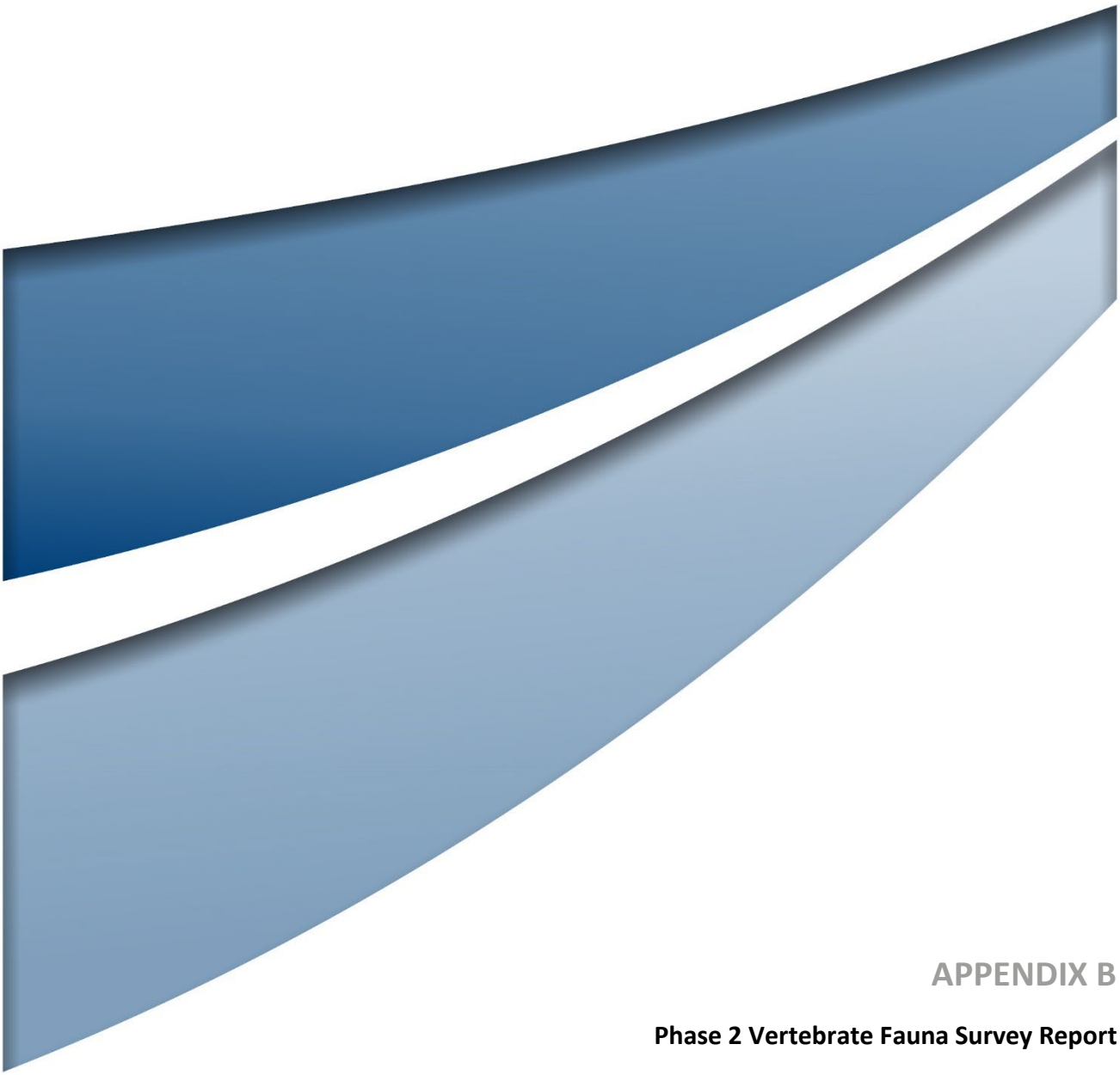


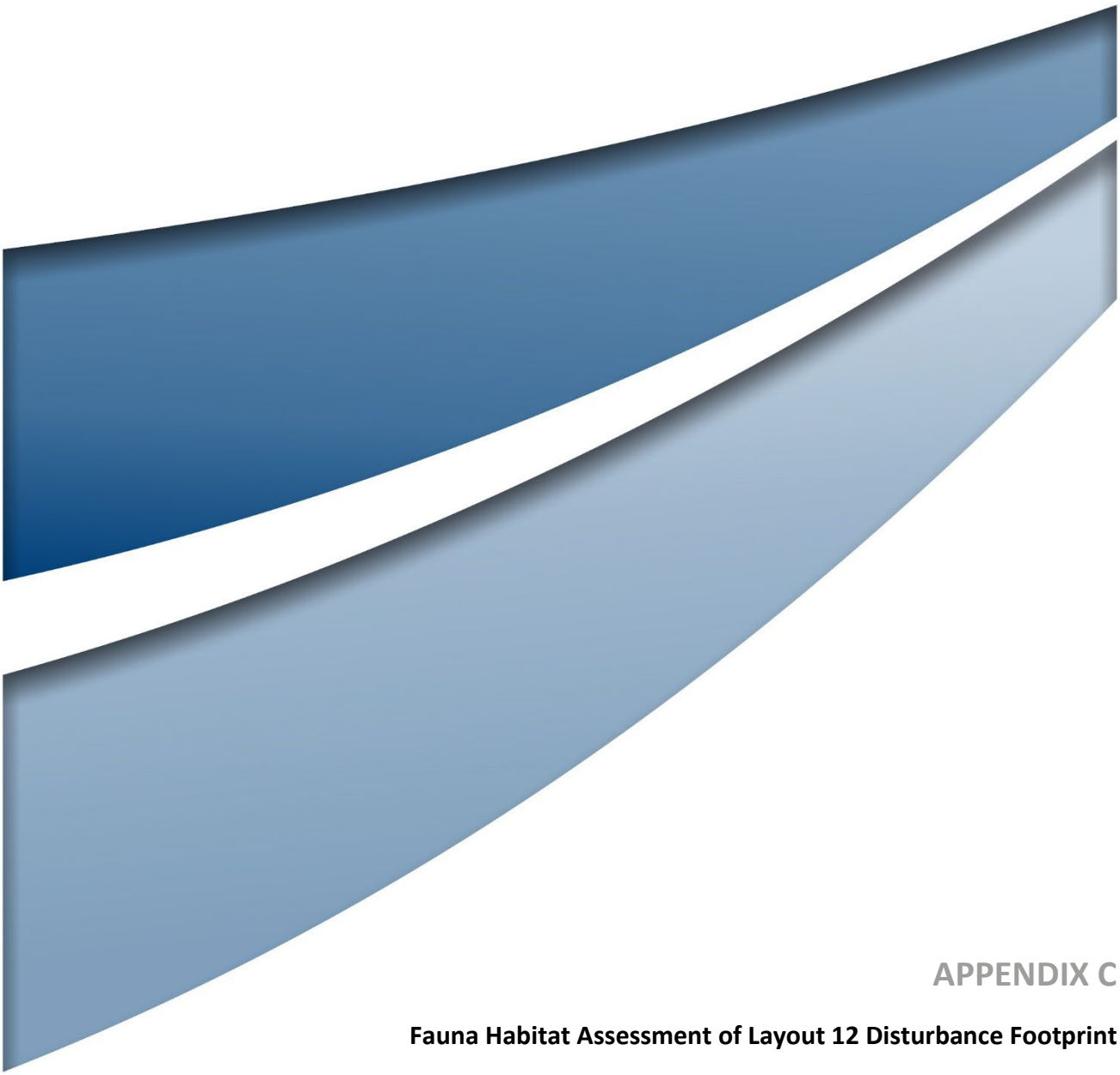
APPENDIX A

Phase 2 Reconnaissance and Targeted Flora and Vegetation Assessment



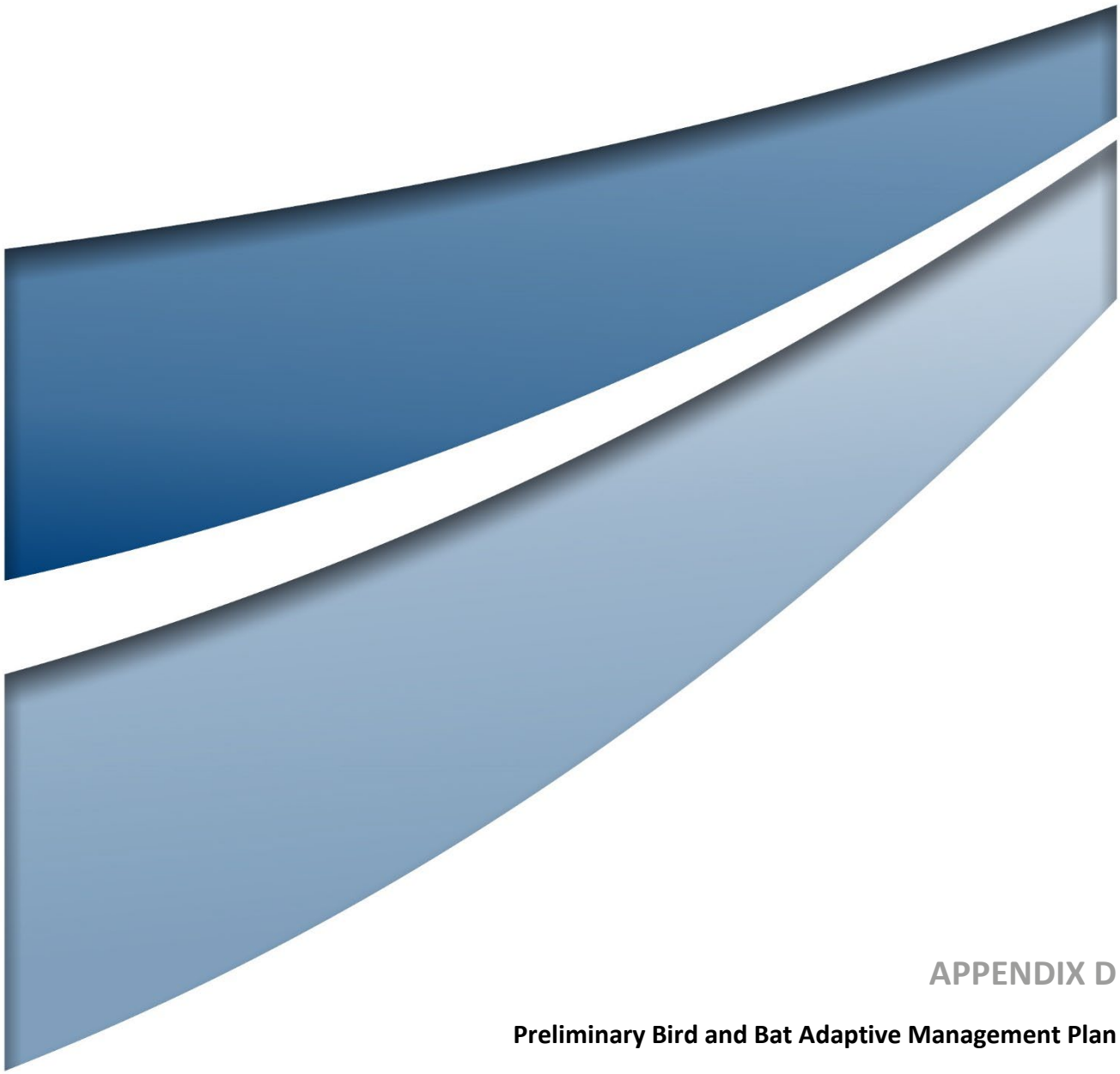
APPENDIX B

Phase 2 Vertebrate Fauna Survey Report



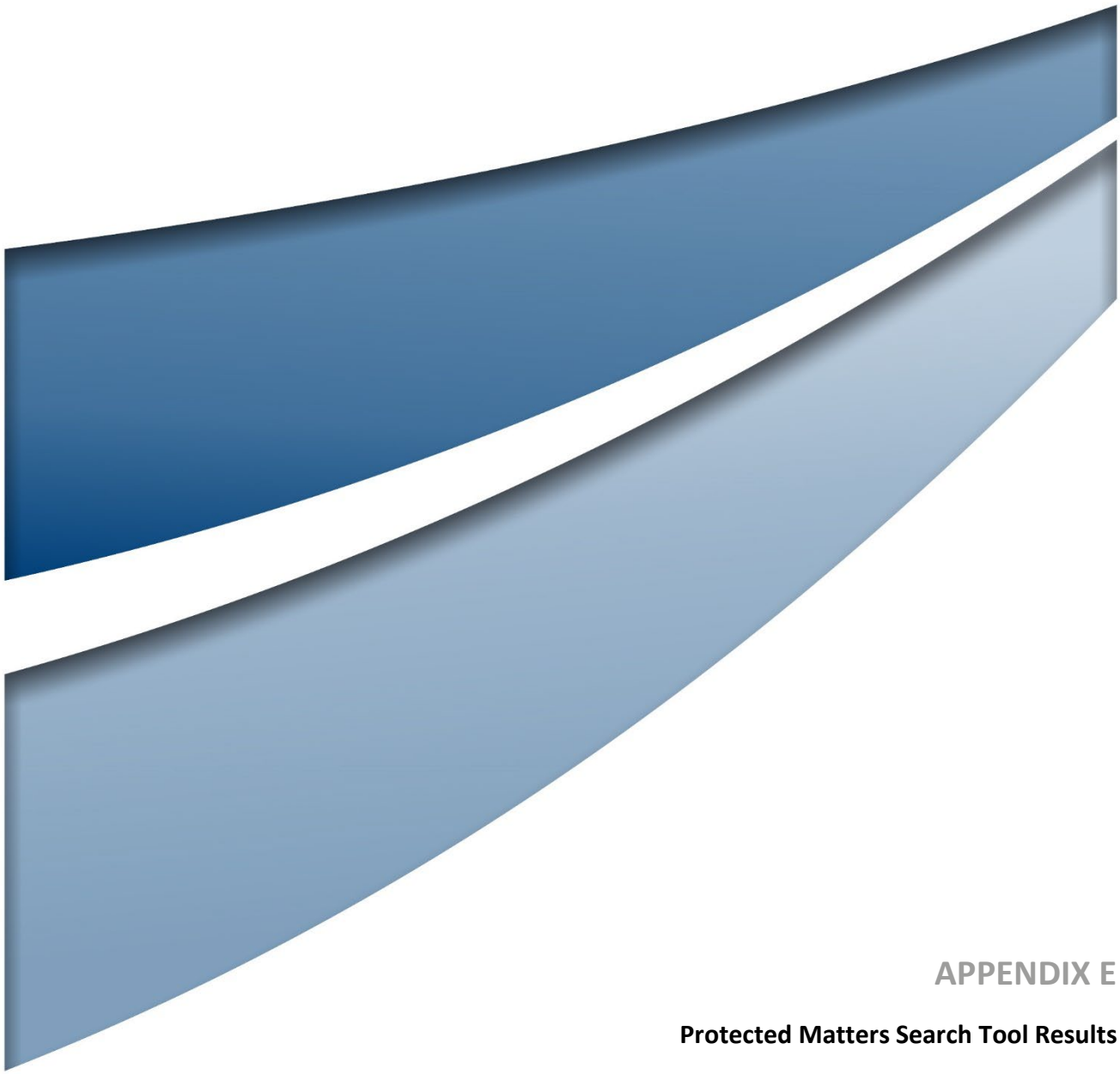
APPENDIX C

Fauna Habitat Assessment of Layout 12 Disturbance Footprint



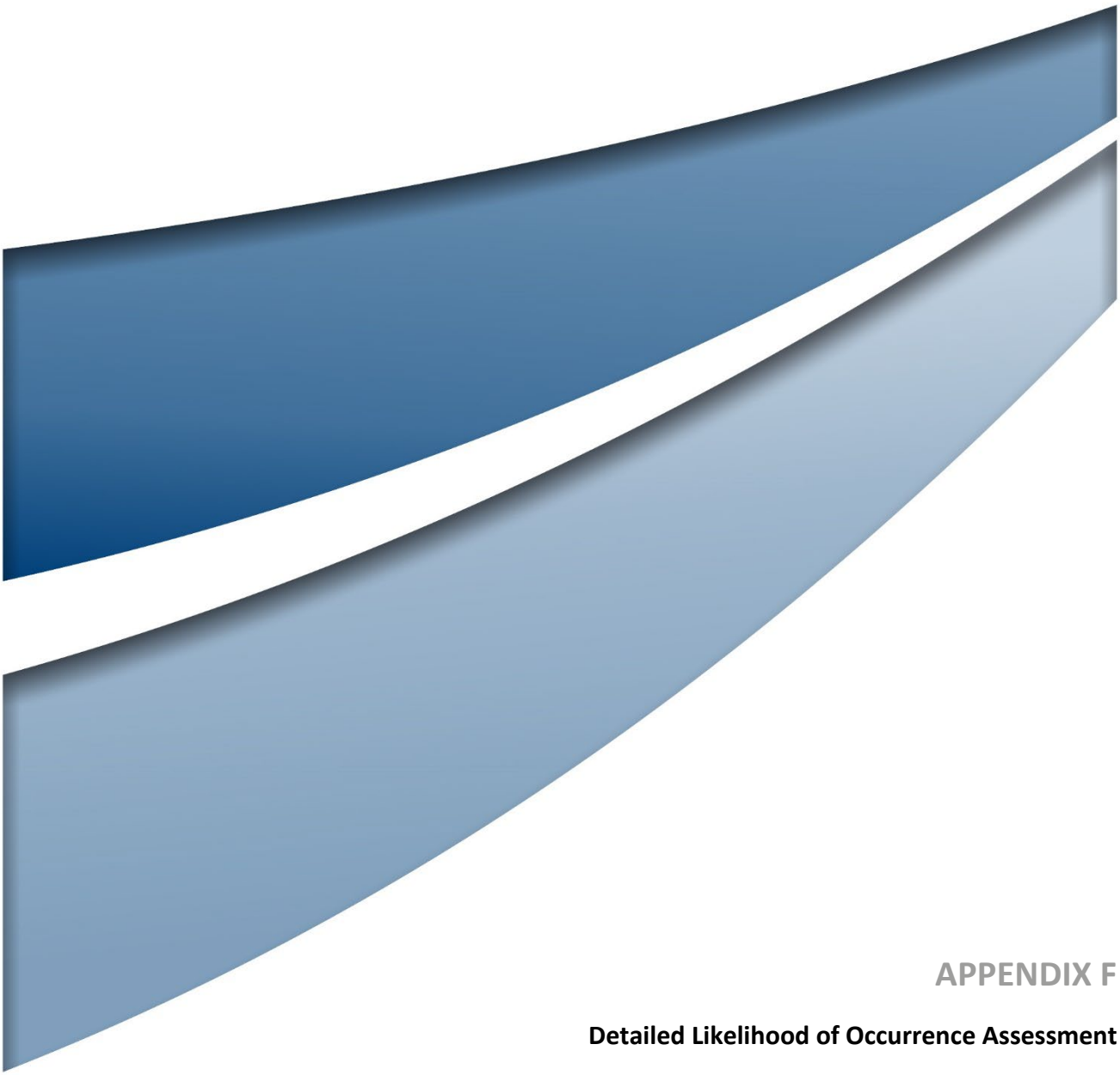
APPENDIX D

Preliminary Bird and Bat Adaptive Management Plan



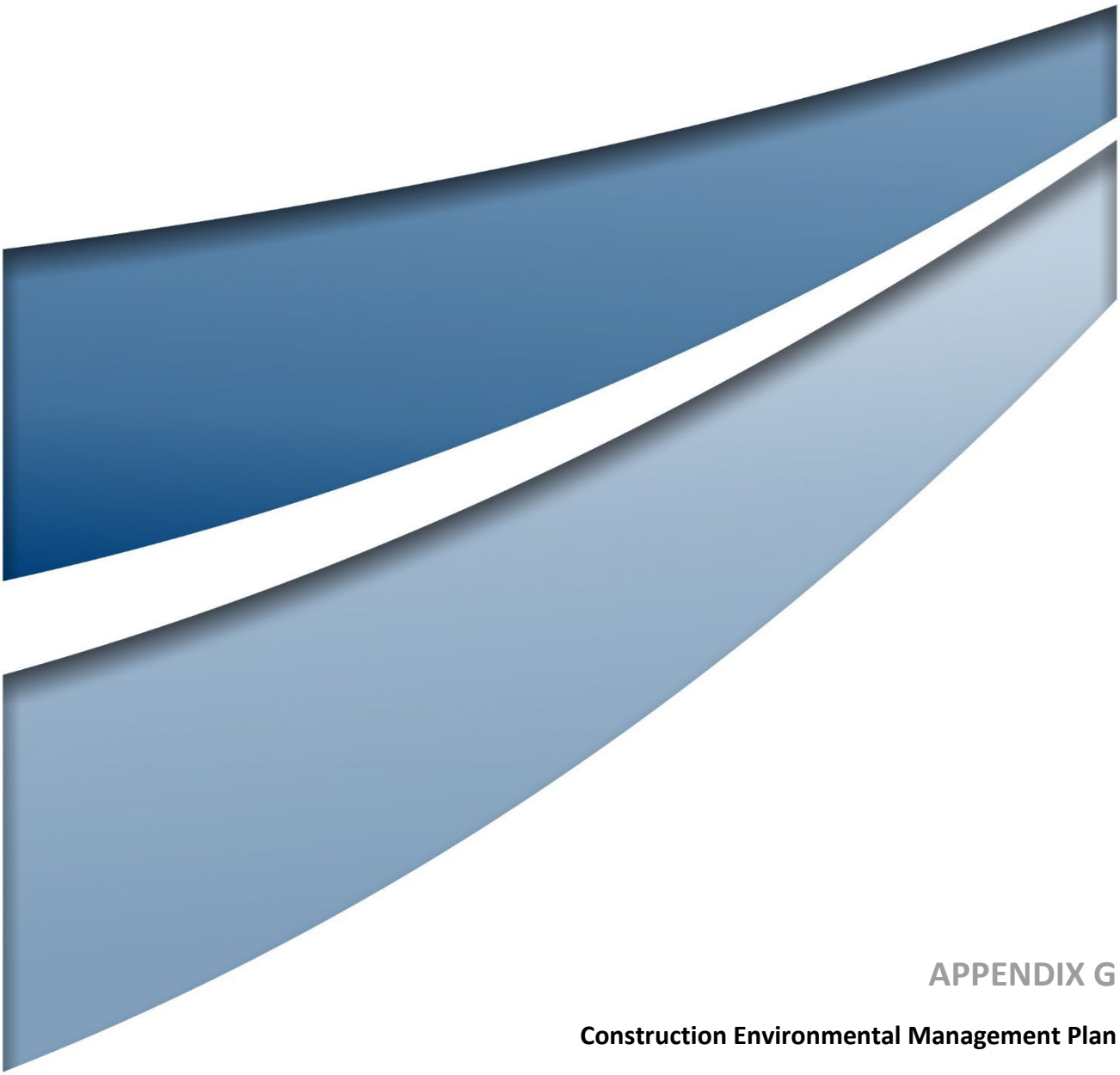
APPENDIX E

Protected Matters Search Tool Results



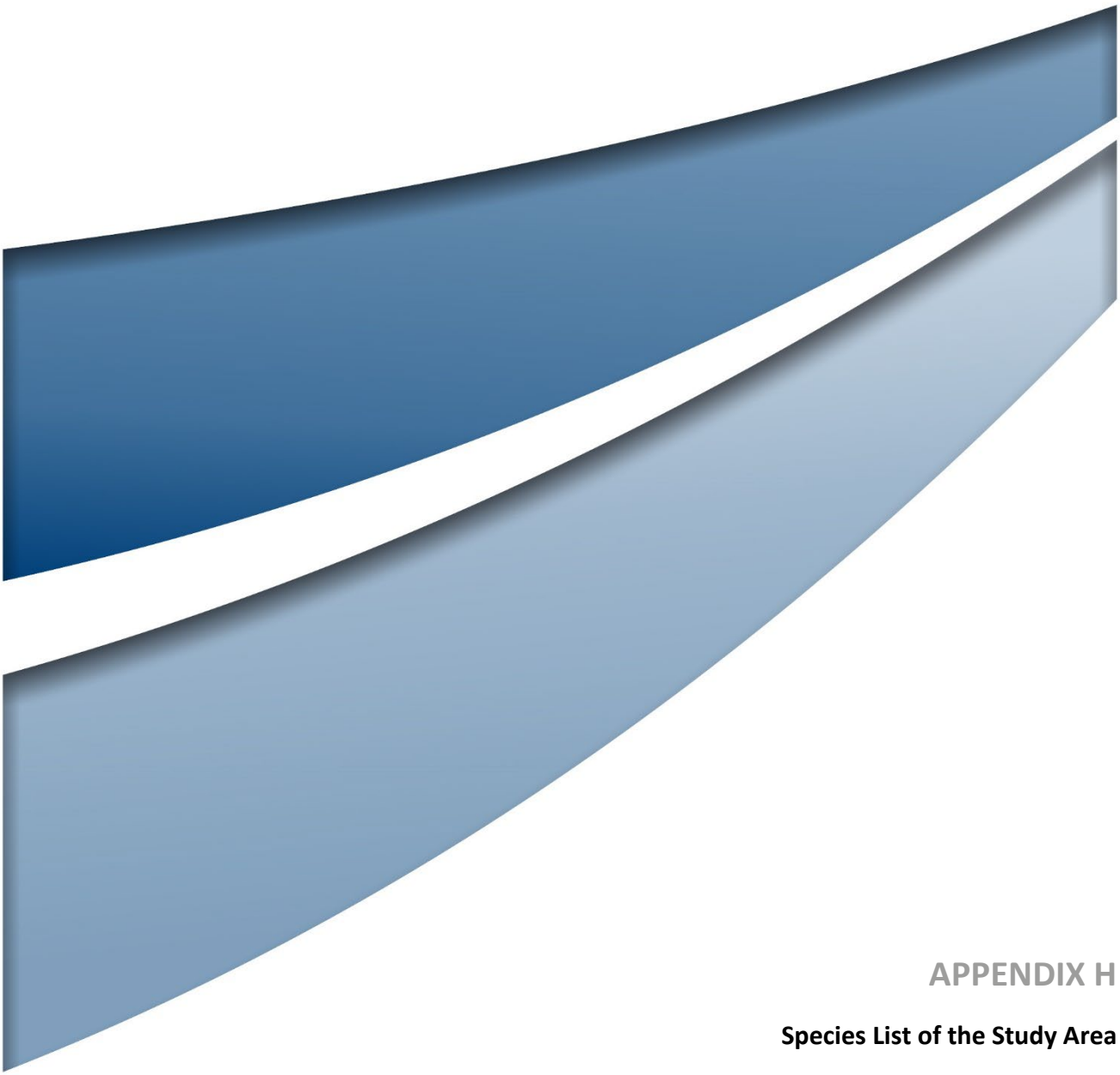
APPENDIX F

Detailed Likelihood of Occurrence Assessment



APPENDIX G

Construction Environmental Management Plan



APPENDIX H

Species List of the Study Area

umwelt
Environmental & Social Consultants

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