



# **Moomba to Wilton Pipeline – APA East Coast Grid Expansion Stage 3a Compressor Station Installation – Modification 2**


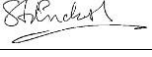
## **Biodiversity Development Assessment Report**

APT Management Services Pty Ltd

January 2024

**→ The Power of Commitment**



<b>Project name</b>		Moomba to Wilton Pipeline – APA East Coast Grid Expansion Stage 3a Compressor Station Installation – Modification 2					
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# Declarations

## i. Certification under clause 6.15 *Biodiversity Conservation Act 2016*

I, Ben Harrington, certify that this report has been prepared based on the requirements of, and information provided under, the Biodiversity Assessment Method and clause 6.15 of the *Biodiversity Conservation Act 2016* (BC Act).

Signature: 

Date: 22/01/2024

BAM Assessor Accreditation no: BAAS17023

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# 1. Introduction

## 1.1 Overview

East Australian Pipeline Ltd and APT Management Services Pty Limited, part of APA Group (APA), own and operate the Moomba to Wilton Pipeline (MWP). The MWP is an underground high-pressure natural gas transmission pipeline about 1,300 kilometres (km) long running between Moomba in South Australia to Wilton in New South Wales (the MWP).

The MWP is the main line of the Moomba to Sydney Pipeline and forms part of the East Coast Grid of interconnected gas transmission pipelines. The MWP is operated subject to the conditions of Pipeline Licence No. 16 (PL16), issued under the *Pipelines Act 1967* (NSW) (Pipelines Act) and the SSI-15548591 approval.

APA is proposing an expansion of gas transportation capacity on its East Coast Grid that links Queensland to southern markets ahead of projected potential supply risks. This expansion would be achieved through the construction of additional compressor stations and associated works on the MWP in NSW.

The construction of a new compressor station (MW244) is Stage 3a of APA's East Coast Grid Expansion Project and will be located about 17 km south-east of Tibooburra along Tibooburra Road, within the Far West Unincorporated Area of NSW on private land (Lot 1, DP 832569) owned by APA.

A temporary accommodation camp is required as ancillary infrastructure to accommodate staff during the construction of the compressor station. During this same period, maintenance works are scheduled on the MWP near Tibooburra, meaning the temporary accommodation camp is proposed to be used by an increased workforce, for the compressor station and the ongoing maintenance project.

In addition to the compressor station, APA is seeking approval for use of the temporary accommodation camp on a three-yearly basis to house a workforce to undertake maintenance activities on the nearby section of the MWP. These maintenance activities are required to comply with conditions of PL16. The temporary accommodation camp proposed for maintenance activities would occupy the same disturbance footprint as the temporary accommodation camp used for the construction of the compressor station.

APA is proposing to construct and operate the compressor station and the ancillary infrastructure through a modification (Mod 2) to the SSI-15548591 Approval under Section 5.25 of the *Environmental Planning and Assessment Act 1979* (EP & A Act).

GHD Pty Ltd (GHD) has been engaged to prepare a Biodiversity Development Assessment Report (BDAR) to accompany Mod 2 for impacts resulting from the proposal.

## 1.2 Purpose and scope of this report

This report has been prepared by GHD as part of the modification report for the proposal. The purpose of this report is to assess potential biodiversity issues from the construction and operation of the proposal, and where required, identify feasible and reasonable mitigation and management measures. This report:

- describes the existing environment of the study area, including the results of the desktop assessment and site surveys
- assesses the value and conservation significance of native vegetation and habitats at the proposal site and the potential for threatened biota including matters of national environmental significance (MNES) to occur or be affected by the proposal
- provides a description of the proposal, including potential impacts on biodiversity values and measures to avoid or mitigate impacts
- assesses the significance of impacts on threatened biota and Commonwealth Matters of National Environmental Significance (MNES) under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act).

- presents the data used to perform the Biodiversity Assessment Method (BAM) (DPIE 2020a) credit calculations for the proposal
- calculates the number and type of biodiversity credits that would be required to offset residual impacts of the proposal in accordance with the BAM
- recommends measures to mitigate and manage the impacts identified including decommissioning and rehabilitation of the proposal site.

## 1.3 Structure of this report

The structure of this BDAR is as follows:

- Section 1 – provides an introduction to the proposal and the assessment
- Section 2 – describes the methodology for the assessment
- Section 3 – describes the context for the site and landscape-scale inputs to the biodiversity assessment
- Section 4 – describes the existing environment of the proposal site including vegetation and threatened ecological communities and site-scale inputs to the biodiversity assessment
- Section 5 – describes the extent and quality of habitat for threatened and migratory species at the proposal site
- Section 6 – identifies prescribed impacts that are relevant to the assessment
- Section 7 – outlines steps taken to avoid and minimise potential impacts on biodiversity values
- Section 8 – assesses the impacts of the construction and operation of the proposal and presents mitigation measures for potential impacts
- Section 9 – considers the potential for serious and irreversible impacts (SAIL), presents a summary of impacts pursuant to the assessment and offsetting thresholds set out in the BAM and presents the biodiversity credits required as offsets for residual impacts on threatened biota and their habitats under the BAM
- Section 10 – presents conclusions of the assessment pursuant to the key requirements of the BAM and related legislation and policy.

## 1.4 The proposal

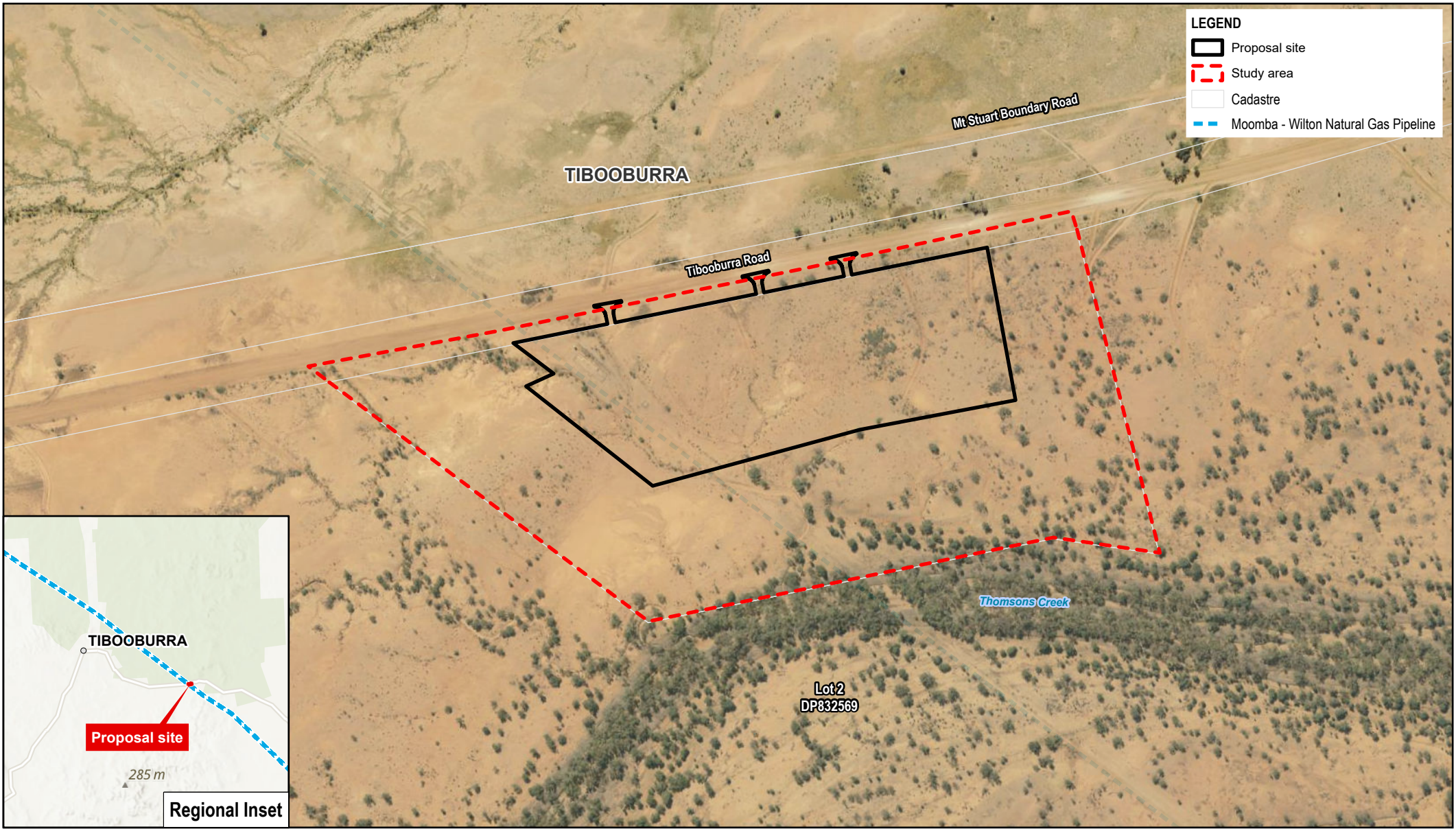
### 1.4.1 Location

The proposal site is located about 17 km south-east of Tibooburra along Tibooburra Road in the Far West Unincorporated Area on freehold land (no zoning applies) owned by APA. The land parcel is Lot 1, DP 832569, containing a study area of around 18 hectares (ha) that was considered as the general location for the proposal and the 9.4 ha 'proposal site' that would accommodate the proposed compressor station and camp site as shown on Figure 1.1.

The study area comprises agricultural land with low intensity sheep grazing, as well as the MWP and associated infrastructure maintained by APA. It contains moderate condition native chenopod low shrublands, Acacia shrubland, Acacia (Gidgee) woodland and River Red Gum (*Eucalyptus camaldulensis*) woodland typical of the semi-arid climatic zone of far-western NSW.

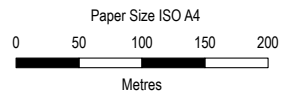
The MWP easement passes through the western portion of the proposal site with the proposed compressor immediately to the east of the MWP and the camp site to the east of the compressor station as shown on Figure 1.2.



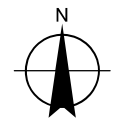


**LEGEND**

- Proposal site
- Study area
- Cadastre
- Moomba - Wilton Natural Gas Pipeline



Map Projection: Lambert Conformal Conic  
Horizontal Datum: GDA2020  
Grid: GDA2020 NSW Lambert



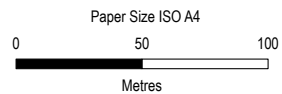
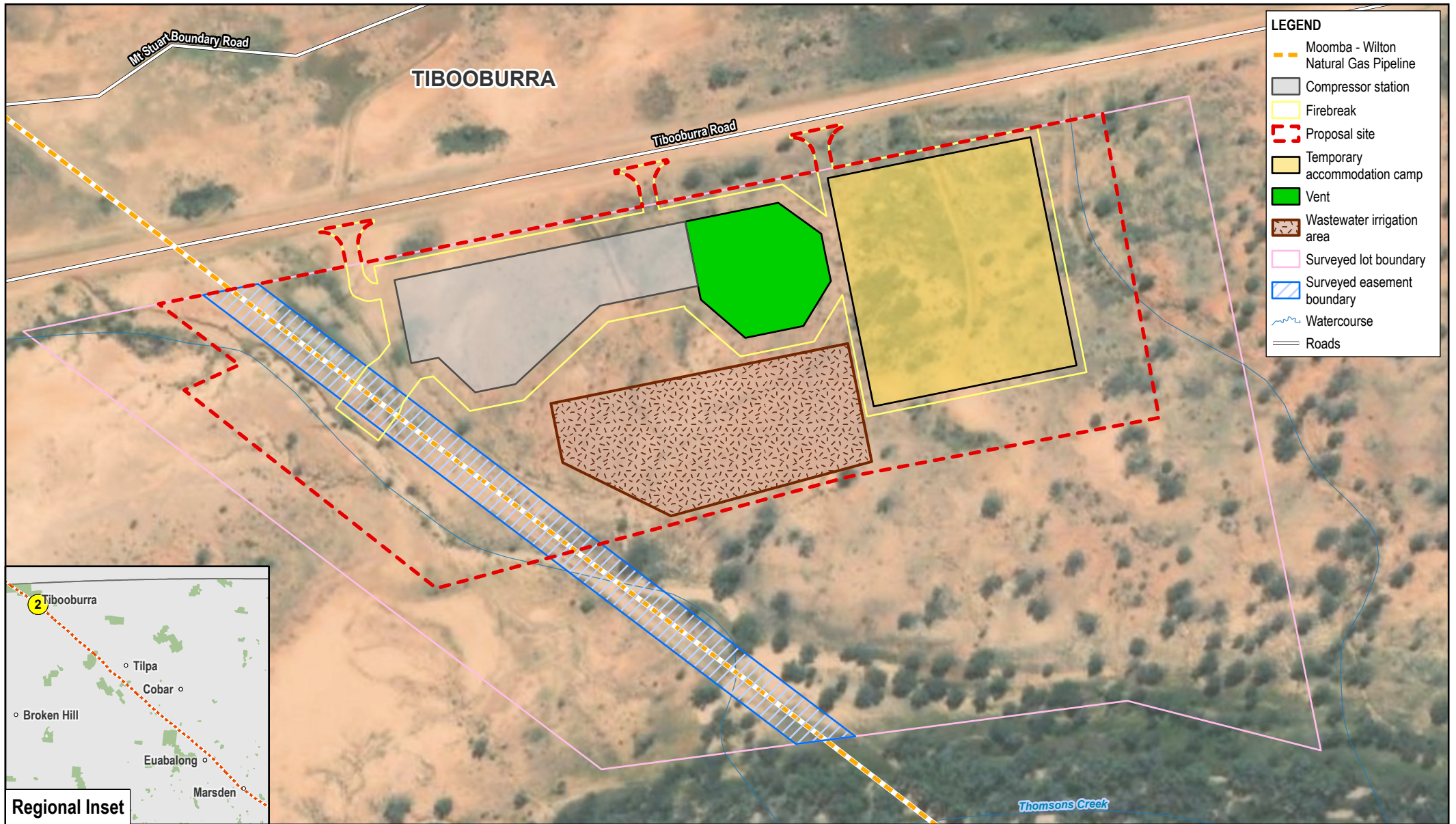
**APT Management Services Pty Ltd**  
**Moomba to Wilton Pipeline Modification 2**  
**Biodiversity Development Assessment Report**

Project No. **12613644**  
Revision No. **1**  
Date **17/01/2024**

**Site map**

**FIGURE 1.1**





Map Projection: Lambert Conformal Conic  
 Horizontal Datum: GDA2020  
 Grid: GDA2020 NSW Lambert



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**Proposal site layout**

**FIGURE 1.2**

## 1.4.2 Key features of the proposal

The modification proposes the construction of a compressor station (MW244) at Tibooburra and represents Stage 3a of the East Coast Grid Expansion project. This expansion project comprises the construction and operation of compressor stations along the length of the MWP in a staged approach to increase the gas transportation capacity of the pipeline. Two compressor stations (MW880 (Stage 1) and MW433 (Stage 2)) along the MWP were approved in Modification 1. The Stage 1 compressor has been constructed and is operational while the Stage 2 compressor is being constructed.

The key elements of the proposed Modification 2 are:

- a compressor station which will be operated for approximately 25 years
- a temporary laydown area which will be established as ancillary infrastructure for the construction stage and transitioned to the operational footprint of the vent for operations
- a temporary accommodation camp for an initial use by up to 128 full time equivalent (FTE) personnel for the compressor station construction and maintenance works on the MWP
- a reduced size temporary accommodation camp for a workforce of up to 80 FTE personnel for ongoing MWP maintenance works
- a wastewater treatment system and an effluent irrigation area
- three access intersections on Tibooburra Road for entry and egress to and from the proposed site.

Construction works are anticipated to commence in Quarter 2 2024, subject to relevant approvals being obtained. The construction and commissioning of the compressor station will take approximately 12 months. The compressor station will have an average design life of approximately 25 years.

The temporary accommodation camp, which will be used intermittently for approximately three months every three years over the life of the proposal and will accommodate up to 80 full time equivalent personnel.

Progressive rehabilitation of cleared areas no longer required for operations will be undertaken to minimise dust generation, soil erosion and weed incursion. The end of project decommissioning of infrastructure and rehabilitation of site will be undertaken after 25 years.

The proposal site layout is shown in Figure 1.2. This layout includes buffer areas between built structures and adjoining native vegetation to provide for flexibility in the final design and to help mitigate against indirect impacts of the proposal on adjoining habitat. For the purposes of this BDAR it is conservatively assumed that the proposal would result in the clearing and grading of the entire proposal site and that application of treated wastewater would adversely affect all native vegetation in the irrigation area. In practice much of this area would only be subject to partial vegetation removal or indirect impacts.

APA initially identified areas for ecological assessment larger than that required for the proposal. This approach allowed for a biodiversity constraints assessment to identify and avoid areas of high biodiversity significance. As a result, the current proposal site shown on Figure 1.2 has been located to avoid biodiversity values such as native trees and drainage lines.

## Compressor station

The compressor station MW244 proposed to be constructed in the modification will include:

- Solar Turbines
- Gas Turbine Compressor Skid
- power unit comprising three 200 kW power modules installed in a common enclosure
- the enclosed gas turbine driven compressor unit and associated infrastructure
- offices and workshop.

The compressor station will be decommissioned when there is no further economic potential to continued use, likely after 25 years of operation.

All components of the compressor station will be installed on driven piles or supported on structural steel skids over gravel sheeting, with the exception that the maintenance building will likely be constructed on a concrete slab.

Once the compressor station and ancillary infrastructure have been constructed, connection to the existing MWP will be undertaken followed by commissioning.

## Laydown area

A temporary laydown area, with a disturbance footprint of approximately 1 ha, for construction vehicles and equipment will be established prior to any construction works commencing. The laydown area will serve as temporary storage area for compressor station and camp building structures. The laydown area will be constructed adjacent to the compressor station (see Figure 1.2) and the camp site. Following the completion of construction works, this area will form the footprint of the operational vent.

## Temporary accommodation camp

The temporary accommodation camp will be established to accommodate up to 128 full time equivalent (FTE) personnel initially but will be subsequently reduced in size to an 80-person camp. The temporary accommodation camp will require a disturbance footprint of approximately 1.62 ha.

The location of the camp relative to the compressor station is shown in Figure 1.2.

The accommodation camp will include:

- individual rooms contained within demountable buildings for either 128 persons or 80 persons as noted above
- water tanks for storing water for the ablution and amenities facilities
- full kitchen and dining area
- food storage and cold room
- offices
- gym and recreational area
- laundry
- diesel generators (350 kVa and 320 kVa), fuel storage tanks, and associated pipelines for the supply of electricity to buildings
- water tanks for bushfire protection
- wastewater treatment plant and a wastewater irrigation area of approximately 1.2 ha.

The camp will be used periodically over a period of 25 years for three months at a time, roughly every 3 years. The camp buildings will be demobilised after the commissioning of the compressor station has been completed. It will be mobilised to the site again after approximately three years for the maintenance works on the MWP.

Wastewater for the camp would be treated by a suitably designed, manufactured, and installed aerated wastewater treatment system to satisfy the requirements Australian Standard (AS) 1547: *On-site domestic wastewater management*.

The wastewater treatment system will use sedimentation and aerobic digestion to separate biomass from wastewater effluent. The biomass will be periodically pumped out for disposal by an authorised waste contractor. The effluent will be disinfected to remove any residual pathogens then pumped to an irrigation spray field on site for disposal. The pipes would be temporary and rolled out across the irrigation area, prior to use. They would then be rolled back up during decommissioning of the site. No intrusive ground activities would be needed in the irrigation area.

### **Site access**

An existing site access exists within the approved easement for the existing MWP. The modification is proposing to construct three new site accesses from Tibooburra Road for vehicle entry and egress for both heavy and light vehicles.

### **Timing**

Subject to receiving planning approval, it is expected that construction of the proposal would commence in Q2 2024. The maintenance work is planned for low gas demand periods which are generally from October to December and February to April.

### **Operation**

The compressor station will be designed to operate remotely without onsite staff for most of its working life. The site will be operated remotely from APA's control centre in Brisbane and will generally operate up to 24 hours per day, seven days per week.

Typical operational activities will involve minor maintenance, calibrations, inspections, equipment performance checks, or equipment repair if needed. These activities will be typically carried out during daylight hours, unless an emergency requires urgent works at night.

Site personnel will carry out inspections ranging from daily inspections to more rigorous inspections that may vary from one month to four years apart, dependent on the works.

## **1.4.3 Decommissioning and rehabilitation**

The proposal site will be rehabilitated progressively as construction activities are completed.

Following the initial construction works:

- The laydown area for the compressor station construction will form the footprint for the operational vent. Any additional area not required for the vent will be rehabilitated.
- The pad required for the temporary accommodation camp will be slightly reduced in size with areas no longer required being rehabilitated.

The reduced camp pad, service connections and some minor underground pipework, including water lines, would be left in-situ, for the ongoing periodic use of the site as a temporary accommodation camp.

## 1.5 Scope and limitations

*This report: has been prepared by GHD for APT Management Services Pty Ltd and may only be used and relied on by APT Management Services Pty Ltd for the purpose agreed between GHD and APT Management Services Pty Ltd as set out in section 1 of this report.*

*GHD otherwise disclaims responsibility to any person other than APT Management Services Pty Ltd arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.*

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

*The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.*

*The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report (refer to sections 2.6.3 and 2.7 and the descriptions of the methods and approach to application of the BAM throughout this report). GHD disclaims liability arising from any of the assumptions being incorrect.*

## 2. Methods

### 2.1 Legislative and policy context to the assessment

#### 2.1.1 Biodiversity Conservation Act 2016

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

The BC Act has been considered in this assessment through the application of the BAM as described below.

##### 2.1.1.1 Biodiversity Offset Scheme and Biodiversity Assessment Methodology

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

The aim of the BOS is to provide a transparent, consistent and scientifically based approach to biodiversity assessment and offsetting, to ensure that the impacts of development, clearing or biodiversity certification will result in no net loss of biodiversity. The scheme creates a market framework for the conservation of biodiversity values and the offsetting of development impacts, by establishing the mechanisms to offset impacts of development, clearing or biodiversity certification through biodiversity credit trading such that there is no net loss of biodiversity values. The scheme also allows for the establishment of biodiversity stewardship agreements, which are in-perpetuity agreements entered into by landholders, to secure offset sites and generate biodiversity credits, which can be used to offset impacts of development.

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

#### 2.1.2 Fisheries Management Act 1994

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



One of the objectives of the FM Act is to 'conserve key fish habitats ' which includes aquatic habitats that are important to the maintenance of fish populations generally and the survival and recovery of threatened aquatic species. To assist in the protection of key fish habitats, DPI has produced the Policy and guidelines for fish habitat conservation and management (DPI 2013). This policy applies to the following developments, works or activities, each of which can impact on key fish habitat:

- dredging or reclamation
- impeding fish passage
- damaging marine vegetation
- de-snagging.

The FM Act has been considered in this assessment through desktop assessment and high-level habitat assessment only. There is no key fish habitat or other aquatic habitat for biota protected under the FM Act in the proposal site or likely to be affected and so the requirements of the FM Act are not considered in further detail.

### 2.1.3 Biosecurity Act 2015

The *Biosecurity Act 2015* provides for risk-based management of biosecurity in NSW. It provides a statutory framework to protect the NSW economy, environment and community from the negative impact of pests, diseases and weeds.

The primary object of the Act is to provide a framework for the prevention, elimination and minimisation of biosecurity risks posed by biosecurity matter, dealing with biosecurity matter, carriers and potential carriers, and other activities that involve biosecurity matter, carriers or potential carriers.

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

Legal requirements to minimise the potential for the introduction and/or spread of weeds as a result of the proposal are discussed in section 8.4.

### 2.1.4 Environment Protection and Biodiversity Conservation Act 1999

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

Specific consideration of the approval and offsetting requirements for MNES is only required for controlled actions. The NSW Government and Australian Government finalised amendments to the Assessment Bilateral Agreement after changes to NSW legislation, and the Amending Agreement no. 1 was signed on 24 March 2020. The Australian Government formally endorsed the NSW BOS through the EPBC Act Condition-setting Policy (DAWE 2020). The EPBC Act condition setting policy (DAWE 2020) notes that where a proposal demonstrates compliance with an endorsed state or territory policy, the proponent will not be required to simultaneously comply with the corresponding Australian Government policy. As such, a proponent for a controlled action is not required to calculate offsets separately using the EPBC Act offsets policy (DSEWPaC 2012) and associated calculator, unless offsets are required for a matter not considered by the BAM.

The EPBC Act has been considered in this assessment through:

- desktop review to determine the listed biodiversity matters that are predicted to occur within the locality of the proposal and hence could occur, subject to the habitats present
- targeted field surveys for listed threatened biota and migratory species

- identification of suitable impact mitigation and environmental management measures for threatened and migratory biota, where required
- discussion of how offsets for significant residual impacts on protected matters would be delivered within the framework of the NSW BOS.

## 2.2 Study area

For the purposes of the assessment the construction footprint, operation footprint, and study area have been defined as follows:

- **Proposal site** – The area that would be directly affected by construction and the location of operational infrastructure. For the proposal this includes the compressor station, temporary laydown area, temporary accommodation camp, effluent irrigation area, site accesses and other ancillary infrastructure as shown on Figure 1.2. This is equivalent to the 'subject land' referred to in the BAM.
- **Study area** – is the area investigated which includes the proposal site and surrounding area, with the potential to be directly or indirectly affected by the proposal. The area of investigation covered by this biodiversity assessment comprised the parcels of land that were considered for construction of the proposal and the associated area that may be affected (directly or indirectly) by the proposal as shown in Figure 1.1.
- **Avoidance footprint** – is the portion of the study area that has not been included in the proposal site and would not be directly affected or subject to notable indirect impacts arising from the proposal. Includes plant communities, habitat resources and other features of the natural environment that have been specifically avoided in the design of the proposal site.
- **Assessment area** – is the area investigated in accordance with the BAM, encompassing the proposal site and study area plus the 1,500 m buffer area surrounding the proposal site, patch size polygon and surrounding land included in the assessment of site context as shown in Figure 3.1.
- **Locality** – the area within a 10 km radius of the proposal site.

## 2.3 Desktop assessment

### 2.3.1 Data review

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

Information sources used in the preparation of this report include:

- NSW Department of Planning, Industry and Environment (DPE) BioNet Atlas (DPE 2023a)
  - records of threatened biota previously recorded in a 10 kilometre radius around the proposal site
  - Threatened Biodiversity Data Collection (TBDC) profiles of threatened species listed under the BC Act
  - Vegetation Classification to help confirm plant community types (PCTs) in the study area and PCT to threatened ecological community (TEC) associations
  - list of candidate species credit-type species and predicted species, accessed via the BAM-C
- The NSW State Vegetation Type Map (SVTM) (DPE 2022a) to identify candidate PCTs in the study area and to map native vegetation extent
- NSW BioNet Vegetation Classification (DPE 2023a) descriptions and characteristic plant species lists to identify and map PCTs at fine scale in the study area
- DPE Threatened biodiversity profile search online database for threatened ecological communities and species listed under the BC Act (DPE 2023d)
- DCCEE (2023a) EPBC Act Protected Matters Search Tool – for a 10 kilometre radius around the proposal site (searched 19 July 2023)

- EPBC Act Species profile and threats database, online profiles (SPRAT) (DCCEE 2023b) and Register of Critical Habitat (DCCEE 2023c)
- Department of Primary Industries (DPI) freshwater threatened species distribution maps (DPI 2023).

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

## 2.3.2 Background research

Background research was conducted to identify:

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

The background research included analysis of the following information sources:

- NSW (Mitchell) Landscapes mapping Version 3.1 (DPIE 2016) and Descriptions for NSW (Mitchell) Landscapes Version 2 (DECC 2002)
- Interim Biogeographic Regionalisation of Australia (IBRA version 7.0) mapping (DoEE 2018)
- initial BAM-Credit calculations
- Atlas of Groundwater Dependent Ecosystems (GDE) (BOM 2023a)
- aerial photograph imagery of the study area and proposal site.

## 2.4 Field surveys

### 2.4.1 Survey overview

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

Survey effort that has directly contributed to this BDAR is summarised in Table 2.1 and is described in detail below. Section 5.1.2 provides a summary of the candidate threatened species (i.e. species credit matters) that were considered during field surveys and section 5.2 presents targeted survey effort and results. Figure 2.1 and Figure 2.2 show survey effort for candidate threatened species. Scanned field data sheets and GPS tracklogs demonstrating survey effort and coverage of the study area have been submitted for approval along with this BDAR.

**Table 2.1** Overview of survey techniques and timing

Survey stage	Date	Survey technique
Preliminary investigation of biodiversity values	30 August 2022	Rapid biodiversity value assessment Habitat assessment including candidate nest tree census Diurnal bird survey Nocturnal fauna surveys including spotlighting and reptile habitat surveys
Vegetation integrity assessment and November targeted species credit surveys	16 November 2022	Vegetation zone mapping Vegetation integrity plots Threatened flora traverses Habitat assessment including systematic candidate nest tree census Diurnal bird survey Anabat recordings
Vegetation integrity assessment and Summer targeted species credit surveys	13-17 February 2023	Vegetation zone mapping Vegetation integrity plots Systematic threatened flora traverses Habitat assessment including systematic candidate nest tree census Diurnal bird survey and reptile habitat surveys Nocturnal fauna surveys including spotlighting, call playback and active searches
Vegetation integrity assessment and September targeted species credit surveys, including consideration of modified proposal site	6 September 2023	Vegetation zone mapping in modified proposal site Vegetation integrity plot Systematic threatened flora traverses Habitat assessment including systematic candidate nest tree census Diurnal bird survey

## 2.4.2 Vegetation and flora surveys

### 2.4.2.1 Vegetation mapping

The SVTM (DPE 2022a) was ground-truthed in the field to verify community type and boundaries, floristic and structural homogeneity within patches and to update mapping as required. Vegetation mapping was undertaken via systematic walked transects across the entire study area and by walking the boundary of likely vegetation units, based on aerial photograph interpretation. The overall condition of vegetation was assessed through general observation and comparison against the PCT condition benchmark data as well as using parameters such as species diversity, history of disturbance, weed invasion and canopy health.

Native vegetation communities in the study area were assigned to the closest equivalent PCT held in the BioNet Vegetation Classification database (DPE 2023a). The closest equivalent PCT for each vegetation community was determined through a comparison of the floristic descriptions of PCTs in the database with the vegetation integrity plot data collected from the site. In addition to floristic and structural similarity, the landscape position, soil type and other diagnostic features of the vegetation communities on the sites were also compared to the descriptions in the database to determine the most suitable PCT. TECs as defined in NSW and Commonwealth legislation were also identified based on diagnostic criteria in the listing documents for each candidate TEC.

The native vegetation in the proposal site was then stratified into vegetation zones in accordance with the BAM. A vegetation zone is defined in the BAM as a relatively homogenous area that is the same PCT and has the same broad condition state. Each vegetation zone was assigned a patch size in accordance with Subsection 4.3.2 of the BAM. Justification for selected PCTs and condition classes is provided in section 4.2.2.

### 2.4.2.2 Vegetation integrity survey plots (assessing site condition)

Vegetation integrity plots were sampled in accordance with the BAM (DPIE 2020a) to obtain vegetation integrity data for the calculation of biodiversity credits. The sampling was undertaken using 20 metre x 20 metre plots nested within a larger 20 metre x 50 metre plot.

Vegetation integrity was calculated by assessing ten attributes used to evaluate vegetation function, composition and structure (refer Table 2.2). These attributes were then assessed against benchmark values using the BAM-C.

All flora species recorded within each plot were allocated a growth form group and designated as either native, exotic or high threat weeds (HTWs) in accordance with defined lists obtained from the BAM-C. Plant identification and nomenclature follows keys and taxonomy in PlantNET (RBGT 2023).

Table 2.2 Site data collected within each vegetation integrity plot

Attribute	Area assessed
Native plant species richness	20 X 20 metre plot
Percentage foliage cover for each species	20 X 20 metre plot
Estimated number of individuals for each species	20 X 20 metre plot
Number of large trees	50 X 20 metre plot
Tree regeneration (presence/absence)	50 X 20 metre plot
Tree stem size class	50 X 20 metre plot
Total length of fallen logs	50 X 20 metre plot
Litter cover	5 times 1 X 1 metre plot
High threat exotic vegetation cover	50 X 20 metre plot
Hollow bearing trees	50 X 20 metre plot

The survey effort undertaken to address the minimum plot sampling required by the BAM is summarised in Table 4.2. Plots were located away from ecotones, tracks and track edges or other disturbed areas where possible. The locations of the survey plots are shown in Figure 2.1.

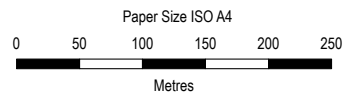
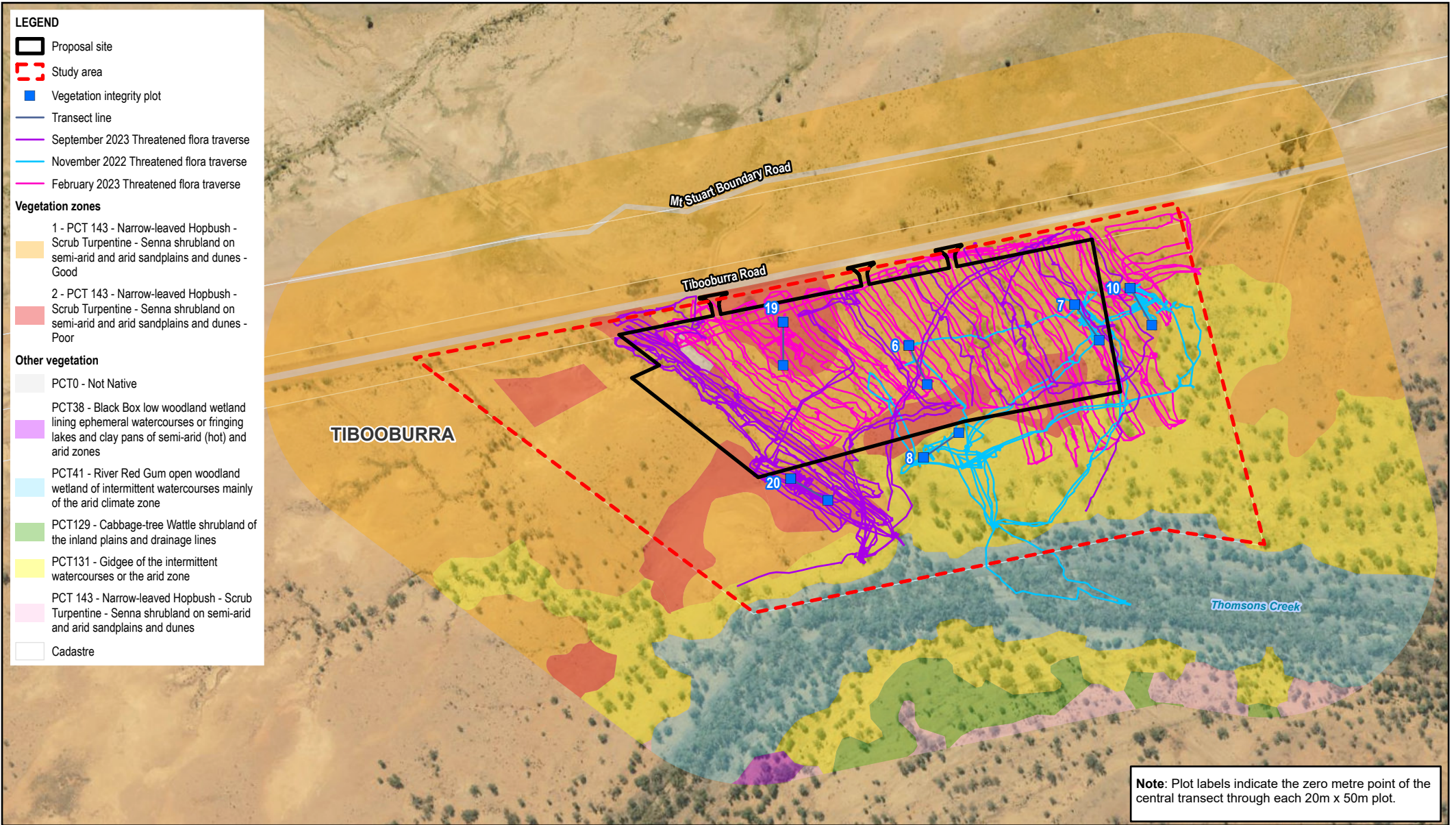
### 2.4.2.3 Threatened flora searches

Potential candidate species credit entities for the proposal site were identified with reference to the BAM. All threatened plants are classified under the BAM as species credit entities as their occurrence cannot be reliably predicted based on vegetation type. The suite of threatened plants with potential to occur in the proposal site was identified based on the desktop assessment results and the candidate species credit entities identified by preliminary BAM-C calculations. Habitat for these species was identified and assessed based on threatened species database records and threatened species profiles (DPE 2023a,d) and the experience and judgement of GHD ecologists.

Targeted searches were undertaken for threatened flora species that were either predicted to occur at the site by the BAM-C or identified during the desktop review as having potential to occur within the study area given known distributions, previous records in the locality and habitat requirements for each species. Habitat was inspected with reference to threatened species survey guidelines (DPIE 2020b) and surveys included systematic coverage of the proposal site with appropriately spaced parallel traverses. Traverses were conducted in the appropriate season for each candidate species as specified by the TBDC (DPE 2023a) and/or under suitable survey conditions as confirmed by desktop assessment of target species' ecology, observed field conditions and consultation with relevant DPE accountable officers (Houlison, C, DPE letter dated 6 December 2023).

Section 5.1.2 provides a summary of the candidate threatened flora species that were considered during field surveys and section 5.2 presents targeted survey effort and results.





Map Projection: Lambert Conformal Conic  
Horizontal Datum: GDA2020  
Grid: GDA2020 NSW Lambert



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Flora survey effort

FIGURE 2.1

## 2.4.3 Terrestrial fauna surveys

### Reptile habitat surveys

Reptile habitat surveys were conducted with a particular focus on the threatened diurnal reptile species listed in Table 5.3 and with reference to the *Threatened reptiles Biodiversity Assessment Method survey guide* (DPE 2022b). Habitat was initially inspected over one day in November 2022. A targeted survey for confirmed candidate threatened species was conducted during the February 2023 survey period over four consecutive days.

Habitat surveys involved walking slowly through suitable habitat observing for both active and non-active individuals, whilst stopping at least every 10 metres to observe moving reptiles. Surveys were concentrated in areas of the landscape where reptiles may be basking or partially hiding. Active searches of microhabitats including shrubs, grasses, rock outcrops, human debris such as corrugated iron sheeting, cracking soil, woody debris and other ground litter were conducted throughout the proposal site. Potential shelter sites were carefully inspected including lifting and replacement of shelter sites where possible.

### Spotlight surveys

Spotlight survey transects were conducted on foot for at least two person hours over four consecutive nights in February 2023 with a particular focus on the threatened nocturnal reptile species listed in Table 5.3 and with reference to the *Threatened reptiles Biodiversity Assessment Method survey guide* (DPE 2022b).

An additional two person hours of spotlight surveys per night were also undertaken throughout the proposal site for nocturnally active mammals, birds and frogs, including dedicated listening periods for fauna vocalisations. Mammals and nocturnal birds were identified by observation under spotlight or by vocalisations heard whilst spotlighting by walking slowly and quietly through potential habitat. Surveyors carried headtorches / hand-held torches with a >200 lumen output.

### Call playback

Nocturnal call playback surveys were conducted on one night in August 2022 and over four consecutive nights during the February 2023 survey period targeting the Bush-stone Curlew (*Burhinus grallarius*) and the Barking Owl (*Ninox connivens*).

Surveys involved an initial listening period of five minutes, followed by call playing for three minutes, followed by a listening period of five minutes (undertaken separately for each species), with a final listening period of approximately 10 minutes. Calls were played through a portable MP3 player connected to a 45-watt megaphone. All potential habitat in the immediate area was then scanned for at least 10 minutes using spotlights. Additional spotlighting and listening for target species was conducted for the duration of each nocturnal survey round.

### Nest tree census

A 'systematic nest tree census' was conducted over the entire proposal site and accessible vegetation within a 300 m buffer area over adjoining areas to help determine the presence of threatened species nest trees to inform the assessment of species credits. All mature trees were inspected for the presence of stick nests and/or hollows. Any large stick nests and hollow bearing trees were mapped and data collected on tree species, diameter at breast height and number of hollows in the size classes >20 cm, 15-20 cm, 5-15cm and <5cm.

Nest tree census surveys included targeted effort within the breeding season to detect evidence of nesting birds as noted in the TBDC profiles for target species such as the presence of a male and female; or any adult with nesting material; or an individual on a large stick nest in the top half of the tree canopy; or pairs displaying (soaring, diving, engaging in chases, or a male observed calling in flight with a female begging from tree) (DPE 2023a). Additional surveys were conducted outside the breeding season for target species, aligned with diurnal bird survey effort, habitat searches and all other time spent on site. These additional survey periods contributed to the overall effort for species credit matters through observation of candidate nest trees with suitable large stick nests or hollows that could be used for breeding at other times of year.

The TBDC notes that where a breeding site has been identified in accordance with the BAM the species polygon should include a buffer by mapping a circular polygon with a radius of up to 300 m (depending on the species) around the nest tree. This includes habitat suitable for roosting, guarding, feeding, grooming perches and fledgling



requirements (DPE 2023a). As such the systematic nest tree census included inspection of candidate trees within a 300 m radius of the proposal site.

## Diurnal bird surveys

Targeted surveys for diurnal birds were undertaken throughout the proposal site in August and November 2022 as well as February and September 2023.

Surveys followed the area search method, comprising walked random meander-traverses through an approximately 500 m<sup>2</sup> area of habitat over approximately one hour per survey round. The pace and location of traverses was guided by observed bird activity with a view to maximising the chances of detecting target species and the overall species richness recorded rather than collecting data according to a repeatable methodology. Birds were identified by observation with binoculars and/or call identification. Diurnal bird surveys also included searches for signs indicative of particular threatened species, including searching for evidence of feeding, foraging and signs of bird presence, such as pellets, whitewash, nests etc. All opportunistic observations of birds were recorded during all field surveys.

## Microchiropteran bat survey

Bat calls were recorded during field surveys using Anabat Express detectors.

Stationary Anabat recordings were captured on the night of 16 November 2022 within the proposal site as shown on Figure 2.2. Recording commenced at least half an hour before dusk and continued until the following morning.

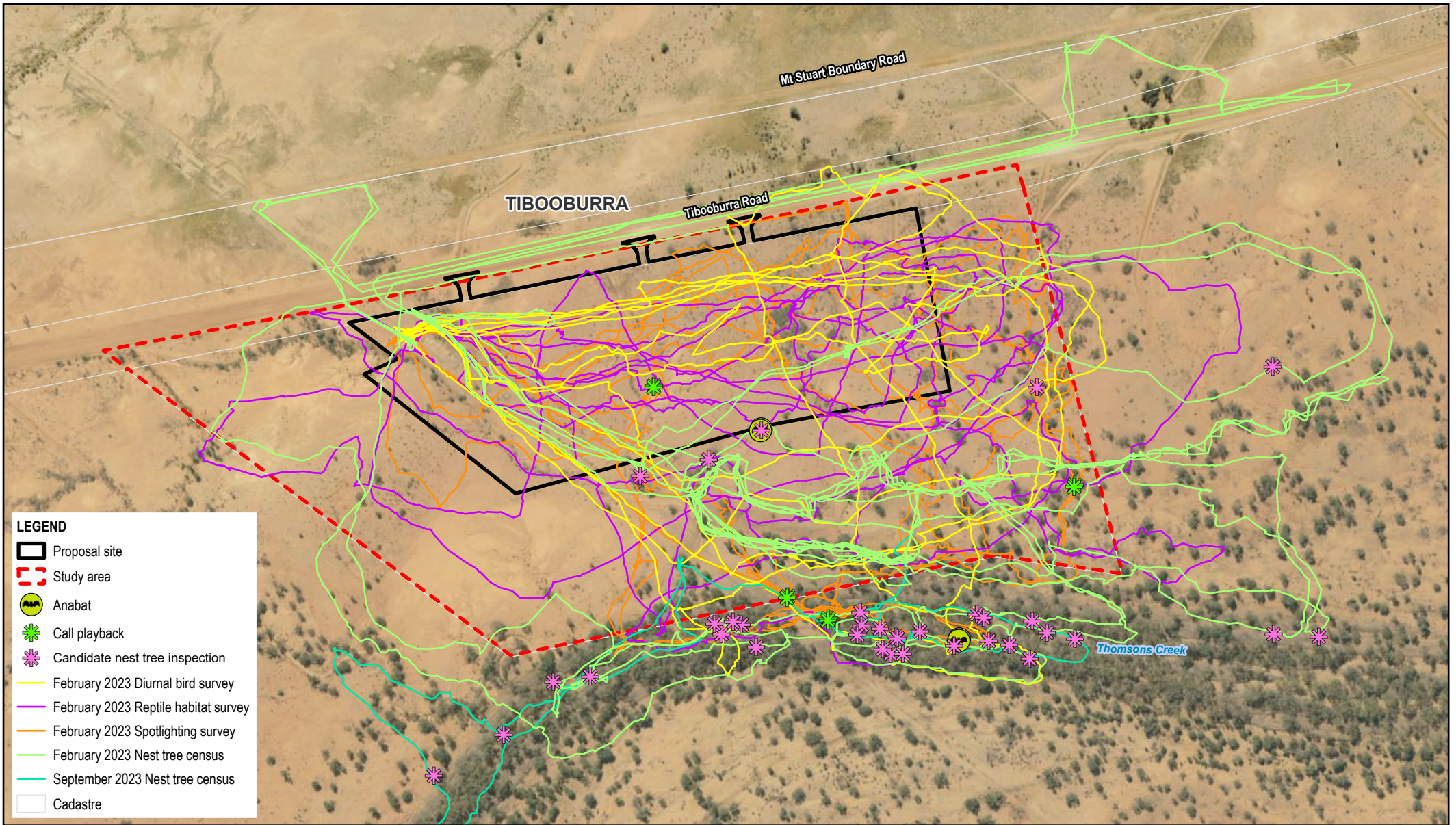
Calls were identified using zero-crossing analysis and AnalookW software (version 4.2n, Chris Corben 2017) by visually comparing the time-frequency graph and call characteristics (e.g. characteristic frequency and call shape) with reference calls and/or species call descriptions from available reference material.

The Bat calls of NSW: Region based guide to the echolocation calls of microchiropteran bats (Pennay *et al.*, 2004) was used to assist call analysis. Call identification was also assisted by consulting distribution information for possible species (Pennay *et al.* 2004; Churchill 2008; Van Dyck *et al.* 2013) and records from BioNet (DPE 2023a). No reference calls were collected during the survey.

A call (pass) was defined as a sequence of three or more consecutive pulses of similar frequency and shape. Calls with less than three defined consecutive pulses of similar frequency and shape were not unambiguously identified to a species but were used as part of the activity count for the survey area. Due to variability in the quality of calls and the difficulty in distinguishing some species the identification of each call was assigned a confidence rating (see Mills *et al.* 1996; Duffy *et al.* 2000) as summarised in Table 2.3. Due to the absence of reference calls from the study area, high level of variability within a bat call and overlap in call characteristics between some species, a conservative approach was taken when analysing calls. Species nomenclature follows van Dyck *et al.* (2013) and Reardon *et al.* (2014).

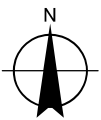
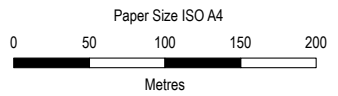
Table 2.3 Confidence ratings applied to calls

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



**LEGEND**

- Proposal site
- Study area
- Anabat
- Call playback
- Candidate nest tree inspection
- February 2023 Diurnal bird survey
- February 2023 Reptile habitat survey
- February 2023 Spotlighting survey
- February 2023 Nest tree census
- September 2023 Nest tree census
- Cadastre



Map Projection: Lambert Conformal Conic  
 Horizontal Datum: GDA2020  
 Grid: GDA2020 NSW Lambert

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**Moomba to Wilton Pipeline Modification 2**  
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**Fauna survey effort**

**FIGURE 2.2**

## Fauna habitat assessment

Fauna habitat assessments were undertaken throughout the study area, including an assessment of potential shelter, basking, roosting, nesting and/or foraging sites. Specific habitat features and resources were noted during dedicated traverses as well generally during all time spent on site.

Indicative habitat criteria for targeted threatened species (i.e. those determined as having the potential to occur within the development footprint following the desktop review) were identified prior to fieldwork occurring with particular focus on species credit matters. Habitat criteria were based on information provided in DPE and DCCEEW threatened species profiles, field guides, and the knowledge and experience of GHD field ecologists.

Habitat assessments were conducted with the presence of the following noted:

- soil and landscape type
- vegetation structure, presence of food trees, the density of understorey vegetation,
- rock outcrops, ground debris and leaf litter
- burrows, dens and warrens
- evidence of fauna occupation such as: distinctive scats or latrine sites; whitewash and regurgitated pellets under roost sites; tracks or animal remains
- evidence of activity such as feeding scars, scratches and diggings.

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

## Opportunistic observations

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

## Aquatic habitat survey

There is no intermittent or permanent aquatic habitat at the proposal site that would require specialist aquatic survey.

## Targeted survey effort

A summary of the type and total effort of the targeted surveys completed is provided in Table 2.4 along with an assessment of the suitability of conditions for targeted survey based on the species targeted and associated survey guidelines. Daily details of weather conditions throughout survey periods are provided in Table 2.5.

*Table 2.4 Targeted fauna survey techniques and effort*

Survey type	Survey timing and effort	Suitability of conditions for targeted surveys
General spotlight surveys Call playback	<p><b>Targeting threatened owls and Bush-stone Curlew</b></p> <p>One night of spotlighting on 30 August 2022 by two ecologists over at least one hour conducted between the hours of 8-11 PM.</p> <p>Four consecutive nights of spotlighting by two ecologists over at least one hour from 13-16 February 2023 were conducted between the hours of 8-11 PM.</p> <p>Single call playback session per night in August and February survey rounds.</p> <p><b>Total effort = &gt;600 person-minutes of spotlighting.</b></p> <p>Five call playback sessions on separate nights.</p>	<p>On-ground temperatures during spotlighting surveys varied between 19 and 35 °C, which is suitable for this technique and for detecting target species. No moon present on most nights in February 2023 surveys. Visibility was good, with no fog, wind and/ or rain hampering detection.</p>



Survey type	Survey timing and effort	Suitability of conditions for targeted surveys
Reptile spotlight surveys	<p><b>Targeting threatened geckoes and snakes</b></p> <p>Four consecutive nights of active searches through areas of suitable reptile habitat by two ecologists over at least one hour from 13-16 February 2023 were conducted between the hours of 8 PM-1230 AM.</p> <p><b>Total effort = &gt;120 person minutes each night across four survey replicates</b></p>	On-ground temperatures during spotlighting surveys varied between 19 and 35 °C, which is suitable for this technique and for detecting target species. Suitability confirmed by direct observation of multiple individuals of non-target gecko, snake and frog species during survey rounds.
Ultrasonic call recording	<p><b>Targeting microbats</b></p> <p>Two Anabat units deployed over one night (10.5 hours on the evening of 16 November 2022).</p> <p><b>Total effort = 21 hours.</b></p>	Ultrasonic call recording surveys conducted in warm to hot periods conducive to microbat bat activity (daily temperatures between 16 and 23 °C (see Appendix D).
Reptile habitat surveys	<p><b>Targeting threatened skinks and snakes</b></p> <p>Four consecutive days of active searches through areas of suitable reptile habitat in mid-morning or late afternoon, by two ecologists over at least one hour from 13-16 February 2023</p> <p><b>Total effort = &gt;&gt;120 person minutes each day across four survey replicates</b></p>	Warm to hot daily temperatures. Morning surveys potentially conducive to basking individuals. Afternoon surveys conducive to active searches under refuge habitat. Suitability confirmed by direct observation of multiple individuals of non-target skink, dragon and snake species during survey rounds.
Nest tree census	<p><b>Targeting threatened birds / general biodiversity survey</b></p> <p>Targeted searches in conjunction with threatened flora traverses across the proposal site in November and February survey rounds.</p> <p>Additional dedicated searches of the proposal site and a 300 m buffer area over the period 13-16 February and re-checking of candidate nest trees on 6 September 2023.</p> <p><b>Total effort = Systematic coverage of the entire proposal site and buffer area.</b></p>	Visibility was good, with no fog, wind and/ or rain hampering detection.
Diurnal bird surveys	<p><b>Targeting threatened birds</b></p> <p>Timed area searches in suitable habitat throughout the study area.</p> <p>Two bird surveys (of up to one hour) over 30 August and 16 November 2022</p> <p>Separate area searches conducted by two ecologists per site, per survey round, in the evenings and/or mornings of 13-16 February 2023. Nine bird surveys conducted for up to one hour each over four days.</p> <p>On bird survey over an hour on 6 September 2023</p> <p><b>Total effort = ~11 person-hours of area searches on seven separate days.</b></p>	Visibility was good, with no fog, wind and/ or rain hampering detection or bird activity.

## 2.5 Survey conditions

Fauna surveys were undertaken in spring and late summer. Conditions were generally warm to hot and humid. There was minimal rainfall during survey periods, though there was around 4 mm of rainfall in the week before the November 2022 survey round and above average rainfall in preceding seasons.

Temperatures throughout the February 2023 targeted survey round were favourable for the detection of both diurnal and nocturnal reptiles potentially present at the site. Wind during bird surveys was generally light to moderate and so would not have hampered the detection of bird species.

Bureau of Meteorology (BOM 2023a) records for survey dates are outlined in Table 2.5. Weather observations were recorded from Tibooburra Airport (Weather Station 046126).

As summarised in Table 2.4, conditions during each dedicated fauna survey round were suitable for the detection of target species. Notably:

- On-ground temperatures during spotlighting surveys were suitable for detecting target species as confirmed by direct observation of multiple individuals of non-target gecko, snake and frog species during survey rounds.
- Temperatures, wind and visibility during diurnal bird surveys and nest tree census were suitable for detecting target species as confirmed by observation of a high species richness and abundance of native birds and presence of non-threatened bird species occupying nests and hollows.

Prolonged dry conditions may, in general, have a negative effect on the ability to accurately detect target threatened flora species or calculate VI, particularly in semi-arid regions. Cumulative rainfall recorded from the Tibooburra Airport weather station for the 12 months prior to mapping PCTs and sampling the majority of vegetation integrity plots in November 2022 was compared with wet or dry rainfall year thresholds to reflect climatic variation in accordance with the *Guidance for assessors and decision-makers in applying modified benchmarks to assessments of vegetation integrity* (DPIE 2020c) and section 1.4.2(3.) of the BAM. As shown in Table 2.6, cumulative rainfall at the proposal site exceeded the wet rainfall year threshold for relevant PCTs and IBRA regions in two out of three survey rounds. The cumulative rainfall in the final, September 2023 survey round was marginally below the wet year benchmark threshold for PCT 143. However, noting that: only one out of five plots sampled in this PCT was sampled in this survey round; the observed cover and health of native plants; that cumulative rainfall was less than 10 mm below the threshold; and that average rainfall had been substantially exceeded for the majority of the previous two years, the wet year benchmarks have been adopted.

The rainfall data in Table 2.6 also confirms that conditions would have been suitable for detection of candidate threatened flora, if present, including species that are only likely to be detectable after rainfall or flooding such as Silky Cow-Vine (*Ipomoea polymorpha*) (DPE 2023a).

**Table 2.5** Daily weather observations during the survey period (BOM 2023a) at the proposal site

Date	Minimum temperature (°C)	Maximum temperature (°C)	Rainfall previous 24 hours (mm)	Rainfall previous 7 days (mm)
30/08/2022	8.8	20.5	0	0.4
16/11/2022	12.4	23.5	0	4.0
13/02/2023	20.3	32.6	0	0
14/02/2023	19.5	32.9	0	0
15/02/2023	18.3	37.5	0	0
16/02/2023	24.1	40.5	0	0
06/09/2023	10.5	26.0	0	7

**Table 2.6** Benchmark classes based on cumulative rainfall in preceding year

Weather Station	PCT ID	Wet rainfall year threshold (cumulative total over 12 months mm) (DPE 2022f)	Cumulative rainfall for 12 months to November 2022 (mm) (BOM 2023a)	Cumulative rainfall for 12 months to February 2023 (mm) (BOM 2023a)	Cumulative rainfall for 12 months to September 2023 (mm) (BOM 2023a)	Confirmed benchmark class
Tibooburra Airport (Weather Station 046126)	131	>296	431.6	337.4	n/a	Wet year
	143	>260	431.6	337.4	251.4	Wet year

## 2.6 Credit calculations

BAM-Credit calculations were completed by Ben Harrington (accredited assessor number BAAS17023) in accordance with the BAM and using the Credit calculator Version 1.4.0.00 and version 1.2 'wet year' benchmark data.

The credit calculations Parent case ID for the proposal is 00036434. The assessment is 00036434/BAAS17023/22/00036603, version 3.

The biodiversity credit report is included in Appendix E.

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

Based on the bioregional context for the assessment and the PCTs, patch size, vegetation cover and habitat resources present at the proposal site, the BAM-C generates a list of threatened fauna species that are predicted to utilise the proposal site (that is, potential 'predicted threatened species', or potential 'ecosystem credit entities'). The potential for these predicted threatened species to occur within the site were further refined based on the desktop assessment, habitat resources observed during field surveys, records during the surveys, and the knowledge and experience of the assessor. Targeted surveys are not required under the BAM for these species.

Targeted surveys may, however, be required if the predicted species are also listed under the EPBC Act, to assess the significance of impacts in accordance with the *MNES Significant impact guidelines 1.1 – Environment Protection and Biodiversity Conservation Act 1999* (DotE 2013). A range of methods were employed to ensure appropriate survey effort for EPBC Act threatened species including diurnal bird surveys and nest tree census for threatened and migratory bird species; and spotlighting and reptile habitat searches for threatened reptiles (see section 2.4.2).

### 2.6.2 Candidate threatened species (species credit entities)

Threatened species that cannot reliably be predicted to occur on a development site based on PCT, distribution and habitat criteria are identified by the Threatened Biodiversity Data Collection (DPE 2023a) as 'species credit' entities. In some circumstances, the particular habitat components of species assessed for ecosystem credit species, such as the breeding habitat of a cave roosting bat or forest owls, are also assessed for species credits.

The credit calculator references geographic, vegetation and habitat data for the proposal site to generate a list of the species credit entities that are predicted to occur (i.e. the 'potential candidate threatened species'). Searches of threatened species databases were also completed to identify any potential candidate threatened species (in addition to those generated by the credit calculator) that are known or predicted to occur in the locality. The likelihood of occurrence of potential candidate threatened species were reviewed, giving consideration to the habitats available in the study area (refer to likelihood of occurrence tables in Appendix A).

### 2.6.3 Assessor's use of judgement

Accredited assessors made the following judgements and/or assumptions while completing this BDAR:

- With regards to the identification of candidate PCTs, descriptions of the regional distribution of PCTs in the Bionet Vegetation Classification (DPE 2023a) was given greater weight than the SVTM (DPE 2022a) which appeared to map PCTs out of their known distribution.
- The core targeted reptile spotlight survey effort for Eastern Fat-tailed Gecko (*Diplodactylus platyurus*, syn. *D. ameyi*) was conducted over four nights in February 2023 in accordance with the techniques specified for the species but outside the nominal survey period for the species of October, November and December only according to the TBDC (DPE 2023a) and reptile survey guidelines (DPE 2022b). As noted in sections 2.4.3 and 2.5 above, conditions were suitable for the detection of the Eastern Fat-tailed Gecko and other target reptile species. The Eastern Fat-tailed Gecko has been excluded from occurring at the proposal site or requiring calculation of species credits through 'Targeted threatened species survey'. The completion of surveys outside of the period nominated for the species in the TBDC (DPE 2023a) has been noted in the BAM-C and Table 5.3 based on survey conditions and other justification provided in section 5.2.

## 2.7 Assumptions

A 'proposal site' polygon (that is, direct and indirect disturbance footprint) was prepared for the proposal based on proposal layout and design data provide by APA. It is assumed that the description and spatial data accurately represent the extent of direct impacts arising from the proposal and so these data have been used to calculate the extent of removal of vegetation and habitat arising from the proposal using GIS. These calculations have in turn been relied upon in the BAM-C calculations and the determination of key thresholds such as whether the proposal would have a direct impact on a threatened species, whether the buffer area between built structures and adjoining native vegetation would be sufficient to mitigate against indirect impacts, whether biodiversity offsets are required for a particular impact and whether a particular impact is likely to be significant. The assessment conclusions may change as a result of the provision of an updated proposal site layout and/or spatial data.

## 2.8 Staff qualifications

This BDAR and associated credit calculations has been prepared and certified by Ben Harrington (accredited assessor number BAAS17023). The credit calculator and BDAR were peer reviewed by Kath Chesnut (accredited assessor number BAAS17031).

Qualifications of GHD ecologists who completed field surveys and report inputs are presented in Table 2.7.

*Table 2.7 Staff qualifications and project roles*

<b>Name</b>	<b>Position/Project role</b>	<b>Qualifications</b>	<b>Relevant experience</b>
Ben Harrington	Technical director – Biodiversity / accredited assessor, lead author of BDAR, flora and fauna surveys, credit calculations	BSc. MSc. BAM Assessor Accreditation	18+ years
Kath Chesnut	Senior ecologist / technical review of report and credit calculations	BEnvSc (Hons) BAM Assessor Accreditation	13+ years
Tom Fee	Ecologist / Vegetation mapping / flora and fauna surveys	BSc, GDip VQA Accredited Assessor	8+ years
Dan Eyles	Senior ecologist / fauna surveys	BSc (Hons Zoology), BForSc. Grad Dip Ornithology.	16+ years
Lukas Fellows	Ecologist / fauna surveys	BSc, MSc.	5+ years
Kelly Dalton	Senior ecologist / fauna surveys	BSc (Hons)	16+ years
Mellissa Wood	Ecologist / fauna surveys	BSc	5+ years
Mal Weerakoon	Ecologist / contributing author of BDAR	BSc, MSc.	10+ years



# Stage 1: Biodiversity assessment

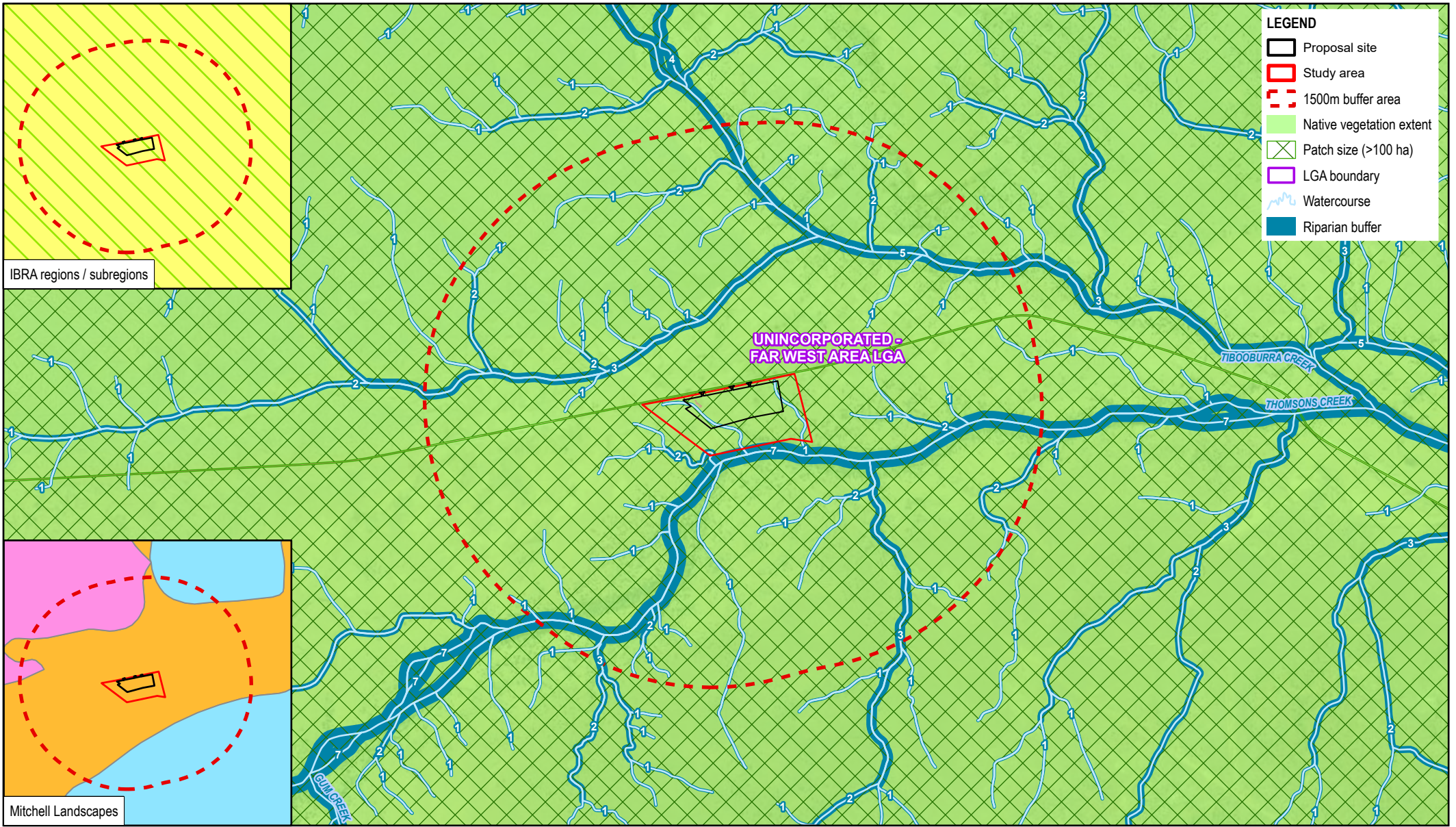
## 3. Site context

### 3.1 Assessment area

Landscape features identified within the proposal site and assessment area are shown on Figure 3.1. A summary of the assessment area and landscape features is provided in Table 3.1 below. Individual landscape features are described in the sections below including justification for the data entered in the BAM-C.

Table 3.1 Summary of landscape features at the proposal site

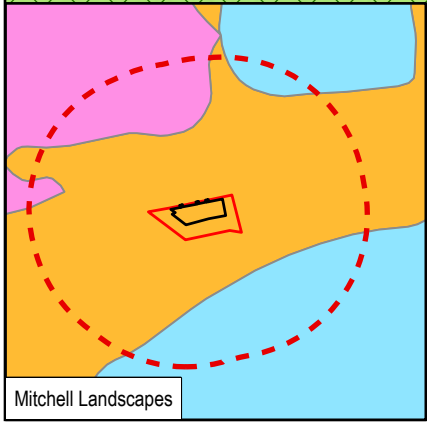
Landscape features	Proposal site
Method applied for site context components	Site-based
Lot / DP	Lot 2 DP832569
Interim Biogeographic regionalisation of Australia (IBRA) bioregion (DoEE 2018a)	Channel Country
IBRA subregion (DoEE 2018a)	Sturt Stony Desert
LGA	Unincorporated – Far West Area LGA
Mitchell landscape (DPE 2016)	Tibooburra Alluvial Plains
% native vegetation extent within buffer area	99.69% (926ha)
Rivers, streams and estuaries	Thomsons Creek Unnamed tributaries
Wetlands	None
Connectivity features	Habitat within the proposal site is connected to extensive areas of similar chenopod shrubland and semi-arid woodland habitat in the surrounding locality. All vegetation zones have a patch size of >101 ha.
Areas of geological significance	The proposal site contains small areas of gibber but none of the major geological features such as extensive rock out crops or mesas known from the broader Tibooburra region.
Soil hazard features	Soil landscapes for the development footprint and surrounding buffer area indicate that the soils have low erosional risk and low acid sulphate potential. Localised mitigation measures such as sediment fences during site earthworks are likely to be sufficient to mitigate the risk of soil hazards (GHD 2023).
Areas of outstanding biodiversity value	There are no areas identified under the BC Act as being of outstanding biodiversity value at the proposal site or in the surrounding area.
Other landscape features	Nil



**LEGEND**

- Proposal site
- Study area
- 1500m buffer area
- Native vegetation extent
- Patch size (>100 ha)
- LGA boundary
- Watercourse
- Riparian buffer

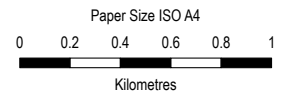
IBRA regions / subregions



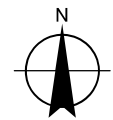
Mitchell Landscapes

- IBRA regions**
- Channel Country
- IBRA subregions**
- Sturt Stony Desert

- Mitchell Landscape**
- Tiboorra Alluvial Plains
  - Tiboorra Downs
  - Tiboorra Tablelands



Map Projection: Lambert Conformal Conic  
 Horizontal Datum: GDA2020  
 Grid: GDA2020 NSW Lambert



**APT Management Services Pty Ltd**  
**Moomba to Wilton Pipeline Modification 2**  
 Biodiversity Development Assessment Report

Project No. **12613644**  
 Revision No. **1**  
 Date **17/01/2024**

Location map

**FIGURE 3.1**

## 3.2 Landscape features

### 3.2.1 Rivers, streams, estuaries and wetlands

The proposal site is located around 200 m to the north of Thomsons Creek, which flows northeast towards the Narriearra Caryapundy Swamp. This reach of Thomsons Creek is an intermittent, channel confined, 7<sup>th</sup> order stream with a sandy bed and intact riparian vegetation of River Red Gum woodland. It contained surface water in occasional isolated pools at the time of the November 2022 and February 2023 surveys.

Two unnamed, ephemeral first order streams drain from the north of the proposal site southeast to Thomsons Creek. They are both channel confined streams with a sandy-clay bed and partially disturbed riparian vegetation of Acacia and chenopod shrubland. Several unnamed 1<sup>st</sup> and 2<sup>nd</sup> order tributaries with similar characteristics drain the surrounding area.

### 3.2.2 Habitat connectivity

Native vegetation extent was mapped across the assessment area using the SVTM (DPE 2022a) and adjusted within the proposal site based on the results of the desktop assessment and air photo interpretation. Patch size polygons were mapped in accordance with the BAM to include native vegetation in the proposal site that has a gap of less than 100 m from the next area of native vegetation (or  $\leq 30$  m for non-woody ecosystems). Native vegetation and patch size polygons are shown on Figure 3.1.

Habitat within the proposal site is connected to extensive areas of similar chenopod shrubland and semi-arid woodland habitat in the surrounding locality. There are no notable gaps in native vegetation cover. There is a gravel road to the north of the proposal site and a network of roads in the surrounding area with no native plant cover that align with an area of PCT0 - Not Native mapped in the SVTM. The remainder of the assessment area and region are sparsely populated and developed. Partial and localised vegetation clearing has occurred for agriculture and various infrastructure but cover of remnant and regenerating native vegetation has been retained. Habitat connectivity is maintained across and beyond the assessment area other than gaps the width of a two-lane road. All vegetation zones at the proposal site have a patch size of  $>101$  ha.

The riparian corridors of Thomsons Creek and its tributaries lie adjacent to the proposal site and may have particular value as fauna movement corridors.

### 3.2.3 Geological features of significance

The study area is located on a gently undulating plain and does not contain any mesas, substantial rock outcrops or other geological features of the broader Tibooburra region. There are occasional  $\sim 1000$  m<sup>2</sup> areas of gibber (i.e. beds of rounded rock fragments 1-10 cm diameter, exposed at the soil surface in an erosional landscape). There are a number of shallow gullies associated with ephemeral first order water courses.

### 3.2.4 NSW (Mitchell) landscapes

NSW Mitchell landscapes within the proposal site and assessment areas are shown on a Figure 3.1 and described in Table 3.2.

Table 3.2 Mitchell Landscapes

Landscape name (DPIE 2016)	Description (DECC 2002)
Tibooburra Alluvial Plains	<p>This landscape comprises scalded alluvial plains, back plains, narrow floodplains and channels with levees with extensive gilgai and scattered dunes. Relief is up to 8 m. Soils across the plains are sandy and loamy, with clays with strong surface crusts in pans and floodouts.</p> <p>Vegetation on the plains include infrequent Mulga, Whitewood (<i>Atalaya hemigluaca</i>), Prickly Wattle (<i>Acacia victoriae</i>), Punty Bush (<i>Senna eremophila</i>), Bushy Groundsel (<i>Senecio cunninghamii</i>), Thorny Saltbush (<i>rhagodia spinescens</i>) and extensive Mitchell grass (<i>Astrelba sp.</i>). Prickly Wattle, Bladder Saltbush (<i>atriplex spp.</i>) and Thorny Saltbush are common in floodouts. Major creeks contain River Red Gum (<i>Eucalyptus camaldulensis</i>) and Coolibah (<i>Eucalyptys coolabah</i>) with Gidgee (<i>Acacia cambagei</i>).</p>

The presence of the Tibooburra Alluvial Plains Mitchell landscape at the study area was confirmed during the site inspection, comprising the floodplain adjoining Thomsons Creek and associated channels of its tributaries and scattered dunes. The proposal site is located in the higher parts of this landscape and features scattered dunes with lighter textured (i.e. higher sand content) soils.

## 3.3 Native vegetation cover

Native vegetation cover was mapped across the 1500 m buffer area surrounding the proposal site using the SVTM (DPE 2022a). Figure 3.1 shows native vegetation cover within the proposal site and assessment area. Table 3.3 summarises the extent of native vegetation cover within the assessment area.

Table 3.3 Native vegetation cover

Site	1500 m buffer area (ha)	Native vegetation cover	Cover class
Proposal site	928	926 ha (99.69%)	>70%



# 4. Native vegetation, threatened ecological communities and vegetation integrity

## 4.1 Native vegetation extent

The following section describes the extent of native vegetation at the proposal site that requires assessment according to Chapter 4 of the BAM. Native vegetation extent was initially mapped across the proposal site using the SVTM (DPE 2022a) and high-resolution aerial photographs and then ground-truthed and adjusted based on the GHD site surveys. The proposal site was confirmed as containing close to full native vegetation cover consistent with the SVTM, as shown on Figure 4.1 and described in sections 4.2 and 4.3. There is a small area of non-native vegetation associated with a fenced compound and infrastructure within the MWP along the western boundary of the proposal site and the formed carriageway of Tibooburra Road to the north.

Areas that are not native vegetation do not require assessment according to Chapter 4 of the BAM. Areas that have been mapped as not native vegetation include MWP infrastructure, hard stand areas and compacted bare earth.

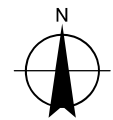
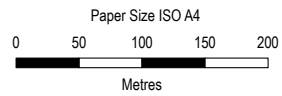
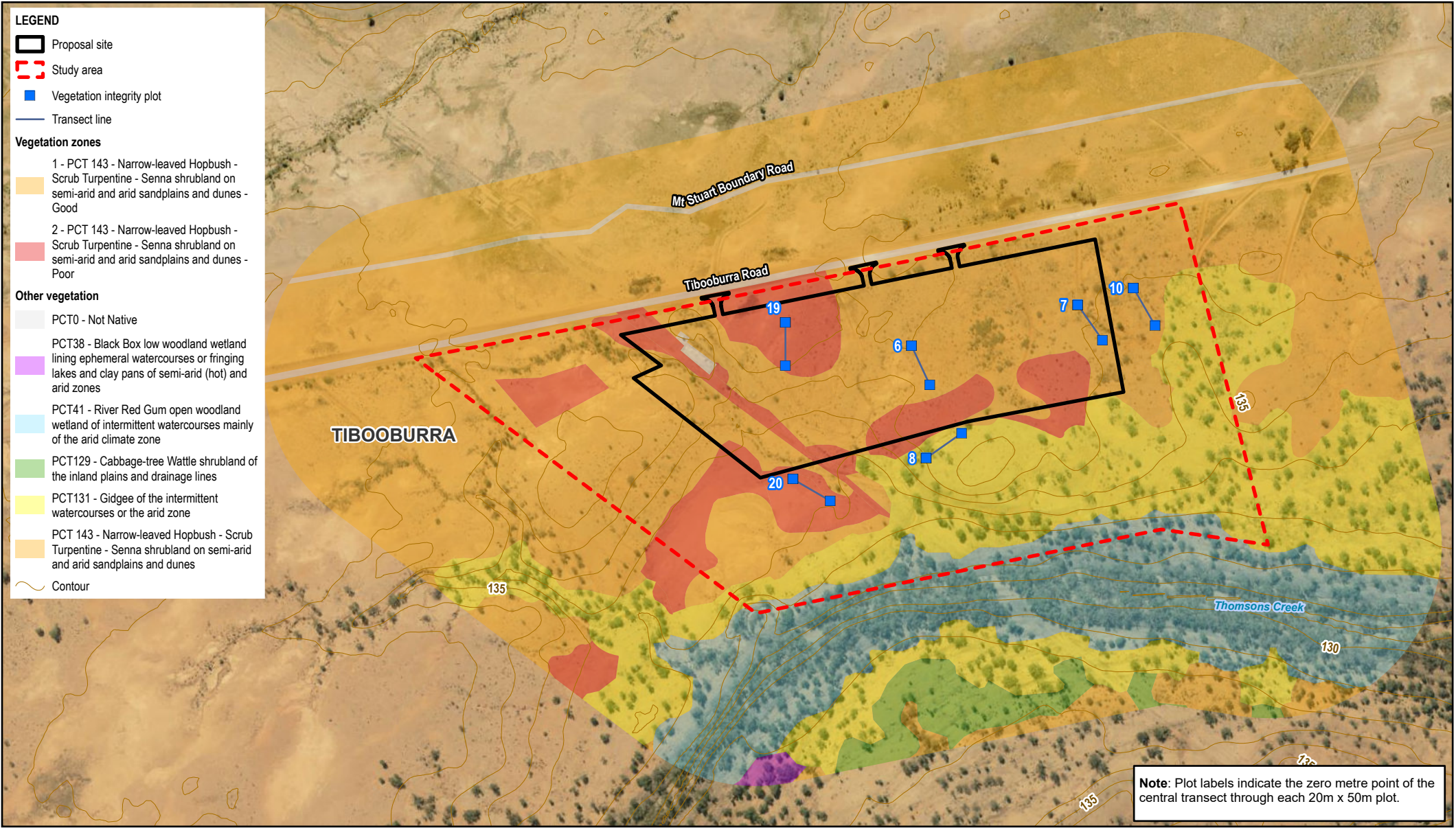
## 4.2 Plant community types

### 4.2.1 Overview

The PCTs identified at the proposal site are summarised in Table 4.1 and mapped on Figure 4.1. Further discussion of threatened ecological communities listed under the BC Act is provided in section 4.4 and ecological communities listed under the EPBC Act in section 5.3.1.

Table 4.1 Plant community types in the proposal site

PCT	BC Act status	EPBC Act status	FM Act status	Extent in proposal site (hectares)
<b>Proposal site</b>				
PCT 143 - Narrow-leaved Hopbush - Scrub Turpentine - Senna shrubland on semi-arid and arid sandplains and dunes	Does not align with any listed TECs	Does not align with any listed TECs	Does not align with any listed TECs	9.25
<b>Avoidance footprint and broader study area</b>				
PCT41 - River Red Gum open woodland wetland of intermittent watercourses mainly of the arid climate zone	Does not align with any listed TECs	Does not align with any listed TECs	Does not align with any listed TECs	0
PCT129 - Cabbage-tree Wattle shrubland of the inland plains and drainage lines	Does not align with any listed TECs	Does not align with any listed TECs	Does not align with any listed TECs	0
PCT131 - Gidgee of the intermittent watercourses or the arid zone	Does not align with any listed TECs	Does not align with any listed TECs	Does not align with any listed TECs	0



Map Projection: Lambert Conformal Conic  
Horizontal Datum: GDA2020  
Grid: GDA2020 NSW Lambert

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**Vegetation**

**FIGURE 4.1**

## 4.2.2 Justification of PCT selection

The SVTM (DPE 2022a) and analysis of aerial photography revealed the following vegetation units across the study area and associated candidate PCTs:

- **Shrubland** on slopes and plains across the majority of the study area mapped as:
  - PCT 129 ‘Cabbage-tree Wattle shrubland of the inland plains and drainage lines’ on lower slopes in gently undulating terrain
  - PCT 139 ‘Prickly Wattle tall open shrubland of dunes and sandplains of semi-arid and arid regions’ on mid and lower slopes in gently undulating terrain
  - PCT 212 ‘Chenopod low open shrubland - ephemeral partly derived forland saline wetland on occasionally flooded pale clay scalds in the NSW North Western Plains’ on mid slopes and flats across the majority of the study area
- **Tall shrubland** on the edge of the riparian corridor of Thomsons Creek mapped as:
  - PCT 131 ‘Gidgee of the intermittent watercourses or the arid zone (mainly Channel Country Bioregion and Simpson Strezlecki Dunefields Bioregion)’ on the levee adjoining the riparian corridor of Thomsons Creek
- **Floodplain woodland** in the riparian corridor of Thomsons Creek mapped as:
  - PCT 38 ‘Black Box low woodland wetland lining ephemeral watercourses or fringing lakes and clay pans of semi-arid (hot) and arid zones’
  - PCT 8 ‘River Red Gum - Warrego Grass - Couch Grass riparian tall woodland wetland of the semi-arid (warm) climate zone (Riverina Bioregion and Murray Darling Depression Bioregion)’.

Plot data and other site observation were considered against these candidate PCTs. Characteristic species, vegetation structure, soil type and landscape position were evaluated and compared with descriptions of candidate PCTs (DPE 2023a) in the BioNet vegetation classification. Where there was not a clear fit with a single candidate PCT then the BioNet Vegetation Classification PCT Filter Tool (DPE 2023e) was used to provide quantitative evidence to support PCT selection. The evidence used to confirm the selection of the best matching PCTs for these three vegetation units at the study area is provided below.

### Shrubland

PCT 212 ‘Chenopod low open shrubland - ephemeral partly derived forland saline wetland was the most widely mapped PCT at the study area in the SVTM (DPE 2022a). This PCT is a reasonable floristic match for areas of chenopod-dominated shrubland at the study area but was discounted as occurring based on:

- Geographic distribution – this PCT is not known to occur in the Sturt Stony Desert IBRA subregion according to the BioNet vegetation classification (DPE 2023a) and as such would only be selected if clearly a better fit than other candidate PCTs.
- Vegetation structure – the majority of this unit features patchy cover of taller shrubs such as Acacia, Senna and Hakea species rather than chenopods. Patches of lower shrubland appear to reflect patterns of human disturbance and grazing, rather than natural environmental factors, and so were considered more likely a ‘poor’ condition form of a taller shrubland PCT.
- Landscape position – there are occasional saline scalds in open areas of this unit, but they are not associated with slightly elevated rises on floodplains that are occasionally flooded. The shrubland unit is well above the floodplain of Thomsons Creek.

PCT 139 – Prickly Wattle tall open shrubland of dunes and sandplains of semi-arid and arid regions climate zone was mapped in broad areas of lower slopes across the study area in the SVTM (DPE 2022a). This PCT is a reasonable structural and floristic match for areas of shrubland at the study area but was discounted as occurring based on:

- Geographic distribution – this PCT is not known to occur in the Sturt Stony Desert subregion (DPE 2023a) and as such would only be selected if clearly a better fit than other candidate PCTs



- Soil landscape – this PCT is associated with sandy loams and sands on dunes in the semi-arid zone of far south western plains which is clearly distinct from the Tibooburra Alluvial Plains landscape at the proposal site (DECC 2002).

PCT 129 – ‘Cabbage-tree Wattle shrubland of the inland plains and drainage lines’ was mapped in broad areas of lower slopes across the study area in the SVTM (DPE 2022a). The study area does not contain any areas of tall shrubland up to 4 m high dominated by Cabbage-tree Wattle (*Acacia cana*), often as dense stands, as described for this PCT (DPE 2023a). PCT 129 is otherwise a moderate fit for the shrubland at the site in terms of structure, floristics, and soil landscape as it is associated with red loams or brown gibber loamy sand soils along watercourses and adjoining floodplains and on scalded red soils and sandy soils in flood-outs on rises or undulating downs, and occurs in the Sturt Stony Desert subregion (DPE 2023a).

Noting the moderate fit of PCT 129 for the shrubland at the study area, and that the other candidate PCTs mapped in the SVTM could be readily discounted, the BioNet Vegetation Classification PCT Filter Tool (DPE 2023e) was used to provide a quantitative assessment of a broader range of candidate PCTs. The following search criteria were entered in the PCT Filter Tool:

- IBRA subregion – ‘Sturt Stony Desert’
- Vegetation Formation – ‘Arid Shrublands (Acacia sub-formation)’ and ‘Arid Shrublands (Chenopod sub-formation)’ (noting that there are areas of both Acacia shrubland and low chenopod shrubland at the study area and to allow for the possibility that low chenopod shrubland was a natural structural form if supported by floristic composition)
- Species – 20 characteristic plant species, including 18 species that featured the highest cover, abundance or frequency in the five plots sampled in shrubland at the study area, and a further two over storey species that did not occur in plots but were characteristic of the surrounding area.

These data, including the 20 characteristic plant species selected, have been provided in spreadsheet format with the outputs of the PCT Filter Tool as part of the submission of this BDAR. As such there were 22 possibly matching search criteria, noting that any given PCT could not occur in both of the vegetation formations selected as options. The outcome of this assessment is that PCT 143 ‘Narrow-leaved Hopbush - Scrub Turpentine - Senna shrubland on semi-arid and arid sandplains and dunes’ is the best fit for the shrubland at the study area, noting:

- The highest number of matching search criteria of all PCTs (13 out of 22 possibly matching search criteria) including positive matches for IBRA subregion and Arid Shrublands (Acacia sub-formation) vegetation formation.
- Species composition and structure including:
  - positive matches for 11 of the 20 characteristic plant species, with notably high cover and/or frequency in plots sampled for the diagnostic species *Acacia victoriae*, *Senna form taxon. zygothylla*, *Aristida contorta*, *Enneapogon avenaceus* and *Sclerolaena bicornis var. bicornis*. A total of 26 species recorded in plots are listed in the description of the PCT (DPE 2023a)
  - Tall open shrubland structure with the tallest stratum various sub-species of *Senna artemisioides* with Mulga (*Acacia aneura*) and a number of other Eremophila species
  - Sparse mid storey of other shrubs such as *Rhagodia spinescens* and *Acacia victoriae* subsp. *arida*
  - Ground cover of chenopods, grasses and herbs characteristic of the PCT including Neverfail (*Eragrostis setifolia*), Bottlewasher (*Enneapogon avenaceus*), *Ptilotus obovatus*; copperburrs (*Sclerolaena muricata*, *S. bicornis var bicornis*, *S. decurrens.*), Tarvine (*Boerhavia dominii*), Grey Wrinklewort (*Rutidosia helichrysoides*), Buckbush (*Salsola tragus*) and *Tetragonia eremaea*.
- Soil landscape - on red-brown, sandy loamy soils on sandplains and low sandy rises of dunefields in the semi-arid and arid zones which is a broad match for the slopes and flats across the study area. The study area is within the Tibooburra Alluvial Plains Mitchell landscape (DECC 2002; pers. obs.), comprising the floodplain adjoining Thomsons Creek and associated channels of its tributaries and scattered dunes. The proposal site is located in the higher parts of this landscape and features scattered dunes with lighter textured (i.e. higher sand content) soils.

The next closest match was PCT 155 'Bluebush shrubland on stony rises and downs in the arid and semi-arid zones' with 12 out of 22 possibly matching search criteria, including positive matches for IBRA subregion and a positive match for 10 of the 20 characteristic plant species. PCT 155 is in the 'Arid Shrublands (Chenopod sub-formation)' and as such would only fit portions of the study area with sparse cover of taller shrubs such as *Acacia* and *Senna* species. PCT 143 was considered a better fit because PCT 155 is dominated by several species of tall bluebushes and mainly Black Bluebush (*Maireana pyramidata*) (DPE 2023a) which does not match the structure or species composition of this vegetation unit at the study area. As described above, PCT 143 and the Arid Shrublands (Acacia sub-formation) vegetation formation appears to be a better fit with the absence of taller shrubs and low groundcover in some areas probably reflecting human disturbance and grazing. As such lower chenopod-dominated shrublands have been treated as the vegetation zone PCT 143\_poor (see section 4.3).

Of the candidate PCTs revealed by the SVTM, PCT 129 – 'Cabbage-tree Wattle shrubland of the inland plains and drainage lines' was ranked highest in joint third position overall with 10 out of 22 possibly matching search criteria, including positive matches for IBRA subregion and a positive match for 8 of the 20 characteristic plant species. PCT 143 was considered a better fit because the study area does not contain any areas of tall shrubland up to 4 m high dominated by Cabbage-tree Wattle (*Acacia cana*) as described for this PCT (DPE 2023a) and has a higher number of characteristic species overall.

There are two candidate PCTs ranked equal third with PCT 129 with 10 out of 22 matches (PCT 38 'Black Box low woodland wetland lining ephemeral watercourses or fringing lakes and clay pans of semi-arid (hot) and arid zones' and PCT 119 'Sandplain Mulga tall shrubland - open shrubland of the semi-arid and arid climate zones'). There is nothing to suggest that these PCTs would be a better fit than PCT 143.

Of the other candidate PCTs mapped by the SVTM:

- PCT 212 was ranked joint 7<sup>th</sup> overall with seven matches and at least 17 PCTs ranked higher
- PCT 139 was ranked joint 9<sup>th</sup> overall with four matches and at least 58 PCTs ranked higher.

This confirms that these two PCTs can be readily discounted.

## Tall shrubland

PCT131 – 'Gidgee of the intermittent watercourses or the arid zone (mainly Channel Country Bioregion and Simpson Strezlecki Dunefields Bioregion)' was confirmed as occurring on the edges of the riparian corridor of Thomsons Creek and its tributaries based on:

- Landscape position:
  - as mapped on the SVTM and in the Sturt Stony Desert IBRA subregion with which the PCT is associated
  - on shallow stony clay soils on intermittent watercourse and adjoining gently undulating plains.
- Species composition and structure including:
  - Gidgee (*Acacia cambagei*) as the dominant canopy species often occurring in dense stands and forming a tall shrubland structure
  - sparse mid storey of shrubs such as *Rhagodia spinescens*, Black Bluebush (*Maireana pyramidata*) and occasional small trees such as Mulga (*Acacia aneura*)
  - a sparse ground cover of chenopods, grasses and herbs characteristic of the PCT including Neverfail (*Eragrostis setifolia*), Bottlewasher (*Enneapogon avenaceus*), *Ptilotus obovatus*; *Enchylaena tomentosa*, copperburrs (*Sclerolaena muricata*, *S. bicornis* var *bicornis*, *S. decurrens*.), *Chamaesyce drummondii*, and *Tetragonia eremaea*.

Noting the strong fit of this candidate PCT with its mapped location in the SVTM no further quantitative analysis was performed.

## Floodplain woodland

Of the candidate PCTs revealed by the SVTM:

- PCT 38 'Black Box low woodland wetland lining ephemeral watercourses or fringing lakes and clay pans of semi-arid (hot) and arid zones' was discounted as occurring in the riparian corridor of Thomsons Creek because no Black Box (*Eucalyptus largiflorens*) was observed

- PCT 8 ‘River Red Gum - Warrego Grass - Couch Grass riparian tall woodland wetland of the semi-arid (warm) climate zone (Riverina Bioregion and Murray Darling Depression Bioregion)’ was discounted as occurring as it is mainly located in the Murray-Darling Basin Bioregion is not known to occur in the Sturt Stony Desert IBRA subregion according to the Bionet vegetation classification (DPE 2023a) and as such would only be selected if clearly a better fit than other candidate PCTs.

‘PCT 41 – River Red Gum open woodland wetland of intermittent watercourses mainly of the arid climate zone’ was considered the best fit for the floodplain woodland at the study area based on:

- Landscape position:
  - not mapped in the local area on the SVTM but is associated with the Sturt Stony Desert IBRA subregion containing the study area
  - on alluvial sand and loam soil on an intermittent watercourse.
- Species composition and vegetation structure including:
  - the characteristic upper stratum species of PCT 41, River Red Gum (*Eucalyptus camaldulensis*), as the tallest stratum with a canopy 15-20 m tall and a woodland vegetation structure
  - Low cover of Coolabah (*Eucalyptus coolabah*) relative to River Red Gum and absence of Black Box (*Eucalyptus largiflorens*) and mid storey species such as Lignum (*Duma florulenta*) that are characteristic of various other floodplain woodland PCTs
  - Characteristic mid storey species such as River Cooba (*Acacia stenophylla*), *Eremophila longifolia* and Prickly Wattle (*Acacia victoriae*)
  - Groundcover of chenopods, grasses and herbs including species characteristic of PCT 41 such as *Salsola kali* var. *kali*; grasses such as *Enneapogon avenaceus*, *Cymbopogon ambiguus*, *Eragrostis dielsii*, *Aristida contorta*, *Paspalidium* spp., *Themeda triandra*; *Tetragonia eremaea*, *Nicotiana velutina*, and *Einadia nutans* subsp. *linifolia*.

Noting the relatively strong fit of this candidate PCT, and that it does not occur in the proposal site and was not sampled by vegetation integrity plots, no further quantitative analysis was performed.

The SVTM was not ground-truthed in detail beyond the study area and so the originally mapped PCTs have been retained in the local area as shown on Figure 4.1.

## 4.3 Vegetation zones

### 4.3.1 Overview

PCTs identified within the study area during field surveys were further split into broad condition classes resulting in the vegetation zones as shown in Figure 4.1 and summarised in Table 4.2. Additional vegetation outside of the proposal site are also described in detail as they provide habitat for threatened and migratory biota and may be subject to indirect and prescribed impacts.

The structure, species composition and condition of the vegetation zones within the study area are described below. All references to condition are relative to version 1.2 ‘wet year’ benchmark data as stated in section 2.6, reflecting the above average rainfall in the years preceding field surveys as described in section 2.5. Plant species lists are provided in Appendix B and plot data is provided in Appendix C along with benchmark values for each PCT.

Table 4.2 Vegetation zones and other vegetation in the study area

Zone ID	PCT ID	PCT name	Condition / other defining feature	Area (ha) in proposal site	Vegetation class	Patch size (hectares)*	Patch size class	Number of vegetation integrity plots required	Vegetation integrity plots sampled
<b>Vegetation zones</b>									
1	143	Narrow-leaved Hopbush - Scrub Turpentine - Senna shrubland on semi-arid and arid sandplains and dune	Good	6.85	Sand Plain Mulga Shrublands	101	☒ >100 ha	3	6, 7, 10
2	143	Narrow-leaved Hopbush - Scrub Turpentine - Senna shrubland on semi-arid and arid sandplains and dune	Poor	2.48	Sand Plain Mulga Shrublands	101	☒ >100 ha	2	19, 20
<b>Other vegetation</b>									
	0	Not Native	Non-native	0.01	n/a	n/a	n/a	0	0
Avoidance area only	131	Gidgee of the intermittent watercourses or the arid zone	Good	0	Gibber Transition Shrublands		☒ >100 ha	0	8
Avoidance area only	41	River Red Gum open woodland wetland of intermittent watercourses mainly of the arid climate zone	Good	0	North-west Floodplain Woodlands		☒ >100 ha	0	0

## 4.3.2 Vegetation integrity (vegetation condition)

Vegetation integrity (VI) scores calculated for the vegetation zones in the proposal site are presented in Table 4.3 below. PCT 131 in good condition in the avoidance area was also sampled by a vegetation integrity plot and so an estimate of VI was also obtained from the BAM-C for this vegetation. PCT131\_Good BAM-C calculations are included in version 2 of the assessment case for the proposal. The VI plot data and benchmark data that have informed these calculations are included in Appendix C.


**Table 4.3** *Vegetation integrity scores*

Zone ID	Vegetation zone	Composition condition score	Structure condition score	Function condition score (where relevant) <sup>1</sup>	Vegetation integrity score	Hollow bearing trees present?
1	143_Good	94.7	78.3	n/a	86.1	No
2	143_Poor	79.4	17.9	n/a	37.7	No
Avoidance area only	131_Good	96.4	56.5	n/a	73.8	Yes

Note: 1. Function score is not calculated for PCTs in the Arid Shrublands (Acacia sub-formation) vegetation formation (DPIE 2020a).

## 4.3.3 Vegetation zone descriptions

**Table 4.4** *Vegetation zone descriptions*


<b>Zone 1 – PCT143 - Narrow-leaved Hopbush - Scrub Turpentine - Senna shrubland on semi-arid and arid sandplains and dunes – good</b>	
Plant community type	Narrow-leaved Hopbush - Scrub Turpentine - Senna shrubland on semi-arid and arid sandplains and dunes.
PCT ID	143
Photo	
Survey effort	Plot 6, plot 7, plot 10
Conservation significance	Native vegetation, not a TEC.

**Zone 1 – PCT143 - Narrow-leaved Hopbush - Scrub Turpentine - Senna shrubland on semi-arid and arid sandplains and dunes – good**

Patch size	101 ha
Condition	<p>Good</p> <ul style="list-style-type: none"> <li>– overall, shrub, forb and fern composition met or was above the benchmark</li> <li>– tree, grass and other composition was slightly below the benchmark</li> <li>– fern and other cover met benchmark</li> <li>– shrub and forb cover was highly variable</li> <li>– grass cover was below benchmark</li> <li>– no trees were recorded, which is typical of shrubland communities</li> <li>– up to 10 m of fallen logs were present</li> <li>– leaf litter cover was highly variable</li> <li>– no high threat exotic plant (HTE) cover was recorded in plots</li> <li>– no hollow-bearing trees were recorded</li> <li>– tree stem classes between 0-10 cm present</li> <li>– note that for this PCT, function data does not feed into the vegetation integrity score.</li> </ul>
Current vegetation integrity score	86.1
Landscape position	Occurs on sandy loams and sands on plains with occasional ephemeral drainage lines and patches of gibber.
Structure	Open shrubland dominated by Prickly Wattle ( <i>Acacia victoriae</i> ) and <i>Senna</i> spp. with a sparse understorey of mainly annual chenopods, perennial grasses and annual herbs.
Over-storey	Generally absent. Occasional Northern Sandalwood ( <i>Santalum lanceolatum</i> ) and Mulga ( <i>Acacia aneura</i> ).
Mid-storey	Prickly Wattle ( <i>Acacia victoriae</i> ), <i>Senna phyllodinea</i> , <i>Senna artemisioides</i> subsp. <i>zygophylla</i> . Occasional dense patches of Needlewood ( <i>Hakea leucoptera</i> )
Groundcover	<p>Shrubs: Blunt-leaved Cassia (<i>Senna</i> form taxon '<i>helmsii</i>'), Smoke Bush (<i>Ptilotus obovatus</i>), Ruby Saltbush (<i>Enchylaena tomentosa</i>), Goathead Burr (<i>Sclerolaena bicornis</i>), Thorny Saltbush (<i>Rhagodia spinescens</i>), <i>Aristida anthoxanthoides</i></p> <p>Forbs: Wires-a-wool (<i>Lemooria burkittii</i>), Rough Raspwort (<i>Haloragis aspera</i>), Grey Wrinklewort (<i>Rutidosis helichrysoides</i>)</p> <p>Grasses: Bunched Kerosene Grass (<i>Aristida contorta</i>), Bottle Washers (<i>Enneapogon avenaceus</i>), Neverfail</p> <p>Other: Desert Bindweed (<i>Convolvulus clementii</i>)</p>
Exotic species	Wild Melon ( <i>Citrullus lanatus</i> var. <i>lanatus</i> )




**Zone 2– PCT143 - Narrow-leaved Hopbush - Scrub Turpentine - Senna shrubland on semi-arid and arid sandplains and dunes– poor**

Plant community type	Narrow-leaved Hopbush - Scrub Turpentine - Senna shrubland on semi-arid and arid sandplains and dunes
PCT ID	143
Photo	
Survey effort	Plot 19, Plot 20
Conservation significance	Native vegetation, not a TEC
Patch size	101 ha
Condition	<p>Poor</p> <ul style="list-style-type: none"> <li>– overall species composition was generally below benchmark</li> <li>– forb composition was highly variable</li> <li>– no trees recorded in plots sampled</li> <li>– shrub cover well below benchmark</li> <li>– no fallen logs present in plot sampled</li> <li>– up to 10% litter cover</li> <li>– no hollow-bearing trees recorded</li> <li>– no tree stem classes present</li> <li>– no HTE cover recorded in plots.</li> </ul>
Current vegetation integrity score	37.7
Landscape position	Occurs on sandy loams and sands on plains with occasional ephemeral drainage lines, patches of gibber and salt scalds.
Structure	Low, open chenopod shrubland with occasional taller <i>Acacia</i> spp. and <i>Senna</i> spp. over a sparse, patchy understorey of annual chenopods, perennial grasses and annual herbs.
Over-storey	Absent
Mid-storey	Largely absent. Occasional Prickly Wattle ( <i>Acacia victoriae</i> ) and <i>Senna artemisioides</i> subsp. <i>zygophylla</i>


**Zone 2– PCT143 - Narrow-leaved Hopbush - Scrub Turpentine - Senna shrubland on semi-arid and arid sandplains and dunes– poor**

Groundcover	<p>Shrubs: Poverty Bush (<i>Sclerolaena intricata</i>), Low Bluebush (<i>Maireana astrotricha</i>), Twin-horned Copperburr (<i>Dissocarpus biflorus</i>), Cotton Bush (<i>Maireana aphylla</i>), Water Weed (<i>Osteocarpum acropterum</i>), Goathead Burr (<i>Sclerolaena bicornis</i>), Salt Copperburr (<i>Sclerolaena ventricosa</i>)</p> <p>Forbs: Woolly-heads (<i>Myriocephalus pluriflorus</i>), Wires-a-wool (<i>Lemooria burkittii</i>), Pop Saltbush (<i>Atriplex holocarpa</i>), Dark Sago-weed (<i>Plantago drummondii</i>), Grey Wrinklewort (<i>Rutidosia helichrysoides</i>)</p> <p>Grasses: Bunched Kerosene Grass (<i>Aristida contorta</i>), <i>Aristida anthoxanthoides</i>, Bottle Washers, Neverfail (<i>Eragrostis setifolia</i>), Fiveminute Grass (<i>Tripogon loliiformis</i>)</p>
Exotic species	<i>Sisymbrium</i> spp., Woolly Burr Medic ( <i>Medicago minima</i> ), London Rocket ( <i>Sisymbrium irio</i> )

**Impact avoidance area - PCT131 - Gidgee of the intermittent watercourses or the arid zone - good**

Plant community type	Gidgee of the intermittent watercourses or the arid zone
PCT ID	131
Photos	
Survey effort	Plot 8
Conservation significance	Native vegetation, not a TEC.
Patch size	101 ha
Condition	<p>Good</p> <ul style="list-style-type: none"> <li>– overall species composition (31 species) slightly above benchmark (28 species)</li> <li>– tree, shrub, grass &amp; grass-like, ferns and other composition at or near benchmark</li> <li>– forb composition above benchmark</li> <li>– tree cover above benchmark</li> <li>– shrub and forb cover well below benchmark</li> <li>– up to 12m of fallen logs</li> <li>– 12% litter cover recorded</li> <li>– one hollow-bearing tree recorded</li> <li>– tree stem classes between 0-80cm present</li> <li>– no HTE cover recorded in plot.</li> </ul>

Impact avoidance area - PCT131 - Gidgee of the intermittent watercourses or the arid zone - good	
Current vegetation integrity score	73.8
Landscape position	Occurs on gravelly sandy loams on banks and levees adjoining ephemeral watercourses.
Structure	Tall shrubland and open woodland dominated by Gidgee ( <i>Acacia cambagei</i> )
Over-storey	Gidgee ( <i>Acacia cambagei</i> ), Whitewood ( <i>Atalaya hemiglauca</i> )
Mid-storey	Black Bluebush ( <i>Maireana pyramidata</i> )
Groundcover	Shrubs: Goathead Burr ( <i>Sclerolaena bicornis</i> var. <i>horrida</i> ), Ruby Saltbush ( <i>Enchylaena tomentosa</i> ), Thorny Saltbush ( <i>Rhagodia spinescens</i> ) Forbs: <i>Sida</i> spp., Wild Onion ( <i>Bulbine semibarbata</i> ), Caustic Weed ( <i>Chamaesyce drummondii</i> ), Pigweed ( <i>Portulaca oleracea</i> ) Grasses: Bottle Washers ( <i>Enneapogon avenaceus</i> ), Neverfail ( <i>Eragrostis setifolia</i> ), <i>Aristida anthoxanthoides</i>
Exotic species	Common Sowthistle ( <i>Sonchus oleraceus</i> )

Impact avoidance area – PCT 41 - River Red Gum open woodland wetland of intermittent watercourses mainly of the arid climate zone	
Plant community type	River Red Gum open woodland wetland of intermittent watercourses mainly of the arid climate zone
PCT ID	41
Photo	
Survey effort	General observations
Conservation significance	Native vegetation, not a TEC.
Patch size	101 ha
Condition	Good
Current vegetation integrity score	Not calculated
Landscape position	Occurs on sandy or loamy soils in sandy creeks on sandplains of lower slopes of rises or hills in the arid climate zone.

**Impact avoidance area – PCT 41 - River Red Gum open woodland wetland of intermittent watercourses mainly of the arid climate zone**

Structure	Tall open woodland with River Red Gum ( <i>Eucalyptus camaldulensis</i> subsp. <i>arida</i> ) and a sparse mid storey layer including River Cooba ( <i>Acacia salicina</i> ) and Thorny Saltbush ( <i>Rhagodia spinescens</i> ). Groundcover comprises small shrubs such as Ruby Saltbush ( <i>Enchylaena tomentosa</i> ) and grasses such as Bunched Kerosene Grass ( <i>Aristida contorta</i> )
Over-storey	River Red Gum ( <i>Eucalyptus camaldulensis</i> subsp. <i>arida</i> ), occasional Coolabah ( <i>Eucalyptus coolabah</i> )
Mid-storey	River Cooba ( <i>Acacia salicina</i> ), <i>Acacia stenophylla</i> , Western Boobialla ( <i>Myoporum montanum</i> ), Thorny Saltbush ( <i>Rhagodia spinescens</i> ), Prickly Wattle ( <i>Acacia victoriae</i> ), Emubush ( <i>Eremophila longifolia</i> ) and Senna form taxon 'artemisioides'
Groundcover	Shrubs: Ruby Saltbush ( <i>Enchylaena tomentosa</i> ), <i>Salsola kali</i> var. <i>kali</i> Grasses: Bottle Washers ( <i>Enneapogon avenaceus</i> ), Native Lemongrass ( <i>Cymbopogon ambiguus</i> ), Mallee Lovegrass ( <i>Eragrostis dielsii</i> ), <i>Aristida echinate</i> , Bunched Kerosene Grass ( <i>Aristida contorta</i> ) Forbs: <i>Tetragonia eremaea</i> , <i>Nicotiana velutina</i> , Apple Bush ( <i>Pterocaulon spacelatum</i> ), Native Carrot ( <i>Daucus glochidiatus</i> ), Climbing Saltbush ( <i>Einadia nutans</i> subsp. <i>linifolia</i> ), Smoke Bush ( <i>Ptilotus obovatus</i> ), <i>Ptilotus atriplicifolius</i> var. <i>atriplicifolius</i>
Exotic species	Low cover. Occasional Blackberry Nightshade ( <i>Solanum nigrum</i> ) and <i>Cucumis myriocarpus</i> subsp. <i>leptodermis</i>

## 4.4 Threatened ecological communities

No TECs listed were recorded in the proposal site or surrounding study area. There is no risk of direct or indirect impacts to any TECs from the construction or operation of the proposal.



# 5. Habitat suitability for threatened and migratory species

## 5.1 Identification of threatened species for assessment

### 5.1.1 Ecosystem credit species

Based on the bioregional context for the assessment and the PCTs, patch size, vegetation cover and habitat resources present at the proposal site, the BAM-C generates a list of threatened fauna species that are predicted to utilise the proposal site (that is, potential 'predicted threatened species', or potential 'ecosystem credit entities'). The potential for these predicted threatened species to occur within the proposal site was further refined based on the desktop assessment, habitat resources observed during field surveys, records during the surveys, and the knowledge and experience of the assessor. Targeted surveys are not required under the BAM for these species as they are assumed to be present in the PCTs at the site.

Table 5.1 lists all ecosystem credit species that are considered likely to occur on or use the proposal site. The list of ecosystem credit species was compiled based on the following information as summarised in the 'Source' column of Table 5.1:

- 'BAM-C', meaning the list of potential ecosystem credit species generated by the Biodiversity Assessment Method Calculator Version 1.4 based on location and vegetation data for the proposal site and the Threatened Biodiversity Data Collection (DPE 2023a)
- 'Previous survey', meaning a direct observation of the species at the proposal site as part of a previous assessment
- 'Current survey' meaning directly observed at the proposal site during field surveys conducted for the proposal
- 'Desktop review' meaning evidence that the species would occur at the proposal site based on BioNet Atlas records (DPE 2023a) or revealed by other information sources.

Table 5.1 also identifies and provides justifications for the removal of species from the BAM-C auto-populated list in accordance with BAM Subsections 5.2.1 and 5.2.2 (DPIE 2020a). Geographic limitations, habitat constraints and vagrant species are the only reasons used for excluding ecosystem credit species.

Each of the predicted threatened species identified by the BAM-C were retained for further assessment. The Southern Whiteface (*Aphelocephala leucopsis*) was added to the list of predicted threatened species because the species was listed as a vulnerable species under the EPBC Act in March 2023 and was identified during surveys at the proposal site. No additional species were added due to being recently listed under the BC Act and not yet added to the TBDC or revealed by other information sources.

The following predicted species were recorded during field surveys:

- The Southern Whiteface, observed in groups of up to 12 foraging in shrubland
- The Little Pied-bat (*Chalinolobus picatus*), detected via 'definite' call identification in the riparian corridor
- A Black Falcon (*Falco subniger*) observed flying over shrubland and tall shrubland
- Dusky Woodswallow (*Artamus cyanopterus cyanopterus*), observed in groups of up to six foraging in shrubland
- A Spotted Harrier (*Circus assimilis*) observed foraging over shrubland
- A Black-breasted Buzzard (*Hamirostra melanosternon*) observed several kilometres from the study area in a similar semi-arid shrubland environment.

The locations of threatened fauna observations are shown on Figure 5.1.



Table 5.1 Predicted (ecosystem credit) species

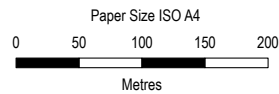
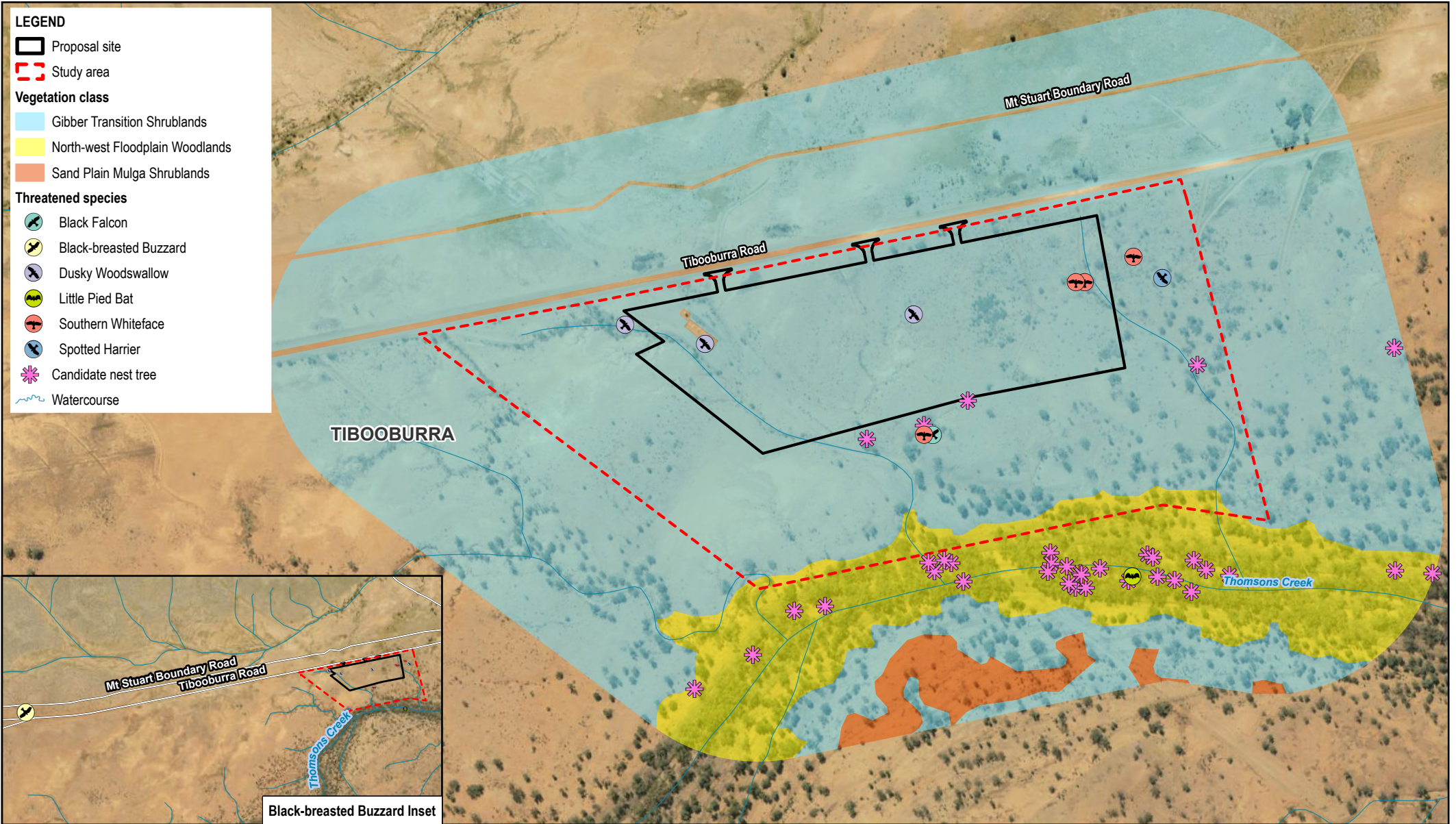
Common name	Scientific name	BC Act status	EPBC Act status	Dual credit species	Sources	Species retained for further assessment?	Reason for exclusion from further assessment	Associated vegetation zone	Sensitivity to gain class
Kultarr	<i>Antechinomys laniger</i>	E			<input checked="" type="checkbox"/> BAM-C <input type="checkbox"/> Previous survey <input type="checkbox"/> Current survey <input type="checkbox"/> Desktop review	Yes	N/A	143_Good 143_Poor	High
Southern Whiteface	<i>Aphelocephala leucopsis</i>		V		<input type="checkbox"/> BAM-C <input type="checkbox"/> Previous survey <input checked="" type="checkbox"/> Current survey <input type="checkbox"/> Desktop review	Yes	N/A	143_Good 143_Poor	*
Dusky Woodswallow	<i>Artamus cyanopterus cyanopterus</i>	V			<input checked="" type="checkbox"/> BAM-C <input type="checkbox"/> Previous survey <input checked="" type="checkbox"/> Current survey <input type="checkbox"/> Desktop review	Yes	N/A	143_Good 143_Poor	Moderate
Woma	<i>Aspidites ramsayi</i>	V			<input checked="" type="checkbox"/> BAM-C <input type="checkbox"/> Previous survey <input type="checkbox"/> Current survey <input type="checkbox"/> Desktop review	Yes	N/A	143_Good 143_Poor	High
Pied Honeyeater	<i>Certhionyx variegatus</i>	V			<input checked="" type="checkbox"/> BAM-C <input type="checkbox"/> Previous survey <input type="checkbox"/> Current survey <input type="checkbox"/> Desktop review	Yes	N/A	143_Good 143_Poor	Moderate
Little Pied Bat	<i>Chalinolobus picatus</i>	V			<input checked="" type="checkbox"/> BAM-C <input type="checkbox"/> Previous survey <input checked="" type="checkbox"/> Current survey <input type="checkbox"/> Desktop review	Yes	N/A	143_Good 143_Poor	High
Spotted Harrier	<i>Circus assimilis</i>	V			<input checked="" type="checkbox"/> BAM-C <input type="checkbox"/> Previous survey <input checked="" type="checkbox"/> Current survey <input type="checkbox"/> Desktop review	Yes	N/A	143_Good 143_Poor	Moderate

Common name	Scientific name	BC Act status	EPBC Act status	Dual credit species	Sources	Species retained for further assessment?	Reason for exclusion from further assessment	Associated vegetation zone	Sensitivity to gain class
Wedgesnout Ctenotus	<i>Ctenotus brooksi</i>	V			<input checked="" type="checkbox"/> BAM-C <input type="checkbox"/> Previous survey <input type="checkbox"/> Current survey <input type="checkbox"/> Desktop review	Yes	N/A	143_Good 143_Poor	High
A whip snake	<i>Demansia rimicola</i>	V			<input checked="" type="checkbox"/> BAM-C <input type="checkbox"/> Previous survey <input type="checkbox"/> Current survey <input type="checkbox"/> Desktop review	Yes	N/A	143_Good 143_Poor	High
Grey Falcon	<i>Falco hypoleucos</i>	E	E		<input checked="" type="checkbox"/> BAM-C <input type="checkbox"/> Previous survey <input type="checkbox"/> Current survey <input type="checkbox"/> Desktop review	Yes	N/A	143_Good 143_Poor	Moderate
Black Falcon	<i>Falco subniger</i>	V			<input checked="" type="checkbox"/> BAM-C <input type="checkbox"/> Previous survey <input checked="" type="checkbox"/> Current survey <input type="checkbox"/> Desktop review	Yes	N/A	143_Good 143_Poor	Moderate
Painted Honeyeater	<i>Grantiella picta</i>	V	V		<input checked="" type="checkbox"/> BAM-C <input type="checkbox"/> Previous survey <input type="checkbox"/> Current survey <input type="checkbox"/> Desktop review	Yes	N/A	143_Good 143_Poor	Moderate
Black-breasted Buzzard (foraging)	<i>Hamirostra melanosternon</i>	E			<input checked="" type="checkbox"/> BAM-C <input type="checkbox"/> Previous survey <input checked="" type="checkbox"/> Current survey <input type="checkbox"/> Desktop review	Yes	N/A	143_Good 143_Poor	Moderate
Little Eagle (foraging)	<i>Hieraaetus morphnoides</i>	V		Yes	<input checked="" type="checkbox"/> BAM-C <input type="checkbox"/> Previous survey <input type="checkbox"/> Current survey <input type="checkbox"/> Desktop review	Yes	N/A	143_Good 143_Poor	Moderate

Common name	Scientific name	BC Act status	EPBC Act status	Dual credit species	Sources	Species retained for further assessment?	Reason for exclusion from further assessment	Associated vegetation zone	Sensitivity to gain class
Forrest's Mouse	<i>Leggadina forresti</i>		V		<input checked="" type="checkbox"/> BAM-C <input type="checkbox"/> Previous survey <input type="checkbox"/> Current survey <input type="checkbox"/> Desktop review	Yes	N/A	143_Good 143_Poor	High
Yellow-tailed Plain Slider	<i>Lerista xanthura</i>	V			<input checked="" type="checkbox"/> BAM-C <input type="checkbox"/> Previous survey <input type="checkbox"/> Current survey <input type="checkbox"/> Desktop review	Yes	N/A	143_Good 143_Poor	High
Major Mitchell's Cockatoo (foraging)	<i>Lophochroa leadbeateri</i>	V	E	Yes	<input checked="" type="checkbox"/> BAM-C <input type="checkbox"/> Previous survey <input type="checkbox"/> Current survey <input type="checkbox"/> Desktop review	Yes	N/A	143_Good 143_Poor	Moderate
Dusky Hopping-mouse	<i>Notomys fuscus</i>	E	V		<input checked="" type="checkbox"/> BAM-C <input type="checkbox"/> Previous survey <input type="checkbox"/> Current survey <input type="checkbox"/> Desktop review	Yes	N/A	143_Good 143_Poor	High
Sandy Inland Mouse	<i>Pseudomys hermannsburgensis</i>	E			<input checked="" type="checkbox"/> BAM-C <input type="checkbox"/> Previous survey <input type="checkbox"/> Current survey <input type="checkbox"/> Desktop review	Yes	N/A	143_Good 143_Poor	High
Ringed Brown Snake	<i>Pseudonaja modesta</i>	E			<input checked="" type="checkbox"/> BAM-C <input type="checkbox"/> Previous survey <input type="checkbox"/> Current survey <input type="checkbox"/> Desktop review	Yes	N/A	143_Good 143_Poor	Moderate
Interior Blind Snake	<i>Ramphotyphlops endoterus</i>	E			<input checked="" type="checkbox"/> BAM-C <input type="checkbox"/> Previous survey <input type="checkbox"/> Current survey <input type="checkbox"/> Desktop review	Yes	N/A	143_Good 143_Poor	Moderate

Common name	Scientific name	BC Act status	EPBC Act status	Dual credit species	Sources	Species retained for further assessment?	Reason for exclusion from further assessment	Associated vegetation zone	Sensitivity to gain class
Long-haired Rat	<i>Rattus villosissimus</i>	V			<input checked="" type="checkbox"/> BAM-C <input type="checkbox"/> Previous survey <input type="checkbox"/> Current survey <input type="checkbox"/> Desktop review	Yes	N/A	143_Good 143_Poor	High
Yellow-bellied Sheath-tail-bat	<i>Saccolaimus flaviventris</i>	V			<input checked="" type="checkbox"/> BAM-C <input type="checkbox"/> Previous survey <input type="checkbox"/> Current survey <input type="checkbox"/> Desktop review	Yes	N/A	143_Good 143_Poor	High
Narrow-banded Snake	<i>Simoselaps fasciolatus</i>	V			<input checked="" type="checkbox"/> BAM-C <input type="checkbox"/> Previous survey <input type="checkbox"/> Current survey <input type="checkbox"/> Desktop review	Yes	N/A	143_Good 143_Poor	Moderate
Stripe-faced Dunnart	<i>Sminthopsis macroura</i>				<input checked="" type="checkbox"/> BAM-C <input type="checkbox"/> Previous survey <input type="checkbox"/> Current survey <input type="checkbox"/> Desktop review	Yes	N/A	143_Good 143_Poor	High

Note: \* Sensitivity to gain class for Southern Whiteface is not known because the species was not listed in the TBDC DPE (2023d) at the time of preparation.



Map Projection: Lambert Conformal Conic  
 Horizontal Datum: GDA2020  
 Grid: GDA2020 NSW Lambert



APT Management Services Pty Ltd  
 Moomba to Wilton Pipeline Modification 2  
 Biodiversity Development Assessment Report

Project No. 12613644  
 Revision No. 1  
 Date 17/01/2024

**Threatened fauna and  
 habitat resources**

**FIGURE 5.1**



## 5.1.2 Species credit species

Threatened species that cannot reliably be predicted to occur on a development site based on PCT, distribution and habitat criteria are identified by the Threatened Biodiversity Data Collection as 'species credit' entities. In some circumstances, the particular habitat components of species assessed for ecosystem credit species, such as the breeding habitat of a cave roosting bat or forest owls, are also assessed for species credits.

The credit calculator references geographic, vegetation and habitat data for the proposal site to generate a list of the species credit entities that are predicted to occur (i.e. the 'potential candidate threatened species'). Searches of threatened species databases were also completed to identify any additional potential candidate threatened species (to those generated by the credit calculator) that are known or predicted to occur in the locality. The likelihood of occurrence of potential candidate threatened species were reviewed, giving consideration to the habitats available in the study area (refer to threatened species for assessment tables in Appendix A).

The list of potential candidate threatened species that could occur are assessed based on the habitat resources observed during field surveys. 'Confirmed' candidate threatened species require further assessment of species presence and the extent of occupied habitat in accordance with the BAM. Habitat assessment and targeted surveys must extend to areas adjoining the proposal site for certain matters, for instance threatened raptor nest trees, because if present a species polygon must be mapped in a buffer area of up to 300 m around the nest tree that includes all PCTs with which the species is associated (DPE 2023a). A number of species could be reliably discounted as occurring at the proposal site or adjoining areas based on the type and quality of habitat resources present and the habitat requirements for the species identified in the TBDC. The list of confirmed candidate threatened species is presented in Table 5.2 along with justification for excluding species from further assessment in accordance with BAM Subsections 5.2.1 and 5.2.2 (DPIE 2020a).

The following habitat types and resources are present at the proposal site or adjoining areas and informed the assessment of candidate threatened species:

- Sand Plain Mulga shrublands, including areas of taller shrubs such as Prickly Wattle (*Acacia victoriae*), Needlewood (*Hakea leucoptera*) and *Senna* species forming a dense shrub layer in places.
- Areas within 500 m of rocks or gibber; rocky areas. There are no substantial rock outcrops in or near the proposal site however there are patches of gibber (i.e. pebbles and rock fragments exposed at the soil surface).
- Waterbodies; land within 40 m of riparian woodland on inland watercourses/waterholes containing dead or dying eucalypts in the riparian corridor of Thomsons Creek which contained very occasional pools at the time of the November 2022 and February 2023 surveys.
- River Red Gum open woodland wetland of an intermittent watercourse including mature trees 'nest trees - live (occasionally dead) large old trees within vegetation'. There are no candidate nest trees in the proposal site however there are several in the riparian corridor of Thomson's Creek and scattered throughout the broader study area as shown on Figure 5.1. No large stick nests (>50 cm diameter) or any nests occupied by target species were observed despite multiple rounds of diurnal bird surveys and candidate tree inspections. A number of smaller stick nests were observed that did not match the size or other characteristics of nests for target species (DPE 2023a, d) and were probably formerly occupied by Babblers or Ravens.
- Hollow bearing trees; living or dead tree with hollows greater than 10 cm diameter. There are no candidate nest trees in the proposal site however there are several in River Red Gums and Coolibah in the riparian corridor of Thomson's Creek as shown on Figure 5.1. No evidence of occupancy by candidate threatened species was observed despite multiple rounds of dusk and spotlighting surveys and candidate tree inspections. Galahs (*Eolophus roseicapillus*) and Australian Owlet-nightjars (*Aegotheles cristatus*) were observed in hollows in River Red Gums and dead stags to the south of the proposal site.

The TBDC as accessed via the BAM-C (DPE 2023a) did not list any specific geographic constraints and habitat resources that are not present at the proposal site or adjoining areas.

Table 5.2 Candidate species credit species

Common name	Scientific name	Listing status		Sources	Species retained for further assessment?	Reason for exclusion from further assessment	Vegetation zone ID species retained within, including PCT ID
		BC Act	EPBC Act				
Stimson's Python	<i>Antaresia stimsoni</i>	V		<input checked="" type="checkbox"/> BAM-C <input type="checkbox"/> Previous survey <input type="checkbox"/> Current survey <input type="checkbox"/> Desktop review	Yes	N/A	143_Good 143_Poor
Australian Bustard	<i>Ardeotis australis</i>	E		<input checked="" type="checkbox"/> BAM-C <input type="checkbox"/> Previous survey <input type="checkbox"/> Current survey <input type="checkbox"/> Desktop review	Yes	N/A	143_Good 143_Poor
A saltbush	<i>Atriplex infrequens</i>	V	V	<input type="checkbox"/> BAM-C <input type="checkbox"/> Previous survey <input type="checkbox"/> Current survey <input checked="" type="checkbox"/> Desktop review	No	Species associated with PCTs 139 and 212 that were considered as candidate PCTs and as such was considered during targeted survey effort. The species is not associated with PCT 143 in the proposal site (DPE 2023a) and as such is not a confirmed candidate species.	
Green Bird Flower	<i>Crotalaria cunninghamii</i>	E		<input checked="" type="checkbox"/> BAM-C <input type="checkbox"/> Previous survey <input type="checkbox"/> Current survey <input type="checkbox"/> Desktop review	Yes	N/A	143_Good 143_Poor
Leopard Ctenotus	<i>Ctenotus pantherinus ocellifer</i>	E		<input checked="" type="checkbox"/> BAM-C <input type="checkbox"/> Previous survey <input type="checkbox"/> Current survey <input type="checkbox"/> Desktop review	Yes	N/A	143_Good 143_Poor
Eastern Fat-tailed Gecko	<i>Diplodactylus platyurus</i>	E		<input checked="" type="checkbox"/> BAM-C <input type="checkbox"/> Previous survey <input type="checkbox"/> Current survey <input type="checkbox"/> Desktop review	Yes	N/A	143_Good 143_Poor
Black-breasted Buzzard (Breeding)	<i>Hamirostra melanostron</i>	V		<input checked="" type="checkbox"/> BAM-C <input type="checkbox"/> Previous survey <input type="checkbox"/> Current survey <input type="checkbox"/> Desktop review	Yes	N/A	143_Good 143_Poor

Common name	Scientific name	Listing status		Sources	Species retained for further assessment?	Reason for exclusion from further assessment	Vegetation zone ID species retained within, including PCT ID
		BC Act	EPBC Act				
Little Eagle (Breeding)	<i>Hieraaetus morphnoides</i>	V		<input checked="" type="checkbox"/> BAM-C <input type="checkbox"/> Previous survey <input type="checkbox"/> Current survey <input type="checkbox"/> Desktop review	Yes	N/A	143_Good 143_Poor
Silky Cow-Vine	<i>Ipomoea polymorpha</i>	V		<input checked="" type="checkbox"/> BAM-C <input type="checkbox"/> Previous survey <input type="checkbox"/> Current survey <input type="checkbox"/> Desktop review	Yes	N/A	143_Good 143_Poor
Silver Indigo	<i>Indigofera leucotricha</i>	E		<input type="checkbox"/> BAM-C <input type="checkbox"/> Previous survey <input type="checkbox"/> Current survey <input checked="" type="checkbox"/> Desktop review	No	Species associated with PCT 131 in the study area and as such was considered during targeted survey effort. Impacts to PCT 131 have been avoided. The species is not associated with PCT 143 in the proposal site (DPE 2023a) and as such is not a confirmed candidate species.	
Major Mitchell's Cockatoo (Breeding)	<i>Lophochroa leadbeateri</i>	V		<input checked="" type="checkbox"/> BAM-C <input type="checkbox"/> Previous survey <input type="checkbox"/> Current survey <input type="checkbox"/> Desktop review	Yes	N/A	143_Good 143_Poor
Crowned Gecko	<i>Lucasium stenodactylum</i>	V		<input checked="" type="checkbox"/> BAM-C <input type="checkbox"/> Previous survey <input type="checkbox"/> Current survey <input type="checkbox"/> Desktop review	Yes	N/A	131_Good 139_Moderate 139_Poor

Notes: E – listed as an endangered species

V – listed as a vulnerable species

## 5.2 Presence of candidate species credit species

Table 5.3 identifies the confirmed candidate species credit species requiring assessment in accordance with BAM Subsection 5.2.4, the method used to confirm their presence and the outcome of targeted surveys. The methods employed during field surveys in accordance with relevant guidelines are described in section 2.4. Figure 2.1 and Figure 2.2 show survey effort for candidate threatened species. Scanned field data sheets and GPS tracklogs demonstrating survey effort and coverage of the study area have been submitted for approval along with this BDAR.

A summary of the survey results as related to species credit calculations is presented below.

A Black-breasted Buzzard (*Hamirostra melanosternon*) was observed opportunistically in the local area between Tibooburra and the proposal site in the February 2023 survey round. The species is a dual credit entity (DPE 2023a) with species credits required for breeding habitat as indicated by occupied nest trees. No occupied or candidate nest trees for the species were recorded at the proposal site or in the surrounding area despite targeted survey. The species is likely to use the study area for foraging habitat only and no species credit calculations are required.

No species credit matters were recorded or are assumed present at the proposal site.

The core targeted reptile spotlight survey effort for Eastern Fat-tailed Gecko (*Diplodactylus platyurus*, syn. *D. ameyi*) was conducted over four nights in February 2023 in accordance with the techniques specified for the species in the BAM reptile survey guidelines (DPE 2022b). This does not align with the nominal survey period for the species of October, November and December only, according to the TBDC (DPE 2023a) and reptile survey guidelines (DPE 2022b). The basis for the restricted Eastern Fat-tailed Gecko survey period is not clear. There would not appear to be anything specific about the ecology of this poorly-known species that would rule out survey under appropriate weather conditions in the survey period October to March like the other nocturnal reptile candidate species that were targeted in accordance with the guidelines (Crowned Gecko, *Lucasium stenodactylum* and Stimson's python, *Antaresia stimsoni*).

The 280 records of the species on the Atlas of Living Australia include recorded observations in each month of the year, with the greatest number in April and September (ALA 2023) though it should be noted that this includes records from tropical northern Australia. The 27 records of the species in NSW are restricted to the north west of the State and include observations in each month from September to April with a peak in November but the same number of records (two) in February as in October and December (ALA 2023, see Figure 5.1 below). The 20 NSW records of the species in BioNet display a similar range of observations in months from September to April, with November the month in which the most records were made, and a single record in July (DPE 2023a).

In addition to the survey period, the guidelines note “*Surveys should not be undertaken in very dry or cool conditions when gecko activity is likely to be very low*” (DPE 2022b, p24). As described in sections 2.4.3 and 2.5, conditions were suitable for the detection of the Eastern Fat-tailed Gecko and other target reptile species noting:

- temperatures typically ranged between 25°C and 30°C for the evening survey period and 18.3°C as the lowest minimum temperature recorded over the four-day period
- 337.4 mm of rainfall in the preceding 12 months (BOM 2023a), substantially exceeding the ‘wet year’ benchmark threshold for PCTs at the study area (DPE 2022f)
- observed high nocturnal reptile activity levels at the proposal site throughout the survey period, with three non-threatened gecko species recorded and from four to 17 individual geckos observed on each survey night
- observed similarly high nocturnal reptile activity levels at the site for another proposal at Tibooburra over the same survey period with three non-threatened gecko species recorded and from eight to 25 individual geckos observed on each survey night.

Based on the above the Eastern Fat-tailed Gecko has been excluded from occurring at the proposal site or requiring calculation of species credits through ‘Targeted threatened species survey’. The completion of surveys outside of the period nominated for the species in the TBDC (DPE 2023a) has been noted in the BAM-C and Table 5.3 below.

By month

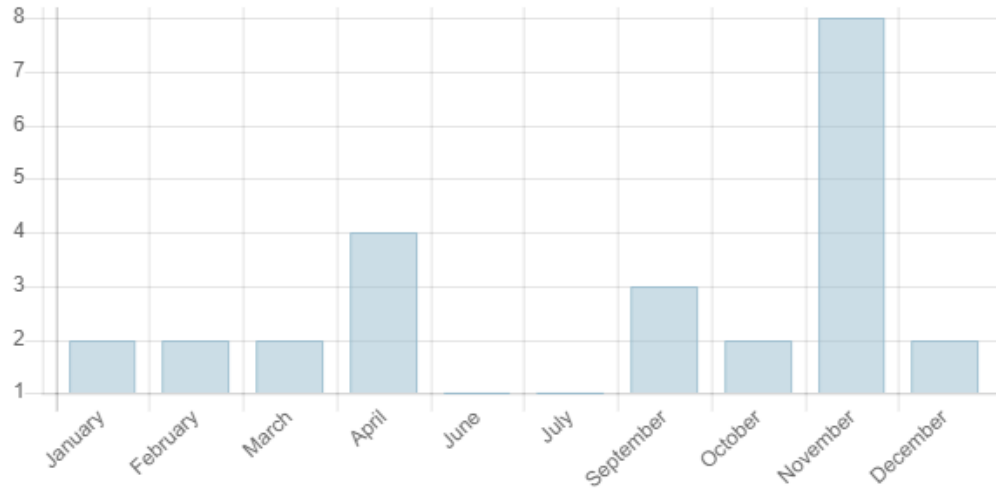


Figure 5.2 Eastern Fat-tailed Gecko (*Diplodactylus platyurus*) records by survey month (ALA 2023)



Table 5.3 Determining the presence of candidate species credit species on the proposal site

Common name	Scientific name	Method used to determine presence	Present?	Survey method	Timing of survey – within recommended period? (BAM-C / TBDC)	Effort
Stimson's Python	<i>Antaresia stimsoni</i>	Targeted threatened species survey	No	Reptile habitat surveys Spotlight surveys	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	>120 person minutes in each of four survey replicates over four days in February 2023 >120 person minutes in each of four survey replicates over four nights in February 2023
Australian Bustard	<i>Ardeotis australis</i>	Targeted threatened species survey	No	Diurnal bird survey	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Diurnal bird surveys over one hour over one day in August 2022, one day in November 2022, four days in February 2023 and one day in September 2023
A saltbush	<i>Atriplex infrequens</i>	Targeted threatened species survey	No	Parallel threatened flora traverses	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Not a confirmed candidate species as not associated with PCT 143 at the proposal site (DPE 2023a). Coverage of potential habitat with traverses in November 2022 and February 2023. Additional coverage of potential habitat with traverses in September 2023.
Green Bird Flower	<i>Crotalaria cunninghamii</i>	Targeted threatened species survey	No	Parallel threatened flora traverses	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Systematic coverage of potential habitat with traverses in November 2022, February 2023 and September 2023.
Leopard Ctenotus	<i>Ctenotus pantherinus ocellifer</i>	Targeted threatened species survey	No	Reptile habitat surveys	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	>120 person minutes in each of four survey replicates over four days in February 2023

Common name	Scientific name	Method used to determine presence	Present?	Survey method	Timing of survey – within recommended period? (BAM-C / TBDC)	Effort
Eastern Fat-tailed Gecko	<i>Diplodactylus platyurus</i>	Targeted threatened species survey	No	Spotlight surveys	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No See notes above regarding survey adequacy.	>120 person minutes in each of four survey replicates over four nights in February 2023 outside the nominal survey period (DPE 2023a) but under suitable conditions for detection of nocturnal reptiles. See notes above regarding survey adequacy.
Black-breasted Buzzard (Breeding)	<i>Hamirostra melnosteron</i>	Targeted threatened species survey	No	Nest tree census Diurnal bird survey	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Nest tree census including systematic coverage of the buffer area over two days in February 2023. Nest tree inspection in breeding season over one day in November 2022 and one day in September 2023. Diurnal bird surveys in the breeding season over one day in November 2022 and one day in September 2023. Additional survey over one day in August 2022 and four days in February 2023.
Little Eagle (Breeding)	<i>Hieraaetus morphnoides</i>	Targeted threatened species survey	No	Nest tree census	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Nest tree census including systematic coverage of the buffer area over two days in February 2023. Nest tree inspection in breeding season over one day in August 2022 and one day in September 2023. Diurnal bird surveys in the breeding season over one day in August 2022 and one day in September 2023. Additional survey over one day in November 2022 and four days in February 2023.

Common name	Scientific name	Method used to determine presence	Present?	Survey method	Timing of survey – within recommended period? (BAM-C / TBDC)	Effort
Silky Cow-Vine	<i>Ipomoea polymorpha</i>	Targeted threatened species survey	No	Parallel threatened flora traverses	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Systematic coverage of potential habitat in infrastructure footprints under appropriate seasonal survey conditions and after a period of above average rainfall in February 2023. Additional coverage of potential habitat with traverses in November 2022 and September 2023.
Major Mitchell's Cockatoo (Breeding)	<i>Lophochroa leadbeateri</i>	Targeted threatened species survey	No	Nest tree census	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Nest tree census over one day in breeding season in November 2022 and one day in September 2023. Nest tree census including systematic coverage of the buffer area over two days in February 2023. Diurnal bird surveys in breeding season over one day in November 2022 and one day in September 2023. Additional survey over one day in August 2022 and four days in February 2023.
Crowned Gecko	<i>Lucasium stenodactylum</i>	Targeted threatened species survey	No	Spotlight surveys	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	>120 person minutes in each of four survey replicates over four nights in February 2023.

Notes: 'Parallel threatened flora traverses' comprise systematic traverses with 5-10m wide spacing through all areas of suitable habitat in associated PCTs according to the TBDC (DPE 2023a). Includes general observations and additional broadly spaced traverses conducted through areas of potentially associated PCTs and unsuitable habitat such as bare earth or dense patches of non-target species within associated PCTs.

'Nest tree census' comprises systematic coverage of a 300 m buffer area surrounding the proposal site over the multiple rounds of field survey and identification of candidate nest trees based on presence of suitably sized trees with stick nests or appropriate hollows for the target species *and* at least one round of diurnal bird surveys and checking of candidate nest trees during the breeding-season survey period for the species as nominated in the TBDC (DPE 2023a).

## 5.3 Matters of National Environmental Significance

### 5.3.1 Threatened ecological communities

No TECs listed under the EPBC Act were recorded in the proposal site or surrounding study area. No candidate TECs were revealed as known or likely to occur in the locality by the PMST (DCCEEW 2023a). There is no risk of direct or indirect impacts to any TECs listed under the EPBC Act.

### 5.3.2 Threatened species

The woodland bird species Southern Whiteface was recorded at the proposal site on several occasions in the August 2022 and February 2023 surveys. The Southern Whiteface is listed as a vulnerable species under the EPBC Act.

No other threatened species listed under the EPBC were recorded at the proposal site. Based on the results of the site surveys and habitat assessments, there is potential habitat for several threatened species included in Table 5.4. There are no known records of any of these species, or specific habitat features or resources at the proposal site that suggest that it would be important to any populations of any of these species. The fauna species listed in Table 5.4 would not occur at the proposal site on a long-term basis or rely on any of the habitat resources at the proposal site for their persistence in the local area. They are only likely to pass over or through the proposal site on a transient basis (if at all) as part of their use of habitat resources as part of a wider home range.

The flora species listed in Table 5.4 are known to occur in the bioregion surrounding the proposal site and may occur in the PCTs and habitat types present. Each of these species have been the subject of targeted, seasonal surveys according to the BAM and were not recorded at the proposal site. The proposal would not remove any known, occupied habitat for these flora species but may remove potential habitat.

Various other species have been assessed to have a low potential to occur given lack of suitable habitat and/or because the proposal site is outside of the known geographic range of the species (see Appendix A). MNES with an 'unlikely' or 'nil' likelihood of occurrence are not considered further in this assessment.

Table 5.4 Threatened species listed under the EPBC Act that may occur at the proposal site

Common name	Scientific name	EPBC Act status	Likelihood of occurrence
Grey Grasswren	<i>Amytornis barbatus barbatus</i>	E	Possible
Southern Whiteface	<i>Aphelocephala leucopsis</i>	V	Present
Grey Falcon	<i>Falco hypoleucos</i>	V	Likely
Painted Honeyeater	<i>Grantiella picta</i>	V	Possible
Major Mitchell's Cockatoo	<i>Lophochroa leadbeateri</i>	E	Possible
Purple-wood Wattle	<i>Acacia carneorum</i>	V	Possible, not recorded despite targeted survey
	<i>Atriplex infrequens</i>	V	Possible, not recorded despite targeted survey

Notes: E – endangered species; V – vulnerable species.

### 5.3.3 Migratory shorebird species

A critical consideration in assessing the significance of potential impacts on listed migratory shorebird species is whether or not a proposed action is likely to affect 'important habitat' (DotE 2015). Important habitat mapping by DPE (2022c) maps areas that support bird numbers exceeding the international and national significance thresholds as defined in the Wildlife Conservation Plan for Migratory Shorebirds (DotE 2015). The proposal site does not intersect any important habitat for any migratory shorebird species.

### 5.3.4 Migratory terrestrial species

There is potential foraging or resting habitat at the proposal site for migratory bird species listed in Table 5.5, that may occur in, or fly over, semi-arid woodland, scrub and shrubland habitats. None of these species would be reliant upon habitats within the proposal site for any part of their life cycle. They would be most likely to fly over the proposal site, if present in the locality at all.

Referral guidelines have been published for 14 migratory terrestrial species with consideration of impacts mainly based on the presence of important habitat (DotE 2015). Habitat in the proposal site is not likely to support an ecologically significant proportion of the population of any of these species, be of critical importance to the species at particular life-cycle stages, is not located at the limit of any of the species' range, and/or located within an area where the species is declining. As such, potential habitat in the study area is not 'important habitat' for any of these species, as defined in the guidelines (DotE 2015).

**Table 5.5** *Migratory species listed under the EPBC Act that may occur at the proposal site*

Common name	Scientific name	EPBC Act status	Likelihood of occurrence
Fork-tailed Swift	<i>Apus pacificus</i>	Migratory (terrestrial)	Possible
Grey Wagtail	<i>Motacilla cinerea</i>	Migratory (terrestrial)	Possible



## 6. Identifying prescribed impacts

The *Biodiversity Conservation Regulation 2017* (BC Regulation) (clause 6.1) identifies potential 'prescribed impacts' to threatened species arising from a proposal that are not related to, or are in addition to, native vegetation clearing and habitat loss. According to the BAM an accredited assessor must identify the prescribed impacts arising from a proposal along with the suite of potentially affected threatened species.

Table 6.1 summarises the prescribed impact features listed in the BC Regulation and BAM along with an assessment of their presence or otherwise at the proposal site, their characteristics and location, and the threatened entities that are associated with the feature at the proposal site. Justifications for features determined as not present are provided as appropriate. Potentially affected threatened species were identified based on the desktop assessment, site inspections, targeted surveys for species credit matters and habitat assessments described above and have been grouped according to shared life histories and habitat associations as follows:

### Threatened microbats:

- Little Pied Bat (*Chalinolobus picatus*)
- Yellow-bellied Sheath-tail-bat (*Saccolaimus flaviventris*)

### Threatened mammals:

- Forrest's Mouse (*Leggadina forresti*)
- Sandy Inland Mouse (*Pseudomys hermannsburgensis*)
- Long-haired Rat (*Rattus villosissimus*)
- Stripe-faced Dunnart (*Sminthopsis macroura*)

### Threatened reptiles:

- A Whip Snake (*Demansia rimicola*)
- Ringed Brown Snake (*Pseudonaja modesta*)

### Threatened woodland and shrubland birds:

- Grey Grasswren (*Amytornis barbatus barbatus*)
- White-fronted Chat (*Epthianura albifrons*)
- Southern Whiteface (*Aphelocephala leucopsis*)
- Fork-tailed Swift (*Apus pacificus*)
- Red-tailed Black-cockatoo (*Calyptorhynchus banksia samuelii*)
- Major Mitchell's Cockatoo (*Lophochroa leadbeateri*)
- Pied Honeyeater (*Certhionyx variegatus*)
- Spotted Harrier (*Circus assimilis*)
- Painted Honeyeater (*Grantiella picta*)
- Grey Wagtail (*Motacilla cinerea*)
- Yellow Wagtail (*Motacilla flava*)
- Flock Bronzewing (*Phaps histrionica*)
- Hall's Babbler (*Pomatostomus hali*)

### Threatened raptors:

- Grey Falcon (*Falco hypoleucos*)
- Black Falcon (*Falco subniger*)
- Black-breasted Buzzard (*Hamirostra melanosternon*)
- Little Eagle (*Hieraaetus morphnoides*)
- Square-tailed Kite (*Lophoictinia isura*)

**Threatened wetland birds:**

- Australian Painted Snipe (*Rostratula australis*)
- Common Sandpiper (*Actitis hypoleucos*)

**Threatened forest owls:**

- Barking Owl (*Ninox connivens*)

Table 6.1 Prescribed impacts

Feature	Present	Description of feature characteristics and location	Threatened entities that use, are likely to use, or are part of the habitat feature. Where relevant, threatened species or fauna that are part of a TEC or EC, that are at risk of vehicle strike
Karst, caves, crevices, cliffs, rocks or other geological features of significance	<input type="checkbox"/> Yes / <input checked="" type="checkbox"/> No	There are no areas of karst, caves, crevices or cliffs in the proposal site or surrounding study area.	N/A
Human-made structures	<input type="checkbox"/> Yes / <input checked="" type="checkbox"/> No	The proposal site contains a fenced compound with MWP infrastructure. It comprises pipework and other structures that are open to the elements and would not have any habitat value. There is also a small, basic building housing electrical equipment. It is sealed and does not contain windows, vents or ceiling or wall cavities and would not have any habitat value.  The remainder of the proposal site is located in vegetated open space that has been subject to low intensity agriculture. It does not contain any bridges, buildings or any other human-made structures that could have value as habitat for threatened species.	The human made structures at the proposal site do not contain potential shelter or roost sites and are unlikely to be used as habitat by any threatened entities.
Non-native vegetation	<input type="checkbox"/> Yes / <input checked="" type="checkbox"/> No	There is a small area of non-native vegetation at the proposal site associated with a fenced compound with MWP infrastructure described above and as shown on Figure 4.1. The compound has been graded and compacted and is almost completely free of vegetation. The area has been kept free of vegetation through ongoing human use. It has negligible potential for regeneration of native or exotic vegetation or any associated habitat resources.	The mapped area of non-native vegetation at the proposal site is predominantly bare earth and does not contain any food resources or potential shelter or roost sites for any threatened entities.  The proposal would not result in any tangible impacts on threatened species through the use or modification of these areas of non-native vegetation and so this potential prescribed impact is not assessed further in this BDAR.
Habitat connectivity	<input checked="" type="checkbox"/> Yes / <input type="checkbox"/> No	The proposal site occurs in an extensive patch of near-intact native vegetation as shown on Figure 3.1. After construction, the proposal site would comprise a gap in native vegetation cover, and built structures as well as noise, light and human activity may limit the ability of fauna to move through the landscape.	Threatened microbats, threatened reptiles, threatened woodland and shrubland birds, threatened raptors, threatened wetland birds and threatened forest owls may travel within or through the proposal site to other areas of habitat.

Feature	Present	Description of feature characteristics and location	Threatened entities that use, are likely to use, or are part of the habitat feature. Where relevant, threatened species or fauna that are part of a TEC or EC, that are at risk of vehicle strike
Waterbodies, water quality and hydrological processes	<input checked="" type="checkbox"/> Yes / <input type="checkbox"/> No	<p>The proposal site is located around 200m to the north of Thomsons Creek, which flows northeast towards the Narriearra Caryapundy Swamp. Thomsons Creek contained surface water in occasional isolated pools at the time of the November 2022 and February 2023 surveys.</p> <p>Two unnamed, ephemeral, first order streams drain from the north of the proposal site southeast to Thomsons Creek. Several unnamed first and second order tributaries with similar characteristics drain the surrounding area. as shown on Figure 3.1.</p> <p>During intermittent wet periods these features would be a significant habitat resource. Perennially, sub surface water flows would be important in maintaining large trees such as River Red Gums and Gidgee that are associated with these features.</p>	<p>Threatened microbats, threatened reptiles, threatened woodland and shrubland birds and threatened raptors, may forage or shelter in the drainage lines in the proposal site.</p> <p>The riparian woodland in the Thomsons Creek corridor would have particular value as shelter and foraging habitat for threatened wetland birds during wet periods as well as locally significant roosting and nesting habitat for threatened forest owls and cockatoos in the context of the surrounding region with few large trees.</p>
Wind turbine strikes (wind farm development only)	<input type="checkbox"/> Yes / <input checked="" type="checkbox"/> No	<p>The proposal does not involve construction of wind turbines.</p>	<p>N/A</p>
Vehicle strikes	<input checked="" type="checkbox"/> Yes / <input type="checkbox"/> No	<p>The proposal site would be accessed via Tibooburra Road and three short entrance tracks along its northern boundary. The proposal site occurs in an extensive patch of near-intact native vegetation adjoining Tibooburra Road as shown on Figure 5.1.</p> <p>Access would be along unfenced carriageway widths of approximately 10 m within a heavily vegetated landscape and so there is a risk of vehicle strikes to native fauna. The proposal would increase the volume of vehicle traffic to and through the proposal site during construction and then periodically when the maintenance camp is occupied.</p>	<p>Threatened microbats, threatened reptiles, threatened woodland and shrubland birds, threatened raptors, threatened wetland birds and threatened forest owls may be at risk of vehicle strike while traveling within or through the proposal site to other areas of habitat.</p> <p>Vehicles travelling to and from the proposal site would increase the risk of collisions with the same suite of fauna in the surrounding region</p>

# Stage 2: Impact assessment (biodiversity values and prescribed impacts)

## 7. Avoid and minimise impacts

The proposal would result in direct impacts on native vegetation and threatened species habitats as shown on Figure 4.1 and Figure 5.1. There is also the potential for indirect impacts on areas of native vegetation adjacent to the proposal site, both during construction and from the periodic use of the temporary accommodation camp used for maintenance activities.

Specific mitigation measures are recommended to minimise likely impacts on biodiversity values. These measures are presented according to the hierarchy of avoid and minimise impacts, mitigation of the effect of unavoidable impacts, and finally the provision of offsets to compensate for residual impacts of the proposal.

### 7.1 Avoid and minimise direct and indirect impacts

#### 7.1.1 Proposal design

APA initially selected sites for the proposal based on criteria including proximity to the MWP, road access, power and water connectivity and apparent level of environmental constraint based on air photo interpretation. The proposal site location was further refined through a detailed environmental constraints assessment carried out by GHD. A desktop assessment of biodiversity constraints was undertaken including:

- review of the SVTM (DPE 2022a) to identify candidate PCTs in each site study area and to help map native vegetation extent
- review of the NSW BioNet Vegetation Classification (DPE 2023a) to identify candidate TECs
- consideration of BioNet Atlas records of threatened biota (DPE 2023a).

The desktop assessment was further refined based on a GHD site inspection of the proposal site in August 2022 and targeted biodiversity survey in November 2022, February 2023 and September 2023.

The location of the proposed compressor station, laydown area, site accesses, camp area and effluent irrigation area was refined to avoid impacts to biodiversity values as far as possible. Specifically:

- complete avoidance of the riparian corridor of Thomsons Creek and associated floodplain woodland, watercourse and hollow-bearing trees
- positioning of infrastructure as far north in the study area as possible to maximise the distance from Thomsons Creek and to minimise the length of access tracks from Tibooburra Road
- complete avoidance of PCT 131 Gidgee tall shrubland and woodland and associated hollow-bearing trees, ephemeral watercourses and other habitat resources
- alignment of camp infrastructure with poor condition PCT 143 as far as possible within the constraints of the lots owned by APA and location of the existing MWP infrastructure.

Further detailed design will include micro-siting of infrastructure and the treated wastewater irrigation area to maintain buffers to watercourses and to help avoid indirect impacts to native vegetation and habitat resources.

It is noted that certain site features, such as land within the flood zone of the Thomsons Creek watercourse, may have been unsuitable for development, however the proposal has aimed to further avoid impacts to native vegetation and habitat values by amending the proposal layout and design in response to detailed understanding of the study area's biodiversity values. PCT 131 Gidgee woodland was specifically avoided because this PCT contains large, mature Gidgee (*Acacia cambadgeii*) trees with associated habitat resources such as hollows, mistletoe, fissured bark and fallen woody debris. In contrast, the PCT 143 shrubland in the proposal site contains less mature vegetation and fewer habitat resources.

Notably there are no candidate nest trees or any other trees with DBH >10cm in the proposal site and the only trees present are occasional Northern Sandalwood (*Santalum lanceolatum*), Mulga (*Acacia aneura*) and Whitewood (*Atalaya hemiglauca*). Any of these small trees in the effluent irrigation area, or other parts of the proposal site outside infrastructure footprints, would be retained if possible.

The temporary accommodation camp layout will be further defined by the construction contractor including micro-siting of each of the features described in section 1.4 and shown in the indicative layout on Figure 1.2. The proposed layout of the proposal site has an approximate total disturbance area of up to 9.4 ha including the compressor, temporary accommodation camp footprint, site amenities, car parks and wastewater irrigation area. The total disturbance area includes establishment of internal roads and carparking. Construction of these features and application of wastewater to the irrigation area has been conservatively assumed to remove all areas of native vegetation at the proposal site.

Subject to detailed design, residual direct impacts of the construction of infrastructure would affect a maximum of 8.2 ha, including non-native vegetation. Impacts would be restricted to the proposal site polygon and within this area, infrastructure, carparking and laydown areas would be placed to ensure the minimum extent of vegetation removal and to maximise the distance from native vegetation on adjoining land.

Subject to detailed design, residual impacts of the wastewater irrigation area would affect around 1.2 ha. Impacts would be restricted to the proposal site polygon and, within this area, wastewater would be discharged at least 10 m from watercourses and any other surface water and would be placed to ensure the maximum possible distance from Thomsons Creek and any mature trees. Depending on rainfall in preceding months, the wastewater irrigation area is likely to contain extensive areas of bare earth, gibber or short-lived chenopods, grasses and herbs. Within the broad area shown on Figure 1.2 wastewater pipes would be placed to ensure that treated wastewater was applied to bare areas and away from trees and other longer-lived native plants as far as possible.

## 7.1.2 Summary of measures to avoid and minimise impacts

A summary of measures undertaken to avoid and minimise impacts is provided in Table 7.1.

**Table 7.1** Avoidance and minimisation measures for direct, indirect and prescribed impacts

Action	Outcome	Timing	Responsibility
Identification of a site with minimal biodiversity value	Not possible to fully avoid impacts noting the location of the MWP in an extensive area of native vegetation.	Site selection	Proponent
Avoidance of impacts to vegetation through the use of existing access to the proposal site.	Avoiding and minimising the amount of native vegetation clearing required.	Site selection	Proponent
Minimisation of impacts to biodiversity values by avoiding higher value habitat features and resources.	Avoidance of impacts to any candidate nest trees or PCT 31 Gidgee woodland.	Preliminary design	Proponent
Reducing the development footprint and concentrating development in non-native or poor condition vegetation.	Avoiding and minimising the amount of native vegetation clearing required.	Design	Construction contractor
Providing an adequate buffer between the development footprint and mature trees, and water courses adjoining the proposal site.	Avoiding indirect impacts to retained native vegetation and watercourses.	Design	Construction contractor



Action	Outcome	Timing	Responsibility
<p>Treating wastewater and ensuring irrigation areas contain lower biodiversity value and are an appropriate distance from mature trees and water courses adjoining the proposal site.</p>	<p>Avoiding indirect impacts to retained native vegetation and water bodies. Within the broad area shown on Figure 1.2, the spray field would be designed to maintain buffers of at least 10 m from trees and watercourses adjoining the proposal site. The irrigation would be undertaken so as to ensure that all wastewater would be absorbed by soil and would not directly affect any surface water body. Wastewater would be applied to bare areas and away from trees and other longer-lived native plants as far as possible.</p>	<p>Operation</p>	<p>Proponent contractor</p>
<p>Preparation and implementation of a construction environmental management plan (CEMP).</p>	<p>Minimising and managing direct and indirect impacts during construction.</p>	<p>Construction</p>	<p>Construction contractor</p>

## 8. Impact assessment

### 8.1 Direct impacts

#### 8.1.1 Summary

The proposal would result in direct impacts to native vegetation and associated threatened species habitat through:

- Clearing of up to 8.13 ha of native vegetation for construction of the compressor, laydown area, site accesses, temporary camp site and associated infrastructure
- Application of treated wastewater to up to 1.2 ha of native vegetation.

Residual direct impacts are summarised in Table 8.1.

**Table 8.1** Summary of residual direct impacts

Direct impact	BC Act status	EPBC Act status	SAIL entity	Project phase/timing of impact (e.g. construction, operation, rehabilitation)	Extent (ha)
Clearing of PCT 143 - Narrow-leaved Hopbush - Scrub Turpentine - Senna shrubland on semi-arid and arid sandplains and dunes_Good and compaction of the soil surface for infrastructure	Not listed	Not listed	No	Construction	6.06
Clearing of PCT 143 - Narrow-leaved Hopbush - Scrub Turpentine - Senna shrubland on semi-arid and arid sandplains and dunes_Poor and compaction of the soil surface for infrastructure	Not listed	Not listed	No	Construction	2.07
<b>Total clearing of native vegetation</b>					<b>8.13</b>
Irrigation of PCT 143 - Narrow-leaved Hopbush - Scrub Turpentine - Senna shrubland on semi-arid and arid sandplains and dunes_Good with wastewater	Not listed	Not listed	No	Construction, operation	0.79
Irrigation of PCT 143 - Narrow-leaved Hopbush - Scrub Turpentine - Senna shrubland on semi-arid and arid sandplains and dunes_Poor with wastewater	Not listed	Not listed	No	Construction, operation	0.41
<b>Total native vegetation in wastewater irrigation area</b>					<b>1.2</b>

## 8.1.2 Removal of vegetation and habitat resources

The proposal would remove or modify a maximum of 9.33 ha of native vegetation, comprising the maximum possible area of Good and Poor condition Narrow-leaved Hoppush - Scrub Turpentine - Senna shrubland on semi-arid and arid sandplains and dunes at the proposal site. Subject to detailed design, residual impacts would include up to 8.13 ha of native vegetation in land to be cleared and compacted for infrastructure and 1.2 ha for wastewater irrigation. Only a portion of land to be impacted contains native plant cover. Impacts would be concentrated in areas of lower plant cover and non-native vegetation as far as possible, including the use of existing access tracks for vehicle access and bare earth for wastewater irrigation. As such, the potential residual direct impacts summarised in Table 8.1 comprise a conservative upper limit. The proposal site contains open vegetation typical of semi-arid environments and has been modified by construction of the existing MWP and ongoing agricultural activities. The existing environment includes substantial areas of bare earth and fine gravel with minimal biodiversity value and so the actual area of disturbance of native vegetation and habitat resources would be considerably less than the total proposal site area.

For the purposes of this BDAR, it is assumed that proposal would result in the clearing and grading of the entire proposal site including the indicative infrastructure footprints shown on Figure 1.2 and surrounding open space and buffer areas. All future composition, structure and function scores would therefore be reduced to 0 for both vegetation zones across the entire proposal site as summarised in Table 8.2. In practice topsoil, understorey plants and habitat features such as gibber would be retained over much of this broad area.

There are no known threatened plant populations in or near the proposal site. The proposal is not likely to result in direct or indirect effects on the life cycle of any local populations of threatened plants.

Surveys recorded a number of threatened fauna species listed as vulnerable under the NSW BC Act within or near the proposal site: the Little Pied Bat (*Chalinolobus picatus*), Black Falcon (*Falco subniger*), Dusky Woodswallow (*Artamus cyanopterus cyanopterus*), Spotted Harrier (*Circus assails*) and Black-breasted Buzzard (*Hamirostra melanosternon*). Additionally, the Southern Whiteface (*Aphelocephala leucopsis*), listed as a vulnerable species under the EPBC Act, was identified during surveys within the study area. No direct evidence of breeding or any important habitat resources were observed to suggest that the proposal site is of particular importance to local populations of these species. The proposal would remove habitat for the threatened fauna species listed above and other fauna of semi-arid environments such as patches of Acacia, Hakea and Senna species, understorey vegetation and shelter substrate such as fallen timber, leaf litter and gibber. The proposal would remove a small proportion of the habitat resources available in the local area.

A nest tree census was conducted to identify hollow-bearing trees, stick nests or other signs of breeding activity of threatened fauna that could require calculation of species credits according to the BAM. The nest tree census revealed a number of hollow-bearing trees and other candidate nest trees in or near the study area as shown on Figure 5.1. There are no candidate nest trees in the proposal site or likely to be affected by indirect impacts.

The study area does not contain important habitat for any migratory species listed under the EPBC Act.

Given the limited extent of removal of vegetation and potential shelter sites, there is a minor risk of direct harm to any resident fauna. The habitat resources at the proposal site would have minor importance to the long-term survival of threatened fauna species in the locality. The surrounding locality and region contain many thousands of hectares of similar vegetation and equivalent habitat resources.

Given this minor quantum of impact and the presence of alternative habitat resources, the proposal would not have an adverse effect on the life cycle of any threatened fauna species such that a viable local population of the species is likely to be placed at risk of extinction.

**Table 8.2**      *Impacts to vegetation integrity*

Vegetation zone	Area (ha)	Before development				After development				
		Composition	Structure	Function <sup>1</sup>	VI score	Composition	Structure	Function <sup>1</sup>	VI Score	Change in VI score
Zone 1 (143_Good)	6.85	94.7	78.3	n/a	86.1	0	0	n/a	0	-86.1
Zone 2 (143_Poor)	2.48	94.7	78.3	n/a	37.7	0	0	n/a	0	-37.7

Note: 1. Function score is not calculated for PCTs in the Arid Shrublands (Acacia sub-formation) vegetation formation (DPIE 2020a).

### 8.1.3 Wastewater irrigation

The proposal would result in direct impacts as a result of wastewater generation and irrigation of treated wastewater from the temporary accommodation camp. As outlined in section 5 within Appendix E of the modification report (GHD 2023) the design, construction and operation of the wastewater treatment and effluent irrigation system is expected to be carried out in accordance with the relevant Australian Standards and in accordance with the *Use of Effluent by Irrigation guidelines* (DEC NSW 2004).

Application of wastewater may, in general, affect the receiving environment by altering soil moisture and chemical properties that adversely affect native plants and soil organisms and/or promote growth of environmental weeds. Downstream impacts may, in general, include elevated chemical concentrations that affect ecological processes such as elevated nitrogen or phosphorus leading to nitrification that promotes excess algae growth. Impacts can be avoided or minimised by implementing wastewater systems that comply with guideline values, or quality standards that should not be exceeded. Environmental guideline values are generally expressed as concentrations or as the measurement of a physical or chemical characteristic of water or soil based on present knowledge of concentrations or characteristics that do not result in any significant risk to any physical or biological component of the environment (NRMMC 2006). Guideline values, for example ANZECC (2000), can be applied to freshwater quality where location-specific values are not available (NRMMC 2006).

Wastewater would be treated by a suitably designed and operated aerated wastewater treatment system. The onsite wastewater management system is subject to further design and would be developed in accordance with relevant guidelines, standards and requirements (see section 1.4.2 for specific requirements). The system will use sedimentation and aerobic digestion to separate biomass from wastewater. The wastewater will be disinfected to remove any residual pathogens then pumped to an irrigation spray field on site for disposal. The pipes would be temporary and rolled out across the irrigation area, prior to use. They would then be rolled back up during decommissioning of the site. No intrusive ground activities would be needed in the irrigation area.

The wastewater irrigation area would be confirmed during detailed design and would include around 1.2 ha of the proposal site. The spray field would be designed to maintain buffers of at least 10 m away from trees and other longer-lived native plants and the upper reaches of first order watercourses adjoining the proposal site. The irrigation would be undertaken so as to ensure that all wastewater would be absorbed by soil and would not directly affect any surface water body. The irrigation area would be located outside the modelled 1% annual exceedance probability (AEP) flood extent to help ensure that irrigation water and potentially contaminated surface soils would not reach any surface water bodies even during flood events.

The volume of water used and disposed has been conservatively calculated as 12-15 ML (potable and non-potable) will be required over the construction period for construction works and for use in the camp.

Table 8.3 identifies the water quality parameters that would be adhered to during wastewater disposal. Assessment of baseline water quality in the receiving environment, setting of site-specific parameters and ongoing downstream monitoring are beyond the scope of this assessment. Comparison with environmental guideline values can provide an appropriate trigger value between 'no appreciable risk' and a risk level that needs further investigation (NRMMC 2006). For the purposes of this assessment wastewater water quality parameters have been compared with freshwater quality guidelines in place of location-specific values: ANZECC (2000) Table 3.4.1 – 95% species protection trigger values for freshwater species.

As shown in Table 8.3, wastewater would be treated to ensure that water quality parameters are below default trigger values for most physical and chemical stressors for freshwater ecosystems of south-east Australia and/or irrigation guidelines at the point they are applied to the soil surface in the irrigation area.

Total phosphorus (P) may be discharged towards the upper end of the trigger values for this parameter (<8 ppm vs guideline 0.8-12 ppm) (ANZECC 2000) and is often the nutrient that stimulates algal blooms in water bodies. The short-term trigger value range for P has been set as an interim range due to the limited data available and the range of factors that affect environmental response such as the fertiliser value of P in water, the P removed from irrigation sites through plant growth and harvest, fertiliser inputs and P sorption/retention capacities of soil (NRMMC 2006). Environmental guideline values need to be considered along with site-specific environmental considerations. Wastewater irrigation would only occur at least 10 m from any surface water body or drain, and at least 150 m from the top of channel of Thomsons Creek. This is likely to be sufficient to ensure that ensure that total P of <8 ppm applied at the soil surface is adsorbed/retained by the soil.



The monitoring regime for the quality of the wastewater to be applied to the irrigation area, to be implemented by the camp operator, will ensure that the trigger values noted in Table 8.3 will not be exceeded. Noting that the water quality parameters are generally below trigger values for direct discharge to freshwater ecosystems and that all wastewater would be absorbed by soil (i.e. chemically bonded to soil particles) and concentrations of contaminants significantly attenuated before reaching any sensitive receiving environment, there is no appreciable risk that the proposed wastewater irrigation would adversely affect the natural environment.

At the proposal site, groundwater depth varies between approximately 5 and 6 m below ground level. This would be sufficient to ensure that concentrations of contaminants in wastewater are significantly reduced. Impacts to groundwater quality due to irrigation of wastewater are expected to be negligible and would not alter the environmental value of groundwater.

**Table 8.3** Comparison of water quality parameters between anticipated values in wastewater and trigger values (ANZECC 2000)

Parameters	Anticipated value in wastewater discharged within proposal site	Trigger values*
Biochemical oxygen demand (BOD)	<20 ppm	15 ppm <sup>a</sup>
Total suspended solids	<30 ppm	40 ppm <sup>a</sup>
Total phosphorus	<8 ppm	0.8-12 ppm <sup>b</sup> in irrigation water 0.02 ppm at river <sup>c</sup>
Residual free chlorine	>0.5 ppm	n/a
Thermotolerant coliforms	<1000 colony forming units/100mL	<1000 colony forming units/100mL <sup>c</sup>
pH	6.5-8.5	6.5-7.5 <sup>b</sup>

- Notes: a. Table 4.4.2 Physico-chemical stressor guidelines for the protection of aquaculture species, freshwater production (ANZECC 2000)  
b. Table 4.2.11 Agricultural irrigation water short-term trigger value (up to 20 years) guidelines for nitrogen and phosphorus  
c. Table 3.3.2 default trigger values for physical and chemical stressors for south-east Australia upland rivers, slightly disturbed ecosystems (ANZECC 2000)  
d. Irrigation guidelines, Raw human food crops not in direct contact with irrigation water (ANZECC 2000)

## 8.2 Indirect impacts

Table 8.4 documents the potential residual indirect impacts that could arise from the construction and operation of the proposal.

**Table 8.4** Summary of residual indirect impacts

Indirect impact	Likelihood and potential consequences
Edge effects	<p>'Edge effects' can include increased noise and light or erosion and sedimentation at the interface of intact vegetation and cleared areas. Edge effects may result in impacts such as changes to vegetation type and structure, increased growth of exotic plants, increased predation of native fauna or avoidance of habitat by native fauna. Altered environmental conditions along new edges can allow invasion by pest animals specialising in edge habitats and/or change the behaviour of resident animals. Edge zones can be subject to higher levels of predation by introduced mammalian predators and native avian predators.</p> <p>Edge effects may, in general, result from the clearing of native vegetation and other construction activities at the proposal site and then continue to affect vegetation and habitats retained outside the development footprint. Subject to detailed design, buffers would be maintained between the development footprint and vegetated areas outside the proposal site. Based on the current proposal site layout shown on Figure 1.2, buffer areas surrounding areas of direct disturbance but contained within the proposal site include: a 10-20 m wide firebreak surrounding infrastructure; a 10 m wide buffer between the wastewater irrigation area and boundary; and 30-50 m of open space between infrastructure and native vegetation to the east, south and west. The buffer area between built structures and adjoining native vegetation is likely to be sufficient to mitigate against indirect impacts extending beyond the proposal site. It should also be noted that the study area contains open vegetation typical of semi-arid environments and has been modified by construction of the MWP and ongoing agricultural activities. The existing environment includes substantial areas of bare earth and fine gravel with minimal biodiversity value and so the actual area of disturbance of native vegetation and habitat resources would be considerably less than the total proposal site area. Vegetation adjoining the</p>

Indirect impact	Likelihood and potential consequences
	<p>direct disturbance area is already open and so the effect of construction on microclimate or opportunities for weed incursion would be minimal.</p> <p>Overall, the contribution to edge effects arising from clearing of vegetation at the proposal site and periodic use of the site would be negligible. No additional offsets are proposed for potential indirect impacts.</p>
Introduction and spread of weeds, pests and pathogens	<p>Disturbance associated with vegetation clearing and vehicle traffic during construction may, in general, increase the potential for the spread, introduction and establishment of weed and pest species, and diseases and pathogens.</p> <p>Construction and environmental management plans will specify measures for restricting access to native vegetation and minimising the risk of transmitting weed propagules.</p> <p>The proposal site adjoins sensitive areas of native vegetation, especially in the riparian corridor of Thomsons Creek and its tributaries. Environmental inductions, visual barriers and/or exclusion fencing will be used to exclude personnel and vehicles from native vegetation outside the proposal site.</p> <p>To further mitigate the risk of pathogens being brought onto and/or spread through the site, all vehicles, plant and equipment will be cleaned down (wash/blow down) and certified weed free prior to initial entry to site; all vehicles, plant and equipment will strictly adhere to the approved roads, tracks, easements and work areas to minimise contact with vegetation.</p>
Noise and light impacts on fauna	<p>Noise levels during the construction period would result in an increase above existing background levels for the duration of construction. Noise levels would vary during the construction period, with some activities being louder and producing higher levels of vibration than others. Noise, vibration, and light have been shown to have a variety of impacts on fauna, including changing foraging behaviour, impacting breeding success and changing species occurrences.</p> <p>Construction activities and then use of the temporary accommodation camp at the proposal site would increase noise levels in a sparsely populated agricultural landscape and would increase noise levels in the vicinity of fauna roosting and nesting habitat in the riparian corridor of Thomsons Creek. Fauna most at risk would be those residing near the works area, and in particular any species that may be nesting, roosting or denning in the area. Some fauna may vacate areas in proximity to the proposal site during construction. There are extensive, connected areas of alternative habitat which any displaced animals could access with minimal risk or energy cost.</p> <p>Lighting for night construction works and use of the camp has the potential to result in light spill into adjoining areas of native vegetation which may disturb resident fauna. Light generated during construction and from camp infrastructure will be managed in general accordance with the requirements in Australian Standard AS 4282-1997 Control of the Obtrusive Effects of Outdoor Lighting. Directional lighting will be used to minimise the effects of light spill outside the camp as far as possible.</p> <p>The construction and commissioning of the compressor station will take approximately 12 months and the temporary accommodation camp will be used intermittently for approximately 3 months every three years over the life of the proposal. Generation of additional noise and light would occur for a relatively small portion of the 25-year life of the proposal.</p> <p>Given the temporary nature of the impacts and the availability of alternate habitat in surrounding areas, it is unlikely the temporary increase in noise and light during construction and periodic use of the maintenance camp would significantly affect fauna populations that occur in adjoining vegetation.</p>
Erosion and sedimentation	<p>Removal of vegetation, soil disturbance and excavation, and construction of camp infrastructure would expose subsoil and generate spoil material and could, in general, result in erosion and sedimentation. The proposal would be undertaken in accordance with a Construction Environment Management Plan (CEMP) and would include industry best practice methods for excavating, handling and storing soils. The proposal footprint would be rehabilitated once works are complete, and revegetation would be undertaken across portions of the proposal site where vegetation was cleared.</p> <p>An assessment of the soil loss hazard for the site has been undertaken for the construction period. The estimated worst case soil loss for the construction of the site is approximately 137.1 m<sup>3</sup>/year. Whilst the site area exceeds 2,500 square-metres, as the estimated soil loss rate does not exceed 150 m<sup>3</sup>/year, a sediment basin was not considered necessary for this proposal and that implementation of other standard erosion and sediment controls is suitable to manage sediment generated during construction so long as slope-lengths are minimised to be lesser than or equal to 80 m at 2% fall (GHD 2023).</p>

Indirect impact	Likelihood and potential consequences
	<p>Noting the gentle topography at the proposal site, relatively small proposed clearing areas, and short construction period, construction impacts are expected to be limited and are likely to be sufficiently mitigated by the construction methodology. Impacts due to the decommissioning and rehabilitation stage are expected to be comparable to the impacts described for construction.</p> <p>Appropriate design and implementation of the CEMP and associated mitigation measures would reduce the likelihood of erosion and sedimentation during construction. Therefore, the project is not anticipated to result in unacceptable downstream erosion and sedimentation impacts (GHD 2023).</p> <p>During the operational phase, potential impacts to watercourses from erosion and sediment risks decommissioning and rehabilitation are expected to similar in nature, but of lesser magnitude than construction and operation decommissioning and therefore have not been assessed in detail (GHD 2023).</p> <p>Given the limited scale of works and the proposed environmental management measures the proposal is highly unlikely to result in a tangible increase in the degree of erosion or sedimentation.</p>
Impacts to groundwater and GDEs	<p>All water required for the project is to be supplied from external sources and trucked to site on an on-demand basis. Therefore, no groundwater abstractions will be required.</p> <p>Foundations for the compressor station will be slab on ground, spread footings or driven or bored steel pile foundations. The available data suggest the foundations will not intercept groundwater and dewatering of groundwater will not be required for construction of the compressor station or establishment of the temporary accommodation camp (GHD 2023).</p> <p>There are no high priority GDEs or culturally significant sites listed in the relevant water sharing plans within 10 km of the site. Therefore, potential impacts are within the Level 1 minimal impact considerations for GDEs and culturally significant sites (GHD 2023).</p> <p>As outlined in section 5 within Appendix E of the modification report (GHD 2023), the design, construction and operation of the wastewater treatment system and effluent irrigation system is expected to be carried out in accordance with the relevant Australian Standards and in accordance with the <i>Use of Effluent by Irrigation guidelines</i> (DEC NSW 2004).</p> <p>Irrigated effluent is expected to be treated and brine will likely be disposed of through the irrigation system. Effluent quality is to be tested prior to use for irrigation, as recommended under DEC NSW (2004). Impacts to groundwater based on irrigation of effluent are expected to be negligible due to the depth to groundwater and low volume of irrigation, and not alter the environmental value groundwater for potential receptors of groundwater, such as GDEs, wetlands and licenced water users. The construction and operation of the proposal is not expected to cause any significant change in groundwater quality (GHD 2023).</p>

### 8.3 Prescribed impacts

Prescribed impacts are the impacts on biodiversity values which are not related to, or are in addition to, native vegetation clearing and habitat loss (Section 6.7 of the BAM). These types of impacts are used by the decision-maker to inform the determination and conditions of consent for developments. In general, these types of impacts affect habitat or features of the environment that are irreplaceable or otherwise important to the maintenance of biodiversity values.

The BC Regulation (clause 6.1) identifies actions that are prescribed as impacts to be assessed under the biodiversity offsets scheme. The likelihood, extent and magnitude of prescribed impacts must be assessed using the approach specified in the BAM Section 8.3. The likely effect of prescribed impacts that are relevant to the proposal is presented in Table 8.5. The suite of threatened species that may be affected by these prescribed impacts are presented in section 6.

The proposal will include implementation of measures to mitigate residual impacts, specified in a Construction Environmental Management Plan (CEMP). The CEMP will provide detailed environmental controls to manage key environmental issues. The CEMP will be reviewed and updated as necessary throughout the relevant phases of the modification. The CEMP will include, as a minimum, industry-standard measures for the management of soil, surface water, weeds and pollutants, as well as site-specific measures for the management of flora and fauna. The mitigation and harm minimisation measures for direct, indirect and prescribed impacts are presented in Table 8.6 including timing, responsibility and outcomes.

Table 8.5 Summary of residual prescribed impacts

Prescribed impact	Likelihood and consequences
Habitat connectivity	<p><b>Nature</b></p> <p>The assessment of landscape context according to the BAM is provided in section 4.1. Figure 3.1 shows the extent of the patch of vegetation that the proposal falls within, with extensive areas of connected vegetation surrounding the site. Tibooburra Road to the north of the proposal site and the MWP running through the western portion of the site, comprise gaps in native vegetation cover. However these would not comprise significant gaps in fauna habitat connectivity or interrupt ecological processes in the context of the semi-arid communities in the locality which naturally contain gaps in vegetation cover of a similar scale.</p> <p>The Thomsons Creek riparian corridor would comprise a regionally significant habitat corridor given the occasional presence of surface water, higher overall vegetation cover and presence of large, frequently hollow bearing trees and other habitat resources. The proposal site is around 150-200 m from the vegetated riparian corridor.</p> <p>There are thousands of hectares of semi-arid shrubland similar to that in the proposal site in the locality. In this context the proposal site is unlikely to comprise a key link in a resource corridor, or to be critical to the ongoing connectivity of habitat in the local area.</p> <p>After construction, the proposal site would comprise a gap in native vegetation cover. The proposal site would contain structures, roads and fences as well as noise, light and human activity which may limit the ability of fauna to move through the landscape.</p> <p><b>Extent</b></p> <p>The proposal would include clearing of native vegetation and erection of structures in up to 8.2 ha of land of which 8.13 ha is native vegetation. Construction of the compressor station and camp would reduce connectivity through the proposal site by decreasing shelter and creating physical barriers. It has conservatively been assumed that the application of treated effluent would remove or significantly modify up to 1.2 ha of native vegetation by harmfully altering soil moisture and/or nutrient content. Removal of native vegetation cover and operation of the proposal would create a gap in east-west habitat connectivity about 500 m wide and about 180 m wide in north-south connectivity.</p> <p>Human occupation is also likely to deter many native fauna species from moving through the local area during construction and during periods when the temporary accommodation camp is occupied. The construction and commissioning of the compressor station will take approximately 12 months and the temporary accommodation camp will be used intermittently for approximately 3 months every three years over the life of the proposal. Impacts associated with human activity would occur for a relatively small portion of the 25-year life of the proposal.</p> <p><b>Duration</b></p> <p>This impact would be for up to 25 years of use of the temporary accommodation camp or for the operational life of the compressor which is estimated at around 25 years. After rehabilitation the proposal would contain native vegetation used for low-intensity agriculture similar to the baseline condition.</p> <p><b>Consequences</b></p> <p>The threatened species listed in section 6 and other native fauna species may travel over or through the proposal site, and groundcover vegetation may be used as shelter by smaller species. The site does not contain any large trees, water bodies or any other habitat features that would comprise an important connecting link between any other areas of habitat. These species may travel through the site on occasion as an extension of their use of habitat in adjoining areas of native vegetation but would not be limited to, or reliant on, the connectivity provided by the proposal site to support their continued use of the local area. Habitat connectivity would be maintained around the proposal site through extensive areas of similar Acacia and chenopod shrubland and the riparian corridor of Thomsons Creek. The proposal does not include the erection of any large or hazardous structures that would increase the risk or energy cost of movement of any threatened or migratory fauna. Removal of vegetation and construction of the compressor and camp infrastructure would only result in a minor increase in the degree of fragmentation between retained areas of habitat for these species and would not result in the isolation of any habitat. The reduction in extent of habitat would be minor. The proposal would create a gap in east-west habitat connectivity about 500 m across and north-south connectivity about 180 m across which would not be sufficient to interrupt any ecological process such as migration or pollination.</p> <p>Overall, the consequences of the proposal's impact on habitat connectivity would be minor.</p>

Prescribed impact	Likelihood and consequences
<p>Waterbodies, water quality and hydrological processes</p>	<p><b>Nature</b></p> <p>The proposal site is located around 200 m to the north of Thomsons Creek, which flows northeast towards the Narriearra Caryapundy Swamp. The creek contained surface water in occasional isolated pools at the time of the November 2022 and February 2023 surveys. During intermittent wet periods these features would be a significant habitat resource. Perennial sub-surface water flows would be important in maintaining large trees such as River Red Gums and Gidgee that are associated with these features.</p> <p>Two unnamed, ephemeral, first order streams drain from the north of the proposal site southeast to Thomsons Creek. Several unnamed first and second order tributaries with similar characteristics drain the surrounding area, as shown on Figure 3.1.</p> <p>The proposal would modify the catchment and result in local changes to hydrology through clearing of vegetation, earthworks and construction of structures. Treated wastewater would also be applied over a 1.2 ha portion of the proposal site.</p> <p>All water required for the proposal is to be supplied from external sources and trucked to site on an on-demand basis. Therefore, no groundwater abstractions will be required.</p> <p><b>Extent</b></p> <p>The proposal would include clearing of native and exotic vegetation, levelling and compaction of soil and erection of structures in up to 8.2 ha of land. Construction activities would be located at least 150 m from the top of bank of Thomsons Creek. Industry standard measures for managing soil and surface water are likely to mitigate against any tangible indirect impacts on Thomsons Creek or any other waterbodies with particular habitat value. Considering the relatively low slopes of the proposal site, the negligible earthworks required and the relatively short construction period, it is likely that water quality impacts arising from construction at the site would be negligible. Therefore, no water quality monitoring program is currently proposed. Given the 12-month construction period, it is unlikely that a water quality monitoring program would be responsive enough to apply changes to management of the construction site in any case (GHD 2023).</p> <p>Around 200 m of an unnamed first order water course and a gully through the site are proposed to be infilled during construction using cut and fill methods. The proposal is likely to decrease the depth and duration that first order watercourses draining and adjoining the proposal site would hold surface water and/or reduce their habitat value during wet periods by clearing, compacting and levelling the land in the upper reaches of the catchment.</p> <p>Changes to surface water flows in the proposal site would have a negligible effect on the hydrology of Thomsons Creek and the Narriearra Caryapundy Swamp downstream.</p> <p>Treated effluent would be applied to a further 1.2 ha of native vegetation. As described in section 8.1.3 wastewater irrigation would not result in sufficient flow volumes to affect any hydrological processes and effluent would be treated to a standard that ensures there would be no tangible impacts to downstream water quality. The spray field would be designed to maintain buffers of at least 10 m from away from trees and other longer-lived native plants and the upper reaches of first order watercourses adjoining the proposal site. The irrigation would be undertaken so as to ensure that all wastewater would be absorbed by soil and would not directly affect any surface water body.</p> <p>No groundwater would be extracted for use on site.</p> <p><b>Duration</b></p> <p>Any potential impacts would be during construction, and then during periods in which the temporary accommodation camp is occupied for up to 25 years. After decommissioning, the proposal site would contain native vegetation used for low-intensity agriculture similar to the baseline condition.</p> <p><b>Consequences</b></p> <p>Each of the threatened species that could occur at the proposal site would rely on Thomsons Creek and to a lesser extent first order watercourses draining the proposal site as a water source during wet periods, foraging habitat and to support flood-dependent tree species that comprise important roosting and nesting habitat. The proposal would have a negligible effect on Thomsons Creek and downstream habitats.</p> <p>The proposal would remove or modify ephemeral watercourses that would have value as short-term foraging habitat during wet periods. The habitat to be removed or modified is associated with the upper reaches of the catchment, would very infrequently hold water, and does not have particular habitat value. There are many linear kilometres of equivalent habitat in the local area. Threatened species or their prey may use habitat resources at or adjoining the proposal site on occasion as an extension of their use of habitat in adjoining areas of native vegetation but would not be limited to, or reliant on, the ephemeral water course habitat present within the proposal site for any stage of their life cycle.</p>



Prescribed impact	Likelihood and consequences
	<p>The proposal design and implementation of the CEMP are likely to ensure that there are no tangible indirect impacts on waterbodies, water quality and hydrological processes outside the proposal site. A Water Resources and Quality Assessment has been prepared to address the water related impacts associated with the temporary accommodation camp and wastewater treatment system. The assessment found that implementation of appropriate measures to manage the identified potential risks to water by the project, that no unacceptable residual adverse impacts would be anticipated (GHD 2023).</p>
Vehicle strike	<p><b>Likelihood</b></p> <p>The proposal would create additional traffic on Tibooburra Road towards the proposal site, generally from west to east from Tibooburra and Broken Hill. This would include construction traffic during the construction and decommissioning stages and staff movements and deliveries during operation of the compressor and temporary accommodation camp used for maintenance activities.</p> <p>Vehicles travelling to and from the site would use around 20 m of unsealed local access track and Tibooburra Road along unfenced carriageway widths of approximately 10 m within a heavily vegetated landscape and so there is a risk of vehicle strikes to native fauna.</p> <p>The anticipated traffic generation for the construction works and the estimated peak hour traffic is summarised in section 6.4 of the Modification report (GHD 2023). There is no separate data for the future operation of the camp and so the traffic generation during construction has been assessed as a worst-case scenario for the proposal (GHD 2023).</p> <p><b>Estimated rate of vehicle strike</b></p> <p>Due to its remote location, the proposal site is only accessible by Tibooburra Road during the various stages of the proposed modification. The road is unsealed with no pedestrian or public transport facilities and has a speed limit of 100 km/hr where it passes the site. Tibooburra Road has no available data provided so traffic volumes have been assumed from nearby roads. Traffic volumes were assumed to be equal to 50% of Silver City Highway traffic volumes (GHD 2023).</p> <p>The construction and commissioning of the compressor station will take approximately 12 months and the temporary accommodation camp will be used intermittently for approximately 3 months every three years over the life of the proposal. Generation of additional traffic would occur for a relatively small portion of the 25-year life of the proposal.</p> <p>Construction of the compressor station is expected to require a daily total of between approximately 100 to 120 heavy vehicle movements and 20 to 30 light vehicle movements. Workers would travel to the camp area by light vehicle on a daily basis to construct the proposal.</p> <p>Operation of the temporary accommodation camp is estimated to involve a daily total of 2-5 heavy vehicle movements. The transport of workers to the work site on a daily basis would be via group transport such as a bus or around 20 to 30 light vehicle movements where site conditions allow.</p> <p>The impacts of the proposal on the road network were quantified by adding the traffic generated by the proposed modification works to the expected future traffic volumes on the road network. The values in section 6.4 and Appendix F of the modification report (GHD 2023) indicate that the construction and operation of the proposal would not have a significant impact on road network operations. The traffic assessment focussed mainly on the capacity of the road network to accommodate additional traffic volumes and did not include any estimation of rates of vehicle strike on native fauna. The assessment indicates that the proposal is expected to have minimal impact on peak hour traffic volumes along the roads within the vicinity of the temporary accommodation camp and so it is likely that the proposal would result in a similarly minor increase in the rate of vehicle strike.</p> <p><b>Consequences</b></p> <p>Access to the site would be along an unfenced two-lane road within a vegetated landscape. Access roads may be travelled over or through, by native fauna including threatened species. Threatened species such as threatened microbats and forest owls are unlikely to experience a significant risk of vehicle strike as vehicle movements will occur during daylight hours when these species are inactive. Threatened raptors and woodland birds and other diurnal species may be at risk of vehicle strike during the day.</p> <p>The proposal would result in a minor, but tangible increase in vehicle movements and associated risk of vehicle strike.</p>

## 8.4 Mitigating residual impacts – management measures and implementation

The proposal will include implementation of measures to mitigate residual impacts, specified in a Construction Environmental Management Plan (CEMP) and an Operational Environmental Management Plan (OEMP). The CEMP and OEMP will provide detailed environmental controls to manage key environmental issues. The CEMP and OEMP will be reviewed and updated as necessary throughout the relevant phases of the modification.

The CEMP and OEMP will include, as a minimum, industry-standard measures for the management of soil, surface water, weeds and pollutants, as well as site-specific measures for the management of flora and fauna. The mitigation and harm minimisation measures for direct, indirect and prescribed impacts are detailed in Table 8.6 including timing, responsibility and outcomes. Additionally, Table 8.7 includes management measures which should be included in the CEMP to manage impacts during construction.

**Table 8.6** Summary of proposed mitigation and management measures for residual impacts (direct, indirect and prescribed)

ID	Impact	Mitigation measures	Timing/ responsibility	Likely effective ness
<b>Direct impacts</b>				
B01	General biodiversity impacts	The CEMP will present measures, processes, and responsibilities to minimise the potential for biodiversity impacts during construction and use of the proposal site, including the measures provided in Table 8.7.	Pre-construction/ Project ecologist	High
B02	General	All workers will be provided with an environmental induction prior to starting work on site. This would include information on the biodiversity values of the site, protection measures to be implemented to protect native biota and penalties for breaches.	Construction / Construction contractor and Project ecologist	High
B03	Removal of vegetation and habitat resources	Plans will be prepared showing areas to be cleared and areas to be protected, including exclusion zones and protected habitat features in the vicinity of work areas.	Pre-construction / Project ecologist	High
B04		Prior to the start of construction, APA (or the contractor) will flag the proposal site boundary that has been approved in the Modification for disturbance. The perimeter of this area would be fenced using high visibility fencing and clearly marked as the limits of clearing. All vegetation outside this fence line will be clearly delineated as an exclusion zone to avoid unnecessary vegetation and habitat removal and the transmission of weeds or disease. Fencing and signage will be maintained for the duration of the construction period. Fencing will be designed to allow fauna to exit the site during clearing activities.	Pre-construction and construction / Project ecologist	High
B05	Unexpected direct impacts to threatened flora and fauna	An unexpected finds protocol detailing measures to be undertaken if threatened flora and fauna not previously recorded on site are detected during clearing or construction activities.	Construction / Project ecologist	High
B06	Harm to resident fauna	Protocols for the management of fauna and habitats including: <ul style="list-style-type: none"> <li>– a procedure for the removal of vegetation to prevent or minimise mortality of fauna</li> <li>– salvage of woody debris and other habitat resources where practicable</li> <li>– management of any trenches or drill sites to prevent fauna from becoming trapped or injured.</li> </ul>	Construction / Construction contractor and Project ecologist	High

ID	Impact	Mitigation measures	Timing/ responsibility	Likely effective ness
B07		Pre-clearing surveys will be undertaken prior to construction by a suitably qualified ecologist. The surveys and inspections, and any subsequent relocation of species, will be undertaken in accordance with the CEMP.	Construction / Construction contractor and Project ecologist	High
B08		A post-clearing report will be prepared documenting all animals that are handled, or otherwise managed, within the site. Data to be recorded includes: <ul style="list-style-type: none"> <li>– date and time of the sighting and details of the observer</li> <li>– species</li> <li>– number of individuals recorded</li> <li>– adult/juvenile</li> <li>– condition of the animal (living/dead/injured/sick)</li> <li>– management action undertaken (e.g. captured, handled, taken to vet)</li> <li>– results of any management actions (e.g. released, placed in a nest box, euthanised, placed with carer).</li> </ul>	Construction / Construction contractor and Project ecologist	High
<b>Indirect and prescribed impacts</b>				
B09	Wastewater irrigation – adverse impacts on downstream water quality and ecosystem health	Where wastewater will be used for irrigation, it will be treated by a suitable aerated wastewater treatment system in accordance with Australian Standard (AS) 1547: <i>On-site domestic wastewater management</i> . Wastewater will be treated and tested prior to use for irrigation. The water quality parameters specified in Table 8.3 will be maintained. An appropriate contingency plan will be developed and implemented.	Operation / APA	High
B10	Location of wastewater irrigation	Wastewater irrigation will be restricted to a 1.2 ha area. Within the indicative area shown on Figure 1.2, the spray field will be designed to maintain buffers of at least 10 m from watercourses within and adjoining the proposal site. The irrigation will be undertaken so as to ensure that all wastewater would be absorbed by soil and would not directly affect any surface water body. Wastewater will be applied to bare areas and away from trees and other longer-lived native plants as far as possible.	Operation / APA	High
B11	Pathogen spread and establishment	Implementation of DPIE (2020d) <i>Hygiene guidelines Protocols to protect priority biodiversity areas in NSW from Phytophthora cinnamomi, myrtle rust, amphibian chytrid fungus and invasive plants</i> including all machinery entering the site to be appropriately washed down and disinfected prior to work on site to prevent the potential spread of weeds and disease.	Construction / Contractor	High
B12	Spread of weeds	Declared priority weeds will be managed according to requirements of the NSW <i>Biosecurity Act 2015</i> .	Construction / Contractor	High
B13	Soil loss hazard – erosion of soils and sediment due to clearing during construction	Erosion and sediment control measures will be established prior to construction in accordance with the principles and guidelines included in <i>Managing Urban Stormwater: Soils and Construction - Volume 1</i> (Landcom 2004).	Pre- construction, construction / Contractor	High

ID	Impact	Mitigation measures	Timing/ responsibility	Likely effectiveness
B14	Reduction in surface water quality due to sedimentation	Erosion and sediment controls throughout the site will be inspected and maintained to ensure they are operating effectively.	Construction / Contractor	High
B15	Vehicle strike	Appropriate speeds for all construction and contractor vehicles will be enforced to limit dust generation and minimise chances of fauna mortality through vehicle strike throughout the construction and during operational use of the temporary accommodation camp.	Construction, operation / Contractor, APA	Moderate
B16	Light spill – displacement of fauna from habitat adjoining the proposal site	Light generated during construction will be managed in general accordance with the requirements in Australian Standard AS 4282-1997 Control of the Obtrusive Effects of Outdoor Lighting. Directional lighting will be used to minimise the effects of light spill outside the camp as far as possible.	Construction, operation / Contractor, APA	Moderate
B17	Noise and vibration generation - displacement of fauna from habitat adjoining the proposal site	All activities on site are to be undertaken as per the approved CEMP, with works confined between the following hours: daytime hours of 7:00 am to 6:00 pm, Monday to Sunday (including public holidays), with the exception of the following activities: <ul style="list-style-type: none"> <li>– the delivery of materials as requested by the NSW Police Force or other authorities for safety reasons; emergency work to avoid the loss of life or damage to property, or to prevent environmental harm</li> <li>– emergency work to avoid the loss of life, property and/or material harm to the environment</li> <li>– works as approved through the out-of-hours works protocol as approved through the CEMP.</li> </ul>	Construction, operation / Contractor, APA	Moderate
B18	Water quality, chemical and fuel impacts on flora and fauna	Maintenance of buffer distances from waterways and use of isolation measures such as bunds as appropriate to minimise the potential for chemical spills and associated impacts on natural environments adjacent to and downstream of the areas of impact. Spill kits will be made available to construction vehicles. A management protocol for accidental spills will be put in place. Chemicals will be stored in bunded areas.	Construction, operation / Construction contractor	High
<b>Decommissioning</b>				
B19	Longer term potential for soil, water and biodiversity impacts listed above	A rehabilitation strategy will be prepared to guide rehabilitation planning, implementation, monitoring and maintenance of disturbed areas outside of the operational footprint (such as compounds and temporary workforce accommodation). It will include clear objectives for rehabilitation of native vegetation in temporary disturbances areas, including: <ul style="list-style-type: none"> <li>– the need for areas to be landscaped and vegetated using native species</li> <li>– the requirement to rehabilitate the site as soon as reasonably practicable following disturbance and to ensure all reasonable steps are taken to minimise the total area exposed at any time</li> <li>– interim stabilisation and temporary vegetation strategies to be employed following each maintenance period.</li> </ul>	Decommissioning / Construction contractor	High

## 8.4.1 Management measures

Example management measures that would be included in the CEMP are listed in Table 8.7.

Table 8.7 Management measures

Impact	Proposal specific management measures
Removal of vegetation and habitat resources	<ul style="list-style-type: none"> <li>– Minimise vegetation clearance and disturbance, including impacts to trees and riparian zones, as far as possible. Where possible, limit clearing to trimming rather than the removal of whole plants</li> <li>– A suitably qualified ecologist must be engaged prior to any clearing works to physically delineate vegetation to be cleared and/or protected on site and install appropriate signage and high-visibility fencing prior to works commencing. All vegetation outside this fence line will be clearly marked as an exclusion zone to avoid unnecessary vegetation and habitat removal. Fencing and signage must be maintained for the duration of the works period. Fencing should be designed to allow fauna to exit the site during clearing activities.</li> <li>– Stockpiles of fill or vegetation should be placed within existing cleared areas (and not within areas of adjoining native vegetation)</li> <li>– Implement hygiene protocols to prevent the introduction and spread of weed propagules and soil pathogens</li> <li>– If excavation is required in the root zone of canopy trees, it is preferred to retain the tree if possible as it would continue to provide foraging and shelter habitat for a range fauna species.</li> </ul>
Harm to resident fauna	<p>Pre-clearance surveys will include:</p> <ul style="list-style-type: none"> <li>– an initial pre-clearance survey of the proposal site undertaken by a suitably qualified ecologist prior to the commencement of any clearing activities including searches for nests in vegetation to be removed and identification of fauna refuge sites potentially requiring fauna management during removal, including woody debris</li> <li>– a daily pre-clearance fauna survey is also to be undertaken by a suitably qualified ecologist each day prior to the clearing of native vegetation</li> <li>– if animals are found, procedures outlined in the protocol for capture and relocation (below) will be followed. Surrounding vegetation within the proposal footprint can then be cleared</li> <li>– if no fauna are found, then surrounding vegetation (within the proposal footprint) can be cleared. This process will be monitored by the ecologist in case fauna are found to be at risk.</li> </ul> <p>Animals that require handling must not be approached or handled until the ecologist is present, unless in an emergency (e.g. when there are both no authorised persons present and where the failure to immediately intervene would place the animal at significant risk). In such an emergency, the site manager may obtain over the phone instructions from the project ecologist to ameliorate the situation. A wildlife rescue organisation (e.g. WIRES) should be made aware of operations in case any injured fauna are found.</p> <p>All animals encountered will be treated humanely, ethically, and in accordance with relevant codes under the NSW <i>Prevention of Cruelty to Animals Act 1979</i>, including:</p> <ul style="list-style-type: none"> <li>– Australian code of practice for the care of animals for scientific purposes (NHMRC, 2013).</li> <li>– Code of practice for the welfare of wildlife during rehabilitation (DPI VIC, 2001).</li> <li>– Animal ethics considerations and protocols outlined in this document.</li> </ul> <p>If the project ecologist considers an animal is at risk of injury or undue stress, it is to be gently directed into secure adjoining habitat. Where deemed necessary by the project ecologist, the animal may be required to be captured and released. Capture and release operations will proceed via the following protocols:</p> <ul style="list-style-type: none"> <li>– All activities that are considered by the project ecologist to be likely to increase the risk of injury, mortality or stress to the animal will be halted until the animal has been removed, which will be enforced with the co-operation of the Contractor. Activities that do not contribute to the risk of injury, mortality or stress to the animal can continue (as determined by the project ecologist).</li> <li>– Only qualified ecologists or wildlife carers are authorised to handle animals.</li> <li>– Animals will be captured (if required) by the project ecologist using a safe and ethical technique, as is appropriate for the particular species (see below). Native animals that are unable to depart of their own accord will be captured and held in a receptacle appropriate for that species until release. All captive-held animals will be provided with food, water and warmth as is appropriate for the species. Each receptacle will only hold one animal at a time and will be cleaned and disinfected between use to avoid the spread of disease.</li> </ul>

Impact	Proposal specific management measures
Spread of weeds or disease	<p>Avoidance of potential spread and establishment of weeds and disease by weed management in key areas prior to construction as follows:</p> <ul style="list-style-type: none"> <li>– appropriate identification, management and disposal of weed species during clearing works, in accordance with the biodiversity management plan</li> <li>– active and intensive weed control in areas where significant weeds are known to occur to reduce the cover of weeds adjacent to the construction activities, preventing the spread of weeds into other areas</li> <li>– washing down and disinfection of all machinery entering the site in accordance with the <i>NSW best practice Protocols to protect priority biodiversity areas</i> (DPIE, 2020c) and certified weed-free prior to initial entry to site</li> <li>– adherence by all vehicles, plant and equipment to the marked roads, tracks, easements, parking areas and other designated work areas to minimise contact with vegetation</li> <li>– re-certification as weed-free of all vehicles, plant and equipment breaching protocol and travelling outside of approved areas</li> <li>– keeping biosecurity certifications with the vehicle and plant at all times</li> <li>– implementation of a weed and pathogen monitoring program with a weed control program to be implemented if weeds are identified within the proposal site boundary</li> <li>– implementation of measures to prevent introduction or spread of weeds and diseases in accordance with <i>Protocols to protect priority biodiversity areas in NSW from Phytophthora cinnamomi, myrtle rust, amphibian chytrid fungus and invasive plants</i> (DPIE, 2020)</li> <li>– management of priority weeds in accordance with the requirements of <i>NSW Biosecurity Act 2015</i></li> <li>– rehabilitation of cleared areas as quickly as possible following construction works in an area.</li> </ul>



## 9. Impact summary

### 9.1 Assessment for serious and irreversible impacts on biodiversity values

Under the BC Act, Section 6.7 of the BC regulation sets out principles for determining whether an impact on a specific threatened species or ecological community is serious and irreversible. If an impact is likely to contribute significantly to the risk of a threatened species or ecological community becoming extinct, this is deemed serious and irreversible. This likelihood is assessed based on the following four principles:

- The impact will cause a further decline of a species or ecological community that is currently observed, estimated, inferred or reasonably suspected to be in a rapid rate of decline.
- The impact will further reduce the population size of the species or ecological community that is currently observed, estimated, inferred or reasonably suspected to have a very small population size.
- The impact is made on the habitat of the species or ecological community that is currently observed, estimated, inferred or reasonably suspected to have a very limited geographic distribution.
- The impacted species or ecological community is unlikely to respond to measures to improve its habitat and vegetation integrity, and therefore its members are not replaceable.

A set of criteria have been developed and are included in the DPE *Guidelines to assist a decision-maker to determine a SAIL* (DPIE, 2019c). Threatened biota that meet the criteria under one or more of the above principles have been identified as SAIL entities. Each potential SAIL entity has an impact threshold identified which can be used to help determine if a development will result in SAIL. The decision-maker must determine whether or not an impact on biodiversity values is likely to be SAIL. The framework allows for decision-makers to take into account the scale of an impact and the potential for avoidance and mitigation. These factors are weighed against the status and vulnerabilities of the potential SAIL entity to ultimately determine if a proposal would result in a SAIL.

Of the threatened biota of relevance to this assessment, no threatened species or ecological communities considered known or likely to occur are candidate SAIL entities. The proposal would not result in any impacts to known or potential SAIL entities or their habitat. Therefore, no further consideration of potential SAILS is required.

### 9.2 Offset requirement for impacts under the BC Act

#### 9.2.1 Impacts on native vegetation (ecosystem credits)

Impacts associated with the proposal that require offsetting comprise the removal or modification of up to 9.33 ha of native vegetation and associated threatened species habitat within the proposal site as shown on Figure 9.1.

The data from the fieldwork and desktop assessment was entered into Version 1.4.0.00 of the BAM-Calculator (BAM data last update 22/06/2023 - Version 61) as a 'Development' assessment to determine the number and type of biodiversity credits that would be required to offset impacts of the proposal. Version 1.2 'wet year' benchmark data was used as stated in section 2.6, reflecting the above average rainfall in the years preceding field surveys as described in section 2.5.

The credit calculations Parent case ID for the proposal is 00036434. The assessment is 00036434/BAAS17023/22/00036603.

The biodiversity credit report is included in Appendix E and identifies the numbers and classes of biodiversity credits required to be retired in accordance with the like-for-like requirements of the offset rules and those that could be retired in accordance with the variation rules. This BDAR has been certified and submitted to the decision-maker within 14 days of the date the BAM-C credit report was finalised.

Ecosystem credit requirements are summarised in in Table 9.1 and offset trading groups (OTGs) to ensure 'like for like' provision of biodiversity offsets are summarised in Table 9.2. Each of the ecosystem credit types can be traded with credits in the same offset trading group (OTG) and located in the Sturt Stony Desert IBRA subregion

containing the proposal site; the Bulloo, Central Depression, Core Ranges and Strzelecki Desert subregions adjoining the proposal site; as well as the Bulloo Dunefields, Mootwingee Downs, Urisino Sandplains and White Cliffs Plateau subregions that fall within 100 km of the proposal site.

**Table 9.1** *Impacts that require an offset – ecosystem credits*

Vegetation zone	PCT name	TEC	Impact area (ha)	Current VI score	Future VI score	Change in VI score	Biodiversity risk weighting	Number of ecosystem credits required
143_Good	PCT 143 - Narrow-leaved Hopbush - Scrub Turpentine - Senna shrubland on semi-arid and arid sandplains and dunes	No	6.85	86.1	0	-86.1	1.5	221
143_Poor	PCT 143 - Narrow-leaved Hopbush - Scrub Turpentine - Senna shrubland on semi-arid and arid sandplains and dunes	No	2.48	37.7	0	-37.7	1.5	35

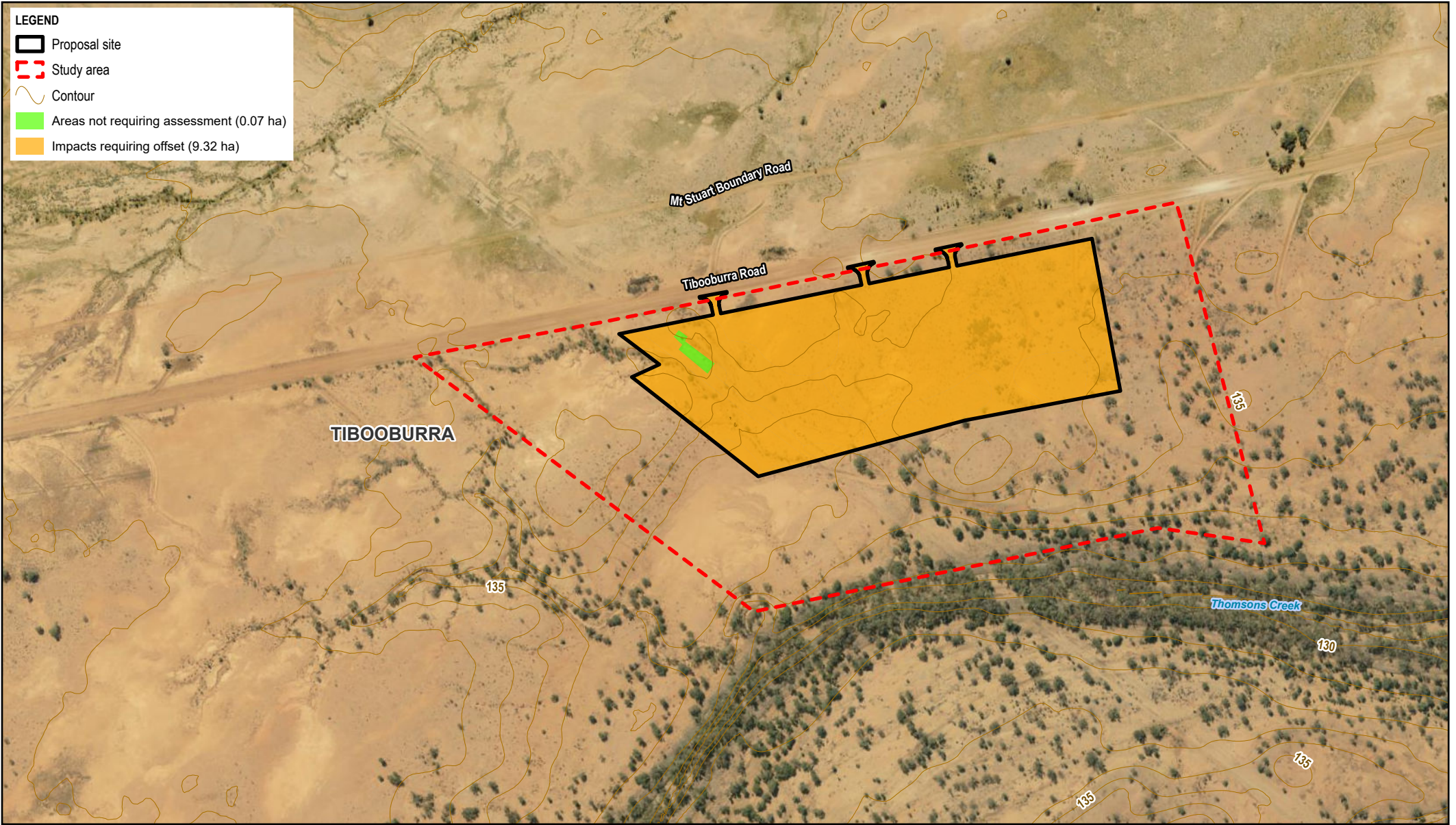
**Table 9.2** *'Like-for-like' ecosystem credits required to offset impacts of the proposal*

Vegetation zone	Credit class	OTG	Containing hollow-bearing trees
143_Good	Sand Plain Mulga Shrublands This includes PCT's: 69, 119, 124, 128, 129, 139, 140, 143, 199, 215, 220, 232	Sand Plain Mulga Shrublands - < 50% cleared group (including Tier 4 or higher threat status)	No
143_Poor	Sand Plain Mulga Shrublands This includes PCT's: 69, 119, 124, 128, 129, 139, 140, 143, 199, 215, 220, 232	Sand Plain Mulga Shrublands - < 50% cleared group (including Tier 4 or higher threat status)	No






## 9.2.2 Impacts on threatened species and their habitat (species credits)

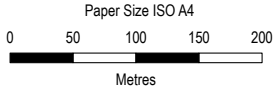
No species credit matters were recorded or are assumed present at the proposed site.

Table 5.3 identifies the confirmed candidate species credit species requiring assessment in accordance with BAM Subsection 5.2.4, the method used to confirm their presence and the outcome of targeted surveys. Each of these species and species credit matters such as nest trees have been excluded through targeted seasonal survey with reference to the TBDC (DPE 2023a) and relevant guidelines as described in section 2.4 above. Therefore, no impacts to threatened species or their habitats require an offset through calculation of species credits in accordance with BAM Subsection 9.2.2(2.).

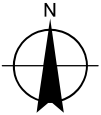


**LEGEND**

-  Proposal site
-  Study area
-  Contour
-  Areas not requiring assessment (0.07 ha)
-  Impacts requiring offset (9.32 ha)



Map Projection: Lambert Conformal Conic  
 Horizontal Datum: GDA2020  
 Grid: GDA2020 NSW Lambert



**APT Management Services Pty Ltd**  
**Moomba to Wilton Pipeline Modification 2**  
**Biodiversity Development Assessment Report**

**Thresholds for assessing and offsetting impacts**

Project No. **12613644**  
 Revision No. **1**  
 Date **17/01/2024**

**FIGURE 9.1**



### 9.2.3 Indirect and prescribed impacts

Significant residual indirect and prescribed impacts that remain after measures to avoid, minimise and mitigate have been applied, may require calculation of biodiversity offsets using additional biodiversity credits (above the credit requirement generated by the BAM C for direct impacts) and/or other conservation measures. The process for determining whether there are any significant residual impacts is documented in this BDAR as follows:

- Table 7.1 (Avoidance and minimisation measures for direct, indirect and prescribed impacts) which shows how the potential for impacts to biodiversity values has been substantially avoided
- Table 8.4 (Summary of residual indirect impacts) and Table 8.5 (Summary of residual prescribed impacts on the proposal site) which presents the minor extent and consequence of potential impacts to biodiversity values
- Table 8.6 (Summary of proposed mitigation and management measures for residual impacts (direct, indirect and prescribed)) which describes how potential residual impacts would be mitigated with generally high confidence of success.

The proposal may result in residual indirect impacts through light spill and noise and vibration generation causing displacement of threatened species and other native fauna from habitat adjoining the proposal site. The proposal site in which direct impacts have been calculated is conservative and includes buffer areas of open space surrounding proposed disturbance footprints. The buffer area between proposed disturbance footprints and adjoining native vegetation is likely to be sufficient to mitigate against indirect impacts extending beyond the proposal site. The proposal would result in residual prescribed impacts interruption of habitat connectivity, minor changes to surface water flows and a moderate risk of vehicle strike causing harm to threatened fauna species and other native fauna using habitats in the vicinity of the proposal site.

Given the limited extent of impacts, exclusion of buffer areas around infrastructure in the proposal site and extensive areas of alternative habitat resources in the locality the consequences of these residual impacts are likely to be minor. No biodiversity credits or conservation measures are proposed for these residual impacts.

## 9.3 Impacts that do not need further assessment under the BC Act

Impacts that do not need further assessment for ecosystem credits are listed in Table 9.3 (as per BAM Section 9.3(1–2)).

**Table 9.3** *Impacts that do not need further assessment for ecosystem credits*

Impact	Location within subject land	Justification why no further assessment is required
Removal of 0.07 ha of non-native vegetation.	MWP infrastructure in the western portion of the proposal site and the Tibooburra Road carriageway as shown on Figure 9.1.	Impact assessment relating to removal or modification of habitat and calculation of biodiversity offsets is not required for non-native vegetation (other than consideration of prescribed impacts, as described above).

## 9.4 Offsets for MNES

Under the *Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy* (DSEWPaC, 2012) (the EPBC Act Environmental Offsets Policy) biodiversity offsets are required to compensate for significant residual impacts on MNES. This BDAR includes the identification and assessment of potentially affected MNES, consideration of the potential significance of impacts on MNES pursuant to the *Matters of National Environmental Significance Significant impact guidelines 1.1 Environment Protection and Biodiversity Conservation Act 1999* (DotE 2013). The outcome of these assessments is that the proposal would not result in a significant impact on any MNES. No biodiversity offsets for impacts on MNES are therefore required in accordance with the EPBC Act Environmental Offsets Policy.

## 10. Summary and conclusions

APA Group own and operate the Moomba to Wilton Pipeline (MWP) subject to the conditions of Pipeline Licence No. 16, issued under the NSW *Pipelines Act 1967* (Pipelines Act). The construction of a new compressor station (MW244) at Tibooburra in north-west NSW is proposed as Stage 3a of APA's East Coast Grid Expansion Project. In addition, the conditions of Pipeline Licence No. 16, require regular integrity surveys to be undertaken on the MWP. A temporary accommodation camp is required as ancillary infrastructure to accommodate staff during the construction of the compressor station, the ongoing maintenance works, and the end of project life decommissioning and rehabilitation works. Accordingly, APA is proposing to construct and operate the compressor station and a temporary accommodation camp site through a modification (Mod 2) to the SSI-15548591 Approval under Section 5.25 of the EP&A Act.

GHD has been engaged to prepare a BDAR to accompany Mod 2 for impacts resulting from the development of the compressor station and associated camp site to facilitate the maintenance of the MWP ('the proposal'). The BDAR:

- describes the existing environment of the study area and assesses the value and conservation significance of native vegetation and habitats at the proposal site and the potential for threatened biota including MNES to occur or be affected by the proposal
- provides a description of the proposal, including potential impacts on biodiversity values and measures to avoid or minimise impacts
- assesses the significance of residual impacts on threatened biota and MNES under the *Environmental Protection and Biodiversity Conservation Act 1999*
- determines the need or otherwise for biodiversity offsets for residual impacts of the proposal in accordance with the Biodiversity Assessment Method (BAM)
- recommends measures to mitigate and manage the impacts identified including decommissioning and rehabilitation of the proposal site after use.

The proposal site is located about 17 km south-east of Tibooburra along Tibooburra Road in an unincorporated area on freehold land, containing a 'study area' of around 18 ha that was considered as the general location for the Mod 2 proposal and the 'proposal site' that would accommodate the proposed compressor station and temporary accommodation camp site. The MWP passes through the western portion of the proposal site. The study area was surveyed and assessed by GHD ecologists according to the BAM.

The study area comprises agricultural land with low intensity sheep grazing, as well as the MWP and associated infrastructure maintained by APA. It contains moderate condition native chenopod low shrublands, Acacia shrubland, Acacia (Gidgee) woodland and River Red Gum (*Eucalyptus camaldulensis*) woodland typical of the semi-arid climatic zone of far-western NSW. The Mod 2 proposal site is located around 200 m to the north of Thomsons Creek, a 7<sup>th</sup> order stream with intact riparian vegetation of River Red Gum woodland which flows northeast towards the Narriearra Caryapundy Swamp.

Surveys revealed a number of threatened fauna listed as vulnerable species under the NSW BC Act: the Little Pied Bat (*Chalinolobus picatus*), Black Falcon (*Falco subniger*), Dusky Woodswallow (*Artamus cyanopterus cyanopterus*), Spotted Harrier (*Circus assimilis*) and Black-breasted Buzzard (*Hamirostra melanosternon*) at or near the study area. Additionally, the Southern Whiteface (*Aphelocephala leucopsis*), which is listed as a vulnerable species under the EPBC Act, was identified during surveys. No direct evidence of breeding or any critical habitat resources were observed to suggest that the study area is of particular importance to local populations of these species. The study area does not contain important habitat for any migratory species listed under the EPBC Act. The proposal site contains habitat for the species listed above and other fauna of semi-arid environments.

A nest tree census was conducted to identify hollow-bearing trees, stick nests or other signs of breeding activity of threatened fauna that could require calculation of species credits according to the BAM. The nest tree census revealed a number of hollow-bearing trees and other candidate nest trees in or near the study area. There are no candidate nest trees in the proposal site.

The proposal has aimed to avoid impacts to biodiversity values by avoiding higher value native vegetation and habitat resources in the study area. Various iterations of the proposal site location and layout have been developed. The locations of the proposed compressor station, camp area and effluent irrigation area were refined in order to avoid impacts to biodiversity values as far as possible. Specifically:

- complete avoidance of the riparian corridor of Thomsons Creek and associated floodplain woodland, watercourse and hollow-bearing trees
- positioning of infrastructure as far north in the study area as possible to maximise the distance from Thomsons Creek and to minimise the length of access tracks from Tibooburra Road
- complete avoidance of Gidgee tall shrubland and woodland and associated hollow-bearing trees, ephemeral watercourses and other habitat resources
- alignment of camp infrastructure with poor condition vegetation as far as possible within the constraints of the lots owned by APA and location of the existing MWP infrastructure.

Further detailed design will include micro-siting of infrastructure and the treated wastewater irrigation area to maintain buffers to water courses and to help avoid indirect impacts to native vegetation and habitat resources.

The proposal would result in direct impacts to native vegetation and associated threatened species habitat through:

- clearing of up to 8.13 ha of native vegetation for construction of the compressor, temporary accommodation camp and associated infrastructure
- application of treated wastewater to up to 1.2 ha of native vegetation.

The proposal site does not contain any known or potential nest or roost sites or any other habitat resources that would be critical to the ecology of any threatened species. The proposal site does not function as an important connecting link between any areas of habitat. The proposal does not include the erection of any structures that would increase the risk or energy cost of movement of any threatened or migratory fauna and would not isolate any areas of habitat.

Specific mitigation measures are recommended to minimise likely impacts on biodiversity values. These measures are presented according to the hierarchy of avoidance and mitigation of impacts, and the identification of residual impacts of the proposal that cannot be avoided or mitigated. The proposal will include, as a minimum, industry-standard measures for the management of soil, surface water, weeds and pollutants, as well as site-specific measures for the management of flora and fauna.

The proposal may result in residual indirect impacts through light spill and noise and vibration generation causing displacement of threatened species and other native fauna from habitat adjoining the proposal site. The proposal would result in residual prescribed impacts through the removal or modification of vegetation within habitat corridors, minor changes to surface water flows and a moderate risk of vehicle strike causing harm to threatened fauna species and other native fauna using habitats in the vicinity of the proposal site. These residual impacts are likely to be minor in intensity and consequence and so no offsets are proposed.

A BAM assessment and credit calculations have been performed in accordance with the methodology (DPIE 2020a) and using credit calculator version 1.4.0.00 incorporating version 1.2 'wet year' benchmarks. A total of 256 ecosystem credits for impacts on PCT 143 - Narrow-leaved Hopbush - Scrub Turpentine - Senna shrubland on semi-arid and arid sandplains and dunes would need to be retired to offset residual impacts of the proposal. Removal of habitat for additional threatened species that were recorded at the study area and/or identified as potentially impacted would be offset through the retirement of ecosystem credits for PCT 143. No species credit matters were recorded or are assumed present at the proposal site.

Impacts on the Southern Whiteface and other threatened species listed under the EPBC Act resulting from the proposal have been assessed in accordance with the *Matters of National Environmental Significance Significant impact guidelines 1.1 Environment Protection and Biodiversity Conservation Act 1999* (DotE 2013). The proposal is unlikely to have a significant impact on any threatened or migratory species. No additional assessment or approval under the EPBC Act is likely to be required.



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# **Appendix A**

## **Threatened species assessment**

Table A.1 Threatened species likelihood of occurrence assessment

Group	Scientific Name	Common Name	NSW Status	EPBC Act Status	Records	Distribution and habitat association	Credit type	Likelihood of occurrence	Likelihood of impact
Bird	<i>Actitis hypoleucos</i>	Common Sandpiper		C,J,K	Species or species habitat may occur within 10km (DCCEEW 2022)	Does not breed in Australia. When in Australia it is found on all coastlines and in inland areas, but is concentrated in the north and west with important areas in WA, the NT and Qld. Utilises a wide range of coastal and inland wetlands with varying salinity levels.	N/A	Unlikely	Unlikely
Bird	<i>Amytornis barbatus barbatus</i>	Grey Grasswren	E	E	1 record within 10km (DPE 2022)	In NSW the Grey Grasswren is recorded from Caryapundy Swamp above the Bulloo Overflow (Bulloorine). Shelters, roosts, nests and feeds almost entirely within dense, tall Lignum, with associated Sandhill Canegrass ( <i>Zygochloa paradoxa</i> ) and sedges in swamps, overflow channels and flood pans. Old Man Saltbush communities close to Lignum are also heavily utilised at times. Also occurs in stands of Canegrass or Oldman Saltbush growing on surrounding sand dunes when the areas of Lignum become flooded. Not dependent on surface water and can persist in dense lignum habitat even if dry for several years.	Species	Possible	Possible

Group	Scientific Name	Common Name	NSW Status	EPBC Act Status	Records	Distribution and habitat association	Credit type	Likelihood of occurrence	Likelihood of impact
Bird	<i>Amytornis modestus obscurior</i>	Grey Range Thick-billed Grasswren	CE	V	Species or species habitat may occur within 10km (DCCEEW 2022)	Formerly occurred in central and western NSW, from the lower reaches of the Namoi River, south to Mossgiel. Generally thought to be extinct in NSW until recently located in the Packsaddle area. Sedentary, usually inhabiting dense, low saltbush, cottonbush, bluebush and nitre-bush areas on sandy plains or depressions in gibber; also occurs along watercourses in clumps of Canegrass.	Species	Unlikely	Unlikely
Bird	<i>Aphelocephala leucopsis</i>	Southern Whiteface		V	Species or species habitat known to occur within 10 km (DCCEEW 2023)	The species occurs across most of mainland Australia south of the tropics. Southern whitefaces live in a wide range of open woodlands and shrublands where there is an understorey of grasses or shrubs, or both.	N/A	Present	Likely
Bird	<i>Apus pacificus</i>	Fork-tailed Swift		C,J,K	2 records within 10km (DPE 2022); Species or species habitat likely to occur within 10km (DCCEEW 2022)	Almost exclusively aerial, flying from less than 1 m to at least 300 m above ground and probably much higher. Many records occur east of the Great Divide, however, a few populations have been found west of the Great Divide. Mostly occur over inland plains but sometimes above foothills or in coastal areas. Mostly found over dry or open habitats, including riparian woodland and tea-tree swamps, low scrub, heathland or saltmarsh. Also found at treeless grassland and sandplains covered with spinifex, open farmland and inland and coastal sand-dunes. Sometimes occur above rainforests, wet sclerophyll	N/A	Possible	Possible



Group	Scientific Name	Common Name	NSW Status	EPBC Act Status	Records	Distribution and habitat association	Credit type	Likelihood of occurrence	Likelihood of impact
						forest or open forest or plantations of pines. Also found over settled areas, including towns, urban areas and cities.			
Bird	<i>Ardeotis australis</i>	Australian Bustard	E		17 records within 10km (DPE 2022)	Occurs in inland Australia. In NSW mainly found in the north-west corner, less often in the lower western and central west plains regions, with occasional vagrants east to the western slopes and riverine plain. Breeding confined to the north-west region. Mainly inhabits tussock and hummock grasslands, also occurs in low shrublands and low open grassy woodlands. Breeds on bare ground on low sandy ridges or stony rises in ecotones between grassland and shrubland cover. Travels long distances, presumably in response to habitat and climatic conditions.	Species	Possible (not recorded despite targeted survey)	Possible
Bird	<i>Calidris acuminata</i>	Sharp-tailed Sandpiper		C,J,K	4 records within 10km (DPE 2022); Species or species habitat may occur within 10km (DCCEEW 2022)	Spends the non-breeding season in Australia with small numbers occurring regularly in New Zealand. Most of the population migrates to Australia, mostly to the south-east and are widespread in both inland and coastal locations and in both freshwater and saline habitats. Many inland records are of birds on passage. In Australasia, prefers muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation. Breeds in northern Siberia.	N/A	Unlikely	Unlikely

Group	Scientific Name	Common Name	NSW Status	EPBC Act Status	Records	Distribution and habitat association	Credit type	Likelihood of occurrence	Likelihood of impact
Bird	<i>Calidris ferruginea</i>	Curlew Sandpiper	E	CE,C,J,K	Species or species habitat may occur within 10km (DCCEEW 2022)	Distributed around most of the Australian coastline. Occurs along the entire coast of NSW, particularly in the Hunter Estuary, and sometimes in freshwater wetlands in the Murray-Darling Basin. Inland records are probably mainly of birds pausing for a few days during migration. Breeds in Siberia and migrates to Australia for the non-breeding period, arriving in Australia between August and November, and departing between March and mid-April. Generally occupies littoral and estuarine habitats, and is mainly found in intertidal mudflats of sheltered coasts in NSW. Also occurs in non-tidal swamps, lakes and lagoons on the coast and sometimes inland. Forages in or at the edge of shallow water, occasionally on exposed algal mats or waterweed, or on banks of beach-cast seagrass or seaweed.	Species/ Ecosystem	Unlikely Nil for species credit matter - site not within areas mapped important habitat map	Unlikely

Group	Scientific Name	Common Name	NSW Status	EPBC Act Status	Records	Distribution and habitat association	Credit type	Likelihood of occurrence	Likelihood of impact
Bird	<i>Calidris melanotos</i>	Pectoral Sandpiper		J,K	Species or species habitat may occur within 10km (DCCEEW 2022)	Widespread but scattered records across NSW, east of the divide and in the Riverina and Lower Western regions. Breeds in the northern hemisphere. In Australasia, prefers shallow fresh to saline wetlands and is found at coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands. Usually in coastal or near-coastal habitats, and prefers wetlands with open mudflats and low emergent or fringing vegetation such as grass or samphire.	N/A	Unlikely	Unlikely
Bird	<i>Calidris ruficollis</i>	Red-necked Stint		C,J,K	1 record within 10km (DPE 2022)	Breeds in north-eastern Siberia and northern and western Alaska. Spend the southern summer months in Australia, except in the arid inland. Found on the coast, in sheltered inlets, bays, lagoons, estuaries, intertidal mudflats and protected sandy or coralline shores. May also be seen in saltworks, sewage farms, saltmarsh, shallow wetlands including lakes, swamps, riverbanks, waterholes, bore drains, dams, soaks and pools in saltflats, flooded paddocks or damp grasslands. Often seen in dense flocks, feeding or roosting.	N/A	Unlikely	Unlikely

Group	Scientific Name	Common Name	NSW Status	EPBC Act Status	Records	Distribution and habitat association	Credit type	Likelihood of occurrence	Likelihood of impact
Bird	<i>Calyptorhynchus banksii samueli</i>	Red-tailed Black-Cockatoo (inland subspecies)	V		1 record within 10km (DPE 2022)	The Red-tailed Black-Cockatoo (inland subspecies) is known to occur around watercourses and overflows of the Darling, Paroo, Bogan, Macquarie and Barwon Rivers extending in an arc along the Darling River from Wentworth (though rare south of Menindee) in the south to Bourke and thence through to Brewarrina in the north. It extends east to Walgett and perhaps Boggabilla on the Barwon and south through to the Macquarie Marshes. The species prefers Eucalyptus forest and woodlands, particularly river red gum and coolabah lined water courses. In the arid zone it usually occurs mainly near eucalypts along larger watercourses and associated Acacia and Casuarina woodlands nearby. Also utilise grasslands, scrublands, wetlands and vegetation on floodplains.	Species/ Ecosystem	Possible, paddock trees with hollows greater than 12 cm diameter and greater than 2 m above the ground AND any trees within riparian zones.	Possible

Group	Scientific Name	Common Name	NSW Status	EPBC Act Status	Records	Distribution and habitat association	Credit type	Likelihood of occurrence	Likelihood of impact
Bird	<i>Certhionyx variegatus</i>	Pied Honeyeater	V		14 records within 10km (DPE 2022)	Widespread throughout acacia, mallee and spinifex scrubs of arid and semi-arid Australia. Occasionally occurs further east, on the slopes and plains and the Hunter Valley, typically during periods of drought. Inhabits wattle shrub, primarily Mulga ( <i>Acacia aneura</i> ), mallee, spinifex and eucalypt woodlands, usually when shrubs are flowering; feeds on nectar, predominantly from various species of emu-bushes ( <i>Eremophila</i> spp.); also from mistletoes and various other shrubs (e.g. <i>Grevillea</i> spp.). Highly nomadic, following the erratic flowering of shrubs; can be locally common at times.	Ecosystem	Likely	Likely
Bird	<i>Circus assimilis</i>	Spotted Harrier	V		11 records within 10km (DPE 2022)	Occurs throughout the Australian mainland, except in densely forested or wooded habitats of the coast, escarpment and ranges. Individuals disperse widely in NSW and comprise a single population. Occurs in grassy open woodland including <i>Acacia</i> and mallee remnants, inland riparian woodland, grassland and shrub steppe. Found most commonly in native grassland, but also occurs in agricultural land, foraging over open habitats including edges of inland wetlands.	Ecosystem	Likely	Likely

Group	Scientific Name	Common Name	NSW Status	EPBC Act Status	Records	Distribution and habitat association	Credit type	Likelihood of occurrence	Likelihood of impact
Bird	<i>Climacteris picumnus victoriae</i>	Brown Treecreeper (eastern subspecies)	V		8 records within 10km (DPE 2022)	The western boundary of the species range runs approximately through Corowa, Wagga Wagga, Temora, Forbes, Dubbo and Inverell. Often found in eucalypt woodlands (including Box-Gum Woodland) and dry open forest of the inland slopes and plains inland of the Great Dividing Range; mainly inhabits woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey, sometimes with one or more shrub species. Also found in mallee and River Red Gum ( <i>Eucalyptus camaldulensis</i> ) Forest bordering wetlands with an open understorey of acacias, saltbush, lignum, cumbungi and grasses. Usually not found in woodlands with a dense shrub layer. Fallen timber is an important habitat component for foraging. Also recorded, though less commonly, in similar woodland habitats on the coastal ranges and plains.	Ecosystem	Possible	Possible



Group	Scientific Name	Common Name	NSW Status	EPBC Act Status	Records	Distribution and habitat association	Credit type	Likelihood of occurrence	Likelihood of impact
Bird	<i>Epthianura albifrons</i>	White-fronted Chat	V		1 record within 10km (DPE 2022)	Found mostly in temperate to arid climates and very rarely sub-tropical areas. Occurs mostly in the southern half of NSW, in damp open habitats along the coast, and near waterways in the western part of the state. Along the coastline, it is found predominantly in saltmarsh vegetation but also in open grasslands and sometimes in low shrubs bordering wetland areas. Typically usually found foraging on bare or grassy ground in wetland areas, singly or in pairs.	Ecosystem	Possible	Possible
Bird	<i>Falco hypoleucos</i>	Grey Falcon	E	V	12 records within 10km (DPE 2022); Species or species habitat known to occur within 10km (DCCEE 2022)	Sparsely distributed in NSW, chiefly throughout the Murray-Darling Basin, with the occasional vagrant east of the Great Dividing Range. Usually restricted to shrubland, grassland and wooded watercourses of arid and semi-arid regions, although it is occasionally found in open woodlands near the coast. Also occurs near wetlands where surface water attracts prey.	Ecosystem	Likely	Likely
Bird	<i>Falco subniger</i>	Black Falcon	V		2 records within 10km (DPE 2022)	Widely, but sparsely, distributed in NSW, mostly occurring in inland regions. Occurs in plains, grasslands, foothills, timbered watercourses, wetland environs, crops, and occasionally over towns and cities. Breeding occurs along timbered waterways in inland areas.	Ecosystem	Likely	Likely

Group	Scientific Name	Common Name	NSW Status	EPBC Act Status	Records	Distribution and habitat association	Credit type	Likelihood of occurrence	Likelihood of impact
Bird	<i>Gallinago hardwickii</i>	Latham's Snipe, Japanese Snipe		J,K, Bonn	Species or species habitat may occur within 10km (DCCEEW 2022)	Non-breeding migrant to the south east of Australia. Breeds in Japan and on the east Asian mainland. Seen in small groups or singly in freshwater wetlands on or near the coast, generally among dense cover. Found in any vegetation around wetlands, in sedges, grasses, lignum, reeds and rushes and also in saltmarsh and creek edges on migration. Also uses crops and pasture.	N/A	Nil	Nil
Bird	<i>Grantiella picta</i>	Painted Honeyeater	V	V	Species or species habitat may occur within 10km (DCCEEW 2022)	Nomadic species occurring at low densities throughout its range. Most commonly found on the inland slopes of the Great Dividing Range in NSW, where almost all breeding occurs. More likely to be found in the north of its distribution in winter. Inhabits Boree/ Weeping Myall ( <i>Acacia pendula</i> ), Brigalow ( <i>A. harpophylla</i> ) and Box-Gum Woodlands and Box-Ironbark Forests. Specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias. Prefers mistletoes of the genus <i>Amyema</i> .	Ecosystem	Possible, site contains mistletoes present at a density of greater than five mistletoes per hectare	Possible
Bird	<i>Grus rubicunda</i>	Brolga	V		2 records within 10km (DPE 2022)	Formerly found across Australia, except for the south-east corner, Tasmania and the south-western third of the country. Very sparse distribution across the southern part of its range. Dependent on wetlands for foraging, especially shallow swamps, but also feed in dry grassland, ploughed paddocks and even desert claypans.	Ecosystem	Unlikley	Unlikley

Group	Scientific Name	Common Name	NSW Status	EPBC Act Status	Records	Distribution and habitat association	Credit type	Likelihood of occurrence	Likelihood of impact
Bird	<i>Hamirostra melanosternon</i>	Black-breasted Buzzard	V		3 records within 10km (DPE 2022)	Sparsely found in areas of less than 500mm rainfall, from north-western NSW to the east coast. Lives in a range of inland habitats, especially along timbered watercourses which is the preferred breeding habitat. Also hunts over grasslands and sparsely timbered woodlands.	Species/ Ecosystem	Possible, site is within 40 m of riparian woodland on inland watercourses/ waterholes containing dead or dying eucalypts	Possible
Bird	<i>Hieraaetus morphnoides</i>	Little Eagle	V		6 records within 10km (DPE 2022)	Found throughout the Australian mainland excepting the most densely forested parts of the Dividing Range escarpment. Occurs as a single population throughout NSW. Occupies open eucalypt forest, woodland or open woodland. Also found in Sheoak or Acacia woodlands and riparian woodlands of inland NSW. Nests in tall living trees within a remnant patch, where pairs build a large stick nest in winter.	Species/ Ecosystem	Possible, site contains breeding habitat in live (occasionally dead) large old trees within suitable vegetation. No confirmed presence of a male and female; or female with nesting material; or an individual on a large stick nest in the top half of the tree canopy, despite targeted survey.	Possible

Group	Scientific Name	Common Name	NSW Status	EPBC Act Status	Records	Distribution and habitat association	Credit type	Likelihood of occurrence	Likelihood of impact
Bird	<i>Lophoictinia isura</i>	Square-tailed Kite	V		2 records within 10km (DPE 2022)	Ranges along coastal and subcoastal areas from south-western to northern Australia. Scattered records throughout NSW indicate that the species is a regular resident in the north, north-east and along the major west-flowing river systems. Summer breeding migrant to the south-east, including the NSW south coast, arriving in September and leaving by March. Found in a variety of timbered habitats including dry woodlands and open forests and shows a particular preference for timbered watercourses. Observed in stony country with a ground cover of chenopods and grasses, open acacia scrub and patches of low open eucalypt woodland in arid north-western NSW.	Species/ Ecosystem	Possible, no nest trees despite targeted survey	Possible
Bird	<i>Motacilla cinerea</i>	Grey Wagtail		C,J,K	Species or species habitat may occur within 10km (DCCEEW 2022)	Widespread species, found throughout Australia. Conspicuous inhabitant of freshwater systems, found in most treed habitats.	N/A	Possible, though not frequently recorded in inland Australia.	Possible
Bird	<i>Motacilla flava</i>	Yellow Wagtail		C,J,K	Species or species habitat may occur within 10km (DCCEEW 2022)	Occurs within Australia in open country habitat with disturbed ground and some water. Recorded in short grass and bare ground, swamp margins, sewage ponds, saltmarshes, playing fields, airfields, ploughed land and town lawns. Breeds in temperate Europe and Asia.	N/A	Unlikely. Restricted to coastal regions of Australia.	Unlikely

Group	Scientific Name	Common Name	NSW Status	EPBC Act Status	Records	Distribution and habitat association	Credit type	Likelihood of occurrence	Likelihood of impact
Bird	<i>Lophochroa leadbeateri</i>	Major Mitchell's Cockatoo	V	E	BAM C; Species or species habitat may occur within 10 km (DCCEEW 2023)	Occurs in arid and semi-arid NSW, regularly as far east as Bourke and Griffith and occasionally further east as vagrants. Inhabits a range of treed and treeless inland habitats within easy reach of water. Nests in tree hollows. Feeds mostly on the ground, especially on the seeds of native and exotic melons and on the seeds of species of saltbush, wattles and cypress pines.	Species/ Ecosystem	Possible	Possible
Bird	<i>Neophema chrysostoma</i>	Blue-winged Parrot		V	Species or species habitat known to occur within 10 km (DCCEEW 2023)	Breed on mainland Australia south of the Great Dividing Range in southern Victoria from Port Albert in Gippsland west to Nelson, occasionally in the far south-east of South Australia, and the north-western, central and eastern parts of Tasmania. A partial migrant, variable numbers of birds migrate across Bass Strait in winter. During the non-breeding period, from autumn to early spring, birds are recorded from northern Victoria, eastern South Australia, south-western Queensland and western New South Wales, with some reaching south-eastern New South Wales and eastern Victoria, particularly on the southern migration. They inhabit a range of habitats from coastal, sub-coastal and inland areas, through to semi-arid zones. They tend to favour grasslands and grassy woodlands, often found near wetlands both near the coast and in semi-arid zones. Habitat critical	N/A	Unlikely	Unlikely

Group	Scientific Name	Common Name	NSW Status	EPBC Act Status	Records	Distribution and habitat association	Credit type	Likelihood of occurrence	Likelihood of impact
						to the survival include: Foraging and staging habitats found from coastal, sub-coastal and inland areas, right through to semi-arid zones including: grasslands, grassy woodlands and semi-arid chenopod shrubland with native and introduced grasses, herbs and shrubs. Live and dead trees and stumps with suitable hollows within the breeding range.			
Bird	<i>Ninox connivens</i>	Barking Owl	V		1 record within 10km (DPE 2022)	Found throughout continental Australia except for the central arid regions. Occurs in a wide but sparse distribution in NSW. Core populations exist on the western slopes and plains and in some northeast coastal and escarpment forests. Sometimes extends home range into urban areas. Inhabit woodland and open forest, including fragmented remnants and partly cleared farmland. Flexible in its habitat use, hunting can extend in to closed forest and more open areas. Typically roosts in shaded portions of tree canopies, including tall midstorey trees with dense foliage such as Acacia and Casuarina species.	Species/ Ecosystem	Possible, study area (within 200m of site), contains living or dead trees with hollows greater than 20 cm diameter and greater than 4m above the ground.	Possible
Bird	<i>Oxyura australis</i>	Blue-billed Duck	V		5 records within 10km (DPE 2022)	Widespread in NSW, but most common in the southern Murray-Darling Basin area. Disperses during the breeding season to deep swamps up to 300 km away, and generally seen in coastal areas only during summer or in drier years. Prefers deep water in large permanent wetlands and swamps with dense aquatic vegetation.	Ecosystem	Unlikely	Unlikely

Group	Scientific Name	Common Name	NSW Status	EPBC Act Status	Records	Distribution and habitat association	Credit type	Likelihood of occurrence	Likelihood of impact
Bird	<i>Pedionomus torquatus</i>	Plains-wanderer	E	CE	Species or species habitat may occur within 10km (DCCEEW 2022)	Most records from an area of the western Riverina bounded by Hay and Narrandera on the Murrumbidgee River in the north, the Cobb Highway in the west, the Billabong Creek in the south, and Urana in the east. Lives in semi-arid, lowland native grasslands that typically occur on hard red-brown soils. Habitat structure appears to play a more important role than plant species composition. Preferred habitat of the Plains-wanderer typically comprises 50% bare ground, 10% fallen litter, and 40% herbs, forbs and grasses.	Species/ Ecosystem	Nil. Species credit if site within areas mapped important habitat map	Nil
Bird	<i>Phaps histrionica</i>	Flock Bronzewing	E		18 records within 10km (DPE 2022)	Patchily distributed and rarely observed in NSW. Likely to occur north of Broken Hill and west of Cobar when conditions are right. Observed in a variety of vegetation types, including grassy plains, saltbush, spinifex and open mulga. Its preferred habitat is tussock grassland, particularly Mitchell grassland.	Ecosystem	Possible	Possible



Group	Scientific Name	Common Name	NSW Status	EPBC Act Status	Records	Distribution and habitat association	Credit type	Likelihood of occurrence	Likelihood of impact
Bird	<i>Pomatostomus halli</i>	Hall's Babbler	V		3 records within 10km (DPE 2022)	Occurs in central-eastern Australia, from Cobar north into south-western Queensland, particularly along or west of the Warrego Rive. Recorded from the White Cliffs area through to the Culgoa River, Nocolche Nature Reserve, Sturt National Park and Mutawintji National Park. Inhabits dry Acacia scrub, mainly Mulga, with a grassy understorey including spinifex, on ridges and plains with either sandy or stony soils. Occasionally occurs in open dry Eucalyptus (Bimblebox) woodland, and mulga- or eucalypt-lined watercourses.	Ecosystem	Possible	Possible
Bird	<i>Rostratula australis</i>	Australian Painted Snipe	E	E	Species or species habitat may occur within 10km (DCCEEW 2022)	In NSW many records are from the Murray-Darling Basin including the Paroo wetlands, Lake Cowal, Macquarie Marshes, Fivebough Swamp and more recently, swamps near Balldale and Wanganella. Other important locations with recent records include wetlands on the Hawkesbury River, the Clarence and lower Hunter Valleys. Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber. Forages nocturnally on mud-flats and in shallow water.	Ecosystem	Unlikely	Unlikely

Group	Scientific Name	Common Name	NSW Status	EPBC Act Status	Records	Distribution and habitat association	Credit type	Likelihood of occurrence	Likelihood of impact
Bird	<i>Stictonetta naevosa</i>	Freckled Duck	V		3 records within 10km (DPE 2022)	Found primarily in south-eastern and south-western Australia, occurring as a vagrant elsewhere. Breeds in large temporary swamps created by floods in the Bulloo and Lake Eyre basins and the Murray-Darling system, particularly along the Paroo and Lachlan Rivers, and other rivers within the Riverina. Forced to disperse during extensive inland droughts when wetlands in the Murray River basin provide important habitat. May also occur as far as coastal NSW and Victoria during such times. Prefers permanent freshwater swamps and creeks with heavy growth of Cumbungi, Lignum or Tea-tree. During drier times they move from ephemeral breeding swamps to more permanent waters such as lakes, reservoirs, farm dams and sewage ponds.	Ecosystem	Unlikely	Unlikely
Mammal	<i>Chalinolobus picatus</i>	Little Pied Bat	V		7 records within 10km (DPE 2022)	Found in inland Queensland and NSW (including Western Plains and slopes) extending slightly into South Australia and Victoria. Occurs in dry open forest, open woodland, mulga woodlands, chenopod shrublands, cypress pine forest and mallee and Bimil box woodlands. The species is known to roost in caves, rock outcrops, mine shafts, tunnels, tree hollows and buildings.	Ecosystem	Present	Likely

Group	Scientific Name	Common Name	NSW Status	EPBC Act Status	Records	Distribution and habitat association	Credit type	Likelihood of occurrence	Likelihood of impact
Mammal	<i>Leggadina forresti</i>	Forrest's Mouse	V		11 records within 10km (DPE 2022)	In north west NSW, it has been recorded from Sturt National Park, Tibooburra, Fowler's Gap, Mutawintji National Park (as subfossil remains), and from near Wilcannia. The species has also recently been recorded from Ledknapper Nature Reserve, and Culgoa National Park near Weilmoringle. Forrest's Mouse occurs in arid and semi-arid plains habitats, especially tussock grassland and chenopod shrubland. Also mulga or savannah woodlands, claypans and sandy ridges.	Ecosystem	Likely	Likely
Mammal	<i>Pseudomys hermannsburgensis</i>	Sandy Inland Mouse	V		1 record within 10km (DPE 2022)	Widely but very sparsely distributed over the arid and semi-arid zones of inland Australia. NSW occurrences are only in the far north-west where it is known from seven widely-scattered localities including Fowlers Gap, Sturt National Park, Tibooburra, east of Enngonia, Mutawintji National Park (as subfossil remains), just east of Mutawintji National Park and near Kajuligah Nature Reserve (north of Ivanhoe). Occurs in a very wide range of open vegetation types including coolibah or Acacia woodlands, tall open shrublands (especially Mulga scrub) and hummock grasslands. Mostly on sands (plains and dunes) and sandy loams, but also in areas of cracking earth soils and gibber plains.	Ecosystem	Likely	Likely

Group	Scientific Name	Common Name	NSW Status	EPBC Act Status	Records	Distribution and habitat association	Credit type	Likelihood of occurrence	Likelihood of impact
Mammal	<i>Rattus villosissimus</i>	Long-haired Rat	V		5 records within 10km (DPE 2022)	The species has been recorded over vast areas of western NSW. Strongholds are north-west of NSW, with plagues spreading south and east along river channels. Sustained in mesic, densely vegetated sites. During plagues can be found in virtually all inland habitats.	Ecosystem	Likely	Likely
Mammal	<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail-bat	V		4 records within 10km (DPE 2022)	Wide-ranging species found across northern and eastern Australia. Rare visitor of south-western NSW in late summer and autumn. Scattered records of this species across the New England Tablelands and North West Slopes. Roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows. It forages in most habitats across its very wide range, with and without trees.	Ecosystem	Likely	Likely
Mammal	<i>Sminthopsis macroura</i>	Stripe-faced Dunnart	V		69 records within 10km (DPE 2022)	Found throughout much of inland central and northern Australia, extending into central and northern NSW. Rare on the NSW Central West Slopes and North West Slopes with the most easterly records of recent times located around Dubbo, Coonabarabran, Warialda and Ashford. Inhabits native dry grasslands and low dry shrublands, often along drainage lines where food and shelter resources tend to be better. Shelters in cracks in the soil, in grass tussocks or under rocks and logs.	Ecosystem	Likely	Likely

Group	Scientific Name	Common Name	NSW Status	EPBC Act Status	Records	Distribution and habitat association	Credit type	Likelihood of occurrence	Likelihood of impact
Reptile	<i>Antaresia stimsoni</i>	Stimson's Python	V		2 records within 10km (DPE 2022)	The Stimson's Python occurs in north-west NSW, from Bourke and Gundabooka National Park in the east to Broken Hill and Wilcannia in the south. It is a terrestrial and semi-arboreal species that inhabits a wide range of arid and semi-arid environments including rock outcrops, sandy plains and dunefields where it is associated with larger trees and termite mounds.	Species	Possible, site includes areas within 500m of rocks or gibber	Possible
Reptile	<i>Ctenotus brooksi</i>	Wedgesnout Ctenotus	V		1 records within 10km (DPE 2022)	In NSW, the species is known from few records, all from Sturt and Paroo-Darling National Parks. Occurs in arid and semi-arid habitats and may be highly specialised, as it has only be recorded from large unconsolidated sand dunes and not from the low consolidated red sand ridges. Prefers areas of loose sand interspersed with vegetation on and near the crests of dunes and in NSW it is probably restricted to habitats containing spinifex or other clumping grassland communities.	Ecosystem	Unlikely	Unlikely
Reptile	<i>Ctenotus pantherinus ocellifer</i>	Leopard Ctenotus	E		BAM C	In NSW, the subspecies is known from a single specimen collected west of Goodooga. Single specimen recorded from spinifex, <i>Triodia mitchelli</i> , habitat upon which it appears to rely. This habitat typically occurs on red sand country.	Species	Unlikely	Unlikely

Group	Scientific Name	Common Name	NSW Status	EPBC Act Status	Records	Distribution and habitat association	Credit type	Likelihood of occurrence	Likelihood of impact
Reptile	<i>Cyclodomorphus venustus</i>		E		4 records within 10km (DPE 2022)	Known from only three locations in NSW, all within Sturt National Park. Occurs on brown to grey cracking clay soils and stony plains in close proximity to ephemeral waterways where there is a grassy understorey.	Species	Possible	Possible
Reptile	<i>Demansia rimicola</i>	a whip snake	V		7 records within 10km (DPE 2022)	Previously collected in Tibooburra and the vicinity of Sturt National Park. Shelters under fallen timber, flat rocks, debris, in deep soil cracks, rock crevices, grass clumps, and animal burrows. Preferred habitats include open forests, woodlands or shrublands with an understorey of grass, shrubs or hummock grasslands on the slopes and plains.	Ecosystem	Possible	Possible
Reptile	<i>Diplodactylus platyurus</i>	Eastern Fat-tailed Gecko	E		2 records within 10km (DPE 2022)	In NSW, the species is known from a small number of specimens detected at three locations: Sturt National Park, Nocolèche Nature Reserve and Wanaaring Nature Reserve and a single record from Mutawintji National Park. Habitat constraints are unknown, although the species' rarity suggests that it is highly specialised in its use of habitat. The recent record collected from Sturt National Park was from riverine habitat (R.A. Sadler, pers. comm.). It is also known to shelter in vertical spider burrows and cracks in the ground.	Species	Possible	Possible

Group	Scientific Name	Common Name	NSW Status	EPBC Act Status	Records	Distribution and habitat association	Credit type	Likelihood of occurrence	Likelihood of impact
Reptile	<i>Lucasium stenodactylum</i>	Crowned Gecko	V		2 records within 10km (DPE 2022)	Known from four separate locations in the far west of NSW: Sturt National Park, Mutawintji National Park, Loch Lilly, 125km south of Broken Hill, and Thurloo Downs, 145km east of Tibooburra. Habitat preferences largely unknown. Recorded from red sand habitats and elsewhere from savannah woodland and stony areas with shrubs in NSW.	Species	Present, camp site 1 Possible, not recorded despite targeted survey at camp site 2	Likely
Reptile	<i>Pseudonaja modesta</i>	Ringed Brown Snake	E		1 record within 10km (DPE 2022)	Thought to occupy the north-west portion of the state having been recorded from Tarawi Nature Reserve, 140km south of Broken Hill, Silverton, Tibooburra, Wanaaring and from Kilberoo, 140km north-west of Bourke. Large population in the Scotia Sanctuary-Tarawi NR region. Inhabits drier areas including rocky outcrops and dry watercourses. Occurs in a variety of vegetation types including woodlands, shrublands, mallee and grasslands. Shelters in ground debris or abandoned animal burrows by night.	Ecosystem	Likely	Likely



Group	Scientific Name	Common Name	NSW Status	EPBC Act Status	Records	Distribution and habitat association	Credit type	Likelihood of occurrence	Likelihood of impact
Reptile	<i>Tympanocryptis lineata</i>	Canberra Grassland Earless Dragon	CE	E	38 records within 10km (DPE 2022)	The only populations in NSW occur at Queanbeyan, and on the Monaro Basalt Plains between Cooma and south-west of Nimitabel. Restricted to a small number of Natural Temperate Grassland sites dominated by wallaby grasses ( <i>Nothodanthonia</i> spp.), spear grasses ( <i>Austrostipa</i> spp.), Poa Tussock ( <i>Poa sieberiana</i> ), Red Grass ( <i>Bothriochloa macra</i> ), and occasionally Kangaroo Grass ( <i>Themeda australis</i> ). Introduced pasture grasses occur at many of the sites supporting this species, which has also been captured in secondary grassland. In addition to tussocks, partially embedded surface rocks, and spider and insect holes are used for shelter. These are important micro-habitat elements within the grassland habitat. Rocks and arthropod holes provide important thermal refuges during temperature extremes. Within its habitat, apparently prefers areas with a more open structure, characterised by small patches of bare ground between the grasses and herbs.	Species	Unlikely	Unlikely

Group	Scientific Name	Common Name	NSW Status	EPBC Act Status	Records	Distribution and habitat association	Credit type	Likelihood of occurrence	Likelihood of impact
Plant	<i>Acacia carneorum</i>	Purple-wood Wattle	V	V	BAM C	Occurs in the far western plains, south from west of Tibooburra to the Menindee area in NSW. Grows in grassland and woodland in red, sandy soil. The species is also found in Mulga communities on sand dunes, level sandy sites and alluvial accumulations along watercourses. Recorded from inland semi-arid Acacia and Casuarina shrublands and woodlands.	Species	Possible, not recorded despite targeted survey	Possible
Plant	<i>Atriplex infrequens</i>		V	V	BAM C	Confined to the NSW far western plains. North western records recorded from east of Tibooburra, south east of Brewarrina and near Wilcannia with isolated collections from the Pooncarie area in the south. <i>Atriplex infrequens</i> is associated with broad drainage tracts, clay flats and possibly occasionally inundated habitats.	Species	Possible, not recorded despite targeted survey	Possible
Plant	<i>Atriplex sturtii</i>	A saltbush	E		3 records within 10km (DPE 2022)	Occurs in the far north-western plains of NSW including Tibooburra, Yantara and Cobham Lakes south-east of Milparinka and along the eastern side of Caryapundy Swamp on the Bulloo River Overflow near the Qld border. Associated species include <i>Eragrostis australasica</i> , <i>Muehlenbeckia</i> species and <i>Atriplex lobativalvis</i> in a recently wet claypan. With <i>Tecticornis verrucosa</i> , <i>Eragrostis dielsii</i> and <i>Frankenia</i> species on claypans and margins at Rainbow Valley in the Northern Territory. <i>Atriplex sturtii</i> has also been recorded growing on a wombat hole, on an isolated gilgai in flat, open	Species	Possible, not recorded despite targeted survey	Possible

Group	Scientific Name	Common Name	NSW Status	EPBC Act Status	Records	Distribution and habitat association	Credit type	Likelihood of occurrence	Likelihood of impact
						chenopod gibber plain, and with taller shrubs including <i>Acacia oswaldii</i> .			
Plant	<i>Frankenia plicata</i>			E	Species or species habitat likely to occur within 10km (DCCEEW 2022)	<i>Frankenia plicata</i> occurs in South Australia, from north of Port Augusta along the Stuart Highway to the Northern Territory border and from Port Augusta north-east to Maree. Grows in a range of habitats, including on small hillside channels, which take the first run-off after rain. In the Simpson Desert, the species has been found predominantly from swales of loamy sands to clay. This species is found in a wide range of vegetation communities that have good drainage.	Species	Unlikely	Unlikely
Plant	<i>Grevillea kennedyana</i>	Flame Spider Flower	V	V	150 records within 10km (DPE 2022); Species or species habitat known to occur within 10km (DCCEEW 2022)	Rare in the far north-west corner of NSW, from a few locations on stony mesa slopes. The four NSW sites are located in the Grey Range on the Olive Downs escarpment, McDonalds Peak, Mount Wood Hills and Onepah Station. Associated with low sparse arid shrublands dominated by <i>Eremophila freelingii</i> , <i>Acacia tetragonophylla</i> and <i>Scaevola spinescens</i> , with <i>Grevillea kennedyana</i> typically in the tallest stratum. Canopy species include <i>Acacia aneura</i> , <i>A. cambagei</i> and <i>Atalaya hemiglauca</i> , with occasional <i>Casuarina pauper</i> . Grows in rocky sites on stony mesa slopes, steep jump-ups and dry rocky watercourses.	Species	Unlikely	Unlikely

Group	Scientific Name	Common Name	NSW Status	EPBC Act Status	Records	Distribution and habitat association	Credit type	Likelihood of occurrence	Likelihood of impact
Plant	<i>Indigofera leucotricha</i>	Silver Indigo	E		12 records within 10km (DPE 2022)	Restricted to rocky hills near Depot Glen, west of Milparinka in the far north-western plains of NSW. Grows mainly on rocky hill-slopes, ridges and creek beds. Soils are skeletal to shallow red loamy sands, on granite, ironstone or sandstone. Associated species at Depot Glen include <i>Eremophila freelingii</i> , <i>Ptilotus atriplicifolius</i> , <i>Ptilotus obovatus</i> and <i>Acacia tetragonophylla</i> . Interstate species include <i>Eremophila latrobei</i> , <i>Acacia aneura</i> , <i>Acacia.ligulata</i> , <i>Senna artemisioides</i> subsp. <i>helmsii</i> , <i>Crotalaria eremaea</i> , <i>Crotalaria cunninghamii</i> , <i>Scaevola depauperata</i> , <i>Triodia</i> and <i>Prostanthera</i> spp.	Species	Possible, not recorded despite targeted survey	Possible
Plant	<i>Ipomoea polymorpha</i>	Silky Cow-vine	E		BAM C	Restricted to the far north-western corner of NSW, occurring north from east of Tibooburra. Associated species include <i>Eucalyptus populnea</i> , Ironwood, <i>Melaleuca leucodendron</i> , <i>Eremophila freelingii</i> and <i>Senna oligophylla</i> . Grows in sandy, rarely clay, soils in open Acacia and Eucalyptus communities. It occurs in a variety of habitats including red sand ridges, small depressions and ephemeral creeks in Mulga communities.	Species	Possible, not recorded despite targeted survey	Possible

Group	Scientific Name	Common Name	NSW Status	EPBC Act Status	Records	Distribution and habitat association	Credit type	Likelihood of occurrence	Likelihood of impact
Plant	<i>Osteocarpum pentapterum</i>		Ex		2 records within 10km (DPE 2022)	<i>Osteocarpum pentapterum</i> is an uncommon species now presumed to be extinct in NSW. Its current distribution is throughout Queensland, South Australia and the Northern Territory.	Species	Unlikely	Unlikely
Plant	<i>Swainsona sericea</i>	Silky Swainson-pea	V		1 record within 10km (DPE 2022)	Occurs from the Northern Tablelands to the Southern Tablelands and further inland on the slopes and plains. One isolated record from far NW NSW. Found in Natural Temperate Grassland and Snow Gum Eucalyptus pauciflora Woodland on the Monaro, in Box-Gum Woodland in the Southern Tablelands and Southwest Slopes and sometimes found in association with cypress pines <i>Callitris</i> spp.	Species	Unlikely	Unlikely
Plant	<i>Xerothamnella parvifolia</i>	Small-leaved Little Dry Shrub	E	V	13 records within 10km (DPE 2022)	Very rare in NSW, being recorded only from Mt Poole north-west of Milparinka in the far north-western plains. Further searches of rocky hill-tops north from Broken Hill to the Queensland border have not yielded new records of the species. Grows in skeletal, fine sandy clays along ridge tops.	Species	Unlikely	Unlikely

Notes: V= vulnerable, E= endangered, CE= critically endangered, Ex= currently presumed extinct in NSW, C= listed as migratory under the China-Australia Migratory Bird Agreement (CAMBA), J= listed as migratory under the Japan-Australia Migratory Bird Agreement (JAMBA), K= listed as migratory under the Republic of Korea-Australia Migratory Bird Agreement (KAMBA)  
BAM-C = identified as a candidate or predicted threatened species by the BAM-C based on site data and information in the TBDC (DPE 2023a)  
See below for definitions of 'Likelihood of occurrence' and 'Likelihood of impact' categories

**Table A.2** *Threatened species likelihood of occurrence categories*

<b>Likelihood</b>	<b>Definition</b>
Present	Threatened species, population or community was recorded in the proposal site during surveys.
Likely	The proposal site is within the known area of occupancy of the species, population or community and suitable habitat occurs within the proposal site. Likely to be dependent on identified suitable habitat (ie for breeding or important life cycle periods such as winter flowering resources), and is known or likely to maintain resident populations in the proposal site. Also includes fauna species known or likely to visit the proposal site during regular seasonal movements or migration, or threatened flora that could potentially regenerate from the soil seed bank or become established from nearby populations.
Possible	The proposal site is within the known area of occupancy of the species, population or community but only marginal suitable habitat recorded as in a modified or degraded state. Fauna species are unlikely to maintain sedentary populations, however, may seasonally use resources within the proposal site opportunistically or during migration. The species is unlikely to be dependent (ie for breeding or important life cycle periods such as winter flowering resources) on habitat within the proposal site.
Unlikely	The proposal site is within the known area of occupancy of the species, population or community but there is no suitable habitat present. The species is dependent on specific vegetation types, habitat features or resources and its presence can be generally discounted based on the absence of these attributes from the proposal site. Fauna species may be an occasional visitor on a vagrant, short term or opportunistic basis.
Nil	The proposal site is outside the known area of occupancy of the species, population or community and there is no suitable habitat present. The species is dependent on specific vegetation types, habitat features or resources and its presence can be readily discounted based on the absence of these attributes from the proposal site. Given the distance of the proposal site from any known populations there is no chance of the species occurring even on a vagrant, short term or opportunistic basis.

**Table A.3** *Threatened species likelihood of impact categories*

<b>Likelihood</b>	<b>Definition</b>
Likely	Species recorded and/or known from the locality and/or; suitable habitat occurs within the proposal site. These species are likely to occur in the proposal site and the project may result in direct or indirect impacts on these species, including through the removal of habitat resources that may be relied upon by local populations of these species.
Possible	Species known or predicted to occur within the locality and low quality potentially suitable habitat occurs within the proposal site. These species may occur in the proposal site on a transitory, seasonal or opportunistic basis. The project may result in negligible direct or indirect impacts on these species, but would not remove any habitat resources that are relied upon by local populations of these species for their ongoing survival in the locality.
Unlikely	The proposal site is outside of the biota's known distribution and/or; suitable habitat not present within the proposal site.
Nil	The proposal would not result in any direct or indirect impacts on these species or their habitats. Threatened ecological communities not identified in the proposal site.

# **Appendix B**

**Species recorded in the study area**

Table B.1 Flora recorded in Plots 6,7,8,9,10,19

Family	Scientific name	Common name	Exotic	Plot 6 Cover	Plot 6 Abundance	Plot 7 Cover	Plot 7 Abundance	Plot 8 Cover	Plot 8 Abundance	Plot 9 Cover	Plot 9 Abundance	Plot 10 Cover	Plot 10 Abundance	Plot 19 Cover	Plot 19 Abundance
Aizoaceae	<i>Tetragonia eremaea</i>			0.1	3	0.2	20	0.1	5	0.1	20				
Amaranthaceae	<i>Ptilotus obovatus</i>	Smoke Bush				0.1	1	1	10	0.2	10	2	20		
Apiaceae	<i>Daucus glochidiatus</i>	Native Carrot										0.1	10		
Asphodelaceae	<i>Bulbine semibarbata</i>	Wild Onion				0.1	5	0.1	20			0.1	30		
Asteraceae	<i>Brachyscome ciliaris</i>	Variable Daisy		0.1	10	0.1	10	0.1	2	0.1	10	0.1	10	0.1	15
Asteraceae	<i>Calotis hispidula</i>	Bogan Flea				0.1	2	0.1	10						
Asteraceae	<i>Chrysocephalum apiculatum</i>	Common Everlasting		0.1	3										
Asteraceae	<i>Dichromochlamys dentatifolia</i>											0.1	1	0.1	2
Asteraceae	<i>Gnephosis arachnoidea</i>	Erect Yellow-heads		0.1	20			0.1	1	0.1	1				
Asteraceae	<i>Lemooria burkittii</i>	Wires-a-wool		0.1	200	30	300			5	300	0.1	500	2	100
Asteraceae	<i>Pterocaulon sphacelatum</i>	Applebush				0.2	3			0.1	1	0.2	1		
Asteraceae	<i>Rhodanthe floribunda</i>	Common White Sunray						0.1	1			0.1	1		
Asteraceae	<i>Rhodanthe pygmaea</i>	Pigmy Sunray								0.1	5				
Asteraceae	<i>Rutidosis helichrysoides</i>	Grey Wrinklewort				5	100			0.1	1	2	50		
Asteraceae	<i>Sonchus oleraceus</i>	Common Sowthistle	*					0.1	7						
Brassicaceae	<i>Lepidium papillosum</i>	Warty Peppergrass								0.1	5	0.1	5		
Brassicaceae	<i>Pachymitus cardaminoides</i>					0.1	2								
Brassicaceae	<i>Sisymbrium</i> spp.		*							0.1	1				



Family	Scientific name	Common name	Exotic	Plot 6 Cover	Plot 6 Abundance	Plot 7 Cover	Plot 7 Abundance	Plot 8 Cover	Plot 8 Abundance	Plot 9 Cover	Plot 9 Abundance	Plot 10 Cover	Plot 10 Abundance	Plot 19 Cover	Plot 19 Abundance
Campanulaceae	<i>Wahlenbergia tumidiflora</i>			0.1	5	0.1	20			0.1	20	0.1	100		
Chenopodiaceae	<i>Atriplex holocarpa</i>	Pop Saltbush		0.1	20							0.1	5	0.1	3
Chenopodiaceae	<i>Atriplex limbata</i>			0.1	20	0.5	20					0.1	5		
Chenopodiaceae	<i>Atriplex spongiosa</i>	Pop Saltbush		0.1	10									0.1	10
Chenopodiaceae	<i>Atriplex vesicaria</i>	Bladder Saltbush		0.1	1										
Chenopodiaceae	<i>Chenopodium desertorum</i>	Desert Goosefoot		0.1	1					0.1	1	0.5	2		
Chenopodiaceae	<i>Dissocarpus biflorus</i> var. <i>biflorus</i>			0.1	5							0.1	3		
Chenopodiaceae	<i>Dissocarpus paradoxus</i>	Cannonball Burr						0.1	2						
Chenopodiaceae	<i>Einadia nutans</i> subsp. <i>nutans</i>	Climbing Saltbush						0.1	1						
Chenopodiaceae	<i>Enchylaena tomentosa</i>	Ruby Saltbush						3	20			3	20		
Chenopodiaceae	<i>Maireana aphylla</i>	Cotton Bush						0.1	1						
Chenopodiaceae	<i>Maireana astrotricha</i>	Low Bluebush												1	1
Chenopodiaceae	<i>Maireana coronata</i>	Crown Fissure-weed		0.1	10	0.1	3			0.1	1				
Chenopodiaceae	<i>Maireana pyramidata</i>	Black Bluebush						5	20	3	15	0.1	1		
Chenopodiaceae	<i>Neobassia proceriflora</i>	Soda Bush		0.1	2							0.1	2		
Chenopodiaceae	<i>Osteocarpum acropterum</i>	Water Weed												0.2	20
Chenopodiaceae	<i>Rhagodia spinescens</i>	Thorny Saltbush				7	15	5	20			10	30		
Chenopodiaceae	<i>Salsola tragus</i>	Buckbush, Soft Rolpoly, Saltwort								0.1	1	0.3	30		
Chenopodiaceae	<i>Sclerolaena anisacanthoides</i>	Yellow Burr						0.1	1						

Family	Scientific name	Common name	Exotic	Plot 6 Cover	Plot 6 Abundance	Plot 7 Cover	Plot 7 Abundance	Plot 8 Cover	Plot 8 Abundance	Plot 9 Cover	Plot 9 Abundance	Plot 10 Cover	Plot 10 Abundance	Plot 19 Cover	Plot 19 Abundance
Chenopodiaceae	<i>Sclerolaena bicornis</i>	Goathead Burr										1	50		
Chenopodiaceae	<i>Sclerolaena bicornis</i> var. <i>bicornis</i>			0.1	1			0.1	1						
Chenopodiaceae	<i>Sclerolaena bicornis</i> var. <i>horrida</i>	Goathead Burr		0.1	5	0.2	10	3	50	2	30			0.5	20
Chenopodiaceae	<i>Sclerolaena decurrens</i>	Green Copperburr		0.2	30	0.1	10	0.1	1	0.1	2	0.1	3	0.1	2
Chenopodiaceae	<i>Sclerolaena diacantha</i>	Grey Copperburr										0.1	10		
Chenopodiaceae	<i>Sclerolaena divaricata</i>	Tangled Copperburr		0.1	10	0.5	20	1	20	0.1	30	0.3	20	0.1	1
Chenopodiaceae	<i>Sclerolaena intricata</i>	Poverty Bush		0.2	20	0.2	10			0.5	10	0.1	5		
Chenopodiaceae	<i>Sclerolaena lanicuspis</i>	Woolly Copperburr		0.1	5	0.1	5			0.1	2				
Chenopodiaceae	<i>Sclerolaena muricata</i>	Black Rolypoly						0.1	5	0.1	5				
Chenopodiaceae	<i>Sclerolaena ventricosa</i>	Salt Copperburr		0.1	10	0.3	100	1	20			0.1	30	0.3	20
Chenopodiaceae	<i>Salsola australis</i>													0.1	1
Convolvulaceae	<i>Convolvulus clementii</i>	Desert Bindweed										0.1	2		
Convolvulaceae	<i>Evolvulus alsinoides</i>	Bindweed		0.1	1	0.1	1					0.1	50	0.1	1
Convolvulaceae	<i>Convolvulus remotus</i>													0.1	1
Cucurbitaceae	<i>Citrullus lanatus</i> var. <i>lanatus</i>	Wild Melon, Camel Melon, Bitter	*									0.1	1		
Cyperaceae	<i>Isolepis</i> spp.	Club-rush												0.1	1
Euphorbiaceae	<i>Chamaesyce drummondii</i>	Caustic Weed				0.1	20	0.1	20	0.1	20	0.1	10	0.1	20
Fabaceae (Caesalpinioideae)	<i>Senna artemisioides</i> <--> <i>zygophylla</i>			1	5	5	10	0.1	1			0.1	2	2	10

Family	Scientific name	Common name	Exotic	Plot 6 Cover	Plot 6 Abundance	Plot 7 Cover	Plot 7 Abundance	Plot 8 Cover	Plot 8 Abundance	Plot 9 Cover	Plot 9 Abundance	Plot 10 Cover	Plot 10 Abundance	Plot 19 Cover	Plot 19 Abundance
Fabaceae (Caesalpinioideae)	<i>Senna form taxon 'helmsii'</i>	Blunt-leaved Cassia		1	5										
Fabaceae (Caesalpinioideae)	<i>Senna phyllodinea</i>			5	50										
Fabaceae (Faboideae)	<i>Lotus cruentus</i>	Red-flowered Lotus										0.1	3		
Fabaceae (Faboideae)	<i>Swainsona oligophylla</i>											0.1	1		
Fabaceae (Faboideae)	<i>Swainsona purpurea</i>			0.1	7	0.5	30			0.1	100	0.1	10		
Fabaceae (Mimosoideae)	<i>Acacia cambagei</i>	Gidgee						20	8						
Fabaceae (Mimosoideae)	<i>Acacia victoriae</i>					5	20					1	1	0.3	1
Haloragaceae	<i>Haloragis aspera</i>	Rough Raspwort				1	50								
Malvaceae	<i>Sida ammophila</i>	Sand Sida				0.3	10								
Malvaceae	<i>Sida corrugata</i>	Corrugated Sida		0.1	2										
Malvaceae	<i>Sida fibulifera</i>	Pin Sida												0.2	20
Malvaceae	<i>Sida spp.</i>					0.1	1	0.5	20						
Malvaceae	<i>Sida spp.</i>		*							0.3	10	0.1	1		
Nyctaginaceae	<i>Boerhavia dominii</i>	Tarvine				0.3	50					0.1	100	0.1	5
Phyllanthaceae	<i>Phyllanthus lacunellus</i>					0.1	2					0.1	5		
Poaceae	<i>Aristida contorta</i>	Bunched Kerosene Grass		0.5	200	5	200			2	100	5	200	1	50
Poaceae	<i>Aristida spp.</i>	A Wiregrass										0.1	1		
Poaceae	<i>Astrebla lappacea</i>	Curly Mitchell Grass				0.1	30								
Poaceae	<i>Enneapogon avenaceus</i>	Bottle Washers		0.2	20	0.5	30	2	100	1	100	2	100	0.3	50
Poaceae	<i>Enteropogon acicularis</i>	Curly Windmill Grass										0.1	1		

Family	Scientific name	Common name	Exotic	Plot 6 Cover	Plot 6 Abundance	Plot 7 Cover	Plot 7 Abundance	Plot 8 Cover	Plot 8 Abundance	Plot 9 Cover	Plot 9 Abundance	Plot 10 Cover	Plot 10 Abundance	Plot 19 Cover	Plot 19 Abundance
Poaceae	<i>Eragrostis dielsii</i>	Mallee Lovegrass		0.1	5									0.1	3
Poaceae	<i>Eragrostis lacunaria</i>	Purple Lovegrass										0.1	2		
Poaceae	<i>Eragrostis setifolia</i>	Neverfail		0.2	50	0.5	20	0.1	20	0.5	20			1	100
Poaceae	<i>Panicum decompositum</i>	Native Millet				0.1	5								
Poaceae	<i>Panicum effusum</i>	Hairy Panic				0.1	2					0.1	3		
Poaceae	<i>Tragus australianus</i>	Small Burrgrass						0.1	1						
Poaceae	<i>Aristida anthoxanthoides</i>			10	300			1	50	2	100	0.1	20		
Poaceae	<i>Tripogonella loliformis</i>	Fiveminute Grass												0.5	100
Poaceae	<i>Enneapogon</i> spp.	Nineawn Grass, Bottlewashers												0.1	5
Portulacaceae	<i>Portulaca oleracea</i>	Pigweed		0.1	10	0.1	10	0.1	10	0.1	50	0.1	20	0.2	30
Proteaceae	<i>Hakea leucoptera</i>	Needlewood				1	2								
Santalaceae	<i>Santalum lanceolatum</i>	Northern Sandalwood				2	5								
Sapindaceae	<i>Atalaya hemiglauca</i>	Whitewood						2	7						
Solanaceae	<i>Solanum esuriale</i>	Quena										0.1	1		
Thymelaeaceae	<i>Pimelea microcephala</i> subsp. <i>microcephala</i>	Shrubby Rice-flower				0.5	1								
Thymelaeaceae	<i>Pimelea trichostachya</i>			0.1	5										

Notes- Cover: 0.1, 0.2, 0.3...1, 2, 3...10, 15, 20, 25...100%

Table B.2 Flora recorded in Plot 20

Family	Scientific name	Common name	Exotic	Plot 20 Cover	Plot 20 Abundance
Aizoaceae	<i>Tetragonia eremaea</i>			0.2	30
Apiaceae	<i>Daucus glochidiatus</i>	Native Carrot		0.1	10
Asphodelaceae	<i>Bulbine alata</i>	Native Onion		0.1	30
Asteraceae	<i>Brachyscome ciliaris</i>	Variable Daisy		0.5	100
Asteraceae	<i>Calotis hispidula</i>	Bogan Flea		0.2	20
Asteraceae	<i>Gnephosis arachnoidea</i>	Erect Yellow-heads		0.15	100
Asteraceae	<i>Myriocephalus pluriflorus</i>	Woolly-heads		5	1000
Asteraceae	<i>Pycnosorus pleiocephalus</i>			0.1	1
Asteraceae	<i>Brachyscome lineariloba</i>	Hard-headed Daisy		0.1	10
Asteraceae	<i>Rutidosia helichrysoides</i>	Grey Wrinklewort		1	30
Brassicaceae	<i>Lepidium papillosum</i>	Warty Peppergrass		0.1	5
Brassicaceae	<i>Lepidium phlebopetalum</i>	Veined Peppergrass		0.1	20
Brassicaceae	<i>Lepidium oxytrichum</i>			0.1	10
Brassicaceae	<i>Sisymbrium irio</i>	London Rocket	*	1	100
Brassicaceae	<i>Stenopetalum lineare</i>	Threadgrass		0.1	1
Chenopodiaceae	<i>Atriplex angulata</i>	Fan Saltbush		0.5	10
Chenopodiaceae	<i>Atriplex holocarpa</i>	Pop Saltbush		5	1000
Chenopodiaceae	<i>Atriplex limbata</i>			0.2	2
Chenopodiaceae	<i>Atriplex lindleyi</i>	Eastern Flat-top Saltbush		0.1	1
Chenopodiaceae	<i>Maireana aphylla</i>	Cotton Bush		1	2
Chenopodiaceae	<i>Maireana coronata</i>	Crown Fissure-weed		0.1	1
Chenopodiaceae	<i>Osteocarpum acropterum</i>	Water Weed		1	20
Chenopodiaceae	<i>Sclerolaena bicornis var. bicornis</i>			2	50
Chenopodiaceae	<i>Sclerolaena decurrens</i>	Green Copperburr		0.3	10
Chenopodiaceae	<i>Sclerolaena intricata</i>	Poverty Bush		1	20
Chenopodiaceae	<i>Sclerolaena ventricosa</i>	Salt Copperburr		2	30

Family	Scientific name	Common name	Exotic	Plot 20 Cover	Plot 20 Abundance
Chenopodiaceae	<i>Dissocarpus biflorus</i>	Twin-horned Cpperburr		2	30
Fabaceae (Faboideae)	<i>Lotus cruentus</i>	Red-flowered Lotus		0.1	2
Fabaceae (Faboideae)	<i>Medicago minima</i>	Woolly Burr Medic	*	2	500
Fabaceae (Faboideae)	<i>Swainsona oligophylla</i>			0.1	1
Fabaceae (Mimosoideae)	<i>Acacia victoriae</i>			0.5	1
Malvaceae	<i>Sida spp.</i>		*	0.1	1
Myoporaceae	<i>Eremophila bignoniiflora</i>	Eurah		0.5	1
Plantaginaceae	<i>Plantago drummondii</i>	Dark Sago-weed		1	2000
Poaceae	<i>Eragrostis spp.</i>	A Lovegrass	*	0.5	20
Poaceae	<i>Tripogon loliiformis</i>	Fiveminute Grass		1	100
Gentianaceae	<i>Centaurium spp.</i>		*	0.1	1

Table B.3 Fauna recorded in the study area

Family	Common name	Scientific name	Exotic	BC Act Status	EPBC Status
<b>Frogs</b>					
Hylidae	Desert Tree Frog	<i>Litoria rubella</i>			
Hylidae	Green Tree Frog	<i>Litoria caerulea</i>			
<b>Birds</b>					
Acanthizidae	Chestnut-rumped Thornbill	<i>Acanthiza uropygialis</i>			
Acanthizidae	Southern Whiteface	<i>Aphelocephala leucopsis</i>			
Acanthizidae	Weebill	<i>Smicronis brevirostris</i>			
Acanthizidae	Western Gerygone	<i>Gerygone fusca</i>			
Acanthizidae	Yellow-rumped Thornbill	<i>Acanthiza chrysorrhoa</i>			
Accipitridae	Black Kite	<i>Milvus migrans</i>			
Accipitridae	Black-breasted Buzzard	<i>Hamirostra melanosternon</i>		V	
Accipitridae	Spotted Harrier	<i>Circus assimilis</i>		V	

Family	Common name	Scientific name	Exotic	BC Act Status	EPBC Status
Accipitridae	Wedge-tailed Eagle	<i>Aquila audax</i>			
Aegothelidae	Australian Owlet-nightjar	<i>Aegotheles cristatus</i>			
Alcedinidae	Red-backed Kingfisher	<i>Todiramphus pyrrhopygius</i>			
Alcedinidae	Sacred Kingfisher	<i>Todiramphus sanctus</i>			
Artamidae	Australian Magpie	<i>Cracticus tibicen</i>			
Artamidae	Black-faced Woodswallow	<i>Artamus cinereus</i>			
Artamidae	Dusky Woodswallow	<i>Artamus cyanopterus cyanopterus</i>		V	
Artamidae	Grey Butcherbird	<i>Cracticus torquatus</i>			
Artamidae	Masked Woodswallow	<i>Artamus personatus</i>			
Artamidae	Pied Butcherbird	<i>Cracticus nigrogularis</i>			
Artamidae	White-breasted Woodswallow	<i>Artamus leucorhynchus</i>			
Cacatuidae	Cockatiel	<i>Nymphicus hollandicus</i>			
Cacatuidae	Galah	<i>Eolophus roseicapillus</i>			
Cacatuidae	Little Corella	<i>Cacatua sanguinea</i>			
Cacatuidae	Sulphur-crested Cockatoo	<i>Cacatua galerita</i>			
Campephagidae	Black-faced Cuckoo-shrike	<i>Coracina novaehollandiae</i>			
Campephagidae	White-winged Triller	<i>Lalage sueurii</i>			
Casuariidae	Emu	<i>Dromaius novaehollandiae</i>			
Columbidae	Common Bronzewing	<i>Phaps chalcoptera</i>			
Columbidae	Crested Pigeon	<i>Ocyphaps lophotes</i>			
Columbidae	Diamond Dove	<i>Geopelia cuneata</i>			
Columbidae	Peaceful Dove	<i>Geopelia striata</i>			
Corvidae	Australian Raven	<i>Corvus coronoides</i>			
Cuculidae	Horsfield's Bronze-Cuckoo	<i>Chalcites basalis</i>			
Estrildidae	Zebra Finch	<i>Taeniopygia guttata</i>			
Falconidae	Australian Hobby	<i>Falco longipennis</i>			
Falconidae	Black Falcon	<i>Falco subniger</i>		V	

Family	Common name	Scientific name	Exotic	BC Act Status	EPBC Status
Falconidae	Brown Falcon	<i>Falco berigora</i>			
Hirundinidae	White-backed Swallow	<i>Cheramoeca leucosterna</i>			
Maluridae	Variegated Fairy-wren	<i>Malurus lamberti</i>			
Maluridae	White-winged Fairy-wren	<i>Malurus leucopterus</i>			
Megaluridae	Rufous Songlark	<i>Cincloramphus mathewsi</i>			
Meliphagidae	Crimson Chat	<i>Epthianura tricolor</i>			
Meliphagidae	Singing Honeyeater	<i>Gavicalis virescens</i>			
Meliphagidae	Spiny-cheeked Honeyeater	<i>Acanthagenys rufogularis</i>			
Meliphagidae	White-plumed Honeyeater	<i>Ptilotula penicillatus</i>			
Meliphagidae	Yellow-throated Miner	<i>Manorina flavigula</i>			
Meropidae	Rainbow Bee-eater	<i>Merops ornatus</i>			
Monarchidae	Magpie-lark	<i>Grallina cyanoleuca</i>			
Motacillidae	Australian Pipit	<i>Anthus novaeseelandiae</i>			
Pachycephalidae	Crested Bellbird	<i>Oreoica gutturalis</i>			
Pachycephalidae	Grey Shrike-thrush	<i>Colluricincla harmonica</i>			
Pachycephalidae	Rufous Whistler	<i>Pachycephala rufiventris</i>			
Petroicidae	Red-capped Robin	<i>Petroica goodenovii</i>			
Pomatostomidae	Chestnut-crowned Babbler	<i>Pomatostomus ruficeps</i>			
Psittacidae	Australian Ringneck	<i>Barnardius zonarius</i>			
Psittacidae	Blue Bonnet	<i>Northiella haematogaster</i>			
Psittacidae	Bourke's Parrot	<i>Neopsephotus bourkii</i>			
Psittacidae	Budgerigar	<i>Melopsittacus undulatus</i>			
Psittacidae	Mulga Parrot	<i>Psephotus varius</i>			
Psophodidae	Chirruping Wedgebill	<i>Psophodes cristatus</i>			
Rhipiduridae	Willie Wagtail	<i>Rhipidura leucophrys</i>			
Tytonidae	Eastern Barn Owl	<i>Tyto javanica</i>			



Family	Common name	Scientific name	Exotic	BC Act Status	EPBC Status
<b>Mammals</b>					
Bovidae	Goat	<i>Capra hircus</i>	*		
Canidae	Fox	<i>Vulpes vulpes</i>	*		
Dasyuridae	Fat-tailed Dunnart	<i>Sminthopsis crassicaudata</i>			
Macropodidae	Red Kangaroo	<i>Macropus rufus</i>			
Tachyglossidae	Short-beaked Echidna	<i>Tachyglossus aculeatus</i>			
<b>Reptiles</b>					
Agamidae	Central Bearded Dragon	<i>Pogona vitticeps</i>			
Agamidae	Central Netted Dragon	<i>Ctenophorus nuchalis</i>			
Elapidae	Strap-snouted Brown Snake	<i>Pseudonaja aspidorhyncha</i>			
Gekkonidae	Bynoe's Gecko	<i>Heteronotia binoei</i>			
Gekkonidae	Gibber Gecko	<i>Lucasium byrnei</i>			
Gekkonidae	Tree Dtella	<i>Gehyra versicolor</i>			
Pythonidae	Murray/Darling Carpet Python	<i>Morelia spilota metcalfei</i>			
Scincidae		<i>Ctenotus</i> sp.			
Scincidae	Gidgee Skink	<i>Egernia stokesii</i>			

Notes: x= recorded, v= vulnerable species under the BC Act

# **Appendix C**

**Vegetation integrity plot data**

Table C.1 Vegetation integrity plots - Composition and structure data

Veg zone	PCT	Condition	Plot	Composition (number of species)							Structure (% cover)					
				TG	SG	GG	FG	EG	OG	Total	TG	SG	GG	FG	EG	OG
	<b>131</b>		<b>Benchmark</b>	<b>2</b>	<b>15</b>	<b>4</b>	<b>6</b>	<b>0</b>	<b>1</b>	<b>28</b>	<b>7</b>	<b>38</b>	<b>1</b>	<b>11</b>	<b>0</b>	<b>0</b>
	131	Good	8	2	15	4	10	0	0	31	22.0	19.8	3.2	1.4	0.0	0.0
	<b>143</b>		<b>Benchmark</b>	<b>1</b>	<b>14</b>	<b>7</b>	<b>13</b>	<b>0</b>	<b>1</b>	<b>36</b>	<b>0</b>	<b>25</b>	<b>16</b>	<b>6</b>	<b>0</b>	<b>0</b>
1	143	Good	6	0	16	5	13	0	0	34	0.0	8.5	11.0	1.3	0.0	0.0
1	143	Good	7	0	14	6	19	0	0	39	0.0	22.1	6.3	39.0	0.0	0.0
1	143	Good	10	0	16	7	21	0	1	45	0.0	18.9	7.5	4.1	0.0	0.1
	<b>143</b>		<b>Benchmark</b>	<b>1</b>	<b>14</b>	<b>7</b>	<b>13</b>	<b>0</b>	<b>1</b>	<b>36</b>	<b>0</b>	<b>25</b>	<b>16</b>	<b>6</b>	<b>0</b>	<b>0</b>
2	143	Poor	19	0	8	6	10	0	1	25	0.0	2.6	2.8	3.1	0.0	0.1
2	143	Poor	20	0	8	2	22	0	0	32	0.0	6.9	1.5	15.5	0.0	0.0

Notes: Benchmark data are Version 1.2 wet year benchmarks. Function data is not required in BAM-Calculations for PCT 131 or PCT 143 but is presented to inform a general description of the site. TG=Tree growth form group; SG=Shrub; GG=Grass and grass-like; FG=forb; EG=Fern; OG=Other (palms, cycads and vines).

Table C.2 Vegetation integrity plots – Function and location data

Veg zone	PCT	Condition	Plot	Large trees	Hollow trees	Litter cover (%)	Fallen logs (m)	Tree regen	Tree DBH 5-10 (cm)	Tree DBH 10-20 (cm)	Tree DBH 20-30 (cm)	Tree DBH 30-50 (cm)	Tree DBH 50-80 (cm)	HTE cover (total)	Zone	Easting	Northing	Bearing
	<b>131</b>	<b>Benchmark</b>		<b>1</b>		<b>25</b>	<b>26</b>											
	131	Good	8	5		12	13	1	1	1	1	1	1	0	54	613110	6737695	55
	<b>143</b>	<b>Benchmark</b>		<b>0</b>		<b>23</b>	<b>18</b>											
	143	Good	6	0	0	5	0	0	0	0	0	0	0	0	54	613100	6737826	155
1	143	Good	7	0	0	28	2	1	1	0	0	0	0	0	54	613295	6737862	145
1	143	Good	10	0	0	63	8	0	1	0	0	0	0	0	54	613360	6737878	150
1	<b>143</b>	<b>Benchmark</b>				<b>23</b>	<b>18</b>											
	143	Poor	19	0	0	6.0	0	0	0	0	0	0	0	0	54	612957	6737861	65
2	143	Poor	20	0	0	10.0	0	0	0	0	0	0	0	0	54	612955	6737680	180

Notes: Notes: Benchmark data are Version 1.2 wet year benchmarks. Function data is not required in BAM-Calculations for PCT 131 or PCT 143 but is presented to inform a general description of the site. For Tree regen and Tree stem size classes 1 = present, 0 = absent. HTE = High Threat Exotic.

# **Appendix D**

**Bat call analysis results**

## D-1 Analysis method

Bat calls were recorded during field surveys using Anabat Express Zero Crossing detectors (Titley Scientific).

The zero crossing analysis file (zca file) recorded using the detector was converted to zc sequence files using Anabat Insight (version 2.0.6-3) for analysis and in order to add metadata (e.g. species label etc). During the conversion process a filter was applied to identify bat sequences and remove noise files. Noise files were moved to a separate folder for later checking.

The *Bat calls of NSW: Region based guide to the echolocation calls of microchiropteran bats* (Pennay et al. 2004) was used to assist call analysis. Call identification was also assisted by consulting distribution information for potential species (Pennay et al. 2011; Churchill 2008; Van Dyck et al. 2013) and records from BioNet (June 2023) and BatMap (June 2023). No reference calls were collected during the survey.

A call (pass) was defined as a sequence of three or more consecutive pulses of similar frequency and shape. Calls with less than three defined consecutive pulses of similar frequency and shape were not unambiguously identified to a species but were used as part of the activity count for the survey area. Due to variability in the quality of calls and the difficulty in distinguishing some species the identification of each call was assigned a confidence rating (see Mills et al. 1996 & Duffy et al. 2000 for similar process) as summarised in Table D.1. Due to the absence of reference calls from the study area, high level of variability within a bat call and overlap in call characteristics between some species, a conservative approach was taken when analysing calls. Species nomenclature follows Armstrong et al. 2022.

Table D.1 Confidence ratings applied to calls

Identification	Description
D - Definite	Species identification not in doubt.
PR - Probable	Call most likely to represent a particular species, but there exists a low probability of confusion with species of similar call type or call lacks sufficient detail.
SG - Species Group	Call made by one of two or more species. Call characteristics overlap making it too difficult to distinguish between species for e.g. <i>Chalinolobus gouldii</i> / <i>Ozimops</i> sp.

## D-2 Analysis results

Table D.2 presents a summary of the species recorded at the site for the survey period as a result of the bat call analysis.

Four species were positively (Definite) identified of the 9 or so species that are known to occur from the locality of the study area. One species listed as vulnerable under the *Biodiversity Conservation Act 2016* was recorded at the proposal site – *Chalinolobus picatus* (see attachment 1 species call examples). Numerous d species group complex calls (*S. greyii*/*C. picatus*) were also recorded. It is more than likely that some of these calls were *C. picatus* however poor call quality and overlapping characteristics prevented definitive (D) identification.

As many as three other species may also have been recorded, but poor data quality (common for all nights reported with bat data) and/or interspecific call similarities precluded reliable identification of additional species. No data was recorded for detector sn434272 for the night of the 16/11/22. The log files for this detector was checked and the detector appeared to operate the entire night. Further examination of the raw zca file revealed no data within.

Table D.2 Summary of bat call analysis results

Species	Anabat 1 / SN528723 2022-11-16	Dracula / SN434272 2022-11-16
<i>Austronomus australis</i>		
<i>Chalinolobus gouldii</i>	D	
<i>Chalinolobus picatus</i>	D	
<i>Nyctophilus geoffroyi</i>	D	

Species	Anabat 1 / SN528723 2022-11-16	Dracula / SN434272 2022-11-16
<i>Ozimops petersi</i>		
<i>Scotorepens balstoni</i>		
<i>Scotorepens greyii</i>	D	
<i>C. gouldii/ S. balstoni</i>	SG	
<i>C. gouldii/O. petersi</i>		
<i>C. picatus/ S. greyii</i>	SG	
<i>S. balstoni/S. greyii</i>		
Other bat calls	Y	
Number of files	725	0
Number of species per night	4	0
Survey effort	10.5	10.5

**Table Notes:**

**Total number of species recorded for each night/site is based on definite (D) identification only. Total number of D species for each night includes one *Nyctophilus* species where recorded.** See Table 1 for confidence rating e.g. D or Pr

\*\* - given the absence of records for other *Nyctophilus* species from the locality a definitive (D) rating was applied to all candidate long-eared bat calls

Other bat calls – incomplete single pulses, call sequences consisting of incomplete, fragmented pulses lacking key diagnostic features  
ce, e, v - species listed under the *NSW Biodiversity Conservation Act 2016*.

CE, E, VU – species listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

Survey effort: estimate of time between sunset and sunrise for a successful night of Anabat detection.

## References

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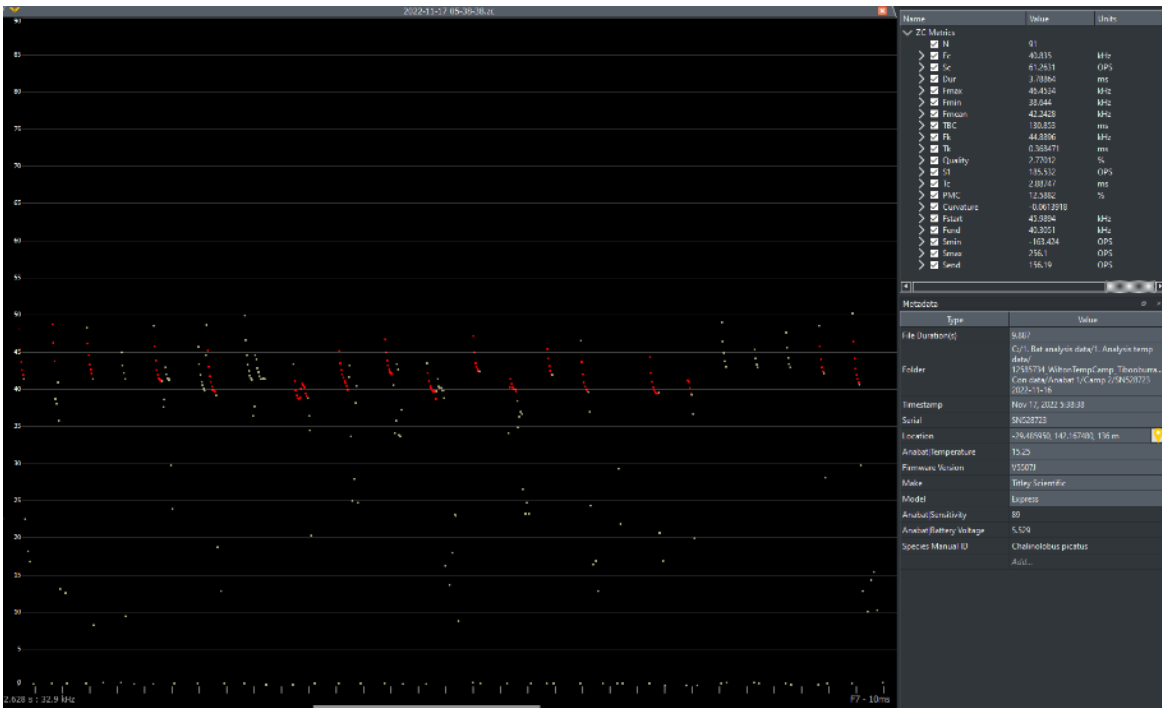
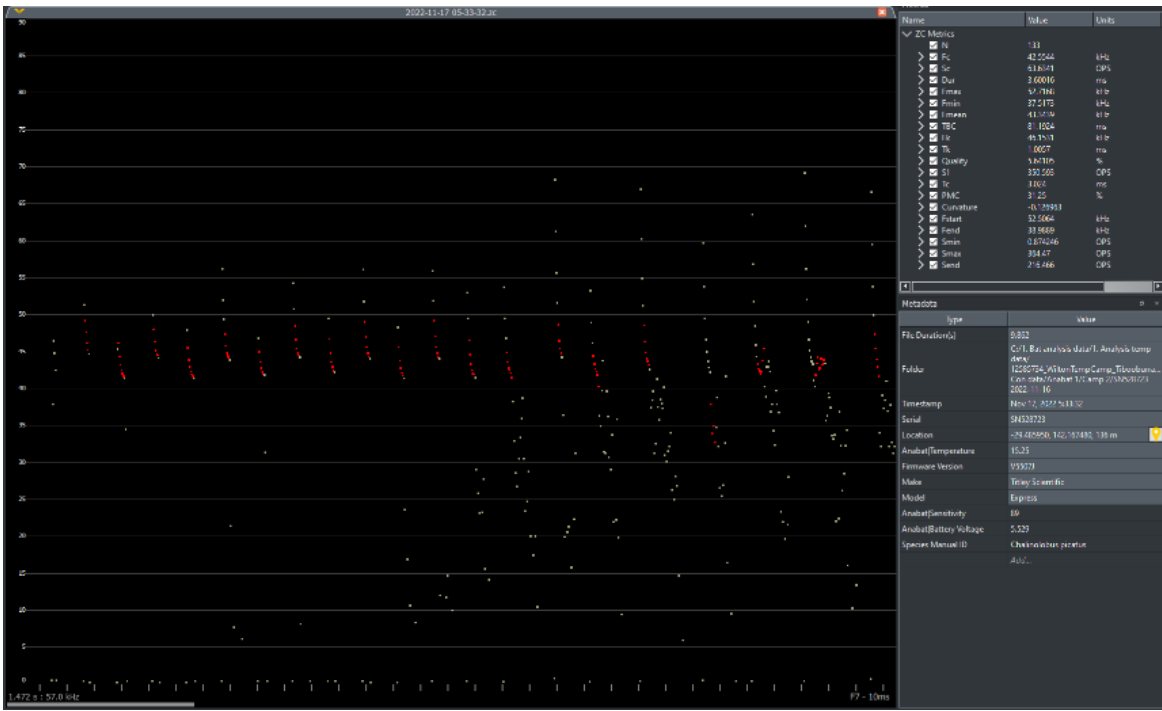
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Attachment 1 – species call example. *Chalinolobus picatus*



## Qualifications of bat call analysis specialist

### Craig Graham

Senior Ecologist



**Qualifications** B. App. Science (Parks, Recreation and Heritage) 1998 (Honours) 2004 Anabat system training course (Titley Scientific, December 2012) Wildlife Accoustic's Song Meter/SongScope training (Faunatech, July 2015), Anabat Insight and bat call analysis workshop (Titley Scientific and Balance Environmental June 2019)

**Relevance to project.** Craig is a Project Manager and Senior Ecologist with GHD's Natural Resource Team in Victoria. He has over 22 years' experience in conducting ecological survey and assessment within Australia. He is currently undertaking targeted surveys for the threatened Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia* (Pilbara form) and Ghost Bat (*Macroderma gigas*).

#### Key experience areas

##### Bat survey and assessment experience

Craig has completed microchiropteran bat surveys and assessments in various states and territories of Australia including the NT (WA, NSW, QLD, Vic, Tasmania) using a variety of methods including: radio-tracking, harp trapping; light tagging; cave occupancy sheeting; habitat surveys (e.g. cave assessments); roost surveillance/roost counts (using infrared and thermal video cameras); bat call (echolocation) survey (using SongMeter and Anabat detectors); and bat call analysis. Craig has also completed bat inventory surveys for National Parks, Nature Reserves, catchment management areas and private land conservation projects.

##### Bat call analysis and reporting

To date Craig has completed echolocation (ultrasonic) analysis and reporting for over 160 GHD projects from WA, NSW, NT, QLD and Vic. Calls collected during field surveys from Anabat or Song Meter devices are analysed primarily using Anabat Insight or Kaleidoscope software. Craig has experience with a variety of analysis methods/programs including manual identification (comparison of sonograms and call characteristics with reference material) and automated analysis (e.g. using recognisers/classifiers in Songscope/ Kaleidoscope or filters within Anabat Insight).

##### Bat Management Plans

Craig has designed and implement management plans for a variety of bridge removal and refurbishment projects with roosting bats in Victoria and NSW. He has also assisted with the peer review of bat management plans for bridges, wind farms, mines and building demolition. The key aim of most plans is to help proponents design and implement a humane program of management, usually by a process of gradual exclusion and/or the retention and monitoring of bat roosts. Plans use strategies from guidelines produced by the Australasian Bat Society and Bat Conservation International.

##### BHP Jimblebar | WA (Pilbara).

*Ghost Bat surveys, proposed mine expansion (2019 - 2020).* Craig has undertaken targeted surveys for the Ghost Bat and assisted with the survey design, analysis and reporting of other surveys for BHP including full spectrum (FS) ultrasonic call survey and analysis (ongoing).

**FMG/FMG Iron Bridge | WA (Pilbara).** *Pilbara Leaf-nosed Bat, North Star Mine (2014-2020).* Craig has been undertaking targeted surveys since 2014 to inform the EPA conditions for approval for its North Star Mine Operations. The scope of works currently includes:

- Full spectrum (FS) ultrasonic call survey and analysis at over 60 locations
- Development of a Survey Plan and standard operating procedures for the methods and techniques to survey the Pilbara Leaf-nosed Bat including handling trapping and release protocols; roost surveillance; cave occupation determination and radio tracking methods and procedures
- Structural and habitat assessments of a known roosts to determine 1. geological characteristics and stability of roost habitat 2. characterisation of the internal architecture of the roosting habitat (e.g. internal dimensions and microhabitat characteristics) 3. classification of roost habitats according to conservation guidelines
- Regional surveys to assist with the location additional roost locations and habitat extent
- Roost occupancy determination surveys using the non-invasive sheeting method described (Survey guidelines for Australia's threatened bats DEWHA 2010) in conjunction with ultrasonic surveys and infrared camera surveillance
- Radio-tracking of Pilbara Leaf-nosed Bat using digitally encoded nanotags, automated receiver base-station array and handheld receiver units (2017 and 2019).





**FMG/FMG Iron Bridge | WA (Pilbara).** *Pilbara Leaf-nosed Bat and Ghost Bat surveys, Proposed Glacier Valley/South Star area (2018-2019).* Craig has been undertaking baseline and targeted surveys for both species to inform the proposed North Star Mine expansion processes including:

- FS ultrasonic call survey and analysis for both species
- Habitat assessment and modelling including cave habitat searches to assist with determining habitat suitability and occupations, and classification of roost habitats according to conservation guidelines
- Regional surveys to assist with the location of other habitat/ roost sites using helicopter
- Roost occupancy determination surveys using the non-invasive sheeting method.

**Targeted bat surveys Balickera Tunnel | Hunter Water, NSW (Newcastle region).** Craig assisted with ultrasonic activity and emergence surveys (using Infrared cameras) for the three threatened bat species that occupy the tunnel (*Myotis macropus*, *Miniopterus schreibersii* and *Miniopterus australis*). Craig has also assisted with the surveys using an innovative drone watercraft capable of recording video imagery of the tunnel ceiling to identify the roosting locations for various bat species.

**Parks Victoria | Cumberland River, Vic.**

*Use of an existing cave – Bent-wing Bat.* Craig completed a survey of a foreshore cave using infrared camera and ultrasonic recorders to determine the presence of threatened bent-wing bats (*Miniopterus orianae bassanii* / *Miniopterus schreibersii oceanensis*). Methods include roost exit counts using infrared camera and handheld ultrasonic detectors and nightly surveys using FS ultrasonic detectors (2018).

**Volunteer position | King Lake NP, Vic.**

*Use of an abandoned mine adits – Eastern Bent-wing Bat.* Craig assisted with the study of this species use of several abandoned mines in the King Lake area. Methods include roost exit counts, harp trapping and bat call survey and analysis (2011 - 2012).

**Murray Wildlife | Hay, NSW**

*Bat survey and analysis of tank sites (dams).* Bat surveys were completed to determine the usage of tank sites within grazing land by micro bats for the Hay Landcare Group. The overall aim of the project was to determine how important these artificial water sources are for native wildlife within this agricultural landscape (2012).

**NSW RTA | Murray River, NSW/Vic** *Cobram-Barooga historic bridge partial demolition.* Targeted surveys (harp trapping, bat call survey and analysis, roost searches) was completed for the threatened Large-footed *Myotis* and other micro bat species to determine the impacts of the partial bridge demolition. A Bat Management Plan was developed to avoid or minimise impacts upon the bat species within the bridge. Monitoring of bats was undertaken during demolition and post demolition phases (2009 – 2010).

**Lower Murray Darling CMA | Lower Murray-Darling, NSW**

*Survey of ground-dwelling vertebrate fauna and microchiropteran bats at pre-determined sites.* Harp trapping, Anabat and reference call collection were completed at six sites. Anabat analysis was completed for 25 locations within the project area (2008).

**QLD Rail | Byerwen, QLD**

*Targeted survey - threatened Little Pied Bat* Including harp trapping, bat call surveys, roost search and cave habitat assessments to determine the impacts of the proposed 450 ha quarry (2008).

**DMR | Hermidale region, NSW**

*Anabat surveys and analysis of 12 derelict mine shafts.* Craig assisted with the development of the management plan and provided recommendations regarding the closure of shafts (2006).

**NSW RTA | Gundagai, NSW**

*Prince Alfred Bridge, (initial assessment and post refurbishment monitoring).* Targeted surveys (harp trapping, bat call survey and analysis, roost searches) were completed to determine the impacts of the bridge refurbishment to micro bats. A Bat Management Plan was developed to minimise impacts upon the bat species within the bridge. Monitoring of bats was undertaken during refurbishment and post refurbishment phases (2005 - 2006).

**NPWS | Kosciusko National Park, NSW**

*Micro bat use of abandoned mine adits.* Anabat surveys and analysis was completed of Kings Mine, Ravine River Adit, and Ravine Mine Adit for the South West Slopes Division of the NSW National Parks and Wildlife Service. Craig provided recommendations regarding the ongoing use of the mine adits by bats (2004).

**Other relevant experience**

Honours (2003 - 2004) Title: '*Bats in fragmented rural landscapes - the use of remnant and revegetated habitats*'. Craig investigated the use of six main habitat types (30 sites) by microchiropteran bats across a fragmented rural landscape including the value of native revegetation to bats.

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# **Appendix E**

**Biodiversity credit reports**



# BAM Biodiversity Credit Report (Like for like)

## Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00036434/BAAS17031/22/00036603	Moomba to Wilton Pipeline - APA East Coast Grid Expansion Stage 3a Compressor Station Installation - Modification 2	22/06/2023
Assessor Name	Assessor Number	BAM Data version *
Ben Harrington	BAAS17023	61
Proponent Names	Report Created	BAM Case Status
Brian Connellan	23/01/2024	Finalised
Assessment Revision	Assessment Type	Date Finalised
5	Major Projects	23/01/2024

\* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

## Potential Serious and Irreversible Impacts

Name of threatened ecological community	Listing status	Name of Plant Community Type/ID
<b>Nil</b>		
Species		
<b>Nil</b>		

## Additional Information for Approval

Assessment Id	Proposal Name	Page 1 of 4
00036434/BAAS17031/22/00036603	Moomba to Wilton Pipeline - APA East Coast Grid Expansion	



## BAM Biodiversity Credit Report (Like for like)

PCT Outside Ibra Added

None added

PCTs With Customized Benchmarks

PCT

143-Narrow-leaved Hopbush - Scrub Turpentine - Senna shrubland on semi-arid and arid sandplains and dunes.

131-Gidgee of the intermittent watercourses or the arid zone (mainly Channel Country Bioregion and Simpson Strezlecki Dunefields Bioregion)

Predicted Threatened Species Not On Site

Name

No Changes

### Ecosystem Credit Summary (Number and class of biodiversity credits to be retired)

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	HBT Cr	No HBT Cr	Total credits to be retired
143-Narrow-leaved Hopbush - Scrub Turpentine - Senna shrubland on semi-arid and arid sandplains and dunes.	Not a TEC	9.3	0	256	256

## BAM Biodiversity Credit Report (Like for like)

143-Narrow-leaved Hopbush - Scrub Turpentine - Senna shrubland on semi-arid and arid sandplains and dunes.	Like-for-like credit retirement options					
	Class	Trading group	Zone	HBT	Credits	IBRA region
	Sand Plain Mulga Shrublands This includes PCT's: 69, 119, 124, 128, 129, 139, 140, 143, 199, 215, 220, 232	Sand Plain Mulga Shrublands <50%	143_Good	No	221	Sturt Stony Desert, Bulloo, Central Depression, Core Ranges and Strzelecki Desert. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Sand Plain Mulga Shrublands This includes PCT's: 69, 119, 124, 128, 129, 139, 140, 143, 199, 215, 220, 232	Sand Plain Mulga Shrublands <50%	143_Poor	No	35	Sturt Stony Desert, Bulloo, Central Depression, Core Ranges and Strzelecki Desert. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.	

### Species Credit Summary

No Species Credit Data

Like-for-like credit retirement options



# BAM Biodiversity Credit Report (Like for like)

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## Credit Retirement Options

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Assessment Id

00036434/BAAS17031/22/00036603

Proposal Name

Moomba to Wilton Pipeline - APA East Coast Grid Expansion

Page 4 of 4

## Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00036434/BAAS17031/22/00036603	Moomba to Wilton Pipeline - APA East Coast Grid Expansion Stage 3a Compressor Station Installation - Modification 2	22/06/2023
Assessor Name	Report Created	BAM Data version *
Ben Harrington	23/01/2024	61
Assessor Number	BAM Case Status	Date Finalised
BAAS17023	Finalised	23/01/2024
Assessment Revision	Assessment Type	
5	Major Projects	

\* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

## Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

Zone	Vegetation zone name	TEC name	Current Vegetation integrity score	Change in Vegetation integrity (loss / gain)	Area (ha)	Sensitivity to loss (Justification)	Species sensitivity to gain class	BC Act Listing status	EPBC Act listing status	Biodiversity risk weighting	Potential SAI	Ecosystem credits
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Narrow-leaved Hopbush - Scrub Turpentine - Senna shrubland on semi-arid and arid sandplains and dunes.											
1	143_Good	Not a TEC	86.1	86.1	6.8	PCT Cleared - 30%	High Sensitivity to Gain			1.50	221
2	143_Poor	Not a TEC	37.7	37.7	2.5	PCT Cleared - 30%	High Sensitivity to Gain			1.50	35
										<b>Subtotal</b>	<b>256</b>
										<b>Total</b>	<b>256</b>

## Species credits for threatened species

Vegetation zone name	Habitat condition (Vegetation Integrity)	Change in habitat condition	Area (ha)/Count (no. individuals)	Sensitivity to loss (Justification)	Sensitivity to gain (Justification)	BC Act Listing status	EPBC Act listing status	Potential SAI	Species credits



## Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00036434/BAAS17031/22/00036603	Moomba to Wilton Pipeline - APA East Coast Grid Expansion Stage 3a Compressor Station Installation - Modification 2	22/06/2023
Assessor Name	Report Created	BAM Data version *
Ben Harrington	23/01/2024	61
Assessor Number	Assessment Type	BAM Case Status
BAAS17023	Major Projects	Finalised
Assessment Revision		Date Finalised
5		23/01/2024

\* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

**Threatened species reliably predicted to utilise the site. No surveys are required for these species. Ecosystem credits apply to these species.**

Common Name	Scientific Name	Vegetation Types(s)
a whip snake	Demansia rimicola	143-Narrow-leaved Hopbush - Scrub Turpentine - Senna shrubland on semi-arid and arid sandplains and dunes.
Black Falcon	Falco subniger	143-Narrow-leaved Hopbush - Scrub Turpentine - Senna shrubland on semi-arid and arid sandplains and dunes.
Black-breasted Buzzard	Hamirostra melanosternon	143-Narrow-leaved Hopbush - Scrub Turpentine - Senna shrubland on semi-arid and arid sandplains and dunes.
Dusky Hopping-mouse	Notomys fuscus	143-Narrow-leaved Hopbush - Scrub Turpentine - Senna shrubland on semi-arid and arid sandplains and dunes.
Dusky Woodswallow	Artamus cyanopterus cyanopterus	143-Narrow-leaved Hopbush - Scrub Turpentine - Senna shrubland on semi-arid and arid sandplains and dunes.
Forrest's Mouse	Leggadina forresti	143-Narrow-leaved Hopbush - Scrub Turpentine - Senna shrubland on semi-arid and arid sandplains and dunes.
Grey Falcon	Falco hypoleucos	143-Narrow-leaved Hopbush - Scrub Turpentine - Senna shrubland on semi-arid and arid sandplains and dunes.
Interior Blind Snake	Ramphotyphlops endoterus	143-Narrow-leaved Hopbush - Scrub Turpentine - Senna shrubland on semi-arid and arid sandplains and dunes.

## BAM Predicted Species Report

Kultarr	<i>Antechinomys laniger</i>	143-Narrow-leaved Hopbush - Scrub Turpentine - Senna shrubland on semi-arid and arid sandplains and dunes.
Little Eagle	<i>Hieraetus morphnoides</i>	143-Narrow-leaved Hopbush - Scrub Turpentine - Senna shrubland on semi-arid and arid sandplains and dunes.
Little Pied Bat	<i>Chalinolobus picatus</i>	143-Narrow-leaved Hopbush - Scrub Turpentine - Senna shrubland on semi-arid and arid sandplains and dunes.
Long-haired Rat	<i>Rattus villosissimus</i>	143-Narrow-leaved Hopbush - Scrub Turpentine - Senna shrubland on semi-arid and arid sandplains and dunes.
Major Mitchell's Cockatoo	<i>Lophochroa leadbeateri</i>	143-Narrow-leaved Hopbush - Scrub Turpentine - Senna shrubland on semi-arid and arid sandplains and dunes.
Narrow-banded Snake	<i>Simoselaps fasciolatus</i>	143-Narrow-leaved Hopbush - Scrub Turpentine - Senna shrubland on semi-arid and arid sandplains and dunes.
Painted Honeyeater	<i>Grantiella picta</i>	143-Narrow-leaved Hopbush - Scrub Turpentine - Senna shrubland on semi-arid and arid sandplains and dunes.
Pied Honeyeater	<i>Certhionyx variegatus</i>	143-Narrow-leaved Hopbush - Scrub Turpentine - Senna shrubland on semi-arid and arid sandplains and dunes.
Ringed Brown Snake	<i>Pseudonaja modesta</i>	143-Narrow-leaved Hopbush - Scrub Turpentine - Senna shrubland on semi-arid and arid sandplains and dunes.
Sandy Inland Mouse	<i>Pseudomys hermannsburgensis</i>	143-Narrow-leaved Hopbush - Scrub Turpentine - Senna shrubland on semi-arid and arid sandplains and dunes.
Spotted Harrier	<i>Circus assimilis</i>	143-Narrow-leaved Hopbush - Scrub Turpentine - Senna shrubland on semi-arid and arid sandplains and dunes.
Stripe-faced Dunnart	<i>Sminthopsis macroura</i>	143-Narrow-leaved Hopbush - Scrub Turpentine - Senna shrubland on semi-arid and arid sandplains and dunes.
Wedgesnout Ctenotus	<i>Ctenotus brooksi</i>	143-Narrow-leaved Hopbush - Scrub Turpentine - Senna shrubland on semi-arid and arid sandplains and dunes.
Woma	<i>Aspidites ramsayi</i>	143-Narrow-leaved Hopbush - Scrub Turpentine - Senna shrubland on semi-arid and arid sandplains and dunes.
Yellow-bellied Sheath-tail-bat	<i>Saccolaimus flaviventris</i>	143-Narrow-leaved Hopbush - Scrub Turpentine - Senna shrubland on semi-arid and arid sandplains and dunes.
Yellow-tailed Plain Slider	<i>Lerista xanthura</i>	143-Narrow-leaved Hopbush - Scrub Turpentine - Senna shrubland on semi-arid and arid sandplains and dunes.

### Threatened species Manually Added

None added

### Threatened species assessed as not within the vegetation zone(s) for the PCT(s)

Refer to BAR for detailed justification

Common Name	Scientific Name	Justification in the BAM-C
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# BAM Predicted Species Report

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## Proposal Details

Assessment Id 00036434/BAAS17031/22/00036603	Proposal Name Moomba to Wilton Pipeline - APA East Coast Grid Expansion Stage 3a Compressor Station Installation - Modification 2	BAM data last updated * 22/06/2023
Assessor Name Ben Harrington	Report Created 23/01/2024	BAM Data version * 61
Assessor Number BAAS17023	Assessment Type Major Projects	BAM Case Status Finalised
Assessment Revision 5	Date Finalised 23/01/2024	

\* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

## List of Species Requiring Survey

Name	Presence	Survey Months
<b><i>Antaresia stimsoni</i></b> Stimson's Python	No (surveyed)	<input type="checkbox"/> Jan <input checked="" type="checkbox"/> Feb <input type="checkbox"/> Mar <input type="checkbox"/> Apr <input type="checkbox"/> May <input type="checkbox"/> Jun <input type="checkbox"/> Jul <input type="checkbox"/> Aug <input type="checkbox"/> Sep <input type="checkbox"/> Oct <input type="checkbox"/> Nov <input type="checkbox"/> Dec <input type="checkbox"/> Survey month outside the specified months?
<b><i>Ardeotis australis</i></b> Australian Bustard	No (surveyed)	<input type="checkbox"/> Jan <input checked="" type="checkbox"/> Feb <input type="checkbox"/> Mar <input type="checkbox"/> Apr <input type="checkbox"/> May <input type="checkbox"/> Jun <input type="checkbox"/> Jul <input type="checkbox"/> Aug <input checked="" type="checkbox"/> Sep <input type="checkbox"/> Oct <input checked="" type="checkbox"/> Nov <input type="checkbox"/> Dec <input type="checkbox"/> Survey month outside the specified months?

## BAM Candidate Species Report

<p><b><i>Crotalaria cunninghamii</i></b> Green Bird Flower</p>	<p>No (surveyed)</p>	<table border="1"> <tr> <td><input type="checkbox"/> Jan</td> <td><input checked="" type="checkbox"/> Feb</td> <td><input type="checkbox"/> Mar</td> <td><input type="checkbox"/> Apr</td> </tr> <tr> <td><input type="checkbox"/> May</td> <td><input type="checkbox"/> Jun</td> <td><input type="checkbox"/> Jul</td> <td><input type="checkbox"/> Aug</td> </tr> <tr> <td><input checked="" type="checkbox"/> Sep</td> <td><input type="checkbox"/> Oct</td> <td><input type="checkbox"/> Nov</td> <td><input type="checkbox"/> Dec</td> </tr> </table> <p><input type="checkbox"/> Survey month outside the specified months?</p>	<input type="checkbox"/> Jan	<input checked="" type="checkbox"/> Feb	<input type="checkbox"/> Mar	<input type="checkbox"/> Apr	<input type="checkbox"/> May	<input type="checkbox"/> Jun	<input type="checkbox"/> Jul	<input type="checkbox"/> Aug	<input checked="" type="checkbox"/> Sep	<input type="checkbox"/> Oct	<input type="checkbox"/> Nov	<input type="checkbox"/> Dec
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<p><b><i>Ctenopus pantherinus ocellifer</i></b> Leopard Ctenopus</p>	<p>No (surveyed)</p>	<table border="1"> <tr> <td><input type="checkbox"/> Jan</td> <td><input checked="" type="checkbox"/> Feb</td> <td><input type="checkbox"/> Mar</td> <td><input type="checkbox"/> Apr</td> </tr> <tr> <td><input type="checkbox"/> May</td> <td><input type="checkbox"/> Jun</td> <td><input type="checkbox"/> Jul</td> <td><input type="checkbox"/> Aug</td> </tr> <tr> <td><input type="checkbox"/> Sep</td> <td><input type="checkbox"/> Oct</td> <td><input type="checkbox"/> Nov</td> <td><input type="checkbox"/> Dec</td> </tr> </table> <p><input type="checkbox"/> Survey month outside the specified months?</p>	<input type="checkbox"/> Jan	<input checked="" type="checkbox"/> Feb	<input type="checkbox"/> Mar	<input type="checkbox"/> Apr	<input type="checkbox"/> May	<input type="checkbox"/> Jun	<input type="checkbox"/> Jul	<input type="checkbox"/> Aug	<input type="checkbox"/> Sep	<input type="checkbox"/> Oct	<input type="checkbox"/> Nov	<input type="checkbox"/> Dec
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<p><b><i>Diplodactylus platyurus</i></b> Eastern Fat-tailed Gecko</p>	<p>No (surveyed) *Survey months are outside of the months specified in Bionet.</p>	<table border="1"> <tr> <td><input type="checkbox"/> Jan</td> <td><input checked="" type="checkbox"/> Feb</td> <td><input type="checkbox"/> Mar</td> <td><input type="checkbox"/> Apr</td> </tr> <tr> <td><input type="checkbox"/> May</td> <td><input type="checkbox"/> Jun</td> <td><input type="checkbox"/> Jul</td> <td><input type="checkbox"/> Aug</td> </tr> <tr> <td><input type="checkbox"/> Sep</td> <td><input type="checkbox"/> Oct</td> <td><input type="checkbox"/> Nov</td> <td><input type="checkbox"/> Dec</td> </tr> </table> <p><input checked="" type="checkbox"/> Survey month outside the specified months?</p>	<input type="checkbox"/> Jan	<input checked="" type="checkbox"/> Feb	<input type="checkbox"/> Mar	<input type="checkbox"/> Apr	<input type="checkbox"/> May	<input type="checkbox"/> Jun	<input type="checkbox"/> Jul	<input type="checkbox"/> Aug	<input type="checkbox"/> Sep	<input type="checkbox"/> Oct	<input type="checkbox"/> Nov	<input type="checkbox"/> Dec
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<p><b><i>Hamirostra melanosternon</i></b> Black-breasted Buzzard</p>	<p>No (surveyed)</p>	<table border="1"> <tr> <td><input type="checkbox"/> Jan</td> <td><input type="checkbox"/> Feb</td> <td><input type="checkbox"/> Mar</td> <td><input type="checkbox"/> Apr</td> </tr> <tr> <td><input type="checkbox"/> May</td> <td><input type="checkbox"/> Jun</td> <td><input type="checkbox"/> Jul</td> <td><input type="checkbox"/> Aug</td> </tr> <tr> <td><input checked="" type="checkbox"/> Sep</td> <td><input type="checkbox"/> Oct</td> <td><input checked="" type="checkbox"/> Nov</td> <td><input type="checkbox"/> Dec</td> </tr> </table> <p><input type="checkbox"/> Survey month outside the specified months?</p>	<input type="checkbox"/> Jan	<input type="checkbox"/> Feb	<input type="checkbox"/> Mar	<input type="checkbox"/> Apr	<input type="checkbox"/> May	<input type="checkbox"/> Jun	<input type="checkbox"/> Jul	<input type="checkbox"/> Aug	<input checked="" type="checkbox"/> Sep	<input type="checkbox"/> Oct	<input checked="" type="checkbox"/> Nov	<input type="checkbox"/> Dec
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<p><b><i>Hieraaetus morphnoides</i></b> Little Eagle</p>	<p>No (surveyed)</p>	<table border="1"> <tr> <td><input type="checkbox"/> Jan</td> <td><input type="checkbox"/> Feb</td> <td><input type="checkbox"/> Mar</td> <td><input type="checkbox"/> Apr</td> </tr> <tr> <td><input type="checkbox"/> May</td> <td><input type="checkbox"/> Jun</td> <td><input type="checkbox"/> Jul</td> <td><input checked="" type="checkbox"/> Aug</td> </tr> <tr> <td><input checked="" type="checkbox"/> Sep</td> <td><input type="checkbox"/> Oct</td> <td><input type="checkbox"/> Nov</td> <td><input type="checkbox"/> Dec</td> </tr> </table> <p><input type="checkbox"/> Survey month outside the specified months?</p>	<input type="checkbox"/> Jan	<input type="checkbox"/> Feb	<input type="checkbox"/> Mar	<input type="checkbox"/> Apr	<input type="checkbox"/> May	<input type="checkbox"/> Jun	<input type="checkbox"/> Jul	<input checked="" type="checkbox"/> Aug	<input checked="" type="checkbox"/> Sep	<input type="checkbox"/> Oct	<input type="checkbox"/> Nov	<input type="checkbox"/> Dec
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<p><b><i>Ipomoea polymorpha</i></b> Silky Cow-Vine</p>	<p>No (surveyed)</p>	<table border="1"> <tr> <td><input type="checkbox"/> Jan</td> <td><input checked="" type="checkbox"/> Feb</td> <td><input type="checkbox"/> Mar</td> <td><input type="checkbox"/> Apr</td> </tr> <tr> <td><input type="checkbox"/> May</td> <td><input type="checkbox"/> Jun</td> <td><input type="checkbox"/> Jul</td> <td><input type="checkbox"/> Aug</td> </tr> <tr> <td><input type="checkbox"/> Sep</td> <td><input type="checkbox"/> Oct</td> <td><input type="checkbox"/> Nov</td> <td><input type="checkbox"/> Dec</td> </tr> </table> <p><input type="checkbox"/> Survey month outside the specified months?</p>	<input type="checkbox"/> Jan	<input checked="" type="checkbox"/> Feb	<input type="checkbox"/> Mar	<input type="checkbox"/> Apr	<input type="checkbox"/> May	<input type="checkbox"/> Jun	<input type="checkbox"/> Jul	<input type="checkbox"/> Aug	<input type="checkbox"/> Sep	<input type="checkbox"/> Oct	<input type="checkbox"/> Nov	<input type="checkbox"/> Dec
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## BAM Candidate Species Report

<p><b><i>Lophochroa leadbeateri</i></b> Major Mitchell's Cockatoo</p>	<p>No (surveyed)</p>	<table border="1"> <tr> <td><input type="checkbox"/> Jan</td> <td><input type="checkbox"/> Feb</td> <td><input type="checkbox"/> Mar</td> <td><input type="checkbox"/> Apr</td> </tr> <tr> <td><input type="checkbox"/> May</td> <td><input type="checkbox"/> Jun</td> <td><input type="checkbox"/> Jul</td> <td><input type="checkbox"/> Aug</td> </tr> <tr> <td><input checked="" type="checkbox"/> Sep</td> <td><input type="checkbox"/> Oct</td> <td><input checked="" type="checkbox"/> Nov</td> <td><input type="checkbox"/> Dec</td> </tr> </table> <p><input type="checkbox"/> Survey month outside the specified months?</p>	<input type="checkbox"/> Jan	<input type="checkbox"/> Feb	<input type="checkbox"/> Mar	<input type="checkbox"/> Apr	<input type="checkbox"/> May	<input type="checkbox"/> Jun	<input type="checkbox"/> Jul	<input type="checkbox"/> Aug	<input checked="" type="checkbox"/> Sep	<input type="checkbox"/> Oct	<input checked="" type="checkbox"/> Nov	<input type="checkbox"/> Dec
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<p><b><i>Lucasium stenodactylum</i></b> Crowned Gecko</p>	<p>No (surveyed)</p>	<table border="1"> <tr> <td><input type="checkbox"/> Jan</td> <td><input checked="" type="checkbox"/> Feb</td> <td><input type="checkbox"/> Mar</td> <td><input type="checkbox"/> Apr</td> </tr> <tr> <td><input type="checkbox"/> May</td> <td><input type="checkbox"/> Jun</td> <td><input type="checkbox"/> Jul</td> <td><input type="checkbox"/> Aug</td> </tr> <tr> <td><input type="checkbox"/> Sep</td> <td><input type="checkbox"/> Oct</td> <td><input type="checkbox"/> Nov</td> <td><input type="checkbox"/> Dec</td> </tr> </table> <p><input type="checkbox"/> Survey month outside the specified months?</p>	<input type="checkbox"/> Jan	<input checked="" type="checkbox"/> Feb	<input type="checkbox"/> Mar	<input type="checkbox"/> Apr	<input type="checkbox"/> May	<input type="checkbox"/> Jun	<input type="checkbox"/> Jul	<input type="checkbox"/> Aug	<input type="checkbox"/> Sep	<input type="checkbox"/> Oct	<input type="checkbox"/> Nov	<input type="checkbox"/> Dec
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### Threatened species Manually Added

None added

# **Appendix F**

**EPBC Act Assessments of Significance**

## **F-1 Vulnerable bird species of semi-arid shrubland and woodland: Southern Whiteface (*Aphelocephala leucopsis*), Grey Falcon (*Falco hypoleucos*), Painted Honeyeater (*Grantiella picta*)**

### **F-1-1 Southern Whiteface**

#### **Distribution**

The Southern Whiteface (*Aphelocephala leucopsis*) occurs across most of mainland Australia south of the tropics, from the north-eastern edge of the Western Australian wheatbelt, east to the Great Dividing Range (DCCEEW 2023b).

#### **Habitat requirements**

The Southern Whiteface inhabits a wide range of open woodlands and shrublands where there is an understorey of grasses or shrubs, or both, generally in areas dominated by acacias or eucalypts on ranges, foothills and lowlands, and plains (DCCEEW 2023b, Higgins & Peter 2002). It forages almost exclusively on the ground, favouring habitat with low tree densities and an herbaceous understorey litter cover (DCCEEW 2023b). When breeding, the Southern Whiteface mainly utilises hollows and crevices, but will nest in low bushes (DCCEEW 2023b, Higgins & Peter 2002).

#### **Habitat in the study area**

There is foraging habitat for the Southern Whiteface throughout the proposal site associated with PCT 143 Narrow-leaved Hopbush - Scrub Turpentine - Senna shrubland. The species was observed in groups of up to 12 foraging in Acacia and chenopod shrubland on multiple occasions during field surveys as shown on Figure 5.1. The species may also nest in denser patches of small trees and shrubs in the proposal site but would be more likely to breed in larger trees with hollows and crevices (DCCEEW 2023b) in PCT 131 Gidgee tall shrubland or PCT 41 River Red Gum open woodland in the broader study area. No evidence of breeding was noted despite diurnal bird surveys and nest tree censuses conducted over multiple seasons.

No important populations of the Southern Whiteface are noted in the conservation advice for the species (DCCEEW 2023b) and no critical habitat has been identified (DCCEEW 2023c). According to the MNES significant impact guidelines 1.1 (DotE 2013) 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.

Given the frequency that the species has been observed at the proposal site, in groups of up to 12 individuals it is likely that this population comprises a key source either for breeding or dispersal and is necessary for maintaining genetic diversity and as such is an important population.

### **F-1-2 Grey Falcon**

#### **Distribution**

The Grey Falcon is sparsely distributed in NSW, chiefly throughout the Murray-Darling Basin, with the occasional vagrant east of the Great Dividing Range. The species is mainly found where annual rainfall is less than 500 mm, except when wet years are followed by drought, when the species might become marginally more widespread, although it is essentially confined to the arid and semi-arid zones (DCCEEW 2023b).



### **Habitat requirements**

Usually restricted to shrubland, grassland and wooded watercourses of arid and semi-arid regions, although it is occasionally found in open woodlands near the coast. Also occurs near wetlands where surface water attracts prey. The species frequents timbered lowland plains, particularly acacia shrublands that are crossed by tree-lined water courses (DCCEEW 2023b).

### **Habitat in the study area**

There is potential habitat for the Grey Falcon throughout the proposal site associated with PCT 143 shrubland. A Black Falcon (*Falco subniger*) and several other raptor species with similar life histories were observed at the study area as well as abundant populations of potential prey species. The species is known to nest in tall trees within timbered watercourses and may potentially breed in PCT 131 Gidgee tall shrubland or PCT 41 River Red Gum open woodland in the broader study area. No evidence of breeding was noted despite diurnal bird surveys and nest tree censuses conducted over multiple seasons.

There are 12 records of the species within the locality (DPE 2023a).

The species consists of a single population with a total size estimated to be <1000 mature birds occurring at low densities across its range (DCCEEW 2023b). As such, any individuals that occurred in the proposal site would form part of an important population. No critical habitat for the species has been identified (DCCEEW 2023c).

## **F-1-3 Painted Honeyeater**

### **Distribution**

The Painted Honeyeater is nomadic and occurs at low densities throughout its range. The greatest concentrations of individuals and almost all breeding occurs on the inland slopes of the Great Dividing Range in New South Wales, Victoria and southern Queensland. During the winter it is more likely to be found in the north of its distribution (DAWE 2021).

### **Habitat requirements**

The Painted Honeyeater inhabits dry open woodland and forests, particularly Boree/ Weeping Myall (*Acacia pendula*), Brigalow (*A. harpophylla*) and Box-Gum Woodlands and Box-Ironbark Forests. It is a specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias, with a preference for the mistletoes of the genus *Amyema*. Insects and nectar from mistletoe or eucalypts are occasionally eaten (DCCEEW 2023b). It may also be found along rivers, on plains with scattered trees and on farmland with remnant vegetation. It has been seen in urban parks and gardens where large eucalypts are available (DCCEEW 2023b).

The Painted Honeyeater nests from spring to autumn in a small, delicate nest hanging within the outer canopy of drooping eucalypts, she-oak, paperbark or mistletoe branches. It breeds in loose colonies, forming pair bonds for the duration of the breeding season. In some areas, the same nest or tree may be re-used over several years (DCCEEW 2023b).

### **Habitat in the study area**

There is potential habitat for the Painted Honeyeater throughout the proposal site associated with PCT 143 shrubland. Foraging resources associated with mistletoe on *Acacia*, *Hakea* and *Eremophila* species were observed throughout the proposal site. The species may potentially breed in the proposal site or in PCT 131 Gidgee tall shrubland or PCT 41 River Red Gum open woodland in the broader study area. No evidence of breeding was noted despite diurnal bird surveys and nest tree censuses conducted over multiple seasons.

There are 14 records of the species within the locality (DPE 2023a).

The Painted Honeyeater is nomadic and occurs at low densities throughout its range. Considering its dispersive habits, the species is considered to comprise a single population (Garnett *et al.* 2011). As such, any individuals that occurred in the proposal site would form part of an important population. No critical habitat for the species has been identified (DCCEEW 2023c)

## EPBC Act Assessment of Significance

Vulnerable bird species of semi-arid shrubland and woodland: Southern Whiteface (*Aphelocephala leucopsis*), Grey Falcon (*Falco hypoleucos*), Painted Honeyeater (*Grantiella picta*)

**According to the DoE (2013) 'significant impact criteria', an action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:**

**Lead to a long-term decrease in the size of an important population**

As described above, each of the populations of these vulnerable bird species of semi-arid shrubland and woodland that could occur at the proposal site would comprise an important population as defined in the MNES significant impact guidelines 1.1 (DoE 2013).

The factors that could potentially lead to a long-term decrease in the size of an important population of these vulnerable bird species include direct harm, loss of foraging habitat affecting an ecologically significant proportion of local populations or loss of important breeding habitat.

The proposal would result in direct impacts to native vegetation and associated threatened species habitat through:

- clearing of up to 8.13 ha of native vegetation for construction of the compressor, temporary camp site and associated infrastructure
- application of treated wastewater to up to 1.2 ha of native vegetation.

The proposed impact mitigation and environmental management measures are likely to mitigate against erosion, sedimentation or any other indirect effects on adjacent habitat during the proposed works.

With the exception of the Southern Whiteface, these species were not recorded in the proposal site but are known to occur in similar habitats in the locality and may occur in the proposal site on occasion.

The proposal would remove or modify 9.33 ha of native vegetation in varying condition, all of which provides foraging habitat and potential nesting habitat for these species. The proposal would not affect any candidate trees of a suitable size or location for nesting of the Grey Falcon. The Southern Whiteface and Painted Honeyeater may build nests in a variety of locations, including trees and shrubs or stumps could also nest in the proposal site. It is assumed that a breeding population of these species is present in the wider locality given the large tracts of vegetation nearby and the proximity of a regionally significant fauna movement corridor associated with Thomsons Creek. There is no direct evidence of these species breeding in the proposal site despite targeted surveys over multiple seasons.

Clearing of vegetation may, in general, directly harm resident fauna. The proposal would remove vegetation in under 8.13 ha of land, with much of this total area open space or low vegetation that would not comprise shelter for these bird species. Most resident birds could easily evade harm once construction activity begins at the proposal site. The proposal would include fauna management protocols including pre-clearing surveys and salvage and treatment of any resident fauna. This would partially mitigate impacts on the local populations of these species if any less mobile nesting individuals or their young are in the proposal site during vegetation clearing works. Application of treated wastewater to 1.2 ha of habitat is unlikely to harm any birds. The proposal would not directly harm a significant proportion of the populations of these bird species, if any.

Noise and vibration, light, vehicle movement and other human activities during the operation of the proposal has the potential to disturb individuals, if nesting in areas adjacent to the proposal site and may result in individuals foraging elsewhere. These indirect impacts resulting from the proposal would be temporary in nature and would only last about 12 months during construction of the compressor and the workers' camp will be used intermittently for approximately 3 – 5 months every three years over the life of the proposal. Generation of additional noise and light would occur for a relatively small portion of the 25-year life of the proposal. Vegetation management measures recommended for the proposal would help to avoid direct impacts and minimise indirect impacts on habitat adjoining the proposal footprint. Extensive areas of comparable foraging and nesting habitat are present in surrounding areas and so the temporary displacement of fauna over short distances would have a minor consequence. The likely magnitude of edge effects or other indirect effects would not be sufficient to tangibly affect the life cycle of these threatened species.

The proposal is therefore unlikely to adversely affect the lifecycle of these vulnerable bird species such that an important population would decline in size.

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

The proposal would remove or modify up to 9.33 hectares of native vegetation that is habitat for these vulnerable bird species. Noise and human activity may affect the quality or occupation of habitat adjoining the proposal site during construction and periods when the site is occupied. The proposal would create a small-scale gap in habitat that could be easily passed over or through by these bird species particularly during the majority of the 25-year life of the proposal when the camp site is unoccupied. Given the extent of habitat in the locality, populations of these species would persist in the local area and region. Therefore, despite removing or modifying a small area of habitat the proposal would not reduce the overall area of occupancy of these species.

## EPBC Act Assessment of Significance

Vulnerable bird species of semi-arid shrubland and woodland: Southern Whiteface (*Aphelocephala leucopsis*), Grey Falcon (*Falco hypoleucos*), Painted Honeyeater (*Grantiella picta*)

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

These species may travel through the site on occasion as an extension of their use of habitat in adjoining areas of native vegetation but would not be limited to, or reliant on, the connectivity provided by the site to support their continued use of the local area. The proposal would include clearing of native vegetation and erection of structures in up to 8.13 ha of land. Construction of the compressor station and camp would reduce connectivity through the proposal site by decreasing shelter and creating physical barriers. It has conservatively been assumed that the application of treated effluent would remove or significantly modify up to 1.2 ha of native vegetation by harmfully altering soil moisture and/or nutrient content. Removal of native vegetation cover and operation of the proposal would create a gap in east-west habitat connectivity about 500m wide and north-south connectivity about 180 m wide.

Human occupation may also deter these bird species from moving through the local area during construction and then periods when the camp is occupied. The construction and commissioning of the compressor station will take approximately 12 months and the workers' camp will be used intermittently for approximately 3 – 5 months every three years over the life of the proposal. Impacts of human activity would occur for a relatively small portion of the 25-year life of the proposal.

Habitat connectivity would be maintained around the proposal site through extensive areas of similar Acacia and chenopod shrubland and the riparian corridor of Thomsons Creek. The proposal does not include the erection of any large or hazardous structures that would increase the risk or energy cost of movement of any threatened or migratory fauna. Removal of vegetation and construction of the compressor and camp infrastructure would only result in a minor increase in the degree of fragmentation between retained areas of habitat for these species and would not result in the isolation of any habitat. The proposal would create a small-scale gap in habitat that could be easily passed over or through by these bird species particularly during the majority of the 25-year life of the proposal when the camp site is unoccupied. Given the extent of habitat in the locality, populations of these species would persist in the local area and region. Therefore, despite removing or modifying a small area of habitat the proposal would not fragment an important population of these bird species into two or more populations.

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

Habitat critical to the survival of the Southern Whiteface includes areas of:

- relatively undisturbed open woodlands and shrublands with an understorey of grasses or shrubs, or both
- habitat with low tree densities and an herbaceous understorey litter cover which provides essential foraging habitat
- living and dead trees with hollows and crevices which are essential for roosting and nesting (DCCEE 2023b).

No Critical Habitat for the species as defined under section 207A of the EPBC Act has been identified or included in the Register of Critical Habitat (DCCEE 2023c). The proposal would remove or modify up to 9.33 hectares of native vegetation that may be foraging habitat critical to the survival of the Southern Whiteface. This is a very small proportion of the extent of similar critical habitat in the locality and region, which includes close to 100 % cover of similar semi-arid woodland and shrubland. The proposal would not remove or otherwise affect any trees with hollows and crevices, essential for roosting and nesting.

Habitat critical to the survival of the Grey Falcon would comprise suitable nesting habitat such as tree-lined watercourses through areas of suitable foraging habitat. The species may hunt in any vegetation or open space that contains prey species and so foraging habitat with particular characteristics is unlikely to be critical to the survival of the species. No Critical Habitat for the species as defined under section 207A of the EPBC Act has been identified or included in the Register of Critical Habitat (DCCEE 2023c). Construction activities would be located at least 150 m from the top of bank of Thomsons Creek. Environmental management measures are likely to mitigate against any tangible indirect impacts on Thomsons Creek or any other treed habitat with particular value. The proposal would not affect any habitat critical to the survival of the Grey Falcon.

There are five key biodiversity areas nominated for the Painted Honeyeater all of which are several hundred kilometres south east of the proposal site (DAWE 2021). No Critical Habitat for the species as defined under section 207A of the EPBC Act has been identified or included in the Register of Critical Habitat (DCCEE 2023c). According to the recovery plan for the species foraging habitat critical to the survival of the Painted Honeyeater includes all preferred foraging species within known and likely foraging habitat particularly mistletoes of the genus *Amyema* growing on forest and woodland eucalypts and acacias (DAWE 2021). The proposal would remove or modify up to 9.33 hectares of semi-arid shrubland containing mistletoe that may be habitat critical to the survival of the Painted Honeyeater. This is a very small proportion of the extent of similar critical habitat in the locality and region, which includes close to 100 % cover of similar semi-arid woodland and shrubland.

**EPBC Act Assessment of Significance**

Vulnerable bird species of semi-arid shrubland and woodland: Southern Whiteface (*Aphelocephala leucopsis*), Grey Falcon (*Falco hypoleucos*), Painted Honeyeater (*Grantiella picta*)

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

The proposal would remove or modify 9.33 ha of native vegetation in varying condition, all of which provides foraging habitat and potential breeding habitat. Removal of vegetation may disrupt the breeding cycle of these species by reducing foraging resources available or displacing or harming nesting birds. The proposal would not affect any candidate trees of a suitable size or location for nesting of the Grey Falcon. The Southern Whiteface and Painted Honeyeater may build nests in a variety of locations, including trees and shrubs or stumps could also nest in the proposal site. It is assumed that a breeding population of these species is present in the wider locality given the large tracts of vegetation nearby and the proximity of a regionally significant fauna movement corridor associated with Thomsons Creek. There is no direct evidence of these species breeding in the proposal site despite targeted surveys over multiple seasons.

Clearing of vegetation may, in general, directly harm resident fauna. The proposal would remove vegetation in up to 8.13 ha of land, with much of this total area open space or low vegetation that would not comprise nesting habitat for these bird species. The proposal would include fauna management protocols including pre-clearing surveys and salvage and treatment of any less mobile nesting individuals or their young that are in the proposal site during vegetation clearing works. The proposal would not directly harm or otherwise interrupt the breeding cycle of a significant proportion of the populations of these bird species, if any.

Indirect impacts such as generation of additional noise and light would occur for a relatively small portion of the 25-year life of the proposal. Extensive areas of comparable foraging and nesting habitat are present in surrounding areas and so the temporary displacement of fauna over short distances would have a minor consequence.

The proposal is therefore unlikely to substantially disrupt the breeding cycle of these vulnerable bird species..

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

The proposal would remove or modify a maximum of 9.33 ha of native vegetation, comprising the maximum possible area of Good and Poor condition Narrow-leaved Hopbush - Scrub Turpentine - Senna shrubland on semi-arid and arid sandplains and dunes at the proposal site. Subject to detailed design residual impacts would include around 8.13 ha of land to be cleared and compacted for infrastructure and 1.2 ha for wastewater irrigation, only a portion of which would contain native vegetation. Impacts would be concentrated in areas of non-native vegetation as far as possible including the use of existing access tracks for vehicle access and bare earth for wastewater irrigation and so the potential residual direct impacts comprise a conservative upper limit. The proposal site contains open vegetation typical of semi-arid environments and has been modified by construction of the WMP and ongoing agricultural activities. The existing environment includes substantial areas of bare earth and fine gravel with minimal biodiversity value and so the actual area of disturbance of native vegetation and habitat resources would be considerably less than the total proposal site area.

The site does not contain any large trees, water bodies or any other habitat features that would comprise an important connecting link between any other areas of habitat. These species may travel through the site on occasion as an extension of their use of habitat in adjoining areas of native vegetation but would not be limited to, or reliant on, the connectivity provided by the site to support their continued use of the local area. Habitat connectivity would be maintained around the proposal site through extensive areas of similar Acacia and chenopod shrubland and the riparian corridor of Thomsons Creek. The proposal does not include the erection of any large or hazardous structures that would substantially increase the risk or energy cost of movement of these bird species. Removal of vegetation and construction of the compressor and camp infrastructure would only result in a minor increase in the degree of fragmentation between retained areas of habitat for these species and would not result in the isolation of any habitat.

The reduction in extent of habitat would be minor. The proposal would create a gap in east-west habitat connectivity about 500 m wide and north-south connectivity about 180 m wide, which would not be sufficient to interrupt any ecological process such as migration or pollination. The surrounding locality and region contain many thousands of hectares of similar vegetation and equivalent habitat resources. Given this minor quantum of impact and the presence of alternative habitat resources the proposal is unlikely to have an adverse effect on habitat for these the species to the extent that they would be likely to decline.

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

Disturbance associated with vegetation clearing and vehicle traffic during construction or use of the camp may, in general, increase the potential for the spread, introduction and establishment of weed and pest species. The proposal site adjoins sensitive areas of native vegetation, especially in the riparian corridor of Thomsons Creek and its tributaries.

Construction and environmental management plans will specify measures for restricting access to native vegetation and minimising the risk of transmitting weed propagules. Environmental inductions, visual barriers and/or exclusion fencing will be used to exclude personnel and vehicles from habitat outside the proposal site.

To further mitigate the risk of pathogens being brought onto and/or spread through the site all vehicles, plant and equipment will be cleaned down (wash/blow down) and certified weed free prior to initial entry to site; all vehicles, plant and equipment will strictly adhere to the approved roads, tracks, easements and work areas to minimise contact with vegetation.

**EPBC Act Assessment of Significance**

Vulnerable bird species of semi-arid shrubland and woodland: Southern Whiteface (*Aphelocephala leucopsis*), Grey Falcon (*Falco hypoleucos*), Painted Honeyeater (*Grantiella picta*)

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

As described for invasive species above, the proposal may, in general, increase the potential for the spread, introduction and establishment of diseases and pathogens. The proposal does not include any higher risk activities such as transport of biological material.

Construction and environmental management plans will specify measures for restricting access to native vegetation and minimising the risk of transmitting disease. To further mitigate the risk of pathogens being brought onto and/or spread through the site all vehicles, plant and equipment will be cleaned and inspected. Personnel, vehicles and equipment will be restricted to work areas to minimise contact with sensitive habitat.

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

The proposal would interfere with the recovery of these species by removing or modifying habitat, which is noted as a key threat for each species (DCCEEW 2023b). As described above, the proposal would remove or modify a maximum of 9.33 ha of habitat for these species at the proposal site. The site does not contain any confirmed breeding habitat, large trees, water bodies or any habitat features that would comprise an important connecting link between any other areas of habitat. These species occupy the proposal site on occasion as an extension of their use of habitat in adjoining areas of native vegetation but would not be limited to, or reliant on, the habitat at the site.

The reduction in extent of habitat would be minor. The surrounding locality and region contain many thousands of hectares of similar vegetation and equivalent habitat resources. Given this minor quantum of impact and the presence of alternative habitat resources the proposal would not interfere substantially with the recovery of these species.

**Conclusion of assessment of significance**

Based on consideration of the above criteria, the proposal is unlikely to have a significant effect on an important population of these vulnerable bird species, as:

- Only a small area of native vegetation (9.33 ha) would be removed or modified, which represents a very small proportion of the available habitat for these species within the locality
- The proposal is unlikely to have an adverse effect on the size or breeding cycle of an important population of these species
- The proposal will only result in a minor increase in the degree of fragmentation between retained areas of habitat for these mobile species and will not result in any isolation of habitat
- The proposal site is unlikely to be important to the recovery of these species.

## **F-2 Endangered bird species of semi-arid shrubland and woodland: Major Mitchell's Cockatoo (*Lophochroa leadbeateri*) and Grey Grasswren (*Amytornis barbatus barbatus*)**

### **F-2-1 Major Mitchell's Cockatoo**

#### **Distribution**

The Major Mitchell's Cockatoo occurs in arid and semi-arid NSW, regularly as far east as Bourke and Griffith and occasionally further east as vagrants.

#### **Habitat requirements**

The species inhabits a range of treed and treeless inland habitats within easy reach of water. The species nests in tree hollows. It feeds mostly on the ground, especially on the seeds of native and exotic melons and on the seeds of species of saltbush, wattles and cypress pines (DPE 2023a).

#### **Habitat in the study area**

There is potential foraging habitat for the Major Mitchell's Cockatoo throughout the proposal site associated with PCT 143 shrubland, which includes favoured foraging resources such as Acacia and native melon fruit. There is potential breeding habitat for the species in PCT 41 River Red Gum open woodland in the broader study area, including a number of candidate nest trees with suitable hollows. No evidence of breeding was noted despite diurnal bird surveys and nest tree censuses conducted over multiple seasons including dedicated survey effort within the breeding season for the species nominated in the TBDC (DPE 2023a).

There are no records of the species within the locality on BioNet (DPE 2023a) though the proposal site is well within the known distribution of the species, and it would be expected to occur at least on occasion.

### **F-2-2 Grey Grasswren**

#### **Distribution**

The Grey Grasswren is endemic to the arid channel country of inland Australia occurring on the swamp floodplain of the Bulloo River northeast of Tibooburra. Its known distribution straddles the north west NSW and south west Queensland border (DCCEEW 2023a).

#### **Habitat requirements**

The subspecies is considered to be a specialist, living in swamps dominated by Lignum (*Muehlenbeckia cunninghamii*) and Canegrass (*Eragrostis australasica*). The Grey Grasswren occurs solely on a small number of leasehold properties. The species shelters, roosts, nests and feeds almost entirely within dense, tall Lignum, with associated Sandhill Canegrass (*Zygochloa paradoxa*) and sedges in swamps, overflow channels and flood pans. Old Man Saltbush communities close to Lignum are also heavily utilised at times. Also occurs in stands of Canegrass or Oldman Saltbush growing on surrounding sand dunes when the areas of Lignum become flooded. Not dependent on surface water and can persist in dense lignum habitat even if dry for several years.

#### **Habitat in the study area**

There is potential habitat for the Grey Grasswren throughout the proposal site associated with PCT 143 shrubland, though this vegetation is drier, more open and higher in the landscape than the species' preferred habitat. There is higher quality habitat for the species in PCT 41 River Red Gum open woodland in the broader study area including dense patches of Swamp Canegrass (*Eragrostis australasica*) and other moisture-loving perennial grasses on dunes near watercourses and occasional Lignum. No direct evidence of the species was noted despite diurnal bird surveys conducted over multiple seasons.

There is one record of the species within the locality on BioNet (DPE 2023a). Thomsons Creek drains to the Narriearra Caryapundy Swamp around 60 km downstream which is recognised as the stronghold of the species in

NSW (DCCEEW 2023b). The proposal site is outside of the known area of occupation of the species but is connected to this core area of habitat by a continuous stretch of potential habitat by the Thomsons Creek riparian corridor and as such may be occupied on occasion.

**EPBC Act Assessment of Significance**

Endangered bird species of semi-arid shrubland and woodland: Major Mitchell's Cockatoo (*Lophochroa leadbeateri*) and Grey Grasswren (*Amytornis barbatus barbatus*)

**According to the DoE (2013) 'significant impact criteria', an action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will: Lead to a long-term decrease in the size of a population**

The factors that could potentially lead to a long-term decrease in the size of a population of these endangered bird species include direct harm, loss of foraging habitat affecting an ecologically significant proportion of local populations or loss of important breeding habitat.

The proposal would result in direct impacts to native vegetation and associated threatened species habitat through:

- clearing of up to 8.13 ha of native vegetation for construction of the compressor, temporary camp site and associated infrastructure
- application of treated wastewater to up to 1.2 ha of native vegetation.

The proposed impact mitigation and environmental management measures are likely to mitigate against erosion, sedimentation or any other indirect effects on adjacent habitat during the proposed works.

These species were not recorded in the proposal site but are known to occur in similar habitats in the locality and may occur in the proposal site on occasion.

The proposal would remove or modify 9.33 ha of native vegetation in varying condition, all of which provides potential foraging habitat for these species. The proposal would not affect any candidate trees with hollows of a suitable size or location for nesting of the Major Mitchell's Cockatoo. The Grey Grasswren nests in dense Lignum or grass thickets on floodplains and would not breed in the open shrubland on dunes and rises in the proposal site. Neither of these species is likely to breed in the proposal site or rely on any habitat resources that are present to maintain populations.

Clearing of vegetation may, in general, directly harm resident fauna. The proposal would remove vegetation in under 8.13 ha of land, with much of this total area open space or low vegetation that would not comprise shelter for these bird species. Any resident birds could easily evade harm once construction activity begins at the proposal site. The proposal would also include fauna management protocols including pre-clearing surveys and salvage and treatment of any resident fauna. Application of treated wastewater to 1.2 ha of habitat is unlikely to harm any birds. The proposal would not directly harm a significant proportion of the populations of these bird species, if any.

Vegetation management measures recommended for the proposal would help to avoid direct impacts and minimise indirect impacts on habitat adjoining the proposal footprint. The likely magnitude of edge effects or other indirect effects would not be sufficient to tangibly affect the life cycle of these threatened species.

Noise and vibration, light, vehicle movement and other human activities during the operation of the proposal have the potential to displace individuals from foraging habitat. These indirect impacts resulting from the proposal would be temporary in nature and would only last about 12 months during construction of the compressor and the workers' camp will be used intermittently for approximately 3 – 5 months every three years over the life of the proposal. Generation of additional noise and light would occur for a relatively small portion of the 25-year life of the proposal. Extensive areas of comparable habitat are present in surrounding areas and so the temporary displacement of fauna over short distances would have a minor consequence.

The proposal is therefore unlikely to adversely affect the lifecycle of these bird species such that a population would decline in size.

**Reduce the area of occupancy of the species**

The proposal would remove or modify up to 9.33 hectares of native vegetation that is habitat for these bird species. Noise and human activity may affect the quality or occupation of habitat adjoining the proposal site during construction and periods when the site is occupied. The proposal would create a small-scale gap in habitat that could be easily passed over or through by these bird species particularly during the majority of the 25-year life of the proposal when the camp site is unoccupied. Given the extent of habitat in the locality, populations of these species would persist in the local area and region. Therefore, despite removing or modifying a small area of habitat, the proposal would not reduce the overall area of occupancy of these species.

## EPBC Act Assessment of Significance

Endangered bird species of semi-arid shrubland and woodland: Major Mitchell's Cockatoo (*Lophochroa leadbeateri*) and Grey Grasswren (*Amytornis barbatus barbatus*)

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

These species may travel through the site on occasion as an extension of their use of habitat in adjoining areas of native vegetation but would not be limited to, or reliant on, the connectivity provided by the site to support their continued use of the local area. The proposal would include clearing of native vegetation and erection of structures in around 8.13 ha of land. Construction of the compressor station and camp would reduce connectivity through the proposal site by decreasing shelter and creating physical barriers. It has conservatively been assumed that the application of treated effluent would remove or significantly modify up to 1.2 ha of native vegetation by harmfully altering soil moisture and/or nutrient content. Removal of native vegetation cover and operation of the proposal would create a gap in east-west habitat connectivity about 500 m wide and north-south connectivity about 180 m wide.

Human occupation may also deter these bird species from moving through the local area during construction and during periods when the camp is occupied. The construction and commissioning of the compressor station will take approximately 12 months and the workers' camp will be used intermittently for approximately 3 – 5 months every three years over the life of the proposal. Impacts associated with human activity would occur for a relatively small portion of the 25-year life of the proposal.

Habitat connectivity would be maintained around the proposal site through extensive areas of similar Acacia and chenopod shrubland and the riparian corridor of Thomsons Creek. The proposal does not include the erection of any large or hazardous structures that would increase the risk or energy cost of movement of any threatened or migratory fauna. Removal of vegetation and construction of the compressor and camp infrastructure would only result in a minor increase in the degree of fragmentation between retained areas of habitat for these species and would not result in the isolation of any habitat. The proposal would create a small-scale gap in habitat that could be easily passed over or through by these bird species particularly during the majority of the 25-year life of the proposal when the camp site is unoccupied. Given the extent of habitat in the locality, populations of these species would persist in the local area and region. Therefore, despite removing or modifying a small area of habitat the proposal would not fragment a population of these bird species into two or more populations.

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

Habitat critical to the survival of the eastern Major Mitchell's cockatoo consist of:

- arid and semi-arid woodlands dominated by mulga (*Acacia aneura*), mallee and box eucalypts, slender cypress pine (*Callitris gracilis*) or belah (*Casuarina cristata*)
- known habitat containing suitable attributes such as large mature trees with suitable hollows
- surrounding matrix of these areas for the role of providing movement corridors for dispersal across the landscape.

No Critical Habitat for the species as defined under section 207A of the EPBC Act has been identified or included in the Register of Critical Habitat (DCCEEW 2023c). The proposal would remove or modify up to 9.33 hectares of native vegetation that may be foraging habitat critical to the survival of the Major Mitchell's Cockatoo. This is a very small proportion of the extent of similar critical habitat in the locality and region, which includes close to 100 % cover of similar semi-arid woodland and shrubland. The proposal would not remove or otherwise affect any large mature trees with suitable hollows for nesting.

Habitat of primary importance for the Grey Grasswren includes swampy floodplains dominated by Lignum and Swamp Canegrass (*Eragrostis australasica*), where these plants form dense thickets of 1 m or greater in diameter and 1-2 m in height. No Critical Habitat for the species as defined under section 207A of the EPBC Act has been identified or included in the Register of Critical Habitat (DCCEEW 2023c). The proposal would remove or modify up to 9.33 hectares of native vegetation that may be occupied by the Grey Grasswren on occasion but would not comprise habitat critical to the survival of the species. The vegetation in the proposal site is drier, more open and higher in the landscape than the species' preferred habitat but may be occupied on occasion as an extension of the use of habitat in the Thomsons Creek riparian corridor. The proposal would affect a very small proportion of the extent of similar habitat in the locality and region, which includes close to 100 % cover of similar semi-arid woodland and shrubland.

### Disrupt the breeding cycle of a population

The proposal would remove or modify 9.33 ha of native vegetation in varying condition, which comprises potential foraging habitat or a movement corridor for these species. Removal of vegetation may disrupt the breeding cycle of these species by reducing foraging resources available or displacing or otherwise affecting the movement of breeding birds. The proposal would not affect any candidate trees of a suitable size or location for nesting of the Major Mitchell's Cockatoo. The proposal site is around 60 km upstream of core breeding habitat for the Grey Grasswren and over 150 m from any higher value shelter or movement habitat in the Thomsons Creek riparian corridor.

The proposal would not directly harm or otherwise interrupt the breeding cycle of a significant proportion of the populations of these bird species, if any.



**EPBC Act Assessment of Significance**

Endangered bird species of semi-arid shrubland and woodland: Major Mitchell's Cockatoo (*Lophochroa leadbeateri*) and Grey Grasswren (*Amytornis barbatus barbatus*)

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

The proposal would remove or modify a maximum of 9.33 ha of native vegetation, comprising the maximum possible area of Good and Poor condition Narrow-leaved Hopbush - Scrub Turpentine - Senna shrubland on semi-arid and arid sandplains and dunes at the proposal site. Subject to detailed design residual impacts would include around 8.13 ha of land to be cleared and compacted for infrastructure and 1.2 ha for wastewater irrigation, only a portion of which would contain native vegetation. Impacts would be concentrated in areas of non-native vegetation as far as possible including the use of existing access tracks for vehicle access and bare earth for wastewater irrigation and so the potential residual direct impacts comprise a conservative upper limit. The proposal site contains open vegetation typical of semi-arid environments and has been modified by construction of the WMP and ongoing agricultural activities. The existing environment includes substantial areas of bare earth and fine gravel with minimal biodiversity value and so the actual area of disturbance of native vegetation and habitat resources would be considerably less than the total proposal site area.

The site does not contain any large trees, water bodies or any other habitat features that would comprise an important connecting link between any other areas of habitat. These species may travel through the site on occasion as an extension of their use of habitat in adjoining areas of native vegetation but would not be limited to, or reliant on, the connectivity provided by the site to support their continued use of the local area. Habitat connectivity would be maintained around the proposal site through extensive areas of similar Acacia and chenopod shrubland and the riparian corridor of Thomsons Creek. The proposal does not include the erection of any large or hazardous structures that would substantially increase the risk or energy cost of movement of these bird species. Removal of vegetation and construction of the compressor and camp infrastructure would only result in a minor increase in the degree of fragmentation between retained areas of habitat for these species and would not result in the isolation of any habitat.

The reduction in extent of habitat would be minor. The proposal would create a gap in east-west habitat connectivity about 500 m wide and north-south connectivity about 180 m wide, which would not be sufficient to interrupt any ecological process such as migration or pollination. The surrounding locality and region contain many thousands of hectares of similar vegetation and equivalent habitat resources. Given this minor quantum of impact and the presence of alternative habitat resources, the proposal is unlikely to have an adverse effect on habitat for these the species to the extent that they would be likely to decline.

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

Disturbance associated with vegetation clearing and vehicle traffic during construction or use of the camp may, in general, increase the potential for the spread, introduction and establishment of weed and pest species. The proposal site adjoins sensitive areas of native vegetation, especially in the riparian corridor of Thomsons Creek and its tributaries.

Construction and environmental management plans will specify measures for restricting access to native vegetation and minimising the risk of transmitting weed propagules. Environmental inductions, visual barriers and/or exclusion fencing will be used to exclude personnel and vehicles from habitat outside the proposal site.

To further mitigate the risk of pathogens being brought onto and/or spread through the site all vehicles, plant and equipment will be cleaned down (wash/blow down) and certified weed free prior to initial entry to site; all vehicles, plant and equipment will strictly adhere to the approved roads, tracks, easements and work areas to minimise contact with vegetation.

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

As described for invasive species above, the proposal may, in general, increase the potential for the spread, introduction and establishment of diseases and pathogens. The proposal does not include any higher risk activities such as transport of biological material.

Construction and environmental management plans will specify measures for restricting access to native vegetation and minimising the risk of transmitting disease. To further mitigate the risk of pathogens being brought onto and/or spread through the site all vehicles, plant and equipment will be cleaned and inspected. Personnel, vehicles and equipment will be restricted to work areas to minimise contact with sensitive habitat.

**Interfere with the recovery of the species**

The proposal would interfere with the recovery of these species by removing or modifying habitat, which is noted as a key threat for each species (DCCEE 2023b). As described above, the proposal would remove or modify a maximum of 9.33 ha of habitat for these species at the proposal site. The site does not contain any confirmed breeding habitat, large trees, water bodies or any habitat features that would comprise an important connecting link between any other areas of habitat. The proposal site does not contain any habitat resources critical to the survival of these species. The proposal would not remove or indirectly affect occupation of any candidate nest trees for the Major Mitchell's Cockatoo and is around 60 km upstream from core habitat for the Grey Grasswren. These species may occupy the proposal site on occasion as an extension of their use of habitat in adjoining areas of native vegetation but would not be limited to, or reliant on, the habitat at the site.

**EPBC Act Assessment of Significance**

Endangered bird species of semi-arid shrubland and woodland: Major Mitchell's Cockatoo (*Lophochroa leadbeateri*) and Grey Grasswren (*Amytornis barbatus barbatus*)

The reduction in extent of habitat would be minor. The surrounding locality and region contain many thousands of hectares of similar vegetation and equivalent habitat resources. Given this minor quantum of impact and the presence of alternative habitat resources the proposal would not interfere substantially with the recovery of these species.

**Conclusion of assessment of significance**

The project is not likely to have a significant impact on these endangered bird species given:

- The limited extent of native vegetation to be removed in comparison to the extensive areas of alternative habitat in the locality.
- The limited quality of habitat to be removed, noting that the proposal site does not contain any candidate nest trees for the Major Mitchell's Cockatoo and is around 60 km upstream from core habitat for the Grey Grasswren and would be occupied infrequently, if at all.
- The proposal is unlikely to have an adverse effect on the size or breeding cycle of a population of these species.
- The proposal will only result in a minor increase in the degree of fragmentation between retained areas of habitat for these species and will not result in any isolation of habitat.
- The proposal site is unlikely to be important to the recovery of the species.



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