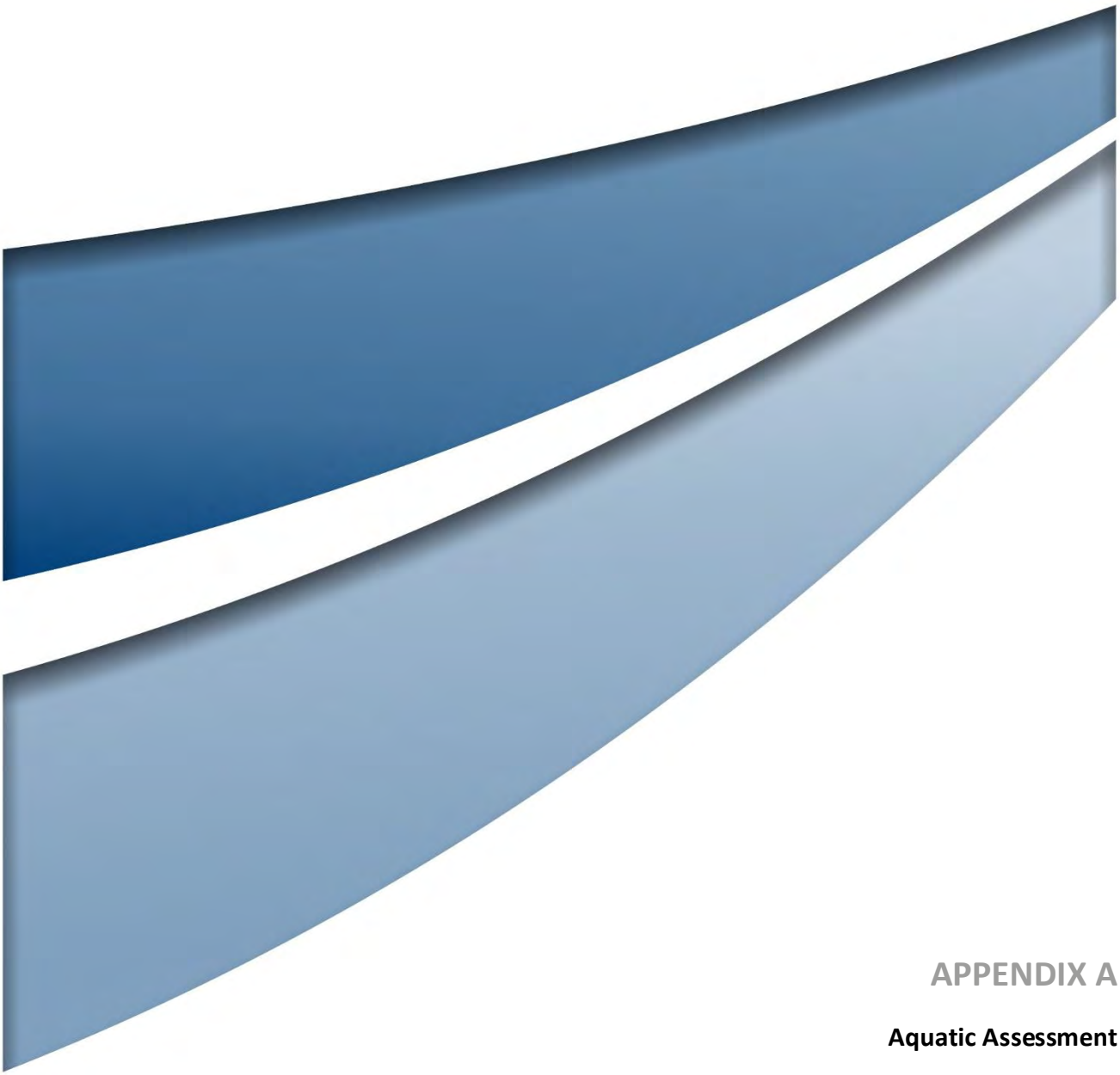

# APPENDIX A

**Aquatic Assessment**

umwelt
Environmental & Social Consultants

lightsource bp

# GOULBURN RIVER SOLAR FARM

Public Road and Culvert Upgrade Works
Aquatic Assessment Report

**DRAFT**

**January 2024**

# GOULBURN RIVER SOLAR FARM

Public Road and Culvert Upgrade Works Aquatic Assessment Report

## DRAFT

Prepared by
Umwelt (Australia) Pty Limited
on behalf of
Lightsource bp

Project Director: Malinda Facey
Project Manager: Jessica Henderson-Wilson
Technical Director: Rachel Musgrave
Technical Manager: Jacob Manners
Report No. 23485/R05/Appendix A
Date: January 2024

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

***Acknowledgement of Country***

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



**Document Status**

| Rev No. | Reviewer | | Approved for Issue | |
|---|---|---|---|---|
| | Name | Date | Name | Date |
| V1 | Jacob Manners | | | |
| V2 | Jacob Manners | | Malinda Facey | 12 Jan 2024 |

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# 1.0 Introduction

Umwelt has been engaged by Lightsource Development Services Australia Pty Ltd (Lightsource bp), the Proponent, to prepare a Revised Aquatic Assessment Report for the response to submissions for the proposed public road, intersection and culvert upgrade works (the proposed works) associated with the Goulburn River Solar Farm (the Project). The Project is a State Significant Development (SSD) under Division 4.7 of Part 4 of the *NSW Environmental Planning and Assessment Act 1979* (EP&A Act).

The Goulburn River Solar Farm and the associated public road upgrade works are all located within the Upper Hunter Local Government Area (LGA) of New South Wales (NSW).

This assessment has been updated to address project changes made in response to submissions during the public exhibition and supports the revised BDAR. This report only addresses aquatic values associated with road upgrades for the Goulburn River Solar Farm. Aquatic values associated with the Goulburn River Solar Farm are assessed in the Goulburn River Solar Farm BDAR.

## 1.1 Proposed Development

The proposed road upgrade works are located at three locations. The Proposed Works include:

- **Golden Highway Intersection Upgrade Development Footprint** – Upgrades to the intersection of the Golden Highway and Ringwood Road, including pruning and removal of vegetation and trees, embankment shaping and formalisation of the informal bus stop on Ringwood Road.
- **Bow River to Binks Road Upgrade Development Footprint** – Approximately 4.4 kilometres (km) of upgrades on Ringwood Road from Bow River to Binks Road, including realignment, widening and culvert upgrades where the road crosses Killoe Creek and the Bow River.
- **Wollara Road Upgrade Development Footprint** – Approximately 4.7 km of road widening and sealing of the unsealed section of Wollara Road from the southern boundary of the Tongo State Forest extending to the north-west toward the Golden Highway.

The locations of the proposed works are mapped in **Figure 1.1** for the Golden Highway Intersection Upgrade Development Footprint, **Figure 1.2** for the Bow River to Binks Road Upgrade Development Footprint and **Figure 1.3** for the Wollara Road Upgrade Development Footprint.

In total, approximately 8.1 km of road will be widened and resealed. These repairs will include 8 metre (m) bitumen-sealed formation with a minimum of 500 millimetre (mm) unsealed shoulders. The works aim to ensure that the horizontal and vertical alignment of the proposed road will ensure safe sight distance, safe movement of longer vehicles, and an improved road network for the users.

Culvert upgrades will occur at two locations where Ringwood Road intersects the Bow River and Killoe Creek. The culvert upgrades will include:

- Installing culverts designed to accommodate two-way heavy vehicles, including B doubles and various farm machinery.
- Culvert width 7 m (3.5 m lane width) sealed carriageway with suitable guardrail and signage and associated drainage works.

- Stockpile site to be located on disturbed land within the road reserve in consultation with Upper Hunter Shire Council.
- Temporary side track at Killoe Creek, and the use of the existing causeway at Bow River to facilitate continued road access during construction.
- All works are contained to the road reserve including any temporary access, stockpiling or compounds.

## 1.2 Scope

The Project SEARs, issued on 1 February 2022, require an assessment of the likely impacts on listed aquatic threatened species, populations or ecological communities, scheduled under the NSW *Fisheries Management Act 1994* (FM Act), and a description of the measures to minimise and rehabilitate impacts.

The SEARs also state, where the project involves works within 40 metres of any river, lake or wetlands (collectively waterfront land), identify likely impacts to the waterfront land, and how the activities are to be designed and implemented in accordance with the DPI *Guidelines for Controlled Activities on Waterfront Land* (2018) (updated in 2022) and (if necessary) *Why Do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings* (NSW DPI/Fairfull and Witheridge 2003), and *Policy & Guidelines for Fish Habitat Conservation & Management* (NSW DPE, 2013).

This aquatic assessment specifically addresses the SEARs relevant to the assessment of the aquatic environment.


**FIGURE 1.1**
Hydrological Context in Road Upgrade Areas

**Image Source:** ESRI Basemap (2022) **Data source:** NSW LPI (2022), NSW DSFI (2022); NPWS Estate (2022)

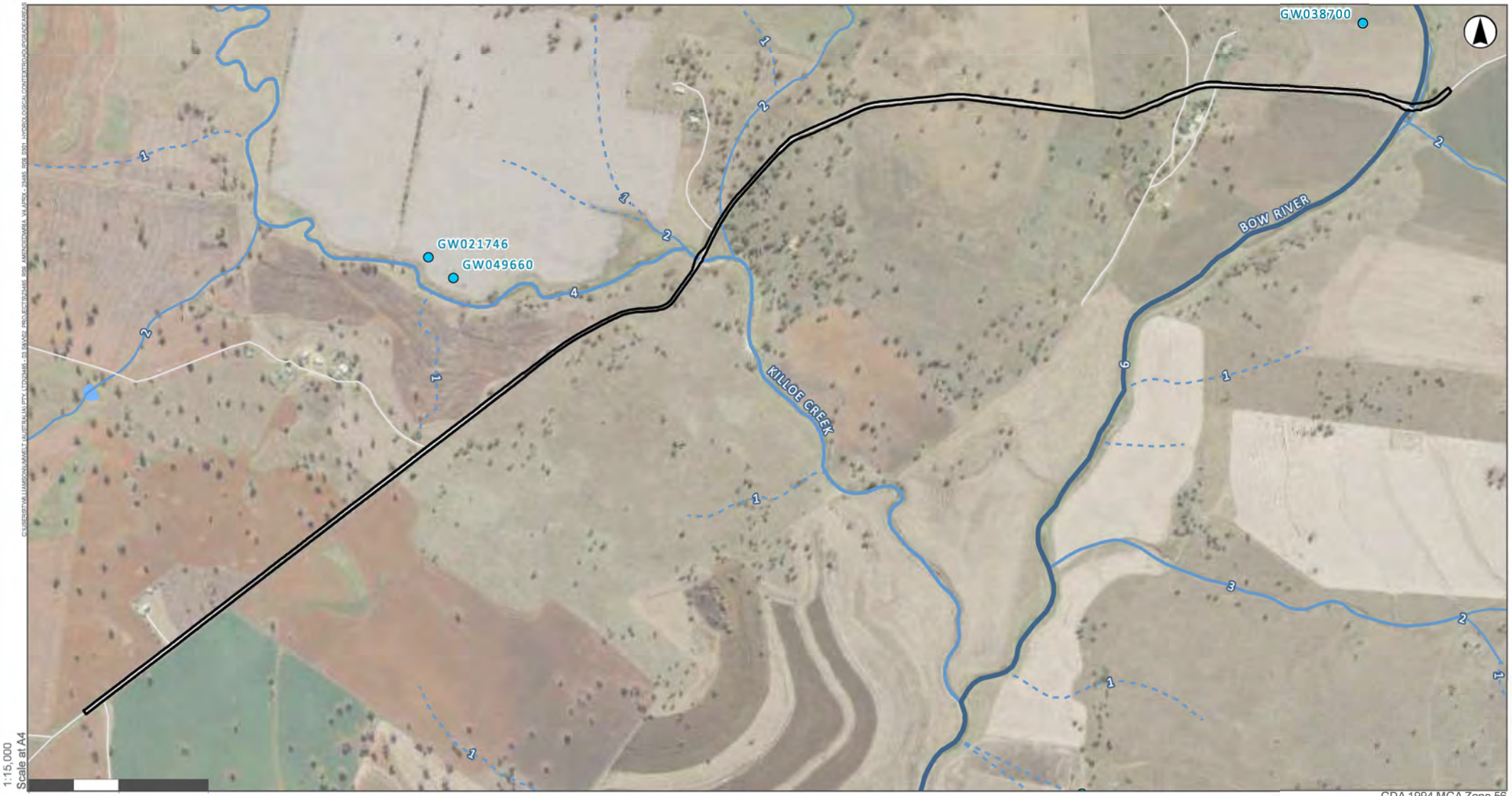


**FIGURE 1.2**
Hydrological Context in Road Upgrade Areas

**Image Source:** ESRI Basemap (2022) **Data source:** NSW LPI (2022), NSW DSFI (2022); NPWS Estate (2022)

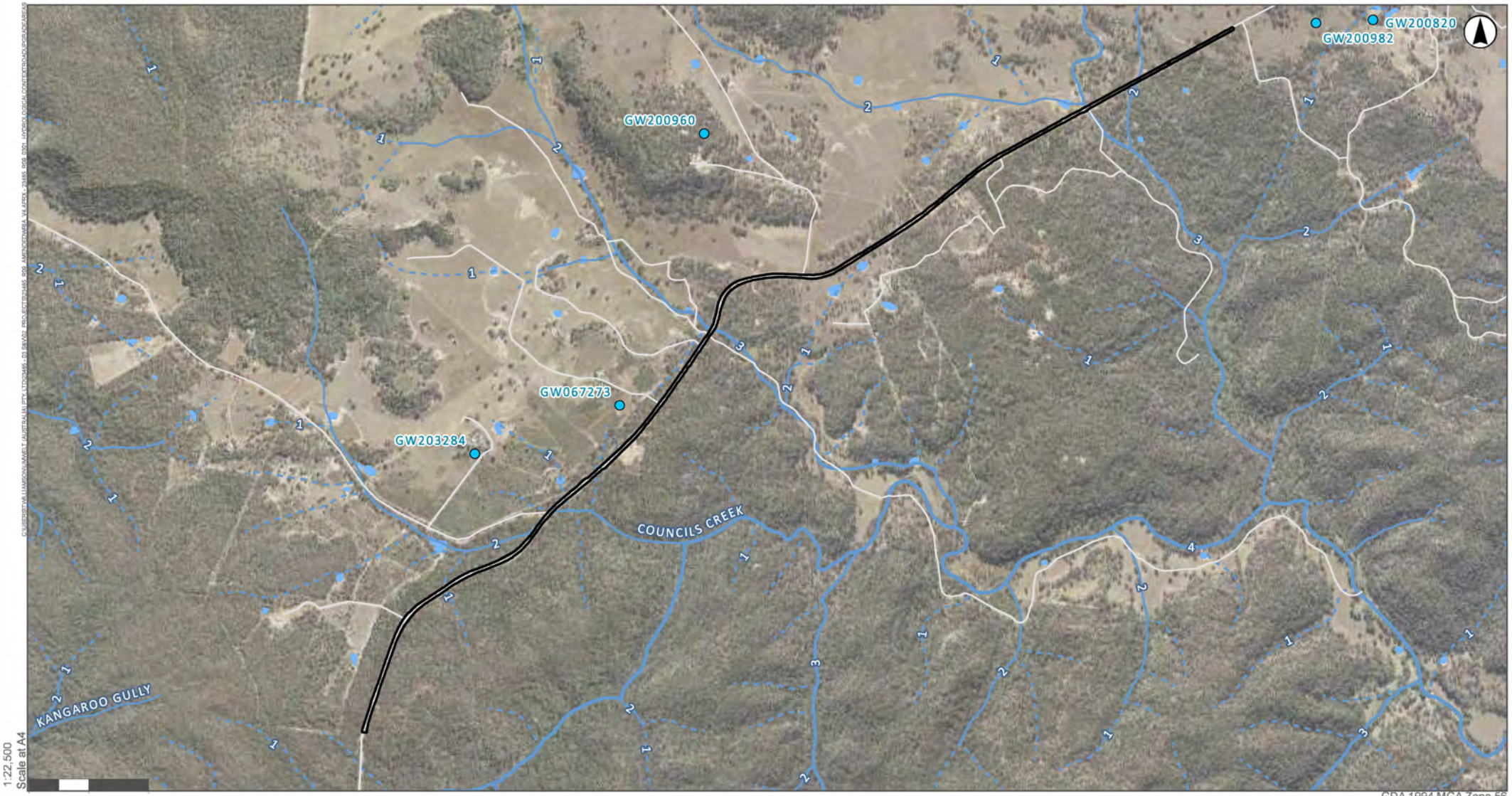


**FIGURE 1.3**
Hydrological Context in Road Upgrade Areas

**Image Source:** ESRI Basemap (2022) **Data source:** NSW LPI (2022), NSW DSFI (2022); NPWS Estate (2022)

# 2.0 Legislation and Policy

## 2.1 NSW Legislation

### 2.1.1 Fisheries Management (FM) Act

The FM Act provides for the conservation, protection and management of fisheries, aquatic systems and habitats in NSW. The FM Act applies in relation to all waters that are within the limits of the State and regulates certain activities that have the potential to impact on aquatic habitats.

Part 7A, section 221ZT(a) of the FM Act relates to the environmental assessment under Part 4 of the EP&A Act. Section 4 of this report identifies threatened species, populations and ecological communities listed under Schedule 4, 4A and 5 of the FM Act which are predicted to occur in the locality. In accordance with sections 221ZV and 221ZX of the FM Act, **Appendix A** of this report assesses likely impacts of the project (assessment of significance) on these listed species.

Permits under section 201, 205 and 219 of the FM Act are not required in accordance with the provisions of Section 4.41 of the EP&A Act.

## 2.2 Policy and guidelines

### 2.2.1 DPI Guidelines for Controlled Activities on Waterfront Land

Waterfront land includes the bed and bank of any river, lake or estuary and all land within 40 metres of the highest bank of the river, lake or estuary. Controlled activities include works and development within these areas. NSW DPI have released controlled activity guidelines for:

- In-stream works.
- Laying pipes and cables in watercourses.
- Outlet structures.
- Riparian corridors.
- Vegetation management plans.
- Watercourse crossings.

These guidelines were updated in 2022 and are listed in the References section of this Report. Controlled activity approvals are not required for SSD projects; however the controlled activity guidelines provide best practice design considerations and management measures for controlled activities.

It is recommended that the *Controlled Activity Guidelines for Watercourse Crossings on Waterfront Land* is considered and the final design for each culvert is generally consistent with this guideline. Specifically, the proposed works should be designed to maintain the existing natural hydraulic, hydrologic, geomorphic and ecological functions of the watercourses. It is also recommended that measures to protect against scour and erosion and sediment control are provided. Where revegetation is required, it is recommended that a vegetation management plan is prepared in accordance with *Controlled Activity Guidelines for Vegetation Management Plans*.

## 2.2.2 Policy and Guidelines for Fish Habitat Conservation and Management

These guidelines focus on promoting compliance with legislation relating to fish habitat conservation and management and are used for assessing developments and activities affecting key fish habitats (KFH). KFH's are defined in the policy and guidelines to include all marine and estuarine habitats up to the highest tide level (that reached by 'king' tides) and most permanent and semi-permanent freshwater habitats including rivers, creeks, lakes, lagoons, billabongs, weir pools and impoundments up to the top of the bank.

If the aquatic habitat in question is defined as KFH, it is then assigned a fish habitat sensitivity ranking which is used within the policy and guideline statements to differentiate between permissible and prohibited activities or developments related to the importance of the 'type' of KFH. **Table 2.1** defines those types of habitats that are considered KFH for the purpose of the application of the FM Act.

**Table 2.1 Key fish habitat and sensitivity classification scheme (DPI, 2013)**

| Sensitivity Ranking | Waterway Description |
|---|---|
| **TYPE 1 –** Highly sensitive key fish habitat | • Freshwater habitats that contain in-stream gravel beds, rocks.<br>• Greater than 500 mm in two dimensions, snags greater than 300 mm in diameter or 3 metres in length, or native aquatic plants.<br>• Any known or expected protected or threatened species. |
| **TYPE 2 –** Moderately sensitive key fish habitat | • Freshwater habitats and brackish wetlands, lakes and lagoons other than those defined in TYPE 1.<br>• Weir pools and dams up to full supply level where the weir or dam is across a natural waterway. |
| **TYPE 3 –** Minimally sensitive key fish habitat | • Coastal and freshwater habitats not included in TYPES 1 or 2.<br>• Ephemeral aquatic habitat not supporting native aquatic or wetland vegetation. |

Bow River is considered to constitute a Type 1 Highly Sensitive Key Fish Habitat as it contains instream gravel beds. Killoe Creek is considered to constitute a Type 2 Moderately Sensitive Key Fish Habitat as it contains freshwater habitats other than those defined in Type 1 and is not an ephemeral habitat.
The tributaries of Councils Creek are considered to constitute a Type 3 Minimally sensitive key fish habitat due to being ephemeral in nature.

## 2.2.3 Why Do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings

This Guideline provides measures to minimise impacts on fish passage by providing practical guidelines for the planning, design, construction and maintenance of watercourse crossings. This guideline defines four classes of fish habitat which are outlined in **Table 2.2**.

**Table 2.2 Classification of waterways for fish passage (Fairfull & Witheridge, 2003)**

| Classification | Characteristics of waterway class |
|---|---|
| **Class 1** – Major Fish Habitat | permanently or intermittently flowing waterway (e.g. river or major creek), habitat of a threatened fish species. |
| **Class 2** – Moderate Fish Habitat | named permanent or intermittent stream, creek or waterway with clearly defined bed and banks with semi-permanent to permanent waters in pools or in connected wetland areas. Marine or freshwater aquatic vegetation is present. Known fish habitat and/or fish observed inhabiting the area. |
| **Class 3** – Minimal Fish Habitat | Named or unnamed waterway with intermittent flow and potential refuge, breeding or feeding areas for some aquatic fauna (e.g. fish, yabbies). Semi - permanent pools form within the waterway or adjacent wetlands after a rain event. Otherwise, any minor waterway that interconnects with wetlands or recognised aquatic habitats |
| **Class 4** – Unlikely Fish Habitat | Named or unnamed waterway with intermittent flow following rain events only, little or no defined drainage channel, little or no flow or free-standing water or pools after rain events (e.g. dry gullies or shallow floodplain depressions with no permanent aquatic flora present). |

The Bow River and Killoe Creek watercourse crossing points are considered to constitute Class 2 Moderate Fish Habitat under these guidelines. Tributaries from Councils Creek are considered to consist of Class 3 Minimal Fish Habitat (Tributary 6) and Class 4 Unlikely Fish habitat (Tributary 5).

For Class 2 Moderate Fish Habitat, this guideline recommends bridges, arch structures, culverts or fords as the crossing type. Class 3 Minimal Fish Habitat recommends culvert or fords as the crossing type whereas Class 4 Unlikely Fish Habitat outline that fish friendly waterway crossing designs may potentially be unwarranted, however if required a culvert, ford or causeway would suffice.

In reference to the Project, culverts are identified as suitable fish friendly waterway crossing designs for the proposed crossings and the level of fish habitat present. It is recommended that the design measures for culverts within this guideline are considered.

# 3.0 Existing Environment

A site inspection of each watercourse crossing located within the study area was completed on 23 August 2023. The characteristics of each crossing observed were categorised into KFH habitat types based on their sensitivity (DPI, 2013), watercourse classifications (Fairfull and Witheridge, 2003) and identified aquatic features (refer to **Table 3.1**). A description of each tributary is further detailed in the sections below.

**Table 3.1 Characteristics of Tributaries**

| Watercourse | Strahler stream order | Fish habitat sensitivity | Waterways class |
|---|---|---|---|
| Bow River | >5 | Type 1 Highly Sensitive Key Fish Habitat | Class 2 Moderate Fish Habitat |
| Killoe Creek (Water crossing) | 4 | Type 2 Moderately Sensitive Key Fish Habitat | Class 2 Moderate Fish Habitat |
| Killoe Creek (Culvert) | 2 | Type 2 Moderately Sensitive Key Fish Habitat | Class 2 Moderate Fish Habitat |
| Councils Creek (Tributary 1) | 1 | Not listed | Not listed |
| Councils Creek (Tributary 2) | 1 | Not listed | Not listed |
| Councils Creek (Tributary 3) | 1 | Not listed | Not listed |
| Councils Creek (Tributary 4) | 2 | Not listed | Not listed |
| Councils Creek (Tributary 5) | 2 | Type 3 Minimally Sensitive Key Fish Habitat | Class 4 Unlikely Fish Habitat |
| Councils Creek (Tributary 6) | 3 | Type 3 Minimally Sensitive Key Fish Habitat | Class 3 Minimal Fish Habitat |

### 3.1.1 Bow River

The Bow River watercourse crossing intersects a >5 order section of the river. Here the river displays an alluvial channel with defined bed and banks with likely semi-permanent pools and flow. Stream width is approximately 15 m upstream and approximately 5–15 m downstream, with restriction of flow and pooling observed upstream due to the existing culverts. The water depth at the time of the inspection was estimated at 0.5–1 m. Water quality visually appeared to be good, with no visual signs of disturbance.

The confluence of the Bow River and Killoe Creek is approximately 2 km downstream, to the south of the Bow River watercourse crossing.

The native riparian vegetation has been generally cleared, with a remnant *Casuarina cunninghamiana* (River Oak) observed approximately 75 m upstream. The riparian vegetation consists of predominantly exotic grasses with low levels of native grasses, sedges and forbs. An exotic willow tree (*Salix babylonica*) is directly adjacent to the downstream side of the crossing. The bed is composed of alluvium and over larger basalt rock. There is concrete within the downstream bed which has broken off from the existing crossing and rock material which has potentially been deposited to stabilise the crossing.

The existing water course crossing consists of a series of small diameter pipes (<400 mm approx.) under a concrete crossing which sits above the natural bed height. The water level was over the crossing during the site inspection.

**Photo 3.1** and **Photo 3.2** show the Bow River watercourse crossing and the adjoining habitats.

**Photo 3.1 View of Bow River watercourse crossing looking upstream**

**Photo 3.2 View of Bow River directly downstream of watercourse crossing**

### 3.1.2 Killoe Creek

The Killoe Creek watercourse crossing intersects a 4th order section of the creek. Here the creek displays an alluvial channel with defined bed and banks with likely semi-permanent to ephemeral pools and flow. Stream width is narrow (<1 m) directly upstream and downstream, although widens with increasing distance from the existing single culvert, with no pools observed directly upstream. Stream depth was observed to be less than 0.5 metres at the time of the site inspection. Water quality visually appeared to be clear, however green algal growth was observed.

The confluence of the Bow River and Killoe Creek is approximately 1.5 km downstream to the south of the Killoe Creek watercourse crossing.

The native instream riparian vegetation has been generally cleared and consists of predominantly exotic grasses with some *Juncus acutus* in clumps along the water edge. Remnant *Eucalyptus melliodora* trees were observed on the high bank on the southern side of the creek. The bed is composed of sandstone bedrock with the stream channel cut into the bedrock through erosion.

The existing water course crossing consists of a small diameter pipe (<400 mm approx.) under a concrete crossing which sits slightly above the natural bed height. The water level was over the crossing during the site inspection.

**Photo 3.3** and **Photo 3.4** show the Killoe Creek watercourse crossing and the adjoining habitats.

**Photo 3.3 View of Killoe Creek watercourse crossing looking upstream**

**Photo 3.4 View of Killoe Creek directly downstream of watercourse crossing**

### 3.1.3 Unnamed Tributaries of Councils Creek

The project area intersects Councils Creek six times. Each tributary has been labelled from 1-6 as shown in **Figure 1.3** . A description of each tributary is provided below.

#### 3.1.3.1 Councils Creek Tributary 1

Tributary 1 of Councils Creek intersects a 1st order section of the creek. This section of the creek is ephemeral has no defined bed or banks both directly upstream and downstream. No water was observed during the site inspection.

The native instream riparian vegetation is limited and consists of predominantly exotic grasses with some *Austrostipa verticillata* (Slender Bamboo Grass) located isolated patches throughout the area.

**Photo 3.5** and **Photo 3.6** show Tributary 1 of Councils Creek and the adjoining habitats.

**Photo 3.5 View of unnamed tributary of Councils Creek (Tributary 1) looking upstream**

**Photo 3.6 View of unnamed tributary of Councils Creek (Tributary 1) looking downstream**

### 3.1.3.2 Councils Creek Tributary 2

Tributary 2 of Councils Creek intersects a X order section of the creek. The creek bed consists of clay/silt and sand. The stream width of Tributary 2 at the road crossing point is narrow (<1 m) and no pools of water were observed directly upstream or downstream.

The native instream riparian vegetation is limited and consists of primarily *Juncus australis* located in isolated clumps. Remnant *Eucalyptus* trees were also observed on either side of the creek.

The existing culvert consists of a medium diameter pipe (>400 mm approx.) which sits slightly above the natural bed height.

**Photo 3.7** and **Photo 3.8** show Tributary 2 of Councils Creek and the adjoining habitats.

**Photo 3.7 View of unnamed tributary of Councils Creek (Tributary 2) looking upstream**

**Photo 3.8 View of unnamed tributary of Councils Creek (Tributary 2) looking downstream**

### 3.1.3.3 Councils Creek Tributary 3

Tributary 3 of Councils Creek intersects a 1st order section of the creek. No pools or flow was observed during site inspection, however some water was observed draining on the side of the road that appeared to be unrelated to the creek crossing.

Creek bed located upstream was defined by grading associated with road works, with the creek bed consisting of a mixture of exposed rock, sand and clay/silt. No banks of the creek were observed.

**Photo 3.9** and **Photo 3.10** show Tributary 3 of Councils Creek watercourse and the adjoining habitats.

**Photo 3.9 View of unnamed tributary of Councils Creek (Tributary 3) looking upstream**

**Photo 3.10 View of unnamed tributary of Councils Creek (Tributary 3) looking downstream**

### 3.1.3.4 Councils Creek Tributary 4

Tributary 4 of Councils Creek intersects a 2nd order section of the creek. The creek bed consists of rock, silt and sand. The stream width of Tributary 4 was narrow (<1 m) however widened out away from the culvert. No pools of water were observed directly upstream or downstream.

The native instream riparian vegetation was sparse and consisted of predominantly exotic grasses with some *Gahnia aspera* (Rough saw-sedge) and *Lomandra spp*. (Mat-rush) located isolated patches throughout the area.

**Photo 3.11** and **Photo 3.12** show Tributary 4 of Councils Creek and the adjoining habitats.

**Photo 3.11 View of Tributary 4 of Councils Creek looking upstream**

**Photo 3.12 View of Tributary 4 of Councils Creek looking upstream**

### 3.1.3.5 Councils Creek Tributary 5

The Development Footprint intersects a 2nd order section of the creek at Tributary 5. Here the creek displays an alluvial channel with defined bed and banks with likely semi-permanent to ephemeral pools and flow. Stream width is narrow (>1 m) directly upstream and downstream, with no pools observed directly upstream. No water was observed.

The native instream riparian vegetation has been generally cleared and consists of predominantly exotic grasses.

**Photo 3.13** and **Photo 3.14** show the Tributary 5 of Councils Creek and the adjoining habitats.

**Photo 3.13 View Tributary 5 of Councils Creek looking upstream**

**Photo 3.14 View of Tributary 5 of Councils Creek looking downstream**

### 3.1.3.6 Councils Creek Tributary 6

Tributary 6 of Councils Creek intersects a 3rd order section of the creek. This section of the creek demonstrates an alluvial channel with defined bed and banks with likely semi-permanent to ephemeral pools and flow. Stream width is narrow (<1 m) directly upstream and downstream, although the channel is increasingly wide (>20 m). Water quality visually appeared to be clear, with minimal green algal growth observed.

It was evident the native instream riparian zone has been previously disturbed, Native vegetation was limited with vegetation primarily consisting of exotic grasses with some *Juncus australis* in clusters along the water edge.

**Photo 3.15** and **Photo 3.16** show Tributary 6 of Councils Creek and the adjoining habitats.

**Photo 3.15 View of Tributary 6 of Councils Creek looking upstream**

**Photo 3.16 View of Tributary 6 of Councils Creek looking downstream**

# 4.0 Desktop Assessment

## 4.1 Fisheries NSW Spatial Data Portal

A review of the *Fisheries NSW Spatial Data Portal* (NSW Department of Primary Industries, 2023a) was undertaken to identify areas of KFH and watercourses present.

### 4.1.1 Condition of Fish Communities

The spatial data portal identifies the condition of freshwater fish communities across NSW and only listed the Bow River as a freshwater fish community occurring within the project area. The Bow River was listed as Poor Condition.

### 4.1.2 Key Fish Habitat

The spatial data portal classifies the Bow River, Killoe Creek and three unnamed tributaries of Councils Creek as KFH for the Hunter Central Rivers Basin. Fish habitat sensitivity and waterway class is documented in **Table 3.1.**

### 4.1.3 Freshwater Fish Threatened Species Habitat Maps

The freshwater fish threatened species habitat maps prepared by the Department of Primary Industries were reviewed for the watercourses which intersect the works area. The maps did not identify the presence of any habitat for threatened species listed within the FM Act, within the works areas, however when reviewing the threatened species profiles provided by Department of Primary Industries the following threatened entities were identified for further assessment (refer to **Appendix A**):

- Southern Purple Spotted Gudgeon (*Mogurnda adspera*).
- Darling River Hardyhead (*Craterocephalus amniculus*) Hunter River population.

# 5.0 Impact Assessment

## 5.1 Water Quality

Without the implementation of appropriate erosion and sediment controls and mitigation measures throughout construction, construction activities have the potential to impact water quality in watercourses within the Project Area and receiving watercourses in the study area, through the mobilisation of sediments and other contaminants via wind or stormwater runoff.

The Water Resources Assessment (Umwelt, 2023) for the project concluded that construction of the project, including the implementation of appropriate mitigation and management measures, is unlikely to cause changes to the water quality environment against the identified NSW Water Quality Objectives.

## 5.2 Riparian and Freshwater Aquatic Vegetation

The proposed works are considered unlikely to require the removal of riparian or freshwater aquatic vegetation as the works areas have been historically cleared and are within an existing road alignment.

## 5.3 Removal of Snags and Large Woody Debris

The proposed works are not likely to affect snags or instream debris as none were observed during the site inspection. If instream snags or debris occur within the works area they will be retained and relocated downstream prior to works commencing.

## 5.4 Impact Minimisation and Habitat Rehabilitation Measures

The proposed culverts are expected to improve fish passage at both the Bow River and Killoe Creek watercourse crossing points. The culverts will have a larger diameter compared to the existing causeway, which will be removed, and will be constructed to maintain existing conditions or further replicate the expected natural hydraulic, hydrologic, geomorphic and ecological functions of both watercourses.

The works will include design and control measures to protect against scour and erosion and sediment control and a vegetation management plan will be prepared and implemented for areas of exposed waterfront land which are disturbed by the works.

# 6.0 Conclusion

It is considered that proposed works:

- Will be undertaken generally in accordance with the relevant Department of Primary Industries Guidelines.
- Will not have a significant effect on threatened entities listed within the FM Act.
- Do not require the preparation of a Species Impact Statement.

It is further recommended that the impact minimisation and habitat rehabilitation measures recommended within **Section 5.4** of this Report are implemented for the proposed works.

# 7.0 References


Department of Primary Industries (DPI) (2007). *Key Fish Habitat Maps*. Available at https://webmap.industry.nsw.gov.au/Html5Viewer/index.html?viewer=Fisheries_Data_Portal

Department of Primary Industries (DPI) (2013). *Policy and Guidelines for Fish Habitat Conservation and Management – Update.*

Department of Primary Industries (DPI) (2016). *Fish Communities and Threatened Species Distributions of NSW.* Available at https://www.dpi.nsw.gov.au/fishing/habitat/yourcatchment/condition-of-fish-communities-in-nsw

Department of Primary Industries: Office of Water (DPI) (2018*). Guidelines for Controlled Activities on Waterfront Land: Riparian Corridors*. Natural Resources Access Regulator.

Department of Primary Industries (DPI) (undated a). *Threatened species lists*. Available at https://www.dpi.nsw.gov.au/fishing/threatenedspecies/what-current

Department of Primary Industries (DPI) (undated b) *Distribution maps.* Available at https://webmap.industry.nsw.gov.au/Html5Viewer/index.html?viewer=Fisheries_Data_Portal

Department of Sustainability, Environment, Water, Population and Communities (DSEWPC) (2011). *Survey Guidelines for Australia's threatened fish: Guidelines for detecting fish listed as threatened under the Environment Protection and Biodiversity Conservation Act, 1999*.

Fairfull, S. and Witheridge, G. (2003) *Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings*. NSW Fisheries, Cronulla.

Office of Environment and Heritage (OEH) (2018). *Threatened Species Test of Significance Guidelines*.

Witheridge, G. (2002) *Fish Passage Requirements for Waterway Crossings - Engineering Guidelines*. Institute of Public Works Engineering, Brisbane.

# APPENDIX A

## Fisheries Management Act Test of Significance

## Fisheries Management Act Threatened Species Likelihood of Occurrence Assessment

A likelihood of occurrence assessment for threatened entities listed within the FM Act is provided in **Table A1.**

**Table A1. FM Act Threatened Entity Likelihood of Occurrence Assessment**

| Entity Name | FM Act Listing Status | Assessment Comments | Likelihood of Occurrence | Included in Test of Significance |
|---|---|---|---|---|
| **Southern Purple Spotted Gudgeon (*Mogurnda adspera*)** | Endangered | This species has a patchy distribution mapped in both east and west flowing waterways on the Fisheries NSW Spatial Data Portal. This species occupies a variety of habitats including freshwater rivers and creeks. The population within the Hunter Valley is known from Goorangoola Creek. | Low | Yes |
| **Darling River Hardyhead (*Craterocephalus amniculus*) Hunter River population** | Endangered Population | Habitat for the Darling River was identified within the locality on the Fisheries NSW Spatial Data Portal for larger watercourses including the Goulburn River, Krui River and the Merriwa River. A small population of this species is known to occur in the Hunter Catchment. This species prefers slow flowing, clear shallow freshwaters and faster flowing runs at the head of pools. | Low to Moderate | Yes |

## Fisheries Management Act Test of Significance

### Test of Significance

The following test of significance has been completed for the proposal in accordance with Section 220ZZ(2A) of the FM Act.

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

The proposed works area provides low potential habitat for one threatened species listed within the FM Act, the Southern Purple Spotted Gudgeon (*Mogurnda adspera*).

Suitable design measures will be implemented to retain the existing areas of habitat present upstream and downstream of the proposed works and improve fish passage.

Suitable erosion and sediment controls will be implemented for all works.

It is considered that the action proposed is not likely to have an adverse effect on the lifecycle of a threatened species such that a viable population of the species is likely to be placed at risk of extinction.

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

The proposed works area provides low to moderate potential habitat for one endangered population listed within the FM Act, Darling River Hardyhead (*Craterocephalus amniculus)* Hunter River population.

Suitable design measures will be implemented to retain the existing areas of habitat present upstream and downstream of the proposed works and improve fish passage.

Suitable erosion and sediment controls will be implemented for all works.

It is considered that the action proposed is not likely to have an adverse effect on the lifecycle of a species that constitutes an endangered population listed under the FM Act, such that a viable local population of the species is likely to be placed at risk of extinction.

**(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed—**

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

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

The Development Footprint does not contain any modelled, known or suitable habitat for endangered ecological communities listed under the FM Act.

Suitable design measures will be implemented to retain the existing areas of habitat present upstream and downstream of the proposed works and improve fish passage.

Suitable erosion and sediment controls will be implemented for all works.

It is considered that the action proposed is not likely to have an adverse effect on the extent of a threatened ecological community or substantially and adversely modify the composition of an ecological community such that its local occurrence is likely to be placed at risk of extinction.

**(d) in relation to the habitat of a threatened species, population or ecological community—**

**(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and**

**(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and**

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

Suitable design measures will be implemented to retain the existing areas of habitat present upstream and downstream of the proposed works and improve fish passage and suitable erosion and sediment controls will be implemented for all works.

It is therefore considered that the proposal will not result in the removal, fragmentation or isolation of any known, modelled or suitable habitat for threatened species, populations or ecological communities listed under the FM Act. Impact associated with the modification of habitats are anticipated to be positive impacts which will improve fish passage.

**(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),**

The Development Footprint does not contain or adjoin any areas of critical habitat listed under the FM Act. The proposal is not likely to have an adverse effect on critical habitat either directly or indirectly.

**(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,**

The proposal is not inconsistent with the objectives or actions of a recovery plan or threat abatement plan made under the FM Act.

**(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.**

Key threatening processes listed under the Fisheries Management Act include:

- Degradation of native riparian vegetation along New South Wales water courses.
- Hook and line fishing in areas important for the survival of threatened fish species.
- Human-caused climate change.
- Installation and operation of instream structures and other mechanisms that alter natural flow regimes of rivers and streams.
- Introduction of fish to waters within a river catchment outside their natural range.
- Introduction of non-indigenous fish and marine vegetation to the coastal waters of New South Wales.
- Removal of large woody debris from New South Wales rivers and streams.
- The current shark meshing program in New South Wales waters.

The proposed works will include the installation of instream structures in the form of culverts; however these will be larger than the existing culverts and will improve fish passage which is not likely to have a significant effect on any threatened entities listed within the FM Act.

**Test of Significance Conclusion**

The proposed works are not likely to significantly effect threatened entities listed under the FM Act and a Species Impact Statement is not required.

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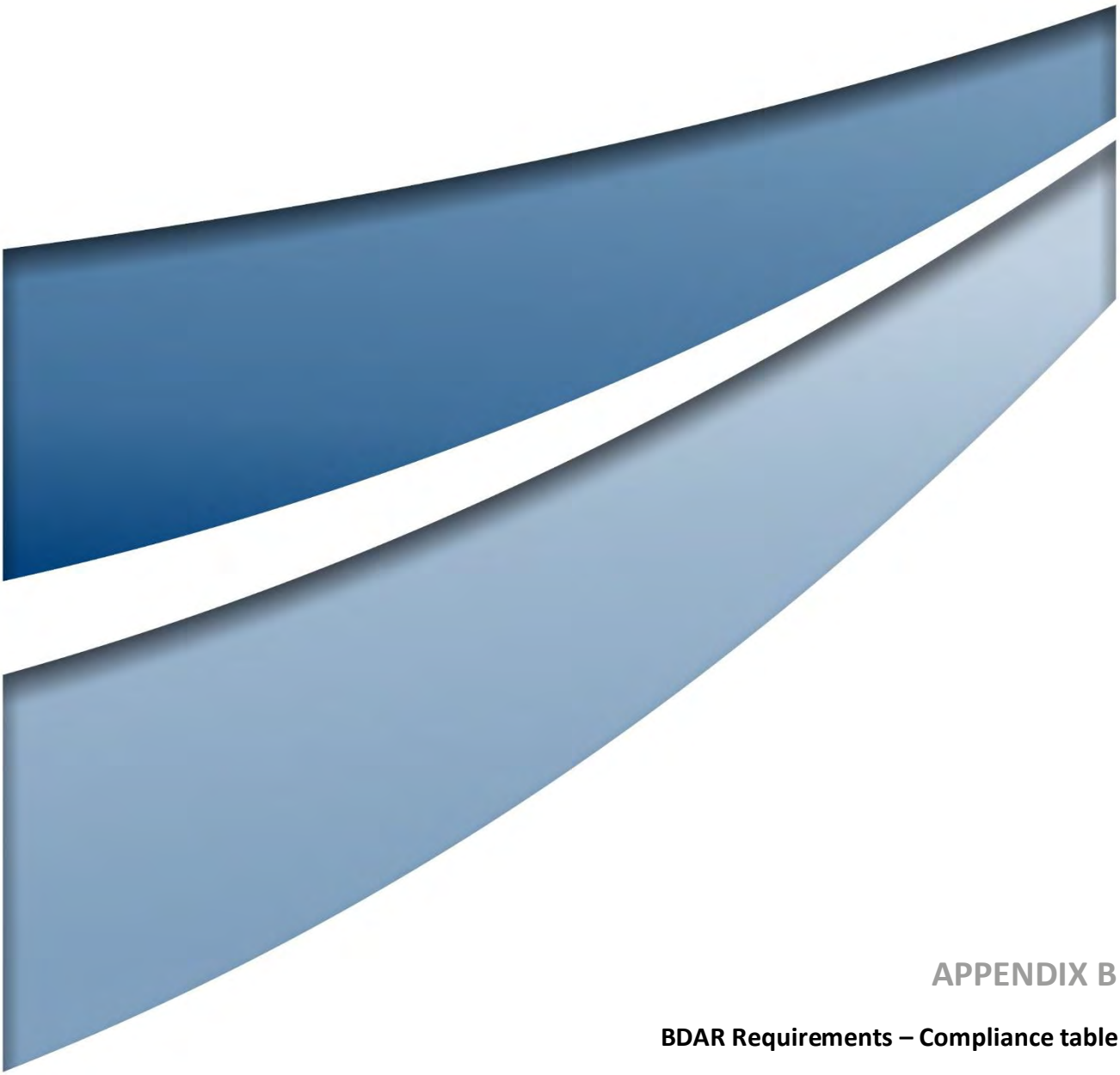


# APPENDIX B

**BDAR Requirements – Compliance table**

# Appendix B BDAR Requirement Compliance

Compliance with the BDAR minimum information requirements of the BAM is documented in **Table B.1**.

**Table B.1 Assessment of Compliance with BDAR Minimum Information Requirements**

| BDAR Section | BAM Ref. | BAM Requirement | Reference(s) in the BDAR |
|---|---|---|---|
| **Introduction** | Chapters 2 and 3 | **Information** | |
| | | Introduction to the biodiversity assessment including: | – |
| | | ☒ brief description of the proposal | **Section 1.2.1** |
| | | ☒ identification of subject land boundary, including:<br>☒ operational footprint<br>☒ construction footprint indicating clearing associated with temporary/ancillary construction facilities and infrastructure | **Section 1.2.2** and **Figure 1.5, 1.6 and 1.7.** |
| | | ☒ general description of the subject land | **Section 1.2.2** |
| | | ☒ sources of information used in the assessment, including reports and spatial data | **Section 1.9**. Also referenced in text and listed in the References Section. |
| | | ☒ identification and justification for entering the BOS | **Section 1.1** and **Section 1.6** |
| | | **Maps and tables** | |
| | | ☒ Map of the subject land boundary showing the final proposal footprint, including the construction footprint for any clearing associated with temporary/ancillary construction facilities and infrastructure | **Figures 1.1a-d, Figures 1.2a-b** and **Figures 1.5-1.7** |
| **Landscape** | Section 3.1 and | **Information** | |
| | | Identification of site context components and landscape features, including: | – |

| BDAR Section | BAM Ref. | BAM Requirement | Reference(s) in the BDAR |
|---|---|---|---|
| | Section 3.2, Appendix E | ☒ general description of subject land topographic and hydrological setting, geology and soils | **Section 1.2.2 and Section 3.2.2** for hydrological setting, **Section 3.2.6** for geological characteristics |
| | | ☒ per cent native vegetation cover in the assessment area (as described in BAM Section 3.2) | **Section 3.3** and **Figures 1.3a-d and 1.4a-b.** |
| | | ☒ IBRA bioregions and subregions (as described in BAM Subsection 3.1.3(2.)) | **Section 3.1** and **Figures 1.3a-d and 1.4a-b** |
| | | ☒ rivers and streams classified according to stream order (as described in BAM Subsection 3.1.3(3.) and Appendix E) | **Section 3.2.2** and **Figures 1.3a-d and Figures 1.4a-b** |
| | | ☒ wetlands within, adjacent to and downstream of the site (as described in BAM Subsection 3.1.3(3.)) | **Section 3.2.2** |
| | | ☒ connectivity of different areas of habitat (as described in BAM Subsection 3.1.3(5–6.)) | **Section 3.2.3** |
| | | ☒ karst, caves, crevices, cliffs, rocks and other geological features of significance and for vegetation clearing proposals, soil hazard features (as described in BAM Subsections 3.1.3(7.) and 3.1.3(12.)) | **Section 3.2.4** |
| | | ☒ areas of outstanding biodiversity value occurring on the subject land and assessment area (as described in BAM Subsection 3.1.3(8–9.)) | **Section 3.2.5** |
| | | ☒ any additional landscape features identified in any SEARs for the proposal | **Section 3.2.7** |
| | | ☒ NSW (Mitchell) landscape on which the subject land occurs | **Section 3.2.6** |
| | | ☒ details of field reconnaissance undertaken to confirm the extent and condition of landscape features and native vegetation cover (as described in Operational Manual Stage 1 Section 2.4) | **Section 2.1.1** and **Section 2.2.2** |
| | | **Maps and tables** | |

| BDAR Section | BAM Ref. | BAM Requirement | Reference(s) in the BDAR |
|---|---|---|---|
| | | ☒ Site Map<br>☒ Property boundary<br>☒ Boundary of subject land<br>☒ Cadastre of subject land (including labelling of Lot and DP or section plan if relevant)<br>☒ Landscape features identified in BAM Subsection 3.1.3. | Site Maps provided as **Figure 1.1a–Figure 1.1d** and **Figure 1.2a–Figure 1.2b** |
| | | ☒ Location Map<br>☒ Digital aerial photography at 1:1,000 scale or finer<br>☒ Boundary of subject land<br>☒ Assessment area (i.e. the subject land and either 1500 m buffer area or 500 m buffer for linear development)<br>☒ Landscape features identified in BAM Subsection 3.1.3<br>☒ Additional detail (e.g. local government area boundaries) relevant at this scale | Location Maps, provided as **Figure 1.3a–Figure 1.3d** and **Figure 1.4a–Figure 1.4b** |
| | | Landscape features identified in BAM Subsection 3.1.3 and to be shown on the Site Map and/or Location Map include: | – |
| | | ☒ IBRA bioregions and subregions<br>☒ rivers, streams and estuaries<br>☒ wetlands and important wetlands<br>☒ connectivity of different areas of habitat<br>☒ karst, caves, crevices, cliffs, rocks and other geological features of significance and if required, soil hazard features<br>☒ areas of outstanding biodiversity value occurring on the subject land and assessment area<br>☒ any additional landscape features identified in any SEARs for the proposal<br>☒ NSW (Mitchell) landscape on which the subject land occurs | Site Maps provided as **Figure 1.1a–Figure 1.1d** and **Figure 1.2a–Figure 1.2b** and the Location Maps, provided as **Figure 1.3a–Figure 1.3d** and **Figure 1.4a–Figure 1.4b** |

| BDAR Section | BAM Ref. | BAM Requirement | Reference(s) in the BDAR |
|---|---|---|---|
| | | **Data** | |
| | | ☒ All report maps as separate jpeg files | – |
| | | Individual digital shape files of: | – |
| | | ☒ subject land boundary | – |
| | | ☒ assessment area (i.e. subject land and 1500 m buffer area) boundary | – |
| | | ☒ cadastral boundary of subject land | – |
| | | ☒ areas of native vegetation cover | – |
| | | ☒ landscape features | – |
| **Native vegetation** | Chapter 4, Appendix A and Appendix H | **Information** | |
| | | ☒ Identify native vegetation extent within the subject land, including cleared areas and evidence to support differences between mapped vegetation extent and aerial imagery (as described in BAM Section 4.1(1–3.) and Subsection 4.1.1) | **Section 4.1** and **Figures 4.1a-f, Figure 4.2a-c** |
| | | ☒ Provide justification for all parts of the subject land that do not contain native vegetation (as described in BAM Subsection 4.1.2) | **Section 4.1.2** |
| | | ☒ Review of existing information on native vegetation including references to previous vegetation maps of the subject land and assessment area (described in BAM Section 4.1(3.) and Subsection 4.1.1) | **Section 2.2.1** |
| | | ☒ Describe the systematic field-based floristic vegetation survey undertaken in accordance with BAM Section 4.2 | **Section 2.2.3** |
| | | ☒ Where relevant, describe the use of more appropriate local data, provide reasons that support the use of more appropriate local data and include the written confirmation from the decision-maker that they support the use of more appropriate local data (as described in BAM Subsection 1.4.2 and Appendix A) | Not applicable |
| | | For each PCT within the subject land, describe: | – |
| | | ☒ PCT name and ID | **Section 4.2** |

| BDAR Section | BAM Ref. | BAM Requirement | Reference(s) in the BDAR |
|---|---|---|---|
| | | ☒ vegetation class | **Section 4.2** |
| | | ☒ extent (ha) within subject land | **Section 4.2** |
| | | ☒ evidence used to identify a PCT including any analyses undertaken, references/sources, existing vegetation maps (BAM Section 4.2(1–3.)) | **Section 4.2** |
| | | ☒ plant species relied upon for identification of the PCT and relative abundance of each species | **Section 4.2** |
| | | ☒ if relevant, TEC status including evidence used to determine vegetation is the TEC (BAM Subsection 4.2.2(1–2.)) | **Section 4.2** and **Section 4.3** |
| | | ☒ estimate of per cent cleared value of PCT (BAM Subsection 4.2.1(5.)) | **Section 4.2** |
| | | Describe the vegetation integrity assessment of the subject land, including: | – |
| | | ☒ identification and mapping of vegetation zones (as described in BAM Subsection 4.3.1) | **Section 4.2** and **Figures 4.3a-f and Figures 4.4a-c** |
| | | ☒ description of vegetation zones within the subject land (as described in Operational Manual Stage 1 Table 2 and Subsection 3.3.2) | **Section 4.2** |
| | | ☒ area (ha) of each vegetation zone | **Table 4.1** and **Table 4.5, Table 4.10** and **Table 4.11** |
| | | ☒ assessment of patch size (as described in BAM Subsection 4.3.2) | **Table 4.10** and **Table 4.11** |
| | | ☒ survey effort (i.e. number of vegetation integrity survey plots) as described in BAM Subsection 4.3.4(1–2.) | **Table 4.10** and **Table 4.11** |
| | | ☒ use of relevant benchmark data from BioNet Vegetation Classification (as described in BAM Subsection 4.3.3(5.)) | **Section 4.5.3** |
| | | Where use of more appropriate local benchmark data is proposed (as described in BAM Subsection 1.4.2, BAM Subsection 4.3.3(5.) and BAM Appendix A): | – |

| BDAR Section | BAM Ref. | BAM Requirement | Reference(s) in the BDAR |
|---|---|---|---|
| | | ☐ identify the PCT or vegetation class for which local benchmark data will be applied<br>☐ identify published sources of local benchmark data (if benchmarks obtained from published sources)<br>☐ describe methods of local benchmark data collection (if reference plots used to determine local benchmark data) | Not applicable |
| | | ☐ provide justification for use of local data rather than BioNet Vegetation Classification benchmark values | Not applicable |
| | | ☐ provide written confirmation from the decision-maker that they support the use of local benchmark data | Not applicable |
| | | **Maps and tables** | |
| | | ☒ Map of native vegetation extent within the subject land at scale not greater than 1:10,000 including identification of all areas of native vegetation including areas that are ground cover only, cleared areas (as described in BAM Section 4.1(1–3.)) and all parts of the subject land that do not contain native vegetation (BAM Subsection 4.1.2) | **Figure 4.1** |
| | | ☒ Map of PCTs within the subject land (as described in BAM Section 4.2(1.)) | **Figure 4.2** |
| | | ☒ Map of vegetation zones within the subject land (as described in BAM Subsection 4.3.1) | **Figure 4.2** |
| | | ☒ Map the location of floristic vegetation survey plots and vegetation integrity survey plots relative to PCT boundaries | **Figure 2.1, Figure 2.2** and **Figure 2.3a-d** |
| | | ☒ Map of TEC distribution on the subject land and table of TEC listing, status and area (ha) | **Figure 4.5a-f and Figure a-c** |
| | | ☒ Map of patch size locations for each native vegetation zone and table of patch size areas (as described in BAM Subsection 4.3.2) | Patch size not mapped and exceeds 100 ha for all vegetation condition zones, as listed in **Table 4.10** |
| | | Table of current vegetation integrity scores for each vegetation zone within the site and including: | – |

| BDAR Section | BAM Ref. | BAM Requirement | Reference(s) in the BDAR |
|---|---|---|---|
| | | ☒ composition condition score<br>☒ structure condition score<br>☒ function condition score<br>☒ presence of hollow bearing trees | **Table 4.12** |
| | | **Data** | |
| | | ☒ All report maps as separate jpeg files | – |
| | | ☒ Plot field data (MS Excel format) | - |
| | | ☒ Plot field datasheets | - |
| | | Digital shape files of: | – |
| | | ☒ PCT boundaries within subject land | – |
| | | ☒ TEC boundaries within subject land | – |
| | | ☒ vegetation zone boundaries within subject land | – |
| | | ☒ floristic vegetation survey and vegetation integrity plot locations | – |
| **Threatened species** | Chapter 5 | **Information** | |
| | | Identify ecosystem credit species likely to occur on the subject land, including: | – |
| | | ☒ list of ecosystem credit species derived from the BAM-C (as described in BAM Subsection 5.1.1 and Section 5.2(1.)) | **Table 5.1** and **Table 5.3** |
| | | ☒ justification and supporting evidence for exclusion of any ecosystem credit species based on geographic limitations, habitat constraints or vagrancy (as described in BAM Subsections 5.2.1 and 5.2.2) | **Table 5.1** and **Table 5.3** |
| | | ☒ justification for addition of any ecosystem credit species to the list | **Section 2.3.2** and **Section 2.4.2** |
| | | Identify species credit species likely to occur on the subject land, including: | – |

| BDAR Section | BAM Ref. | BAM Requirement | Reference(s) in the BDAR |
|---|---|---|---|
| | | ☒ list of species credit species derived from the BAM-C (as described in BAM Subsection 5.1.1) | **Section 5.1.2** |
| | | ☒ justification and supporting evidence for exclusions based on geographic limitations, habitat constraints or vagrancy (as described in BAM Subsections 5.2.1 and 5.2.2) | **Section 5.1.2** and **Section 5.3** |
| | | ☒ justification and supporting evidence for exclusions based on degraded habitat constraints and/or microhabitats on which the species depends (as described in BAM Subsection 5.2.2) | **Section 5.1.2** and **Section 5.3** |
| | | ☒ justification for addition of any species credit species to the list | **Section 2.3.2** and **Section 2.4.2** |
| | | From the list of candidate species credit species, identify: | – |
| | | ☒ species assumed present within the subject land (if relevant) (as described in BAM Subsection 5.2.4(2.a.))<br>☒ species present within the subject land on the basis of being identified on an important habitat map for a species (as described in BAM Subsection 5.2.4(2.d.))<br>☒ species for which targeted surveys are to be completed to determine species presence (BAM Subsection 5.2.4(2.b.))<br>☒ species for which an expert report is to be used to determine species presence (BAM Subsection 5.2.4(2.c.)) | **Table 5.7, Table 5.8, Table 5.9** and **Table 5.10** |
| | | Present the outcomes of species credit species assessments from: | – |
| | | ☒ threatened species survey (as described in BAM Section 5.2.4) | **Section 5.3** including **Tables 5.11** and **Table 5.12** |
| | | ☐ expert reports (if relevant) including justification for presence of the species and information used to make this determination (as described in BAM Subsection 5.2.4, Section 5.3, Box 3) | Not applicable |
| | | Where survey has been undertaken include detailed information on: | – |
| | | ☒ survey method and effort (as described in BAM Section 5.3) | **Tables 5.11** and **Table 5.12** |

| BDAR Section | BAM Ref. | BAM Requirement | Reference(s) in the BDAR |
|---|---|---|---|
| | | ☒ justification of survey method and effort (e.g. citation of peer-reviewed literature) if approach differs from the department's taxa-specific survey guides or where no relevant guideline has been published | **Section 2.3.4** and **Section 2.4.4** |
| | | ☒ timing of survey in relation to requirements in the TBDC or the department's taxa-specific survey guides. Where survey was undertaken outside these guides include justification for the timing of surveys | **Section 2.3.4,** **Section 2.4.4** and **Section 5.3** |
| | | ☒ survey personnel and relevant experience | **Section 1.5** and CVs presented in **Appendix C** |
| | | ☒ describe any limitations to surveys and how these were addressed/overcome | **Section 2.7** |
| | | Where an expert report has been used in place of survey (as described in BAM Section 5.3, Box 3), include: | – |
| | | ☐ justification of the use of an expert report<br>☐ identify the expert, provide evidence of their expert credentials and departmental approval of expert status<br>☐ all requirements of Box 3 have been addressed in the expert report | Not applicable |
| | | Where use of local data is proposed (BAM Subsection 1.4.2): | – |
| | | ☐ identify relevant species<br>☐ identify data to be amended<br>☐ identify source of information for local data, e.g. published literature, additional survey data, etc.<br>☐ justify use of local data in preference to VIS Classification or TBDC data | Not applicable |
| | | ☐ provide written confirmation from the decision-maker that they support the use of local data | Not applicable |
| | | Species polygon completed for species credit species present within the subject land (assumed present or determined on the basis of survey, expert report or important habitat map) ensuring that: | **Section 5.5.1** |
| | | ☒ the unit of measure for each species is documented | As above |
| | | for species assessed by area: | As above |

| BDAR Section | BAM Ref. | BAM Requirement | Reference(s) in the BDAR |
|---|---|---|---|
| | | ☒ the polygon includes the extent of suitable habitat for the target species within the subject land (as described in BAM Subsection 5.2.5) | As above |
| | | ☒ a description of, and evidence-based justification for, the habitat constraints, features or microhabitats used to map the species polygon including reference to information in the TBDC for that species and any buffers applied | As above |
| | | for species assessed by counts of individuals: | – |
| | | ☒ the number of individual plants present on the subject land (as described in BAM Subsection 5.2.5(3.)) | Not applicable |
| | | ☒ the method used to derive this number (i.e. threatened species survey or expert report) and evidence-based justification for the approach taken | Not applicable |
| | | ☒ the polygon includes all individuals located on the subject land with a buffer of 30 m around the individuals or groups of individuals on the subject land | Not applicable |
| | | ☒ Identify the biodiversity risk weighting for each species credit species identified as present within the subject land (as described in BAM Section 5.4) | Section 5.5.1 |
| | | **Maps and tables** | |
| | | ☒ Table showing ecosystem credit species in accordance with BAM Subsection 5.1.1, and identifying: | **Table 5.1** and **Table 5.2** |
| | | ☒ the ecosystem credit species removed from the list | **Table 5.1** and **Table 5.2** |
| | | ☒ the sensitivity to gain class of each species | **Table 5.1** and **Table 5.2** |
| | | ☒ Table detailing species credit species in accordance with BAM Section 5.2 and identifying: | **Tables 5.3, 5.4, 5.5** and **5.6** |
| | | ☒ the species credit species removed from the list of species because the species is considered vagrant, out of geographic range or the habitat or microhabitat features are not present | **Tables 5.3, 5.4, 5.5** and **5.6** |
| | | ☒ the candidate species credit species not recorded on the subject land as determined by targeted survey, expert report or important habitat map | **Tables 5.7, 5.8, 5.9** and **5.10** |

| BDAR Section | BAM Ref. | BAM Requirement | Reference(s) in the BDAR |
|---|---|---|---|
| | | ☒ Table detailing species credit species recorded or assumed as present within the subject land, habitat constraints or microhabitats associated with the species, counts of individuals (flora)/extent of suitable habitat (flora and fauna) (as described in BAM Subsection 5.2.6) and biodiversity risk weighting (BAM Section 5.4) | **Tables 5.13–5.22** |
| | | ☒ Map indicating the GPS coordinates of all individuals of each species recorded within the subject land and the species polygon for each species (as described in BAM Subsection 5.2.5) | **Figures 5.1–5.10** |
| | | **Data** | |
| | | ☒ Digital shape files of suitable habitat identified for survey for each candidate species credit species | – |
| | | ☒ Survey locations including GPS coordinates of any plots, transects, grids | - |
| | | ☒ Digital shape files of each species polygon including GPS coordinates of located individuals | – |
| | | ☒ Species polygon map in jpeg format | – |
| | | ☐ Expert reports and any supporting data used to support conclusions of the expert report | Not applicable |
| | | ☒ Field datasheets detailing survey information including prevailing conditions, date, time, equipment used, etc. | - |
| **Prescribed impacts** | Chapter 6 | **Information** | |
| | | Identify potential prescribed biodiversity impacts on threatened entities, including: | – |
| | | ☒ karst, caves, crevices, cliffs, rocks and other geological features of significance (as described in BAM Subsection 6.1.1)<br>☒ occurrences of human-made structures and non-native vegetation (as described in BAM Subsection 6.1.2)<br>☒ corridors or other areas of connectivity linking habitat for threatened entities (as described in BAM Subsection 6.1.3)<br>☒ waterbodies or any hydrological processes that sustain threatened entities (as described in BAM Subsection 6.1.4) | **Table 6.1** |

| BDAR Section | BAM Ref. | BAM Requirement | Reference(s) in the BDAR |
|---|---|---|---|
| | | ☐ protected animals that may use the proposed wind farm development site as a flyway or migration route (as described in BAM Subsection 6.1.5) | Not applicable |
| | | ☒ where the proposed development may result in vehicle strike on threatened fauna or on animals that are part of a threatened ecological community (as described in BAM Subsection 6.1.6) | **Section 3.2.4** and **Section 5.7** |
| | | ☒ Identify a list of threatened entities that may be dependent upon or may use habitat features associated with any of the prescribed impacts | **Table 5.24** |
| | | ☒ Describe the importance of habitat features to the species including, where relevant, impacts on life cycle or movement patterns (e.g. Subsection 6.1.3) | **Table 5.24** |
| | | Where the proposed development is for a wind farm: | – |
| | | ☐ identify a candidate list of protected animals that may use the development site as a flyway or migration route, including: resident threatened aerial species, resident raptor species and nomadic and migratory species that are likely to fly over the proposal area (as described in BAM Subsection 6.1.5) | Not applicable |
| | | ☐ provide details of targeted survey for candidate species of wind farm developments undertaken in accordance with BAM Subsection 6.1.5(2–3.) | Not applicable |
| | | ☐ predict the habitual flight paths for nomadic and migratory species likely to fly over the subject land and map the likely habitat for resident threatened aerial and raptor species (BAM Subsection 6.1.5(4.)) | Not applicable |
| | | Where the proposal may result in vehicle strike: | – |
| | | ☒ identify a list of threatened fauna or protected fauna species that are part of a TEC and at risk of vehicle strike due to the proposal | **Table 5.24** |
| | | **Maps and tables** | |

| BDAR Section | BAM Ref. | BAM Requirement | Reference(s) in the BDAR |
|---|---|---|---|
| | | ☒ Map showing location of any prescribed impact features (i.e. karst, caves, crevices, cliffs, rocks, human-made structures, etc.) | There are no karst, caves, cliffs or crevices within the development footprint. Culverts are present where watercourses are mapped and rocks occur in several locations which are are not able to be practically mapped. |
| | | ☒ Map showing location of potential vehicle strike locations | Applies to entire length of development footprint / described in text. |
| | | ☐ Maps of habitual flight paths for nomadic and migratory species likely to fly over the site and maps of likely habitat for threatened aerial species resident on the site (for wind farm developments only) | Not applicable |
| | | **Data** | |
| | | ☒ Digital shape files of prescribed impact feature locations | – |
| | | ☒ Prescribed impact features map in jpeg format | – |
| **Avoid and minimise impacts** | Chapter 7 | **Information** | |
| | | Demonstration of efforts to avoid and minimise impacts on biodiversity values (including prescribed impacts) associated with the proposal location in accordance with Chapter 7, including an analysis of alternative: | – |
| | | ☒ modes or technologies that would avoid or minimise impacts on biodiversity values and justification for selecting the proposed mode or technology | **Section 6.1.2.6** |
| | | ☒ routes that would avoid or minimise impacts on biodiversity values and justification for selecting the proposed route | **Section 6.1.1.6** |
| | | ☒ alternative locations that would avoid or minimise impacts on biodiversity values and justification for selecting the proposed location | **Section 6.1.1** |

| BDAR Section | BAM Ref. | BAM Requirement | Reference(s) in the BDAR |
|---|---|---|---|
| | | ☒ alternative sites within a property on which the proposal is located that would avoid or minimise impacts on biodiversity values and justification for selecting the proposed site | **Section 6.1.1.7** |
| | | ☒ Describe efforts to avoid and minimise impacts (including prescribed impacts) to biodiversity values through proposal design (as described in BAM Sections 7.1 and 7.2) | **Section 6.1** and **Section 6.2** |
| | | ☒ Identification of any other site constraints that the proponent has considered in determining the location and design of the proposal (as described in BAM Subsection 7.2.1(3.)) | **Section 6.1.2.7** |
| | | ☒ Detail measures or options considered but not implemented because they are not feasible and/or practical (e.g. due to site constraints) | **Section 6.3** |
| | | **Maps and tables** | |
| | | ☒ Table of measures to be implemented to avoid and minimise the impacts of the proposal, including action, outcome, timing and responsibility | **Table 6.1** |
| | | ☒ Map of alternative footprints considered to avoid or minimise impacts on biodiversity values; and of the final proposal footprint, including construction and operation | Not applicable |
| | | ☒ Maps demonstrating indirect impact zones where applicable | Not applicable |
| | | **Data** | |
| | | Digital shape files of: | – |
| | | ☒ alternative and final proposal footprint | – |
| | | ☒ direct and indirect impact zones | – |
| | | ☒ Maps in jpeg format | – |
| **Assessment of impacts** | Chapter 8, Sections 8.1 and 8.2 | **Information** | |
| | | ☒ Determine the impacts on native vegetation and threatened species habitat, including a description of direct impacts of clearing of native vegetation, threatened ecological communities and threatened species habitat (as described in BAM Section 8.1) | **Section 7.1** |

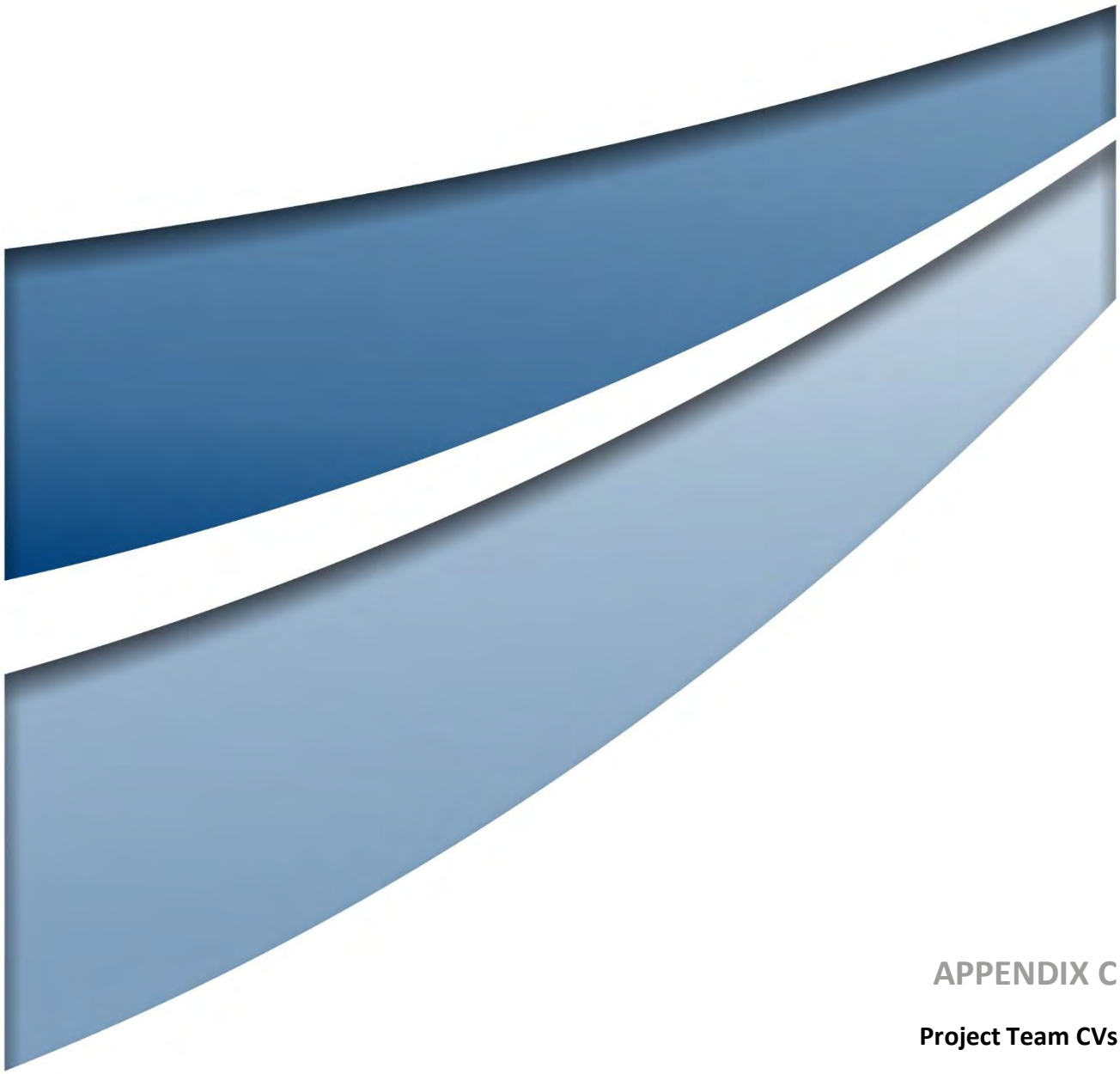
| BDAR Section | BAM Ref. | BAM Requirement | Reference(s) in the BDAR |
|---|---|---|---|
| | | Assessment of indirect impacts on vegetation and threatened species and their habitat including (as described in BAM Section 8.2): | – |
| | | ☒ description of the nature, extent, frequency, duration and timing of indirect impacts of the proposal | **Section 7.2, Table 7.3** |
| | | ☒ documenting the consequences to vegetation and threatened species and their habitat including evidence-based justifications | **Section 7.2, Table 7.3** |
| | | ☒ reporting any limitations or assumptions, etc. made during the assessment | **Section 7.2, Table 7.3** |
| | | ☒ identification of the threatened entities and their habitat likely to be affected | **Section 7.2, Table 7.3** |
| | | Assessment of prescribed biodiversity impacts (as described in BAM Section 8.3) including: | – |
| | | assessment of the nature, extent frequency, duration and timing of impacts on the habitat of threatened species or ecological communities associated with: | – |
| | | ☒ karst, caves, crevices, cliffs, rocks and other features of geological significance | **Section 7.3.6** |
| | | ☒ human-made structures | **Section 7.3.1** |
| | | ☒ non-native vegetation | **Section 7.3.2** |
| | | ☒ connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range | **Section 7.3.3** |
| | | ☒ movement of threatened species that maintains their life cycle | **Section 7.3.3** |
| | | ☒ water quality, waterbodies and hydrological processes that sustain threatened species and threatened ecological communities | **Section 7.3.4** |
| | | ☐ assessment of the impacts of wind turbine strikes on protected animals | Not applicable |
| | | ☒ assessment of the impacts of vehicle strikes on threatened species of animals or on animals that are part of a TEC | **Section 7.3.5** |
| | | ☒ evaluate the consequences of prescribed impacts | **Section 7.3** |

| BDAR Section | BAM Ref. | BAM Requirement | Reference(s) in the BDAR |
|---|---|---|---|
| | | ☒ describe impacts that are uncertain | **Section 7.5** |
| | | ☒ document limitations to data, assumptions and predictions | **Section 2.7** |
| | | **Maps and tables** | |
| | | ☒ Table showing change in vegetation integrity score for each vegetation zone as a result of identified impacts | **Table 7.2** |
| | | **Data** | |
| | | N/A | – |
| **Mitigation and management of impacts** | Chapter 8, Sections 8.4 and 8.5 | **Information** | |
| | | Identification of measures to mitigate or manage impacts in accordance with the recommendations in BAM Sections 8.4 and 8.5 including: | – |
| | | ☒ techniques, timing, frequency and responsibility<br>☒ identify measures for which there is risk of failure<br>☒ evaluate the risk and consequence of any residual impacts | **Table 7.3, Table 7.4** |
| | | ☒ document any adaptive management strategy proposed | **Table 8.5** |
| | | Identification of measures for mitigating impacts related to: | – |
| | | ☒ displacement of resident fauna (as described in BAM Subsection 8.4.1(2.))<br>☒ indirect impacts on native vegetation and habitat (as described in BAM Subsection 8.4.1(3.))<br>☒ mitigating prescribed biodiversity impacts (as described in BAM Subsection 8.4.2) | **Section 8.4** |
| | | ☒ Details of the adaptive management strategy proposed to monitor and respond to impacts on biodiversity values that are uncertain (BAM Section 8.5) | **Table 7.5** |
| | | **Maps and tables** | |

| BDAR Section | BAM Ref. | BAM Requirement | Reference(s) in the BDAR |
|---|---|---|---|
| | | ☒ Table of measures to be implemented before, during and after construction to mitigate and manage impacts of the proposal, including action, outcome, timing and responsibility | **Table 7.4** |
| | | **Data** | |
| | | N/A | – |
| **Impact summary** | Chapter 9 | **Information** | |
| | | Identification and assessment of impacts on TECs and threatened species that are at risk of a serious and irreversible impacts (SAII, in accordance with BAM Section 9.1) including: | – |
| | | ☒ addressing all criteria in Subsection 9.1.1 for each TEC listed as at risk of an SAII present on the subject land | **Section 8.1.1** |
| | | ☒ for each TEC, report the extent of the TEC in NSW | **Section 8.1.1** |
| | | ☒ addressing all criteria in Subsection 9.1.2 for each threatened species at risk of an SAII present on the subject land | **Section 8.1.2** |
| | | ☒ for each threatened species, report the population size in NSW | **Section 8.1.2** |
| | | ☒ documenting assumptions made and/or limitations to information<br>☒ documenting all sources of data, information, references used or consulted<br>☒ clearly justifying why any criteria could not be addressed | **Section 8.0** |
| | | ☒ Identification of impacts requiring offset in accordance with BAM Section 9.2 | **Table 9.2** and **Table 9.3** |
| | | ☒ Identification of impacts not requiring offset in accordance with BAM Subsection 9.2.1(3.) | **Table 9.1** |
| | | ☒ Identification of areas not requiring assessment in accordance with BAM Section 9.3 | **Section 9.2** |
| | | **Maps and tables** | |
| | | ☒ Map showing the extent of TECs at risk of an SAII within the subject land | **Figures 4.5a-f** and **Figures 4.6a-c** |

| BDAR Section | BAM Ref. | BAM Requirement | Reference(s) in the BDAR |
|---|---|---|---|
| | | ☒ Map showing location of threatened species at risk of an SAII within the subject land | Non observed / not applicable |
| | | Map showing location of: | – |
| | | ☒ impacts requiring offset | **Figure 9.1** |
| | | ☒ impacts not requiring offset | **Figure 9.1** |
| | | ☒ areas not requiring assessment | **Figure 9.1** |
| | | **Data** | |
| | | Digital shape files of: | – |
| | | ☒ extent of TECs at risk of an SAII within the subject land | - |
| | | ☒ location of threatened species at risk of an SAII within the subject land | - |
| | | ☒ boundary of impacts requiring offset | – |
| | | ☒ boundary of impacts not requiring offset | - |
| | | ☒ boundary of areas not requiring assessment | - |
| | | ☒ Maps in jpeg format | – |
| **Impact summary** | Chapter 10 | **Information** | |
| | | Ecosystem credits and species credits that measure the impact of the development on biodiversity values, including: | – |
| | | ☒ future vegetation integrity score for each vegetation zone within the subject land (Equation 25 and Equation 26 in BAM Appendix H)<br>☒ change in vegetation integrity score (BAM Subsection 8.1.1)<br>☒ number of required ecosystem credits for the direct impacts of the proposal on each vegetation zone within the subject land (BAM Subsection 10.1.2) | **Table 9.2** |

| BDAR Section | BAM Ref. | BAM Requirement | Reference(s) in the BDAR |
|---|---|---|---|
| | | ☒ biodiversity risk weighting for each | **Table 9.2** and **Table 9.3** |
| | | ☒ number of required species credits for each candidate threatened species that is directly impacted on by the proposal (BAM Subsection 10.1.3) | **Table 9.3** |
| | | **Maps and tables** | |
| | | ☒ Table of PCTs requiring offset and the number of ecosystem credits required | **Table 9.2** |
| | | ☒ Table of threatened species requiring offset and the number of species credits required | **Table 9.3** |
| | | **Data** | |
| | | ☒ Submitted proposal in the BAM Calculator | – |
| **Biodiversity credit report** | Chapter 10 | **Information** | |
| | | ☒ Description of credit classes for ecosystem credits and species credits at the development or clearing site or land to be biodiversity certified (BAM Section 10.2) | **Table 11.1** and **Table 11.2** |
| | | ☒ BAM credit report in pdf format | **Appendix F** |
| | | **Maps and tables** | |
| | | ☒ Table of credit class and matching credit profile | **Table 11.1** and **Table 11.2** |
| | | **Data** | |
| | | ☒ BAM credit report in pdf format | **Appendix F** |



# APPENDIX C

**Project Team CVs**

# Allison Riley

Ecology Manager South East Australia

Allison is a Principal Ecologist and Umwelt's Ecology Manager for the South East Australia operations (Newcastle, Sydney and Canberra) and has a strong background in preparing biodiversity assessments, offset strategies, EPBC Referrals and monitoring reports for projects assessed under the NSW *Biodiversity Conservation Act 2016* (BC Act) and NSW *Environmental Planning and Assessment Act 1974* (EP&A Act) and at a Commonwealth level under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). She has a thorough understanding of ecological values, impacts and assessment processes allows her to provide a streamlined approach that delivers quality outcomes for clients that meet government authority and community expectations.

Allison has reviewed and provided director overview for a range of large-scale renewable energy projects across NSW in the last 5 years, including impact assessments under the Biodiversity Assessment Method (BAM), regulator consultation, preparation of post approval management plans and ecological assessments of potential Stewardship (offset) sites required under the NSW Biodiversity Offsets Scheme.

Allison has substantial knowledge on directing regional-scale projects. She was the project manager for the Central Coast Biodiversity Certification Project scoping report and the project director for the subsequent winter, spring and summer surveys and reporting works. She has an in-depth knowledge of the potential development areas gained through the desktop assessments completed as part of the scoping report and field surveys.

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|---|---|
| **Qualifications/Affiliations:** | Bachelor of Science, University of Newcastle<br>Accredited BAM Assessor (BAAS17042) under the NSW *Biodiversity Conservation Act 2016*<br>Accredited BioBanking Assessor under the NSW *Threatened Species Conservation Act 1995* |
| **Years of Industry Experience:** | 20+ |
| **Specialisation:** | Strategic impact assessment and biodiversity conservation planning/offset strategy delivery, State Significant Development (SSD) and State Significant Infrastructure (SSI) ecological impact assessment, Commonwealth EPBC Referrals and EPBC Offset Calculator assessments, Threatened species and communities assessment, management and monitoring. |

## Relevant Project Experience

**Central Coast Biodiversity Certification Project | DPIE | 2018–current | Project Director |** Allison is the project director for the Central Coast Biodiversity Certification Project. Allison oversaw the preparation of the scoping document for the Project which provided an analysis of the existing biodiversity data and planning information available to support a strategic assessment of future biodiversity impacts, identification of data collection needs to meet state and Commonwealth requirements, including timeframes and projected costs, strategic context and issues to inform the Biodiversity Certification, identification of opportunities to mitigate and offset residual impacts and avoid unacceptable impacts on biodiversity. This study was integral for defining the survey and assessment needs of the project. Al also provided advice on Matters of National Environmental Significance (MNES) under the EPBC Act to inform the terms of reference of the Strategic Assessment with the Commonwealth Department. A key component of this project has been identifying potential offset areas within the Central Coast LGA to offset the impacts associated with the project. This involved ranking land available for offsetting based on biodiversity values and providing DPE target areas for establishing conservation areas.

**Spicers Creek Wind Farm | Squadron Energy | Current | NSW | Project Director |** Allison is project directing a desktop based preliminary category 1 land mapping exercise. This GIS based package of work is being completed across the wider desktop boundary being considered in the early stages for the Project. It covers an extensive area of land within the locality. The project will consider all required publicly available mapping material and digital aerial photography, with a preliminary allocation of category 1 land mapping confidence levels comprising high, medium and low. Once complete, this mapping product will assist CWPR with preliminary project design so as to reduce impacts to biodiversity values and in turn reduce survey and offset requirements.

**Preliminary Biodiversity Assessment for Confidential Solar Farm | RES | Current | NSW | NSW Team Lead/Project Director |** Allison has overseen the delivery of a preliminary ecological assessment of this proposed solar project. This included an initial desktop assessment, with review of existing ecological databases, regional vegetation mapping products and mapping of Category 1 – Exempt Land. The last component involved a GIS mapping exercise where land historically cleared of native vegetation (through intensive agricultural land use) was identified and will subsequently be excluded from application of BAM and therefore any biodiversity offset liability should the project progress. Following this, Umwelt completed a preliminary ecological field survey of the Project site (excluding the Category 1 – Exempt Land) to assess the likely ecological constraints for the Project. This included rapid vegetation assessments, preliminary vegetation community identification, preliminary Threatened Ecological Community analysis and fauna habitat assessment.

**Liverpool Range Wind Farm | Tilt Renewables | 2020–Current | NSW | NSW Team Lead/Project Director |** Allison is project directing an extensive ecological impact assessment for this wind farm project in NSW. Initially, an extensive review of the modified project compared to the previously approved Project was completed, including detailed desktop review and subsequent GAP analysis of survey effort. As part of the project modification, Allison is overseeing the impact assessment being completed in accordance with the BAM.

**Hunter Valley Operations (HVO) BAM Assessment | HVO | Hunter Valley, NSW |2019–Ongoing | Project Director |** Al is the project director in the preparation of the BDAR for the HVO North and South Projects, near Lemington, NSW. This has required the coordination and management of multiple years of biodiversity survey and assessment for a project that spans over 1,000 hectares in the Central Hunter Valley. This has involved key considerations including Category 1 – Exempt Land mapping, mapping of *Warkworth Sands Woodland CEEC* and *Central Hunter Valley Eucalypt Forest and Woodland CEEC*.

**Glendell Continued Operations Project | Ravensworth NSW | Glencore | 2018–Current | Project Director |** This is a major project comprising a coal mine expansion. Allison is the project director for the ecological assessment which includes an ecological impact assessment, biodiversity conservation planning and an EPBC referral. The assessment pathway is the Biodiversity Assessment Method (BAM) and Allison is the accredited assessor who has reviewed and authorised the Biodiversity Development Assessment Report (BDAR). The impacts of the project in excess of 600 hectares of vegetation.

**Mangoola Coal Continued Operations Project FBA Assessment | Mangoola NSW | Glencore | 2016–Current | Project Director |** This is a major project comprising a coal mine expansion. Allison is the project director for the ecological assessment which includes an ecological impact assessment, biodiversity offsetting and an EPBC referral. The assessment pathway is a blend of FBA and the Biodiversity Assessment Method (BAM). The impacts of the project in excess of 500 ha of vegetation with conservation of approximately 2500 ha of land-based conservation measures that were designed to meet NSW and Commonwealth requirements. The development of the strategy included close liaison and consultation with the Mangoola project team, subject matter experts and state and Commonwealth government agencies and this iterative and collaborative approach to the design and execution of the strategy was key to its successful completion in July 2019.

**Melbourne to Brisbane Inland Railway (IR) Biodiversity Assessment Report | Western NSW | ARTC | 2016–Current | Ecology – Project Director |** Allison is the Ecology Project Director for the state significant infrastructure biodiversity assessment of the Parkes to Narromine and Narrabri to North Star sections of the Inland Rail Project. The project includes preparation and delivery of the Biodiversity Assessment Report (BAR), Aquatic Assessment and Referral under the Commonwealth EPBC Act for the two sections of Inland Rail. The Project includes targeted threatened flora and fauna surveys across approximately 300 kilometres of railway corridor. The project includes the development of a range of impact mitigations strategies to minimise the impact of the project on biodiversity values, including threatened ecological communities, threatened flora species and threatened fauna species, including the koala and provides detailed analysis to inform conservation planning priorities for the development.

**Aquatic Impact Assessment – Inland Rail | Western NSW | ARTC | 2016 | Project Director |** Allison is the Project Director for the preparation of two state significant infrastructure aquatic impact assessments that describe the impacts of rail upgrades on freshwater aquatic environments. This project involved key fish habitat mapping and assessment against the Policy and Guidelines for Fish Habitat Conservation and Management (DPI 2013) and a detailed assessment of impacts on listed state and Commonwealth aquatic species. The project includes consideration of impact mitigation measures design to reduce the impact of the project on state and Commonwealth listed threatened species and ecological communities.

**Invincible Coal Mine Southern Extension Project | Cullen Bullen NSW | 2015–2018 | Project Director |** The project included an Ecological Assessment, Biodiversity Offset Strategy and strategic agency consultation using the Framework for Biodiversity Assessment (FBA). The Project had been rejected previously by the NSW Department of Planning for biodiversity impacts (among others). Allison directed the preparation of the BAR and Offset Strategy with project approval received February 2018.

**Terminal Four (T4) Project | Port Waratah Coal Services | Kooragang Island, NSW | 2011–2013 | Project Manager |** Allison was the project manager and primary author for the comprehensive Ecological Assessment and Biodiversity Offset Strategy for this high profile major infrastructure project. The Project involved analysis of complex ecological interactions and threatened species issues and included the development of a range of impact mitigation and offsetting measures. The project required approval under the EPBC Act, including for likely impacts on EPBC listed migratory bird populations within the Hunter Estuary Wetlands Ramsar site and for the construction of a major 120 ha system of intertidal migratory shorebird habitat. The T4 project would further develop Port of Newcastle in response to demand for increased coal export capacity in region, and Allison was integral in negotiating and securing a positive ecological outcome for the Project in terms of mitigating and offsetting the impacts of the Project.

# Rachel Musgrave

Sydney Ecology Lead – Principal Ecologist – Botanist

Rachel is an experienced ecologist/botanist and accredited assessor with over 12 years' experience delivering biodiversity assessments for a range of development types, biodiversity monitoring programs, and biodiversity management plans. Rachel has been involved in numerous ecological impact assessments of threatened species and endangered ecological communities in accordance with NSW and Commonwealth threatened species legislation. She has had experience in a broad range of environmental impact assessment projects, including REFs, EISs and biodiversity technical reports for large infrastructure, road, rail, renewable energy, and residential developments.

Prior to joining Umwelt, Rachel lead a team of 12 ecologists across NSW and the ACT within a multidisciplinary engineering company. The responsibilities carried out as part of this team lead role included delivering projects within project timeframes and set budgets, team financial management and forecasting, team performance management and resource forecasting, business development and preparing tender responses, and technical reviews.

Rachel has extensive experience in carrying out and leading teams on field assessments. Her skills include vegetation mapping, Plant Community Type and Threatened Ecological Community identification, BAM plots, targeted threatened flora and fauna species surveys, and habitat condition assessment. Furthermore, Rachel has also participated in expeditions to poorly botanised mountains in Borneo, the Philippines, Venezuela, and Madagascar for the purposes of research and species-specific population monitoring.

Rachel is an accredited person under the NSW Biodiversity Offset Scheme and was an accredited assessor under s142B(1)(c) of the *Threatened Species Conservation Act 1995.* As a result, Rachel has a strong working knowledge of the principles for biodiversity offsetting in NSW and provides accurate and concise advice on major projects.

Rachel is an adaptable, resourceful, and consultative team member who delivers high quality work for our clients.

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|---|---|
| **Qualifications/Affiliations:** | Bachelor of Science (Hons) Ecology |
| **Years of Industry Experience:** | 12 |
| **Specialisation:** | BAM accreditation (BAAS18032), BAM assessments, BAM VI assessments, Plant identification, PCT and TEC identification, Fauna surveys, BAM-C, Survey design, Data management, Technical Reviews, Environmental Management Plans, Vegetation & Bushland Management Plans, GIS. |

## Relevant Project Experience

**Boorolong Wind Farm | CWP Renewables | Armidale | 2021–Present |** Project Director and Accredited Biodiversity Assessor for a 6,500 ha wind farm development on the Northern Tablelands. Responsibilities include all aspects of impact assessment including, but not limited to, management of ecology team undertaking flora and fauna surveys, logistical management, vegetation mapping, targeted threatened species surveys flora, assessment of impacts in accordance with BAM, and consultation with NSW and Commonwealth agencies. Potential impacts on numerous TECs and threatened species were considered as part of the assessment process.

**Narrabri to North Star – Inland Rail | ARTC | Narrabri–North Star | 2021 | Project Manager & Accredited Assessor |** Project manager and accredited assessor for an FBA Major Project Assessment of impacts associated with N2NS. Assessment of impacts in accordance with FBA, including preparation of an addendum Biodiversity Assessment Report and consultation with NSW and Commonwealth agencies

**Warragamba Dam Raising| WNSW | Warragamba | 2017–2020 | Accredited Assessor |** Ecology lead on an FBA Major Project Assessment of impacts associated with the raising of Warragamba Dam wall. Responsibilities include all aspects of impact assessment including, but not limited to, management of ecology team undertaking flora and fauna surveys, logistical management, vegetation mapping, targeted threatened species surveys flora, assessment of impacts in accordance with FBA, preparation of three standalone Biodiversity Assessment Reports and MNES assessment report, consultation with NSW and Commonwealth agencies.

**Bathurst Second Circuit | Apex | Bathurst | 2018–2020 | Accredited Assessor |** Ecology lead on a BAM Major Project Assessment of impacts associated with the construction of a car racing circuit. Responsibilities include all aspects of impact assessment including, but not limited to, management of ecology team undertaking flora and fauna surveys, logistical management, vegetation mapping targeted threatened species surveys, assessment of impacts in accordance with BAM, reporting and consultation with NSW and Commonwealth agencies.

**Elysian Wind Farm | Willy Willy/Alinta | Tuross | 2019–2020 | Accredited Assessor |** Ecology lead on a BAM Major Project Assessment of impacts associated with the construction of a wind farm. Responsibilities include all aspects of impact assessment including, but not limited to, management of ecology team undertaking flora and fauna surveys, logistical management, vegetation mapping targeted threatened species surveys, assessment of impacts in accordance with BAM, reporting and consultation with NSW and Commonwealth agencies.

**Roaches Water Storage | Murrumbidgee Irrigation | Leeton | 2018–2020 | Accredited Assessor |** Ecology lead on a BAM Assessment for a Part 4 designated and integrated development of a water storage in Leeton. Responsibilities include all aspects of impact assessment including, but not limited to, management of ecology team undertaking flora and fauna surveys, logistical management, vegetation mapping, assessment of impacts in accordance with BAM, reporting and consultation with NSW and Commonwealth agencies.

**Eurobodalla Southern Storage | Eurobodalla Shire Council | Eurobodalla | 2016–2019 | Accredited Assessor |** Ecology lead on a FBA Major Project Assessment of impacts associated with the construction of a water storage facility in Eurobodalla Shire Council. Responsibilities include all aspects of impact assessment including, but not limited to, management of ecology team undertaking flora and fauna surveys, logistical management, flora and fauna surveying, assessment in accordance with FBA, reporting and mapping.

**Granite Hills Wind Farm |Akuo Energy | Glenbog | 2018–2020 | Accredited Assessor |** Ecology lead on a FBA Major Project Assessment of impacts associated with the construction of a wind farm near Nimmitabel. Responsibilities include all aspects of impact assessment including, but not limited to, management of ecology team undertaking flora and fauna surveys, logistical management, flora and fauna surveying, assessment in accordance with FBA, reporting and mapping.

**Snowy 2.0 | Snowy Hydro | Kosciuszko National Park | 2017 | Biodiversity specialist |** Preparation of REF's for Snowy Hydro 2.0 geotechnical investigations. Responsible for vegetation assessment and preparation of REFs pertaining to geotechnical works for the Snowy 2.0 Feasibility Study. Potential impacts on numerous EECs and threatened species were considered as part of the assessment process.

**Milton Ulladulla Bypass | TfNSW | Milton-Ulladulla | 2020–2021 | Project Manager & Accredited Assessor |** Project manager and ecology lead for biodiversity surveys to inform the concept design of Milton Ulladulla Bypass. Biodiversity surveys carried out in accordance with the BAM within a 300-metre boundary of proposed upgrade footprint. Work included vegetation mapping and BAM plot surveys, targeted threatened species surveys, preparation of technical memo updates, and a Biodiversity Survey Report. Potential impacts on numerous TECs and threatened species were considered as part of the assessment process. Also responsible for contract execution, program delivery, and financial reporting for the project.

**Moruya Bypass| TfNSW | Moruya | 2020–2021 | Biodiversity specialist |** Biodiversity specialist responsible for technical reviews for biodiversity surveys to inform the options selection and concept design of Moruya Bypass. Biodiversity surveys carried out in accordance with the BAM within a 300-metre boundary of proposed upgrade options footprint. Work included vegetation mapping and BAM plot surveys, targeted threatened species surveys, preparation of technical memo updates, and a Biodiversity Survey Report. Potential impacts on numerous TECs and threatened species were considered as part of the assessment process. Also provided support and assistance with contract execution, program delivery, and financial reporting for the project.

**Olympic Highway Intersections Upgrade | TfNSW | Wagga Wagga | 2021–2021 | Biodiversity specialist |** Biodiversity specialist responsible for technical reviews for a Biodiversity Assessment Report prepared to inform an REF for an upgrade of intersections on Olympic Highway in Wagga Wagga. Work included vegetation mapping and BAM plot surveys, targeted threatened species surveys, preparation of a Biodiversity Survey Report. Potential impacts on numerous TECs and threatened species were considered as part of the assessment process.

**Garfield Road Upgrade DD | TfNSW | Riverstone | 2019–2020 | Ecology Lead |** Preparation and technical review of a Biodiversity Assessment Report for inclusion to the REF for Garfield Road upgrade. Vegetation assessment, targeted threatened species surveys, and preparation of a Biodiversity Assessment Report pertaining to the upgrade of one section of Garfield Road in Riverstone. Potential impacts on numerous TECs and threatened species were considered as part of the assessment process.

**RP2J DD | TfNSW | Rankin Park-Jesmond | 2019–2020 | Ecology Lead |** Preparation of a Biodiversity Assessment Report, Fauna Crossing Structure Report, Vegetation Clearing Report, and Bat Management Plan for the detailed design phase of RP2J DD, and inclusion into addendum REF as required. Vegetation assessments, targeted threatened species surveys, and the preparation of Biodiversity Assessment Report, Fauna Crossing Structure Report, Bat Management Plan, and Vegetation Clearing Report pertaining to the RP2J DD. Potential impacts on numerous TECs and threatened species were considered as part of the assessment process.

**Heathcote Road Upgrade DD | TfNSW | Holsworthy | 2018–2019 | Ecology Lead |** Preparation of a Biodiversity Assessment Report, Fauna Crossing Structure Report, and Vegetation Clearing Report for the detailed design phase of Heathcote Road Upgrade, and inclusion into addendum REF as required. Vegetation assessments, targeted threatened species surveys, and the preparation of Biodiversity Assessment Report, Fauna Crossing Structure Report, and Vegetation Clearing Report pertaining to the upgrade of Heathcote Road in Hammondville. Potential impacts on numerous TECs and threatened species were considered as part of the assessment process.

**Golden Highway Upgrade | TfNSW | Singleton | 2016–2020 | Ecology Lead |** Preparation of a Biodiversity Assessment Reports for inclusion to the REFs for three segments of Golden Highway upgrade, preparation of technical memos to inform MREFs for Geotechnical works and UXO pre-clearance. Potential impacts on numerous TECs and threatened species were considered as part of the assessment process. Offsetting requirements calculated in accordance with FBA.

**Northern Beaches Hospital Road Upgrade | TfNSW | Belrose | 2017–2020 | Ecology Lead |** Preparation of a Biodiversity Offset Package for works associated with Northern Beaches Hospital and Mona Vale Road East road upgrades. Works included identification of potential offset sites, vegetation assessments, targeted threatened species surveys, and preparation of a Biodiversity Offset Package for approval by relevant agencies. Biodiversity credit calculations carried out in accordance with FBA and BAM.

**Pacific Highway Upgrade N2L | TfNSW | Narara–Lisarow | 2016–2017 | Ecology Lead |** Preparation of a Species Impact Statement for inclusion to the REF for N2L road upgrade. Vegetation assessment and preparation of SIS in accordance with Secretary's Environmental Assessment Requirements pertaining to the upgrade of the Pacific Highway from Narara to Lisarow. Potential impacts on numerous EECs and threatened species were considered as part of the assessment process. Offsetting requirements calculated in accordance with FBA.

**Mona Vale Road West Upgrade | TfNSW | Terry Hills | 2016–2017 | Ecology Lead |** Preparation of a Species Impact Statement for inclusion to the REF for Mona Vale Road upgrade. Vegetation assessment and preparation of SIS in accordance with Secretary's Environmental Assessment Requirements pertaining to the upgrade of Mona Vale Road. Potential impacts on numerous EECs and threatened species were considered as part of the assessment process. Offsetting requirements calculated in accordance with FBA.

**Bells Line of Road Strategic Environmental Assessment | TfNSW | Castlereagh | 2016 | Biodiversity specialist |** Preparation of Biodiversity Technical Specialist Assessment Report for inclusion into a Strategic Environmental Assessment for a corridor study to investigate options for the preservation of a future transport corridor in north western Sydney.

**Taralga Wind Farm | Downer | Taralga | 2013–2016 | Biodiversity specialist |** Implementation of Project Ecologist tasks outlined in State and Federally Approved Management Plans for the construction of a 60-turbine wind farm and 132Kv transmission line near Taralga NSW. Responsibilities include undertaking pre-clearance surveys for threatened microbat species and other native fauna present on site, relocation and monitoring of relocated individuals, habitat assessment, consistency reviews, fauna surveys and management, provision of expert advice.

**Boco Rock Wind Farm | Downer | Nimmitabel | 2013–2014 | Biodiversity specialist |** Implementation of Project Ecologist tasks outlined in State and Federally Approved Management Plans for the construction of a 70-turbine wind farm and 132Kv transmission line in Cooma Monaro LGA. Responsibilities include undertaking pre-clearance surveys for threatened reptile species and other native fauna present on site, relocation and monitoring of relocated individuals, habitat assessment, consistency reviews, fauna surveys and management, provision of expert advice.

# Jacob Manners

Senior Ecologist

Jacob is a Senior Ecologist with 15 years' experience in the planning and implementation of terrestrial biodiversity surveys and impact assessments in support of Local, State and Commonwealth approvals for a diverse range of projects. He has extensive experience across a range of industries including renewable energy development, resource extraction, transport, linear infrastructure and urban development. Jacob enjoys engaging with clients to deliver challenging projects which achieve high quality impact assessment, mitigation and offsetting outcomes.

Jacob is an accredited BAM Assessor under the BC Act and has certified over 15 Biodiversity Development Assessment Reports. Jacob has led numerous large-scale and technically complex ecological projects across NSW and has appeared as an **expert** witness in Class 1 Development Appeals in the NSW Land and Environment Court and has an in-depth working knowledge of the Environmental Planning and Assessment Act, Biodiversity Conservation Act and the Environment Protection and Biodiversity Conservation Act.

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| **Qualifications/ Affiliations:** | Bachelor of Science (Sustainable Resource Management & Marine Science) – University of Newcastle,<br>Master of Wildlife Management – Macquarie University<br>Arboriculture Graduate Certificate – University of Melbourne<br>Certificate 3 in Commercial Photography – Ultimo TAFE<br>Accredited BAM Assessor under the *Biodiversity Conservation Act 2016* |
| **Years of Industry Experience:** | >15 |
| **Specialisation:** | Biodiversity impact assessment including under the Biodiversity Assessment Method (BAM), rehabilitation planning, project management, flora and fauna field surveys, GIS Mapping, arboriculture. |

## Relevant Project Experience

**Goulburn River Solar Farm Biodiversity Assessment| Merriwa LGA| 2021–Ongoing |Author and accredited BAM Assessor |** Jacob is the Project Manager and lead BAM Accredited Assessor for the preparation of the BDAR for the Goulburn River Solar Farm, an approximately 800 ha Solar Farm in the Merriwa LGA. This has involved the coordination and completion of several years of biodiversity surveys and assessment for the project that covers an area of 800ha. This has involved the consideration of plant community type mapping, Category 1 – Exempt Land Mapping, and assessment of impacts to the vulnerable Barking Owl and critically endangered Regent Honeyeater and NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions ecological community.

**Stone Ridge Quarry Biodiversity Assessment | 2022–Ongoing |Author and accredited assessor |** Jacob is the Project Manager and lead BAM Accredited Assessor for the preparation of the BDAR for the proposed Stone Ridge hard rock quarry, an approximately 80 ha quarry development in the Port Stephens LGA. This has involved the coordination and synthesis of several years of biodiversity surveys including vegetation mapping, BAM Plot surveys and management of field teams completing targeted threatened species surveys.

**Martins Creek Quarry Biodiversity Assessment and Offsets Strategy| Dungog LGA | 2014–2022 |Author and accredited assessor |** Jacob was the Project Manager and lead biodiversity assessor for the preparation of the BAR for the proposed Martins Creek hard rock quarry, in the Dungog LGA. This has involved the coordination and completion of several years of biodiversity surveys including vegetation mapping, BAM Plot surveys and targeted threatened species surveys.

**Confidential Windfarm Project in the NSW Southern Highlands | 2021–Ongoing | Project Manager |** Jacob is the Project Manager responsible for coordinating the completion of biodiversity surveys and assessments for a large windfarm project in the NSW Southern Highlands which is currently in the scoping phase. Considerations have included Category 1 – Exempt Land Mapping, plant community type mapping, threatened flora and fauna surveys and bird and bat utilisation surveys.

**Kurri Kurri Lateral Gas Pipeline Project| 2023 |** Jacob was responsible for undertaking a revised assessment of the project under the BAM, in response to design changes to recalculate project impacts and associated biodiversity offset liability.

**Transgrid Major Infrastructure Transmission Line Project | Tamworth to Winton NSW | 2021 |** Jacob was the Project manager and lead biodiversity assessor for the preparation of updated advice on the Transgrid Tamworth to Winton biodiversity constraints assessment. Jacob completed a detailed analysis of the constraints for the project and provided advice on the cost of offsetting the biodiversity impacts associated with the Project.

**Taylors Beach NSW Biodiversity Assessments and Management Plans Mixed Use Industrial Development | Port Stephens LGA | 2019–2020 |** Jacob was the Project Manager and lead BAM Accredited Assessor for the preparation of the BDAR for the project. Jacob completed the biodiversity surveys for the project and considered impacts to the Swamp Sclerophyll Forest endangered ecological community, Koala, Squirrel Glider and Southern Myotis. Jacob was also responsible for the preparation of vegetation koala management plans for the project.

**Hadden Ridge Rural Residential Subdivision Biodiversity Impact Assessment and Farm Management Planning |2021-2022|Author and Project Manager |** Jacob was responsible for undertaking a monitoring and a critical review of the existing Farm Management Plan which had been prepared for a large rural property at Hadden Ridge in the Hawkesbury LGA. Jacob prepared a Revised Farm Management Plan in consultation with the landowner and authored a flora and fauna assessment in support of a rural residential subdivison for the property.

**Grants Road Sand Quarry Biodiversity Assessment and Post Approvals Biodiversity Planning and Monitoring | 2008–2021 |Author and Project Manager |** Jacob was the Project Manager and lead biodiversity assessor for the preparation of the BAR for the Grants Road Sand Quarry, in the Gosford LGA. This involved the coordination and completion of several years of biodiversity surveys including vegetation mapping, plot surveys and targeted threatened species surveys. Jacob was also responsible for the completion of groundwater dependent ecosystem, landscape rehabilitation and threatened species monitoring plans for the project.

**Project Management and Land and Environment Court Expert Witness for Landscape Supply and Agricultural Use Project | South-west Sydney NSW | 2022 |** Jacob was the Project Management responsible for undertaking site investigations and preparing the BDAR and Arboricultural Impact Assessment documentation for the project. Jacob participated in the Joint Expert Conferencing and attended the Land and Environment Court as an Expert Witness.

**Bells Wellness Centre and Hotel Expansion | Killcare NSW | 2021 |** Jacob was the Project Manager and lead BAM Accredited Assessor for the preparation of the BDAR for a $5.5M upgrade to an existing resort facility. Jacob completed the biodiversity surveys for the project and authored the BDAR which was completed using a Streamlined BDAR assessment module.

**Central Coast Airport Obstacle Limitation Surface Vegetation Management | Warnervale NSW | 2020 |** Jacob was the Accredited Assessor for the preparation of two Biodiversity Development Assessment Reports for the northern and southern obstacle limitation surfaces at the Central Coast Airport. Jacob worked with Central Coast Council to determine the extent of the OLS and vegetation management works required and provided an assessment of the partial clearing works under the BAM.

**Flora and Fauna Assessment and Vegetation Management Plan for Residential Dwelling for Peter Stutchbury and Associates | Macmasters Beach NSW | 2018 |** Jacob was the Project Manager and lead author for the preparation of a Flora and Fauna Assessment and Vegetation Management Plan for the project designed by the renowned architect Peter Stuchbury. Jacob provided detailed advice and mitigation measures in relation to the Yellow-bellied Glider.

**Thompson Healthcare $27.8M Aged Care Facility | Gosford | 2019–2020 |** Jacob was the author of a Flora and Fauna Assessment for the project and completed detailed assessments on the Umina Coastal Sandplain endangered ecological community. Jacob appeared for the applicant at the Joint Regional Planning Panel Meeting for the Project, which was approved with conditions.

**State Significant Development Residential Flat Building | Gosford | 2019–2020 |** Jacob was the Project Manager responsible for the completion of site investigations and the completion of the BDAR, Arboricultural Impact Assessment and Vegetation Management Plan for a $110 million Apartment precinct development in the Gosford LGA.

**Pacific Highway Turramurra Biodiversity Assessment and Expert Witness for Residential Flat Building | Ku-ring-gai LGA | 2019–2020 |** Jacob prepared a biodiversity assessment and vegetation management plan for the project, attended a S34 conference and appeared as an Expert Witness in the Land and Environment Court.

**Killeaton St, St Ives Seniors Living Development Biodiversity Assessment and Planning and Expert Witness | Ku-ring-gai LGA | 2018 |** Jacob prepared a biodiversity assessment, vegetation management plan and ecological site management plan and appeared as an expert witness at a S34 Conference.

**Annangrove Road Rouse Hill Biodiversity Assessment for Mixed Use Development | 2019–2020 |** Jacob prepared completed site surveys and was the lead accredited assessor for the preparation of a BDAR which addressed serious and irreversible impacts to Cumberland Plain Woodland CEEC. Jacob also attended meetings with local Council to negotiate a development outcome for the client and prepared the Vegetation Management Plan for the Project.

**Warnervale Road, Warnervale Rural Residential Subdivision | Wyong LGA | 2019 |** Jacob was the Project Manager and lead BAM Accredited Assessor for the preparation of the BDAR for the project. Jacob completed the biodiversity surveys for the project and considered impacts to the Squirrel Glider.

**Environmental Impact Assessments for Local Infrastructure Works Projects |** Jacob has completed numerous environmental impact assessments for Part 5 Projects which have included field investigations and preparing reports to assess environmental impacts under the *Environmental Planning and Assessment Act 1979* (NSW), *Biodiversity Conservation Act 2016* (NSW), *Environment Protection and Biodiversity Conservation Act 1999* (Cth) and the *National Parks and Wildlife Act 1974* (NSW).

Selected local infrastructure projects which I have delivered environmental impact assessments for include:

- Perina Road Sewage Main Upgrade Gosford.
- Wagstaff Sewer Pump Station Upgrade.
- Summerland Point Sewer Pump Station Upgrade.
- Ettalong Beach Sewer Pump Station Upgrade.
- Koolewong Sewer Pump Station Upgrade.
- Green Point Sewer Pump Station Upgrade.
- Bridge replacement at Palmdale NSW.
- Private access road upgrade – Dharug National Park.
- Stormwater Infrastructure Upgrade – Davies Street Kincumber.

**Thornton Sewer Main Arboricultural Impact Assessment | Maitland LGA | 2020 |** Completion of GPS site survey, GIS mapping and assessment of 231 trees, including provision of management recommendations for trees to be retained.

**SIMS Metal Recycling Facility West Gosford Biodiversity Assessment and Post Approval Monitoring | Central Coast LGA | 2019 |** Jacob was the lead accredited biodiversity assessor and report author for the project and coordinated the field surveys and GIS mapping. Post approval works completed included Arborist Reporting, nest box installation and civil contractor induction.

**Lady Carrington Estate Expert Witness and Biodiversity Offset Assessment Report | Helensburgh NSW | 2014 |** Jacob worked with a specialist flora survey consultant to prepare a Biodiversity Offset Assessment for the project using the Biobanking Assessment Methodology. Jacob also appeared as an expert witness on threatened fauna at a Section 34 Conference for the Project.

**Biodiversity Assessment Report for an approved Resource Recovery Facility at Kemlba Grange NSW | 2014 |** Jacob coordinated the biodiversity surveys, including vegetation mapping and threatened flora and fauna surveys and authored the Biodiversity Assessment Report for the project.

**Monitoring of *Rutidosis heterogama* | Charmhaven, Wyong LGA |** Jacob authored the management plan, oversaw the fencing and establishment of the conservation area and completed monitoring surveys over several years to identify the extent and trends for a population of *Rutidosis heterogama*. He provided practical protection and management measures and devised a strategy to ensure accurate counting of individuals between monitoring events.

**Preparation of Species Impact Statements | Various Dates |** Jacob has prepared the following Species Impact Statements under the now repealed Threatened Species Conservation Act:

- Residential Subdivision Kellyville NSW – focussing on Cumberland Plain Woodland ecological community.
- Residential Subdivision Warnervale NSW – focussing on the Squirrel Glider.
- Rural-residential Subdivisions Bensville NSW – focussing on the Yellow-bellied Glider and Bush Stone Curlew.
- Residential Dwelling Davistown NSW – focussing on the Green and Golden Bell Frog.

# Ryan Parsons

Principal Ecologist – Botanist

Ryan is a highly experienced Principal Ecologist with a wealth of ecological consulting experience and is an accredited Biodiversity Assessment Method (BAM) Assessor under the *Biodiversity Conservation Act 2016*. He has over 15 years' experience in the preparation of Ecological Impact Assessments and Commonwealth EPBC approvals for major projects and State Significant Development /Infrastructure (SSD/SSI), ranging from significant road/railway upgrades, strategic biodiversity certification for residential development and mining/quarry projects. He has substantial experience in all stages of a project, including design/constraints phase, EPBC Act Referral process, biodiversity assessment under the BAM and preparation of biodiversity offset strategies/plans (including the setup and monitoring of Stewardship sites). As part of developing biodiversity offset strategies, Ryan has a large amount of experience in locating suitable offsets for major projects.

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| **Qualifications/Affiliations:** | Bachelor of Environmental Science and Management (Hons), University of Newcastle,<br>Accredited BAM Assessor under the *Biodiversity Conservation Act 2016*<br>Accredited BioBanking Assessor under the former Threatened Species Conservation Act 1995 |
| **Years of Industry Experience:** | 15 + |
| **Specialisation:** | Flora Survey, vegetation community mapping and Plant Community Type (PCT) Identification, Threatened Ecological Community identification and assessment, REF and EIS Ecological Assessments, Targeted threatened flora and fauna surveys, BAM Assessor, EPBC Offset Calculator, Biodiversity offsetting strategies. |

## Relevant Project Experience

**Central Coast Strategic Conservation Plan Project – Biodiversity Certification (BAM) | DPIE | 2018–Current | Project Manager |** Ryan is the project manager and one of the lead BAM assessors for the current Central Coast Biodiversity Certification and Strategic Assessment Project being completed for the Department of Planning, Industry and Environment under the BAM. Ryan led the preparation of the scoping document for the Project which provided an analysis of the existing biodiversity data and planning information available to support a strategic assessment of future biodiversity impacts, identification of data collection needs to meet state and Commonwealth requirements, including timeframes and projected costs, strategic context and issues to inform the Biodiversity Certification, identification of opportunities to mitigate and offset residual impacts and avoid unacceptable impacts on biodiversity. This study was integral for defining the survey and assessment needs of the project. Ryan was one of the lead BAM assessors for targeted seasonal threatened species surveys, BAM vegetation integrity plot surveys and mapping of plant community types (PCTs)/threatened ecological communities (TECs) across a 3,100-hectare study area. Ryan has also provided advice on Matters of National Environmental Significance (MNES) under the EPBC Act to inform the terms of reference of the Strategic Assessment with the Commonwealth Department of Agriculture, Water and the Environment (DAWE). A key component of this project has been identifying potential offset areas within the Central Coast LGA to offset the impacts associated with the project. This involved ranking land available for offsetting based on biodiversity values and providing DPE target areas for establishing conservation areas.

**FBA Biometric Assessment for Major Infrastructure Project – Parkes to Narromine and Narrabri to North Star Sections of the Inland Rail Project | ARTC | 2016–Current | Ecology Project Manager |** Ryan is the project manager and lead ecologist for the FBA assessments and Commonwealth referrals for over 300 km of railway corridor and adjacent compounds for the SSI Inland Rail Project. As part of this project Ryan completed a constraints analysis, designed the field survey effort, comprising a number of targeted threatened species surveys and the collection of biometric data from over 100 plots/transects, and completed the FBA assessments under the NSW Biodiversity Offset Policy for Major Projects. The large linear nature of this project made it a complex FBA assessment and a total of eight separate BioBanking Credit Calculator assessments were required to determine the project credit requirements. The project includes the development of a range of impact mitigations strategies to minimise the impact of the project on biodiversity values, including threatened ecological communities, threatened flora species and threatened fauna species, including the koala.

**Biodiversity Stewardship Agreements | Bulga coal (Glencore) | July 2020–Current | Project Director |** Ryan is overseeing the delivery of the package of documents required for the establishment of Biodiversity Stewardship Agreements at a proposed stewardship site covering ~160 ha.

**Review of Biodiversity Conservation Fund (BCF) Charge System | BCT | 2022 | Project Manager/Lead Reviewer |** Ryan undertook a detailed review of the yet to be released BCF charge system on behalf of the Biodiversity Conservation Trust (BCF) in relation to species categorisation. This review looked at the categorisation of over 300 threatened flora and fauna species.

**Expert Report for Lot 2 Sawtell Road Toormina | Coffs Harbour City Council | Coffs Harbour, NSW | 2018 | Technical Input |** Umwelt prepared an expert report on behalf of Coffs Harbour City Council for a large remnant bushland site at Toormina addressing a range of contentious ecological issues, including vegetation classification, threatened ecological community identification and threatened species habitat. As part of this project Ryan assisted in the review of an ecological assessment prepared by a private consultancy company. Key ecological matters included *Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions* endangered ecological community (EEC) under the BC Act, koala habitat and identification of plant community types (PCTs). These key ecological matters are widespread across the north coast and Umwelt was selected as a subject matter expert to assist Coffs Harbour City Council.

**Singleton Bypass Biodiversity Impact Assessment | Transport for NSW | 2019–Current | Singleton, NSW | Project Manager |** Umwelt were engaged to prepare the Biodiversity Impacts Assessment for the proposed Singleton bypass. The bypass includes about 9 km of new highway, interchanges and new bridges over the Main North railway, the Hunter River and floodplain. Ryan undertook detailed vegetation mapping of the proposed impact area and collated specialist studies by other ecological consultants into one assessment report part of the REF prepared by AECOM. The key ecological impacts included disturbance of remnant vegetation to the west of Singleton Heights including threatened ecological communities and impacts to the Hunter River and its floodplain. As part of this work Ryan as completed a preliminary Biodiversity Assessment Method (BAM) credit calculator assessment to determine required biodiversity credits in accordance with RMS offset guidelines. Umwelt are currently completing further work in terms of a consistency assessment due to project updates.

**BioBanking Site Review | Office of Environment and Heritage (OEH) | Goulburn/Gunnedah, NSW | 2018 | Technical Specialist |** Umwelt were commissioned by OEH to complete a comprehensive peer review of all work completed by a private consultancy for two proposed BioBanking sites near Goulburn (Glenara property) and near Gunnedah (Little Moolagundi property) NSW. This peer review included the offset report, survey effort, credit calculator assessment and total fund deposit calculations.

**Review of NSW Plant Community Type Attributes | Office of Environment and Heritage| 2017–2018 | Project Manager |** Review of two key PCT attributes (per cent cleared values and IBRA subregion occurrence) to support the recently established BAM. Analytical checks involved reviewing entire pooled datasets for each attribute to identify unexpected or outlying values and anomalous values were flagged for closer scrutiny by a secondary expert check. A subset of PCTs were subjected to expert review by professional field botanists with relevant knowledge and experience. This subset of PCTs was identified through a priority rating system based on landuse pressure, threatened ecological community status, priority vegetation class/IBRA region combinations, high (≥60%) per cent cleared values and how widespread a given PCT is.

**Mt Owen Continued Operations Modification 2 | Glencore | 2017–2018 | Mt Owen NSW | Project Manager |** FBA assessment for Mt Owen Continued Operations Modification 2 project. This included the collection of both FBA and the new BAM data for the site as well as comparative analyses to determine the preferred methodology for Glencore. Ryan prepared the FBA report and consulted directly with OEH and Glencore on the outcomes and proposed offsetting strategies for the Modification.

**Haerses Road and Porters Road BioBank Site Biodiversity Assessment Reports | Dixon Sand (Penrith) Pty Ltd | 2017–2018 | Maroota/Kenthurst NSW | Project Manager |** These BioBank sites were prepared on behalf of Dixon Sand (Penrith) Pty Ltd to meet the biodiversity credit requirements of an FBA assessment of the Haerses Road Quarry Extraction Area Modification Project. These BioBank sites will conserve habitat for a range of threatened species, including the eastern pygmy possum, Dural woodland snail, *Darwinia biflora*, *Tetratheca glandulosa* and *Grevillea parviflora* subsp. *supplicans*.

**Feedback on Practicality of the *Central Hunter Valley Eucalypt Forest and Woodland* Critically Endangered Ecological Community EPBC Act Listing | NSW Minerals Council | 2018 |** Through Ryan's extensive vegetation survey and assessment work he provided feedback to the NSW Minerals Council on the practicality and challenges of applying the *Central Hunter Valley Eucalypt Forest and Woodland* Critically Endangered Ecological Community listing under the EPBC Act.

**Glencore Upper Hunter Strategic Assessment | Glencore | 2014–2015 | Project Coordinator and Lead Field Surveyor |** Primary botanist and reviewer of PCT allocations and vegetation mapping across the sites. The Commonwealth and NSW Governments have entered into an agreement to undertake a strategic assessment of a Biodiversity Plan for Coal Mining in the Upper Hunter Valley. As part of this project, Ryan undertook project coordination, field surveys and desktop BioCertification Assessments for four large Glencore owned mine sites in the Hunter valley with a combined area of over 10,000 hectares. Proposed impacts assessed under the UHSA include mining related infrastructure projects such as powerlines, gas and water pipelines, roads and other linear impact infrastructure.

**Vegetation mapping and condition assessment of Southern Wallis Lake Foreshore | Great Lakes Council | 2016 | Wallis Lakes NSW |** Ryan undertook detailed vegetation mapping and condition assessment of Southern Wallis Lake foreshore on behalf of Great Lakes Council. Surveys included baseline vegetation mapping, resilience (condition assessment), community description, full inventory of native and exotic species present (primarily flora), targeted threatened species searches, baseline weed density mapping and identification of key threats to significant foreshore vegetation. Following the surveys a detailed report was provided to Council which included vegetation maps, weed density maps, recommended restoration management actions and priority areas for restoration management.

**Melbourne to Brisbane Inland Railway (MBIR) Biodiversity Assessment Report | ARTC | Western NSW | 2016 |** Ryan undertook desktop assessments and field surveys to identify ecological constraints along the Parkes to Narromine and Narrabri to North Star sections of the linear infrastructure project MBIR. In addition targeted seasonal surveys for several threatened plants were undertaken in spring for this project. Given the long linear nature of the project areas, eight separate FBA calculator assessments were completed to determine the level of impacts of the project and define the offset requirements.

**BioBanking Advice | Orica Mining Services | 2015 | Richmond Vale NSW |** Ryan undertook field surveys and prepared advice for Orica regarding the results of the biodiversity offset surveys at Orica's Richmond Vale site in order to determine whether on-site ecological values will be sufficient to offset the biodiversity impacts associated with the re-zoning that is currently proposed within the site. This required targeted floristic surveys, collection of BioMetric data and searches for *Tetratheca juncea*. Ryan assisted in preparing a preliminary BioBanking assessment which determined the credits requirements and credit availability under a BioBanking scenario.

**Terminal Four Project | Port Waratah Coal Services | 2011–2014 | Kooragang Island, NSW |** Ryan assisted in the preparation of the ecological component of the construction of new $3.5 billion coal export terminal. Ryan was integral in the preparation of the Biodiversity Offset Management Strategy in which he undertook BioBanking Assessments of the four biodiversity offset sites established to offset the impacts of the project which included impacts associated with electricity infrastructure upgrades and relocation, water and gas pipeline impacts.

**TransGrid – Threatened Flora Pre-Clearance Surveys of Vegetation Maintenance Works along Existing Electricity Easement, Tomalpin NSW | 2014 | Tomalpin, NSW | Project Manager and Lead Botanist |** Detailed threatened flora surveys for over 20 kilometres of existing electricity easement (including tower structures), prior to regular maintenance activities. This project required detailed field survey with TransGrid surveying contractors to search areas scheduled for maintenance and to clearly mark and record threatened flora species and hollow-bearing trees in the area to be impacted. Clear demarcation in the field allowed clearing staff to avoid these areas (where possible) to minimise ecological impact.

**Northparkes Mine Step Change Project | Rio Tinto | 2012–2015 | Parkes NSW |** Ryan undertook vegetation mapping and flora surveys for the ecological assessment component of the Northparkes Step Change project. This project also included rapid ecological constraints surveys of potential water pipeline easements between the study area north of Parkes and the town of Forbes. Ryan assisted in the preparation and the delivery of the ecological component of the Environmental Assessment, including assessments of the impacts under state and Commonwealth legislation.

# Sarah Hart

Senior Ecologist

Sarah is an ecologist with nine years professional experience in Natural Resource Management and she has experience delivering consulting projects ranging from small impact assessments and developments to larger collaborations and long-term monitoring and compliance projects in the mining sector. Sarah graduated from James Cook University with a Master of Science majoring in Ecology and Zoology, additionally completing a Graduate Diploma in Environmental Management from the University of Queensland.

Sarah has a strong background in the assessment of the impacts on species, populations and ecological communities listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (the EPBC Act), NSW *Biodiversity Conservation Act 2016* (BC Act) and ACT *Nature Conservation Act 2014* (NC Act). She has also undertaken project management and reporting associated with ACT impact assessment and the NSW Biodiversity Offset Scheme including, Biodiversity Development Assessment Reports (BDAR) and her field-based experience includes vegetation survey, plant species identification, regional and localised vegetation mapping, BAM/BBAM plots and targeted threatened flora and fauna surveys. She has created and managed large-scale long-term monitoring projects for compliance within the Southern Coalfields for ongoing monitoring of sensitive ecological systems and threatened species management.

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| **Qualifications/Affiliations:** | Master of Science (Ecology and Zoology), Bachelor of Science (Zoology), James Cook University, Graduate Diploma of Environmental Management, University of Queensland, Accredited BAM Assessor. |
| **Years of Industry Experience:** | 9 |
| **Specialisation:** | Environmental monitoring, Environmental impact assessments, Native vegetation classification mapping, Habitat condition assessments |

## Relevant Project Experience

### Linear Infrastructure

**Environmental approvals for the relocation of the Tumut Powerline | Neoen | Canberra, ACT & border of NSW | 2022–2023 | Senior Ecologist |** Sarah was the lead ecologist for fieldwork and reporting to complete vegetation mapping across the site and completing impact assessment reports for each state; both NSW and ACT as separate reports; and Commonwealth and scoped fieldwork for the broader ACT ecology team. Mapping all vegetation zones and completing floristic plots to determine PCTs across the site. Targeted flora surveys and providing technical advice to the Client.

**Transmission Line 6X (Upper Tumut 330 kV Substation to Ravine 330 kV Substation) Ecological Assessment | Transgrid | Kosciuszko National Park, NSW | 2022–2023 | Senior Ecologist |** Sarah was the lead ecologist for fieldwork and reporting to complete vegetation mapping across the site and completing reporting. Mapping all vegetation zones and completing rapid data plots to determine PCTs across the various locations within the site. Habitat assessments for Booroolong Frog, Smoky mouse and many threatened flora species and providing technical advice to the Client.

**Transmission Line U3 and Line 2 Ecological Assessment | Transgrid | Kosciuszko National Park, NSW | June 2022 | Senior Ecologist |** Sarah was the lead ecologist for fieldwork and reporting to complete vegetation mapping across the site and completing reporting for two separate Transmission lines. Mapping all vegetation zones and completing rapid data plots to determine PCTs across the various locations within the site. Habitat assessments for Booroolong Frog, Smoky mouse and many threatened flora species and providing technical advice to the Client.

**Great Western Highway Upgrades | TfNSW | Blue Mountains, NSW| 2020–2021 | Ecologist |** Sarah assisted in the fieldwork and report preparation for a large-scale BDAR. The fieldwork consistent of using the NSW Biodiversity Assessment Methods (BAM) plots in various threatened and non-threatened ecological communities, habitat assessments for a variety of threatened fauna species, placement of camera traps, targeted flora surveys using transects and nocturnal surveys across the study area.

**Picton Road Upgrades | TfNSW | Wollongong, NSW | 2020 | Ecologist |** Sarah assisted in the fieldwork and report preparation for an impact assessment along Picton Road, NSW. The fieldwork consistent of using the NSW Biodiversity Assessment Methods (BAM) plots in various threatened and non-threatened ecological communities, habitat assessments for a variety of threatened fauna species, targeted flora surveys using transects and nocturnal surveys across the study area.

**Various NBN upgrades | Telstra | Greater Sydney, NSW | 2019–2020 | Ecologist, Project Manager |** Sarah was project manager and lead ecologist in the fieldwork and report preparation for impact assessments using the Telecommunications Act in conjunction with the standard impact assessment framework. The fieldwork consistent of an ecologist and an Archaeology consultant to assess the sites.

As an ecologist Sarah used rapid data plots to confirm and inform regional vegetation mapping in various threatened and non-threatened ecological communities, habitat assessments for a variety of threatened fauna species across the study area.

### Urban Development

**Holsworthy Sewerage Treatment Plant Flora and Fauna Management Plan | Holsworthy, NSW | 2022–2023| Senior Ecologist and Project Manager |** Sarah was the lead ecologist for fieldwork; to update vegetation mapping across the site and include any areas of potential habitat for microbats. Providing technical advice to the Client and reporting of Flora and Fauna Management Plan, specifically for microbat management.

**Ginninderra West Ecological Assessment | Canberra, ACT | 2023 | Senior Ecologist and Project Manager |** Sarah was the lead ecologist for fieldwork and reporting to complete vegetation mapping across the site and completing preliminary constraints reporting and scoping fieldwork for the MNES report and EIS. Mapping all vegetation zones and completing floristic plots to determine PCTs across the site. Targeted flora surveys and providing technical advice to the Client.

**Gundary Solar Farm Biodiversity Development Assessment Report | Goulburn, NSW | 2022–2023 | Senior Ecologist and Project Manager |** Sarah was the lead ecologist for fieldwork and reporting to complete vegetation mapping across the site and completing preliminary constraints reporting and scoping fieldwork for DBAR to inform the EIS. Mapping all vegetation zones and completing BAM plots to determine PCTs across the site. Including targeted flora and fauna surveys under the relevant guidelines.

**Surf Beach Flora and Fauna Report | Public Works Authority| Batemans Bay, NSW | 2022 | Senior Ecologist and Project Manager |** Sarah was the Project manager and lead ecologist of vegetation and habitat impact assessment to compliment the REF for the Client. Mapping all vegetation zones and completing BAM plots to determine PCTs across the site. Undertaking spotlighting for nocturnal fauna and habitat assessments for all fauna species.

**Goulburn River Solar Farm Biodiversity Development Assessment Report | Merriwa, NSW | 2022 | Senior Ecologist |** Sarah completed BAM plots and ecology surveys across the site. Sarah also assisted in reporting for the BDAR, collating data and integrating into the biodiversity development assessment report.

**Wattle Creek Wind Farm | Marulan, NSW | 2022 | Senior Ecologist |** Sarah completed rapid vegetation plots and ecology fauna habitat surveys across the site. Sarah also completed the constraints reporting for the scoping report, collating data and integrating into the future biodiversity development assessment report.

**Booroolong Wind Farm | NSW | 2022 | Senior Ecologist and Field Coordinator |** Sarah completed logistics for a large field team over several seasons, to get safe access and discussions with landowners about access requirements and survey effort. Sarah also completed BAM plots and vegetation boundary mapping across the site to determine PCTs and survey for threatened flora.

**Boronia Grove Biodiversity Assessment Report | Bokor Pty Ltd | Sydney | 2020 | Ecologist and Project Manager |** Sarah was the project manager and completed the report preparation for a small-scale BDAR. The project involved application of the Biodiversity Assessment Method (BAM) and Biodiversity Offset Scheme (BOS) under the Biodiversity Conservation Act 2016 (BC Act), including use of the BAM Calculator to determine offsetting requirements.

**Flora and Fauna Assessment Reports | EPM Projects Pty Ltd | Sydney | 2019–2020 | Ecologist and Project Manager|** Sarah was the Project manager and lead ecologist of vegetation and habitat impact assessment to compliment the REF for the Client under a variety of legislations including SEPP44: Koala habitat protection and the State Environmental Planning Policy (Educational Establishment and Child Care Facilities). Managing internal multi-disciplinary teams (Aboriginal heritage, Aquatic ecology and European heritage).

### Conservation and Biodiversity Stewardship Site Assessments (NSW)

**The Molonglo Catchment Rehydration Initiative (BDAR) | Queanbeyan, NSW | 2022–2023 | Senior Ecologist and Project Manager |** Sarah was the lead ecologist for fieldwork and reporting to complete vegetation mapping across the site and completing preliminary constraints reporting and scoping fieldwork for the BSSAR. Mapping all vegetation zones and completing BAM plots to determine PCTs across the site.

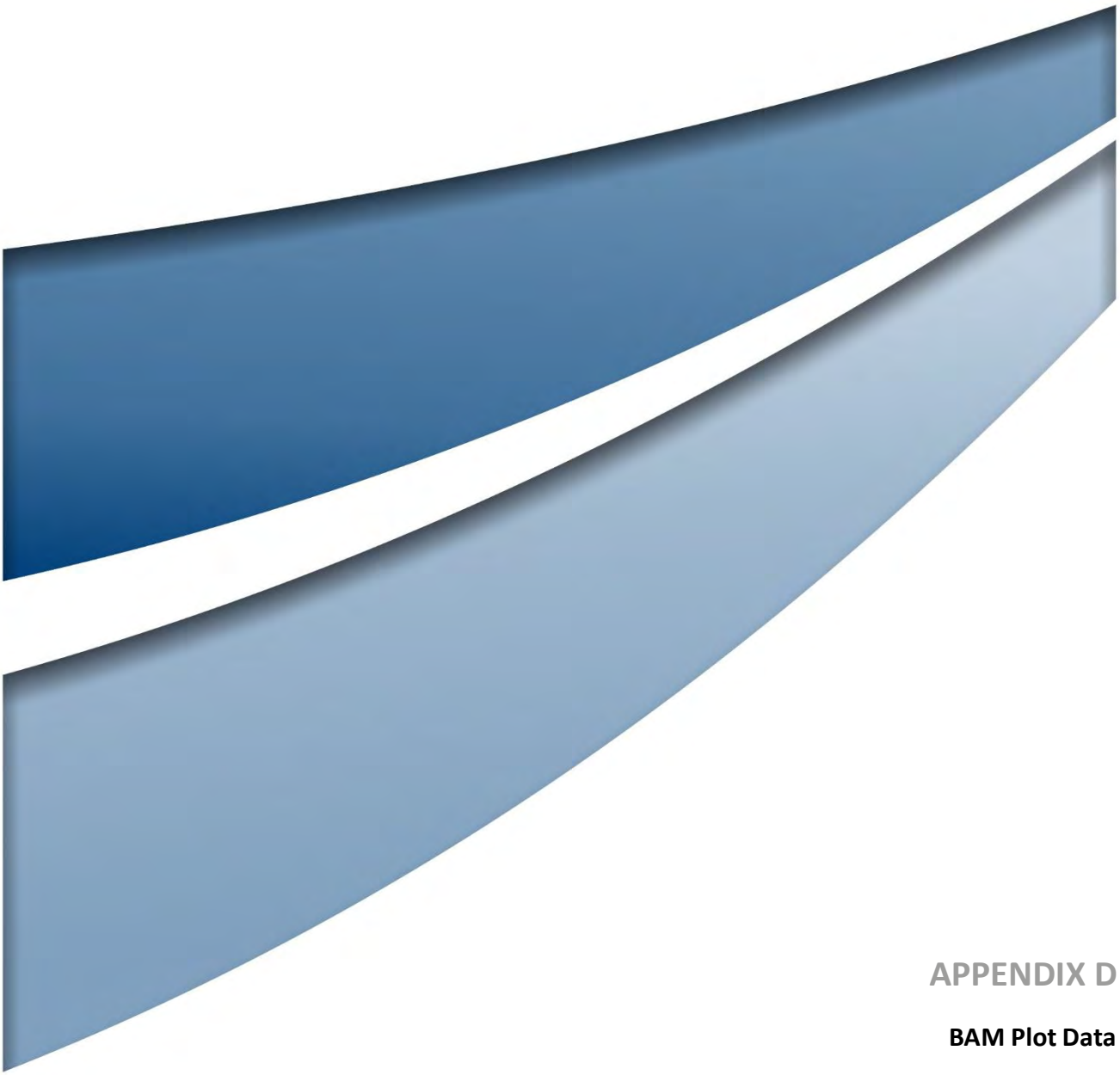
### Mining Sector

**Dendrobium Terrestrial Monitoring Program | South32 Illawarra Metallurgical Coal | Wollongong | 2020–2021 | Ecologist, Project Manager |** Sarah was the lead ecologist for field assessments and monitoring (before, after, control and impact monitoring (BACI)) across the Dendrobium mining domain in the Southern Coalfields. Including replication of previous data collection (defined transects and quadrats, photo points and threatened frogs breeding pools), interpreting potential impacts to swamps and streams, threatened frog populations and any threatened flora in the area. Sarah was also the project manager tasks involving the logistics of equipment, scheduling multiple staff members, causal consultants and subcontractors, assisting the spatial data team with LiDAR and modelling deadlines for Upland Swamp monitoring targets. Sarah also completed the reporting and conducted meetings with the Client and internally.

**Tahmoor Terrestrial Monitoring Program/ Tahmoor South Baselines Monitoring | SIMEC Mining | Tahmoor | 2018–2021 | Ecologist |** Sarah was the lead ecologist for the terrestrial team and conducted baseline monitoring of vegetation and amphibian populations across several creeks within the three mining domains (Tahmoor Coal Western Domain, Redbank Creek and Tahmoor South). Using the NSW Biodiversity Assessment Methods (BAM) plots to maintain a standard methodology for ongoing monitoring of vegetative changes and standard transects to replicate amphibian surveys. The project involved biannual monitoring of control and impact sites, data analysis, as well as the preparation of spring and autumn monitoring reports, comparing before, after, control and impact sites (BACI), pre and post mining. Including replication of previous data collection and interpreting potential impacts to streams, threatened frog populations and any threatened flora in the area.

**Ecological Rehabilitation Plans | South32 Illawarra Metallurgical Coal | Wollongong | 2019–2021 | Project Manager, Ecologist |** Sarah was the project manager and lead ecologist to generate rehabilitation plans for each Coal Mining Exploration Program adhering to the WaterNSW approvals compliance conditions across various small-scale areas (>1ha per site) that created a mosaic within the Subject Area. Conducted field assessments of previously drilled exploration borehole locations across various programs within Water NSW water Catchment, using the NSW Biodiversity Assessment Methods (BAM) plots to maintain a standard methodology for ongoing monitoring of vegetative changes and local benchmark data collected for comparison and to allow patterns and trends at a Catchment level to be detected.

**Annual Biodiversity Monitoring Program, Ventshaft No.6 Offset monitoring, WestCliff (Appin North) Emplacement Rehabilitation Area Monitoring| South32 Illawarra Metallurgical Coal | Appin | 2019–2021 | Botanist, Project Manager |** Sarah was the project manager and lead Botanist in field assessments for biodiversity monitoring across a number of sites operated by South32 Illawarra Metallurgical Coal, including the Appin No. 6 Ventilation Shaft Offset Area, West Cliff (Appin North) Emplacement Rehabilitation Area and monitoring of *Persoonia hirsuta* population at West Cliff (Appin North) Colliery. Undertaking BioBanking plots, targeted threatened species searches for *Persoonia hirsuta*. Collating data and report writing with recommendations to better improve the system and reduce the impact to the surrounding areas.



# APPENDIX D

**BAM Plot Data**

# Appendix D BAM Plot Data

**Table D.1 BAM Plot Flora Species List**

| BAM Growth Form Group | Family | Scientific Name | Common Name |
|---|---|---|---|
| Tree (TG) | Casuarinaceae | *Allocasuarina littoralis* | Black She-Oak |
| Tree (TG) | Casuarinaceae | *Allocasuarina luehmannii* | Bulloak |
| Tree (TG) | Cupressaceae | *Callitris endlicheri* | Black Cypress Pine |
| Tree (TG) | Fabaceae (Mimosoideae) | *Acacia dealbata* | Silver Wattle |
| Tree (TG) | Fabaceae (Mimosoideae) | *Acacia linearifolia* | Narrow-leaved Wattle |
| Tree (TG) | Malvaceae | *Brachychiton populneus* | Kurrajong |
| Tree (TG) | Myrtaceae | *Angophora floribunda* | Rough-barked Apple |
| Tree (TG) | Myrtaceae | *Eucalyptus albens <--> moluccana* | |
| Tree (TG) | Myrtaceae | *Eucalyptus blakelyi* | Blakely's Red Gum |
| Tree (TG) | Myrtaceae | *Eucalyptus crebra* | Narrow-leaved Ironbark |
| Tree (TG) | Myrtaceae | *Eucalyptus fibrosa* | Red Ironbark |
| Tree (TG) | Myrtaceae | *Eucalyptus melliodora* | Yellow Box |
| Tree (TG) | Myrtaceae | *Eucalyptus punctata* | Grey Gum |
| Tree (TG) | Oleaceae | *Notelaea microcarpa* | Native Olive |
| Shrub (SG) | Asteraceae | *Cassinia quinquefaria* | |
| Shrub (SG) | Asteraceae | *Cassinia sifton* | |
| Shrub (SG) | Chenopodiaceae | *Maireana microphylla* | Small-leaf Bluebush |
| Shrub (SG) | Chenopodiaceae | *Sclerolaena birchii* | Galvinized Burr |
| Shrub (SG) | Dilleniaceae | *Hibbertia circumdans* | |
| Shrub (SG) | Ericaceae | *Astroloma humifusum* | Native Cranberry |
| Shrub (SG) | Ericaceae | *Leucopogon muticus* | Blunt Beard-heath |
| Shrub (SG) | Ericaceae | *Lissanthe strigosa* | Peach Heath |
| Shrub (SG) | Ericaceae | *Styphelia tubiflora* | Red Five-Corner |
| Shrub (SG) | Fabaceae (Caesalpinioideae) | *Senna artemisioides <--> zygophylla* | |
| Shrub (SG) | Fabaceae (Faboideae) | *Daviesia genistifolia* | Broom Bitter Pea |
| Shrub (SG) | Fabaceae (Faboideae) | *Dillwynia retorta* | |
| Shrub (SG) | Fabaceae (Faboideae) | *Pultenaea linophylla* | |
| Shrub (SG) | Fabaceae (Mimosoideae) | *Acacia brownii* | Heath Wattle |
| Shrub (SG) | Fabaceae (Mimosoideae) | *Acacia linifolia* | White Wattle |
| Shrub (SG) | Fabaceae (Mimosoideae) | *Acacia montana* | Mallee Wattle |
| Shrub (SG) | Fabaceae (Mimosoideae) | *Acacia spectabilis* | Mudgee Wattle |
| Shrub (SG) | Fabaceae (Mimosoideae) | *Acacia triptera* | Spurwing Wattle |
| Shrub (SG) | Phyllanthaceae | *Phyllanthus gunnii* | |
| Shrub (SG) | Phyllanthaceae | *Phyllanthus hirtellus* | Thyme Spurge |

| BAM Growth Form Group | Family | Scientific Name | Common Name |
|---|---|---|---|
| Shrub (SG) | Picrodendraceae | *Micrantheum ericoides* | |
| Shrub (SG) | Pittosporaceae | *Bursaria spinosa* | Native Blackthorn |
| Shrub (SG) | Proteaceae | *Grevillea speciosa* | Red Spider Flower |
| Shrub (SG) | Proteaceae | *Isopogon dawsonii* | Nepean Conebush |
| Shrub (SG) | Proteaceae | *Persoonia linearis* | Narrow-leaved Geebung |
| Shrub (SG) | Scrophulariaceae | *Eremophila debilis* | Amulla |
| Shrub (SG) | Thymelaeaceae | *Pimelea latifolia* | |
| Grass & grasslike (GG) | Cyperaceae | *Carex inversa* | Knob Sedge |
| Grass & grasslike (GG) | Cyperaceae | *Cyperus gracilis* | Slender Flat-sedge |
| Grass & grasslike (GG) | Cyperaceae | *Gahnia aspera* | Rough Saw-sedge |
| Grass & grasslike (GG) | Cyperaceae | *Gahnia sieberiana* | Red-fruit Saw-sedge |
| Grass & grasslike (GG) | Cyperaceae | *Lepidosperma laterale* | Variable Sword-sedge |
| Grass & grasslike (GG) | Juncaceae | *Juncus australis* | Rush |
| Grass & grasslike (GG) | Lomandraceae | *Lomandra filiformis* | Wattle Matt-rush |
| Grass & grasslike (GG) | Lomandraceae | *Lomandra filiformis subsp. filiformis* | |
| Grass & grasslike (GG) | Lomandraceae | *Lomandra longifolia* | Spiny-headed Mat-rush |
| Grass & grasslike (GG) | Poaceae | *Anthosachne scabra* | Wheatgrass, Common Wheatgrass |
| Grass & grasslike (GG) | Poaceae | *Aristida ramosa* | Purple Wiregrass |
| Grass & grasslike (GG) | Poaceae | *Aristida vagans* | Threeawn Speargrass |
| Grass & grasslike (GG) | Poaceae | *Austrostipa aristiglumis* | Plains Grass |
| Grass & grasslike (GG) | Poaceae | *Austrostipa nodosa* | |
| Grass & grasslike (GG) | Poaceae | *Austrostipa scabra* | Speargrass |
| Grass & grasslike (GG) | Poaceae | *Austrostipa verticillata* | Slender Bamboo Grass |
| Grass & grasslike (GG) | Poaceae | *Bothriochloa macra* | Red Grass |
| Grass & grasslike (GG) | Poaceae | *Chloris truncata* | Windmill Grass |
| Grass & grasslike (GG) | Poaceae | *Cymbopogon refractus* | Barbed Wire Grass |
| Grass & grasslike (GG) | Poaceae | *Cynodon dactylon* | Common Couch |
| Grass & grasslike (GG) | Poaceae | *Deyeuxia quadriseta* | |
| Grass & grasslike (GG) | Poaceae | *Dichanthium sericeum subsp. sericeum* | Queensland Bluegrass |
| Grass & grasslike (GG) | Poaceae | *Dichelachne crinita* | Longhair Plumegrass |
| Grass & grasslike (GG) | Poaceae | *Echinopogon caespitosus* | Bushy Hedgehog-grass |
| Grass & grasslike (GG) | Poaceae | *Entolasia marginata* | Bordered Panic |
| Grass & grasslike (GG) | Poaceae | *Eragrostis brownii* | Brown's Lovegrass |
| Grass & grasslike (GG) | Poaceae | *Lachnagrostis filiformis* | |
| Grass & grasslike (GG) | Poaceae | *Microlaena stipoides* | Weeping Grass |
| Grass & grasslike (GG) | Poaceae | *Microlaena stipoides var. stipoides* | Weeping Grass |
| Grass & grasslike (GG) | Poaceae | *Panicum effusum* | Hairy Panic |

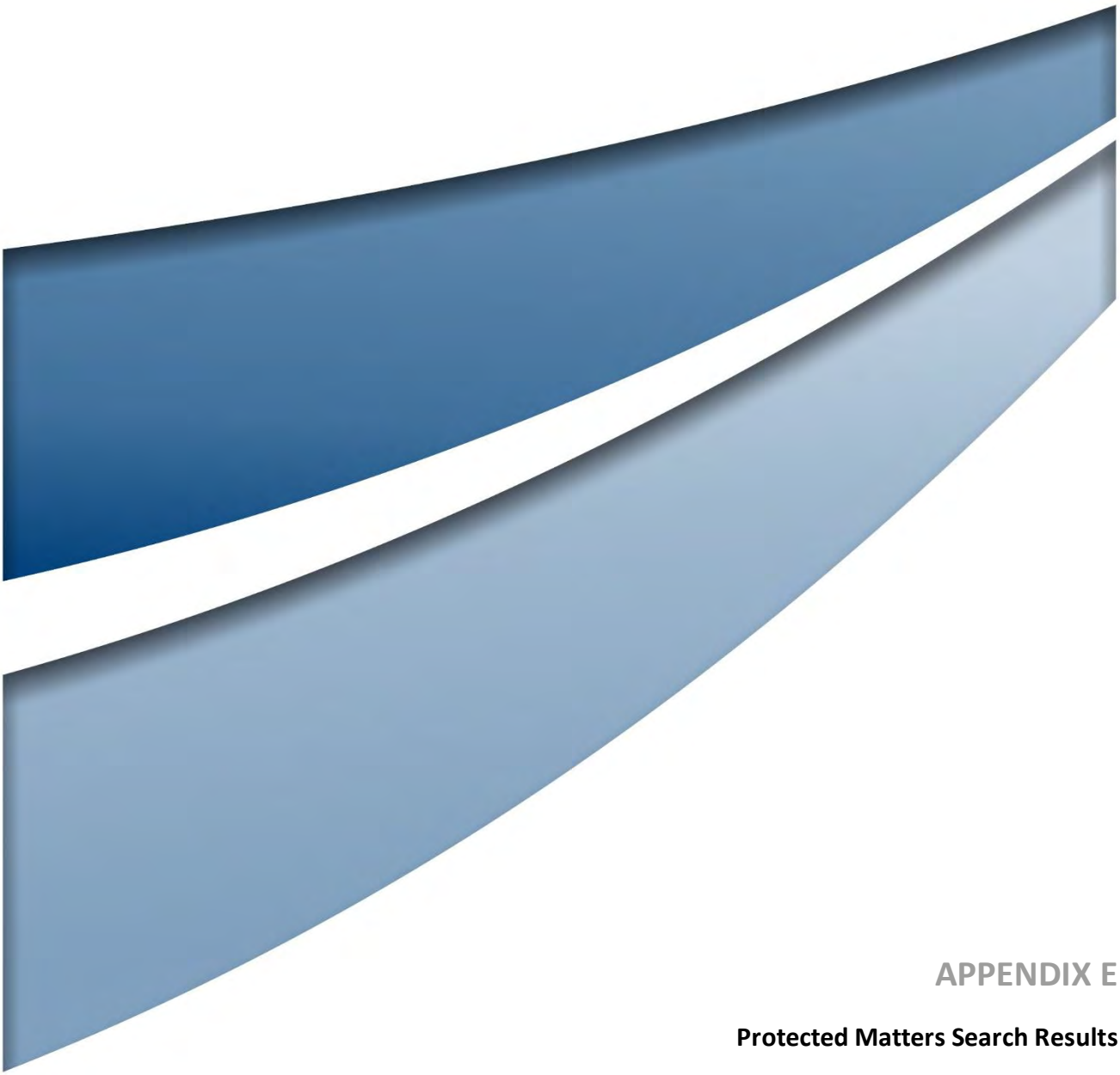
| BAM Growth Form Group | Family | Scientific Name | Common Name |
|---|---|---|---|
| Grass & grasslike (GG) | Poaceae | *Poa sieberiana* | Snowgrass |
| Grass & grasslike (GG) | Poaceae | *Rytidosperma bipartitum* | Wallaby Grass |
| Grass & grasslike (GG) | Poaceae | *Rytidosperma caespitosum* | Ringed Wallaby Grass |
| Grass & grasslike (GG) | Poaceae | *Rytidosperma richardsonii* | Straw Wallaby-grass |
| Grass & grasslike (GG) | Poaceae | *Sporobolus creber* | Slender Rat's Tail Grass |
| Grass & grasslike (GG) | Poaceae | *Themeda triandra* | |
| Grass & grasslike (GG) | Poaceae | *Walwhalleya spp.* | |
| Forb (FG) | Acanthaceae | *Rostellularia adscendens* | Pink Tongues |
| Forb (FG) | Anthericaceae | *Tricoryne elatior* | Yellow Autumn-lily |
| Forb (FG) | Asparagaceae | *Arthropodium minus* | Small Vanilla Lily |
| Forb (FG) | Asphodelaceae | *Dianella revoluta* | Blueberry Lily |
| Forb (FG) | Asteraceae | *Calotis lappulacea* | Yellow Burr-daisy |
| Forb (FG) | Asteraceae | *Chrysocephalum apiculatum* | Common Everlasting |
| Forb (FG) | Asteraceae | *Vittadinia cuneata* | |
| Forb (FG) | Asteraceae | *Vittadinia muelleri* | |
| Forb (FG) | Campanulaceae | *Wahlenbergia communis* | Tufted Bluebell |
| Forb (FG) | Caryophyllaceae | *Stellaria pungens* | Prickly Starwort |
| Forb (FG) | Chenopodiaceae | *Einadia hastata* | Berry Saltbush |
| Forb (FG) | Chenopodiaceae | *Einadia nutans* | Climbing Saltbush |
| Forb (FG) | Convolvulaceae | *Dichondra repens* | Kidney Weed |
| Forb (FG) | Fabaceae (Faboideae) | *Cullen tenax* | Emu-foot |
| Forb (FG) | Geraniaceae | *Geranium solanderi* | Native Geranium |
| Forb (FG) | Geraniaceae | *Geranium solanderi var. solanderi* | |
| Forb (FG) | Goodeniaceae | *Goodenia hederacea* | Ivy Goodenia |
| Forb (FG) | Haloragaceae | *Gonocarpus teucrioides* | Germander Raspwort |
| Forb (FG) | Lamiaceae | *Mentha satureioides* | Native Pennyroyal |
| Forb (FG) | Malvaceae | *Sida corrugata* | Corrugated Sida |
| Forb (FG) | Malvaceae | *Sida filiformis* | |
| Forb (FG) | Oxalidaceae | *Oxalis perennans* | |
| Forb (FG) | Phyllanthaceae | *Poranthera ericifolia* | |
| Forb (FG) | Plantaginaceae | *Veronica plebeia* | Trailing Speedwell |
| Forb (FG) | Polygonaceae | *Rumex brownii* | Swamp Dock |
| Forb (FG) | Rosaceae | *Acaena novae-zelandiae* | Bidgee-widgee |
| Forb (FG) | Rosaceae | *Acaena spp.* | Sheep's Burr |
| Forb (FG) | Rubiaceae | *Pomax umbellata* | Pomax |
| Forb (FG) | Haloragaceae | *Haloragis heterophylla* | Variable Raspwort |
| Fern (EG) | Pteridaceae | *Cheilanthes sieberi* | Rock Fern |
| Other (OG) | Fabaceae (Faboideae) | *Desmodium varians* | |

| BAM Growth Form Group | Family | Scientific Name | Common Name |
|---|---|---|---|
| Other (OG) | Fabaceae (Faboideae) | *Glycine clandestina* | Twining glycine |
| Other (OG) | Fabaceae (Faboideae) | *Glycine tabacina* | Variable Glycine |
| Other (OG) | Fabaceae (Faboideae) | *Hardenbergia violacea* | False Sarsaparilla |
| Other (OG) | Lauraceae | *Cassytha glabella* | |
| Other (OG) | Loranthaceae | *Amyema congener subsp. congener* | |
| Other (OG) | Loranthaceae | *Amyema miquelii* | Box Mistletoe |
| Other (OG) | Viscaceae | *Notothixos cornifolius* | Kurrajong Mistletoe |
| Other (OG) | Zamiaceae | *Macrozamia reducta* | |
| Exotic (HTE) | Asteraceae | *Bidens pilosa* | Cobbler's Pegs |
| Exotic (HTE) | Asteraceae | *Senecio madagascariensis* | Fireweed |
| Exotic (HTE) | Clusiaceae | *Hypericum perforatum* | St. Johns Wort |
| Exotic (HTE) | Juncaceae | *Juncus acutus subsp. acutus* | Sharp Rush |
| Exotic (HTE) | Poaceae | *Bromus diandrus* | Great Brome |
| Exotic (HTE) | Poaceae | *Cenchrus clandestinus* | Kikuyu Grass |
| Exotic (HTE) | Poaceae | *Eragrostis curvula* | African Lovegrass |
| Exotic (HTE) | Poaceae | *Hyparrhenia hirta* | Coolatai Grass |
| Exotic (HTE) | Poaceae | *Paspalum dilatatum* | Paspalum |
| Exotic (HTE) | Solanaceae | *Lycium ferocissimum* | African Boxthorn |
| Exotic (Non HTE) | Apiaceae | *Cyclospermum leptophyllum* | Slender Celery |
| Exotic (Non HTE) | Apiaceae | *Daucus carota* | Wild Carrot |
| Exotic (Non HTE) | Asteraceae | *Cirsium arvense* | Perennial Thistle |
| Exotic (Non HTE) | Asteraceae | *Cirsium vulgare* | Spear Thistle |
| Exotic (Non HTE) | Asteraceae | *Conyza bonariensis* | Flaxleaf Fleabane |
| Exotic (Non HTE) | Asteraceae | *Conyza sumatrensis* | Tall fleabane |
| Exotic (Non HTE) | Asteraceae | *Silybum marianum* | Variegated Thistle |
| Exotic (Non HTE) | Asteraceae | *Sonchus oleraceus* | Common Sowthistle |
| Exotic (Non HTE) | Asteraceae | *Tragopogon porrifolius subsp. Porrifolius* | Salsify |
| Exotic (Non HTE) | Brassicaceae | *Rapistrum rugosum* | Turnip Weed |
| Exotic (Non HTE) | Cactaceae | *Opuntia stricta* | Common Prickly Pear |
| Exotic (Non HTE) | Caryophyllaceae | *Petrorhagia dubia* | |
| Exotic (Non HTE) | Fabaceae (Faboideae) | *Medicago lupulina* | Black Medic |
| Exotic (Non HTE) | Fabaceae (Faboideae) | *Medicago sativa* | Lucerne |
| Exotic (Non HTE) | Fabaceae (Faboideae) | *Vicia sativa* | Common vetch |
| Exotic (Non HTE) | Gentianaceae | *Centaurium tenuiflorum* | Branched Centaury, Slender centaury |
| Exotic (Non HTE) | Lamiaceae | *Marrubium vulgare* | White Horehound |
| Exotic (Non HTE) | Lamiaceae | *Salvia verbenaca* | Vervain |
| Exotic (Non HTE) | Malvaceae | *Sida rhombifolia* | Paddy's Lucerne |

| BAM Growth Form Group | Family | Scientific Name | Common Name |
|---|---|---|---|
| Exotic (Non HTE) | Oxalidaceae | *Oxalis pes-caprae* | Soursob |
| Exotic (Non HTE) | Plantaginaceae | *Plantago lanceolata* | Lamb's Tongues |
| Exotic (Non HTE) | Poaceae | *Avena barbata* | Bearded Oats |
| Exotic (Non HTE) | Poaceae | *Bromus catharticus* | Praire Grass |
| Exotic (Non HTE) | Poaceae | *Bromus molliformis* | Soft Brome |
| Exotic (Non HTE) | Poaceae | *Lolium perenne* | Perennial Ryegrass |
| Exotic (Non HTE) | Poaceae | *Phalaris aquatica* | Phalaris |
| Exotic (Non HTE) | Poaceae | *Polypogon monspeliensis* | Annual Beardgrass |
| Exotic (Non HTE) | Poaceae | *Vulpia bromoides* | Squirrel Tail Fesque |
| Exotic (Non HTE) | Polygonaceae | *Rumex crispus* | Curled Dock |
| Exotic (Non HTE) | Primulaceae | *Lysimachia arvensis* | Scarlet Pimpernel |
| Exotic (Non HTE) | Scrophulariaceae | *Verbascum virgatum* | Twiggy Mullein |
| Exotic (Non HTE) | Verbenaceae | *Verbena bonariensis* | Purpletop |

**Table D.2 Vegetation Integrity BAM Plot Data**

| Plot | PCT No. | Area | Patch size | Condition class | Zone | Easting | Northing | Bearing | Composition (Species Richness) | | | | | | Structure (Percentage Cover) | | | | | | Function | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Tree | Shrub | Grass | Forbs | Ferns | Other | Tree | Shrub | Grass | Forbs | Ferns | Other | Large Trees | Hollows | Litter Cover | Fallen Logs | Stems | | | | | Tree Regen. | High Threat Exotics |
| | | | | | | | | | | | | | | | | | | | | | | | | | 5–9cm | 10–19cm | 20–29cm | 30–49 cm | 50–79cm | | |
| 1 | 483 | 3.12 | 100 | Exotic_Grassland | 56 | 237323 | 6438597 | 10 | 0 | 0 | 5 | 1 | 0 | 0 | 0 | 0 | 3 | 0.2 | 0 | 0 | 0 | 0 | 83 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 70 |
| 3 | 483 | 3.12 | 100 | Exotic_Grassland | 56 | 239171 | 6439020 | 100 | 0 | 1 | 2 | 5 | 0 | 0 | 0 | 0.1 | 10.1 | 5.9 | 0 | 0 | 0 | 0 | 66 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 |
| 4 | 483 | 3.12 | 100 | Exotic_Grassland | 56 | 239385 | 6439048 | 205 | 0 | 0 | 3 | 2 | 0 | 0 | 0 | 0 | 7 | 0.2 | 0 | 0 | 0 | 0 | 84 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 22 |
| 2 | 483 | 0.2 | 100 | Remnant_Trees | 56 | 237436 | 6438774 | 40 | 1 | 2 | 5 | 13 | 0 | 3 | 25 | 0.2 | 51.4 | 3.5 | 0 | 0.4 | 10 | 4 | 42.5 | 74 | 1 | 1 | 1 | 1 | 1 | 0 | 25 |
| 12 | 483 | 0.2 | 100 | Remnant_Trees | 56 | 243420 | 6441066 | 295 | 2 | 1 | 9 | 6 | 0 | 3 | 35 | 0.3 | 28.8 | 1 | 0 | 16.5 | 0 | 0 | 32 | 86 | 1 | 1 | 1 | 1 | 0 | 1 | 0.3 |
| 11 | 483 | 0.2 | 100 | Remnant_Trees | 56 | 237380 | 6438681 | 160 | 1 | 1 | 8 | 5 | 0 | 0 | 20 | 0.2 | 56 | 1.1 | 0 | 0 | 1 | 1 | 2 | 25 | 1 | 1 | 0 | 0 | 1 | 1 | 20 |
| 10 | 1691 | 0.12 | 100 | Remnant_Forest | 56 | 231438 | 6431948 | 50 | 6 | 3 | 12 | 4 | 0 | 1 | 46 | 32.1 | 57.7 | 0.6 | 0 | 0.5 | 1 | 1 | 17.2 | 67 | 1 | 1 | 0 | 0 | 0 | 1 | 0.1 |
| 9 | 3334 | 0.06 | 100 | Remnant_Forest | 56 | 231060 | 6431775 | 30 | 4 | 1 | 15 | 3 | 0 | 0 | 45 | 0.1 | 57.7 | 0.3 | 0 | 0 | 1 | 0 | 56 | 132 | 1 | 1 | 1 | 1 | 1 | 1 | 0.6 |
| 6 | 3388 | 0.46 | 100 | Remnant_Forest | 56 | 229419 | 6430910 | 215 | 2 | 12 | 11 | 3 | 1 | 0 | 45.5 | 76.9 | 2.8 | 0.3 | 0.1 | 0 | 1 | 0 | 8 | 36 | 1 | 1 | 0 | 1 | 1 | 1 | 0.1 |
| 7 | 3388 | 0.46 | 100 | Remnant_Forest | 56 | 230188 | 6431182 | 30 | 4 | 11 | 11 | 1 | 0 | 2 | 11 | 38.5 | 22.6 | 0.1 | 0 | 1.2 | 0 | 0 | 2 | 7 | 1 | 1 | 0 | 0 | 0 | 1 | 0 |
| 5 | 3768 | 1.21 | 100 | Remnant_Forest | 56 | 227892 | 6429041 | 345 | 6 | 15 | 8 | 3 | 0 | 1 | 36.1 | 48.3 | 2 | 0.4 | 0 | 0.5 | 1 | 2 | 31 | 194 | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| 8 | 3768 | 1.21 | 100 | Remnant_Forest | 56 | 230886 | 6431648 | 230 | 3 | 11 | 14 | 5 | 0 | 1 | 68 | 22.3 | 26.4 | 0.5 | 0 | 0.2 | 1 | 0 | 28 | 83 | 1 | 1 | 1 | 1 | 1 | 1 | 0.1 |



# APPENDIX E

**Protected Matters Search Results**

# EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Please see the caveat for interpretation of information provided here.

Report created: 15-Dec-2023

# Summary

## Matters of National Environment Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

| | |
|---|---|
| World Heritage Properties: | None |
| National Heritage Places: | None |
| Wetlands of International Importance (Ramsar | 1 |
| Great Barrier Reef Marine Park: | None |
| Commonwealth Marine Area: | None |
| Listed Threatened Ecological Communities: | 7 |
| Listed Threatened Species: | 39 |
| Listed Migratory Species: | 10 |

## Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at https://www.dcceew.gov.au/parks-heritage/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

| | |
|---|---|
| Commonwealth Lands: | None |
| Commonwealth Heritage Places: | None |
| Listed Marine Species: | 18 |
| Whales and Other Cetaceans: | None |
| Critical Habitats: | None |
| Commonwealth Reserves Terrestrial: | None |
| Australian Marine Parks: | None |
| Habitat Critical to the Survival of Marine Turtles: | None |

## Extra Information

This part of the report provides information that may also be relevant to the area you have

| | |
|---|---|
| State and Territory Reserves: | 1 |
| Regional Forest Agreements: | None |
| Nationally Important Wetlands: | None |
| EPBC Act Referrals: | 5 |
| Key Ecological Features (Marine): | None |
| Biologically Important Areas: | None |
| Bioregional Assessments: | 1 |
| Geological and Bioregional Assessments: | None |

# Details

## Matters of National Environmental Significance

### Wetlands of International Importance (Ramsar Wetlands) [ Resource Information ]

| Ramsar Site Name | Proximity | Buffer Status |
|---|---|---|
| Hunter estuary wetlands | 150 - 200km upstream from Ramsar site | In feature area |

### Listed Threatened Ecological Communities [ Resource Information ]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.
Status of Vulnerable, Disallowed and Ineligible are not MNES under the EPBC Act.

| Community Name | Threatened Category | Presence Text | Buffer Status |
|---|---|---|---|
| Central Hunter Valley eucalypt forest and woodland | Critically Endangered | Community may occur within area | In feature area |
| Coolibah - Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions | Endangered | Community may occur within area | In feature area |
| Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia | Endangered | Community likely to occur within area | In feature area |
| Hunter Valley Weeping Myall (Acacia pendula) Woodland | Critically Endangered | Community may occur within area | In feature area |
| Natural grasslands on basalt and fine-textured alluvial plains of northern New South Wales and southern Queensland | Critically Endangered | Community may occur within area | In feature area |
| Weeping Myall Woodlands | Endangered | Community may occur within area | In feature area |
| White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland | Critically Endangered | Community likely to occur within area | In feature area |

### Listed Threatened Species [ Resource Information ]

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.
Number is the current name ID.

| Scientific Name | Threatened Category | Presence Text | Buffer Status |
|---|---|---|---|
| BIRD | | | |

| Scientific Name | Threatened Category | Presence Text | Buffer Status |
|---|---|---|---|
| [Anthochaera phrygia](#)<br>Regent Honeyeater [82338] | Critically Endangered | Species or species habitat known to occur within area | In feature area |
| [Aphelocephala leucopsis](#)<br>Southern Whiteface [529] | Vulnerable | Species or species habitat known to occur within area | In feature area |
| [Calidris ferruginea](#)<br>Curlew Sandpiper [856] | Critically Endangered | Species or species habitat may occur within area | In feature area |
| [Callocephalon fimbriatum](#)<br>Gang-gang Cockatoo [768] | Endangered | Species or species habitat may occur within area | In feature area |
| [Calyptorhynchus lathami lathami](#)<br>South-eastern Glossy Black-Cockatoo [67036] | Vulnerable | Species or species habitat likely to occur within area | In feature area |
| [Climacteris picumnus victoriae](#)<br>Brown Treecreeper (south-eastern) [67062] | Vulnerable | Species or species habitat known to occur within area | In feature area |
| [Falco hypoleucos](#)<br>Grey Falcon [929] | Vulnerable | Species or species habitat likely to occur within area | In feature area |
| [Grantiella picta](#)<br>Painted Honeyeater [470] | Vulnerable | Species or species habitat known to occur within area | In feature area |
| [Hirundapus caudacutus](#)<br>White-throated Needletail [682] | Vulnerable | Species or species habitat known to occur within area | In feature area |
| [Lathamus discolor](#)<br>Swift Parrot [744] | Critically Endangered | Species or species habitat may occur within area | In feature area |
| [Leipoa ocellata](#)<br>Malleefowl [934] | Vulnerable | Species or species habitat likely to occur within area | In buffer area only |

| Scientific Name | Threatened Category | Presence Text | Buffer Status |
|---|---|---|---|
| Melanodryas cucullata cucullata<br>South-eastern Hooded Robin, Hooded Robin (south-eastern) [67093] | Endangered | Species or species habitat known to occur within area | In feature area |
| Neophema chrysostoma<br>Blue-winged Parrot [726] | Vulnerable | Species or species habitat may occur within area | In feature area |
| Pedionomus torquatus<br>Plains-wanderer [906] | Critically Endangered | Species or species habitat may occur within area | In feature area |
| Polytelis swainsonii<br>Superb Parrot [738] | Vulnerable | Species or species habitat may occur within area | In feature area |
| Rostratula australis<br>Australian Painted Snipe [77037] | Endangered | Species or species habitat likely to occur within area | In feature area |
| Stagonopleura guttata<br>Diamond Firetail [59398] | Vulnerable | Species or species habitat known to occur within area | In feature area |
| FROG | | | |
| Heleioporus australiacus<br>Giant Burrowing Frog [1973] | Vulnerable | Species or species habitat may occur within area | In feature area |
| Litoria booroolongensis<br>Booroolong Frog [1844] | Endangered | Species or species habitat may occur within area | In feature area |
| MAMMAL | | | |
| Chalinolobus dwyeri<br>Large-eared Pied Bat, Large Pied Bat [183] | Endangered | Species or species habitat known to occur within area | In feature area |
| Dasyurus maculatus maculatus (SE mainland population)<br>Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184] | Endangered | Species or species habitat likely to occur within area | In feature area |
| Nyctophilus corbeni<br>Corben's Long-eared Bat, South-eastern Long-eared Bat [83395] | Vulnerable | Species or species habitat likely to occur within area | In feature area |

| Scientific Name | Threatened Category | Presence Text | Buffer Status |
|---|---|---|---|
| Petrogale penicillata | | | |
| Brush-tailed Rock-wallaby [225] | Vulnerable | Species or species habitat may occur within area | In feature area |
| Phascolarctos cinereus (combined populations of Qld, NSW and the ACT) | | | |
| Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104] | Endangered | Species or species habitat likely to occur within area | In feature area |
| Pseudomys novaehollandiae | | | |
| New Holland Mouse, Pookila [96] | Vulnerable | Species or species habitat likely to occur within area | In feature area |
| Pteropus poliocephalus | | | |
| Grey-headed Flying-fox [186] | Vulnerable | Foraging, feeding or related behaviour may occur within area | In feature area |
| PLANT | | | |
| Androcalva procumbens | | | |
| [87153] | Vulnerable | Species or species habitat may occur within area | In feature area |
| Androcalva rosea | | | |
| Sandy Hollow Commersonia [86861] | Endangered | Species or species habitat may occur within area | In feature area |
| Dichanthium setosum | | | |
| bluegrass [14159] | Vulnerable | Species or species habitat likely to occur within area | In feature area |
| Euphrasia arguta | | | |
| [4325] | Critically Endangered | Species or species habitat may occur within area | In feature area |
| Homoranthus darwinioides | | | |
| [12974] | Vulnerable | Species or species habitat known to occur within area | In feature area |
| Lepidium aschersonii | | | |
| Spiny Peppercress [10976] | Vulnerable | Species or species habitat may occur within area | In feature area |
| Ozothamnus tesselatus | | | |
| [56203] | Vulnerable | Species or species habitat may occur within area | In feature area |

| Scientific Name | Threatened Category | Presence Text | Buffer Status |
|---|---|---|---|
| Prasophyllum sp. Wybong (C.Phelps ORG 5269) | | | |
| a leek-orchid [81964] | Critically Endangered | Species or species habitat may occur within area | In feature area |
| Swainsona murrayana | | | |
| Slender Darling-pea, Slender Swainson, Murray Swainson-pea [6765] | Vulnerable | Species or species habitat may occur within area | In feature area |
| Thesium australe | | | |
| Austral Toadflax, Toadflax [15202] | Vulnerable | Species or species habitat likely to occur within area | In feature area |
| Vincetoxicum forsteri listed as Tylophora linearis | | | |
| [92384] | Endangered | Species or species habitat may occur within area | In feature area |
| REPTILE | | | |
| Aprasia parapulchella | | | |
| Pink-tailed Worm-lizard, Pink-tailed Legless Lizard [1665] | Vulnerable | Species or species habitat likely to occur within area | In feature area |
| Delma impar | | | |
| Striped Legless Lizard, Striped Snake-lizard [1649] | Vulnerable | Species or species habitat likely to occur within area | In feature area |

| Listed Migratory Species | | | [ Resource Information ] |
|---|---|---|---|
| Scientific Name | Threatened Category | Presence Text | Buffer Status |
| Migratory Marine Birds | | | |
| Apus pacificus | | | |
| Fork-tailed Swift [678] | | Species or species habitat likely to occur within area | In feature area |
| Migratory Terrestrial Species | | | |
| Hirundapus caudacutus | | | |
| White-throated Needletail [682] | Vulnerable | Species or species habitat known to occur within area | In feature area |
| Motacilla flava | | | |
| Yellow Wagtail [644] | | Species or species habitat may occur within area | In feature area |
| Myiagra cyanoleuca | | | |
| Satin Flycatcher [612] | | Species or species habitat likely to occur within area | In feature area |

| Scientific Name | Threatened Category | Presence Text | Buffer Status |
|---|---|---|---|
| Rhipidura rufifrons<br>Rufous Fantail [592] | | Species or species habitat likely to occur within area | In feature area |
| **Migratory Wetlands Species** | | | |
| Actitis hypoleucos<br>Common Sandpiper [59309] | | Species or species habitat may occur within area | In feature area |
| Calidris acuminata<br>Sharp-tailed Sandpiper [874] | | Species or species habitat may occur within area | In feature area |
| Calidris ferruginea<br>Curlew Sandpiper [856] | Critically Endangered | Species or species habitat may occur within area | In feature area |
| Calidris melanotos<br>Pectoral Sandpiper [858] | | Species or species habitat may occur within area | In feature area |
| Gallinago hardwickii<br>Latham's Snipe, Japanese Snipe [863] | | Species or species habitat may occur within area | In feature area |

## Other Matters Protected by the EPBC Act

| Listed Marine Species | | | [ Resource Information ] |
|---|---|---|---|
| Scientific Name | Threatened Category | Presence Text | Buffer Status |
| **Bird** | | | |
| Actitis hypoleucos<br>Common Sandpiper [59309] | | Species or species habitat may occur within area | In feature area |
| Apus pacificus<br>Fork-tailed Swift [678] | | Species or species habitat likely to occur within area overfly marine area | In feature area |
| Bubulcus ibis as Ardea ibis<br>Cattle Egret [66521] | | Species or species habitat may occur within area overfly marine area | In feature area |

| Scientific Name | Threatened Category | Presence Text | Buffer Status |
|---|---|---|---|
| Calidris acuminata<br>Sharp-tailed Sandpiper [874] | | Species or species habitat may occur within area | In feature area |
| Calidris ferruginea<br>Curlew Sandpiper [856] | Critically Endangered | Species or species habitat may occur within area overfly marine area | In feature area |
| Calidris melanotos<br>Pectoral Sandpiper [858] | | Species or species habitat may occur within area overfly marine area | In feature area |
| Chalcites osculans as Chrysococcyx osculans<br>Black-eared Cuckoo [83425] | | Species or species habitat known to occur within area overfly marine area | In feature area |
| Gallinago hardwickii<br>Latham's Snipe, Japanese Snipe [863] | | Species or species habitat may occur within area overfly marine area | In feature area |
| Haliaeetus leucogaster<br>White-bellied Sea-Eagle [943] | | Species or species habitat may occur within area | In feature area |
| Hirundapus caudacutus<br>White-throated Needletail [682] | Vulnerable | Species or species habitat known to occur within area overfly marine area | In feature area |
| Lathamus discolor<br>Swift Parrot [744] | Critically Endangered | Species or species habitat may occur within area overfly marine area | In feature area |
| Merops ornatus<br>Rainbow Bee-eater [670] | | Species or species habitat may occur within area overfly marine area | In feature area |
| Motacilla flava<br>Yellow Wagtail [644] | | Species or species habitat may occur within area overfly marine area | In feature area |

| Scientific Name | Threatened Category | Presence Text | Buffer Status |
|---|---|---|---|
| Myiagra cyanoleuca | | | |
| Satin Flycatcher [612] | | Species or species habitat likely to occur within area overfly marine area | In feature area |
| Neophema chrysostoma | | | |
| Blue-winged Parrot [726] | Vulnerable | Species or species habitat may occur within area overfly marine area | In feature area |
| Pterodroma cervicalis | | | |
| White-necked Petrel [59642] | | Species or species habitat may occur within area | In feature area |
| Rhipidura rufifrons | | | |
| Rufous Fantail [592] | | Species or species habitat likely to occur within area overfly marine area | In feature area |
| Rostratula australis as Rostratula benghalensis (sensu lato) | | | |
| Australian Painted Snipe [77037] | Endangered | Species or species habitat likely to occur within area overfly marine area | In feature area |

## Extra Information

| State and Territory Reserves | | | [ Resource Information ] |
|---|---|---|---|
| Protected Area Name | Reserve Type | State | Buffer Status |
| Goulburn River | National Park | NSW | In feature area |

| EPBC Act Referrals | | | | [ Resource Information ] |
|---|---|---|---|---|
| Title of referral | Reference | Referral Outcome | Assessment Status | Buffer Status |
| Controlled action | | | | |
| Gas Transmission Pipeline | 2011/5917 | Controlled Action | Completed | In buffer area only |
| Goulburn River Solar Farm | 2021/9102 | Controlled Action | Assessment Approach | In buffer area only |
| Valley of the Winds wind farm | 2020/8668 | Controlled Action | Assessment Approach | In feature area |
| Not controlled action | | | | |
| Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia | 2015/7522 | Not Controlled Action | Completed | In feature area |
| Not controlled action (particular manner) | | | | |

| Title of referral | Reference | Referral Outcome | Assessment Status | Buffer Status |
|---|---|---|---|---|
| Not controlled action (particular manner) | | | | |
| Aerial baiting for wild dog control | 2006/2713 | Not Controlled Action (Particular Manner) | Post-Approval | In feature area |

## Bioregional Assessments

| SubRegion | BioRegion | Website | Buffer Status |
|---|---|---|---|
| Hunter | Northern Sydney Basin | BA website | In feature area |

# Caveat

## 1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

## 2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data are available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance

## 3 DATA SOURCES

Threatened ecological communities

For threatened ecological communities where the distribution is well known, maps are generated based on information contained in recovery plans, State vegetation maps and remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species

Threatened, migratory and marine species distributions have been discerned through a variety of methods. Where distributions are well known and if time permits, distributions are inferred from either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc.) together with point locations and described habitat; or modelled (MAXENT or BIOCLIM habitat modelling) using

Where little information is available for a species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc.).

In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More detailed distribution mapping methods are used to update these distributions

## 4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded
- seals which have only been mapped for breeding sites near the Australian continent

The breeding sites may be important for the protection of the Commonwealth Marine environment.

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

# Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact us page.



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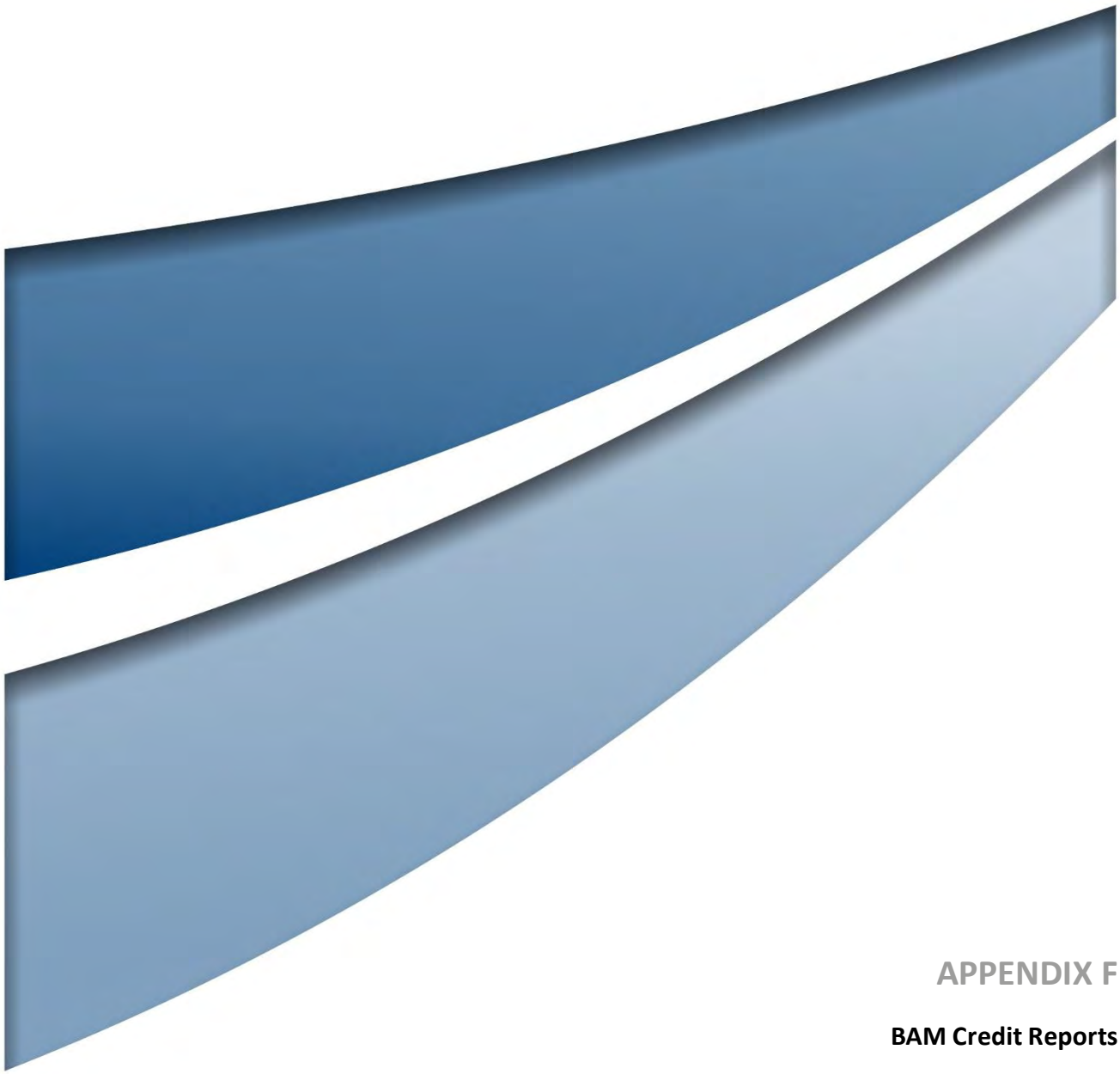

# APPENDIX F

**BAM Credit Reports**

# BAM Biodiversity Credit Report (Variations)

## Proposal Details

**Assessment Id**
00032861/BAAS17099/23/00044406

Proposal Name
Road Upgrade - Kerrabee IBRA Subregion

BAM data last updated *
22/06/2023

Assessor Name
Jacob Manners

Assessor Number
BAAS17099

BAM Data version *
61

Proponent Name(s)

Report Created
24/01/2024

BAM Case Status
Finalised

Assessment Revision
1

Assessment Type
Major Projects

Date Finalised
24/01/2024

* 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 |
|---|---|---|
| White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla | Critically Endangered Ecological Community | 3388-Central West Valleys White Box Forest |

| Species |
|---|
| **Commersonia rosea** / Commersonia rosea |
| **Chalinolobus dwyeri** / Large-eared Pied Bat |
| **Hoplocephalus bungaroides** / Broad-headed Snake |
| **Vespadelus troughtoni** / Eastern Cave Bat |

**Anthochaera phrygia** / Regent Honeyeater

## Additional Information for Approval

PCT Outside Ibra Added

None added

PCTs With Customized Benchmarks

| PCT |
|---|
| No Changes |

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 |
|---|---|---|---|---|---|
| 3388-Central West Valleys White Box Forest | White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla | 0.4 | 0 | 12 | 12.00 |
| 3334-Western Hunter Flats Red Gum Sedge Forest | Not a TEC | 0.0 | 0 | 1 | 1.00 |
| 3781-Ulan Sandstone Ironbark-Pine Woodland | Not a TEC | 1.1 | 32 | 0 | 32.00 |

**3334-Western Hunter Flats Red Gum Sedge Forest**

**Like-for-like credit retirement options**

| Class | Trading group | Zone | HBT | Credits | IBRA region |
|---|---|---|---|---|---|

| | | | | | | |
|---|---|---|---|---|---|---|
| | Coastal Valley Grassy Woodlands<br>This includes PCT's: 618, 622, 623, 1603, 1604, 1691, 1692, 3269, 3312, 3314, 3315, 3316, 3318, 3319, 3320, 3323, 3325, 3327, 3328, 3329, 3330, 3332, 3334, 4052 | Coastal Valley Grassy Woodlands >=50% and <70% | 3334_CZ4_Remnant_Forest | No | 1 | Kerrabee,Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo.<br>or<br>Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site. |
| | **Variation options** | | | | | |
| | Formation | Trading group | Zone | HBT | Credits | IBRA region |
| | Grassy Woodlands | Tier 3 or higher threat status | 3334_CZ4_Remnant_Forest | No | 1 | IBRA Region: Sydney Basin,<br>or<br>Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site. |
| **3388-Central West Valleys White Box Forest** | **Like-for-like credit retirement options** | | | | | |
| | Class | Trading group | Zone | HBT | Credits | IBRA region |
| | White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla<br>This includes PCT's: 74, 75, 83, 250, 266, 267, | - | 3388_CZ5_Remnant_Forest | No | 12 | Kerrabee,Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo.<br>or<br>Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site. |

| | | | | | | |
|---|---|---|---|---|---|---|
| | 268, 270, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 286, 298, 302, 312, 341, 342, 347, 350, 352, 356, 367, 381, 382, 395, 401, 403, 421, 433, 434, 435, 436, 437, 451, 483, 484, 488, 492, 496, 508, 509, 510, 511, 528, 538, 544, 563, 567, 571, 589, 590, 597, 599, 618, 619, 622, 633, 654, 702, 703, 704, 705, 710, 711, 796, 797, 799, 847, 851, 921, 1099, 1303, 1304, 1307, 1324, 1329, 1330, 1332, 1383, 1606, 1608, 1611, 1691, 1693, 1695, 1698, 3314, 3359, 3363, 3373, 3376, 3387, 3388, 3394, 3395, 3396, 3397, 3398, 3399, 3406, 3415, 3533, 4147, 4149, 4150 | | | | | |
| **3781-Ulan Sandstone Ironbark-Pine Woodland** | **Like-for-like credit retirement options** | | | | | |
| | Class | Trading group | Zone | HBT | Credits | IBRA region |
| | Western Slopes Dry Sclerophyll Forests This includes PCT's: 54, 110, 179, 217, 243, | Western Slopes Dry Sclerophyll Forests <50% | 3781_CZ6_Remnant_Forest | Yes | 32 | Kerrabee,Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | 255, 270, 273, 287, 291, 309, 321, 322, 323, 324, 325, 327, 330, 331, 333, 341, 343, 346, 348, 354, 358, 379, 387, 396, 398, 399, 401, 402, 403, 404, 405, 406, 407, 408, 409, 414, 415, 417, 419, 420, 423, 425, 430, 431, 440, 443, 449, 455, 456, 457, 459, 462, 463, 467, 468, 469, 470, 471, 472, 473, 476, 477, 478, 479, 480, 482, 515, 531, 532, 576, 577, 581, 592, 610, 617, 671, 673, 676, 712, 713, 714, 746, 863, 889, 940, 956, 1133, 1176, 1277, 1278, 1279, 1307, 1313, 1314, 1316, 1381, 1610, 1654, 1655, 1656, 1660, 1661, 1663, 1668, 1669, 1671, 1672, 1674, 1676, 1679, 1709, 1711, 1770, 1771, 3753, 3754, 3756, 3757, 3758, 3759, 3760, 3761, 3762, 3763, 3766, 3767, 3768, 3769, 3770, 3771, 3772, 3773, 3774, 3775, 3776, 3777, 3778, 3780, 3781, 3782, 3783, | | | | | kilometers of the outer edge of the impacted site. |

| | | | | | | |
|---|---|---|---|---|---|---|
| | 3784, 3785, 3786, 4153 | | | | | |
| | **Variation options** | | | | | |
| | Formation | Trading group | Zone | HBT | Credits | IBRA region |
| | Dry Sclerophyll Forests (Shrubby sub-formation) | Tier 4 or higher threat status | 3781_CZ6_Remnant_Forest | Yes (including artificial) | 32 | IBRA Region: Sydney Basin, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site. |

## Species Credit Summary

| Species | Vegetation Zone/s | Area / Count | Credits |
|---|---|---|---|
| **Anthochaera phrygia** / Regent Honeyeater | **3388_CZ5_Remnant_Forest, 3334_CZ4_Remnant_Forest, 3781_CZ6_Remnant_Forest** | 0.1 | 8.00 |
| **Chalinolobus dwyeri** / Large-eared Pied Bat | **3388_CZ5_Remnant_Forest, 3334_CZ4_Remnant_Forest, 3781_CZ6_Remnant_Forest** | 1.5 | 80.00 |
| **Commersonia rosea** / Commersonia rosea | **3388_CZ5_Remnant_Forest** | 0.4 | 14.00 |
| **Heleioporus australiacus** / Giant Burrowing Frog | **3388_CZ5_Remnant_Forest, 3781_CZ6_Remnant_Forest** | 0.9 | 25.00 |
| **Hoplocephalus bungaroides** / Broad-headed Snake | **3781_CZ6_Remnant_Forest** | 1.1 | 64.00 |
| **Ninox connivens** / Barking Owl | **3388_CZ5_Remnant_Forest, 3781_CZ6_Remnant_Forest** | 0.3 | 13.00 |
| **Vespadelus troughtoni** / Eastern Cave Bat | **3388_CZ5_Remnant_Forest** | 0.4 | 14.00 |

## Credit Retirement Options

**Like-for-like options**

| | | | |
|---|---|---|---|
| **Anthochaera phrygia**/ Regent Honeyeater | Spp | | IBRA region |
| | **Anthochaera phrygia**/Regent Honeyeater<br><br>*Note: Variation rules do not apply for Critically Endangered species and impacts on Commonwealth listed entities that are a controlled action.* | | Any in NSW |
| **Chalinolobus dwyeri**/ Large-eared Pied Bat | Spp | | IBRA region |
| | **Chalinolobus dwyeri**/Large-eared Pied Bat | | Any in NSW |
| | **Variation options** | | |
| | Kingdom | Any species with same or higher category of listing under Part 4 of the BC Act shown below | IBRA region |
| | Fauna | Vulnerable | Kerrabee, Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo.<br>or<br>Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site. |
| **Commersonia rosea**/ Commersonia rosea | Spp | | IBRA region |
| | **Commersonia rosea**/Commersonia rosea | | Any in NSW |
| | **Variation options** | | |
| | Kingdom | Any species with same or higher category of listing under Part 4 of the BC Act | IBRA region |

| | | | |
|---|---|---|---|
| | | shown below | |
| | Flora | Endangered | Kerrabee, Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo.<br>or<br>Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site. |
| **Heleioporus australiacus**/ Giant Burrowing Frog | Spp | IBRA region | |
| | **Heleioporus australiacus**/Giant Burrowing Frog | Any in NSW | |
| | **Variation options** | | |
| | Kingdom | Any species with same or higher category of listing under Part 4 of the BC Act shown below | IBRA region |
| | Fauna | Vulnerable | Kerrabee, Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo.<br>or<br>Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site. |
| **Hoplocephalus bungaroides**/ Broad-headed Snake | Spp | IBRA region | |
| | **Hoplocephalus bungaroides**/Broad-headed Snake | Any in NSW | |
| | **Variation options** | | |
| | Kingdom | Any species with same or | IBRA region |

| | | | |
|---|---|---|---|
| | | higher category of listing under Part 4 of the BC Act shown below | |
| | Fauna | Endangered | Kerrabee, Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo.<br>or<br>Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site. |
| **Ninox connivens**/ Barking Owl | Spp | IBRA region | |
| | **Ninox connivens**/Barking Owl | Any in NSW | |
| | **Variation options** | | |
| | Kingdom | Any species with same or higher category of listing under Part 4 of the BC Act shown below | IBRA region |
| | Fauna | Vulnerable | Kerrabee, Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo.<br>or<br>Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site. |
| **Vespadelus troughtoni**/ Eastern Cave Bat | Spp | IBRA region | |
| | **Vespadelus troughtoni**/Eastern Cave Bat | Any in NSW | |

| | | | |
|---|---|---|---|
| **Vespadelus troughtoni**/ Eastern Cave Bat | **Variation options** | | |
| | Kingdom | Any species with same or higher category of listing under Part 4 of the BC Act shown below | IBRA region |
| | Fauna | Vulnerable | Kerrabee, Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo.<br>or<br>Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site. |

# BAM Biodiversity Credit Report (Like for like)

## Proposal Details

Assessment Id
00032861/BAAS17099/23/00044406

Proposal Name
Road Upgrade - Kerrabee IBRA Subregion

BAM data last updated *
22/06/2023

Assessor Name
Jacob Manners

Assessor Number
BAAS17099

BAM Data version *
61

Proponent Names

Report Created
24/01/2024

BAM Case Status
Finalised

Assessment Revision
1

Assessment Type
Major Projects

Date Finalised
24/01/2024

* 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 |
|---|---|---|
| White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla | Critically Endangered Ecological Community | 3388-Central West Valleys White Box Forest |

| Species |
|---|
| **Commersonia rosea** / Commersonia rosea |
| **Chalinolobus dwyeri** / Large-eared Pied Bat |
| **Hoplocephalus bungaroides** / Broad-headed Snake |
| **Vespadelus troughtoni** / Eastern Cave Bat |
| **Anthochaera phrygia** / Regent Honeyeater |

## Additional Information for Approval

PCT Outside Ibra Added

None added

PCTs With Customized Benchmarks

| PCT |
|---|
| No Changes |

Predicted Threatened Species Not On Site

| Name |
|---|
| No Changes |

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

# BAM Biodiversity Credit Report (Like for like)

| Name of Plant Community Type/ID | Name of threatened ecological community | Area of impact | HBT Cr | No HBT Cr | Total credits to be retired |
|---|---|---|---|---|---|
| 3388-Central West Valleys White Box Forest | White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla | 0.4 | 0 | 12 | 12 |
| 3334-Western Hunter Flats Red Gum Sedge Forest | Not a TEC | 0.0 | 0 | 1 | 1 |
| 3781-Ulan Sandstone Ironbark-Pine Woodland | Not a TEC | 1.1 | 32 | 0 | 32 |

**3334-Western Hunter Flats Red Gum Sedge Forest**

**Like-for-like credit retirement options**

| Class | Trading group | Zone | HBT | Credits | IBRA region |
|---|---|---|---|---|---|
| Coastal Valley Grassy Woodlands<br>This includes PCT's: 618, 622, 623, 1603, 1604, 1691, 1692, 3269, 3312, 3314, 3315, 3316, 3318, 3319, 3320, 3323, 3325, 3327, 3328, 3329, 3330, 3332, 3334, 4052 | Coastal Valley Grassy Woodlands >=50% and <70% | 3334_CZ4_Remnant_Forest | No | 1 | Kerrabee, Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo.<br>or<br>Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site. |

# BAM Biodiversity Credit Report (Like for like)

**3388-Central West Valleys White Box Forest**

**Like-for-like credit retirement options**

| Name of offset trading group | Trading group | Zone | HBT | Credits | IBRA region |
|---|---|---|---|---|---|
| White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla This includes PCT's: 74, 75, 83, 250, 266, 267, 268, 270, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 286, 298, 302, 312, 341, 342, 347, 350, 352, 356, 367, 381, 382, 395, 401, 403, 421, 433, 434, 435, 436, 437, 451, 483, 484, 488, 492, 496, 508, 509, 510, 511, 528, 538, 544, 563, 567, 571, 589, 590, 597, 599, 618, 619, 622, 633, 654, | - | 3388_CZ5_Remnant_Forest | No | 12 | Kerrabee, Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site. |

| | | | | | | |
|---|---|---|---|---|---|---|
| | 702, 703, 704, 705, 710, 711, 796, 797, 799, 847, 851, 921, 1099, 1303, 1304, 1307, 1324, 1329, 1330, 1332, 1383, 1606, 1608, 1611, 1691, 1693, 1695, 1698, 3314, 3359, 3363, 3373, 3376, 3387, 3388, 3394, 3395, 3396, 3397, 3398, 3399, 3406, 3415, 3533, 4147, 4149, 4150 | | | | | |
| **3781-Ulan Sandstone Ironbark-Pine Woodland** | **Like-for-like credit retirement options** | | | | | |
| | Class | Trading group | Zone | HBT | Credits | IBRA region |
| | Western Slopes Dry Sclerophyll Forests This includes PCT's: 54, 110, 179, 217, 243, 255, 270, 273, 287, 291, 309, 321, 322, 323, 324, 325, 327, 330, 331, 333, 341, 343, 346, 348, 354, 358, 379, 387, 396, 398, 399, 401, 402, 403, 404, 405, 406, 407, 408, 409, 414, 415, 417, 419, 420, | Western Slopes Dry Sclerophyll Forests <50% | 3781_CZ6_Remnant_Forest | Yes | 32 | Kerrabee, Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo.<br>or<br>Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site. |

| | | | | | | |
|---|---|---|---|---|---|---|
| | 423, 425, 430, 431, 440, 443, 449, 455, 456, 457, 459, 462, 463, 467, 468, 469, 470, 471, 472, 473, 476, 477, 478, 479, 480, 482, 515, 531, 532, 576, 577, 581, 592, 610, 617, 671, 673, 676, 712, 713, 714, 746, 863, 889, 940, 956, 1133, 1176, 1277, 1278, 1279, 1307, 1313, 1314, 1316, 1381, 1610, 1654, 1655, 1656, 1660, 1661, 1663, 1668, 1669, 1671, 1672, 1674, 1676, 1679, 1709, 1711, 1770, 1771, 3753, 3754, 3756, 3757, 3758, 3759, 3760, 3761, 3762, 3763, 3766, 3767, 3768, 3769, 3770, 3771, 3772, 3773, 3774, 3775, 3776, 3777, 3778, 3780, 3781, 3782, 3783, 3784, 3785, 3786, 4153 | | | | | |

## Species Credit Summary

| Species | Vegetation Zone/s | Area / Count | Credits |
|---|---|---|---|
| **Anthochaera phrygia** / Regent Honeyeater | **3388_CZ5_Remnant_Forest, 3334_CZ4_Remnant_Forest, 3781_CZ6_Remnant_Forest** | 0.1 | 8.00 |
| **Chalinolobus dwyeri** / Large-eared Pied Bat | **3388_CZ5_Remnant_Forest, 3334_CZ4_Remnant_Forest, 3781_CZ6_Remnant_Forest** | 1.5 | 80.00 |
| **Commersonia rosea** / Commersonia rosea | **3388_CZ5_Remnant_Forest** | 0.4 | 14.00 |
| **Heleioporus australiacus** / Giant Burrowing Frog | **3388_CZ5_Remnant_Forest, 3781_CZ6_Remnant_Forest** | 0.9 | 25.00 |
| **Hoplocephalus bungaroides** / Broad-headed Snake | **3781_CZ6_Remnant_Forest** | 1.1 | 64.00 |
| **Ninox connivens** / Barking Owl | **3388_CZ5_Remnant_Forest, 3781_CZ6_Remnant_Forest** | 0.3 | 13.00 |
| **Vespadelus troughtoni** / Eastern Cave Bat | **3388_CZ5_Remnant_Forest** | 0.4 | 14.00 |

## Credit Retirement Options

Like-for-like credit retirement options

| | Spp | IBRA subregion |
|---|---|---|
| **Anthochaera phrygia** / Regent Honeyeater | **Anthochaera phrygia /** Regent Honeyeater | Any in NSW |

| | | |
|---|---|---|
| **Chalinolobus dwyeri** / Large-eared Pied Bat | Spp | IBRA subregion |
| | **Chalinolobus dwyeri /** Large-eared Pied Bat | Any in NSW |
| **Commersonia rosea** / Commersonia rosea | Spp | IBRA subregion |
| | **Commersonia rosea /** Commersonia rosea | Any in NSW |
| **Heleioporus australiacus** / Giant Burrowing Frog | Spp | IBRA subregion |
| | **Heleioporus australiacus /** Giant Burrowing Frog | Any in NSW |
| **Hoplocephalus bungaroides** / Broad-headed Snake | Spp | IBRA subregion |
| | **Hoplocephalus bungaroides /** Broad-headed Snake | Any in NSW |
| **Ninox connivens** / Barking Owl | Spp | IBRA subregion |
| | **Ninox connivens /** Barking Owl | Any in NSW |
| **Vespadelus troughtoni** / Eastern Cave Bat | Spp | IBRA subregion |
| | **Vespadelus troughtoni /** Eastern Cave Bat | Any in NSW |

# BAM Credit Summary Report

## Proposal Details

Assessment Id
00032861/BAAS17099/23/00044406

Proposal Name
Road Upgrade - Kerrabee IBRA Subregion

BAM data last updated *
22/06/2023

Assessor Name
Jacob Manners

Report Created
24/01/2024

BAM Data version *
61

Assessor Number
BAAS17099

BAM Case Status
Finalised

Date Finalised
24/01/2024

Assessment Revision
1

Assessment Type
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 SAII | Ecosystem credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Central West Valleys White Box Forest** | | | | | | | | | | | | |
| 1 | 3388_CZ5_Remnant_Forest | White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla | 51.8 | 51.8 | 0.36 | Population size | High Sensitivity to Gain | Critically Endangered Ecological Community | Not Listed | 2.50 | True | 12 |
| | | | | | | | | | | | **Subtotal** | **12** |
| **Ulan Sandstone Ironbark-Pine Woodland** | | | | | | | | | | | | |
| 3 | 3781_CZ6_Remnant_Forest | Not a TEC | 81.1 | 81.1 | 1 | PCT Cleared - 46% | High Sensitivity to Gain | | | 1.50 | | 32 |
| | | | | | | | | | | | **Subtotal** | **32** |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Western Hunter Flats Red Gum Sedge Forest** | | | | | | | | | | | |
| 2 | 3334_CZ4_Remnant_Forest | Not a TEC | 62.1 | 62.1 | 0.04 | PCT Cleared - 57% | High Sensitivity to Gain | | | 1.75 | 1 |
| | | | | | | | | | | **Subtotal** | **1** |
| | | | | | | | | | | **Total** | **45** |

## 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 SAII | Species credits |
|---|---|---|---|---|---|---|---|---|---|
| ***Anthochaera phrygia / Regent Honeyeater ( Fauna )*** | | | | | | | | | |
| 3388_CZ5_Remnant_Forest | 51.8 | 51.8 | 0.05 | Biodiversity Conservation Act listing status | Effectiveness of management in controlling threats | Critically Endangered | Critically Endangered | True | 2 |
| 3334_CZ4_Remnant_Forest | 62.1 | 62.1 | 0.01 | Biodiversity Conservation Act listing status | Effectiveness of management in controlling threats | Critically Endangered | Critically Endangered | True | 1 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 3781_CZ6_Remnant_Forest | 81.1 | 81.1 | 0.08 | Biodiversity Conservation Act listing status | Effectiveness of management in controlling threats | Critically Endangered | Critically Endangered | True | 5 |
| | | | | | | | | **Subtotal** | **8** |
| ***Chalinolobus dwyeri / Large-eared Pied Bat ( Fauna )*** | | | | | | | | | |
| 3388_CZ5_Remnant_Forest | 51.8 | 51.8 | 0.36 | Biodiversity Conservation Act listing status | Species dependent on habitat attributes | Vulnerable | Vulnerable | True | 14 |
| 3334_CZ4_Remnant_Forest | 62.1 | 62.1 | 0.04 | Biodiversity Conservation Act listing status | Species dependent on habitat attributes | Vulnerable | Vulnerable | True | 2 |
| 3781_CZ6_Remnant_Forest | 81.1 | 81.1 | 1 | Biodiversity Conservation Act listing status | Species dependent on habitat attributes | Vulnerable | Vulnerable | True | 64 |
| | | | | | | | | **Subtotal** | **80** |
| ***Commersonia rosea / Commersonia rosea ( Flora )*** | | | | | | | | | |
| 3388_CZ5_Remnant_Forest | 51.8 | 51.8 | 0.36 | Population size | Effectiveness of management in controlling threats | Endangered | Endangered | True | 14 |
| | | | | | | | | **Subtotal** | **14** |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ***Heleioporus australiacus / Giant Burrowing Frog ( Fauna )*** | | | | | | | | | |
| 3388_CZ5_Remnant_Forest | 51.8 | 51.8 | 0.29 | Biodiversity Conservation Act listing status | Effectiveness of management in controlling threats | Vulnerable | Vulnerable | False | 6 |
| 3781_CZ6_Remnant_Forest | 81.1 | 81.1 | 0.61 | Biodiversity Conservation Act listing status | Effectiveness of management in controlling threats | Vulnerable | Vulnerable | False | 19 |
| | | | | | | | | **Subtotal** | **25** |
| ***Hoplocephalus bungaroides / Broad-headed Snake ( Fauna )*** | | | | | | | | | |
| 3781_CZ6_Remnant_Forest | 81.1 | 81.1 | 1 | Biodiversity Conservation Act listing status | Species dependent on habitat attributes | Endangered | Vulnerable | True | 64 |
| | | | | | | | | **Subtotal** | **64** |
| ***Ninox connivens / Barking Owl ( Fauna )*** | | | | | | | | | |
| 3388_CZ5_Remnant_Forest | 51.8 | 51.8 | 0.02 | Biodiversity Conservation Act listing status | Species dependent on habitat attributes | Vulnerable | Not Listed | False | 1 |
| 3781_CZ6_Remnant_Forest | 81.1 | 81.1 | 0.29 | Biodiversity Conservation Act listing status | Species dependent on habitat attributes | Vulnerable | Not Listed | False | 12 |
| | | | | | | | | **Subtotal** | **13** |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ***Vespadelus troughtoni / Eastern Cave Bat ( Fauna )*** | | | | | | | | | |
| 3388_CZ5_Remnant_Forest | 51.8 | 51.8 | 0.36 | Biodiversity Conservation Act listing status | Species dependent on habitat attributes | Vulnerable | Not Listed | True | 14 |
| | | | | | | | | **Subtotal** | **14** |

# BAM Biodiversity Credit Report (Variations)

## Proposal Details

**Assessment Id**
00032861/BAAS17099/23/00040004

Proposal Name
Goulburn River Solar Farm - Ringwood Road Upgrade Works

BAM data last updated *
22/06/2023

Assessor Name
Jacob Manners

Assessor Number
BAAS17099

BAM Data version *
61

Proponent Name(s)

Report Created
24/01/2024

BAM Case Status
Finalised

Assessment Revision
2

Assessment Type
Major Projects

Date Finalised
24/01/2024

* 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 |
|---|---|---|
| White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla | Critically Endangered Ecological Community | 1691-Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter |
| White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla | Critically Endangered Ecological Community | 483-Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley |

| Species |
|---|
| **Anthochaera phrygia** / Regent Honeyeater |
| **Chalinolobus dwyeri** / Large-eared Pied Bat |

## Additional Information for Approval

PCT Outside Ibra Added

None added

PCTs With Customized Benchmarks

| PCT |
|---|
| No Changes |

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 |
|---|---|---|---|---|---|
| 483-Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley | White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla | 3.3 | 11 | 0 | 11.00 |

| | | | | | |
|---|---|---|---|---|---|
| 1691-Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter | White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla | 0.1 | 4 | 0 | 4.00 |

**483-Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley**

**Like-for-like credit retirement options**

| Class | Trading group | Zone | HBT | Credits | IBRA region |
|---|---|---|---|---|---|
| White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla<br>This includes PCT's:<br>74, 75, 83, 250, 266, 267, 268, 270, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 286, 298, 302, 312, 341, 342, 347, 350, 352, 356, 367, 381, 382, 395, 401, 403, 421, 433, 434, 435, 436, 437, 451, 483, 484, 488, 492, 496, 508, 509, 510, 511, 528, 538, 544, 563, 567, 571, 589, 590, 597, 599, 618, 619, 622, 633, 654, | - | 483_CZ2_Exotic_Grassland | No | 0 | Liverpool Range,Hunter, Kerrabee, Liverpool Plains, Peel and Pilliga.<br>or<br>Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site. |

| | | | | | | |
|---|---|---|---|---|---|---|
| | 702, 703, 704, 705, 710, 711, 796, 797, 799, 847, 851, 921, 1099, 1303, 1304, 1307, 1324, 1329, 1330, 1332, 1383, 1606, 1608, 1611, 1691, 1693, 1695, 1698, 3314, 3359, 3363, 3373, 3376, 3387, 3388, 3394, 3395, 3396, 3397, 3398, 3399, 3406, 3415, 3533, 4147, 4149, 4150 | | | | | |
| | White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla<br>This includes PCT's:<br>74, 75, 83, 250, 266, 267, 268, 270, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 286, 298, 302, 312, 341, 342, 347, 350, 352, 356, 367, 381, 382, 395, 401, 403, 421, 433, 434, 435, 436, 437, 451, 483, 484, 488, 492, | - | 483_CZ1_Remnant_Trees | Yes | 11 | Liverpool Range,Hunter, Kerrabee, Liverpool Plains, Peel and Pilliga.<br>or<br>Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site. |

| | | | | | | |
|---|---|---|---|---|---|---|
| | 496, 508, 509, 510, 511, 528, 538, 544, 563, 567, 571, 589, 590, 597, 599, 618, 619, 622, 633, 654, 702, 703, 704, 705, 710, 711, 796, 797, 799, 847, 851, 921, 1099, 1303, 1304, 1307, 1324, 1329, 1330, 1332, 1383, 1606, 1608, 1611, 1691, 1693, 1695, 1698, 3314, 3359, 3363, 3373, 3376, 3387, 3388, 3394, 3395, 3396, 3397, 3398, 3399, 3406, 3415, 3533, 4147, 4149, 4150 | | | | | |
| **1691-Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter** | **Like-for-like credit retirement options** | | | | | |
| | Class | Trading group | Zone | HBT | Credits | IBRA region |
| | White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla<br>This includes PCT's: 74, 75, 83, 250, 266, 267, 268, 270, 274, 275, 276, | - | 1691_CZ3_Remnant_Forest | Yes | 4 | Liverpool Range,Hunter, Kerrabee, Liverpool Plains, Peel and Pilliga.<br>or<br>Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site. |

| | | | | | | |
|---|---|---|---|---|---|---|
| | 277, 278, 279, 280, 281, 282, 283, 284, 286, 298, 302, 312, 341, 342, 347, 350, 352, 356, 367, 381, 382, 395, 401, 403, 421, 433, 434, 435, 436, 437, 451, 483, 484, 488, 492, 496, 508, 509, 510, 511, 528, 538, 544, 563, 567, 571, 589, 590, 597, 599, 618, 619, 622, 633, 654, 702, 703, 704, 705, 710, 711, 796, 797, 799, 847, 851, 921, 1099, 1303, 1304, 1307, 1324, 1329, 1330, 1332, 1383, 1606, 1608, 1611, 1691, 1693, 1695, 1698, 3314, 3359, 3363, 3373, 3376, 3387, 3388, 3394, 3395, 3396, 3397, 3398, 3399, 3406, 3415, 3533, 4147, 4149, 4150 | | | | | |

## Species Credit Summary

| Species | Vegetation Zone/s | Area / Count | Credits |
|---|---|---|---|
| **Anthochaera phrygia** / Regent Honeyeater | **1691_CZ3_Remnant_Forest** | 0.0 | 1.00 |
| **Chalinolobus dwyeri** / Large-eared Pied Bat | **1691_CZ3_Remnant_Forest** | 0.1 | 5.00 |
| **Diuris tricolor** / Pine Donkey Orchid | **1691_CZ3_Remnant_Forest** | 0.1 | 2.00 |
| **Hoplocephalus bitorquatus** / Pale-headed Snake | **1691_CZ3_Remnant_Forest** | 0.1 | 3.00 |

| | | | |
|---|---|---|---|
| **Planigale maculata** / Common Planigale | **1691_CZ3_Remnant_Forest** | 0.1 | 3.00 |

## Credit Retirement Options

**Like-for-like options**

| | | | |
|---|---|---|---|
| **Anthochaera phrygia**/ Regent Honeyeater | Spp | IBRA region | |
| | **Anthochaera phrygia**/Regent Honeyeater<br><br>*Note: Variation rules do not apply for Critically Endangered species and impacts on Commonwealth listed entities that are a controlled action.* | Any in NSW | |
| **Chalinolobus dwyeri**/ Large-eared Pied Bat | Spp | IBRA region | |
| | **Chalinolobus dwyeri**/Large-eared Pied Bat | Any in NSW | |
| | **Variation options** | | |
| | Kingdom | Any species with same or higher category of listing under Part 4 of the BC Act shown below | IBRA region |
| | Fauna | Vulnerable | Liverpool Range, Hunter, Kerrabee, Liverpool Plains, Peel and Pilliga.<br>or<br>Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site. |
| **Diuris tricolor**/ Pine Donkey Orchid | Spp | IBRA region | |
| | **Diuris tricolor**/Pine Donkey Orchid | Any in NSW | |
| | **Variation options** | | |

| | | | |
|---|---|---|---|
| | Kingdom | Any species with same or higher category of listing under Part 4 of the BC Act shown below | IBRA region |
| | Flora | Vulnerable | Liverpool Range, Hunter, Kerrabee, Liverpool Plains, Peel and Pilliga.<br>or<br>Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site. |
| **Hoplocephalus bitorquatus**/ Pale-headed Snake | Spp | IBRA region | |
| | **Hoplocephalus bitorquatus**/Pale-headed Snake | Any in NSW | |
| | **Variation options** | | |
| | Kingdom | Any species with same or higher category of listing under Part 4 of the BC Act shown below | IBRA region |
| | Fauna | Vulnerable | Liverpool Range, Hunter, Kerrabee, Liverpool Plains, Peel and Pilliga.<br>or<br>Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site. |
| **Planigale maculata**/ Common Planigale | Spp | IBRA region | |
| | **Planigale maculata**/Common Planigale | Any in NSW | |
| | **Variation options** | | |

| | | | |
|---|---|---|---|
| | Kingdom | Any species with same or higher category of listing under Part 4 of the BC Act shown below | IBRA region |
| | Fauna | Vulnerable | Liverpool Range, Hunter, Kerrabee, Liverpool Plains, Peel and Pilliga.<br>or<br>Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site. |

# BAM Biodiversity Credit Report (Like for like)

## Proposal Details

Assessment Id
00032861/BAAS17099/23/00040004

Proposal Name
Goulburn River Solar Farm - Ringwood Road Upgrade Works

BAM data last updated *
22/06/2023

Assessor Name
Jacob Manners

Assessor Number
BAAS17099

BAM Data version *
61

Proponent Names

Report Created
24/01/2024

BAM Case Status
Finalised

Assessment Revision
2

Assessment Type
Major Projects

Date Finalised
24/01/2024

* 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 |
|---|---|---|
| White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla | Critically Endangered Ecological Community | 1691-Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter |

| | | |
|---|---|---|
| White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla | Critically Endangered Ecological Community | 483-Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley |

| Species |
|---|
| **Anthochaera phrygia** / Regent Honeyeater |
| **Chalinolobus dwyeri** / Large-eared Pied Bat |

## Additional Information for Approval

PCT Outside Ibra Added

None added

PCTs With Customized Benchmarks

| PCT |
|---|
| No Changes |

Predicted Threatened Species Not On Site

| Name |
|---|
| No Changes |

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

# BAM Biodiversity Credit Report (Like for like)

| Name of Plant Community Type/ID | Name of threatened ecological community | Area of impact | HBT Cr | No HBT Cr | Total credits to be retired |
|---|---|---|---|---|---|
| 483-Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley | White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla | 3.3 | 11 | 0 | 11 |
| 1691-Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter | White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla | 0.1 | 4 | 0 | 4 |

**483-Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley**

**Like-for-like credit retirement options**

| Name of offset trading group | Trading group | Zone | HBT | Credits | IBRA region |
|---|---|---|---|---|---|
| White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla | - | 483_CZ2_Exotic_Grassland | No | 0 | Liverpool Range, Hunter, Kerrabee, Liverpool Plains, Peel and Pilliga.<br>or<br>Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site. |

| | | | | | | |
|---|---|---|---|---|---|---|
| | This includes PCT's: 74, 75, 83, 250, 266, 267, 268, 270, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 286, 298, 302, 312, 341, 342, 347, 350, 352, 356, 367, 381, 382, 395, 401, 403, 421, 433, 434, 435, 436, 437, 451, 483, 484, 488, 492, 496, 508, 509, 510, 511, 528, 538, 544, 563, 567, 571, 589, 590, 597, 599, 618, 619, 622, 633, 654, 702, 703, 704, 705, 710, 711, 796, 797, 799, 847, 851, 921, 1099, 1303, 1304, 1307, 1324, 1329, 1330, 1332, 1383, 1606, 1608, 1611, 1691, 1693, 1695, 1698, 3314, 3359, 3363, 3373, 3376, 3387, 3388, 3394, 3395, 3396, 3397, 3398, 3399, 3406, 3415, 3533, 4147, 4149, 4150 | | | | | |
| | White Box - Yellow Box - | - | 483_CZ1_Remn | Yes | 11 | Liverpool Range, Hunter, Kerrabee, |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla<br>This includes PCT's: 74, 75, 83, 250, 266, 267, 268, 270, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 286, 298, 302, 312, 341, 342, 347, 350, 352, 356, 367, 381, 382, 395, 401, 403, 421, 433, 434, 435, 436, 437, 451, 483, 484, 488, 492, 496, 508, 509, 510, 511, 528, 538, 544, 563, 567, 571, 589, 590, 597, 599, 618, 619, 622, 633, 654, 702, 703, 704, 705, 710, 711, 796, 797, 799, 847, 851, 921, 1099, 1303, 1304, 1307, 1324, 1329, | | ant_Trees | | | Liverpool Plains, Peel and Pilliga.<br>or<br>Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site. |

| | | | | | | |
|---|---|---|---|---|---|---|
| | 1330, 1332, 1383, 1606, 1608, 1611, 1691, 1693, 1695, 1698, 3314, 3359, 3363, 3373, 3376, 3387, 3388, 3394, 3395, 3396, 3397, 3398, 3399, 3406, 3415, 3533, 4147, 4149, 4150 | | | | | |
| **1691-Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter** | **Like-for-like credit retirement options** | | | | | |
| | Name of offset trading group | Trading group | Zone | HBT | Credits | IBRA region |
| | White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla This includes PCT's: 74, 75, 83, 250, 266, 267, 268, 270, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 286, 298, | - | 1691_CZ3_Remnant_Forest | Yes | 4 | Liverpool Range, Hunter, Kerrabee, Liverpool Plains, Peel and Pilliga. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site. |

| | | | | | | |
|---|---|---|---|---|---|---|
| | 302, 312, 341, 342, 347, 350, 352, 356, 367, 381, 382, 395, 401, 403, 421, 433, 434, 435, 436, 437, 451, 483, 484, 488, 492, 496, 508, 509, 510, 511, 528, 538, 544, 563, 567, 571, 589, 590, 597, 599, 618, 619, 622, 633, 654, 702, 703, 704, 705, 710, 711, 796, 797, 799, 847, 851, 921, 1099, 1303, 1304, 1307, 1324, 1329, 1330, 1332, 1383, 1606, 1608, 1611, 1691, 1693, 1695, 1698, 3314, 3359, 3363, 3373, 3376, 3387, 3388, 3394, 3395, 3396, 3397, 3398, 3399, 3406, 3415, 3533, 4147, 4149, 4150 | | | | | |

## Species Credit Summary

| Species | Vegetation Zone/s | Area / Count | Credits |
|---|---|---|---|
| **Anthochaera phrygia** / Regent Honeyeater | **1691_CZ3_Remnant_Forest** | 0.0 | 1.00 |
| **Chalinolobus dwyeri** / Large-eared Pied Bat | **1691_CZ3_Remnant_Forest** | 0.1 | 5.00 |

| | | | |
|---|---|---|---|
| **Diuris tricolor** / Pine Donkey Orchid | **1691_CZ3_Remnant_Forest** | 0.1 | 2.00 |
| **Hoplocephalus bitorquatus** / Pale-headed Snake | **1691_CZ3_Remnant_Forest** | 0.1 | 3.00 |
| **Planigale maculata** / Common Planigale | **1691_CZ3_Remnant_Forest** | 0.1 | 3.00 |

## Credit Retirement Options

Like-for-like credit retirement options

| | | |
|---|---|---|
| **Anthochaera phrygia** / Regent Honeyeater | Spp | IBRA subregion |
| | **Anthochaera phrygia /** Regent Honeyeater | Any in NSW |
| **Chalinolobus dwyeri** / Large-eared Pied Bat | Spp | IBRA subregion |
| | **Chalinolobus dwyeri /** Large-eared Pied Bat | Any in NSW |
| **Diuris tricolor** / Pine Donkey Orchid | Spp | IBRA subregion |
| | **Diuris tricolor /** Pine Donkey Orchid | Any in NSW |
| **Hoplocephalus bitorquatus** / Pale-headed Snake | Spp | IBRA subregion |
| | **Hoplocephalus bitorquatus /** Pale-headed Snake | Any in NSW |
| **Planigale maculata** / Common Planigale | Spp | IBRA subregion |
| | **Planigale maculata /** Common Planigale | Any in NSW |

# BAM Credit Summary Report

## Proposal Details

Assessment Id
00032861/BAAS17099/23/00040004

Proposal Name
Goulburn River Solar Farm - Ringwood Road Upgrade Works

BAM data last updated *
22/06/2023

Assessor Name
Jacob Manners

Report Created
24/01/2024

BAM Data version *
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Assessor Number
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BAM Case Status
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Date Finalised
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Assessment Revision
2

Assessment Type
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 SAII | Ecosystem credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|

| Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 483_CZ2_Exotic_Grassland | White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla | 9.9 | 9.9 | 3.1 | Population size | High Sensitivity to Gain | Critically Endangered Ecological Community | Not Listed | 2.50 | True | 0 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 483_CZ1_Remnant_Trees | White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla | 86.1 | 86.1 | 0.2 | Population size | High Sensitivity to Gain | Critically Endangered Ecological Community | Not Listed | 2.50 | True | 11 |
| | | | | | | | | | | | **Subtotal** | **11** |

| Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 1691_CZ3_Remnant_Forest | White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla | 67.9 | 67.9 | 0.09 | Population size | High Sensitivity to Gain | Critically Endangered Ecological Community | Not Listed | 2.50 | True | 4 |
| | | | | | | | | | | | **Subtotal** | **4** |
| | | | | | | | | | | | **Total** | **15** |

## 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 SAII | Species credits |
|---|---|---|---|---|---|---|---|---|---|

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ***Anthochaera phrygia / Regent Honeyeater ( Fauna )*** | | | | | | | | | |
| 1691_CZ3_Remnant_Forest | 67.9 | 67.9 | 0.02 | Biodiversity Conservation Act listing status | Effectiveness of management in controlling threats | Critically Endangered | Critically Endangered | True | 1 |
| | | | | | | | | **Subtotal** | **1** |
| ***Chalinolobus dwyeri / Large-eared Pied Bat ( Fauna )*** | | | | | | | | | |
| 1691_CZ3_Remnant_Forest | 67.9 | 67.9 | 0.09 | Biodiversity Conservation Act listing status | Species dependent on habitat attributes | Vulnerable | Vulnerable | True | 5 |
| | | | | | | | | **Subtotal** | **5** |
| ***Diuris tricolor / Pine Donkey Orchid ( Flora )*** | | | | | | | | | |
| 1691_CZ3_Remnant_Forest | 67.9 | 67.9 | 0.09 | Biodiversity Conservation Act listing status | Effectiveness of management in controlling threats | Vulnerable | Not Listed | False | 2 |
| | | | | | | | | **Subtotal** | **2** |
| ***Hoplocephalus bitorquatus / Pale-headed Snake ( Fauna )*** | | | | | | | | | |
| 1691_CZ3_Remnant_Forest | 67.9 | 67.9 | 0.09 | Biodiversity Conservation Act listing status | Species dependent on habitat attributes | Vulnerable | Not Listed | False | 3 |
| | | | | | | | | **Subtotal** | **3** |

| ***Planigale maculata / Common Planigale ( Fauna )*** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1691_CZ3_Remnant_Forest | 67.9 | 67.9 | 0.09 | Biodiversity Conservation Act listing status | Effectiveness of management in controlling threats | Vulnerable | Not Listed | False | 3 |
| | | | | | | | | **Subtotal** | **3** |

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