



Biodiversity Development Assessment
Report for Battery Energy Storage System

FINAL

October 2021

Biodiversity Development Assessment Report for Battery Energy Storage System

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Prepared by
Umwelt (Australia) Pty Limited
on behalf of
Eraring Power Station

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Executive Summary

Umwelt was engaged by Origin Energy (Origin) to prepare a Biodiversity Development Assessment Report (BDAR) for a proposed Battery Energy Storage System located at Eraring Power Station (EPS), NSW, south of Newcastle.

Origin is seeking approval for the State Significant Development (SSD) application of a grid scale BESS to be developed on land adjacent to EPS and connected to the existing transmission lines. The proposed BESS would be developed in three stages to achieve installed capacity up to 700 MW and energy generation of 2800 MWh. The BESS would have potential for future expansion beyond 700 MW/2800 MWh.

This BDAR has been prepared by Umwelt for Origin to assess the potential biodiversity impacts of the Development in accordance with the BAM.

Surveys of the Development Footprint identified the following Plant Community Types (PCTs) and vegetation:

- 1636 Scribbly Gum - Red Bloodwood - *Angophora inopina* heathy woodland on lowlands of the Central Coast moderate condition (4.6 ha)
- 1716 Prickly-leaved Paperbark Forest on coastal lowlands of the Central Coast and Lower North Coast low condition (0.3 ha)
- Planted native vegetation (10.2 ha)
- Exotic vegetation (6.4 ha)

Following the application of avoidance and mitigation measures, and the completion of seasonal biodiversity surveys, the BAM assessment identified that the following biodiversity credits are required to offset the impacts of the Development:

- 111 credits for 1636 Scribbly Gum - Red Bloodwood - *Angophora inopina* heathy woodland on lowlands of the Central Coast *moderate condition*
- 8 credits for 1716 Prickly-leaved Paperbark Forest on coastal lowlands of the Central Coast and Lower North Coast *low condition*
- 128 credits for swift parrot (*Lathamus discolor*)
- 135 credits for squirrel glider (*Petaurus norfolcensis*)
- 6 credits for small- flower grevillea (*Grevillea parviflora* subsp. *parviflora*)
- 6 credits for black- eyed Susan (*Tetratheca juncea*)

Impacts to the planted native vegetation, exotic vegetation and disturbed areas have been quantified and these do not require offsetting.

Glossary

BCD	Biodiversity Conservation Division
BDAR	Biodiversity Development Assessment Report
BAM	Biodiversity Assessment Methodology
BC Act	<i>NSW Biodiversity Conservation Act 2016</i>
CEEC	Critically Endangered Ecological Community
DAWE	Commonwealth Department of Agriculture, Water and Environment
Development Footprint	The proposed disturbance area is referred to throughout this report as the Development Footprint in accordance with the BAM
DNG	Derived Native Grasslands
DPIE	NSW Department of Planning, Industry and Environment
Ecosystem credit	A measurement of the value of EECs, CEECs and threatened species habitat for species that can be reliably predicted to occur within a PCT. Ecosystem credits measure the loss in biodiversity values at a development site and the gain in biodiversity values at an offset site.
EEC	Endangered Ecological Community
EP	Endangered Population
EP&A Act	<i>NSW Environmental Planning and Assessment Act 1979</i>
EPBC Act	<i>Commonwealth Environment Protection and Biodiversity Conservation Act 1999</i>
GDEs	Groundwater-dependent Ecosystems
GIS	Geographical Information System
IBRA	Interim Biogeographic Regionalisation for Australia (Version 7)
LGA	Local Government Area
MGA	Map Grid of Australia
NSW	New South Wales
OEH	NSW Office of Environment and Heritage
PCT	Plant Community Type
PMST	Protected Matters Search Tool
SEARs	DPE Secretary's Environmental Assessment Requirements
SEPP	State Environmental Planning Policy
Species credit	The class of biodiversity credits created or required for the impact on threatened species that cannot be reliably predicted to use an area of land based on habitat surrogates.
Strahler Stream Order	Classification system that gives a waterway an 'order' according to the number of tributaries associated with it.
TEC	Threatened Ecological Community
TBDC	Threatened Biodiversity Data Collection
VIS	Vegetation Information System

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1.0 Introduction

Umwelt (Australia) Pty Ltd (Umwelt) was engaged by Origin Energy at Eraring Power Station (EPS) to prepare a Biodiversity Development Assessment Report (BDAR) for a proposed Battery Energy Storage System (BESS) located at Eraring, NSW, approximately 30km south of Newcastle (refer to Figure 1.1). The BESS would be located within the EPS landholdings surrounding the existing coal- fired power station.

1.1 Project Description

Origin is seeking approval for the State Significant Development (SSD) application of a grid scale BESS to be developed on land adjacent to EPS and connected to the existing transmission lines. The proposed BESS would be developed in three stages to achieve installed capacity up to 700 MW and energy generation of 2800 MWh. The BESS would have potential for future expansion beyond 700 MW/2800 MWh.

The Project would include:

- Constructing a grid connected BESS with discharge capacity of up to 700 megawatts (MW) and storage capacity of 2800 MWh able to dispatch over variable durations from four hours to beyond eight hours
- Establishing High voltage (HV) and medium voltage (MV) transformers and associated infrastructure
- Connecting the BESS to 330 kV TransGrid switchyard by an approximate 400 metre overhead 330kV transmission line
- Installing safety protection systems and site ancillary facilities such as laydown areas and site offices.

Further detail regarding the Project design is provided in the Environmental Impact Statement (Jacobs 2021b).



FIGURE 1.1

Locality

1.2 Location

The location of the Development Footprint and other relevant landscape features that pertain to this assessment and required by Appendix K of the BAM are shown on Figure 1.2 and Figure 1.3. Figure 3.1 is as close as possible to 1:10,000 scale (as required by the BAM). A figure at any finer a projection would be spread over several figures and be distorted and difficult to read.

Refer to **Table 1.1** for a summary of the Development Footprint's location in the landscape.

Table 1.1 Development Footprint Location in the Landscape

Development Footprint Location in the Landscape	
IBRA Bioregion	Sydney Basin
IBRA Subregion	Wyong
Mitchell Landscape	Gosford – Cooranbong Coastal Slopes
LGA	Lake Macquarie
Assessment Type	Site-based
Development Footprint Size	25 ha

1.3 Development Footprint Information

The Development Footprint will be subject to a range of impacts as outlined in **Section 5.0**. The Development Footprint is shown on Figure 1.2.

Locally, the proposed BESS occurs within a large tract of remnant vegetation extending from Dora Creek to the south, through to Cameron Park in the north, Lake Macquarie in the east, and bounded by the Newcastle to Sydney Motorway (M1) in the west.

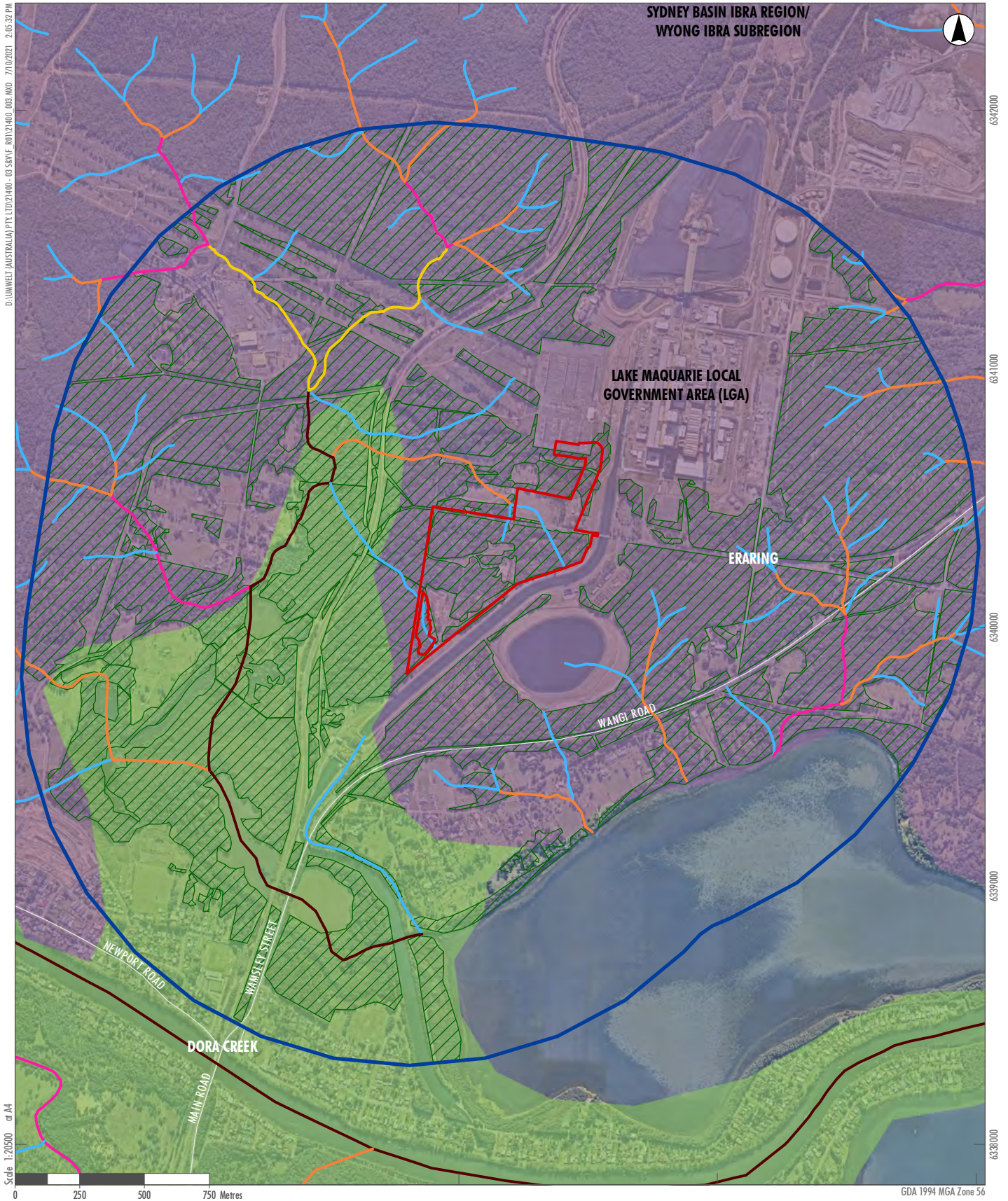
1.3.1 Background and Development Footprint Positioning

Much of the Project area is largely modified as a result of historical disturbance and is now vegetated as a result of re-seeding and regeneration. The disturbance is related to the approved development (DA 06_238) of a cooling water attemperating dam. Figure 1.4 below shows the Development Footprint in March 2010 and highlights the level of clearing of native vegetation at this time (discussed further in **Section 3.2.1**).

The Development Footprint was refined as a result of the biodiversity constraint work completed in early 2021 (Umwelt 2020), where targeted threatened species searches and broad-scale PCT mapping was completed to inform a constraints assessment. The previously disturbed areas within the wider constraints area were prioritised for development and local refinements have been made since to further reduce, as far as practicable, impacts on biodiversity. The surveys completed as part of the constraints assessment is documented in **Section 2.0** of this report and further information about the quantification of avoidance is provided in **Section 4.0**.



FIGURE 1.2
Development Footprint



- Scale 1:20500 at A4
- 0 250 500 750 Metres
- GDA 1994 MGA Zone 56
- Legend**
- Development Footprint
 - 1500m Buffer
 - Native Vegetation
 - Mitchell Landscapes**
 - Gosford - Cooranbong Coastal Slopes
 - Sydney - Newcastle Coastal Alluvial Plains
 - Strahler Stream Order**
 - 1st Order
 - 2nd Order
 - 3rd Order
 - 4th Order
 - 5th Order or Greater

FIGURE 1.3

Landscape Features



FIGURE 1.4

Development Footprint in March 2010

1.3.2 Local Ecological Context

The land uses immediately surrounding the site predominantly include residential areas, large tracts of public and privately- owned vegetation, and Lake Macquarie. The vegetation present in the Development Footprint and surrounds comprises a mixture of native woodland and forest and cleared areas of exotic pasture. No creeks or streams occur within the Development Footprint, and the large attenuating reservoir and a salt-water inlet canal owned by EPS occur immediately to the south east.

Where there is remnant native vegetation in the locality (within a 10 km radius), a number of threatened ecological communities (TECs) are known to occur including Coastal Swamp Oak (*Casuarina glauca*) Forest of NSW and South East Queensland ecological community (EEC) listed under the *Biodiversity Conservation Act 2016* (BC Act) and the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act); River- flat Eucalypt forest on coastal floodplains of the NSW mid- coast, Sydney Basin and South- east corner bioregions EEC listed under the BC Act and the EPBC Act; and Swamp Sclerophyll Forest of coastal floodplains of the NSW mid- coast, Sydney Basin and South- east corner bioregions EEC listed under the BC Act.

1.4 Key Resources, Policies and Documents

The following key resources, policies and documents were used during the preparation of this BDAR:

- Biodiversity Assessment Method 2020 (DPIE 2020a)
- Biodiversity Assessment Method Operational Manual (Stage 1) (DPIE 2017)
- Biodiversity Assessment Method Calculator
- BioNet Atlas of NSW Wildlife database and mapping tool (DPIE 2021a), last accessed September 2021
- Threatened Biodiversity Data Collection (TBDC) (DPIE 2021b), last accessed September 2021
- Vegetation Information System (VIS) Classification Database (DPIE 2021c), last accessed September 2021
- Surveying Threatened Plants and Their Habitats (DPIE 2020b) and
- Department of Agriculture, Water and the Environment (DAWE) Protected Matters Search Tool (DAWE 2021), last accessed September 2021.

1.5 Report Preparation and Submission

This BDAR was prepared by Philippa Fagan (Senior Ecologist: Botanist) (BAM Accreditation Number BAAS18117) with review and technical direction from Shaun Corry (Principal Ecologist) (BAM Accreditation Number BAAS17041). Field surveys were undertaken by Philippa Fagan, Shaun Corry and a number of other Umwelt ecologists under the guidance of the accredited assessor.

This BDAR was finalised on 12 October 2021 and the BAM Calculator was submitted to the authority within two weeks of the report submission.



2.0 Methods

The methods executed in this BDAR were undertaken in accordance with the Biodiversity Assessment Method 2020 and the Biodiversity Assessment Method Operational Manual (Stage 1). Further details on the methodologies used to complete this assessment are outlined in **Appendix A** as directed by Table 2.1 below.

Table 2.1 Methods

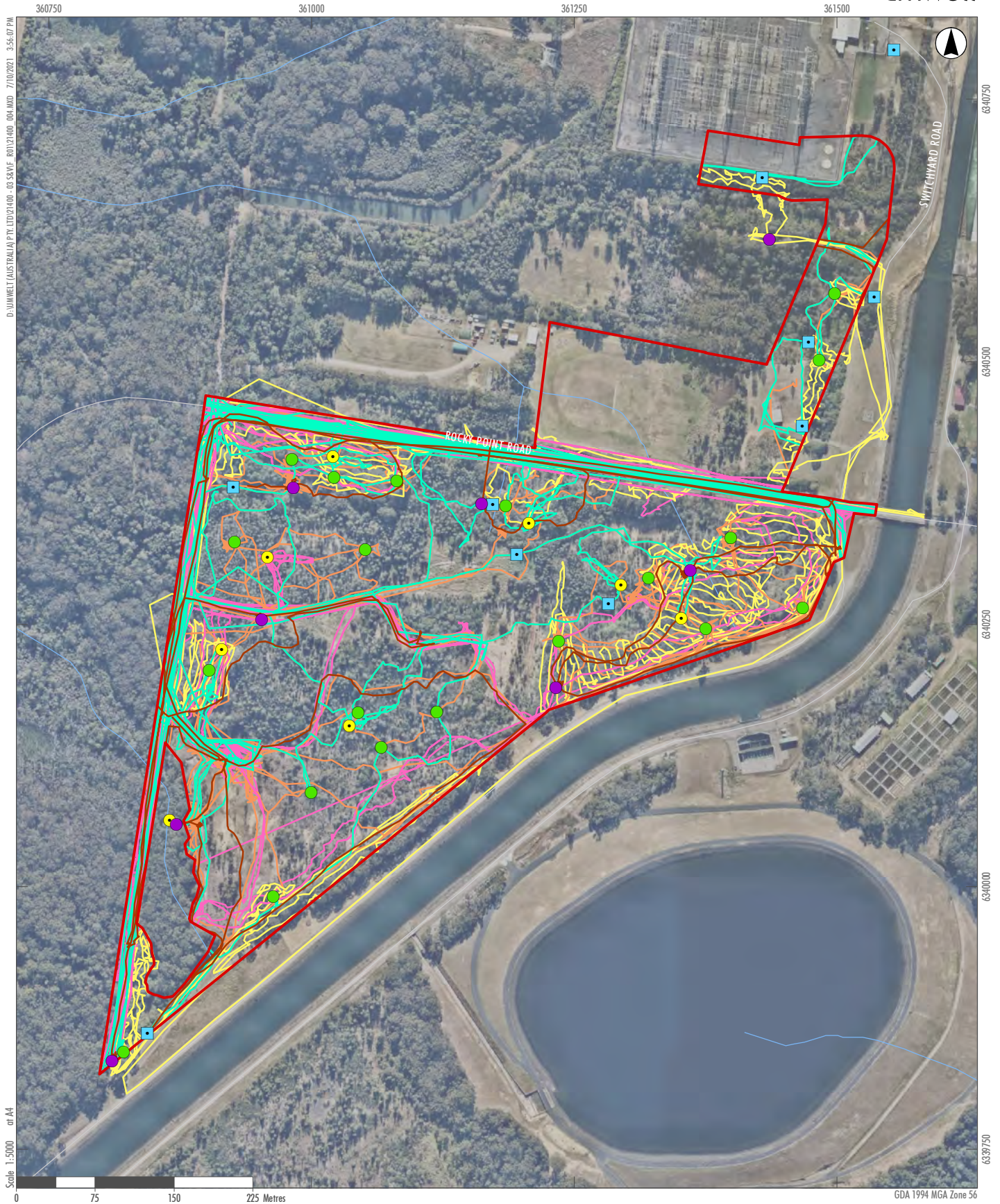
Methods Undertaken	Relevant Appendix A Section
Landscape Value	
Landscape Features and Site Context	Section A1.1
Native Vegetation Assessment	
Literature and Database Review	Section A1.2.1
Floristic and Vegetation Integrity Surveys	Section A1.2.2
Meandering Transects	Section A1.2.3
Digital Aerial Photo Interpretation	Section A1.2.4
Plant Identification and Nomenclature Standards	Section A1.2.5
Vegetation Mapping	Section A1.2.6
Threatened Ecological Community Delineation	Section A1.2.7
Plant Community Type Allocation	Section A1.2.8
Threatened Species	
Literature and Database Review	Section A1.3.1
Ecosystem-Credit Species Assessment	Section A1.3.2
Species-Credit Species Assessment	Section A1.3.3
Weather Conditions	
Weather Conditions and Limitations	Section A1.4

A total of eight BAM plots were undertaken within the Development Footprint (refer to Figure 2.1). Floristic and vegetation integrity data was collected in accordance with minimum requirements under the BAM (DPIE 2020a), as shown in **Table 2.2**.

The survey effort for the aforementioned constraints assessment is shown on **Figure 2.2**.

Table 2.2 Adequacy of Floristic and Vegetation Integrity Survey

Veg. Zone	Plant Community Type (PCT) <i>Condition Class</i>	Area in the Development Footprint (ha)	Number of Floristic and Vegetation Integrity Plots		Rapid Vegetation Assessments Completed
			Required	Completed	
1	1636 Scribbly Gum - Red Bloodwood - <i>Angophora inopina</i> heathy woodland on lowlands of the Central Coast <i>moderate condition</i>	4.6	3	3	3
2	1716 Prickly-leaved Paperbark Forest on coastal lowlands of the Central Coast and Lower North Coast <i>low condition</i>	0.3	1	2	0
3	Planted native vegetation	10.2	0	3	4
4	Exotic Vegetation	6.4	0	0	3
5	Disturbed	3.5	0	0	0
TOTAL		25	4	8	10



Legend

- | | |
|---|--|
| Development Footprint | — Autumn Spotlighting Track |
| ● Plot Location | — Summer Survey Track |
| ■ Rapid Assessment | — Autumn Survey Track |
| ● Remote Camera Location | — Winter Survey Track |
| ● Call Playback Location | — Spring Survey Tracks |

FIGURE 2.1

Survey Effort



FIGURE 2.2

Survey Effort Within Constraints Area

3.0 Results

3.1 Landscape Value

3.1.1 Landscape Features

In accordance with the requirements of the BAM, landscape features within a 1,500 metre (m) buffer have been mapped surrounding the Development Footprint. This 1,500 m buffer area contains a mixture of forested areas from regrowth to intact, as well as built- up infrastructure and residential areas, and parts of Lake Eraring. These landscape features are outlined in relation to the Development Footprint in Table 3.1 below.

Table 3.1 Landscape Features in the Development Footprint

Landscape Features	
IBRA Bioregion	Sydney Basin
IBRA Subregion	Wyong
Mitchell Landscape	Gosford – Cooranbong Coastal Slopes
Rivers, Streams, Estuaries	None within the Development Footprint. Lake Eraring, Lake Macquarie and Dora Creek occur to the south east
Wetlands (within, adjacent to and downstream)	Muddy Lake wetlands occurs approximately 900m south west of the Development Footprint.
Native Vegetation Extent*	Approximately 525.4 ha in the 1,500 m buffer area (50%) – predominantly comprised of forested areas in various conditions from remnant to regrowth
Areas of Geological Significance and Soil Hazard Features	None identified
Areas of Outstanding Biodiversity Value	None
Exotic/Disturbed Areas	Cleared areas exist within the Development Footprint, largely for tracks and historic storage areas. There are also areas of exotic vegetation.
Connectivity Features	<p>The Development Footprint is not an important link for any fauna movement and has not been identified in connectivity mapping.</p> <p>Not identified within a Priority Investment Area.</p> <p>Not identified as an important flyway for migratory species.</p>

3.2 Native Vegetation within the Development Footprint


3.2.1 Plant Community Types and Vegetation Zones

Surveys of the Development Footprint identified two Plant Community Types (PCTs), in two condition types, as well as planted native vegetation (refer to Figure 3.1):

- 1636 Scribbly Gum - Red Bloodwood - *Angophora inopina* heathy woodland on lowlands of the Central Coast moderate condition (4.6 ha)
- 1716 Prickly-leaved Paperbark Forest on coastal lowlands of the Central Coast and Lower North Coast low condition (0.3 ha)
- Planted native vegetation (10.2 ha)


Descriptions of the vegetation zones are outlined below, and a flora species list is included in **Appendix B**.

3.2.1.1 Zone 1 – PCT 1636 – Scribbly Gum - Red Bloodwood - *Angophora inopina* heathy woodland on lowlands of the Central Coast *moderate condition*

PCT Name	PCT 1636 Scribbly Gum - Red Bloodwood - <i>Angophora inopina</i> heathy woodland on lowlands of the Central Coast	
Condition	Moderate Condition	
PCT Formation	Dry Sclerophyll Forests (Shrubby sub-formation)	
PCT Class	Sydney Coastal Dry sclerophyll forests	
PCT Per cent cleared	58	
Area (ha)	4.6	
Patch Size Class (ha)	101	
General Description	This vegetation zone occurs largely around the boundaries of the Development Footprint (refer to Figure 3.1). The identification of this vegetation zone was based on information collected during surveys and considering topography and landscape position.	
Canopy Description	A fairly closed canopy dominated by red bloodwood (<i>Corymbia gummifera</i>) and scribbly gum (<i>Eucalyptus haemastoma</i>) with occasional smooth-barked apple (<i>Angophora costata</i>) and brown stringybark (<i>Eucalyptus capitellata</i>).	
Mid-storey Description	PCT 1636 within the Development Footprint contains a shrubby midstorey dominated by fern-leaved banksia (<i>Banksia oblongifolia</i>), slender tea-tree (<i>Leptospermum trinervium</i>), mountain devil (<i>Lambertia formosa</i>), chaffy push-pea (<i>Pultenaea paleacea</i>), <i>Xanthorrhoea latifolia</i> and finger hakea (<i>Hakea dactyloides</i>).	


PCT Name	PCT 1636 Scribbly Gum - Red Bloodwood - <i>Angophora inopina</i> heathy woodland on lowlands of the Central Coast
Condition	Moderate Condition
Ground Cover Description	<p>This vegetation zone was characterised by a moderately diverse and fairly dense ground layer generally less than one metre in height. Common herbs, sedges, ferns and rushes include poison rock fern (<i>Cheilanthes sieberi</i> subsp. <i>sieberi</i>), Indian pennywort (<i>Centella asiatica</i>), <i>Cyathochaeta diandra</i>, fishbones (<i>Lomandra obliqua</i>) and pale mat- rush (<i>Lomandra glauca</i>).</p> <p>Native grasses include oat speargrass (<i>Anisopogon avenaceus</i>), kangaroo grass (<i>Themeda triandra</i>), wiry panic (<i>Entolasia stricta</i>) and two- colour panic (<i>Panicum simile</i>).</p> <p>Exotic species were uncommon within this PCT, with cobbler's pegs (<i>Bidens Pilosa</i>) being occasionally present.</p>
PCT Allocation	PCT 1636 was chosen because both diagnostic canopy species occur, as well as all five of the shrubs in the mid- layer. Other scribbly gum units were considered, such as PCT 1083, PCT 1134 and PCT 1643, which were all discounted due to their position on plateaus and ridgetops. It was therefore considered likely that PCT 1636 was the most suitable scribbly gum unit, given the species assemblage and the position in the landscape at low elevations on the coast.
BC Act Status	Not consistent with any listed TEC under the BC Act.
EPBC Act Status	Not consistent with any listed TEC under the EPBC Act.

3.2.1.2 Zone 2 – 1716 Prickly-leaved Paperbark Forest on coastal lowlands of the Central Coast and Lower North Coast *moderate condition*

PCT Name	PCT 1716 Prickly- leaved Paperbark Forest on coastal lowlands of the Central Coast and Lower North Coast	
Condition	Low Condition	
PCT Formation	Forested Wetlands	
PCT Class	Coastal Swamp Forests	
PCT Per cent cleared	66	
Area (ha)	0.3	
Patch Size Class (ha)	101	
General Description	This vegetation zone occurs as a very small portion on the northern boundary of the Development Footprint (refer to Figure 3.1). The identification of this vegetation zone was based on information collected during surveys and considering topography and landscape position.	

PCT Name	PCT 1716 Prickly- leaved Paperbark Forest on coastal lowlands of the Central Coast and Lower North Coast
Condition	Low Condition
Canopy Description	A fairly closed canopy dominated by prickly- leaved paperbark (<i>Melaleuca nodosa</i>), flax-leaved paperbark (<i>Melaleuca linariifolia</i>) and swamp oak (<i>Casuarina glauca</i>), which is encroaching from the surrounding planted native vegetation.
Mid-storey Description	PCT 1716 within the Development Footprint contains a very sparse midstorey. It mostly contains young paperbarks and swamp oak, with the occasional tick bush (<i>Kunzea ambigua</i>), which is encroaching from the nearby planted native vegetation.
Ground Cover Description	This vegetation zone was characterised by a very sparse ground cover, aside from the dominance of red-fruit saw-sedge (<i>Gahnia sieberiana</i>). Occasional grasses such as weeping meadow grass (<i>Microlaena stipoides</i>) occurs, as well as forbs like branched goodenia (<i>Goodenia paniculate</i>). Lantana (<i>Lantana camara</i>) was common in this community, with occasional pampas grass (<i>Cortaderia selloana</i>) and Rhodes grass (<i>Chloris gayana</i>).
PCT Allocation	PCT 1716 was chosen because it almost perfectly describes the vegetation community on site. Red mahogany is cited as the only canopy species, which is true for the vegetation on site, with a paperbark, cheese tree and shrub layer beneath, which is also true. In fact, 13 out of 15 (87%) species were present in this PCT (not all captured within the plot). Additionally, the description of this PCT matches that which was on site, being on poorly drained coastal lowlands. While other PCTs were briefly considered, such as PCT 1717, none matches the community on site as suitably as PCT 1716.
BC Act Status	Consistent with <i>Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions EEC</i> .
EPBC Act Status	Not consistent with any listed TEC under the EPBC Act. However, it may conform to <i>Coastal swamp sclerophyll forests of south-eastern Australia community</i> currently nominated for listing under the EPBC Act.

3.2.1.3 Zone 3 – Planted native vegetation

PCT Name	Planted Native Vegetation	
Condition	Moderate Condition	
PCT Formation	NA	
PCT Class	NA	
PCT Per cent cleared	-	
Area (ha)	10.2	
Patch Size Class (ha)	101	
General Description	This vegetation zone occurs largely within the centre of the Development Footprint (refer to Figure 3.1). Historical imagery from August 2010 shows excessive clearing within the Development Footprint, and when this is overlayed with the vegetation mapping, this clearing aligns with this vegetation. Further, the species assemblage in this community on site does not appear to be a ‘natural’ vegetation community. Rather, it appears to originate from a native seed mix or planted native seedlings (discussed further below in PCT allocation). The identification of this vegetation zone was based on information collected during surveys and considering topography and landscape position.	
Canopy Description	A closed canopy dominated by swamp oak (<i>Casuarina glauca</i>) which all appear to be of a similar age, being fairly young with no large trees (>30 cm diameter at breast height) present.	
Mid-storey Description	The midstorey within this PCT in the Development Footprint is dense in places, while being sparse in other areas. Dominant midstorey species include the commonly grown and planted Sydney golden wattle (<i>Acacia longifolia</i> subsp. <i>sophorae</i>), prickly beard- heath (<i>Leucopogon juniperinus</i>), tick bush (<i>Kunzea ambigua</i>), tautoon (<i>Leptospermum polygalifolium</i>) and coffee bush (<i>Breynia oblongifolia</i>).	
Ground Cover Description	<p>This vegetation zone is characterised by a sparse ground layer. Species present include Indian pennywort (<i>Centella asiatica</i>), blady grass (<i>Imperata cylindrica</i>), a saw- sedge (<i>Gahnia spp.</i>) and a <i>Juncus spp.</i></p> <p>Exotic species were common in this PCT on site, including dominant high threat weeds such as Coolatai grass (<i>Hyparrhenia hirta</i>), whisky grass (<i>Andropogon virginicus</i>), pampas grass (<i>Cortaderia selloana</i>) and African lovegrass (<i>Eragrostis curvula</i>).</p>	

PCT Name	Planted Native Vegetation
Condition	Moderate Condition
PCT Allocation	<p>Choosing a PCT for this vegetation community on site was not possible. The area appears to have been re-seeded with a native seed mix sometime after it was completely cleared in 2010, as well as likely being supplemented by a random assortment of native seedlings grown in the onsite nursery at EPS. It would appear that the swamp oak has recolonised the area as a seed mix, as swamp oak is not typically found in the area adjacent to the Development Footprint. Therefore, while swamp oak (<i>Casuarina glauca</i>) is overwhelmingly the dominant species in this community, there is also a midstorey that comprises various commonly grown shrubs such as crimson bottlebrush (<i>Callistemon citrinus</i>), tick bush (<i>Kunzea ambigua</i>), large-leaf hop-bush (<i>Dodonaea triquetra</i>) and Sydney golden wattle (<i>Acacia longifolia</i> subsp. <i>sophorae</i>), none of which would normally occur in a swamp oak community, and most of the swamp oak PCTs contain a very sparse midstorey.</p> <p>Given that this vegetation community was so difficult to assign, and because swamp oak PCTs, including PCT 783, 898, 1232, 1234 and 1727 did not seem overly suitable due to their situation in estuarine and saline environments, there was very little choice but to determine that the vegetation cannot be assigned to a natural PCT and is aligned with planted native vegetation.</p>
BC Act Status	Not consistent with any listed TEC under the BC Act. The community on site is not consistent with <i>Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner Bioregions</i> due to its species assemblage (with many planted species) and its location away from any saline influence, and does not occur on a periodically inundated flat, drainage line, lake margin or estuarine fringe.
EPBC Act Status	Not consistent with Coastal Swamp Oak (<i>Casuarina glauca</i>) Forest of South-east Queensland and NSW EEC under the EPBC Act due to its degraded nature and species assemblage.

3.2.2 Planted Native Vegetation

In accordance with Appendix D of the BAM (DPIE 2020a), any native vegetation that was planted and cannot reasonably be assigned to a PCT can be mapped as planted native vegetation. Via this process, the swamp oak (*Casuarina glauca*)-dominated community has been determined as planted native vegetation. There are 10.0 ha of this vegetation type in the Development Footprint. Whilst technically this area could be assessed separately as a streamlined module, the requirements of the streamlined module are completely covered by the requirements of the full BDAR (in accordance with Appendix K of the BAM) and threatened species, including prescribed impacts, have been assessed appropriately for this area. A justification for the classification of planted vegetation is provided in the following subsection.

3.2.2.1 Justification in Accordance with Appendix D of the BAM

Table 3.2 outlines the criteria for determining whether planted vegetation is eligible to be assessed under Appendix D of the BAM and the key points for this determination include the following:

- Historic imagery from August 2010 shows excessive clearing within the Development Footprint, and when this is overlaid with the vegetation mapping, this clearing aligns with this vegetation type.
- The species assemblage in this community on site does not appear to be a 'natural' vegetation community and cannot be reasonably aligned with a PCT.

- The Project Approval (Major Project Application 06_238) for the original disturbance in the Development Footprint specifies in Clause 2.22 “As soon as practicable after the completion of construction works, the Proponent shall stabilise and rehabilitate disturbed areas associated with the attemperation reservoir and borrow pit using locally endemic native species”. This supports the suggestion that this community was planted for the purposes of stabilisation and rehabilitation, but not for the purpose of providing habitat for threatened species or for replacement of existing PCTs.
- Swamp oak is not found in the area adjacent to the Development Footprint, outside of areas that were historically cleared, and the landscape of the Development Footprint does not suit swamp oak. It is not riparian, estuarine, brackish, a lake shore or a swampy floodplain, which is typically the landscape conducive to this species.
- A closed canopy dominated by swamp oak (*Casuarina glauca*) which all appear to be of a similar age, being young with no large trees (>30 cm diameter at breast height) are present and which are very thickly spread, supporting the idea that the community is not naturally occurring.
- No use by threatened fauna species in this vegetation was observed during any surveys. It is not considered to provide any habitat for threatened fauna species, given the very young age and homogenous nature of the swamp oak, no hollows being present, a general paucity of logs and the only leaf litter being from swamp oak (i.e., needles that provide low functional value).

Table 3.2 Criteria for Planted Native Vegetation Assessment Under Appendix D

Decision- Making Key for Planted Native Vegetation	
<p>Does the planted native vegetation occur within an area that contains a mosaic of planted and remnant native vegetation and which can be reasonably assigned to a PCT known to occur in the same IBRA subregion as the proposal?</p>	<p>The planted native vegetation occurs within an area that was completely cleared of native vegetation and utilised as a borrow pit for the development of a nearby dam. The substrate is substantially modified and highly erodible and the revegetation is completely driven by seeding rather than regeneration from a seed bank. The planted vegetation adjoins patches of remnant native vegetation however it shares no resemblance to the adjoining remnant vegetation in terms of floristic diversity or community structure and it does not form a mosaic in that there is no pattern or floristic transition from revegetation to remnant vegetation. Where the planted vegetation occurs adjoining remnant vegetation there is a stark edge defining the boundary which is always accompanied by a substantial elevation change from where material had been excavated.</p> <p>The area of planted native vegetation cannot be reasonably assigned to a PCT known to occur in the same IBRA subregion either. The vegetation in question is dominated almost exclusively by swamp oak (<i>Casuarina glauca</i>), with occasional commonly planted shrub species such as, Sydney golden wattle (<i>Acacia longifolia</i>) and tick bush (<i>Kunzea ambigua</i>), as well as typical coloniser species such as blady grass (<i>Imperata cylindrica</i>) and Indian pennywort (<i>Centella asiatica</i>).</p> <p>This assemblage of species is not consistent with any swamp oak-dominated PCT in the Wyong IBRA sub- region. While swamp oak (<i>Casuarina glauca</i>) is overwhelmingly the dominant species in this community, there is also a midstorey that comprises various commonly grown shrubs such as those mentioned above, as well as crimson bottlebrush (<i>Callistemon citrinus</i>) and large- leaf hop-bush (<i>Dodonaea triquetra</i>), none of which would normally occur in a swamp oak community. Further, most of the swamp oak PCTs contain a very sparse midstorey, while the vegetation on site is quite thick in the midstorey in places. Furthermore, swamp oak-dominated PCTs in the Wyong IBRA sub- region are all estuarine communities which occur in areas such as on the margins or shores of lakes or tidal areas, with a strong estuarine, tidal or brackish influence. This is not relevant to the planted native vegetation in question.</p> <p>PCTs which were considered are 783, 1232, 1234, 1236, 1717, 1724, 1727, 1728, 1729 and 1731. All of these PCTs were closely interrogated when attempting to assign a PCT to the vegetation on site. None of these PCTs have a strong floristic match to the vegetation, with no PCT showing greater than 30% floristic match. Generally, the swamp oak is the only consistent species matching the vegetation in question.</p> <p>As such, based on the above information, the planted native vegetation does not occur within an area that contains a mosaic of planted and remnant native vegetation and cannot be reasonably assigned to a PCT known to occur in the same IBRA subregion.</p>

Decision- Making Key for Planted Native Vegetation	
<p>Is the planted native vegetation:</p> <p>a. planted for the purpose of environmental rehabilitation or restoration under an existing conservation obligation listed in BAM Section 11.9(2.), and</p> <p>b. the primary objective was to replace or regenerate a plant community type or a threatened plant species population or its habitat?</p>	<p>No</p> <p>No. Clause 2.22 of the Project Approval states, "As soon as practicable after the completion of construction works, the Proponent shall stabilise and rehabilitate disturbed areas associated with the attestation reservoir and borrow pit using locally endemic native species". Therefore, the primary objective was the stabilise and rehabilitate the area using any locally endemic native species, rather than for the specific rehabilitation of a PCT or to provide specific habitat for a threatened plant species.</p>
<p>Is the planted/translocated native vegetation individuals of a threatened species or other native species planted/translocated for the purpose of providing threatened species habitat under one of the following:</p> <p>a. a species recovery project</p> <p>b. <i>Saving our Species</i> project</p> <p>c. other types of government funded restoration project</p> <p>d. condition of consent for a development approval that required those species to be planted or translocated for the purpose of providing threatened species habitat</p> <p>e. legal obligation as part of a condition or ruling of court. This includes regulatory directed or ordered remedial plantings (e.g., Remediation Order for clearing without consent issued under the BC Act or the Native Vegetation Act)</p> <p>f. ecological rehabilitation to re-establish a PCT or TEC that was, or is carried out under a mine operations plan, or</p> <p>g. approved vegetation management plan (e.g., as required as part of a Controlled Activity Approval for works on waterfront land under the NSW <i>Water Management Act 2000</i>)?</p>	<p>As stated above, the consent did not specify any purpose for the provision of threatened species habitat.</p> <p>Not applicable to the vegetation in question.</p> <p>Not applicable to the vegetation in question.</p> <p>Not applicable to the vegetation in question.</p> <p>While the condition of consent required locally endemic native species to rehabilitate and stabilise the area, it did not require a specific assemblage of native species to be used, and there is no mention of the provision for providing threatened species habitat.</p> <p>Not applicable to the vegetation in question.</p> <p>Not applicable to the vegetation in question.</p> <p>Not applicable to the vegetation in question.</p>
<p>Was the planted native vegetation (including individuals of a threatened flora species) undertaken voluntarily for revegetation, environmental rehabilitation or restoration without a legal obligation to secure or provide for management of the native vegetation?</p>	<p>The project approval stated that the area must be rehabilitated and stabilised using locally endemic native species. Therefore, the vegetation was not planted voluntarily.</p>

Decision- Making Key for Planted Native Vegetation	
Is the native vegetation (including individuals of a threatened flora species) planted for functional, aesthetic, horticultural or plantation forestry purposes? This includes examples such as: windbreaks in agricultural landscapes, roadside plantings (including street trees, median strips, roadside batters), landscaping in parks, gardens and sport fields/complexes, macadamia plantations or teatree farms?	The vegetation in question was not planted for functional, aesthetic, horticultural or plantation forestry purposes. It was required as part of the Project Approval for stabilisation and rehabilitation.
Is the planted native vegetation a species listed as a widely cultivated native species on a list approved by the Secretary of the Department (or an officer authorised by the Secretary)?	No.

To support the information above, **Plates 1 to 3** below show representative examples of the condition of the areas of planted native vegetation, as well as the exotic vegetation present.



Plate 1 Planted native vegetation in the development footprint showing the degraded and disturbed nature of this vegetation type, and the substrate which it exists upon.

The image on the left also shows the unusual assemblage of swamp oak with Sydney golden wattle. This vegetation also coincides exactly with the cleared area in the March 2010 (**Figure 1.4**).



Plate 2 Further photographs showing the planted native vegetation in the development footprint and the disturbed nature of the substrate



Plate 3 Exotic vegetation in the Development Footprint. Note the eroded nature of the ground also, which is present under much of the planted native vegetation also (previously disturbed ground).

3.2.3 Threatened Ecological Communities

PCT 1716 corresponds to Swamp Sclerophyll Forest on Coastal Floodplains Endangered Ecological Community (EEC), listed under the Biodiversity Conservation Act 2016 (BC Act) and may conform to the Coastal swamp sclerophyll forests of south-eastern Australia community currently nominated for listing under the EPBC Act.

PCT 1636 was compared to the final determination of any potentially occurring TECs but was not considered commensurate with any currently listed TECs in NSW.

3.2.4 Vegetation Integrity Score

Figure 3.2 below details the vegetation integrity scores for the vegetation zones in the Development Footprint. The vegetation integrity data for each of the vegetation zones is provided in **Appendix C**.

Table 3.3 Vegetation Zone Vegetation Integrity Scores

Veg Zone	PCT Name	Presence of Hollow-bearing Trees	Composition	Structure	Function	Current Vegetation Integrity Score
1	1636 Scribbly Gum - Red Bloodwood - <i>Angophora inopina</i> heathy woodland on lowlands of the Central Coast <i>moderate condition</i>	Yes	53.7	56.2	55.4	55.1
2	1716 Prickly-leaved Paperbark Forest on coastal lowlands of the Central Coast and Lower North Coast <i>low condition</i>	No	68.4	51.8	43.2	53.5
3	Planted native vegetation	No	-	-	-	-

3.3 Threatened Species within the Development Footprint

3.3.1 Ecosystem-credit Species

A list of the ecosystem-credit species predicted to occur by the BAM Calculator and/or the literature review and whether they are considered likely to occur in the vegetation zones within the Development Footprint is provided in **Appendix D**.

Ecosystem- credit species that are considered to have potential to occur in the Development Footprint include glossy black- cockatoo (*Calyptorhynchus lathami*), little lorikeet (*Glossopsitta pusilla*), eastern false pipistrelle (*Falsistrellus tasmaniensis*), eastern coastal free-tailed bat (*Micronomus norfolkensis*), little bent-winged bat (*Miniopterus australis*), large bent- winged bat (*Miniopterus orianae oceanensis*) and grey-headed flying- fox (*Pteropus poliocephalus*). Breeding habitat for these species is fairly limited in the Development Footprint. Some hollows are present within PCT 1636, though these exist in relatively small, fragmented patches.

3.3.2 Species-credit Species

A list of the species-credit species predicted to occur by the BAM Calculator and/or the literature review and whether they are considered likely to occur in the vegetation zones within the Development Footprint is provided in **Appendix D**. Those detected on site are shown on **Figure 3.1**.

The green and golden bell frog (*Litoria aurea*) was detected approximately 200 m west of the Project Area, within EPS landholdings during surveys in 2021. The occurrence of this species within EPS landholdings is believed to be the result of individuals periodically dispersing from the known population from Muddy Lake (south west of EPS) when conditions are suitable. They were occupying a relatively small (0.3 hectare) swamp and both male and females were detected during the survey. With consideration of the NSW survey guideline for threatened frogs (DPIE 2020c), species polygons should align with aquatic habitats linked directly to the record and a buffer, incorporating the PCTs which the species is associated, of 200 metres radius from the top of bank. A polygon drawn to this specification does not encroach the development footprint. As this polygon does not extend into the Project Area, and no direct impacts to this threatened species or their habitats is expected to occur as a result of the Project, no credits have been generated for this species.

There is, however, some potential for indirect impacts to the habitat of this species. Parts of the Development Footprint form part of the catchment which feeds the small swamp that this species occupies nearby and changes to this catchment area may impact the hydrology of the swamp. Changes to water flow or quality are not predicted to occur (Jacobs 2021) and will be managed throughout the construction process through an adaptive management plan. The potential for indirect impacts on this species are considered further in **Section 5.1.2** and again in **Section 5.4**.

Potential individuals of red helmet orchid (*Corybas dowlingii*) were detected within the Project Area, but outside the Development Footprint within PCT 1716 in good condition. The individuals were confirmed to be in the *Corybas aconitiflorus* – *barbarae* – *dowlingii* complex by the NSW Royal Botanic Gardens though definitive identification wasn't able to be provided from the inquiry. These individuals will not be removed and no impacts to their habitat is proposed, as PCT 1716 in poor condition in the Development Footprint did not contain any individuals of this species and is not considered to provide suitable habitat. Therefore, a species-credit species polygon has not been developed and no credits were generated for this species.

3.3.3 Species Habitat Polygons and Biodiversity Risk Weighting

Species- credit species polygons are displayed on **Figure 3.2**.

Small- flower grevillea (*Grevillea parviflora subsp. parviflora*) was detected within the Development Footprint with 42 individuals present at one location. A thirty-metre buffer has been placed around these individuals for the generation of credits, totalling 0.2 ha. Similarly, black- eyed Susan (*Tetralochea juncea*) was detected at one location over an area of approximately 20cm across (assumed to be one individual) in the Development Footprint, and a thirty- metre buffer has been placed around this individual, totalling 0.2 ha.

Squirrel glider (*Petaurus norfolcensis*) was also captured on remote camera and is known from the EPS landholdings. It has been aligned with PCT 1636 and 1716.

Swift parrot (*Lathamus discolor*) important habitat mapping occurs in the development footprint based on previous records in the vicinity. However, this mapping has been completed at a broad scale using regional vegetation mapping products and does not reflect the habitat on ground. Portions of the planted native vegetation, as well as the roads and the built-up areas have been included in the mapping for this species. As none of this is relevant to the habitats used by this species, credits have only been generated for PCT 1636 that falls within the habitat mapping, a total of 3.1 ha. This PCT could provide winter foraging habitat when the eucalypts are in flower.

3.4 Aquatic Habitats

Several un-named, ephemeral, first-order tributaries are mapped as occurring within the Development Footprint. These were not observed as formed creeklines during the field surveys, and no riparian vegetation or typically riparian species appear to be present. These areas were wet during surveys in March and May but appeared as boggy areas rather than aquatic habitats.

There is one waterway which flows east to west into the man-made canal to the north west of the Development Footprint. This waterway appears to be relatively permanent (though, by its very straight nature, appears to be man-made) and may provide aquatic habitat and resources for local fauna species. A small portion of planted native vegetation would be removed from the banks of this waterway.

Existing creek lines surrounding the Project area eventually flow into Muddy Lake to the west. Surface water from the Project Area would also drain to Muddy Lake.

No significant impacts to riparian vegetation or water flow are expected to occur. The Project Area is currently subject to the Water Management plan for EPS.



Legend

 Development Footprint

▲ *Tetratheca juncea*

● Plot Location

■ Rapid Assessment

● Large Hollow- bearing Tree Location

● Green and Golden Bell Frog Location

● *Grevillea parviflora* subsp. *parviflora* Location

■ Potential *Corybas dowlingii* Location

 Swift Parrot Important Habitat

Plant Community Type (PCT):

1636 Scribbly Gum - Red Bloodwood - *Angophora inopinata* heathy woodland on lowlands of the Central Coast good condition

1716 Prickly-leaved Paperbark forest on coastal lowlands of the Central Coast and Lower North Coast low condition

Disturbed/cleared

Exotic

Exotic - Pine Trees

Planted Native Vegetation

FIGURE 3.1

Plant Community Types, Threatened Species and Habitat Features in the Development Footprint



FIGURE 3.2

Species-credit Species Polygons

4.0 Avoidance and Minimisation of Impacts

4.1 Avoidance of Impacts

4.1.1 Avoidance of Native Vegetation and Habitat

Umwelt was engaged early in the design process with a constraints analysis undertaken (Umwelt 2021), so that the Footprint could be designed with the least ecological impact possible. A much larger potential area for the BESS was proposed by EPS, and Umwelt assessed this area in its entirety, before a Footprint was chosen in an area of generally low ecological values. Large areas of TEC and numerous threatened species were recorded in the wider constraints survey area that do not occur in the Development Footprint. This includes:

- 14.1 ha of swamp sclerophyll forest EEC
- Green and golden bell frog (*Litoria aurea*)
- Netted bottlebrush (*Callistemon linearifolius*)
- Potential red helmet orchid (*Corybas dowlingii*)

The total Development Footprint for the proposed BESS was minimised as much as possible, with the original proposed footprint shown in **Figure 4.1**, which has been further reduced. Whilst detailed design hasn't been completed, there is the potential that further refinements could be made and any currently unavoidable residual impacts, such as those relating to the small flower-grevillea or swamp sclerophyll TEC, will be prioritised if possible.

The Development Footprint is placed largely within areas that have been previously cleared. The planted native vegetation constitutes almost half the Development Footprint, and this has been previously cleared and consists of an unnatural vegetation type, which provides very little habitat. When compared to alternative locations within the wider constraints areas, this position reduces the impact on remnant vegetation by a substantial amount, up to approximately 50% if it had been positioned completely in intact vegetation. The chosen location is also proximate to the transmission line which avoids large linking infrastructure corridors.

Additionally, following the completion of the vegetation mapping, of the intact, remnant pact Swamp Sclerophyll Forest on Coastal Floodplains EEC was excised from the Development Footprint for total avoidance. It is situated on the eastern boundary of the Development Footprint and was removed from the project design to reduce impacts to EECs and the potentially threatened helmet orchid (*Corybas dowlingii*).

No direct impacts on the green and golden bell frog (*Litoria aurea*) population are expected as part of the Project as it's known habitat has been avoided. The Project will not result in the physical removal of any known areas of occupancy or any areas of potential breeding habitat.



Legend

Development Footprint

Alternative Footprint Considered

FIGURE 4.1

Alternative Footprints Considered

4.1.2 Avoidance of Prescribed Impacts

The following impacts are considered ‘prescribed impacts’ under the *Biodiversity Conservation Regulation 2017*:

- impacts on the habitat of threatened species or ecological communities associated with karst, caves, crevices, cliffs and other geological features of significance, rocks, human-made structures or non-native vegetation
- impacts on the connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range
- impacts on movement of threatened species that maintains their life cycle
- impacts of development on water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities
- impacts of wind turbine strikes on protected animals, and
- impacts of vehicle strikes on threatened species or on animals that are part of a TEC.

As outlined in **Section 4.1.1** above, EPS sought to avoid and minimise the potential impacts on the ecological values of the Development Footprint primarily through general avoidance of remnant vegetation and careful placement of the BESS. The Development Footprint has been located in an area of relatively low biodiversity value, resulting in a small area of disturbance to native vegetation or fauna habitats.

Further detail on the assessment of prescribed impacts is outlined in **Section 5.2**.

4.2 Minimisation and Management of Impacts

The Project has committed to the design and implementation of a comprehensive biodiversity mitigation strategy to minimise the unavoidable impacts of the Project. The following specific control measures are considered to be integral to the mitigation of impacts on the biodiversity features of the Development Footprint:

- salvage of biodiversity features, including habitat resources (e.g., hollow logs, tree hollows, fallen timber and rocks/boulders)
- a pre-clearing procedure will be implemented to minimise the potential for impacts on native fauna species (focusing on threatened species) as a result of the clearing of hollow-bearing trees. The pre-clearing procedure is designed to minimise impacts to hollow-dependent and ground-dwelling fauna
- weed management
- fencing and access control
- bushfire management
- erosion and sedimentation control
- workforce education and training.

Each of these minimisation measures will be included in a Construction Environmental Management Plan.

4.2.1 Pre-clearance and tree-felling

Pre-clearance surveys and tree-felling supervision recommendations will be implemented to minimise the potential for impacts on native fauna species (including threatened species) as a result of the clearing of hollow-bearing trees.

4.2.1.1 Pre-clearance surveys

Pre-clearance surveys are to be undertaken prior to tree felling works, be undertaken by suitably qualified and experienced persons/personnel and include:

- the demarcation of areas approved for clearing to reduce risk of accidental clearing
- habitat resources and habitat trees should be identified and marked (Note: habitat trees are those containing hollows, cracks or fissures and spouts, active nests, dreys or other signs of recent fauna usage. Other habitat features to be identified include fallen timber/hollow logs, burrows, and boulder piles)
- the potential presence of threatened flora and fauna species, endangered populations and TECs should be identified
- the identification of threatened species or habitat features that are suitable for translocation or salvage
- disturbance activities should be targeted to specific times of the year to minimise impacts to threatened species usage of habitat features for breeding and roosting, where practicable.

4.2.1.2 Tree-felling supervision

Tree felling will be completed as close to the completion of pre-clearance surveys as practicable to limit the potential for new issues to arise (such as new active nests being built). Tree felling supervision will be undertaken by an appropriately qualified and experienced person after pre-clearance surveys have identified potential habitat features.

The tree-felling process will include the following:

Prior to Felling Habitat Trees

- Completion of actions recommended from the pre-clearing surveys, including (but not limited to) salvage of identified habitat features, additional surveys to determine threatened fauna usage of the area (if required), identification of active dens or burrows, any actions required to discourage fauna occupation and weed or feral fauna management requirements
- Removal of non-habitat trees/vegetation as close to the habitat tree felling date as possible in order to create disturbance to discourage fauna usage of the habitat trees
- Shaking of habitat trees (with heavy machinery) as appropriate to encourage fauna to abandon trees.

On the Day of Felling Habitat Trees

- All habitat trees will be subject to a visual inspection to survey for threatened species
- Trees previously identified as containing fauna will be shaken and then felled, providing no threatened species are identified
- The lowering of hollow-bearing trees will be done as gently as possible with heavy machinery

- If a threatened species is identified in a habitat tree on the day of felling, the supervising person is to advise the most appropriate method to minimise potential harm. This may include leaving the tree overnight, further shaking to encourage the animal to vacate the tree, gradual removal of branches to discourage ongoing use, soft-felling of the tree with the animal in the tree, or measures to capture and relocate the animal to secure habitats
- Uninjured animals should be released on the day of capture into nearby suitable secure habitat and should not be held for extended periods of time
- Injured animals will be taken to the nearest veterinary clinic or wildlife carer as soon as possible for assessment and treatment
- Felled trees are to be rolled where appropriate so that the number of hollows blocked against the ground is minimised
- All felled habitat trees should remain in place for a least one night to allow any remaining fauna to escape, and
- Habitat features identified for translocation or salvage operations should be extracted and stored appropriately.

4.2.2 Water Management

Changes to hydrology are considered unlikely and Origin is committed to a design that maintains pre-development flows from the development area (quantity and quality) into the green and golden bell frog habitat identified in the EPS holding as well as Muddy Lake system. Proposed surface water management commitments may include:

Design commitments

- Design erosion and sediment controls as per sensitive environments (Managing Urban Stormwater – Soils and Construction (Landcom 2004)).
- Detailed design of drainage will balance clean water discharges to maintain minimum flows (as estimated based on current topography and hydrology) to identified green and golden bell frog habitats.

Construction commitments

- Implement hygiene protocol in accordance with the NSW Threatened Species Management Information Circular No.6 (April 2008)).
- Flocculants or other chemicals proposed to be used on site are required to be known and verified as being safe in sensitive environments and particularly in relation to amphibians.
- Implement appropriate hygiene controls in accordance with Saving Our Species Guidelines for threatened frog species.
- Erosion and sediment control will be designed, installed and managed as follows:
- Progressive erosion and sediment control plans (ESCPs) will be developed by the Contractor and implemented prior to the commencement of topsoil stripping and earthworks.

- Erosion and sediment control structures are to be regularly inspected and maintained, particularly in advance of and following significant rainfall events.
- Any water discharges are required to be managed to avoid pollution of waters having regard to the sensitivity of the receiving environment. In particular, any flocculants are to be demonstrated as being both effective and safe for amphibians prior to use.
- All disturbed surfaces will be revegetated as soon as possible.

Construction monitoring

- Pre-discharge physical water quality condition (temperature; dissolved oxygen; pH; electrical conductivity (EC)) and chemical water quality condition in sediment dams.
- Water quality leaving the Project Area must meet the specified criteria for total suspended solids (less than 50mg/L), pH (between 6.5 and 8.5) and no hydrocarbon or any other chemical contaminants exceeding the trigger levels set out in relevant guidelines (refer to **Section 5.4**).
- Visual post rainfall checks of sediment dam water level and water quality, and to ensure erosion and sediment control effectively functioning.

4.2.3 Weed Management

Weed species could be inadvertently brought into the Development Footprint or surrounding habitats with imported materials or could invade naturally through removal of native vegetation. The presence of weed species has the potential to decrease the value of vegetation for native species, particularly threatened species.

Weed management controls will include:

- all machinery and equipment will be cleaned thoroughly prior to entering the Development Footprint. Cleaning must include the removal of all mud and plant matter, followed by washing with high pressure water.
- mulch containing weeds is to be placed in piles separate from clean mulch, removed from site, and disposed of in accordance with weed management guidelines as soon as practicable.

4.2.4 Fencing and access control

During construction, fencing will be used to demarcate vegetation where required to avoid accidental damage to areas outside of the Development Footprint.

Access control is an important feature in protecting and demarcating areas outside the Development Footprint from vehicle access, human access, and accidental disturbance. Measures include:

- appropriate fencing and signposting of areas to prevent the uncontrolled entry of people, accidental disturbance and to minimise vehicular and human traffic
- clear and visible signage is to be appropriately located to inform the workforce and others of the restricted access or otherwise of areas outside the Development Footprint and
- locking of gates to prevent unwanted vehicle, person access and disturbance.

4.2.5 Erosion and sediment control

A Stormwater Management Plan will be prepared to appropriately limit post development flows and manage downstream water quality as part of the SSDA for site establishment and clearing works.

Measures to be implemented include:

- minimising the area of disturbance
- diverting run-off water around disturbed areas
- installation and ongoing maintenance of erosion and sediment controls (e.g., sediment fencing) throughout the duration of the Project
- stabilisation (i.e., sealing, landscaping) of all disturbed areas to reduce the potential for future erosion.

4.2.6 Workforce education and training

The development of education packages and training can help to mitigate anthropogenic impacts on biodiversity. The ability of non-ecological personnel to identify key threatened species or key ecological threats can help to mitigate impacts on threatened species. The following mitigation actions will be implemented for the Project to develop a greater understanding and awareness of biodiversity issues in non-ecological trained personnel:

- Inductions for the workforce will be undertaken to make them aware of the key ecological issues present in the Development Footprint and so that they know their role and responsibilities in the protection and/or minimisation of impacts to all native biodiversity
- Inductions will identify the location of sensitive flora and fauna and the policies being implemented to protect the biodiversity values of such areas.

4.2.7 Summary of Measures, Timing and Responsibility

Management including the timing, action, outcome and responsibility of these measures.

Table 4.1 Recommended Avoidance and Minimisation Measures

Measure	Timing	Responsibility	Proposed Techniques	Outcome
Before				
Preliminary ecological site inspection	Pre-project design	N/A	N/A	<ul style="list-style-type: none"> Preliminary assessment of areas of avoidance to inform project design.
Location and design of works in existing disturbed areas.	Project design	N/A	N/A	<ul style="list-style-type: none"> Focus impacts on areas of low biodiversity value (i.e., regrowth swamp oak vegetation).
Workforce education and training	Pre-construction and during construction	Site Manager	<ul style="list-style-type: none"> Environmental induction 	<ul style="list-style-type: none"> Environmental awareness for construction crews
Frog exclusion fence	Project design	Project ecologist and site manager	<ul style="list-style-type: none"> Installation of a frog exclusion fence prior to construction to prevent the movement of green and golden bell frogs into the Project Area 	<ul style="list-style-type: none"> Minimise potential impacts to threatened frog species
During				
Implement Construction Environmental Management Plan	Prior to clearance and during clearance activities	Site Manager	<ul style="list-style-type: none"> Develop plan to adequately manage environmental impacts during construction 	<ul style="list-style-type: none"> Minimal impacts to environmental values
Demarcation of approved clearance boundaries	Prior to clearance and during clearance activities	Site Manager	<ul style="list-style-type: none"> Clearly identify areas not proposed for clearance. 	<ul style="list-style-type: none"> Minimisation of unnecessary impacts to surrounding vegetation and habitats.
Pre clearance and tree felling supervision	Prior to clearance and during clearance activities	Project ecologist and site manager	<ul style="list-style-type: none"> Pre- clearance and tree felling in accordance with Section 4.2. 	<ul style="list-style-type: none"> Minimal impacts to local fauna and their habitats
Water Management	Prior to clearance and during clearance activities	Project ecologist and site manager	<ul style="list-style-type: none"> Implementation of outlined techniques during design and construction 	<ul style="list-style-type: none"> Minimisation of harm to green and golden bell frogs

Measure	Timing	Responsibility	Proposed Techniques	Outcome
After				
Weed management	Construction and operation	Site Manager	<ul style="list-style-type: none"> Chemical and physical removal of invasive weed species in accordance with the <i>Noxious and Environmental Weeds Handbook</i> (DPI 2014). Regular inspection to identify potential weed infestations. 	<ul style="list-style-type: none"> Minimisation of environmental and noxious weeds within the site Minimisation of weed spread from and into the wider locality.
Fencing and access control	Construction and operation	Site Manager		<ul style="list-style-type: none"> Provides for access control to avoid unwanted human interference and disturbance to non-operational areas. Minimisation of impacts to native fauna species from the use of barbed-wire fences.
Erosion and sedimentation control	Construction and operation	Site Manager	<ul style="list-style-type: none"> Adequate controls during works for erosion and sediment control 	<ul style="list-style-type: none"> Avoid sediment entering local creeks

5.0 Assessment of Impacts

5.1 Impacts on Native Vegetation and Habitat

5.1.1 Direct Impacts

The proposal will result in direct impacts on biodiversity values. Direct impacts include the loss of vegetation and fauna habitat as a result of clearance works and BESS installation. The Development Footprint generally contains a low abundance of important habitat features such as fallen logs and hollow-bearing trees, due to the majority being planted native vegetation. The majority of the Development Footprint consists of a planted swamp oak (*Casuarina glauca*) community in a poor condition and of a young age. A 6.4 ha area of exotic vegetation will be impacted for the Project, as well as 3.5 ha of disturbed/cleared areas.

Table 5.1 below outlines the direct impacts on native vegetation, which totals approximately 15.1 ha, the majority of which is comprises planted native vegetation. Avoidance and mitigation measures associated with minimising these direct impacts are discussed in **Section 4.0** above.

Table 5.1 Direct Impacts on Biodiversity Features

Species	Area within the Development Footprint (ha)
Plant Community Type	
1636 Scribbly Gum - Red Bloodwood - <i>Angophora inopina</i> heathy woodland on lowlands of the Central Coast moderate condition	4.6
1716 Prickly-leaved Paperbark Forest on coastal lowlands of the Central Coast and Lower North Coast moderate condition	0.3
Planted native vegetation	10.2
Swift parrot (<i>Lathamus discolor</i>)	3.1
Squirrel glider (<i>Petaurus norfolcensis</i>)	4.9
Small- flower grevillea (<i>Grevillea parviflora</i> subsp. <i>parviflora</i>)	0.2
Black- eyed Susan (<i>Tetradlea juncea</i>)	0.2

5.1.2 Indirect Impacts

The proposed BESS is not expected to result in any substantial indirect impacts on the biodiversity values of the adjacent land. No indirect impacts are expected to occur in relation to surrounding connectivity, corridors or habitat fragmentation, considering the already disturbed nature of the Development Footprint. However, some minor indirect impacts associated with noise, dust and weeds may occur during construction. These are discussed below in **Table 5.2**. No indirect impact zones have been identified for this assessment.

Table 5.2 Indirect Impacts

Impact	Description
Water	Changes to the water flow or quality from the Development Footprint into the ephemeral streams supplying water to the swamp occupied by the green and golden bell frog has the potential to impact this species. Changes to hydrology are considered unlikely and Origin is committed to a design that maintains pre-development flows from the development area (quantity and quality) into the green and golden bell frog habitat identified in the EPS holding as well as Muddy Lake system. They are therefore not expected to be of any level of significance in relation to threatened species, populations and communities.
Noise	Construction noise may disrupt the roosting and foraging behaviour of fauna species and reduce the occupancy of areas of suitable habitat. With regard to potential impacts on biodiversity, there will be no substantial change to noise impacts given that the BESS will be adjacent to the existing power station and associated infrastructure with existing noise impacts. Any additional impacts resulting from noise emissions are not expected to be of any level of significance in relation to threatened species, populations and communities.
Weed management	Weed species could be inadvertently brought into the Development Footprint with imported materials or could invade naturally through removal of native vegetation. The presence of weed species within the Development Footprint have the potential to decrease the value of proximate extant vegetation. Mitigation measures outlined in Section 4.2 will be implemented to minimise the potential for weed encroachment into areas surrounding the Development Footprint.
Pest animal species	Populations of feral fauna species such as foxes, rabbits and cats can increase and quickly populate new areas as a result of disturbance. Clearing, thinning of vegetation and the creation of tracks have the ability to assist the establishment and spread of feral fauna species. However, given the level of clearing proposed, it is unlikely that fauna species would populate the Development Footprint due to an absence of vegetation. Mitigation measures outlined in Section 4.2 will minimise the potential for feral animal spread and impacts into surrounding areas around the Development Footprint.
Air quality impacts	Air quality impacts have the potential to adversely impact native species during ground disturbance works. Potential impacts include dust covering vegetation thereby potentially reducing vegetation health and growth. The design of the proposal will include inherent measures to minimise the potential for adverse dust impacts.

With regard to potential impacts on biodiversity, there will be little substantial change to water, noise, weed species, pest animal, lighting or air quality related impacts given that the land is already fairly disturbed and is adjacent to existing land uses that are fairly disruptive, including the Power Station, main roads and a fairly busy rail line. While the BESS itself is permanent, construction is a temporary activity. Any additional impact resulting from the Project is not expected to be of any level of significance in relation to threatened species, populations, and communities, given that the Development Footprint will occur in an already disturbed area surrounded by tracks, roads and the existing power station.

5.2 Prescribed Impacts

Prescribed impacts are described in **Section 4.1.2** and an assessment of potential prescribed impacts is provided in **Table 5.3**. No threatened entities are considered likely to be dependent upon or may use habitat features associated with any of the prescribed impacts.

Table 5.3 Prescribed Impacts

Prescribed Impact	Potential for Impact	Justification
Impacts on the habitat of threatened species or ecological communities associated with karst, caves, crevices, cliffs and other geological features of significance, rocks, human-made structures or non-native vegetation	No	Karst, caves, crevices, cliffs and other geological features of significance, rocks or human-made structures that have potential to provide habitat for threatened fauna species are not located within, or in proximity to, the Development Footprint. A 6.2 ha area of non- native vegetation is proposed to be impacted, though the area is not considered to be habitat for any threatened species or ecological communities.
Impacts on the connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range	No	Important connectivity and movement habitat is unlikely to be impacted by the proposed development. While the Development Footprint is largely vegetated, its current disturbed state does not provide any high-quality habitat or substantial movement habitat for terrestrial, arboreal or aquatic threatened species. The Development Footprint's location in the landscape is not conducive for fauna movement given the poor quality of much of the vegetation, and the because the entirety of the Development Footprint is surrounded by tracks, roads and waterways.
Impacts on movement of threatened species that maintains their life cycle	No	The habitat present in the Development Footprint is of low quality due to its small size and relatively disturbed state and is unlikely to be important to the movement of threatened species. It may support the occasional movement of more mobile species such as large forest owls and microbats.
Impacts of development on water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities	No	Changes to hydrology are considered unlikely and Origin is committed to a design that maintains pre-development flows from the development area (quantity and quality) into the green and golden bell frog habitat identified in the EPS holding as well as Muddy Lake system. They are therefore not expected to be of any level of significance in relation to threatened species, populations and communities.
Impacts of wind turbine strikes on protected animals	No	The impacts of wind turbines are not applicable to this proposed development.

Prescribed Impact	Potential for Impact	Justification
Impacts of vehicle strikes on threatened species or on animals that are part of a TEC.	No	While the frequency of vehicular activity into the Development Footprint may be increased, it is not considered likely that this would result in vehicle strikes on threatened species or animals part of a TEC. Once the BESS has been constructed, vehicle movements will be minimal, and there are already frequent vehicular movements along Rocky Point Road.
Uncertain prescribed impacts - unable to be reliably predicted during the assessment process or are infrequent in nature. Associated with caves, cliffs, mine subsidence and wind turbine / increased vehicle strikes	No	Based on the nature and location of the Development Footprint it is unlikely that any uncertain prescribed impacts will occur.

5.3 Serious and Irreversible Impacts

Under the BC Act, a determination of whether an impact is serious and irreversible must be made in accordance with the principles prescribed in the BC Regulation. The principles have been designed to capture those impacts which are likely to contribute significantly to the risk of extinction of a threatened species or ecological community in New South Wales. These are impacts that:

- will cause a further decline of the species or ecological community that is currently observed, estimated, inferred or reasonably suspected to be in a rapid rate of decline, or
- will further reduce the population size of the species or ecological community that is currently observed, estimated, inferred or reasonably suspected to have a very small population size, or
- impact on the habitat of a species or ecological community that is currently observed, estimated, inferred or reasonably suspected to have a very limited geographic distribution, or
- impact on a species or ecological community that is unlikely to respond to measures to improve habitat and vegetation integrity and is therefore irreplaceable.

Eight species-credit species predicted by the BAM calculator for the proposed development are also listed as serious and irreversible impact (SII) entities in the *Guidance to Assist a Decision-Maker to Determine a Serious and Irreversible Impact* (OEH 2017c) (Table 5.4).

Table 5.4 Likelihood of impacts to SAI entities

Species	Reason for Listing	Likelihood of Impact
Flora		
<i>Corunastylis</i> sp. Charmhaven (NSW896673)	The estimated total number of mature individuals of the species is very low. The species is experiencing a high rate of decline. Geographic distribution is very highly restricted.	This species has not been historically recorded within the wider locality and was not recorded within the Development Footprint despite extensive targeted surveys. The Project is not expected to result in a serious and irreversible impact on this species.
variable midge orchid (<i>Genoplesium insigne</i>)	Number of mature individuals is very low. Geographic distribution is very highly restricted.	This species has not been historically recorded within the wider locality and was not recorded within the Development Footprint despite extensive targeted surveys. The Project is not expected to result in a serious and irreversible impact on this species.
Fauna		
regent honeyeater (<i>Anthochaera phrygia</i>)	The species has undergone, is observed, estimated, inferred, or reasonably suspected to have undergone or is likely to undergo a very large reduction in population size.	The Development Footprint does not occur in the area mapped as “important habitat” and the species has not been recorded in the Development Footprint. The Project is not expected to result in a serious and irreversible impact on this species.
large-eared pied bat (<i>Chalinolobus dwyeri</i>)	Species dependent on non-responding attribute (maternity caves). This species is considered unlikely to respond to management.	While the Development Footprint may contain foraging habitat for this species, no breeding habitat is present. Required features for this species include habitat within two kilometres of rocky areas containing caves, overhangs, escarpments, outcrops, or crevices, or within two kilometres of old mines or tunnels (DPIE 2021a). The Project is not expected to result in a serious and irreversible impact on this species.
swift parrot (<i>Lathamus discolor</i>)	Numbers have been reduced to such a critical level and habitats have been so drastically reduced that the species is in immediate danger of extinction.	The Development Footprint occurs in the area mapped as important habitat. As such an assessment of this species against the SAI principles is required and included below.
little bent-winged bat (<i>Miniopterus australis</i>)	The species is dependent on non-responding attribute (breeding habitat only). This species is considered unlikely to respond to management.	While the Development Footprint may contain foraging habitat for this species, no rocky areas supporting breeding habitat are present. Required features for this species include caves, tunnels, mines, culverts, or other structures known or suspected to be used for breeding (DPIE 2021a). The Project is not expected to result in a serious and irreversible impact on this species.

Species	Reason for Listing	Likelihood of Impact
large bent-winged bat (<i>Miniopterus orianae oceanensis</i>)	The species is dependent on non-responding attribute (breeding habitat only). This species is considered unlikely to respond to management.	While the Development Footprint may contain foraging habitat for this species, no rocky areas supporting breeding habitat are present. Required features for this species include caves, tunnels, mines, culverts, or other structures known or suspected to be used for breeding (DPIE 2021a). The Project is not expected to result in a serious and irreversible impact on this species.
brush-tailed rock-wallaby (<i>Petrogale penicillata</i>)	Species dependent on non-responding attribute (rocky habitat).	This species has not been historically recorded within the wider locality and was not recorded within the Development Footprint despite extensive surveys. Suitable habitat, land within 1 km of rocky escarpments, gorges, steep slopes, boulder piles, rock outcrops or cliff lines (DPIE 2021a), is not present within the Development Footprint. The Project is not expected to result in a serious and irreversible impact on this species.

For all candidate species, other than the swift parrot, the Project is not expected to have an impact that is serious and irreversible and further assessment against the principles is not required. Further assessment of the swift parrot against the principles of SAI species is provided below.

5.3.1 Swift Parrot SAI Assessment (S9.1 BAM 2020)

An impact is to be regarded as serious and irreversible if it is likely to contribute significantly to the risk of a threatened species or ecological community becoming extinct if:

- It will cause a further decline of the species or ecological community that is currently observed, estimated, inferred or reasonably suspected to be in a rapid rate of decline, or
- It will further reduce the population size of the species or ecological community that is currently observed, estimated, inferred or reasonably suspected to have a very small population size, or
- The impact on the habitat of a species or ecological community that is currently observed, estimated, inferred or reasonably suspected to have a very limited geographic distribution, or
- The impact on a species or ecological community that is unlikely to respond to measures to improve habitat and vegetation integrity and is therefore irreplaceable.

In relation to the swift parrot, none of the principles above are considered likely to occur as a result of the proposed project. Notwithstanding, an assessment in accordance with Section 9.1.2 of the BAM is provided in **Table 5.5** and **Table 5.6** below.

Table 5.5 SAIL Assessment – Current Population Status

Criteria	Assessment
Evidence of rapid decline (Principle 1, clause 6.7(2)(a) BC Regulation) presented by an estimate of the:	
Decline in population of the species in NSW in the past 10 years or three generations (whichever is longer), or	While this species is currently estimated as having a population size of between 750 and 300 individuals in Australia (Birdlife Australia 2021), it is not considered likely that the removal of approximately 3.1 ha of potential foraging habitat would cause a further decline in the species or reduce its population size. Estimating the population size of this species in NSW is not possible due to its migratory nature and yearly fluctuations.
Decline in population of the species in NSW in the past 10 years or three generations (whichever is longer) as indicated by: an index of abundance appropriate to the species; decline in geographic distribution and/or habitat quality; exploitation; effect of introduced species, hybridisation, pathogens, pollutants, competitors or parasites.	Estimating the population size of this species in NSW is not possible due to its migratory nature and annual fluctuations to dispersal. It is likely that breeding habitat quality has declined in Tasmania, resulting in a population decline (Birdlife Australia 2015), which is not applicable to this assessment.
Evidence of small population size (Principle 2, clause 6.7(2)(b) BC Regulation) presented by:	
An estimate of the species' current population size in NSW,	Estimating the population size of this species in NSW is not possible due to its migratory nature and annual fluctuations to dispersal. However, the species reportedly contains between 300 and 750 individuals in Australia (Birdlife Australia 2021).
An estimate of the decline in the species' population size in NSW in three years or one generation (whichever is longer), and	Estimating the population size of this species in NSW is not possible due to its migratory nature and annual fluctuations to dispersal. However, it is estimated that ten years ago, there were 2000 mature individuals of this species were breeding in Tasmania (Tasmanian Greens, 2020). Therefore, it is likely that the species' population has declined over the previous decade, however this is likely to be attributed to a range of factors over a very wide geographic distribution.
Where such data is available, an estimate of the number of mature individuals in each subpopulation, or the percentage of mature individuals in each subpopulation, or whether the species is likely to undergo extreme fluctuations	The species is not considered to contain subpopulations because the entire species migrates from Tasmania to the mainland each winter and returns again. Therefore, identifying individual populations is not possible.
Evidence of limited geographic range for the threatened species (Principle 3, clause 6.7(2)(c) BC Regulation) presented by:	
Extent of occurrence	This species is highly mobile and migrates from Tasmania to the mainland each year (DPIE 2021b), and therefore does not have a limited geographic range.

Criteria	Assessment
Area of occupancy	<p>The species breeds in Tasmania during spring and summer, migrating in the autumn and winter months to south-eastern Australia from Victoria and the eastern parts of South Australia to south-east Queensland. In NSW it mostly occurs on the coast and south west slopes (DPIE 2021b).</p> <p>The species is present in northern NSW for a shorter period than in southern NSW (DPIE 2021b). Therefore, it is more likely that the removal of preferred feed trees in southern NSW would cause this species to be at risk of SAIL, rather than the removal of a small area of PCT 1636 within the Development Footprint. None of the favoured feed trees listed in the TBDC for this species occur within the Development Footprint.</p>
Number of threat-defined locations (geographically or ecologically distinct areas in which a single threatening event may rapidly affect all species occurrences), and	Not applicable to this species.
Whether the species' population is likely to undergo extreme fluctuations	The population of this species is not likely to undergo extreme fluctuations, as it is not typically a 'boom and bust' species subject to major fluctuations in the availability of resources. Even if a 'boom' of winter-flowering trees occurred in NSW, this is unlikely to cause an extreme fluctuation of this species, because this would be occurring when the species is not breeding, and therefore will not affect the rate at which the species can produce young and increase the population.
Evidence that the species is unlikely to respond to management (Principle 4, clause 6.7(2)(d) BC Regulation) because:	
Known reproductive characteristics severely limit the ability to increase the existing population on, or occupy new habitat (e.g., species is clonal) on, a biodiversity stewardship site	This species does not have reproductive characteristics that severely limit its ability to increase in population size or occupy new habitat. While the species is reliant on old-growth forest in Tasmania for breeding, this is not applicable to this assessment.
The species is reliant on abiotic habitats which cannot be restored or replaced (e.g., karst systems) on a biodiversity stewardship site, or	This species is not reliant on abiotic habitats.
Life history traits and/or ecology is known but the ability to control key threatening processes at a biodiversity stewardship site is currently negligible (e.g., frogs severely impacted by chytrid fungus).	This species does not have life history traits whereby the ability to control key threatening processes is negligible.

Table 5.6 SAIL Assessment – Impact Assessment

In relation to the impacts from the proposal on the species at risk of an SAIL, the assessor must include data and information on:	
The impact on the species' population (Principles 1 and 2) presented by:	
i. an estimate of the number of individuals (mature and immature) present in the subpopulation on the subject land (the site may intersect or encompass the subpopulation) and as a percentage of the total NSW population, and	No individuals are present in the Development Footprint. This species was not detected during surveys and is being assessed for important mapped habitat only.
ii. an estimate of the number of individuals (mature and immature) to be impacted by the proposal and as a percentage of the total NSW population, or	No individuals are present in the Development Footprint. This species was not detected during surveys and is being assessed for important mapped habitat only.
iii. if the species' unit of measure is area, provide data on the number of individuals on the site, and the estimated number that will be impacted, along with the area of habitat to be impacted by the proposal	No individuals are present in the Development Footprint. This species was not detected during surveys and is being assessed for important mapped habitat only. 3.1 ha of important mapped habitat occurs in the Development Footprint.
Impact on geographic range (Principles 1 and 3) presented by:	
i. the area of the species' geographic range to be impacted by the proposal in ha, and a percentage of the total AOO, or EOO within NSW	Information regarding AOO or EOO is not available, due to the migratory nature of the species and its sporadic occurrence across NSW during migration. This species occupies breeding habitat in Tasmania, but also migrates into Victoria and NSW, therefore the proposed removal of 3.1 ha of habitat is negligible to this large area.
ii. the impact on the subpopulation as either: all individuals will be impacted (subpopulation eliminated); OR impact will affect some individuals and habitat; OR impact will affect some habitat, but no individuals of the species will be directly impacted	3.1 ha of important mapped habitat occurs in the Development Footprint, but no individuals of the species will be directly impacted.
iii. to determine if the persisting subpopulation that is fragmented will remain viable, estimate (based on published and unpublished sources such as scientific publications, technical reports, databases or documented field observations) the habitat area required to support the remaining population, and habitat available within dispersal distance, and distance over which genetic exchange can occur (e.g., seed dispersal) and pollination distance for the species	A subpopulation is not considered to be present. Given that the species is highly mobile and migrates over large distances (i.e., from Tasmania to northern NSW). Therefore, the removal of 3.1 ha of important mapped habitat is unlikely to impact upon the viability of any individuals that may forage within the Development Footprint. Genetic exchange is likely to remain unaffected due to the highly mobile nature of the species.
iv. to determine changes in threats affecting remaining subpopulations and habitat if the proposed impact proceeds, estimate changes in environmental factors including changes to fire regimes (frequency, severity); hydrology, pollutants; species interactions (increased competition and effects on pollinators or dispersal); fragmentation, increased edge effects, likelihood of disturbance; and disease, pathogens and parasites. Where these factors have been considered elsewhere in relation to the target species, the assessor may refer to the relevant sections of the BDAR or BCAR.	A subpopulation is not considered to be present. However, the removal of 3.1 ha of important mapped habitat is unlikely to change any potential threats for this highly mobile species. The proposal is not likely to change fire regimes, hydrology, pollutants, species interactions, fragmentation, edge effects, likelihood of disturbance, disease, pathogens and parasites. Most of the aforementioned threats are not applicable to the swift parrot, and things such as fragmentation and increased edge effects are highly unlikely to impact upon any locally occurring individuals of this species. Refer to Section 4.2 for minimisation and avoidance measures.

The vegetation currently mapped in the Development Footprint as swift parrot important habitat consists of PCT 1636 Scribbly Gum - Red Bloodwood - *Angophora inopina* heathy woodland on lowlands of the Central Coast in a moderate condition. This habitat on site is unlikely to be regularly relied upon by any population of swift parrot that may occur in the locality, especially considering that scribbly gum (*Eucalyptus haemastoma*), smooth-barked apple (*Angophora costata*), red bloodwood (*Corymbia gummifera*) and brown stringybark (*Eucalyptus capitellata*) are not typically winter-flowering species. It is unlikely that this small area of habitat would be relied upon year after year by the swift parrot as a foraging resource, and this is especially true given that the species has only been recorded once on the EPS landholdings in 2011 (DPIE 2021a), despite regular ecological surveys by Umwelt and other consultants within the landholdings prior to and since that time. This species also does not breed in NSW, so the removal of any potential nest sites, and therefore causing further population decline in a short period, is not applicable to this assessment.

Furthermore, given that the Project is avoiding 14.1 ha of swamp sclerophyll forest EEC, which typically includes the winter-flowering feed tree swamp mahogany (*Eucalyptus robusta*), known to provide resources for the swift parrot, it is unlikely that the removal of 3.1 ha of marginal habitat would be significant to the survival of the swift parrot, or impede its recovery.

5.4 Impacts to Matters of National Environmental Significance

A referral was submitted to the Department on 28 May 2021 regarding the above matters. A “Not a Controlled Action” if taken “In a Particular Manner” (NCA-PM) decision was made by the Minister. The decision and supporting biodiversity information provided with the Referral is provided in **Appendix G**.

Matters of National Environmental Significance (MNES) are those that are listed under the Commonwealth EPBC Act. Two species listed under the EPBC Act, small-flower grevillea (*Grevillea parviflora* subsp. *parviflora*) and black-eyed Susan (*Tetradlea juncea*) are present within the Development Footprint and will be impacted by the project. Impacts to the 42 individual stems of small-flower grevillea and one individual of black-eyed Susan in the Development Footprint are not anticipated to be significant to the local populations of these species. Residual impacts on these species will be offset in accordance with the BC Act and the Bilateral Agreement in a like for like manner.

The NCA -PM provides controlling provisions for works in relation to water management which specifically address the potential for indirect impacts of the project on the Green and Golden Bell Frog. These include:

- Design and implement erosion and sediment control measures and water management infrastructure in accordance with the best management practices specified in Managing Urban stormwater – Soils and Construction to prevent loss of soil and the entry of sediment into any receiving waters.
- Undertake visual assessment of surface water runoff structures, drainage structures and erosion control structures at least once every week and also following any heavy rain during construction, until such time as permanent drainage is established and functioning to prevent sediment laden run-off to ensure all water structures are operating effectively for their designed purpose, and decommissioning stages; and promptly address any deficiency in their operation by clearing sediment traps of sediment, storing and/or disposing of sediment (if required) in accordance with Managing Urban Stormwater – Soils and Construction; and repairing any damaged structures immediately after the damage is identified.
- Ensure that the quality of all water associated with the proposed action leaving the area designated as the ‘Project area’ meets the following performance criteria:
 - Total Suspended Solids: less than 50mg/L (using appropriate real-time turbidity levels);

- pH: Between 6.5 and 8.5 and;
- No hydrocarbon or any other chemical contaminants exceeding the relevant triggering levels set out in the ANZG (2018) and Heads of EPAs Australia and New Zealand (HEPA) (2018) guidelines.
- Undertake routine monitoring, at least fortnightly during the construction and decommissioning stages and, until such time as permanent drainage are demonstrated to be functioning and non-polluting, capable of detecting whether the requirements of condition 3 are being met. Following completion of construction, biannual surveillance monitoring and sampling to confirm permanent drainage achieves the requirements of Condition 3. All water monitoring records must be retained and made publicly accessible.
- Not use any flocculants that are harmful to amphibians. Records must be kept of any flocculant use and be made available to the Department, upon request.
- Implement hygiene protocols in accordance with the SAVING OUR SPECIES Hygiene guidelines.

One individual green and golden bell frog was detected within the EPS holding by Umwelt in January 2021, with follow up surveys in March 2021 detecting a further seven individuals from a small swamp (3000 m²) approximately 200 metres from the Project area. This swamp is likely to be an extension to the Muddy Lake habitat though it is unclear, at this stage, whether this new location is a permanent breeding habitat resource for this species, or the individuals recorded are simply dispersing. While this small area of potential breeding habitat identified in the EPS holdings is not located within the Project area, it is proximate and potentially susceptible to any changes to water flow or quality.

The Project has the potential to impact an important population of the green and golden bell frog, though it is considered unlikely. The Project is unlikely to directly impact the species, or its habitat and indirect impacts will be prevented through design and controls listed above.

With consideration of the controls referred to in **Section 4.2** and the plausibility of managing potential indirect impact, i.e., no changes to surface water (flow or quality) and managing further spread of chytrid fungus, the Project is considered unlikely to have any significant impacts upon the green and golden bell frog important population.

While swift parrot important habitat mapping is present in the development footprint, this species is considered unlikely to occur. Any occurrence would be foraging individuals and impacts are not considered to be significant to this species (refer to **Section 5.3.1**).

Avoidance and mitigation measures associated with minimising the impacts of any direct or indirect impacts are discussed in **Section 4.0** above.

5.5 Aquatic Impacts

Aquatic habitats within the Development Footprint consist of boggy areas that are wet following rain, as well as a likely man-made waterway in the north. The potential impacts on water quality are anticipated to be limited, given the nature and scale of the construction works and the low quality of aquatic habitats.

Standard environmental management measures will be implemented and are expected to sufficiently manage any impacts. Water and erosion management controls will be employed to minimise erosion and discharge of sediment and other pollutants during construction.

6.0 Biodiversity Credit Impact Summary

6.1 Impacts Not Requiring Assessment

Under Section 10.1 of the BAM, impacts to areas of land without native vegetation do not require further assessment. The Development Footprint contains 3.5 ha of disturbed land. These areas do not require assessment under the BAM and do not require Offsetting.

Figure 6.1 shows the disturbed areas within the Development Footprint that do not require assessment in accordance with Section 10.1 of the BAM.

6.2 Impacts Requiring Offsets

Impacts on native vegetation not requiring offsets under the BAM include native vegetation that has a vegetation integrity score of less than 20 (where it is not associated with ecosystem-credit species habitat or a TEC), less than 17 (where it is associated with ecosystem-credit habitat or a VEC) or less than 15 (where it is representative of an EEC or CEEC).

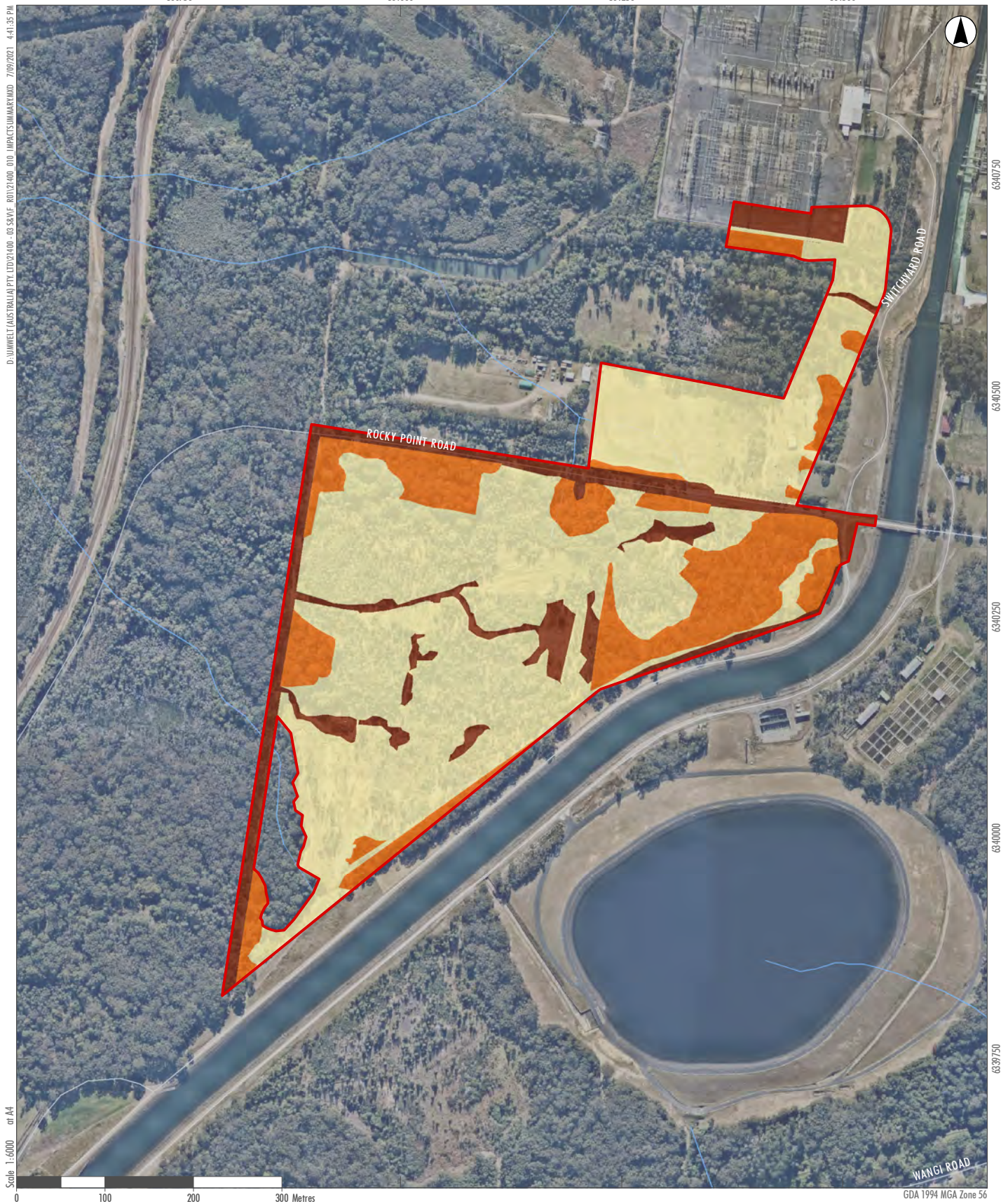
All PCTs have a vegetation integrity score of higher than 17 (refer to **Table 3.2**). Therefore, offsetting under the BAM is required. Species- credit species present within the Development Footprint also require offsetting. **Table 6.1** and **Figure 6.1** summarises this outcome.

Table 6.1 Impacts Requiring Offset

Veg Zone	PCT/Species-credit species	Vegetation Integrity Score			Area (ha)	Credits Required
		Current	Future	Change		
1	1636 Scribbly Gum - Red Bloodwood - <i>Angophora inopina</i> heathy woodland on lowlands of the Central Coast <i>moderate condition</i>	55.1	0	-55.1	4.6	111
2	1716 Prickly-leaved Paperbark Forest on coastal lowlands of the Central Coast and Lower North Coast <i>low condition</i>	53.5	0	-53.5	0.3	8
-	Swift parrot (<i>Lathamus discolor</i>)	-	-	-	3.1	128
-	Squirrel glider (<i>Petaurus norfolcensis</i>)	-	-	-	4.9	135
-	Small- flower grevillea (<i>Grevillea parviflora</i> subsp. <i>parviflora</i>)	-	-	-	0.2	6
-	Black- eyed Susan (<i>Tetradlea juncea</i>)	-	-	-	0.2	6
Total						394

6.3 Impacts Not Requiring Offset

The 10.2 ha of planted native vegetation do not require offsetting in accordance with Appendix D of the BAM (DPIE 2020a). Similarly, the 6.4 ha of exotic vegetation within the Development Footprint does not require offsetting in accordance with the BAM (DPIE 2020a). Refer to **Figure 6.1**.



- Legend
- Development Footprint
 - Impacts requiring offset
 - Impacts not requiring assessment
 - Impacts not requiring offset

FIGURE 6.1

Impact Summary

7.0 Biodiversity Credit Report

A full Biodiversity Credit Report is included in **Appendix E**.

A summary of the key outcomes is provided in **Table 7.1**.

Table 7.1 Credits Required to Offset the Proposed Development

PCT/Species-credit	Credits Required
Ecosystem Credits	
1636 Scribbly Gum - Red Bloodwood - <i>Angophora inopina</i> heathy woodland on lowlands of the Central Coast <i>moderate condition</i>	111
1716 Prickly-leaved Paperbark Forest on coastal lowlands of the Central Coast and Lower North Coast <i>low condition</i>	8
Swift parrot (<i>Lathamus discolor</i>)	128
Squirrel glider (<i>Petaurus norfolcensis</i>)	135
Small- flower grevillea (<i>Grevillea parviflora</i> subsp. <i>parviflora</i>)	6
Black- eyed Susan (<i>Tetralthea juncea</i>)	6
Total	394

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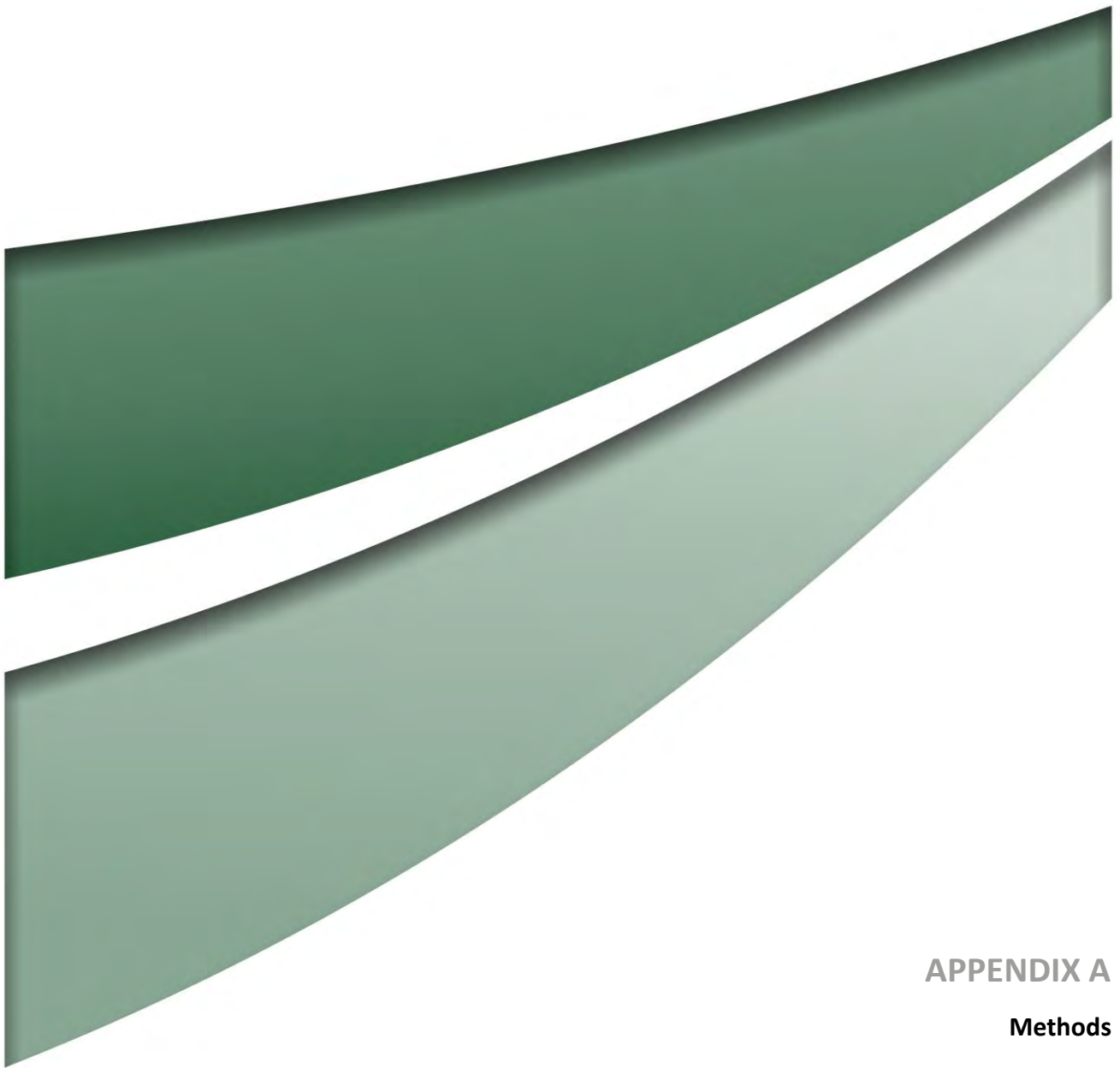
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APPENDIX A

Methods

A1 Methods

A1.1 Landscape Features and Site Context

Landscape features such as IBRA bioregions, IBRA subregions and NSW Mitchell Landscape regions, native vegetation extent within a 1500m buffer area, cleared areas, rivers, streams, wetlands and connectivity features were identified within the Development Footprint where appropriate in accordance with Section 3.1 of the BAM (DPIE 2020a).

Determining the 'Site Context' of the Development Footprint is calculated by assessing the native vegetation cover and patch size within the Development Footprint in accordance with Section 3.2 of the BAM (DPIE 2020a).

A1.2 Native Vegetation Assessment

A1.2.1 Literature and Database Review

A review of previous documents and reports relevant to the Proposed Development was undertaken. The information obtained was used to inform survey design and was also used to assist in the assessment of potentially occurring threatened and migratory species, endangered populations (EPs) and TECs.

Relevant documents included:

- VIS Classification Database (DPIE 2021c), last accessed September 2021
- DAWE Protected Matters Search Tool for known/predicted EPBC Act-listed TECs, last accessed September 2021

A1.2.2 Floristic and Vegetation Integrity Survey

Floristic and vegetation integrity surveys were undertaken on 4 May 2021. One plot was also conducted in the Development Footprint on 18 November 2020 as part of the constraints assessment conducted on EPS landholdings. This constraints assessment involved a total of 12 floristic plots undertaken in November 2020 and January 2021.

A total of seven BAM plots were conducted within the Development Footprint during the surveys undertaken for this assessment, bringing the total to eight (refer to **Figure 2.1**). Floristic and vegetation integrity data was collected in accordance with the minimum requirements under the BAM (DPIE 2020a).

At each floristic and vegetation integrity plot, data was recorded according to Section 5 of the BAM (OEH 2017a). This involved setting out 20 x 50 m, 20 x 20 m and 1 x 1m plots. The location of each 20 x 50 m plot was recorded using a hand-held GPS with accuracy of ± 5 m. The Map Grid of Australia (MGA) coordinate system was used.

At each plot/transect, roughly 45 to 60 minutes was spent searching for all vascular flora species present within the 20 x 20 m plot. Searches of each 20 x 20 m plot were generally undertaken through parallel transects from one side of the plot to another. Most effort was spent on examining the groundcover, which usually supported well over half of the species present, however the composition of any shrub, mid-storey, canopy and emergent layers were also thoroughly examined.

Semi-quantitative rapid assessments were undertaken at five locations (refer to **Figure 2.1**). At each location the dominant species in each stratum were recorded to assist in vegetation mapping and PCT allocation.

Table A.1 outlines the floristic survey effort in the Development Footprint.

Table A.1 Adequacy of Floristic and Vegetation Integrity Survey

Veg. Zone	Plant Community Type (PCT) <i>Condition Class</i>	Area in the Development Footprint (ha)	Number of Floristic and Vegetation Integrity Plots		Rapid Assessment
			Required	Completed	
1	1636 Scribbly Gum - Red Bloodwood - <i>Angophora inopina</i> heathy woodland on lowlands of the Central Coast <i>moderate condition</i>	4.6	3	3	3
2	1716 Prickly-leaved Paperbark forest on coastal lowlands of the Central Coast and Lower North Coast <i>low condition</i>	0.3	1	2	0
3	Planted native vegetation	10.2	0	3	4
-	Exotic vegetation	6.4	0	0	3
-	Disturbed/cleared	3.5	0	0	0
TOTAL		25.0	4	8	10

A1.2.3 Targeted Threatened Species Searches

Targeted threatened species transects were walked across the entirety of the Development Footprint by Umwelt Ecologists during November 2020, and January, May June and September 2021. These transects were conducted generally in accordance with the *NSW Guide to Surveying Threatened Plants* (OEH 2016) and were walked ten to twenty metres apart where possible, whereby the observer was continually scanning left and right to search for threatened flora species.

A1.2.4 Meandering Transects

Meandering transects were also walked across the area in between the collection of floristic plots, or for the deployment or collection of remote cameras. Opportunistic sampling of vegetation was undertaken along these transects, particularly searches for threatened and otherwise significant species, endangered populations and TECs. Records along transects supplemented floristic sampling carried out in plots, however, the data collected are in the form of presence records, rather than semi-quantitative cover abundance scores.

Meandering transects provided information on spatial patterns of vegetation that informed vegetation community mapping of the Development Footprint.

A1.2.5 Digital Aerial Photograph Interpretation

Digital imagery (aerial photographs) of the Development Footprint was viewed prior to and after vegetation survey to identify spatial patterns in vegetation, land use and landscape features. These informed field survey design and implementation, ecological assessment and vegetation community mapping of the Development Footprint. Mapping was undertaken using the Manifold System 8.0 GIS and ESRI ArcMap 10.6.

A1.2.6 Plant Identification and Nomenclature Standards

All vascular plants recorded or collected within plots and on meandering transects were identified using keys and nomenclature in Harden (1992, 1993, 2000 and 2002). Where known, changes to nomenclature and classification have been incorporated into the results. Updated taxonomy has been derived from PlantNET (Botanic Gardens Trust 2020).

Common names follow Harden (1992, 1993, 2000 and 2002) where available, and draw on other sources such as local names where these references do not provide a common name.

A1.2.7 Vegetation Mapping

Vegetation mapping was undertaken using best-practice techniques to delineate vegetation communities across the Development Footprint. Vegetation mapping involved the following key steps:

- preliminary review of digital aerial imagery to explore vegetation distribution patterns as dictated by change in canopy texture, tone and colour, as well as topography
- predicting the distribution of particular vegetation communities based on understanding the distribution of PCTs (DPIE 2021c) and previous mapping undertaken in the area (Bell 2007).
- ground-truthing of the vegetation map based on survey effort
- revision of vegetation community floristic delineations based on plot data, and
- revision of the vegetation map based on ground-truthing.

Vegetation communities were delineated through the identification of repeating patterns of plant species assemblages in each of the identified strata.

A1.2.8 Threatened Ecological Community Delineation Techniques

Where applicable, vegetation communities identified in the Development Footprint were compared to TECs listed under the Commonwealth EPBC Act and NSW BC Act and an assessment of similarity with the NSW Scientific Committee Final Determinations and the Commonwealth Threatened Species Scientific Committee Listing and Conservation Advice. The following approach was used:

- full-floristic plot assessments and meandering surveys to determine floristic composition and structure of each ecological community
- comparison with published species lists, including lists of ‘important species’ as identified on the listing advice provided by the NSW Scientific Committee and/or Commonwealth Threatened Species Scientific Committee

- comparison with habitat descriptions and distributions for listed TECs
- assessment using guidelines and recovery plans published by the Commonwealth Department of Environment and Energy (DoEE) and the NSW OEH
- comparison with other assessments of TECs in the region.

A1.2.9 Plant Community Type (PCT) Allocation

Each of the vegetation communities described within the Development Footprint were aligned with an equivalent PCT as detailed in the VIS Classification Database (DPIE 2021c). For each vegetation community described in the Development Footprint, the dominant and characteristic species were entered into the online plant community identification tab and an initial list of PCTs was generated. The profiles for each of the possible PCTs were then interrogated and the most appropriate match assigned based on floristic, structure, soil, landform and distribution details.

Further detail regarding this allocation for individual PCT is outlined in **Section 3.2.1**.

A1.3 Threatened Species

A1.3.1 Literature and Database Review

A review of previous documents and reports relevant to the proposed development was undertaken. This included relevant ecological database searches. The information obtained was used to inform survey design where required and was also used to assist in the assessment of potentially occurring ecosystem-credit and species-credit species. Relevant documents and resources included:

- BioNet Atlas of NSW Wildlife database and mapping tool (DPIE 2021a), last accessed September 2021.
- Threatened Biodiversity Data Collection (DPIE 2021b) for known/predicted threatened species in the Wyong IBRA subregion, last accessed September 2021.
- PlantNET (Botanic Gardens Trust) database search for threatened plants within a 10 km radius from the Development Footprint, last accessed September 2021.
- DAWE Protected Matters Search Tool (DAWE 2021) for known/predicted EPBC Act-listed species, last accessed September 2021.

A preliminary assessment using the TBDC was undertaken which provided a list of species-credit species that might require survey and the suitable survey periods for each species. The results of these database searches, literature review and TBDC review were used to design the appropriate survey requirements for species-credit species.

A1.3.2 Ecosystem-credit Species

Ecosystem-credit species are those threatened species that can be predicted by vegetation surrogates and landscape features. Ecosystem-credit species are not required to be specifically targeted during field surveys, however an assessment of the suitability of habitat in the Development Footprint is undertaken to determine the species presence or otherwise in the vegetation zones identified.

Appendix D outlines the ecosystem credit species predicted by the BAM calculator or identified in the literature review.

A1.3.3 Species-credit Species

Targeted and opportunistic surveys for species-credit species were undertaken across the Development Footprint during flora surveys. **Table A.2** below outlines the dates, methods and species targeted during the surveys.

Appendix D outlines the species-credit species predicted by the BAM calculator or identified in the literature review, and the targeted survey effort undertaken in accordance with BAM survey requirements.

Appendix D also notes where species-credit species were not considered to require further survey in accordance with Section 5 of the BAM (DPIE 2020a).

Species-credit surveys considered the following survey guidelines:

- *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities – Working Draft* (DEC 2004)
- *Surveying Threatened Plants and Their Habitats* (DPIE 2020b)
- *Draft Survey Guidelines for Australia's Threatened Orchids* (DoEE 2013)
- *'Species credit threatened bats and their habitats'* (OEH 2018)
- *Hygiene protocol for the control of disease in frogs* (DECC 2008).
- *NSW Survey Guideline for Threatened Frogs* (DPIE 2020c)

Table A.2 Species credit species survey methodology and timing

Survey Date	Method	Species Targeted
16/11/2020 to 20/11/2020	BAM flora plots Targeted searches for threatened flora species	<p>Bynoe's wattle (<i>Acacia bynoeana</i>)</p> <p>Charmhaven apple (<i>Angophora inopina</i>)</p> <p>Thick-leaf star-hair (<i>Astrotricha crassifolia</i>)</p> <p>Netted bottlebrush (<i>Callistemon linearifolius</i>)</p> <p><i>Corunastylis</i> sp. Charmhaven</p> <p>Leafless tongue orchid (<i>Cryptostylis hunteriana</i>)</p> <p>Camfield's stringybark (<i>Eucalyptus camfieldii</i>)</p> <p><i>Eucalyptus parramattensis</i> subsp. <i>decadens</i></p> <p><i>Eucalyptus parramattensis</i> subsp. <i>parramattensis</i> endangered population</p> <p>Small- flower grevillea (<i>Grevillea parviflora</i> subsp. <i>parviflora</i>)</p> <p><i>Maundia triglochinoides</i></p> <p>Biconvex paperbark (<i>Melaleuca biconvexa</i>)</p> <p>Grove's paperbark (<i>Melaleuca groveana</i>)</p> <p>Heath wrinklewort (<i>Rutidosis heterogama</i>)</p> <p>Black- eyed susan (<i>Tetradlea juncea</i>)</p> <p><i>Tetradlea glandulosa</i></p>
16/11/2020 to 20/11/2020	Habitat assessments Nocturnal spotlighting Call playback for threatened frogs Searches for stick- nests and active hollows	<p>Bush- stone curlew (<i>Burhinus grallarius</i>)</p> <p>Gang-gang cockatoo (<i>Callocephalon fimbriatum</i>)</p> <p>Wallum froglet (<i>Crinia tinnula</i>)</p> <p>white-bellied sea-eagle (<i>Haliaeetus leucogaster</i>)</p> <p>little eagle (<i>Hieraaetus morphnoides</i>)</p> <p>pale-headed snake (<i>Hoplocephalus bitorquatus</i>)</p> <p>square-tailed kite (<i>Lophoictinia isura</i>)</p> <p>green and golden bell frog (<i>Litoria aurea</i>)</p> <p>little bentwing-bat (<i>Miniopterus australis</i>)</p> <p>eastern bentwing-bat (<i>Miniopterus oceanensis schreibersii</i>)</p> <p>eastern osprey (<i>Pandion cristatus</i>)</p> <p>greater glider (<i>Petauroides Volans</i>)</p> <p>squirrel glider (<i>Petaurus norfolcensis</i>)</p> <p>brush-tailed phascogale (<i>Phascogale tapoatafa</i>)</p> <p>koala (<i>Phascolarctos cinereus</i>)</p> <p>grey-headed flying-fox (<i>Pteropus poliocephalus</i>)</p>

Survey Date	Method	Species Targeted
12/01/2021 to 14/01/2021	Targeted searches for threatened flora species	Bynoe's wattle (<i>Acacia bynoeana</i>) Charmhaven apple (<i>Angophora inopina</i>) Netted bottlebrush (<i>Callistemon linearifolius</i>) <i>Corunastylis</i> sp. Charmhaven Leafless tongue orchid (<i>Cryptostylis hunteriana</i>) Camfield's stringybark (<i>Eucalyptus camfieldii</i>) <i>Eucalyptus parramattensis</i> subsp. <i>decadens</i> <i>Eucalyptus parramattensis</i> subsp. <i>parramattensis</i> endangered population <i>Maundia triglochinosoides</i> Biconvex paperbark (<i>Melaleuca biconvexa</i>) Grove's paperbark (<i>Melaleuca groveana</i>) Tall knotweed (<i>Persicaria elatior</i>) Heath wrinklewort (<i>Rutidosis heterogama</i>)
12/01/2021 to 14/01/2021	Habitat assessments Nocturnal spotlighting Call playback for threatened frogs Searches for stick- nests and active hollows	Bush- stone curlew (<i>Burhinus grallarius</i>) Gang-gang cockatoo (<i>Callocephalon fimbriatum</i>) Wallum froglet (<i>Crinia tinnula</i>) little eagle (<i>Hieraaetus morphnoides</i>) pale-headed snake (<i>Hoplocephalus bitorquatus</i>) square-tailed kite (<i>Lophoictinia isura</i>) green and golden bell frog (<i>Litoria aurea</i>) giant dragonfly (<i>Petalura gigantea</i>) greater glider (<i>Petauroides Volans</i>) squirrel glider (<i>Petaurus norfolcensis</i>) brush-tailed phascogale (<i>Phascogale tapoatafa</i>) koala (<i>Phascolarctos cinereus</i>) grey-headed flying-fox (<i>Pteropus poliocephalus</i>)
8/03/2021 to 11/03/2021	Nocturnal spotlighting Targeted searches and call-playback for threatened frogs	bush stone-curlew (<i>Burhinus grallarius</i>) Wallum froglet (<i>Crinia tinnula</i>) green and golden bell frog (<i>Litoria aurea</i>) greater glider (<i>Petauroides Volans</i>) squirrel glider (<i>Petaurus norfolcensis</i>) brush-tailed phascogale (<i>Phascogale tapoatafa</i>) pale-headed snake (<i>Hoplocephalus bitorquatus</i>) grey-headed flying-fox (<i>Pteropus poliocephalus</i>) koala (<i>Phascolarctos cinereus</i>)
4/05/2021	BAM flora plots Installation of remote cameras (580 trap nights) Opportunistic searches for large stick nests and active hollows Opportunistic searches for threatened flora	Glossy black- cockatoo (<i>Calyptorhynchus lathami</i>) Eastern pygmy- possum (<i>Cercartetus nanus</i>) little eagle (<i>Hieraaetus morphnoides</i>) eastern osprey (<i>Pandion cristatus</i>) greater glider (<i>Petauroides Volans</i>) squirrel glider (<i>Petaurus norfolcensis</i>) brush-tailed phascogale (<i>Phascogale tapoatafa</i>) koala (<i>Phascolarctos cinereus</i>)

Survey Date	Method	Species Targeted
31/05/2021 to 3/06/2021	Targeted searches for threatened flora	Bynoe's wattle (<i>Acacia bynoeana</i>) Charmhaven apple (<i>Angophora inopina</i>) Camfield's stringybark (<i>Eucalyptus camfieldii</i>) Red helmet orchid (<i>Corybas dowlingii</i>) <i>Eucalyptus parramattensis</i> subsp. <i>decadens</i> <i>Eucalyptus parramattensis</i> subsp. <i>parramattensis</i> endangered population Biconvex paperbark (<i>Melaleuca biconvexa</i>) Grove's paperbark (<i>Melaleuca groveana</i>) Heath wrinklewort (<i>Rutidosia heterogama</i>)
01/06/2021	Collection of remote cameras (20 cameras over 29 nights equating to 580 trap nights)	Eastern pygmy- possum (<i>Cercartetus nanus</i>) greater glider (<i>Petauroides Volans</i>) squirrel glider (<i>Petaurus norfolcensis</i>) brush-tailed phascogale (<i>Phascogale tapoatafa</i>) koala (<i>Phascolarctos cinereus</i>)
31/05/2021 to 3/06/2021	Nocturnal spotlighting and call-playback for threatened owl species Stag-watching and searches for active hollows by threatened owl species Nocturnal spotlighting and call-playback for bush- stone curlew Targeted searches for large stick nests and active hollows	Barking owl (<i>Ninox connivens</i>) Powerful owl (<i>Ninox strenua</i>) Masked owl (<i>Tyto novaehollandiae</i>) bush stone-curlew (<i>Burhinus grallarius</i>) Glossy black- cockatoo (<i>Calyptorhynchus lathami</i>) eastern osprey (<i>Pandion cristatus</i>) greater glider (<i>Petauroides Volans</i>) squirrel glider (<i>Petaurus norfolcensis</i>) brush-tailed phascogale (<i>Phascogale tapoatafa</i>) koala (<i>Phascolarctos cinereus</i>)
15/09/2021 to 16/09/2021	Targeted searches for threatened flora Targeted searches for large stick nests	Heath wrinklewort (<i>Rutidosia heterogama</i>) Black- eyed susan (<i>Tetradlea juncea</i>) <i>Tetradlea glandulosa</i> Variable midge orchid (<i>Genoplesium insigne</i>) Bynoe's wattle (<i>Acacia bynoeana</i>) little eagle (<i>Hieraaetus morphnoides</i>) square-tailed kite (<i>Lophoictinia isura</i>)

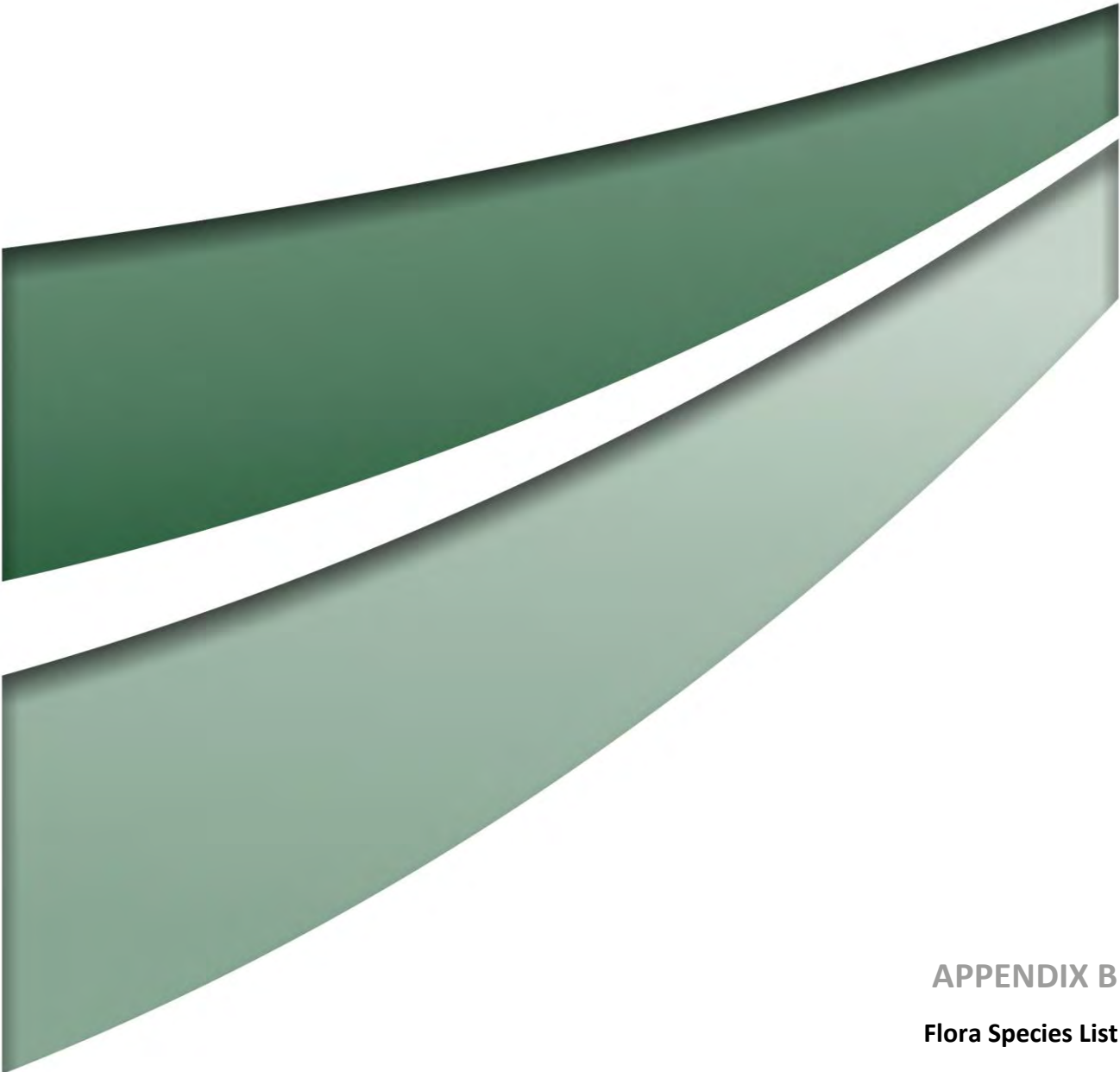
A1.4 Weather Conditions and Limitations

Table A.3 below outlines the weather conditions for the surveys. Data is derived from the Lake Macquarie weather station (061412) from the Bureau of Meteorology (BOM) (2021).

Table A.3 Weather Conditions for Surveys

Date	Daily Data			Monthly Data		
	Min-Max Temp. (°C)	Rainfall (mm)	Relative Humidity (%)	Min-Max Temp (°C) (mean)	Rainfall (mm) (total)	Relative Humidity(%) (mean)
16/11/2020	13.7-38.1	0	51	14.0-26.6	57.0	62
17/11/2020	19.1-23.2	7.2	67			
18/11/2020	16.3-23.6	3.4	61			
19/11/2020	11.5-25.0	0	67			
20/11/2020	13.8-34.5	0	54			
12/01/2021	13.5-28.7	0	69	16.6-27.1	104.8	70
13/01/2021	15.4-27.9	0	70			
14/01/2021	16.5-35.4	0	64			
8/03/2021	14.6-31.1	0	80	16.2-25.4	421.6	79
9/03/2021	16.3-32.4	0.4	62			
10/03/2021	19.8-25.5	0.2	71			
11/03/2021	17.8-26.3	0	79			
4/05/2021	10.9-19.3	0	94	8.2-21.3	26.0	71
31/05/2021	5.7-19.8	0	63			
1/06/2021	2.5-19.5	0	52	6.7-17.6	58.8	98
2/06/2021	4.1-22.1	0	56			
3/06/2021	6.5-17.0	0	97			
15/09/2021	9.4-18.6	6.2	60	7.8-23.8	18.6	79
16/09/2021	7.0-18.4	0	67			

For herbaceous and graminoid species, such as those belonging to the families Asteraceae, Cyperaceae and Poaceae, the allocation of specimens to sub-specific levels was affected by the availability of adequate flowering or fruiting material. The specimens collected during the survey that were lacking adequate flowering or fruiting material were not of potential significance or importance and so were identified to genus level only.



APPENDIX B

Flora Species List

Flora Species List

The following list was developed from the floristic plot surveys. It includes all species of vascular plants observed during these surveys. It is acknowledged that the list is not comprehensive, as not all species are readily detected at any one time of the year. Many species flower only during restricted periods of the year, and some flower only once in several years. In the absence of flowering material, many of these species cannot be identified, or even detected.

Names of classes and families follow a modified Cronquist (1981) System.

Any species that could not be identified to the lowest taxonomic level are denoted in the following manner:

sp. specimens that are identified to genus level only.

The following abbreviations or symbols are used in the list:

A denotes abundance rating according to BAM

C cover measure according to BAM

asterisk (*) denotes species non-native species

HT denotes High Threat Weed species under the BAM

subsp. subspecies and

var. variety.

All vascular plants recorded or collected were identified using keys and nomenclature in Harden (1992, 1993, 2000 and 2002). Where known, changes to nomenclature and classification have been incorporated into the results, as derived from PlantNET (Botanic Gardens Trust 2020), the on-line plant name database maintained by the National Herbarium of New South Wales.

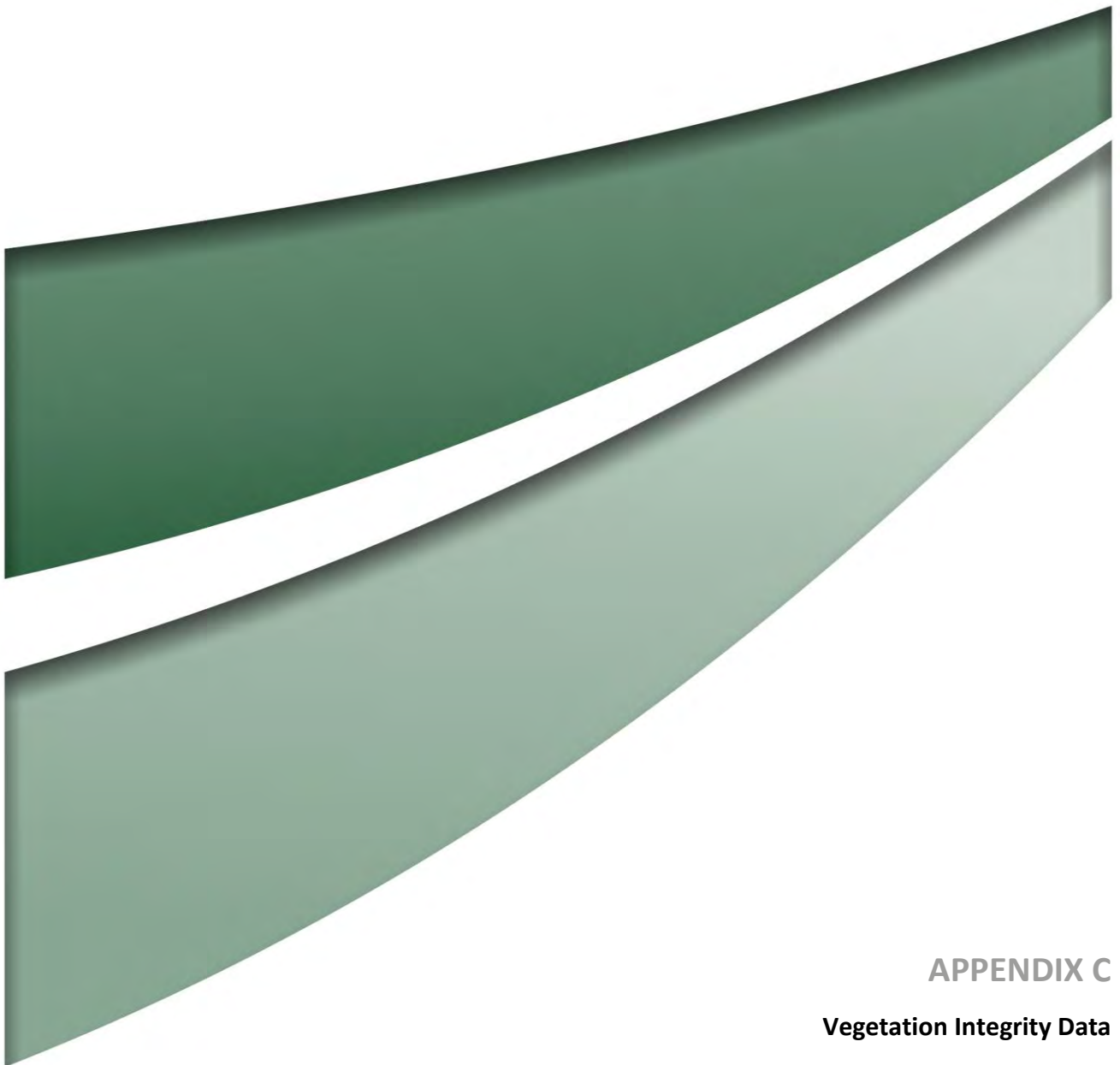
Common names used follow Harden (1992, 1993, 2000 and 2002) where available, and draw on other sources such as local names where these references do not provide a common name.

			P01		P02		P03		P04		P05		P06		P07		P08	
Common Name	Species Name	Growth Form	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance
Sickled- leaved wattle	<i>Acacia falcata</i>	SG	0.1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sydney golden wattle	<i>Acacia longifolia subsp. sophorae</i>	SG	0	0	15	50	0.2	20	0.1	2	5	15	0	0	1	10	0	0
Sweet wattle	<i>Acacia suaveolens</i>	SG	0	0	0	0	0.1	2	0	0	0	0	0	0	0	0	0	0
-	<i>Acrotriche divaricata</i>	SG	0	0	0	0	0	0	0	0	0.1	1	0	0	0.1	2	0	0
Maidenhair fern	<i>Adiantum aethiopicum</i>	EG	0	0	0	0	0	0	0	0	0	0	0.2	50	0	0	0	0
Crofton weed	<i>Ageratina adenophora</i>	HT	0	0	0	0	0.1	10	0	0	0	0	0	0	0	0	0	0
black she-oak	<i>Allocasuarina littoralis</i>	TG	0	0	0	0	0	0	0	0	0.1	2	0	0	0	0	0	0
Forest oak	<i>Allocasuarina torulosa</i>	TG	0	0	0	0	0	0	0.2	1	0	0	0	0	0	0	0	0
Smooth-barked wattle	<i>Angophora costata</i>	TG	0	0	0	0	0.1	1	0	0	10	2	2	1	0	0	0	0
Oat speargrass	<i>Anisopogon avenaceus</i>	GG	0	0	0	0	0	0	30	1000	0	0	0	0	0.1	3	0	0
Whisky grass	<i>Andropogon virginicus</i>	HT	0.1	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Three-awns speargrass	<i>Aristida vagans</i>	GG	0	0	0	0	0	0	0	0	1	500	0	0	0.1	10	0	0
Fern-leaved banksia	<i>Banksia oblongifolia</i>	SG	0	0	0	0	0	0	0.1	5	0	0	0	0	0	0	0	0
Cobbler's pegs	<i>Bidens pilosa</i>	HT	0	0	0	0	0.1	10	0	0	0	0	0	0	0	0	0	0
-	<i>Billardiera scandens</i>	OG	0	0	0	0	0	0	0.1	5	0.1	10	0	0	0	0	0	0
Coffee bush	<i>Breynia oblongifolia</i>	SG	0.1	3	0	0	0	0	0	0	0	0	0.1	3	0	0	0	0
-	<i>Cassytha glabella</i>	OG	0	0	0	0	0	0	0.1	1	0	0	0	0	0	0	0	0
Swamp oak	<i>Casuarina glauca</i>	TG	50	80	40	200	60	100	0	0	0	0	0	0	0	0	9	50
Indian pennywort	<i>Centella asiatica</i>	FG	0.1	50	0.1	20	0.1	20	0	0	0	0	0	0	0	0	0	0
Rhodes grass	<i>Chloris gayana</i>	HT	0	0	0	0	50	3000	0	0	0	0	0	0	0	0	0.1	5
Camphor laurel	<i>Cinnamomum camphora</i>	HT	0	0	0	0	0	0	0	0	0	0	0.1	1	0	0	0	0
Pampas grass	<i>Cortaderia selloana</i>	HT	0.1	1	0.1	1	0	0	0	0	0	0	0	0	0	0	0.1	1
Red bloodwood	<i>Corymbia gummifera</i>	TG	0	0	0	0	0	0	15	8	0	0	0	0	0	0	0	0
-	<i>Cyathochaeta diandra</i>	GG	0	0	0	0	0	0	30	1000	0	0	0	0	0	0	0	0
Common couch	<i>Cynodon dactylon</i>	GG	0	0	10	500	0	0	0	0	0	0	0	0	0	0	0	0
-	<i>Dampiera purpurea</i>	FG	0	0	0	0	0	0	0.1	10	0	0	0	0	0	0	0	0
-	<i>Daviesia ulicifolia</i>	SG	0.1	2	0	0	0	0	0	0	0.2	10	0	0	0.1	5	0	0
Blue flax-lily	<i>Dianella caerulea</i>	GG	0	0	0	0	0	0	0	0	0	0	0.1	5	0.1	5	0	0

			P01		P02		P03		P04		P05		P06		P07		P08	
Common Name	Species Name	Growth Form	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance
Blueberry lily	<i>Dianella longifolia</i>	GG	0	0	0	0	0	0	0.1	5	0.1	5	0	0	0	0	0	0
-	<i>Dillwynia retorta</i> var. <i>retorta</i>	SG	0	0	0.1	5	0	0	0.1	2	0	0	0	0	0	0	0	0
Large-leaf hop-bush	<i>Dodonaea triquetra</i>	SG	0	0	0.1	10	0.2	20	10	20	0	0	0	0	25	200	0	0
Hedgehog grass	<i>Echinopogon caespitosus</i>	GG	0	0	0	0	0	0	0	0	0.1	10	0	0	0	0	0	0
Wiry panic	<i>Entolasia stricta</i>	GG	0	0	0	0	0	0	1	500	15	1000	0.1	10	5	500	0	0
-	<i>Epacris pulchella</i>	SG	0	0	0	0	0	0	0	0	0.2	50	0	0	0	0	0	0
Brown's lovegrass	<i>Eragrostis brownii</i>	GG	0	0	0.1	10	0	0	0	0	0	0	0	0	0	0	0	0
African lovegrass	<i>Eragrostis curvula</i>	HT	0	0	0.1	20	0	0	0	0	0	0	0	0	0	0	0	0
Brown stringybark	<i>Eucalyptus capitellata</i>	TG	0	0	0	0	0	0	5	2	0	0	0	0	10	2	0.2	1
Scribbly gum	<i>Eucalyptus haemastoma</i>	TG	0	0	0	0	0	0	5	3	30	7	5	2	30	30	0	0
Red mahogany	<i>Eucalyptus resinifera</i>	TG	0	0	0	0	0	0	0	0	0	0	20	11	0	0	0	0
Red-fruit saw-sedge	<i>Gahnia sieberiana</i>	GG	0.1	3	1	10	0.2	5	0.1	1	0	0	10	20	0.2	5	25	20
Cheese tree	<i>Glochidion ferdinandi</i>	TG	0	0	0	0	0	0	0.1	1	0	0	20	50	0	0	0	0
-	<i>Glycine tabacina</i>	OG	0	0	0	0	0	0	0.1	10	0	0	0	0	0.1	5	0	0
Golden glory pea	<i>Gompholobium latifolium</i>	SG	0	0	0	0	0	0	0.1	1	0.1	1	0	0	0	0	0	0
-	<i>Gonocarpus tetragynus</i>	FG	0	0	0.1	10	0	0	0	0	0	0	0	0	0	0	0	0
Branched goodenia	<i>Goodenia paniculata</i>	FG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	10
Finger hakea	<i>Hakea dactyloides</i>	SG	0	0	0	0	0	0	0.1	3	0	0	0	0	0	0	0	0
Needlebush	<i>Hakea sericea</i>	SG	0	0	0	0	0.2	5	0	0	0	0	0	0	0	0	0	0
-	<i>Hakea spp.</i>	SG	0	0	0	0	0.1	3	0.1	3	0	0	0	0	0	0	0	0
Purple happy wanderer	<i>Hardenbergia violacea</i>	OG	0.1	15	0	0	0	0	0	0	0.1	1	0	0	0.1	2	0	0
-	<i>Hibbertia aspera</i>	FG	0	0	0	0	0	0	0.1	10	0.1	10	0	0	0	0	0	0
Bleeding heart	<i>Homolanthus populifolius</i>	SG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	1
Coolatai grass	<i>Hyparrhenia hirta</i>	HT	0	0	5	100	5	100	0	0	30	1000	0	0	5	200	0	0
Blady grass	<i>Imperata cylindrica</i>	GG	0.1	50	5	500	0	0	0.2	50	0.2	50	0.1	20	15	100	0	0
-	<i>Juncus spp.</i>	GG	0.1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tick bush	<i>Kunzea ambigua</i>	SG	0	0	1	50	0.2	10	2	5	0.1	1	0	0	0	0	0.5	10
Mountain devil	<i>Lambertia formosa</i>	SG	0	0	0	0	0	0	0.1	3	0	0	0	0	0	0	0	0
Lantana	<i>Lantana camara</i>	HT	0	0	0	0	0	0	0	0	0	0	1	10	0	0	0.1	1
-	<i>Lepidosperma laterale</i>	GG	0	0	0	0	0	0	10	500	0.2	50	0	0	0	0	0	0
Tantoon	<i>Leptospermum polygalifolium</i>	SG	0.1	1	0	0	0.1	2	0.1	3	0	0	0	0	0	0	0	0

			P01		P02		P03		P04		P05		P06		P07		P08	
Common Name	Species Name	Growth Form	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance
Flaky-barked tea tree	<i>Leptospermum trinervium</i>	SG	0	0	0	0	0	0	0.2	5	0	0	0	0	0	0	0	0
-	<i>Leucopogon juniperinus</i>	SG	0.1	2	0.1	2	0	0	0	0	0.1	3	0	0	0.1	2	0	0
Small-leaf privet	<i>Ligustrum sinense</i>	HT	0	0	0	0	0	0	0	0	0	0	0.1	5	0	0	0	0
Cabbage palm	<i>Livistona australis</i>	OG	0	0	0	0	0	0	0	0	0	0	0.1	1	0	0	0	0
Whiteroot	<i>Lobelia purpurascens</i>	FG	0	0	0	0	0	0	0	0	0.1	10	0.1	5	0	0	0	0
-	<i>Lomandra glauca</i>	GG	0	0	0	0	0	0	0	0	0.1	10	0	0	0.1	5	0	0
Fishbones	<i>Lomandra obliqua</i>	GG	0	0	0	0	0	0	0.1	20	0	0	0	0	0.1	5	0	0
Guinea grass	<i>Megathyrsus maximus var. pubiglumis</i>	HT	0	0	0	0	0.1	10	0	0	0	0	0	0	0	0	0	0
Flax- leaved paperbark	<i>Melaleuca linariifolia</i>	SG	0	0	0	0	0	0	0	0	0	0	5	20	0	0	1	10
Prickly-leaved paperbark	<i>Melaleuca nodosa</i>	SG	0	0	0	0	0	0	5	10	0	0	45	200	0	0	50	100
-	<i>Melaleuca sieberi</i>	SG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2	10
Weeping meadow grass	<i>Microlaena stipoides</i>	GG	0	0	0	0	0	0	0	0	0	0	0.1	20	0	0	0.1	10
-	<i>Mirbelia rubiifolia</i>	SG	0.1	3	0.1	10	0	0	0	0	0.1	10	0	0	0.1	3	0	0
Scotch thistle	<i>Onopordum acanthium</i>	HT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	5
Coarse stinkweed	<i>Opercularia aspera</i>	FG	0	0	0	0	0	0	0.1	10	0	0	0	0	0.1	10	0	0
Basket grass	<i>Oplismenus imbecilis</i>	GG	0	0	0	0	0	0	0	0	0	0	3	1000	0	0	0	0
Two-colour panic	<i>Panicum simile</i>	GG	0	0	0	0	0	0	0	0	5	500	0	0	0	0	0	0
Common silkpod	<i>Parsonsia straminea</i>	OG	0	0	0	0	0	0	0.1	2	0	0	1	3	0	0	0.1	2
-	<i>Paspalidium aversum</i>	GG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2	50
-	<i>Paspalum dilatatum</i>	HT	0	0	0.1	10	0	0	0	0	0	0	0	0	0	0	0	0
Silky purple flag	<i>Patersonia sericea</i>	FG	0	0	0	0	0	0	0	0	0.1	5	0	0	0	0	0	0
Geebung	<i>Persoonia levis</i>	SG	0	0	0	0	0	0	0.1	2	0	0	0	0	0	0	0	0
Common reed	<i>Phragmites australis</i>	GG	0	0	0	0	0.2	50	0	0	0	0	0	0	0	0	0	0
-	<i>Phyllanthus hirtellus</i>	FG	0	0	0	0	0	0	0	0	0	0	0	0	0.1	20	0	0
Radiata pine	<i>Pinus radiata</i>	HT	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0
Sweet pittosporum	<i>Pittosporum undulatum</i>	SG	0	0	0	0	0	0	0	0	0	0	2	10	0.2	20	0	0
Polyscias	<i>Polyscias sambucifolia</i>	SG	0	0	0	0	0	0	0.2	20	0	0	0	0	0.1	3	0	0
whiteroot	<i>Pratia purpurascens</i>	FG	0	0	0	0	0	0	0.1	20	0	0	0	0	0	0	0	0

			P01		P02		P03		P04		P05		P06		P07		P08	
Common Name	Species Name	Growth Form	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance
Bracken fern	<i>Pteridium esculentum</i>	EG	0	0	0	0	0	0	20	100	30	1000	0	0	0	0	0	0
Chaffy bush-pea	<i>Pultenaea paleacea</i>	SG	0	0	0.1	20	0	0	0	0	0.1	20	0	0	0	0	0	0
Bog rush	<i>Schoenus apogon</i>	GG	0	0	0.1	10	0	0	0	0	0	0	0	0	0	0	0	0
Fireweed	<i>Senecio madagascariensis</i>	HT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	5
Senna	<i>Senna pendula</i>	HT	0	0	0	0	0.1	5	0	0	0	0	0	0	0	0	0	0
Pale pigeon grass	<i>Setaria pumila subsp. pumila*</i>	-	0	0	0	0	0.1	10	0	0	0	0	0	0	0	0	0	0
Tobacco bush	<i>Solanum mauritianum</i>	HT	0	0	0	0	0.1	5	0	0	0	0	0	0	0	0	0.1	2
Buffalo grass	<i>Stenotaphrum secundatum*</i>	-	0	0	0	0	5	100	0	0	0	0	0	0	0	0	0	0
Kangaroo grass	<i>Themeda triandra</i>	GG	0	0	0.1	10	0	0	0.2	50	0.2	20	0	0	0.2	20	0	0
-	<i>Xanthorrhoea latifolia</i>	GG	0	0	0	0	0	0	0.2	7	0	0	0	0	0.2	5	0	0



APPENDIX C

Vegetation Integrity Data

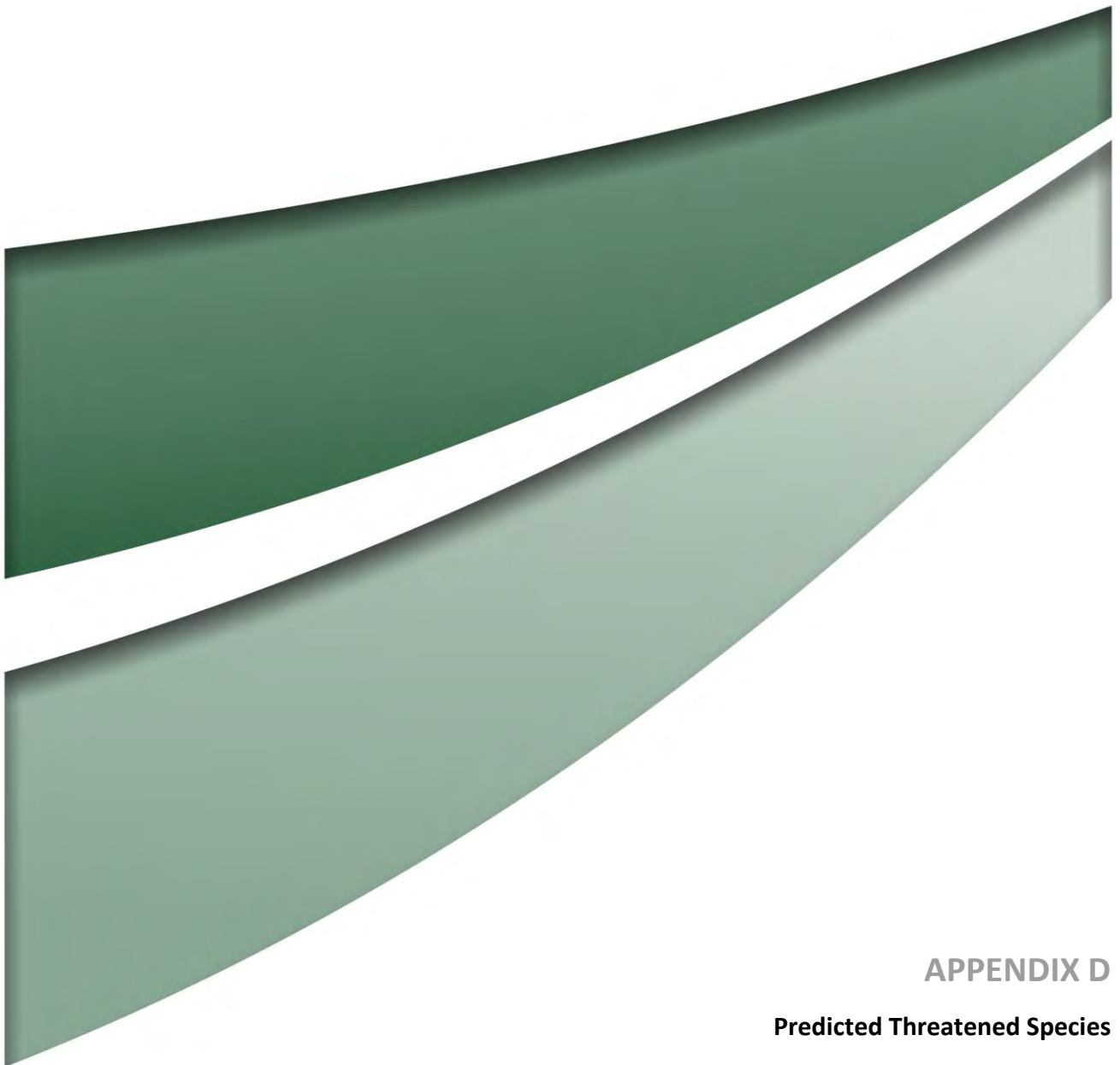
Vegetation Integrity Data

The following vegetation integrity data was collected from surveys of the Development Footprint. It includes the composition, structure and function attributes that are recorded in each BAM plot. This data is assessed against benchmark data for PCTs and entered into the BAM Calculator to assess the condition of each PCT in the Development Footprint.

The following abbreviations are used in the table below:

Tr	Tree (growth form)
Sh	Shrub (growth form)
Gr	Grass (growth form)
Fb	Forb (growth form)
Fn	Fern (growth form)
Ot	Other (growth form)

	COMPOSITION						STRUCTURE						FUNCTION										
	Tr	Sh	Gr	Fb	Fn	Ot	Tr	Sh	Gr	Fb	Fn	Ot	Regen >5	Stem Classes (cm)					No. Large Trees	No. Hollow Trees	Litter (%)	Fallen Logs (m)	High Threat Weeds
														5-10	10-20	20-30	30-50	50-80					
P01	1	7	2	1	0	1	50	0.7	0.2	0.1	0	0.1	1	1	1	0	0	0	0	0	56	1	0.2
P02	1	6	6	2	0	0	40	16.4	16.3	0.2	0	0	1	1	1	1	0	0	0	0	17	3	5.3
P03	2	7	2	1	0	0	60.1	1.1	0.4	0.1	0	0	1	1	1	0	0	0	0	0	21	0	60.3
P04	5	15	8	4	1	5	25.3	18.4	71.6	0.4	20	0.6	1	1	1	1	1	1	3	0	58	11	0
P05	3	10	8	3	1	2	40.1	6.1	21.8	0.3	30	0.2	1	1	1	1	1	1	2	0	67	2	30
P06	4	4	5	2	1	2	47	52.1	13.3	0.2	0.2	1.1	1	1	1	1	1	1	1	0	75	37	1.2
P07	2	9	8	2	0	3	40	26.8	20.8	0.2	0	0.4	1	1	0	1	1	1	4	1	81	9	6
P08	2	5	3	1	0	1	9.2	51.8	25.3	0.1	0	0.1	1	1	1	1	0	0	0	0	36	2	0.6



APPENDIX D

Predicted Threatened Species

Predicted Ecosystem-credit Species

Species	BC Act	EPBC Act	Sensitivity to Gain	Habitat Constraint	Vegetation Zone Prediction
glossy black- cockatoo <i>Calyptorhynchus lathami</i> (foraging)	V	-	High	Presence of <i>Allocasuarina</i> and <i>Casuarina</i> species	1636
speckled warbler <i>Chthonicola sagittata</i>	V	-	High	-	1636
spotted harrier <i>Circus assimilis</i>	V	-	Moderate	-	1636
brown treecreeper (eastern subspecies) <i>Climacteris picumnus victoriae</i>	V	-	High	-	1636
varied sittella <i>Daphoenositta chrysoptera</i>	V	-	Moderate	-	1636 1716
spotted tailed quoll <i>Dasyurus maculatus</i>	V	E	High	-	1636 1716
eastern false pipistrelle <i>Falsistrellus tasmaniensis</i>	V	-	High	-	1636 1716
little lorikeet <i>Glossopsitta pusilla</i>	V	-	High	-	1636 1716
painted honeyeater <i>Grantiella picta</i>	V	V	Moderate	Mistletoes at five per hectare	1636
White-bellied sea-eagle <i>Haliaeetus leucogaster</i> (foraging)	V	-	High	Waterbodies; within 1km of rivers, lakes, large dams or creeks, wetlands and coastlines	1716
little eagle (foraging) <i>Hieraaetus morphnoides</i>	V	-	Moderate	-	1636 1716

Species	BC Act	EPBC Act	Sensitivity to Gain	Habitat Constraint	Vegetation Zone Prediction
black bittern <i>Ixobrychus flavicollis</i>	V	-	Moderate	Waterbodies; land within 40m of freshwater and estuarine wetlands, in areas of permanent water and dense vegetation	1636 1716
swift parrot <i>Lathamus discolor</i>	E	CE	Moderate	-	1636 1716
square- tailed kite <i>Lophoictinia isura</i> (foraging)	E	CE	Moderate	-	1636 1716
black- chinned honeyeater <i>Melithreptus gularis gularis</i>	V	-	Moderate	-	1636
Eastern coastal free-tailed bat <i>Micronomus norfolkensis</i>	V	-	High	-	1636 1716
Little bentwing-bat (foraging) <i>Miniopterus australis</i>	V	-	High	-	1636 1716
eastern bentwing-bat (foraging) <i>Miniopterus schreibersii oceanensis</i>	V	-	High	-	1636 1716
turquoise parrot <i>Neophema pulchella</i>	V	-	High	-	1636
barking owl (foraging) <i>Ninox connivens</i>	V	-	High	-	1636 1716
powerful owl (foraging) <i>Ninox strenua</i>	V	-	High	-	1636
eastern osprey <i>Pandion cristatus</i>	V	-	Moderate	-	1636 1716
yellow- bellied glider <i>Petaurus asutralis</i>	V	-	High	Hollow- bearing trees; Hollows >25 cm diameter	1636

Species	BC Act	EPBC Act	Sensitivity to Gain	Habitat Constraint	Vegetation Zone Prediction
scarlet robin <i>Petroica boodang</i>	V	-	Moderate	-	1636
Koala <i>Phascolarctos cinereus</i> (foraging)	V	V	High	-	1636
Golden- tipped bat <i>Phoniscus papuensis</i>	V	-	High	-	1636 1716
grey-crowned babbler (eastern subspecies) <i>Pomatostomus temporalis</i>	V	-	Moderate	-	1636
Eastern chestnut mouse <i>Pseudomys gracilicaudatus</i>	V	-	High	-	1636 1716
grey-headed flying-fox <i>Pteropus poliocephalus</i>	V	V	High	-	1636 1716
yellow-bellied sheath-tail-bat <i>Saccolaimus flaviventris</i>	V	-	High	-	1636 1716
greater broad- nosed bat <i>Scoteanax rueppellii</i>	V	-	High	-	1636 1716
masked owl (foraging) <i>Tyto novaehollandiae</i>	V	-	High	-	1636

Predicted Species-credit Species

Species	BC Act	EPBC Act	Sensitivity to Gain	Habitat Constraint	Survey Period	SAII Entity	Survey Method and Justification
Bynoe's wattle <i>Acacia bynoeana</i>	E	V	High	-	Sept-Mar	No	Species not detected. Threatened species transects undertaken across the disturbance footprint in September and November 2020 in suitable habitat.
Charmhaven apple <i>Angophora inopina</i>	V	V	High	-	All year	No	Species not detected. Threatened species transects undertaken across the entirety of the disturbance footprint in suitable habitat during November, January and May.
Thick- leaf star-hair <i>Astrotricha crassifolia</i>	V	V	Very High	-	Jul - Dec	No	Species not detected. Threatened species transects undertaken across the entirety of the disturbance footprint in suitable habitat during November, January and May. While some of this was conducted outside of the survey period, no <i>Astrotricha</i> type shrubs were detected.

Species	BC Act	EPBC Act	Sensitivity to Gain	Habitat Constraint	Survey Period	SAIL Entity	Survey Method and Justification
bush stone-curlew <i>Burhinus grallarius</i>	E	-	High	Fallen/standing dead timber including logs.	All year	No	<p>Species not detected. Habitat assessments were conducted in November, January and May over to identify potential habitat available for the species across the Development Footprint. Opportunistic observations were completed during all surveys during targeted flora transect surveys.</p> <p>Nocturnal spotlighting searches were undertaken in May 2021 over four nights in suitable habitat areas between sunset and midnight using 30-watt hand-held spotlights and head torches. This involved playing the call of the species for five minutes, followed by a listening period of five minutes. Opportunistic observations were completed throughout all Umwelt survey periods and this species was not flushed during flora transects.</p> <p>There are no previous records of the species within 10 km of the Development Footprint (DPIE 2021).</p> <p>The species was not flushed during any surveys and has never been detected by Umwelt on EPS landholdings despite intensive surveys since 2013.</p>
netted bottle brush <i>Callistemon linearifolius</i>	V	-	High	-	Sept-Mar	No	<p>Species not detected. Threatened species transects undertaken across the entirety of the disturbance footprint in suitable habitat during November, January and May.</p>
gang-gang cockatoo (breeding) <i>Callocephalon fimbriatum</i>	V	-	Moderate	Eucalypt tree species with hollows greater than 9 cm diameter	Oct - Jan	No	<p>No further survey required. The vegetation present is not considered suitable for this species as it typically breeds in tall mountain forests. Opportunistic observations were completed during all assessments.</p>

Species	BC Act	EPBC Act	Sensitivity to Gain	Habitat Constraint	Survey Period	SAIL Entity	Survey Method and Justification
glossy black-cockatoo (breeding) <i>Calyptorhynchus lathami</i>	V	-	High	Living or dead trees with hollows greater than 15 cm diameter, and greater than 5 m above ground.	Mar - Aug	No	<p>Species not detected. Habitat assessments were undertaken in May 2021 over five days to identify potential habitat available for the species across the Development Footprint Two hollows were detected on site that appeared potentially suitable (i.e. higher than 5m and larger than 20cm). These were inspected for whitewash or other signs of occupation, with none detected, and were examined at dusk in May with no diurnal activity detected.</p> <p>Opportunistic observations were completed during all assessments.</p>
eastern pygmy-possum <i>Cercartetus nanus</i>	V	-	High	-	Oct - Mar	No	<p>Species not present. The Development Footprint was found to be lacking suitable intact heathy foraging habitat for the species. There are no previous records of the species within 10 km of the Development Footprint (DPIE 2021a).</p> <p>Bushnell Trophy Cam HD cameras were installed at 20 locations within the Development Footprint for a duration of four weeks (580 trap nights). At each site, a remote camera was mounted on a tree trunk and positioned towards a bait station containing peanut butter, honey and oats. Cameras were set to take three photos in quick succession when movement was detected.</p> <p>All cameras re-baited after two weeks, and the species was not detected. While this is outside normal survey time, the species should still have been active during May.</p>

Species	BC Act	EPBC Act	Sensitivity to Gain	Habitat Constraint	Survey Period	SAIL Entity	Survey Method and Justification
large-eared pied bat <i>Chalinolobus dwyeri</i>	V	V	Very High	Within 2 km of rocky areas containing caves, overhangs, escarpments, outcrops or crevices, or within 2 km of old mines or tunnels.	Sep - Mar	Yes	<p>No further survey required. This species is typically found in areas with extensive cliffs and caves (DPIE 2021a). They can also occur in built structures (culverts) and old buildings. They are also reportedly found in well- timbered areas containing gullies, with breeding habitat associated with caves located 100 m from associated PCTs (DPIE 2021a). Habitat assessments were undertaken to identify potential habitat available for the species across the Development Footprint.</p> <p>No suitable breeding or roosting features were detected during the habitat assessment, no foraging habitat (well- timbered areas containing gullies) and no breeding habitat will be impacted by the proposed development. Additionally, a radius of 2km around the site, examined through API where possible, shows no suitable rocky areas, and no known old mines or tunnels of particular importance are known to be present.</p>
<i>Corunastylis sp.</i> <i>Charmhaven</i>	CE	CE	High	-	Nov-Apr	Yes	<p>Species not detected. Threatened species transects undertaken across the Project Area in suitable habitat during November, January and May. No records within 10km (DPIE 2021a).</p>
wallum froglet <i>Crinia tinnula</i>	V	-	Moderate	-	All year	No	<p>Species not detected. Habitat assessments were undertaken in March and May 2021 over nine days to identify potential habitat available for the species across the Development Footprint. Nine nights of spotlighting conducted, with those in March conducted after recent heavy rain. Marginal habitat detected.</p> <p>Opportunistic observations were completed during all assessments.</p>

Species	BC Act	EPBC Act	Sensitivity to Gain	Habitat Constraint	Survey Period	SAIL Entity	Survey Method and Justification
leafless tongue orchid <i>Cryptostylis hunteriana</i>	V	V	High	-	Nov-Jan	No	Species not detected. Threatened species transects undertaken in the Project Area in suitable habitat during November and January.
rough doubletail <i>Diuris praecox</i>	V	V	Moderate	Within the parish boundaries of Newcastle, Kahibah, Wallarah, Tuggerah and Kincumber	Aug	No	No further survey required. Development Footprint occurs outside geographic range of species, no records within 10 km and no suitable habitat present.
Camfield's stringybark <i>Eucalyptus camfieldii</i>	V	V	High	-	All year	No	Species not detected. Threatened species transects undertaken across the entirety of the disturbance footprint in suitable habitat during November, January and May.
<i>Eucalyptus parramattensis</i> subsp. <i>decadens</i>	V	V	High	-	All year	No	Species not detected. Threatened species transects undertaken across the entirety of the disturbance footprint in suitable habitat during November, January and May.
<i>Eucalyptus parramattensis</i> subsp. <i>parramattensis</i> endangered population	EP	-	High	Wyong and Lake Macquarie LGAs	All year	No	Species not detected. Threatened species transects undertaken across the entirety of the disturbance footprint in suitable habitat during November, January and May.
Variable midge orchid <i>Genoplesium insigne</i>	CE	CE	High	-	Sept-Nov	Yes	Species not detected. Threatened species transects undertaken across the disturbance footprint in suitable habitat during November 2020.

Species	BC Act	EPBC Act	Sensitivity to Gain	Habitat Constraint	Survey Period	SAII Entity	Survey Method and Justification
small-flower grevillea <i>Grevillea parviflora</i> subsp. <i>parviflora</i>	V	V	High	-	Aug - Nov	No	Species detected. 42 individuals detected in the Development Footprint. Species polygon created as a 30m buffer around individuals and credits generated for unavoidable impacts on this species.
white-bellied sea-eagle (breeding) <i>Haliaeetus leucogaster</i>	V	-	High	Living or dead mature trees within suitable vegetation within 1km of a rivers, lakes, large dams or creeks, wetlands and coastlines.	Jul - Dec	No	No further survey required. This species is a species-credit species for breeding habitat only being nest trees within 1 km of rivers, lakes, large dams or creeks, wetlands and coastlines. Targeted searches for large stick nests were conducted during November 2020 while completing flora transects. Further habitat assessments conducted outside of survey period, with no large stick nests detected anywhere in the Project Area or immediate vicinity.
Giant burrowing frog <i>Heleioporus australiacus</i>	V	V	Moderate	-	Sept - May	No	Species not detected. Habitat assessments were undertaken in March and May 2021 over nine days to identify potential habitat available for the species across the Development Footprint. Nine nights of spotlighting conducted, with those in March conducted after recent heavy rain. No habitat detected. Opportunistic observations were completed during all assessments.

Species	BC Act	EPBC Act	Sensitivity to Gain	Habitat Constraint	Survey Period	SAII Entity	Survey Method and Justification
little eagle (breeding) <i>Hieraaetus morphnoides</i>	V	-	Moderate	Nest trees - live (occasionally dead) large old trees within vegetation.	Aug - Oct	No	No further survey required. This species is a species-credit species for breeding habitat only. Targeted searches for large stick nests were conducted during all surveys. While these were outside the survey period, no large stick nests have been detected in the Project Area or immediate vicinity during any survey to date. Habitat is marginal (very few large old trees in the Project Area), and no records of this species within 10km.
pale-headed snake <i>Hoplocephalus bitorquatus</i>	V	-	High	-	Nov - Mar	No	No further survey required. Habitat is not considered suitable for this species, being highly fragmented and disturbed in the past. No records within 10km (DPIE 2021a).
swift parrot (breeding) <i>Lathamus discolor</i>	E	CE	Moderate	Important habitat only (mapped by DPIE)	NA	Yes	No survey required. Important habitat areas mapped by DPIE and provided in the BAM Calculator within the important species habitat mapping. 3.1 ha of important mapped habitat aligned with suitable PCTs (1636) occurs within the Development Footprint. Important habitat mapping over planted native vegetation (no flowering resources) and built-up areas has been excluded.

Species	BC Act	EPBC Act	Sensitivity to Gain	Habitat Constraint	Survey Period	SAII Entity	Survey Method and Justification
green and golden bell frog <i>Litoria aurea</i>	E	V	High	Within 1km of semi-permanent/ephemeral wet areas, swamps or waterbodies.	Nov - Mar	No	Species not detected in Development Footprint. Habitat assessments were undertaken in March and May 2021 over nine days to identify potential habitat available for the species across the Development Footprint. Four nights of spotlighting conducted in March after recent heavy rain. The species was detected 200 m west of the Development Footprint in suitable habitat, but no habitat detected in the Development Footprint. Opportunistic observations were completed during all assessments.
Green- thighed frog <i>Litoria brevipalmata</i>	V	-	Moderate	-	Oct - Mar	No	Species not detected. Habitat assessments were undertaken in March and May 2021 over nine days to identify potential habitat available for the species across the Development Footprint. Four nights of spotlighting conducted after recent heavy rain. No habitat detected. Opportunistic observations were completed during all assessments.
square-tailed kite (breeding) <i>Lophoictinia isura</i>	V	-	Moderate	Nest trees.	Sep - Jan	No	No further survey required. This species is a species-credit species for breeding habitat only. Targeted searches for large stick nests were conducted during all surveys, including November 2020 and January 2021 while completing flora transects. No large stick nests have been detected in the Project Area or immediate vicinity during any survey to date. Habitat is marginal (very few large old trees in the Project Area), and no records of this species within 10km.

Species	BC Act	EPBC Act	Sensitivity to Gain	Habitat Constraint	Survey Period	SAIL Entity	Survey Method and Justification
<i>Maundia triglochinos</i>	V	-	High	Riparian areas/drainage lines, water ponding, man-made dams and drainage channels up to 1m deep; semi-permanent/ephemeral wet areas; swamps	Nov - Mar	No	Species not detected. Threatened species transects undertaken across the entirety of the disturbance footprint in during November, January and May. No suitable habitat present.
Biconvex paperbark <i>Melaleuca biconvexa</i>	V	-	High	-	All year	No	Species not detected. Threatened species transects undertaken across the entirety of the disturbance footprint in suitable habitat during November, January and May.
Grove's paperbark <i>Melaleuca groveana</i>	V	-	High	-	All year	No	Species not detected. Threatened species transects undertaken across the entirety of the disturbance footprint in suitable habitat during November, January and May.
little bentwing-bat <i>Miniopterus australis</i>	V	-	Very High	Caves, tunnels, mines, culverts or other structures known or suspected to be used for breeding.	Dec-Feb	Yes	No further survey required. This species is a species-credit species for breeding habitat only being caves, tunnels, mines and culverts. Habitat assessments were conducted in November 2020, and January and May 2021 to identify potential habitat available for the species across the Development Footprint. No breeding habitat is anticipated to be impacted by the proposal and therefore, no further survey is required.
eastern bentwing-bat (breeding) <i>Miniopterus schreibersii oceanensis</i>	V	-	High	Caves, tunnels, mines, culverts or other structures known or suspected to be used for breeding.	Nov - Feb	Yes	No further survey required. This species is a species-credit species for breeding habitat only being caves, tunnels, mines and culverts. Habitat assessments were conducted in November 2020, and January and May 2021 to identify potential habitat available for the species across the Development Footprint. No breeding habitat is anticipated to be impacted by the proposal and therefore, no further survey is required.

Species	BC Act	EPBC Act	Sensitivity to Gain	Habitat Constraint	Survey Period	SAII Entity	Survey Method and Justification
southern myotis <i>Myotis macropus</i>	V	-	High	Hollow-bearing trees or bridges, caves or artificial structures within 200 m of riparian zone.	Nov - Mar	No	<p>No further survey required. Targeted habitat assessments were conducted in November 2020 and March and May 2021 to identify any potential habitat available for the species across the Development Footprint. A species- credit polygon is generated for this species when associated PCTs are within 200 m of waterbodies as defined by the survey guidelines for species-credit bat species . No such waterways exist within the Development Footprint or within 200 metres.</p> <p>No impacts to this species are anticipated and no further assessment is required.</p>

Species	BC Act	EPBC Act	Sensitivity to Gain	Habitat Constraint	Survey Period	SAIL Entity	Survey Method and Justification
barking owl (breeding) <i>Ninox connivens</i>	V	-	High	Living or dead trees with hollows greater than 20 cm diameter and greater than 4 m above the ground.	May - Dec	No	<p>Species not detected. Targeted survey for this species conducted over four nights in May 2021. Call- playback for the species was conducted each night across the Project Area, with suitable hollows also stag- watched and checked for signs of occupation. Two hollows were detected on site that appeared potentially suitable (i.e. higher than 5m and larger than 20cm). These were inspected for whitewash, pellets or other signs of occupation, with none detected, and were stagwatched for two nights in May.</p> <p>Nocturnal spotlighting searches were undertaken in May 2021 over four nights in suitable habitat areas between sunset and midnight using 30 watt hand-held spotlights and head torches. This involved playing the call of the species for five minutes, followed by a listening period of five minutes.</p> <p>No previous records of the species are known to occur within 10 km of the Development Footprint (DPIE 2021a).</p>

Species	BC Act	EPBC Act	Sensitivity to Gain	Habitat Constraint	Survey Period	SAII Entity	Survey Method and Justification
powerful owl (breeding) <i>Ninox strenua</i>	V	-	High	Living or dead trees with hollow greater than 20 cm diameter.	May - Aug	No	Species not detected. Nocturnal spotlighting searches were undertaken in May 2021 over four nights in suitable habitat areas between sunset and midnight using 30-watt hand-held spotlights and head torches. This involved playing the call of the species for five minutes, followed by a listening period of five minutes. Suitable hollows were also stag- watched and checked for signs of occupation. Two hollows were detected on site that appeared potentially suitable (i.e. higher than 5m and larger than 20cm). These were inspected for whitewash, pellets or other signs of occupation, with none detected, and were stagwatched for two nights in May.
Eastern osprey <i>Pandion cristatus</i> (breeding)	V	-	Moderate	Presence of stick- nests in living and dead trees (>15m) or artificial structures within 100m of a floodplain	Apr – Nov	No	No further survey required. This species is a species-credit species for breeding habitat only. Targeted searches for large stick nests were conducted during all surveys, particularly during May 2021 over four days. No large stick nests have been detected in the Project Area or immediate vicinity during any survey to date.
tall knotweed <i>Persicaria elatior</i>	V	V	High	Semi-permanent/ephemeral wet areas; or within 50m of swamps, waterbodies and wetlands	Dec - May	No	Species not detected. Threatened species transects undertaken across the entirety of the disturbance footprint in marginal habitat during November, January and May. No suitable habitat present.
giant dragonfly <i>Petalura gigantea</i>	E	-	Very high	Swamps; within 500m of swamps	Dec - Jan	Yes	Species not detected. Threatened species transects undertaken across the entirety of the disturbance footprint in marginal habitat during November, January and May. No suitable habitat present.

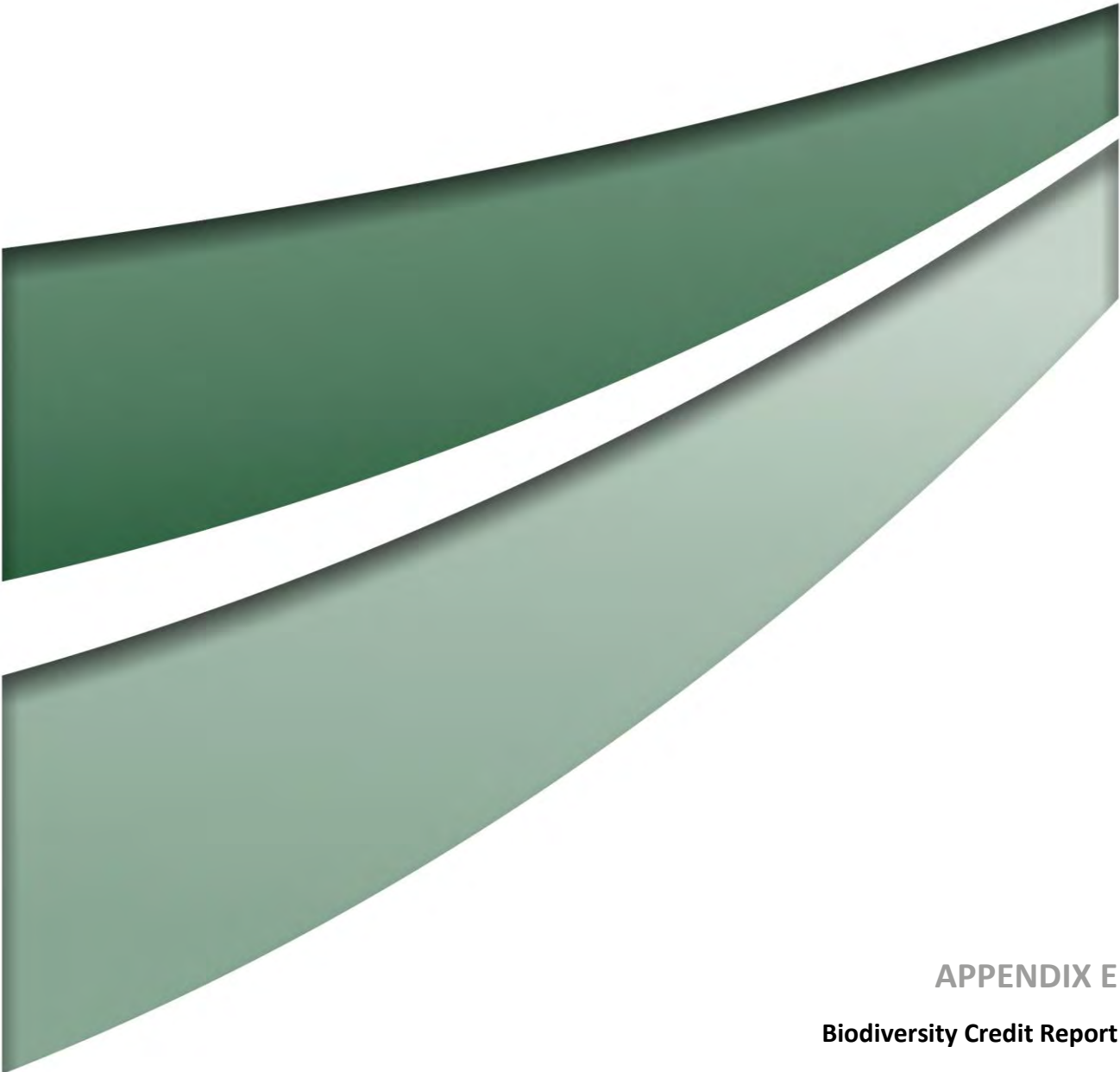
Species	BC Act	EPBC Act	Sensitivity to Gain	Habitat Constraint	Survey Period	SAII Entity	Survey Method and Justification
Greater glider <i>Petauroides volans</i>	-	V	High	Hollow- bearing trees	All year	No	<p>No further survey required. No habitat on site for this species, given the lack of tall forests and no records within 10km of the Development Footprint.</p> <p>Bushnell Trophy Cam HD cameras were installed at 20 locations within the Development Footprint for a duration of four weeks (580 trap nights). At each site, a remote camera was mounted on a tree trunk and positioned towards a bait station containing peanut butter, honey and oats. Cameras were set to take three photos in quick succession when movement was detected. All cameras re- baited after two weeks, and the species was not detected.</p>
Squirrel glider <i>Petaurus norfolcensis</i>	V	-	High	-	All year	No	<p>Species detected. Species detected on remote camera and known from EPS landholdings. Aligned with PCT 1636 and 1716.</p>
brush-tailed rock-wallaby <i>Petrogale penicillata</i>	E	V	Very High	Land within 1 km of rocky escarpments, gorges, steep slopes, boulder piles, rock outcrops or cliff lines	All year	Yes	<p>Not present. No rocky escarpments, gorges, steep slopes, boulder piles, rock outcrops or cliff lines are located within 2 km of the Development Footprint.</p>

Species	BC Act	EPBC Act	Sensitivity to Gain	Habitat Constraint	Survey Period	SAII Entity	Survey Method and Justification
brush-tailed phascogale <i>Phascogale tapoatafa</i>	V	-	High	Hollow bearing trees	Dec - Jun	No	<p>Species not detected. Bushnell Trophy Cam HD cameras were installed at 20 locations within the Development Footprint for a duration of four weeks (580 trap nights). At each site, a remote camera was mounted on a tree trunk and positioned towards a bait station containing peanut butter, honey and oats. Cameras were set to take three photos in quick succession when movement was detected.</p> <p>All cameras re- baited after two weeks, and the species was not detected.</p>
koala (breeding) <i>Phascolarctos cinereus</i>	V	V	High	Important habitat only (mapped by OEH)	All year	No	<p>Species not detected. Nocturnal spotlighting searches were undertaken in May 2021 over four nights in suitable habitat areas between sunset and midnight using 30-watt hand-held spotlights and head torches. Call- playback was also undertaken for this species over three consecutive nights during March 2019. This involved playing the call of the species for five minutes, followed by a listening period of five minutes. Opportunistic observations were completed throughout all Umwelt survey periods.</p> <p>Bushnell Trophy Cam HD cameras were installed at 20 locations within the Development Footprint for a duration of four weeks (580 trap nights). At each site, a remote camera was mounted on a tree trunk and positioned towards a bait station containing peanut butter, honey and oats. Cameras were set to take three photos in quick succession when movement was detected.</p>

Species	BC Act	EPBC Act	Sensitivity to Gain	Habitat Constraint	Survey Period	SAII Entity	Survey Method and Justification
common planigale <i>Planigale maculata</i>	V	-	High	-	All year	No	No further survey required. No records of this species occur to the south of Newcastle. There are no previous records of the species within 10 km of the Development Footprint (DPIE 2021a).
Long-nosed potoroo <i>Potorous tridactylus</i>	V	V	High	Dense shrub layer or high canopy cover exceeding 70%	All year	No	No further survey required. The fragmented and disturbed habitat in the Development Footprint does not support this species. There are no previous records of the species within 10 km of the Development Footprint (DPIE 2021a). Species not flushed during any surveys in November 2020, January, March or May 2021.
Tranquility mint bush <i>Prostanthera askania</i>	E	E	High	South of Wyong River in Central Coast LGA	Sept-Oct	No	No further survey required. Species does not occur in the locality and no records within 10km.
grey-headed flying-fox (breeding) <i>Pteropus poliocephalus</i>	V	V	High	Breeding camps	Oct - Dec	No	Species not detected. Threatened species transects undertaken across the entirety of the disturbance footprint in marginal habitat during November, January and May. No breeding camps present.
Heath Wrinklewort <i>Rutidosis heterogama</i>	V	-	High	South and east of Jerry's Plains	All year	No	Species not detected. Threatened species transects undertaken across the entirety of the disturbance footprint in suitable habitat during November, January and May.
<i>Tetratheca glandulosa</i>	V	-	High	-	Aug – Nov	No	Species not detected. Threatened species transects undertaken across the disturbance footprint in suitable habitat during November. No previous records of the species are known to occur within 10 km of the Development Footprint (DPIE 2021a).

Species	BC Act	EPBC Act	Sensitivity to Gain	Habitat Constraint	Survey Period	SAII Entity	Survey Method and Justification
Black- eyed susan <i>Tetratheca juncea</i>	V	-	High	-	Sept - Oct	No	Species not detected. Threatened species transects undertaken across the disturbance footprint in suitable habitat during November. While this is not strictly within the flowering period for the species, surveys conducted within Eraring landholdings (but outside the Development Footprint) at this time (November 2020) detected <i>T. juncea</i> still in flower. This area was surveyed extensively by Dr Stephen Bell as part of the 2008 Attemperating Dam development application and this species was not detected within this Development Footprint during that survey either (Bell 2007).
masked owl (breeding) <i>Tyto novaehollandiae</i>	V	-	High	Living or dead trees with hollows greater than 20 cm diameter.	May - Aug	No	Species not detected. Nocturnal spotlighting searches were undertaken in May 2021 over four nights in suitable habitat areas between sunset and midnight using 30-watt hand-held spotlights and head torches. This involved playing the call of the species for five minutes, followed by a listening period of five minutes. Suitable hollows were also stag- watched and checked for signs of occupation. Two hollows were detected on site that appeared potentially suitable (i.e. higher than 5m and larger than 20cm). These were inspected for whitewash, pellets or other signs of occupation, with none detected, and were stagwatched for two nights in May.

Species	BC Act	EPBC Act	Sensitivity to Gain	Habitat Constraint	Survey Period	SAII Entity	Survey Method and Justification
Mahony's toadlet <i>Uperoleia mahonyi</i>	E	-	High	-	Oct - Mar	No	<p>Species not detected. Habitat assessments were undertaken in March and May 2021 over nine days to identify potential habitat available for the species across the Development Footprint. Nine nights of spotlighting conducted, with those in March conducted after recent heavy rain. No habitat detected.</p> <p>No previous records of the species are known to occur within 10 km of the Development Footprint (DPIE 2021a).</p> <p>Opportunistic observations were completed during all assessments.</p>



APPENDIX E

Biodiversity Credit Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00025346/BAAS18117/21/00025347	Eraring BESS	10/06/2021
Assessor Name	Report Created	BAM Data version *
Philippa Fagan	17/09/2021	45
Assessor Number	BAM Case Status	Date Finalised
BAAS18117	Open	To be finalised
Assessment Revision	Assessment Type	
0	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)	BC Act Listing status	EPBC Act listing status	Species sensitivity to gain class (for BRW)	Biodiversity risk weighting	Potential SAI	Ecosystem credits

BAM Credit Summary Report

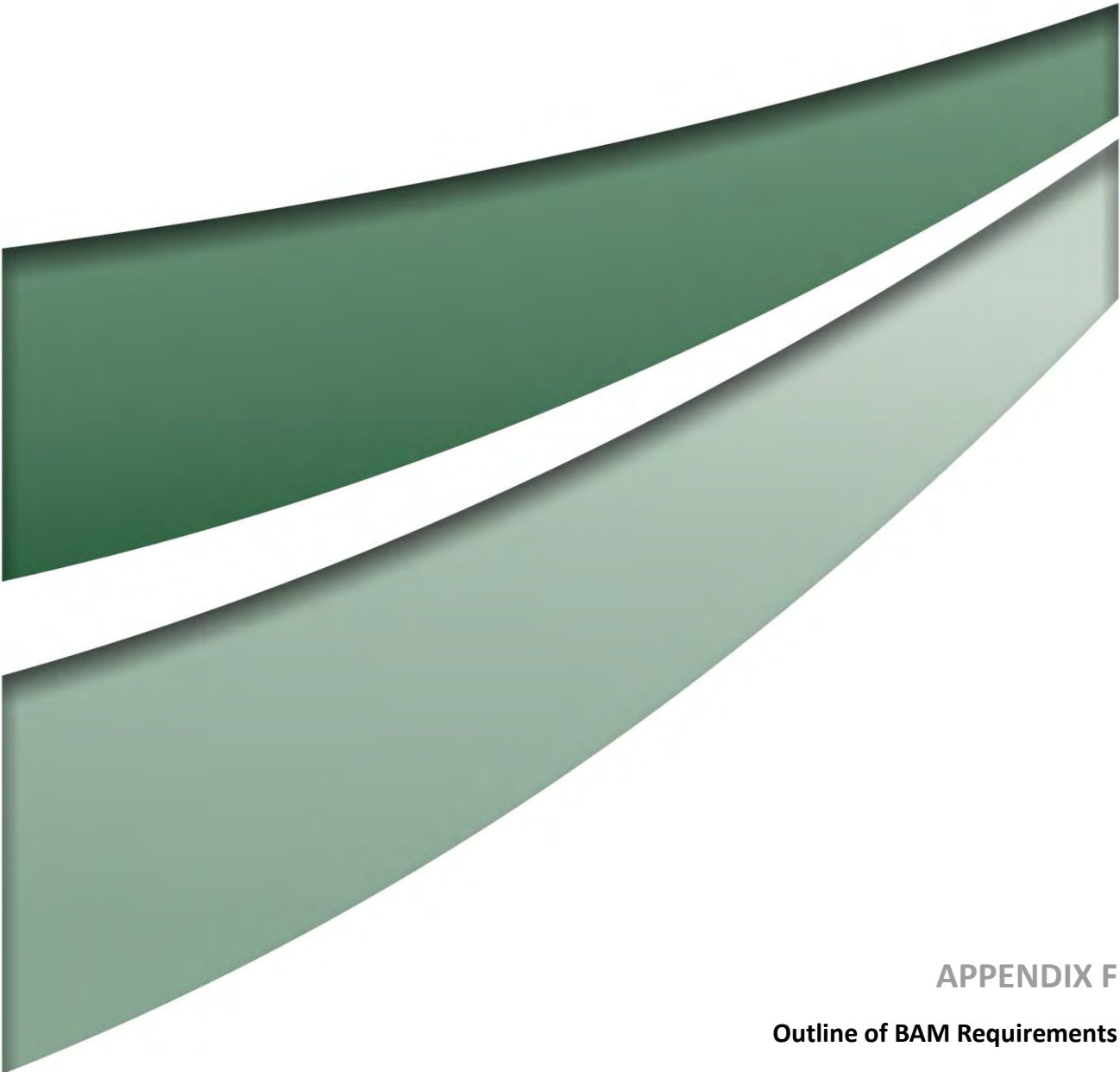
Prickly-leaved Paperbark forest on coastal lowlands of the Central Coast and Lower North Coast										
2	1716_Low	Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	53.5	53.5	0.3	Endangered Ecological Community	Not Listed	High Sensitivity to Potential Gain	2.00	8
									Subtotal	8
Scribbly Gum - Red Bloodwood - Angophora inopina heathy woodland on lowlands of the Central Coast										
1	1636_Moderate	Not a TEC	55.1	55.1	4.6			High Sensitivity to Potential Gain	1.75	111
									Subtotal	111
									Total	119

Species credits for threatened species

Vegetation zone name	Habitat condition (Vegetation Integrity)	Change in habitat condition	Area (ha)/Count (no. individuals)	BC Act Listing status	EPBC Act listing status	Biodiversity risk weighting	Potential SAIL	Species credits
<i>Grevillea parviflora subsp. parviflora</i> / <i>Small-flower Grevillea</i> (<i>Flora</i>)								
1636_Moderate	55.1	55.1	0.2	Vulnerable	Vulnerable	2	False	6
							Subtotal	6

BAM Credit Summary Report

<i>Lathamus discolor / Swift Parrot (Fauna)</i>								
1636_Moderate	55.1	55.1	3.1	Endangered	Critically Endangered	3	True	128
							Subtotal	128
<i>Petaurus norfolcensis / Squirrel Glider (Fauna)</i>								
1636_Moderate	55.1	55.1	4.6	Vulnerable	Not Listed	2	False	127
1716_Low	53.5	53.5	0.3	Vulnerable	Not Listed	2	False	8
							Subtotal	135
<i>Tetradlea juncea / Black-eyed Susan (Flora)</i>								
1636_Moderate	55.1	55.1	0.2	Vulnerable	Vulnerable	2	False	6
							Subtotal	6



APPENDIX F

Outline of BAM Requirements

Report Section	BAM Reference	Requirement
Section 1, and Figure 1.1 and 1.2	Chapters 2 and 3	<p>INFORMATION</p> <p>Introduction to the biodiversity assessment including:</p> <ul style="list-style-type: none"> <input type="checkbox"/> brief description of the proposal <input type="checkbox"/> identification of subject land1 boundary, including: <input type="checkbox"/> operational footprint (if BDAR) <input type="checkbox"/> construction footprint indicating clearing associated with temporary/ancillary construction facilities and infrastructure (if BDAR) <input type="checkbox"/> land proposed for biodiversity certification (if BCAR) <input type="checkbox"/> general description of the subject land <input type="checkbox"/> sources of information used in the assessment, including reports and spatial data <p>MAPS and TABLES (in document)</p> <ul style="list-style-type: none"> <input type="checkbox"/> 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 (if BDAR)
Section 1.2, 1.3 and 3.1, Figure 1.3 and Table 3.1	Sections 3.1. and 3.2, Appendix E	<p>INFORMATION</p> <p>Identification of site context components and landscape features, including:</p> <ul style="list-style-type: none"> <input type="checkbox"/> general description of subject land topographic and hydrological setting, geology and soils <input type="checkbox"/> percent native vegetation cover in the assessment area (as described in BAM Section 3.2) <input type="checkbox"/> IBRA bioregions and subregions (as described in BAM Subsection 3.1.3) <input type="checkbox"/> rivers and streams classified according to stream order (as described in BAM Subsection 3.1.3 and Appendix E) <input type="checkbox"/> wetlands within, adjacent to and downstream of the site (as described in BAM Subsection 3.1.3) <input type="checkbox"/> connectivity of different areas of habitat (as described in BAM Subsection 3.1.3) <input type="checkbox"/> 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 and 3.1.3) <input type="checkbox"/> areas of outstanding biodiversity value occurring on the subject land and assessment area (as described in BAM Subsection 3.1.3) <input type="checkbox"/> any additional landscape features identified in any SEARs for the proposal <p>MAPS and TABLES (in document)</p> <ul style="list-style-type: none"> <input type="checkbox"/> Site Map <input type="checkbox"/> Boundary of subject land <input type="checkbox"/> Cadastre of subject land <input type="checkbox"/> Landscape features identified in BAM Subsection 3.1.3

Report Section	BAM Reference	Requirement
		<input type="checkbox"/> Location Map <input type="checkbox"/> Digital aerial photography at 1:1,000 scale or finer <input type="checkbox"/> Boundary of subject land <input type="checkbox"/> Assessment area, (i.e. the subject land and either 1500 m buffer area or 500 m buffer for linear development) <input type="checkbox"/> Landscape features identified in BAM Subsection 3.1.3 <input type="checkbox"/> Additional detail (e.g. local government area boundaries) relevant at this scale Landscape features identified in BAM Subsection 3.1.3 and to be shown on the Site Map and/or Location map include: <input type="checkbox"/> IBRA bioregions and subregions <input type="checkbox"/> rivers, streams and estuaries <input type="checkbox"/> wetlands and important wetlands <input type="checkbox"/> connectivity of different areas of habitat <input type="checkbox"/> karst, caves, crevices, cliffs, rocks and other geological features of significance and if required, soil hazard features <input type="checkbox"/> areas of outstanding biodiversity value occurring on the subject land and assessment area <input type="checkbox"/> any additional landscape features identified in any SEARs for the proposal <input type="checkbox"/> NSW (Mitchell) landscape on which the subject land occurs
Section 3.2, Figure 3.1, Table 3.2 and Appendix A, B and C	Chapter 4, Appendix A and Appendix H	INFORMATION <input type="checkbox"/> 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 and Subsection 4.1.1) <input type="checkbox"/> Provide justification for all parts of the subject land that do not contain native vegetation (as described in BAM Subsection 4.1.2) <input type="checkbox"/> 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 and Subsection 4.1.1) <input type="checkbox"/> Describe the systematic field-based floristic vegetation survey undertaken in accordance with BAM Section 4.2 <input type="checkbox"/> 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) For each PCT within the subject land, describe: <input type="checkbox"/> vegetation class <input type="checkbox"/> extent (ha) within subject land

Report Section	BAM Reference	Requirement
		<input type="checkbox"/> evidence used to identify a PCT including any analyses undertaken, references/sources, existing vegetation maps (BAM Section 4.2) <input type="checkbox"/> plant species relied upon for identification of the PCT and relative abundance of each species <input type="checkbox"/> if relevant, TEC status including evidence used to determine vegetation is the TEC (BAM Subsection 4.2.2 (1 –2 .)) <input type="checkbox"/> estimate of percent cleared value of PCT (BAM Subsection 4.2.1) Describe the vegetation integrity assessment of the subject land, including: <input type="checkbox"/> identification and mapping of vegetation zones (as described in BAM Subsection 4.3.1) <input type="checkbox"/> assessment of patch size (as described in BAM Subsection 4.3.2) <input type="checkbox"/> survey effort (i.e. number of vegetation integrity survey plots) as described in BAM Subsection 4.3.4 (1 – 2.) <input type="checkbox"/> use of relevant benchmark data from BioNet Vegetation Classification (as described in BAM Subsection 4.3.3) MAPS and TABLES (in document) <input type="checkbox"/> Map of native vegetation extent within the subject land at scale not greater than 1:10,000 including identification of 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) <input type="checkbox"/> Map of PCTs within the subject land (as described in BAM Section 4.2) <input type="checkbox"/> Map of vegetation zones within the subject land (as described in BAM Subsection 4.3.1) <input type="checkbox"/> Map the location of floristic vegetation survey plots and vegetation integrity survey plots relative to PCTs boundaries <input type="checkbox"/> Map of TEC distribution on the subject land and table of TEC listing, status and area (ha) <input type="checkbox"/> Map of patch size locations for each native vegetation zone and table of patch size areas (as described in BAM Subsection 4.3.2) Table of current vegetation integrity scores for each vegetation zone within the site and including: <input type="checkbox"/> composition condition score <input type="checkbox"/> structure condition score <input type="checkbox"/> function condition score <input type="checkbox"/> presence of hollow bearing trees
Section 3.3, Figure 3.2, Appendix 1.3, and Appendix D.	Chapter 5	INFORMATION Identify ecosystem credit species likely to occur on the subject land, including: <input type="checkbox"/> list of ecosystem credit species derived from the BAM-C (as described in BAM Subsection 5.1.1 and Section 5.2)

Report Section	BAM Reference	Requirement
		<p><input type="checkbox"/> 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)</p> <p><input type="checkbox"/> justification for addition of any ecosystem credit species to the list</p> <p>Identify species credit species likely to occur on the subject land, including:</p> <p><input type="checkbox"/> list of species credit species derived from the BAM-C (as described in BAM Subsection 5.1.1)</p> <p><input type="checkbox"/> 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)</p> <p><input type="checkbox"/> 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)</p> <p><input type="checkbox"/> justification for addition of any species credit species to the list</p> <p>From the list of candidate species credit species, identify:</p> <p><input type="checkbox"/> species assumed present within the subject land (if relevant) (as described in BAM Subsection 5.2.4 (2.a .))</p> <p><input type="checkbox"/> 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 .))</p> <p><input type="checkbox"/> species for which targeted surveys are to be completed to determine species presence (Subsection 5.2.4 (2.b .))</p> <p><input type="checkbox"/> species for which an expert report is to be used to determine species presence (Subsection 5.2.4 (2.c .))</p> <p>Present the outcomes of species credit species assessments from:</p> <p><input type="checkbox"/> threatened species survey (as described in BAM Section 5.2.4)</p> <p><input type="checkbox"/> expert reports (if relevant) including justification for presence of the species and information used to make this determination (as described in BAM Section 5.2.4 and 5.3 , Box 3)</p> <p>Where survey has been undertaken include detailed information on:</p> <p><input type="checkbox"/> survey method and effort, (as described in BAM Section 5.3)</p> <p><input type="checkbox"/> 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</p> <p><input type="checkbox"/> 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</p> <p><input type="checkbox"/> survey personnel and relevant experience</p> <p><input type="checkbox"/> describe any limitations to surveys and how these were addressed/overcome</p> <p>MAPS and TABLES (in document)</p> <p><input type="checkbox"/> Table showing ecosystem credit species in accordance with BAM Section 5.1.1 , and identifying:</p> <p><input type="checkbox"/> the ecosystem credit species removed from the list</p>

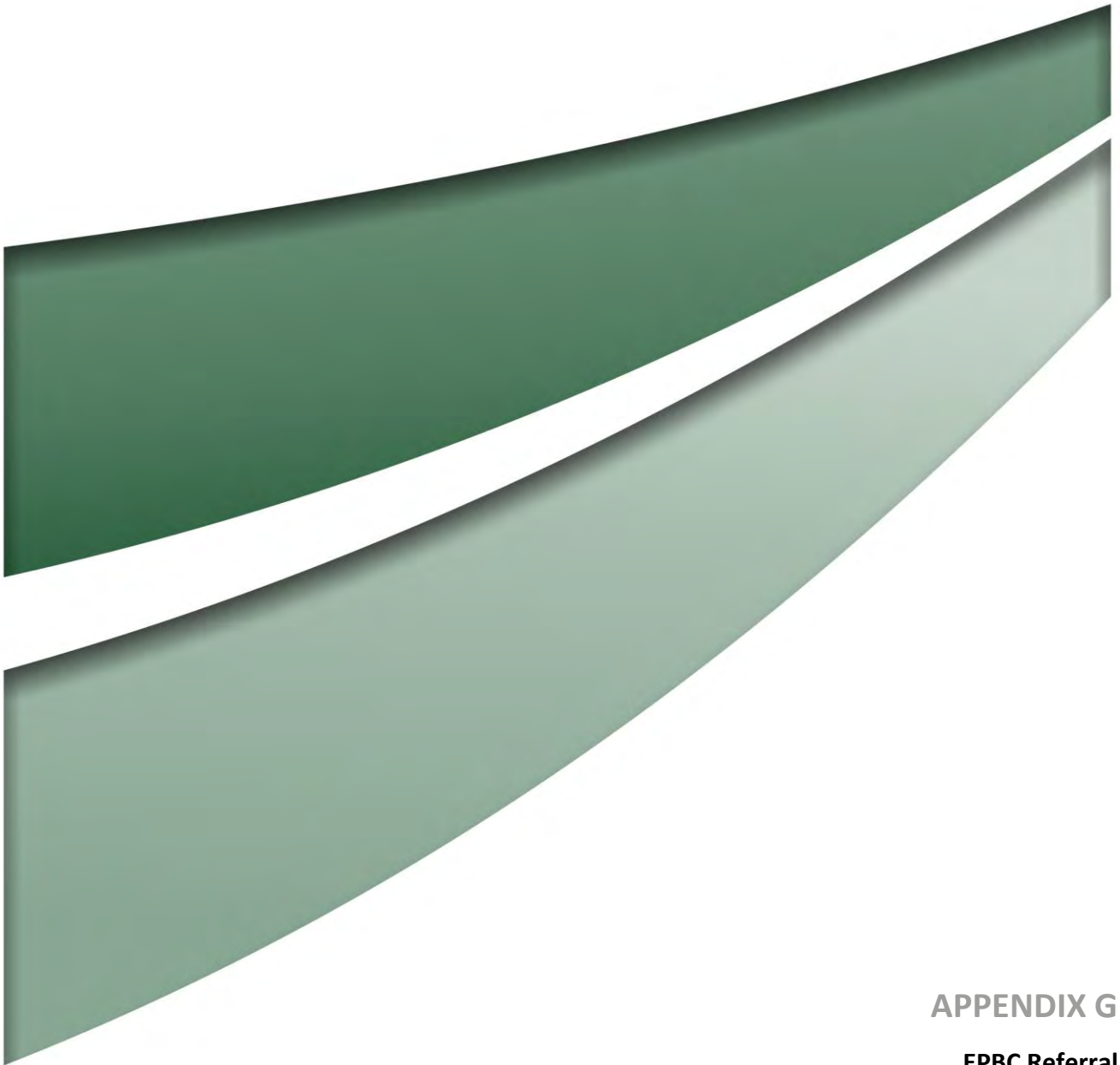
Report Section	BAM Reference	Requirement
		<input type="checkbox"/> the sensitivity to gain class of each species <input type="checkbox"/> Table detailing species credit species in accordance with BAM section 5.2 and identifying: <input type="checkbox"/> the species credit species removed from the list of species because the species is considered vagrant, out of geographic range or the habitat or micro habitat features are not present <input type="checkbox"/> the candidate species credit species not recorded on the subject land as determined by targeted survey, expert report or important habitat map <input type="checkbox"/> 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) <input type="checkbox"/> 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)
Section 4.1.2 and 5.2	Chapter 6	<p>INFORMATION</p> <p>Identify potential prescribed biodiversity impacts on threatened entities, including:</p> <input type="checkbox"/> karst, caves, crevices, cliffs, rocks and other geological features of significance (as described in BAM Subsection 6.1.1) <input type="checkbox"/> occurrences of human-made structures and non-native vegetation (as described in BAM Subsection 6.1.2) <input type="checkbox"/> corridors or other areas of connectivity linking habitat for threatened entities (as described in BAM Subsection 6.1.3) <input type="checkbox"/> water bodies or any hydrological processes that sustain threatened entities (as described in BAM Subsection 6.1.4) <input type="checkbox"/> 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) <input type="checkbox"/> 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) <input type="checkbox"/> Identify a list of threatened entities that may be dependent upon or may use habitat features associated with any of the prescribed impacts <input type="checkbox"/> 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) <p>MAPS and TABLES (in document)</p> <input type="checkbox"/> Map showing location of any prescribed impact features (i.e. karst, caves, crevices, cliffs, rocks, human-made structures, etc.) <input type="checkbox"/> 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)

Report Section	BAM Reference	Requirement
Section 4, Figure 4.1 and Table 4.1	Chapter 7	<p>INFORMATION</p> <p>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:</p> <ul style="list-style-type: none"> <input type="checkbox"/> modes or technologies that would avoid or minimise impacts on biodiversity values and justification for selecting the proposed mode or technology <input type="checkbox"/> routes that would avoid or minimise impacts on biodiversity values and justification for selecting the proposed route <input type="checkbox"/> alternative locations that would avoid or minimise impacts on biodiversity values and justification for selecting the proposed location <input type="checkbox"/> 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 <input type="checkbox"/> 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) <input type="checkbox"/> Identification of any other site constraints that the proponent has considered in determining the location and design of the proposal (as described in BAM Section 7.2.1(3 .)) <p>MAPS and TABLES (in document)</p> <ul style="list-style-type: none"> <input type="checkbox"/> Table of measures to be implemented to avoid and minimise the impacts of the proposal, including action, outcome, timing and responsibility <input type="checkbox"/> Map of alternative footprints considered to avoid or minimise impacts on biodiversity values; and of the final proposal footprint, including construction and operation <input type="checkbox"/> Maps demonstrating indirect impact zones where applicable
Section 5, Table 5.1 and 5.2, and Table 6.1	Chapter 8, Sections 8.1 and 8.2	<p>INFORMATION</p> <ul style="list-style-type: none"> <input type="checkbox"/> 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) <p>Assessment of indirect impacts on vegetation and threatened species and their habitat including (as described in BAM Section 8.2):</p> <ul style="list-style-type: none"> <input type="checkbox"/> description of the nature, extent, frequency, duration and timing of indirect impacts of the proposal <input type="checkbox"/> documenting the consequences to vegetation and threatened species and their habitat including evidence-based justifications <input type="checkbox"/> reporting any limitations or assumptions, etc. made during the assessment <input type="checkbox"/> identification of the threatened entities and their habitat likely to be affected <p>Assessment of prescribed biodiversity impacts (as described in BAM Section 8.3) including:</p>

Report Section	BAM Reference	Requirement
		<p>assessment of the nature, extent and duration of impacts on the habitat of threatened species or ecological communities associated with:</p> <ul style="list-style-type: none"> <input type="checkbox"/> karst, caves, crevices, cliffs, rocks and other features of geological significance <input type="checkbox"/> human-made structures <input type="checkbox"/> non-native vegetation <input type="checkbox"/> connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range <input type="checkbox"/> movement of threatened species that maintains their life cycle <input type="checkbox"/> water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities <input type="checkbox"/> assessment of the impacts of wind turbine strikes on protected animals <input type="checkbox"/> assessment of the impacts of vehicle strikes on threatened species of animals or on animals that are part of a TEC <p>MAPS and TABLES (in document)</p> <ul style="list-style-type: none"> <input type="checkbox"/> Table showing change in vegetation integrity score for each vegetation zone as a result of identified impacts
Section 4.2 and Table 4.1	Chapter 8, Sections 8.4 and 8.5	<p>INFORMATION</p> <p>Identification of measures to mitigate or manage impacts in accordance with the recommendations in BAM Sections 8.4 and 8.5 including:</p> <ul style="list-style-type: none"> <input type="checkbox"/> techniques, timing, frequency and responsibility <input type="checkbox"/> identify measures for which there is risk of failure <input type="checkbox"/> evaluate the risk and consequence of any residual impacts <input type="checkbox"/> document any adaptive management strategy proposed <p>Identification of measures for mitigating impacts related to:</p> <ul style="list-style-type: none"> <input type="checkbox"/> displacement of resident fauna (as described in BAM Subsection 8.4.1 (2 .)) <input type="checkbox"/> indirect impacts on native vegetation and habitat (as described in BAM Subsection 8.4.1 (3 .)) <input type="checkbox"/> mitigating prescribed biodiversity impacts (as described in BAM Subsection 8.4.2) <input type="checkbox"/> Details of the adaptive management strategy proposed to monitor and respond to impacts on biodiversity values that are uncertain (BAM Section 8.5) <p>MAPS and TABLES (in document)</p> <ul style="list-style-type: none"> <input type="checkbox"/> Table of measures to be implemented to mitigate and manage impacts of the proposal, including action, outcome, timing and responsibility

Report Section	BAM Reference	Requirement
Section 5.3 and Section 6, and Figure 6.1	Chapter 9	<p>INFORMATION</p> <p>Identification and assessment of impacts on TECs and threatened species that are at risk of serious and irreversible impacts (SAII, in accordance with BAM Section 9.1) including:</p> <ul style="list-style-type: none"> <input type="checkbox"/> addressing all criteria in Subsection 9.1.1 for each TEC listed as at risk of an SAII present on the subject land <input type="checkbox"/> addressing all criteria in Subsection 9.1.2 for each threatened species at risk of an SAII present on the subject land <input type="checkbox"/> documenting assumptions made and/or limitations to information <input type="checkbox"/> documenting all sources of data, information, references used or consulted <input type="checkbox"/> clearly justifying why any criteria could not be addressed <input type="checkbox"/> Identification of impacts requiring offset in accordance with BAM Section 9.2 <input type="checkbox"/> Identification of impacts not requiring offset in accordance with BAM Subsection 9.2.1 (3 .) <input type="checkbox"/> Identification of areas not requiring assessment in accordance with BAM Section 9.3 <p>MAPS and TABLES (in document)</p> <ul style="list-style-type: none"> <input type="checkbox"/> Map showing the extent of TECs at risk of an SAII within the subject land <input type="checkbox"/> Map showing location of threatened species at risk of an SAII within the subject land <p>Map showing location of:</p> <ul style="list-style-type: none"> <input type="checkbox"/> impacts requiring offset <input type="checkbox"/> impacts not requiring offset <input type="checkbox"/> areas not requiring assessment
Section 6.2 and Section 7, and Table 6.1 and Table 7.1	Chapter 10	<p>INFORMATION</p> <p>Ecosystem credits and species credits that measure the impact of the development on biodiversity values, including:</p> <ul style="list-style-type: none"> <input type="checkbox"/> future vegetation integrity score for each vegetation zone within the subject land (Equation 25 and Equation 26 in BAM Appendix H) <input type="checkbox"/> change in vegetation integrity score (BAM Subsection 8.1.1) <input type="checkbox"/> number of required ecosystem credits for the direct impacts of the proposal on each vegetation zone within the subject land (BAM Subsection 9) <input type="checkbox"/> number of required species credits for each candidate threatened species that is directly impacted on by the proposal (BAM Subsection 10.1.3) <p>MAPS and TABLES (in document)</p> <ul style="list-style-type: none"> <input type="checkbox"/> Table of PCTs requiring offset and the number of ecosystem credits required <input type="checkbox"/> Table of threatened species requiring offset and the number of species credits required

Report Section	BAM Reference	Requirement
Section 7 and Table 7.1	Chapter 10	INFORMATION <input type="checkbox"/> 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) MAPS and TABLES (in document) <input type="checkbox"/> Table of credit class and matching credit profile



APPENDIX G

EPBC Referral



Notification of

REFERRAL DECISION – not controlled action if undertaken in a particular manner

Eraring Battery Energy Storage System, NSW (2021/8956)

This decision is made under sections 75 and 77A of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Proposed action

person named in the referral	Origin Energy Eraring Pty Limited ACN: 164 994 012
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proposed action	To construct, operate, maintain, and decommission a grid-scale Battery Energy Storage System adjacent to the Eraring Power Station site, Eraring, NSW [See EPBC Act referral 2021/8956]
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Referral decision: Not a controlled action if undertaken in a particular manner

status of proposed action	The proposed action is not a controlled action provided it is undertaken in the manner set out in this decision.
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Person authorised to make decision

Name and position	Kate Gowland A/g Assistant Secretary Environment Assessments (NSW, ACT) Branch
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signature

date of decision

19/7/2021

manner in which proposed action must be taken	To avoid significant impacts on EPBC Act listed threatened species and communities (sections 18 & 18A), the person taking the action must:
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1. Design and implement erosion and sediment control measures and water management infrastructure in accordance with the best management practices specified in **Managing Urban Stormwater – Soils and Construction** to prevent loss of soil and the entry of sediment into any receiving waters.
-

-
2. Undertake visual assessment of surface water runoff structures, drainage structures and erosion control structures at least once every week and also following any heavy rain during construction and decommissioning, until such time as permanent drainage is established and functioning to prevent sediment laden run-off, to ensure all water structures are operating effectively for their designed purpose; promptly address any deficiency in their operation by clearing sediment traps of sediment, storing and/or disposing of sediment (if required) in accordance with **Managing Urban Stormwater – Soils and Construction**; and repairing any damaged structures immediately after the damage is identified.
 3. Ensure that the quality of all water associated with the proposed action leaving the area designated as the 'Project area' in the map at Annexure A meets the following performance criteria:
 - a. Total Suspended Solids: less than 50 mg/L (using appropriate real-time turbidity levels);
 - b. pH: Between 6.5 and 8.5 and;
 - c. No hydrocarbon or any other chemical contaminants exceeding the relevant triggering levels set out in the **ANZG (2018)** and **Heads of EPAs Australia and New Zealand (HEPA) (2018)** guidelines
 4. Undertake routine monitoring, at least fortnightly during the construction and decommissioning stages and, until such time as permanent drainage are demonstrated to be functioning and non-polluting, capable of detecting whether the requirements of Particular Manner 3 are being met. Following completion of construction, undertake biannual surveillance monitoring and sampling to confirm permanent drainage achieves the requirements of Particular Manner 3. All water monitoring records must be retained and made publicly accessible.
 5. Not use any **flocculants** that are harmful to amphibians. Records must be kept of any flocculant use and be made available to the Department, upon request.
 6. Implement hygiene protocols in accordance with the **SAVING OUR SPECIES Hygiene guidelines**.

Definitions

ANZG, 2018 means the publication *Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia -95% species protection in marine waters.*

Flocculants refer to chemicals that promote suspended particles in liquid to aggregate, forming a floc.

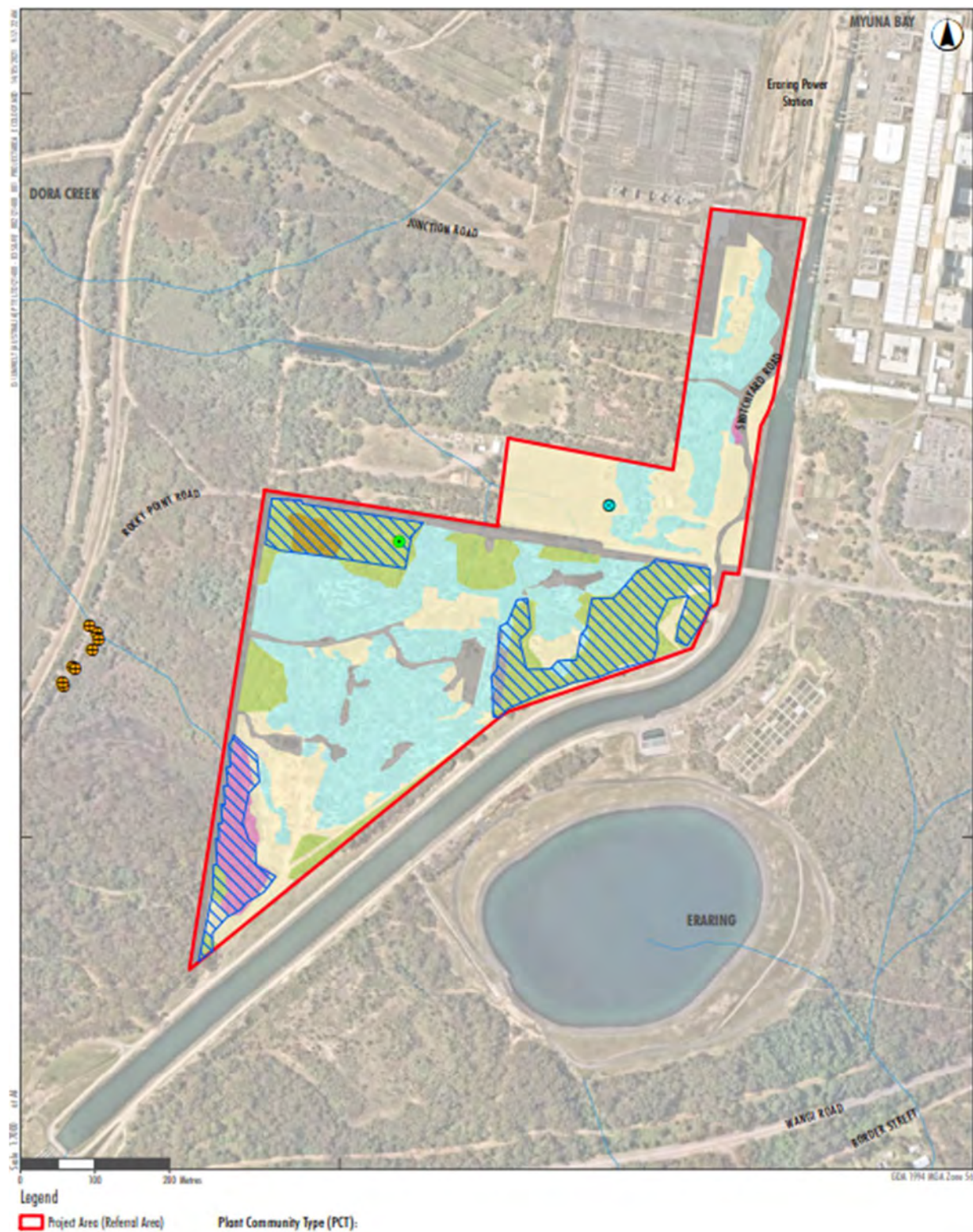
Heads of EPAs Australia and New Zealand (HEPA) 2018 means the publication *PFAS National Environmental Management Plan 2.0*. January 2020.

Managing Urban Stormwater – Soils and Construction means the publication *Managing Urban Stormwater – Soils and Construction (1st Volume, 4th Edition)*, NSW Landcom (2004).

SAVING OUR SPECIES Hygiene guidelines means the publication *SAVING OUR SPECIES Hygiene guidelines: Protocols to protect priority biodiversity areas in NSW from Phytophthora cinnamomi, myrtle rust, amphibian chytrid fungus and invasive plants*, NSW DPIE (2020).



Annexure A



Our Ref: 21400/R02/SC/PF/17052021

17 May 2021

Marianne Gibbons
Senior Environment & Community Business Partner
Origin Energy
Level 24, 180 Ann Street
Brisbane Queensland 4000

Dear Marianne

Re: EPBC Referral Supporting Material - Biodiversity

Umwelt (Australia) Pty Limited (Umwelt) has been engaged by Origin Energy (Origin) to provide ecological input into a EPBC referral for the Battery Energy Storage System (BESS). This supporting material has been prepared to inform the referral being prepared by Jacobs.

1.0 Project Description

Origin is seeking approval for the State Significant Development (SSD) application of a grid scale BESS to be developed on land adjacent to the Eraring Power Station (EPS) and connected to the existing transmission lines. The proposed BESS would be developed in three stages to achieve installed capacity up to 700 MW and energy generation of 2800 MWh. The BESS would have potential for future expansion beyond 700 MW/2800 MWh.

The Project would include:

- Constructing a grid connected BESS with discharge capacity of up to 700 megawatts (MW) and storage capacity of 2800 MWh able to dispatch over variable durations from four hours to beyond eight hours
- Establishing High voltage (HV) and medium voltage (MV) transformers and associated infrastructure
- Connecting the BESS to 330 kV TransGrid switchyard by an approximate 400 metre overhead 330kV transmission line
- Installing safety protection systems and site ancillary facilities such as laydown areas and site offices.

Inspired People
Dedicated Team
Quality Outcomes

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Umwelt (Australia) Pty Limited
ABN 18 059 519 041

- On a regional scale, the Project area occurs within the Sydney Basin Interim Biogeographic Regionalisation for Australia (IBRA) in the Wyong sub-region. Locally, the proposed BESS occurs within a large tract of remnant vegetation extending from Dora Creek to the south, through to Cameron Park in the north, Lake Macquarie in the east, and bounded by the Newcastle to Sydney Motorway (M1) in the west. The majority of the Project area is largely modified as a result of historical disturbance.

2.0 Previous Ecological Studies and Ecological Values

2.1 Ecological Studies

Recent ecological studies of the Project area were completed in November 2020, January 2021 and March 2021 to inform a constraints assessment across a larger study area (Umwelt 2021). These surveys were designed to collect preliminary ecological data to identify the broad ecological features of the study areas and included:

- 12 floristic plots in accordance with the NSW Biodiversity Assessment Methodology (BAM),
- Threatened species survey transects in accordance with *NSW Guide to Surveying Threatened Plants and their habitats* (DPIE 2020b),
- Nocturnal spotlighting surveys for birds, mammals and reptiles, and
- Targeted green and golden bell frog searches

Whilst these surveys were completed over a larger study area, the current Project area was included in the surveys.

2.2 Ecological Values

The Project area largely comprises areas that have previously been disturbed and historically cleared (refer to **Figure 1**). Vegetation surveys conducted by Umwelt in 2020 and 2021 have confirmed the presence of three plant community types in the Project area:

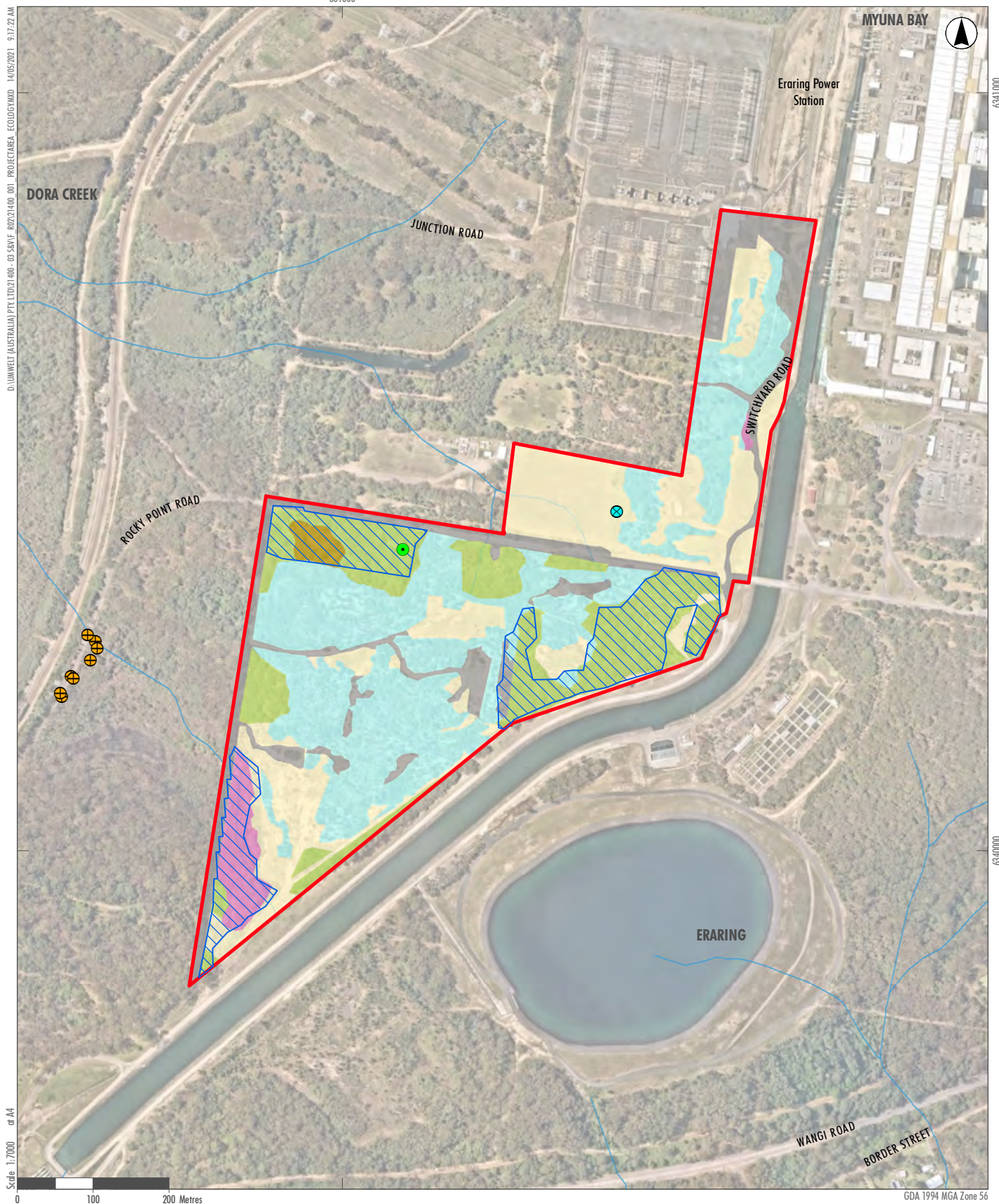
- 1636 Scribbly Gum - Red Bloodwood - *Angophora inopina* heathy woodland on lowlands of the Central Coast moderate condition (approximately 5.5 hectares)
- 1727 Swamp Oak - Sea Rush - *Baumea juncea* swamp forest on coastal lowlands of the Central Coast and Lower North Coast poor condition (approximately 10.8 hectares)
- 1716 Prickly-leaved Paperbark forest on coastal lowlands of the Central Coast and Lower North Coast moderate condition (approximately 1.0 hectare)

PCT 1716 corresponds to Swamp Sclerophyll Forest on Coastal Floodplains Endangered Ecological Community (EEC), listed under the Biodiversity Conservation Act 2016 (BC Act) and may conform to the Coastal swamp sclerophyll forests of south-eastern Australia community currently nominated for listing under the EPBC Act.

Fauna habitat within the project is limited. The project area contains a small number of hollow-bearing trees and is bounded by roads, tracks and the EPS inlet canal. Further connectivity to the north is interrupted by Power Station infrastructure and power line easements and connectivity to the west is interrupted by the Newcastle to Sydney railway line.

Three threatened species listed under the EPBC Act have been recorded proximate to the Project area. The small- flower grevillea (*Grevillea parviflora* subsp. *parviflora*) was detected within the Project area, while the green and golden bell frog (*Litoria aurea*) was detected approximately 200 metres to the west of the Project area. Both are listed as vulnerable under the EPBC Act. A single record of the swift parrot (*Lathamus discolor*), listed as critically endangered under the EPBC Act, is located within the Project area. The record is shown on the NSW Bionet Atlas with an observation date of 2011.

The preliminary vegetation mapping and these three threatened species are shown on **Figure 1** in relation to the Project area.



Legend

 Project Area (Referral Area)

Threatened Species

- *Grevillea parviflora* subsp. *parviflora*
- ⊗ Green and Golden Bell Frog
- ⊗ Swift Parrot
- Swift Parrot Habitat Mapping

Plant Community Type (PCT):

- 1636 Scribbly Gum - Red Bloodwood - Angophora inapina heathy woodland on lowlands of the Central Coast good condition
- 1716 Prickly-leaved Paperbark forest on coastal lowlands of the Central Coast and Lower North Coast good condition
- 1727 Swamp Oak - Sea Rush - Baumea juncea swamp forest on coastal lowlands of the Central Coast and Lower North Coast poor condition
- Disturbed/cleared
- Exotic
- Exotic - Pine Trees

FIGURE 1

**Project Area,
Preliminary Vegetation Mapping
and Threatened Species**

3.0 Identification of Matters of National Environmental Significance

In addition to the field surveys completed to date, MNES that may occur in the Project area have been identified through a desktop review of available literature and databases. This includes:

- A search of the NSW Department of Planning, Industries and Environment (DPIE) BioNet Atlas of NSW Wildlife (2021) and the Commonwealth Department of Agriculture, Water and the Environment (DAWE) Protected Matters Database (2021) within a 10-kilometre radius of the Project area to identify threatened species, endangered populations and TECs previously recorded within the locality.
- Eraring Power Station Ecological Constraints Assessment: Future Energy Developments (Umwelt 2021).
- Eraring Power Station Biodiversity Development Assessment Report for the Ash Dam Augmentation Modification Project (Umwelt 2018).
- The Vegetation of Lake Macquarie City Council (Bell and Driscoll 2015).
- Threatened Biodiversity Data Collection (DPIE 2021a) reporting for known/predicted threatened communities in the Hunter IBRA subregion

A desktop assessment of the likelihood of occurrence of biodiversity related MNES in the Project area has been undertaken (refer to **Table 3**). This assessment has been prepared on the basis of the definitions as provided in **Table 1** and for the Project area it includes consideration of the results from ecological surveys undertaken in November 2020 and January (Umwelt 2021) and March 2021 (Umwelt in prep), as well as knowledge of the EPS landholding by Umwelt ecologists from previous surveys (Umwelt 2018). It should be noted that for mobile matters, occurrence in the context of **Tables 1** and **3** in this document refers to the utilisation of the habitats of the Project area for foraging, breeding, roosting or nesting and does not include movement activities where the specific habitats of the Project areas are not utilised such as flyovers for birds or bats.

Table 1 - Definitions of Likelihood of Occurrence

Likelihood of Occurrence	Definition
Known	Recent and reliable records of this matter exist within the Project area.
High	Despite a lack of records, it is probable that the matter occurs in the Project area.
Medium	Suitable habitat is present for this matter however records of the matter are not known to occur in the immediate locality.
Low	There are no records for this matter, the matter is conspicuous all year and not recorded during targeted searches, habitat requirements are not met, or its normal distribution range does not coincide with the locality. Despite this, the matter may be present in rare circumstances.
No	There is no potential for the species to occur within the locality.

Those species identified as medium or higher likelihood of occurrence in the Project area are assessed further in **Appendix A**.

The desktop assessment identified 104 threatened and/or migratory entities have been recorded in the locality and/or are predicted to occur within the locality. This includes 3 ecological communities, 23 plants, 6 frogs, 5 fish, 6 reptiles, 51 birds and 10 mammals (refer to **Table 2**).

Table 2 – Summary of Threatened Entities Identified from the Desktop Review

Group	Number of Threatened and/or Migratory Entities in Locality listed under:		
	EPBC Act threatened	EPBC Act migratory	Total
Ecological communities	3	0	3
Plants	23	0	23
Frogs	6	0	6
Fish	5	0	5
Reptiles	6	5	6
Birds	29	39	51
Mammals	8	1	10
Total	80	45	104

The potential for each biodiversity-related matter to occur within the EPS (entire land holding) and the current Project area (approximately 30 ha) is provided in **Table 3**. The likelihood provided for matters within the Project area is based on both the desktop review and the results of the ecological surveys undertaken across the Project area. The likelihood provided for the EPS area is provided for context only.

Table 3 – Assessment of Likelihood of Occurrence of Threatened and Migratory Species

Scientific Name	Common Name	Conservati on Status EPBC Act	Recorded in Locality (within 10km)		Likelihood of Occurrence	
			PMST	BioNet Records	in EPS	in Project area
Ecological Communities						
Coastal Swamp Oak (<i>Casuarina glauca</i>) Forest of NSW and South East Queensland ecological community		E	likely to occur	In locality	Known	No
River-flat Eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria		CE	Likely to occur	-	Low	No
Subtropical and Temperate Coastal Saltmarsh		V	likely to occur	-	No	No
Birds						
<i>Actitis hypoleucos</i>	common sandpiper	C, J, K	Predicted	1	Medium	No habitat present for this species.
<i>Anous stolidus</i>	common noddy	C, J, K	Predicted	-	No	No habitat present for this species.
<i>Anthochaera phrygia</i>	regent honeyeater	CE	Predicted	20	Medium	Medium. Foraging habitat present within PCT 1636 and 1716. Assessment Required.
<i>Apus pacificus</i>	fork-tailed swift	C, J, K	Predicted	1	Low	Low. Aerial foraging above the Project area only.
<i>Ardenna grisea</i>	sooty shearwater	C, J	Predicted	-	No	No habitat present for this species.
<i>Ardenna tenuirostris</i>	short-tailed shearwater	C, J, K	-	2	No	No habitat present for this species.

Scientific Name	Common Name	Conservation Status EPBC Act	Recorded in Locality (within 10km)		Likelihood of Occurrence	
			PMST	BioNet Records	in EPS	in Project area
<i>Botaurus poiciloptilus</i>	Australasian bittern	E	Predicted	-	Low	No habitat present for this species.
<i>Calidris acuminata</i>	sharp-tailed sandpiper	B, C, J, K	Predicted	-	Medium	No habitat present for this species.
<i>Calidris canutus</i>	red knot	E, C, J, K	Predicted	-	Medium	No habitat present for this species.
<i>Calidris ferruginea</i>	curlew sandpiper	CE, B, C, J, K	Predicted	-	Medium	No habitat present for this species.
<i>Calidris ruficollis</i>	red-necked stint	C, J, K	-	-	Low	No habitat present for this species.
<i>Calonectris leucomelas</i>	streaked shearwater	C, J, K	Predicted	-	Low	No habitat present for this species.
<i>Cuculus optatus</i>	oriental cuckoo	C	Predicted	-	Low	Low. Habitat for this species is marginal.
<i>Diomedea antipodensis</i>	antipodean albatross	V, C, J, K	Foraging, feeding or related behaviour likely to occur	-	No	No habitat present for this species.
<i>Diomedea antipodensis gibsoni</i>	Gibson's albatross	V	Foraging, feeding or related behaviour likely to occur	-	No	No habitat present for this species.
<i>Diomedea epomophora</i>	southern royal albatross	V, C, J, K	Foraging, feeding or related behaviour likely to occur	-	No	No habitat present for this species.
<i>Diomedea exulans</i>	wandering albatross	V, C, J, K	Foraging, feeding or related behaviour likely to occur	-	No	No habitat present for this species.

Scientific Name	Common Name	Conservation Status EPBC Act	Recorded in Locality (within 10km)		Likelihood of Occurrence	
			PMST	BioNet Records	in EPS	in Project area
<i>Diomedea sanfordi</i>	northern royal albatross	E, C, J, K	Foraging, feeding or related behaviour likely to occur	-	No	No habitat present for this species.
<i>Erythrotriorchis radiatus</i>	red goshawk	V	Predicted	-	Low	Low. Habitat for this species is marginal.
<i>Falco hypoleucos</i>	grey falcon	V	Predicted	-	Low	Low. Habitat for this species is marginal.
<i>Fregata ariel</i>	lesser frigatebird	C, J, K	Predicted	-	No	No habitat present for this species.
<i>Fregata minor</i>	great frigatebird	C, J, K	Predicted	-	No	No habitat present for this species.
<i>Gallinago hardwickii</i>	Latham's snipe	B, C, J, K	Predicted	-	Medium	Low. Habitat for this species is marginal.
<i>Grantiella picta</i>	painted honeyeater	V	Predicted	-	Low	Low. Habitat for this species is marginal.
<i>Hirundapus caudacutus</i>	white-throated needletail	V, C, J, K	Predicted	12	Low	Low. Habitat for this species is marginal.
<i>Lathamus discolor</i>	swift parrot	CE	Predicted	17	Known, near EPS outlet	Medium. Nearby records and foraging habitat present Assessment Required.
<i>Limosa lapponica</i>	bar-tailed godwit	C, J, K	Predicted	-	No	No habitat present for this species.
<i>Macronectes giganteus</i>	Southern giant petrel	E, C, J, K	Predicted	-	No	No habitat present for this species.
<i>Macronectes halli</i>	Northern giant petrel	V, C, J, K	Predicted	-	No	No habitat present for this species.

Scientific Name	Common Name	Conservation Status EPBC Act	Recorded in Locality (within 10km)		Likelihood of Occurrence	
			PMST	BioNet Records	in EPS	in Project area
<i>Monarcha melanopsis</i>	black-faced monarch	B	Predicted	-	Medium	Medium. Habitat present within PCT 1636 and 1716. Assessment Required.
<i>Monarcha trivirgatus</i>	spectacled monarch	B	Predicted	-	Medium	Low. Habitat for this species is marginal.
<i>Motacilla flava</i>	yellow wagtail	C, J, R	Predicted	-	Low	Low. Habitat for this species is marginal.
<i>Myiagra cyanoleuca</i>	satin flycatcher	B	Predicted	-	Low	Low. Habitat for this species is marginal.
<i>Numenius madagascariensis</i>	eastern curlew	CE, C, J, K	Predicted	-	No	No habitat present for this species.
<i>Pachyptila turtur subantarctica</i>	fairy prion	V	Predicted	-	No	No habitat present for this species.
<i>Pandion haliaetus</i>	osprey	C, J, K	Predicted	-	Medium	Low. Habitat for this species is marginal.
<i>Pluvialis fulva</i>	Pacific gull	C, J, K	Predicted	-	No	No habitat present for this species.
<i>Rhipidura rufifrons</i>	rufous fantail	B	Predicted	-	Low	Low. Habitat for this species is marginal.
<i>Rostratula australis</i>	Australian painted snipe	E	Predicted	-	Low	Low. Habitat for this species is marginal.
<i>Sternula nereis nereis</i>	Australian fairy tern	V	Predicted	-	No	No habitat present for this species.
<i>Thalassarche bulleri</i>	Buller's albatross	V, C, J, K	Predicted	-	No	No habitat present for this species.

Scientific Name	Common Name	Conservation Status EPBC Act	Recorded in Locality (within 10km)		Likelihood of Occurrence	
			PMST	BioNet Records	in EPS	in Project area
<i>Thalassarche bulleri platei</i>	northern Buller's albatross	V	Predicted	-	No	No habitat present for this species.
<i>Thalassarche cauta</i>	shy albatross	E, C, J, K	Foraging, feeding or related behaviour likely to occur	-	No	No habitat present for this species.
<i>Thalassarche eremita</i>	Chatham albatross	E, C, J, K	Foraging, feeding or related behaviour likely to occur	-	No	No habitat present for this species.
<i>Thalassarche impavida</i>	Campbell albatross	V, C, J, K	Predicted	-	No	No habitat present for this species.
<i>Thalassarche melanophris</i>	black- browed albatross	V, C, J, K	Predicted	-	No	No habitat present for this species.
<i>Thalassarche salvini</i>	Salvin's albatross	V, C, J, K	Foraging, feeding or related behaviour likely to occur	-	No	No habitat present for this species.
<i>Thalassarche steadi</i>	white- capped albatross	V, C, J, K	Foraging, feeding or related behaviour likely to occur	-	No	No habitat present for this species.
<i>Thalasseus bergii</i>	crested tern	P, J	-	1	Low	No habitat present for this species.
<i>Thinornis cucullatus cucullatus</i>	hooded plover	V	Predicted	-	No	No habitat present for this species.
<i>Tringa nebularia</i>	common greenshank	C, J, K	Predicted	-	No	No habitat present for this species.
Fish						

Scientific Name	Common Name	Conservation Status EPBC Act	Recorded in Locality (within 10km)		Likelihood of Occurrence	
			PMST	BioNet Records	in EPS	in Project area
<i>Epinephelus daemeli</i>	black rockcod	V	Predicted	-	No	No habitat present for this species.
<i>Lamna nasus</i>	porbeagle	B	Predicted	-	No	No habitat present for this species.
<i>Manta alfredi</i>	reef manta ray	B	Predicted	-	No	No habitat present for this species.
<i>Manta birostris</i>	giant manta ray	B	Predicted	-	No	No habitat present for this species.
<i>Sousa chinensis</i>	Indo-Pacific humpback dolphin	B	Predicted	-	No	No habitat present for this species.
Amphibians						
<i>Heleioporus australiacus</i>	giant burrowing frog	V	Predicted	-	Low	No habitat present for this species.
<i>Litoria aurea</i>	green and golden bell frog	V	Predicted	43	Known	Low. Habitat for this species is marginal within the Project area, though it was detected 200 metres to the west within EPS landholdings. Assessment Required.
<i>Litoria littlejohni</i>	Littlejohn's tree frog	V	Predicted	-	No	No habitat present for this species.
<i>Mixophyes balbus</i>	stuttering frog	V	Predicted	-	No	No habitat present for this species.
<i>Mixophyes iteratus</i>	giant barred frog	E	Predicted	-	No	No habitat present for this species.

Scientific Name	Common Name	Conservation Status EPBC Act	Recorded in Locality (within 10km)		Likelihood of Occurrence	
			PMST	BioNet Records	in EPS	in Project area
<i>Uperoleia mahonyi</i>	Mahony's toadlet	E	Predicted	-	Low	No habitat present for this species.
Mammals						
<i>Chalinolobus dwyeri</i>	large-eared pied bat	V	Predicted	1	Medium	Medium. Nearby records and foraging habitat present across the Project area. Assessment Required.
<i>Dasyurus maculatus</i>	spotted-tailed quoll	E	Predicted	6	Medium	Low. Habitat for this species is marginal.
<i>Dugong dugon</i>	dugong	B	Predicted	-	No	No habitat present for this species.
<i>Petauroides volans</i>	greater glider	V	Predicted	1	Low	No habitat present for this species.
<i>Petrogale pencillata</i>	brush-tailed rock-wallaby	E	Predicted	-	No	No habitat present for this species.
<i>Phascolarctos cinereus</i>	koala	V	Predicted	12	Medium	Low. Habitat for this species is marginal.
<i>Potorous tridactylus</i>	long-nosed potoroo	V	Predicted	-	Low	Low. Habitat for this species is marginal.
<i>Pseudomys novaehollandiae</i>	New Holland mouse	V	Predicted	1	Low	Low. Habitat for this species is marginal.
<i>Pteropus poliocephalus</i>	grey-headed flying-fox	V	Predicted	39	Known	Medium. Foraging habitat is present within PCT 1636 and 1716.

Scientific Name	Common Name	Conservation Status EPBC Act	Recorded in Locality (within 10km)		Likelihood of Occurrence	
			PMST	BioNet Records	in EPS	in Project area
						Assessment Required.
Reptiles						
<i>Caretta caretta</i>	loggerhead turtle	E, B	Predicted	2	Known, EPS inlet canal	No habitat present for this species.
<i>Chelonia mydas</i>	green turtle	V, B	Predicted	60	Known, EPS inlet canal	No habitat present for this species.
<i>Dermochelys coriacea</i>	leatherback turtle	E, B	Predicted	-	No	No habitat present for this species.
<i>Eretmochelys imbricata</i>	hawksbill turtle	V, B	Predicted	-	No	No habitat present for this species.
<i>Hoplocephalus bungaroides</i>	broad-headed snake	V	Predicted	-	Low	Low. Habitat for this species is marginal.
<i>Natator depressus</i>	flatback turtle	V, B	Predicted	-	No	No habitat present for this species.
Flora						
<i>Acacia bynoeana</i>	Bynoe's wattle	V	Predicted	81	Known	Low. Not identified despite targeted searches for this species conducted in November 2020 and January 2021 in PCT 1636.
<i>Angophora inopina</i>	Charmhaven apple	V	Predicted	283	Known in east of operational land	Low. Habitat for this species is marginal and species not detected during targeted surveys.

Scientific Name	Common Name	Conservation Status EPBC Act	Recorded in Locality (within 10km)		Likelihood of Occurrence	
			PMST	BioNet Records	in EPS	in Project area
<i>Astrotricha crassifolia</i>	thick-leaf star-hair	V	-	1	Low	Low. Habitat for this species is marginal and species not detected during targeted surveys.
<i>Caladenia tessellata</i>	thick- lipped spider- orchid	V	Predicted	-	Low	Low. Habitat for this species is marginal and species not detected during targeted surveys.
<i>Corunastylis insignis</i>	Wyong midge orchid	CE	-	51	Medium	Medium. Habitat for this species is marginal, however targeted surveys not conducted during flowering period. Assessment Required.
<i>Cryptostylis hunteriana</i>	leafless tongue orchid	V	Predicted	3	Known	Low. Not identified despite targeted searches for this species conducted in November 2020.
<i>Cynanchum elegans</i>	white-flowered wax plant	E	Predicted	-	Low	Low. Habitat for this species is marginal and species not detected during targeted surveys.
<i>Diuris praecox</i>	rough doubletail	V	Predicted	-	Low	Low. Habitat for this species is marginal.

Scientific Name	Common Name	Conservation Status EPBC Act	Recorded in Locality (within 10km)		Likelihood of Occurrence	
			PMST	BioNet Records	in EPS	in Project area
<i>Eucalyptus camfieldii</i>	Camfield's stringybark	V	Predicted	-	Low	Low. Habitat for this species is marginal and species not detected during targeted surveys.
<i>Eucalyptus parramattensis</i> subsp. <i>decadens</i>	Earp's gum	V	Predicted	-	Low	Low. Habitat for this species is marginal and species not detected during targeted surveys.
<i>Euphrasia arguta</i>	-	CE	Predicted	-	Low	Low. Habitat for this species is marginal and no records within 10 km.
<i>Grevillea parviflora</i> subsp. <i>parviflora</i>	small-flower grevillea	V	Predicted	37	Known	Known. Detected within Project area. Assessment Required.
<i>Melaleuca biconvexa</i>	biconvex paperbark	V	Predicted	16	Low	Low. Habitat for this species is marginal and species not detected during targeted surveys.
<i>Persicaria elatior</i>	tall knotweed	V	Predicted	-	Low	Low. Habitat for this species is marginal and species not detected during targeted surveys.
<i>Persoonia hirsuta</i>	hairy geebung	E	-	-	Low	Low. Habitat for this species is marginal and

Scientific Name	Common Name	Conservation Status EPBC Act	Recorded in Locality (within 10km)		Likelihood of Occurrence	
			PMST	BioNet Records	in EPS	in Project area
						species not detected during targeted surveys.
<i>Pterostylis gibbosa</i>	Illawarra greenhood	E	Predicted	-	Low	Low. Habitat for this species is marginal and no records within 10 km.
<i>Rhizanthella slateri</i>	eastern underground orchid	E	Predicted	-	Low	Low. Habitat for this species is marginal and no records within 10 km.
<i>Rhodamnia rubescens</i>	scrub turpentine	CE	Predicted	-	No	No habitat present for this species.
<i>Rhodomyrtus psidioides</i>	native guava	CE	Predicted	-	No	No habitat present for this species.
<i>Rutidosis heterogama</i>	heath wrinklewort	V	Predicted	-	Medium	Medium. Habitat present within PCT 1636. Assessment Required.
<i>Syzygium paniculatum</i>	magenta lilly pilly	V	Predicted	1	No	No habitat present for this species.
<i>Tetradlea juncea</i>	black-eyed Susan	V	Predicted	1823	Known	Medium. Habitat present within PCT 1636, though not detected during targeted surveys in November 2020 and January 2021. This is outside flowering

Scientific Name	Common Name	Conservation Status EPBC Act	Recorded in Locality (within 10km)		Likelihood of Occurrence	
			PMST	BioNet Records	in EPS	in Project area
						period, though flowering individuals were detected adjacent to the Project area at this time. Assessment Required.
<i>Thesium austral</i>	Austral toadflax	V	Predicted	-	Low	Low. Habitat for this species is marginal and no records within 10 km.

Note: FM Act = *Fisheries Management Act 1994*; CE = critically endangered; E = endangered; V = vulnerable; M = Migratory, Ma = Marine, C = CAMBA, J = JAMBA, K = ROKAMBA, B = Bonn; ESP = Eraring Power Station

Of the 104 threatened and migratory entities identified in the database searches and literature review, 10 are categorised as having a medium or greater likelihood of utilising the terrestrial habitats in the Project area and require further consideration in this report (see **Table 4**).

Table 4 Threatened and Migratory Entities Known or Likely to occur in the Project area

Species	EPBC Act
<i>Chalinolobus dwyeri</i> (large- eared pied bat)	V
<i>Grevillea parviflora</i> subsp. <i>parviflora</i> (small- flower grevillea)	V
<i>Litoria aurea</i> (green and golden bell frog)	V
<i>Pteropus poliocephalus</i> (grey- headed flying-fox)	V
<i>Rutidosia heterogama</i> (heath wrinklewort)	V
<i>Tetratheca juncea</i> (black- eyed susan)	V
<i>Anthochaera phrygia</i> (regent honeyeater)	CE
<i>Corunastylis insignis</i> (Wyang midge orchid)	CE
<i>Lathamus discolor</i> (swift parrot)	CE
<i>Monarcha melanopsis</i> (black- faced monarch)	B

4.0 MNES Impact Assessment

The results of the database searches, review of existing information and field investigations completed recently by Umwelt (2021 in prep) have identified that the project may or will impact upon the MNES identified in **Table 4** above.

Assessment of the significance of impact of the project against the 'Significant Impact Guidelines 1.1' for MNES as listed under the EPBC Act are provided in **Appendix A**. These Assessments of Significance consider the direct and indirect impacts associated with the project. A summary of the potential impacts and assessment outcomes is presented in **Table 5** below.

Table 5 Threatened and Migratory Species Assessment Summary and Outcomes

Species	Summary of Potential Impact	Significance of Impact
<i>Chalinolobus dwyeri</i> (large-eared pied bat)	Removal of approximately 30 ha of open forest and woodland that contains potential foraging habitat only (potential to forage sporadically across the entire site)	Not Significant
<i>Grevillea parviflora</i> subsp. <i>parviflora</i> (small- flower grevillea)	Potential removal of 42 individuals and approximately 5.5 hectares of potential habitat	Not Significant
<i>Litoria aurea</i> (green and golden bell frog)	No direct impacts. Potential indirect impacts on the Muddy Lake Important Population.	Not Significant
<i>Pteropus poliocephalus</i> (grey- headed flying-fox)	Removal of approximately 6.5 ha of open forest and woodland that contains potential foraging habitat	Not Significant
<i>Rutidosia heterogama</i> (heath wrinklewort)	Removal of approximately 5.5 ha of potential habitat	Not Significant
<i>Tetratheca juncea</i> (black-eyed susan)	Removal of approximately 5.5 ha of potential habitat	Not Significant
<i>Anthochaera phrygia</i> (regent honeyeater)	Removal of approximately 6.5 ha of open forest and woodland that contains potential foraging habitat	Not Significant
<i>Corunastylis insignis</i> (Wyang midge orchid)	Removal of approximately 5.5 ha of potential habitat	Not Significant
<i>Lathamus discolor</i> (swift parrot)	Removal of approximately 6.5 ha of open forest and woodland that contains potential foraging habitat	Not Significant
<i>Monarcha melanopsis</i> (black- faced monarch)	Removal of approximately 6.5 ha of open forest and woodland that contains potential foraging habitat	Not Significant

The assessment has concluded that the Project is unlikely to result in a significant impact on an *important population* of the vulnerable grey-headed flying-fox, green and golden bell frog, large-eared pied bat, *Grevillea parviflora* subsp. *parviflora*, *Rutidosia heterogama* or *Tetratheca juncea* and unlikely to result in a significant impact on a *population* of the critically endangered regent honeyeater, swift parrot or *Corunastylis insignis*. In addition, the project is unlikely to result in a significant impact on an *important population* of the migratory black-faced monarch.

Notwithstanding, as there are potential impacts on MNES, it is recommended that the project is referred to DAWE for consideration.

Yours sincerely

A handwritten signature in black ink, appearing to read 'P. Fagan', written in a cursive style.

Philippa Fagan
Senior Ecologist

5.0 References

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Department of Planning, Industry and Environment (DPIE) (2017b) heath wrinklewort – profile [Heath Wrinklewort - profile | NSW Environment, Energy and Science](#)

Department of Planning, Industry and Environment (DPIE) (2017c) green and golden bell frog – profile [Green and Golden Bell Frog - profile | NSW Environment, Energy and Science](#)

Department of Planning, Industry and Environment (DPIE) (2020a) Regent Honeyeater – profile [Regent Honeyeater - profile | NSW Environment, Energy and Science](#)

Department of Planning, Industry and Environment (DPIE) (2020b) variable midge orchid– profile
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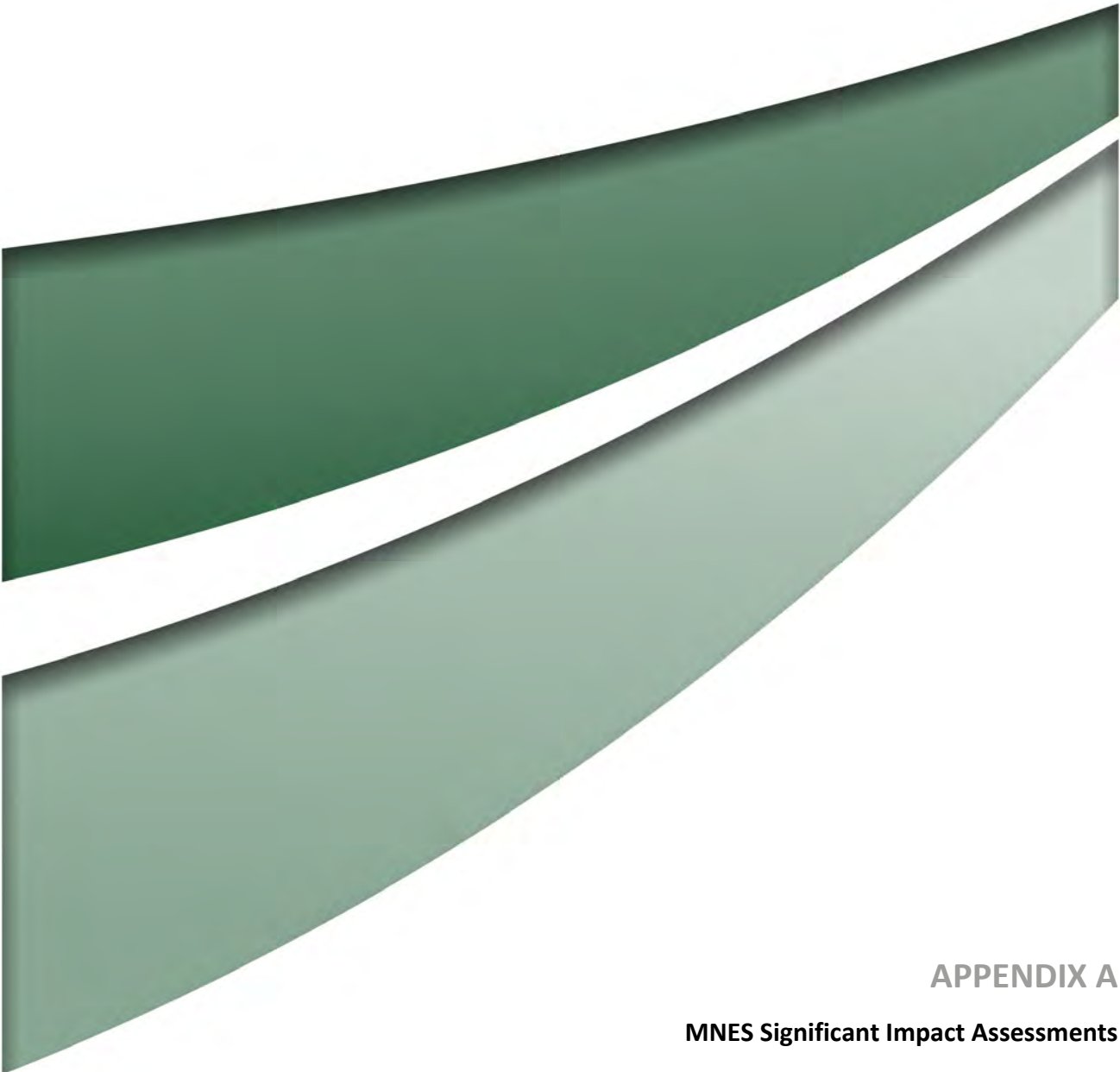
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APPENDIX A

MNES Significant Impact Assessments

The 'Significant Impact Guidelines 1.1' (DoE 2013) define a significant impact as '*an impact which is important, notable, or of consequence, having regard to its context or intensity*' (DoE 2013 p. 2). When determining whether a project (proposed action) may result in a significant impact, consideration is given to the sensitivity, value, and quality of the environment which is impacted; and upon the intensity, duration, magnitude, and geographic extend of the impacts. The '*Significant Impact Guidelines 1.1*' outlines specific criteria to use when making such an assessment, based on the MNES that are being considered; which are to be complemented by additional guidelines that have been prepared for specific MNES (as available). These criteria are used as relevant in the following sections.

The **Action** referred to throughout this assessment relates to the Project as described in Section 1.0 of the main text. This includes all direct and indirect impacts from the development of the BESS including the storage area and related infrastructure including connectivity services.

The following species have been assessed:

- Large- eared pied bat (*Chalinolobus dwyeri*)
- Small- flower grevillea (*Grevillea parviflora* subsp. *Parviflora*)
- Green and golden bell frog (*Litoria aurea*)
- Grey- headed flying- fox (*Pteropus poliocephalus*)
- Heath wrinklewort (*Rutidosia heterogama*)
- Black- eyed susan (*Tetradlea juncea*)
- Regent honeyeater (*Anthochaera Phrygia*)
- Wyong midge orchid (*Corunastylis insignis*)
- Swift parrot (*Lathamus discolor*)
- Black- faced monarch (*Monarcha melanopsis*)

A.1 Large-eared Pied Bat (*Chalinolobus dwyeri*)

The large-eared pied-bat is listed as vulnerable under the EPBC Act.

In the case of a vulnerable species, an *important population* is a population that is necessary for a species' long-term survival and recovery. This may include populations that are:

- **key source populations either for breeding or dispersal; or**
- **populations that are necessary for maintaining genetic diversity, and/or**
- **populations that are near the limit of the species range.**

The large-eared pied-bat (*Chalinolobus dwyeri*) has a range from Rockhampton in Queensland to Bungonia in the NSW Southern Highlands. It is generally rare with a very patchy distribution in NSW. The majority of records of the species occur within several kilometres of clifflines or caves, in which it is known to roost (NSW Bionet 2021).

There is limited available information regarding what constitutes a population of the large-eared pied bat. However, the National Recovery Plan identifies one record of this species at Shoalwater Bay, NSW and recognises this record as an important population (DERM, 2011). Given the paucity of records within the Project area and the lack of roosting habitat, the Project area or the locality is unlikely to support key source large-eared pied bat populations for breeding or dispersal. The Project area is unlikely to comprise populations necessary for maintaining genetic diversity given the lack of potential breeding habitat and the Project area is not near the limit of the known range of this species. Therefore, the Project area is unlikely to contain an *important population* of the large-eared pied bat.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

- **lead to a long-term decrease in the size of an *important population* of a species;**

Despite the large range of the large-eared pied-bat, it is assumed that the species is far more restricted within the species' range than previously understood (DoE, 2017b). The largest group of populations of this species in NSW is the sandstone escarpments of the Sydney basin and the north-west slopes.

Records of the large-eared pied-bat within the Hunter Valley generally occur near the escarpment habitat associated with Yengo and Wollemi National Parks. A search of the Atlas of NSW Wildlife reveals one record of the large-eared pied bat within a 10 km radius of the Project area (NSW Bionet 2021).

The proposed project is not considered likely to lead to a long-term decrease in the size of an *important population* of this species as the area of foraging habitat proposed to be removed is minimal compared to its known range and potential roost sites were not identified during any survey of the Project area of wider EPS landholdings.

- **reduce the area of occupancy of an *important population*, or;**

The proposed project will result in the removal of approximately 30 ha of potential foraging habitat for the species.

The proposed project is not considered likely to reduce the area of occupancy of an *important population* of this species as the area of foraging habitat proposed to be removed is minimal compared to its known range and potential roost sites have not been identified in the Project area during surveys.

- **fragment an existing *important population* into two or more populations, or;**

Roosting sites of the large-eared pied-bat are unevenly distributed with populations occurring in north-east NSW and south-east Queensland, Shoalwater Bay and Blackdown Tablelands. Due to the distance between these populations are likely to be isolated with little interaction with their nearest populations (DERM 2011).

The proposed project is therefore unlikely to result in an important population of the species becoming fragmented into two or more populations.

- **adversely affect habitat critical to the survival of a species, or;**

The National Recovery Plan for the large-eared pied bat (DERM 2011) states that habitat critical for the survival of the species requires the presence of diurnal roosts and shelter habitat, usually in the form of sandstone cliffs and adjacent fertile woodland valley foraging habitat. The Project area is not considered to provide habitat critical to the survival of an *important population* of this species.

- **disrupt the breeding cycle of an *important population*, or;**

Over most of its range, the large-eared pied bat appears to roost predominantly in caves and overhangs in sandstone cliffs and forage in nearby high-fertility forest or woodland near watercourses.

The Project area does not provide any suitable breeding habitat for this species, therefore the proposed project is not expected to disrupt the breeding cycle of an important population of this species.

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

Due to the absence of suitable cliffline or cave roosting habitat within the Project area and the infrequency of foraging records of the species within the wider Project area, the Project area is not considered to contain important habitat for the species. However, woodland habitat within the Project area is considered to provide potential foraging habitat for the species. The proposed project is not expected to modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.

- **result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat;**

The proposed project is not expected to result in invasive species that are harmful to large-eared-pied bat becoming established in the species habitat.

- **introduce disease that may cause the species to decline; or**

The large-eared pied-bat is not known to be affected by diseases that are causing the species to decline. Therefore, the proposed project is not likely to result in the introduction of disease.

- **interfere substantially with the recovery of the species.**

The following recovery plan has been prepared:

- National Recovery Plan for the Large-eared Pied-Bat *Chalinolobus dwyeri* (DERM 2011).

Any impacts to known habitat for the large-eared pied-bat will likely contravene the objectives of the recovery plan. Roosting/breeding habitat for the large-eared pied-bat has not been recorded within the Project area during targeted surveys, however potential woodland foraging habitat has been identified. It is considered unlikely that the project will interfere with the recovery of an *important population* of the large-eared pied-bat.

Conclusion

The proposed project is unlikely to result in a significant impact on an *important population* of the large-eared pied-bat. Roosting habitat for the large-eared pied-bat has not been recorded within the Project area during targeted surveys, however potential foraging habitat has been identified.

A.2 Small-flower grevillea (*Grevillea parviflora* subsp. *parviflora*)

The shrub *Grevillea parviflora* subsp. *parviflora* is listed as vulnerable under the EPBC Act.

Small-flower grevillea is known to occur in sporadic populations throughout the Sydney Basin on ridge crests, upper slopes and flat plains. Its documented range extends from Karuah in the north to Mittagong in the south. The species inhabits a range of vegetation types from heath and shrubby woodland to open forest. Approximately 5.5 ha of potential habitat was identified within the Project area identified for the species within PCT 1636, and 42 individuals were detected along the northern boundary of the Project area.

In this case, an *important population* is a population that is necessary for a species' long-term survival and recovery. This may include populations that are:

- key source populations either for breeding or dispersal; or
- populations that are necessary for maintaining genetic diversity, and/or
- populations that are near the limit of the species range.

Forty- two small-flower grevillea (*Grevillea parviflora* subsp. *parviflora*) were recorded in the Project area during targeted surveys in 2021 and the species is known to occur in the wider EPS land holding and the local area. The small population identified in the Project area, when considered in isolation, it is not considered to provide a key source of breeding or dispersal habitat and is not necessary for the maintenance of genetic diversity. The species is not at the limit of its range in the local area, being known to occur in the Prospect–Camden and Appin areas, with other disjunct populations occurring in the Lower Hunter Valley, on the Central Coast and in the Port Stephens area. A far southern population may also occur at Moss Vale, NSW. This species occurs within the Hawkesbury–Nepean, Hunter–Central Rivers and Sydney Metro (NSW) Natural Resource Management Regions.

Similarly, when the individuals are considered as part of the population occurring within and proximate to EPS, that wider population is not considered to provide a key source of breeding or dispersal habitat, is not necessary for the maintenance of genetic diversity and is not at the limit of its range in the local area. A total of 37 records of this species exist within 10km of the project area comprising >100 individuals and 202 records occur within 20km of the Project area comprising >1200 individuals.

Therefore, the individuals recorded in the Project area is not considered represent or be part of an *important population* of small-flower grevillea (*Grevillea parviflora* subsp. *parviflora*).

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

- lead to a long-term decrease in the size of an important population of a species;

Approximately 5.5 ha of potential habitat for small-flower grevillea (*Grevillea parviflora* subsp. *parviflora*) will be impacted by the proposed project.

Due to the small area of vegetation that could potentially be removed, and 42 individuals to be removed, relative to the known and predicted occurrence of the species within the local area (2529 plants recorded at one site at Cooranbong in 2008) (SPRAT 2021c) the proposed project is unlikely to result in a long-term decrease in the size of an important population of this species.

- **reduce the area of occupancy of an *important population*, or;**

The Project area does not support an important population of this species and the proposed project will not result in a significant reduction in the area of occupancy of this species.

- **fragment an existing *important population* into two or more populations, or;**

The Project area does not support an important population of this species and the proposed project will not lead to the fragmentation of existing important population of small-flower grevillea into two or more populations.

- **adversely affect habitat critical to the survival of a species, or;**

The habitats occurring in and around the Project area is not considered to form critical habitat for the survival of small-flower grevillea.

- **disrupt the breeding cycle of an *important population*, or;**

The proposed project is not expected to disrupt the breeding cycle of an important population of small-flower grevillea.

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

It is unlikely that the removal of approximately 5.5 ha of habitat for the species would modify, destroy, remove or isolate or decrease the availability or quality of habitat for small-flower grevillea such that the species is likely to decline.

- **result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat, or;**

It is unlikely that the project would result in the establishment of an invasive species that are harmful to the species.

- **introduce disease that may cause the species to decline; or**

The proposed project involves the clearing of approximately 42 individuals and 5.5 ha of potential habitat for the species. It is considered unlikely that the activities associated with the proposed project could introduce disease that may cause the decline of any potentially occurring population of small-flower grevillea (*Grevillea parviflora* subsp. *parviflora*).

- **interferes substantially with the recovery of the species.**

The proposed project will not result in the loss of important habitat for small-flower grevillea (*Grevillea parviflora* subsp. *parviflora*), and it is not expected to substantially interfere with the recovery of this species.

Conclusion

The Project area is not likely to contain an important population of the small-flowered grevillea (*Grevillea parviflora* subsp. *parviflora*) and the project will not result in a significant impact on the species.

A.3 Green and Golden Bell Frog (*Litoria aurea*)

The green and golden bell frog is listed as vulnerable under the EPBC Act.

In the case of a vulnerable species, an *important population* is a population that is necessary for a species' long-term survival and recovery. This may include populations that are:

- **key source populations either for breeding or dispersal; or**
- **populations that are necessary for maintaining genetic diversity, and/or**
- **populations that are near the limit of the species range.**

A population of green and golden bell frog is known to inhabit Muddy Lake, which is less than one kilometre south-west of the Project area (GHD 2018). The Muddy Lake population was identified in 2015 (RPS 2015) and a research program was established to monitor that population in 2018 (GHD, 2018). A total of 109 individuals were recorded during summer 2020/21 within the Muddy Lake system, west of the Project area. As part of the research program, a genetic study was undertaken to determine the genetic health and to determine if the Muddy Lake system represented more than one genetically distinct population. The genetic work (Cesar 2019) determined that the Muddy Lake system contained a single, genetically healthy, population. The results suggest that the population is large, relatively stable and that random mating occurs across the Muddy Lake system (approx. 2km²). As such, the Muddy Lake system is considered to represent a single "important population" of this species.

One individual green and golden bell frog was detected within the EPS holding by Umwelt in January 2021, with follow up surveys in March 2021 detecting a further seven individuals from a small swamp (3000 m²) approximately 200 metres from the Project area. This swamp is likely to be an extension to the Muddy Lake habitat though it is unclear, at this stage, whether this new location is a permanent breeding habitat resource for this species, or the individuals recorded are simply dispersing. While this small area of potential breeding habitat identified in the EPS holdings is not located within the Project area, it is proximate and potentially susceptible to any changes to water flow or quality.

The green and golden bell frog inhabits marshes, dams and stream-sides, particularly those containing bullrushes (*Typha* spp.) or spikerushes (*Eleocharis* spp.). Optimum habitat includes waterbodies that are unshaded, free of predatory fish such as Plague Minnow (*Gambusia holbrooki*), have a grassy area nearby and diurnal sheltering sites available. Some sites, particularly in the Greater Sydney region occur in highly disturbed areas. The species is active by day and usually breeds in summer when conditions are warm and wet (DPIE 2017c).

An analysis of the NSW Bionet Atlas records shows 28,967 records along the entirety of the east coast of NSW (NSW Bionet 2021). There are areas, such as the far South coast, western Sydney, Kooragang Island in Newcastle, Broughton Island off Port Stephens, Crescent Head, and Byron Bay, that appear to contain regional populations with a higher density of records. However, the species is generally recorded along the entirety of the coastline. Since 1990 there have been approximately 50 recorded locations in NSW, most of which are small, coastal, or near coastal populations. These locations occur over the species' former range, however they are now widely separated and isolated (DPIE 2017c). The nearest extant population (known) is approximately 30km to the north at Kooragang Island or 40km south near Avoca.

There are 43 records of this species within 10 km of the Project area, all centred around Muddy Lake (see **Figure 1**).

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

- **lead to a long-term decrease in the size of an *important population* of a species;**

No direct impacts on the important population are expected as part of the Action. The Action will not result in the physical removal of any known areas of occupancy or any areas of potential breeding habitat.

There is potential for indirect impacts, mainly from surface water changes (flow and quality) and potential spread of Chytrid fungus (*Batrachochytrium dendrobatidis*), as a result of the Action. Changes to hydrology are considered unlikely and whilst the Project is not progressed to the extent of having detailed design to qualify this, Origin is committed to a design that maintains pre-development flows from the development area (quantity and quality) as per the commitments below. Some of the proposed surface water management commitments may include:

Design commitments

- Design erosion and sediment controls as per sensitive environments (Managing Urban Stormwater – Soils and Construction (Landcom 2004)).
- Detailed design of drainage will balance clean water discharges to maintain minimum flows (as estimated based on current topography and hydrology) to identified green and golden bell frog habitats.

Construction commitments

- Implement hygiene protocol in accordance with the NSW Threatened Species Management Information Circular No.6 (April 2008)).
- Flocculants or other chemicals proposed to be used on site are required to be known and verified as being safe in sensitive environments and particularly in relation to amphibians.
- Erosion and sediment control will be designed, installed and managed as follows:
- Progressive erosion and sediment control plans (ESCPs) will be developed by the Contractor and implemented prior to the commencement of topsoil stripping and earthworks.
- Erosion and sediment control structures are to be regularly inspected and maintained, particularly in advance of and following significant rainfall events.
- Any water discharges are required to be managed to avoid pollution of waters having regard to the sensitivity of the receiving environment. In particular, any flocculants are to be demonstrated as being both effective and safe for amphibians prior to use.
- All disturbed surfaces will be revegetated as soon as possible.

Construction monitoring

- Pre-discharge physical water quality condition (temperature; dissolved oxygen; pH; electrical conductivity (EC)) and chemical water quality condition in sediment dams.

- Post rainfall checks of sediment dam water level and water quality and erosion and sediment control functioning.

Indirect impact relating to the spread of Chytrid will be managed through construction control plans noting that all development works will be completed outside the known or potential occupancy area for this species and physical contact with green and golden bell frogs or their breeding habitat is unlikely. All other potential indirect impact will be investigated throughout the Environmental Impact Assessment process and appropriate design and/or controls will be implemented to prevent impacts

Considering the action is not expected to have any direct impacts on the important population and all potential indirect impacts will be managed through design, the action is unlikely to lead to a long-term decrease in the Muddy Lake important population.

- **reduce the area of occupancy of an important population of the species; or**

The Project area does not contain suitable breeding habitat for this species. Whilst surveys for the project has extended the known area of occupancy for the Muddy Lake important population into EPS land, this area of occupancy doesn't extend into the Project area. As such, no direct impacts on the important population are expected as part of the Action.

There is potential for indirect impacts, mainly from surface water changes (flow and quality) and potential spread of Chytrid fungus, as a result of the Action. Changes to hydrology are considered unlikely and whilst the Project is not progressed to the extent of having detailed design to qualify this, Origin is committed to a design that maintains pre-development flows from the development area (quantity and quality) into the green and golden bell frog habitat identified in the EPS holding as well as Muddy Lake system. Indirect impact relating to the spread of Chytrid will be managed through construction control plans noting that all development works will be completed outside the known or potential occupancy area for this species and physical contact with green and golden bell frogs or their breeding habitat is unlikely. All other potential indirect impact will be investigated throughout the Environmental Impact Assessment process and appropriate design and/or controls will be implemented to prevent impacts.

Considering the action is not expected to have any direct impacts on the area of occupancy of important population and all potential indirect impacts will be managed through design, the action is unlikely to reduce the area of occupancy of the Muddy Lake important population.

- **fragment an existing *important population* into two or more populations; or**

The important population does not extend into the Project area and no direct impacts on the important population are expected as a result of the Action. All potential indirect impacts will be managed through the design. Genetic studies of the Muddy Lake population suggest that the population is large, relatively stable and that random mating occurs between localised occurrences across the whole Muddy Lake system. As such, the Action is considered unlikely to result in the fragmentation of the Muddy Lake important population into two or more populations.

- **adversely affect habitat critical to the survival of a species; or**

Whilst not formally recognised in a recovery plan or by the EPBC Act, The Muddy Lake system is considered to provide habitat that is critical to the survival of the green and golden bell frog. As documented above, this species habitat has declined across its former range and it now occurs in isolated areas and all breeding habitat could be considered critical to the survival of this species.

The proposed Action will not directly impact the habitat critical to the survival of the species and all indirect impacts will be managed through design and/or construction controls to avoid impact.

As a result, the proposed Action is unlikely to adversely affect the Muddy Lake system which represent habitat critical to the survival of the green and golden bell frog.

- **disrupt the breeding cycle of an *important population*; or**

The green and golden bell frog can breed during late winter to early autumn, but generally during September–February with a peak around January–February after heavy rain or storms (SPRAT 2021c). The proposed action will not have any direct impacts on breeding habitat and although breeding habitat has been identified proximate to the Project area the separation distance (approximately 200m of vegetation) is sufficient to conclude that construction activities are unlikely to disrupt a breeding cycle. Origin is committed to managing all potential indirect impact on potential breeding habitats and any indirect impacts will be managed such that the Action will not disrupt the breeding cycle of the important population of green and golden bell frog.

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

The Project area does not contain suitable breeding habitat for this species. Whilst surveys for the project has extended the known area of habitat for the Muddy Lake important population into EPS land, this area of habitat doesn't extend into the Project area. As such, no direct impacts on the habitat of the green and golden bell frog are expected as part of the Action.

There is potential for indirect impacts, mainly from surface water changes (flow and quality) and potential spread of Chytrid fungus, as a result of the Action. Changes to hydrology are considered unlikely and whilst the Project is not progressed to the extent of having detailed design to qualify this, Origin is committed to a design that maintains pre-development flows from the development area (quantity and quality) into the green and golden bell frog habitat identified in the EPS holding as well as Muddy Lake system. Indirect impact relating to the spread of Chytrid will be managed through construction control plans noting that all development works will be completed outside the known or potential habitat for this species and physical contact with green and golden bell frogs or their breeding habitat is unlikely. All other potential indirect impact will be investigated throughout the Environmental Impact Assessment process and appropriate design and/or controls will be implemented to prevent impacts.

Considering the action is not expected to have any direct impacts on habitat for this species and all potential indirect impacts will be managed through design, the action is unlikely to modify, destroy, remove, isolate, or decrease the availability or quality of habitat to the extent that the species is likely to decline.

- **result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat;**

The green and golden bell frog is particularly susceptible to predation by the introduced plague minnow (*Gambusia holbrooki*), when in tadpole form (SPRAT 2021c). This species has been detected in the Muddy Lake system previously (GHD 2016). No other invasive species is known to be harmful to the green and golden bell frog. As such, the proposed Action is unlikely to result in invasive species that are harmful to the green and golden bell frog becoming established in the available habitats

- **introduce disease that may cause the species to decline; or**

The green and golden bell frog is particularly susceptible to infection by chytrid fungus (*Batrachochytrium dendrobatidis*) resulting in *chytridiomycosis*. The fungus causes a highly virulent infection resulting in death in most individuals (SPRAT 2021c). It is a waterborne pathogen that survives in fresh water for up to 3 months (Johnson and Speare 2003) and contact with Chytrid-contaminated water can cause infection (Berger et al. 1998). Chytrid requires a moist habitat because the pathogen is susceptible to desiccation (Johnson et al. 2003), and studies have shown that the fungus can survive in damp soil for weeks at a time (Johnson and Speare 2005). The fungus can be introduced into soil and waterways through infected machinery, tools and other objects.

It is likely that the fungus is present within the important green and golden bell frog population in Muddy Lake currently but being controlled by other abiotic factor including salinity. As such, it is unlikely that the proposed Action will introduce disease that may cause the species to decline. Notwithstanding, indirect impacts that could contribute to the spread of Chytrid will be managed during and post construction.

- **interfere substantially with the recovery of the species.**

A commonwealth recovery plan has not been prepared for the species however the Approved Conservation Advice for the species identifies a range of threats to the species including:

- habitat destruction and degradation,
- changes to the structure and diversity of aquatic vegetation,
- habitat fragmentation,
- predation of eggs and tadpoles by plague minnow (*Gambusia holbrooki*) and, to a lesser extent, European carp (*Cyprinus carpio*), goldfish (*Carassius auratus*), brown trout (*Salmo trutta*) and rainbow trout (*Oncorhynchus mykiss*), and
- infection with amphibian chytrid fungus (*Batrachochytrium dendrobatidis*) (DEC, 2005).

The proposed action is unlikely to introduce or exacerbate any of the threats listed above and as such, the Action is unlikely to interfere substantially with the recovery of the species.

Conclusion

The proposed Action has the potential to impact an important population of the green and golden bell frog. The proposed action is unlikely to directly impact the species, or its habitat and indirect impacts will be prevented through design and controls.

With consideration of the responses above and the plausibility of managing potential indirect impact, i.e., no changes to surface water (flow or quality) and managing further spread of chytrid fungus, the Action is considered unlikely to have any significant impacts upon the green and golden bell frog important population.

A.4 Grey-headed Flying-fox (*Pteropus poliocephalus*)

The grey-headed flying-fox is listed as vulnerable under the EPBC Act.

In the case of a vulnerable species, an *important population* is a population that is necessary for a species' long-term survival and recovery. This may include populations that are:

- **key source populations either for breeding or dispersal; or**
- **populations that are necessary for maintaining genetic diversity, and/or**
- **populations that are near the limit of the species range.**

The grey-headed flying-fox has been recorded in the EPS land holding and is likely to forage on seasonal flowering and/or fruiting resources across the EPS site including in the Project area. PCTs 1636 and 1716 are likely to provide foraging resources for this species in the Project area, which are a total of approximately 6.5 hectares in area. PCT 1727 is unlikely to provide any resources for the species, due to an absence of flowering trees.

Camp sites (breeding habitat) have not been identified within the Project area and are not expected to occur.

The National Flying-Fox Monitoring Viewer (DoEE 2021) identifies 26 known roost camp sites within a 50 kilometre (km) radius of EPS including 5 nationally important sites. Not all of these sites have been identified as supporting a population in surveys conducted between February 2013 and August 2020. The nearest roost camp sites are at:

- Martinsville, approximately 12 km to the north-west from the Project area however surveys conducted since 2013 have not identified any grey-headed flying-foxes.
- Mandalong, approximately 12 km to the south-west from the Project area and had a population estimate of 16,000 to 49,999 individuals in February 2016 up from 500 to 2,499 individuals in 2015 (DoE 2017). It had between 2,500 and 9,999 in 2019.
- Blackalls Park near Toronto, approximately 12 km to the north-west from the Project area where the population estimate is generally 500 to 2,499 individuals (2015, 2016, 2017 and 2018) or 2,500 to 9,999 individuals (2013, 2015 and 2016) with a peak of 16,000 to 49,999 individuals in May 2016 (DoEE 2017). No individuals have been recorded since 2018.

None of these three camp sites are identified as nationally important (DoEE 2020). Foraging individuals in EPS are likely to be from any of the camp sites located within the maximum foraging distance of an adult (i.e., 50km) of the Project area.

The Project area is considered to comprise areas of potentially suitable foraging habitat for this species but is unlikely to contain significant breeding and roosting habitat necessary for maintaining genetic diversity. The Project area is also not near the limit of the known range of this species. Therefore, the Project area is unlikely to contain an *important population* of the grey-headed flying-fox.

An action has, will have, or is likely to have a significant impact on a vulnerable species if it does, will, or is likely to:

- **lead to a long-term decrease in the size of an *important population* of a species;**

Given that the Project area does not support an *important population* of the grey-headed flying-fox, the project will not lead to a long-term decrease in the size of an *important population* of this species.

- **reduce the area of occupancy of an *important population*, or;**

The project will result in the loss of approximately 6.5 hectares (ha) of potential foraging habitat for grey-headed flying-fox. However, since the Project area does not contain an *important population* of the grey-headed flying-fox, the project will not reduce the area of occupancy of an *important population* of this species.

- **fragment an existing *important population* into two or more populations, or;**

The habitat within the Project area is already disturbed and does not contain an *important population* of the grey-headed flying-fox. Therefore, the project will not result in the fragmentation of an *important population* of this species.

- **adversely affect habitat critical to the survival of a species, or;**

According to the draft *National Recovery Plan for the Grey-Headed Flying-Fox* (DECCW 2009), foraging habitat that meets one of the following criteria is considered critical or essential to the survival of the species:

- productive during winter and spring when food bottlenecks have been identified
- known to support populations of >30,000 individuals within an area of 50 km radius (the maximum foraging distance of an adult)
- productive during the final weeks of gestation, and during the weeks of birth, lactation and conception (September to May)
- productive during the final stages of fruit development and ripening in commercial crops affected by grey-headed flying-foxes, and/or
- known to support a continuously occupied camp.

The Project area is considered to comprise approximately 6.5 ha of potentially suitable foraging habitat for this species as it may be productive over the summer months and occurs within the foraging range from roost sites known to support populations of >30,000 individuals at some time over the last six years. However, given that this species has not been recorded in the Project area, the relatively small area of suitable habitat when compared to the local area, the project is unlikely to significantly reduce the availability of foraging habitat critical to the survival of the species.

The National Recovery Plan for the grey-headed flying-fox (DECCW 2009) also includes criteria for roosting habitat critical to the survival of the species. Since the Project area does not contain a grey-headed flying-fox camp it will not impact roosting habitat critical to the survival of the species.

Therefore, the project is unlikely to substantially adversely affect habitat that is critical to the survival of the species.

- **disrupt the breeding cycle of an *important population*, or;**

No grey-headed flying-fox breeding populations or camps have been identified in the Project area. The project is not expected to disrupt the breeding cycle of an *important population* of this species.

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

The project will result in the loss of approximately 6.5 ha of potential foraging habitat for grey-headed flying-fox. Given the small area of potential foraging habitat to be removed and the substantial area of high-quality remnant vegetation in adjoining areas, the Project area is unlikely to be depended on by local grey-headed flying-fox colonies.

It is considered unlikely that the project will modify, destroy, remove, isolate, or decrease the availability or quality of habitat to the extent that the grey-headed flying-fox would decline.

- **result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat;**

The project is not expected to result in invasive species that are harmful to the grey-headed flying-fox becoming established in the species habitat.

- **introduce disease that may cause the species to decline; or**

No diseases that may cause the grey-headed flying-fox to decline are likely to be introduced as a result of the Project.

- **interfere substantially with the recovery of the species.**

There is currently no approved recovery plan for the grey-headed flying-fox. The overall objectives of the draft *National Recovery Plan for the Grey-headed Flying Fox* (DECCW 2009) are to:

- reduce the impact of threatening processes on grey-headed flying-foxes and arrest decline throughout the species' range
- conserve the functional roles of grey-headed flying-foxes in seed dispersal and pollination and
- improve the standard of information available to guide recovery of the grey-headed flying-fox, in order to increase community knowledge of the species and reduce the impact of negative public attitudes on the species.

No significant effect on the recovery of the grey-headed flying-fox is expected to occur as a result of the project as the potential areas of foraging habitat that will be impacted as a result of the project are not expected to impact an *important population* of this species.

Conclusion

The project is unlikely to result in a significant impact on an *important population* of grey-headed flying-fox as the Project area is not considered to support an *important population* of this species.

A.5 Heath wrinklewort (*Rutidosia heterogama*)

The forb *Rutidosia heterogama* is listed as vulnerable under the EPBC Act.

Heath wrinklewort (*Rutidosia heterogama*) is confined to the North Coast and Northern Tablelands regions of NSW. It is known from the Hunter Valley to Maclean, Wooli to Evans Head, and Torrington; occurring within the Border Rivers–Gwydir, Hunter–Central Rivers and Northern Rivers (NSW) Natural Resource Management Regions. The species mostly inhabits heath and is often found along disturbed roadsides (Harden 1992). The coastal populations from Wooli to Evans Head occur on clay soil in grassland, heath, open forest and woodland.

In this case, an *important population* is a population that is necessary for a species' long-term survival and recovery. This may include populations that are:

- key source populations either for breeding or dispersal; or
- populations that are necessary for maintaining genetic diversity, and/or
- populations that are near the limit of the species range.

Heath wrinklewort (*Rutidosia heterogama*) was not recorded in the Project area, and it has not been recorded within 10km of the Project area (NSW Bionet 2021). The closest records of heath wrinklewort (*Rutidosia heterogama*) in the local area occur approximately occur 12 km to the south and are not considered to form parts of important population of this species as they do not represent a key source population for breeding or dispersal; are not necessary for the maintenance of genetic diversity and are not at the limit of the species range. Key populations of the species are known from the Cessnock – Kurri Kurri area, the north coast populations between Wooli and Evans Head (in Yuraygir and Bundjalung National Parks) and in the New England Tablelands from Torrington and Ashford south to Wandsworth south-west of Glen Innes (DPIE 2017b).

The Project area is not considered to provide an area of potential habitat for an important population of heath wrinklewort (*Rutidosia heterogama*).

An action has, will have, or is likely to have a significant impact on a vulnerable species if it does, will, or is likely to:

- **lead to a long-term decrease in the size of an important population of a species;**

Approximately 5.5 ha of potential habitat for heath wrinklewort (*Rutidosia heterogama*) will be impacted by the proposed project within PCT 1636.

Due to the small area of vegetation that could potentially be removed, relative to the known and predicted occurrence of the species within the local area, the proposed project is unlikely to result in a long-term decrease in the size of an important population of this species.

- **reduce the area of occupancy of an *important population*, or;**

The Project area does not support an important population of this species and the proposed project will not result in a significant reduction in the area of occupancy of this species.

- **fragment an existing *important population* into two or more populations, or;**

The Project area does not support an important population of this species and the proposed project will not lead to the fragmentation of existing important population of heath wrinklewort (*Rutidosia heterogama*) into two or more populations.

- **adversely affect habitat critical to the survival of a species, or;**

The habitats occurring in and around the Project area is not considered to form critical habitat for the survival of heath wrinklewort (*Rutidosia heterogama*).

- **disrupt the breeding cycle of an *important population*, or;**

The proposed project is not expected to disrupt the breeding cycle of on important population of heath wrinklewort (*Rutidosia heterogama*).

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

It is unlikely that the removal of approximately 5.5 ha of potential habitat for the species would modify, destroy, remove or isolate or decrease the availability or quality of habitat for heath wrinklewort (*Rutidosia heterogama*) such that the species is likely to decline.

- **result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat, or;**

It is unlikely that the removal of approximately 5.5 ha of potential habitat for the species would result in the establishment of an invasive species that is harmful to heath wrinklewort (*Rutidosia heterogama*).

- **introduce disease that may cause the species to decline; or**

The proposed project involves the clearing of approximately 5.5 ha of potential habitat for the species. It is considered unlikely that the activities associated with the proposed project could introduce disease that may cause the decline of any potentially occurring population of heath wrinklewort (*Rutidosia heterogama*).

- **interfere substantially with the recovery of the species.**

The proposed project will not result in the loss of important habitat for heath wrinklewort (*Rutidosia heterogama*), and it is not expected to substantially interfere with the recovery of this species.

Conclusion

The proposed project is not expected to result in a significant impact on an important population of heath wrinklewort (*Rutidosia heterogama*).

A.6 Black-eyed Susan (*Tetratheca juncea*)

Tetratheca juncea is listed as vulnerable under the EPBC Act.

In the case of a vulnerable species, an *important population* is a population that is necessary for a species' long-term survival and recovery.

Tetratheca juncea is a low sprawling shrub growing as a single stem or clumps of stems arising from a single rootstock, as such an individual plant may have numerous stems (CoA 2011). The species is known to occur in dry sclerophyll forest, woodlands and moist heath, from 0 - 200 metres (m) in altitude with an annual rainfall of 1000 – 1200 millimetres (mm) and restricted to open forest of *Angophora costata*, *Eucalyptus haemastoma*, *E. globoidea*, *Corymbia gummifera*, and *E. capitellata* (SPRAT Profile 2021b). Soils are generally sandy skeletal soil on sandstone, sandy-loam soils, low nutrients, and clayey soil from conglomerates, pH neutral. PCT 1636 (approximately 5.5 ha) represents suitable habitat within the Project area.

It is endemic to NSW between Wyong and Bulahdelah with the current distribution divided into two metapopulations: the central coast metapopulation (from Wyong to Beresfield) and the northern metapopulation (from Karuah to Bulahdelah) (CoA 2011). Most populations occur in the Wyong and Lake Macquarie local government areas.

There are a large number (>150) records of *Tetratheca juncea* in the EPS landholding in the DPIE Bionet atlas including numerous records to the north and east of the ash dam (AECOM 2008). *Tetratheca juncea* has not been recorded in the Project area and while it was surveyed outside the recommended flowering period (September to October), individuals of this species were detected still in flower during November 2020 surveys outside of the Project area in the EPS landholding.

Important populations of *Tetratheca juncea* are defined in the referral guidelines as meeting any of the criteria outlined in Table A.

Table A Important Population Definition for *Tetradleca juncea* (CoA 2011)

Important Population Criteria	Application to the Project area
Has greater than 1000 plant clumps	No. Recorded at 64 locations
An area of habitat has an average estimated plant clump density of 20 clumps/ha or greater	No areas with a clump density of 20 clumps/ha. Overall density of 6.4 clumps/ha.
Occurs in rare habitat	Habitats in Project area are not rare
Occurs in an area of “important habitat” as defined in Maps 4a and 4b (of the referral guidelines (CoA, 2011)) and has greater than 500 plant clumps	Area of important habitat is to the north and west of the EPS operational area
Occurs at or near the distributional limits of black-eyed Susan	No
Occurs in close proximity to a protected area (e.g. National Park) where <i>Tetradleca juncea</i> is known to occur. Where close proximity is: (a) within 500m if connected by a suitable habitat corridor such as native vegetation, or (b) within 100m over disturbed habitat or non-native vegetation	Further than 500m from any protected area where <i>Tetradleca juncea</i> is known to occur
Conclusion:	Not an important population as defined by the referral guidelines

Tetradleca juncea within the Project area is not considered to represent a key source population for breeding or dispersal or necessary for maintaining genetic diversity and is not on or near the limit of its range. As such, the *Tetradleca juncea* population within the Project area is not an *important population*.

An action has, will have, or is likely to have a significant impact on a vulnerable species if it does, will, or is likely to:

- **lead to a long-term decrease in the size of an *important population* of a species;**

Given that the Project area does not support an *important population* of *Tetradleca juncea* the project will not lead to a long-term decrease in the size of an *important population* of this species.

- **reduce the area of occupancy of an *important population*, or;**

The project will result in the loss of approximately 5.5 ha of potential habitat for *Tetradleca juncea*. However, since the Project area does not contain an *important population* of the *Tetradleca juncea*, the project will not reduce the area of occupancy of an *important population* of this species.

- **fragment an existing *important population* into two or more populations, or;**

The Project area is generally contiguous with a large area of important habitat to the west of Lake Macquarie. The project will not fragment this population.

- **adversely affect habitat critical to the survival of a species, or;**

Tetratheca juncea is commonly recorded in remnant bushland around Lake Macquarie and is known to occur in conservation reserves in the region. A large tract of important habitat occurs to the west and north of the Project area. The project is unlikely to adversely affect this area of important habitat that is critical to the survival of the species.

- **disrupt the breeding cycle of an *important population*, or;**

Reproduction in *Tetratheca juncea* is through asexual rhizomal spread and sexual pollination (possibly by native bees capable of buzz pollination), seed development and germination (SPRAT Profile 2021b). *Tetratheca juncea* has a short-lived seed bank and very low seed viability after soil storage. The project will directly disrupt the breeding cycle of individuals within the Project area however it is unlikely to disrupt the breeding cycle of the *important population* to the west and north of the Project area.

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

The project will result in the loss of approximately 5.5 ha of potential habitat for *Tetratheca juncea*. Large areas of known habitat will not be removed within EPS and PCT 1636 and other suitable PCTs are widely distributed within the Wyong sub-region IBRA.

It is unlikely that the project will modify, destroy, remove, isolate, or decrease the availability or quality of habitat to the extent that *Tetratheca juncea* would decline.

- **result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat;**

Tetratheca juncea is threatened by weed invasion. Implementation of weed management measures during clearing and construction works would reduce risk of establishment of weeds such that the project is not expected to result in invasive species becoming established in potential habitat for *Tetratheca juncea*.

- **introduce disease that may cause the species to decline; or**

The NSW key threatened process listing for the plant pathogen *Phytophthora cinnamomi* identifies that *Tetratheca juncea* may be adversely affected by direct infestation or habitat degradation. However, the *Threat Abatement Plan for diseases in natural ecosystems caused by Phytophthora cinnamomi* (CoA 2018) does not recognise *Tetratheca juncea* as being susceptible to disease from *Phytophthora cinnamomi* infection. Notwithstanding that, the risk of introducing *Phytophthora cinnamomi* may be managed during clearing and construction works.

- **interfere substantially with the recovery of the species.**

There is currently no approved recovery plan for *Tetratheca juncea*.

Conclusion

The project is unlikely to result in a significant impact on an *important population* of *Tetratheca juncea* as the Project area is not considered to support an *important population* of this species.

A.7 Regent Honeyeater (*Athochaeria Phrygia*)

The regent honeyeater is listed as critically endangered under the EPBC Act.

The species has a patchy distribution extending from south-east Queensland, into NSW and the Australian Capital Territory, to central Victoria (DPIE 2020a). The species is highly mobile, capable of travelling large distances and occurs only irregularly at most sites in varying numbers. Adding further difficulty to the survey and study of this species is that their movements are poorly understood (DPIE 2020). Its primary habitat is box-ironbark eucalypt woodland and dry sclerophyll forest, however it does utilise riparian vegetation and lowland coastal forest. Habitat critical to the survival of the regent honeyeater includes any breeding or foraging areas where the species is likely to occur and any newly discovered breeding or foraging locations.

The proposal area does not occur within the four known breeding areas for the species where it is regularly recorded, namely Bundarra-Barraba area of NSW, the Capertee Valley in NSW, the lower Hunter Valley in NSW and the Chiltern area of north-east Victoria.

The regent honeyeater is not known to occur within the Project area, however the species has been recorded on 20 occasions within 10km of the Project area, with records concentrated in Morisset to the south of EPS (NSW Bionet 2021). This species may occasionally forage within PCT 1636 in the Project area and PCT 1716 (approximately 6.5 ha) when feed trees such as scribbly gum and swamp mahogany are in flower.

In this case, a *population* means:

- **a geographically distinct regional population, or collection of local populations; or**
- **a regional population, or collection of local populations, that occurs within a particular bioregion.**

The regent honeyeater is endemic to mainland south-eastern Australia and mostly inhabits inland slopes of the Great Dividing Range (TSSC, 2019b). The regent honeyeater comprises a single population, with some exchange of individuals between regularly used areas (TSSC, 2019b). It is estimated that the NSW population of Regent Honeyeaters may now be fewer than 250 mature individuals (TSSC, 2019b).

As the species occurs as a single population in Australia, any record of the species would constitute part of a population as described above.

An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:

- **lead to a long-term decrease in the size of a population; or**

The population of the regent honeyeater has not been recorded within the Project area however marginal foraging habitat was identified. The project may result in the loss of approximately 6.5 ha of vegetation containing potential moderate quality foraging habitat for the regent honeyeater as their diet primarily consists of nectar from eucalypts and mistletoe (TSSC, 2019b). The Project area is not known as a historical or important foraging site for this species. The regent honeyeater has been recorded in the region however this species has not been recorded within the EPS landholding despite many ecological surveys having been conducted over the previous decade

It is considered unlikely that the project will lead to a decrease in the size of the population of regent honeyeater.

- **reduce the area of occupancy of the species; or**

The regent honeyeater has not been recorded within the Project area, however it is known to occur within 10km of the Project area. The proposed project may result in the loss of approximately 6.5 ha of potential habitat. While the Project will remove potential moderate quality habitat for this species, it is not likely to lead to a significant reduction in known habitat in the region.

The proposed project may result in a reduction of the potential area of occupancy for the regent honeyeater in the Project area, however this is unlikely to substantially reduce the area of known occupancy in the wider locality or region.

- **fragment an existing *population* into two or more populations; or**

The decline of the population of the regent honeyeater is attributed to clearing, fragmentation and degradation of its habitat (TSSC 2019b).

The *population* of regent honeyeater has not been recorded within the Project area. The regent honeyeater is highly dispersive, and it is unlikely that the Project would create a significant change to the species' dispersal capacity or create a significant barrier the movement of the species.

It is unlikely that the project would result in the fragmentation of the existing *population* into two or more populations.

- **adversely affect habitat critical to the survival of a species; or**

Habitat critical to the survival of the regent honeyeater includes any breeding or foraging areas where the species is likely to occur and any newly discovered breeding or foraging locations (TSSC 2019b). The species has not been recorded breeding in the Project area. The project may result in the loss of approximately 6.5 ha of potential moderate quality habitat.

The proposed project is unlikely to substantially adversely affect habitat that is critical to the survival of a *population* of the regent honeyeater.

- **disrupt the breeding cycle of a population; or**

The regent honeyeater mainly breeds in three key sites in NSW being the Bundarra-Barraba area, the Capertee Valley, and the Lower Hunter Valley (DPIE 2020a). Other breeding areas are known in the Pilliga woodlands and the Mudgee-Wollar areas of NSW. The regent honeyeater has not been recorded in the Project area and it is unlikely to contain breeding or nesting habitat for the species.

The project is not expected to disrupt the breeding cycle of the *population* of regent honeyeater.

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

The regent honeyeater has been recorded in the region however this species has not been recorded within the EPS landholding despite many ecological surveys having been conducted over the previous decade. The regent honeyeater is considered to have potential to occur in areas of eucalypt habitat.

The project will involve the removal of approximately 6.5 ha of vegetation of potential habitat that does not contain areas of key feed tree species, as described by the National recovery Plan for the species.

It is considered unlikely that the project would modify, destroy, remove, isolate, or decrease the availability or quality of habitat to the extent that a *population* of the regent honeyeater would decline.

- **result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat;**

The project is not expected to result in invasive species that are harmful to the regent honeyeater becoming established in the species habitat.

- **introduce disease that may cause the species to decline; or**

The project is not expected to introduce any disease that may cause the regent honeyeater to decline.

- **interfere with the recovery of the species.**

The following recovery plan has been prepared:

- National Recovery Plan for the Regent Honeyeater (*Anthochaera phrygia*) (CoA 2016)

Any impacts to known habitat for the regent honeyeater will likely contravene the objectives of the recovery plan. The regent honeyeater has not been recorded within the Project area, however approximately 6.5 ha of potential moderate quality foraging habitat has been identified. It is considered unlikely that the proposed project will interfere with the recovery of the regent honeyeater (*Anthochaera phrygia*) throughout Australia.

Conclusion

The project is unlikely to result in a significant impact on the population of the regent honeyeater. Although the Project area provides potential foraging habitat for this species, the area proposed to be disturbed is small relative to the area of occupancy of the species and the regent honeyeater has not been recorded utilising the potential habitat within the Project area or in the immediate surrounds despite regular surveys and monitoring being conducted within EPS landholdings.

A.8 Wyong Midge Orchid (*Corunastylis insignis*)

The terrestrial orchid *Corunastylis insignis* is listed as critically endangered under the EPBC Act.

Corunastylis insignis occurs within the Wyong and Lake Macquarie Local Government Area on the NSW Central Coast. The species occurs within the Sydney Basin Bioregion and the Hunter-Central Rivers Catchment Management Authority. The species has been recorded from Chain Valley Bay (found at two localities), Charmhaven (found at three localities) and Lakehaven (no flowering plants recorded in the past 10 years) with recent (2019) records from near Awaba and Morisset. The Awaba records occur approximately 3km north of the Project area and were identified along transmission line easements. Currently, all locations are considered to represent separate populations.

Corunastylis insignis occurs in patches of *Themeda australis* (kangaroo grass) amongst shrubs and sedges in heathland and forest. The species is known from three locations: at Chain Valley Bay, the vegetation associated with the species has been described as 'Dry sclerophyll woodland dominated by *Eucalyptus haemastoma* (scribbly gum), *Corymbia gummifera* (red bloodwood), *Angophora costata* (smooth-barked apple) and *Allocasuarina littoralis* (black she-oak)' (NSW Bionet 2020). The flowering period of the species is from August to November (DPIE 2020b). Within the Project area, PCT 1636 (approximately 5.5 ha) is considered potential habitat.

The species has not been recorded within EPS landholdings despite numerous surveys. Additional surveys for this species will be undertaken during the appropriate flowering period as part of the studies for the EIS. This species is difficult to detect and, despite the absence of records to date, the potential habitat within the Project area has been assessed below.

In this case, a **population** means:

- a geographically distinct regional population, or collection of local populations; or
- a regional population, or collection of local populations, that occurs within a particular bioregion.

An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:

- lead to a long-term decrease in the size of a population; or

Corunastylis insignis has not been recorded within EPS landholdings. The Project area is close (approx. 3km) to known records though the habitat within the Project area is considered marginal and unlikely to contain a population of this species. The loss of approximately 5.5 ha of potential habitat is not considered likely to result in a long-term decrease the *population* of *Corunastylis insignis*.

- reduce the area of occupancy of the species; or

Corunastylis insignis has not been recorded within the Project area, despite targeted surveys undertaken within the known flowering period of the species. The loss of approximately 5.5 ha of potential habitat is not considered likely to result in a reduction in the area of occupancy of the species.

- fragment an existing *population* into two or more populations; or

Corunastylis insignis has not been recorded within EPS landholdings, however potential habitat was identified. If the species occurs within the Project area, the proposed area of disturbance relative to the known extent of the species is considered unlikely to result in the fragmentation of an existing population of the species into two or more populations.

- **adversely affect habitat critical to the survival of a species; or**

The Approved Conservation Plan identifies habitat critical to the survival of this species as *patches of Themeda australis (kangaroo grass) amongst shrubs and sedges in heathland and forest*. It also mentions that *vegetation associated with this species has been described as dry sclerophyll woodland dominated by Eucalyptus haemastoma (scribbly gum), Corymbia gummifera (red bloodwood), Angophora costata (smooth-barked apple) and Allocasuarina littoralis (black she-oak)*. Whilst parts of the remnant vegetation within the Project area superficially resembles the description above, all vegetation within the Project areas lacks the grassy understorey required by this species. As such, the potential habitat within the Project area is not considered to represent habitat critical to the survival of the species and it is unlikely that habitat critical to the survival of the species will be adversely affected.

- **disrupt the breeding cycle of a population; or**

The species' lifecycle is believed to be similar to other *Corunastylis* species in that it is believed to be a seasonal perennial, which shoots from a dormant underground tuber following winter rain. The species is likely to be pollinated by small flies (midges), usually in the Chloropidae family. Seed dispersal is by wind and water (TSSC 2015).

This species has not been recorded and, although potential habitat occurs in the Project area, it is considered unlikely to occur. Therefore, the proposed Action is unlikely to disrupt the breeding cycle of a population of *Corunastylis insignis*.

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

Corunastylis insignis has not been recorded within the Project area, however potential habitat was identified. Approximately 5.5 ha of potential habitat is proposed to be removed, however as the species is not known to occur and considered unlikely to occur, this loss of potential habitat is not considered important, notable, or of consequence, in accordance with the significant impact guidelines (DoE 2013).

The proposed Action is unlikely to modify, destroy, remove, isolate, or decrease the availability or quality of habitat to the extent that a population of this species is likely to decline.

- **result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat;**

The proposed project is not expected to result in invasive species that are harmful to the *Corunastylis insignis* becoming established in the species habitat.

- **introduce disease that may cause the species to decline; or**

Corunastylis insignis is not known to be affected by diseases that are causing the population of the species to decline. The Project is not likely to result in the introduction of disease.

- **interfere with the recovery of the species.**

A recovery plan has not been prepared for the species and the action does not contravene the primary conservation objectives listed in the approved conservation advice, being

- Maintain and enhance the species' habitat
- Increase the number and size of wild populations
- Raise awareness of the species, and the legislative requirements surrounding the harm of threatened species, within the local community
- Effectively administer the recovery effort.

As such the proposed action is unlikely to interfere with the recovery of the species

Conclusion

Corunastylis insignis has not been recorded within the Project area, however potential habitat has been identified. Based on the species habitat preferences listed in the Approved conservation Advice and its typical association with maintained grass patches, the habitat within the Project is considered marginal and it is unlikely that this species occurs. As such, the proposed Action is unlikely to have a significant impact on this species.

Notwithstanding, additional targeted surveys for this species will be completed as part of the studies for the EIS.

A.9 Swift Parrot (*Lathamus discolor*)

The swift parrot is listed as critically endangered under the EPBC Act.

The species breeds in Tasmania and moves to mainland Australia for the non-breeding season (usually arriving between February and March) (Saunders and Tzaros 2011). Most of the population winters in Victoria and NSW where it disperses across broad landscapes foraging on nectar and lerps in eucalypts. Until recently it was believed that in NSW, swift parrots forage mostly in the coastal and western slopes region along the inland slopes of the Great Dividing Range but are patchily distributed along the north and south coasts including the Sydney region (Saunders and Tzaros 2011). However, evidence is gathering that the forests on the coastal plains from southern to northern NSW are also important. They return to Tasmania in spring (September-October). The movements of this species on the mainland are poorly understood, but it is considered to be nomadic and irruptive, moving in response to food supply.

Upon reaching their core non-breeding range there is no known geographical pattern of movement. During the non-breeding season, the home-range varies tremendously between individuals and between years.

Priority sites for the swift parrot have been identified within the National Recovery Plan for the species (Saunders and Tzaros 2011). This species is likely to utilise coastal forest and river-flat vegetation associations within the coastal natural resource management region (which includes the Hunter-Central Rivers), in communities dominated by swamp mahogany (*Eucalyptus robusta*), blackbutt (*Eucalyptus pilularis*), forest red gum (*Eucalyptus tereticornis*) and spotted gum (*Corymbia maculata*) (Saunders and Tzaros 2011).

In this case, a *population* means:

- **a geographically distinct regional population, or collection of local populations; or**
- **a regional population, or collection of local populations, that occurs within a particular bioregion.**

The swift parrot occurs as a single population that migrates annually from breeding grounds in Tasmania to the winter foraging grounds on the coastal plains and slope woodlands of mainland eastern Australia (Saunders et al. 2011). Approximately 200 mature birds (10% of the total estimated population) are known to over-winter in the Lower Hunter Region of New South Wales (Roderick et al. 2013).

As the species occurs as a single population in Australia, any record of the species would constitute a part of a population as described above. This species has the potential to make use of the open forest and woodland habitats of the Project area, particularly where there are prolific flowering eucalypts, and this migratory species is likely to move throughout the area in response to mass flowering events. This species does not breed on mainland Australia, and as such the Project area only represents potential foraging habitat for this species.

The Project area contains low to moderate quality potential foraging habitat for this species, as the priority feed tree species that are nominated in the National Recovery Plan (Saunders and Tzaros 2011) as key foraging resources for the swift parrot in the Hunter Valley were not recorded in the PCTs identified during surveys. It is considered that the swift parrot may occupy the habitats within the Project area occasionally when foraging resources are available however the Project area is not expected to provide important habitat for the species based on the lack of priority feed tree species.

PCTs 1636 and 1716 are likely to provide foraging resources for this species in the Project area, which are a total of approximately 6.5 hectares in area. PCT 1727 is unlikely to provide any resources for the species, due to an absence of flowering trees. 5.1 ha of the Project area is also mapped as important habitat for the swift parrot under the Biodiversity Assessment Methodology (BAM) (DPIE 2021b), which forms a portion of the 6.5 hectares above.

An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:

- **lead to a long-term decrease in the size of a *population*; or**

The population of the swift parrot has not been recorded within the Project area, however it is known to occur in the EPS land holding near the outlet canal in lowland vegetation dominated by swamp mahogany/forest red gum, and there is one record of the species within the Project area, recorded from August 2011 (NSW Bionet 2021).

The project may result in the loss of approximately 6.5 ha of open forest and woodland of potential foraging habitat that does not contain key feed trees as identified in the National recovery Plan (Saunders et al. 2011). The Project area is not known as a historical or important foraging site for this species.

It is considered unlikely that the proposed project will lead to a decrease in the size of the population of swift parrot.

- **reduce the area of occupancy of the species; or**

The swift parrot has not been recorded within the Project area, however it is known to occur in the EPS land holding near the outlet canal in lowland vegetation dominated by swamp mahogany/forest red gum. Portions of the Project area are also mapped as important habitat for the swift parrot under the Biodiversity Assessment Methodology (BAM) (DPIE 2021b).

The proposed project may result in the loss of approximately 6.5 ha of potential foraging habitat, including a small portion (approximately 1.0 ha) of area containing a key feed tree species swamp mahogany (*Eucalyptus robusta*) as identified in the National recovery Plan (Saunders et al. 2011). The Project area is not known as a historical or important foraging site for this species. While the proposed project will remove potential moderate quality foraging habitat for the swift parrot, it is not likely to lead to a significant reduction in foraging habitat in the local area or region.

The proposed project may result in a reduction of the potential area of occupancy for the swift parrot in the Project area, however this is unlikely to substantially reduce the area of known occupancy in the wider locality or region for a population of the swift parrot.

- **fragment an existing *population* into two or more populations; or**

A *population* of the swift parrot has not been recorded within the Project area however it is known to occur in the EPS land holding near the outlet canal in lowland vegetation dominated by swamp mahogany/forest red gum. The swift parrot is highly dispersive, and it is unlikely that the proposed project would create a significant change to the species' dispersal capacity or create a significant barrier to movement of the species.

It is unlikely that the proposed project would result in the fragmentation of the existing *population* into two or more populations.

- **adversely affect habitat critical to the survival of a species; or**

Habitat critical to the survival of the swift parrot includes those areas of priority habitat for which the species has a level of site fidelity or possess phenological characteristics likely to be of importance to the swift parrot (Saunders et al. 2011). The swift parrot was recorded within the Project area in 2011 (NSW Bionet 2021), and it is known to occur in the EPS land holding near the outlet canal in lowland vegetation dominated by swamp mahogany/forest red gum. The Project area does not include vegetation containing key feed tree species for the swift parrot in the Hunter-Central Rivers (Saunders et al. 2011). The project will result in the loss approximately 6.5 ha of this potential habitat.

Breeding habitat, which is restricted to Tasmania, will not be affected by the project.

The project is unlikely to adversely affect habitat that is critical to the survival of the species.

- **disrupt the breeding cycle of a *population*; or**

The swift parrot breeds and nests exclusively in Tasmania and migrates to mainland Australia during the non-breeding season. There is no potential for breeding habitat to occur in the Project area.

The proposed project will not disrupt the breeding cycle of the *population* of swift parrot.

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

The swift parrot has been recorded in the region, with records concentrated in the lower Hunter Valley. There is one record from 2011 within the Project area near the canal.

The project will involve the removal of approximately 6.5 ha of open forest and woodland that contains potential foraging habitat, however key feed tree species for the swift parrot were not identified during surveys.

It is considered unlikely that the project would modify, destroy, remove, isolate, or decrease the availability or quality of habitat to the extent that a *population* of the swift parrot would decline.

- **result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat;**

The project is not expected to result in invasive species that are harmful to a population of the swift parrot becoming established in this species habitat.

- **introduce disease that may cause the species to decline; or**

Psittacine beak and feather disease is a common and potentially deadly disease of parrots caused by a circovirus named beak and feather disease virus. The disease appears to have originated in Australia and is widespread and continuously present in wild populations of Australian parrots. Beak and feather disease affecting endangered psittacine species (parrots and related species) was listed in April 2001 as a key threatening process under the EPBC Act.

It is considered highly unlikely that the project will introduce beak and feather disease or any other disease that may cause the swift parrot to decline.

- **interfere with the recovery of the species.**

The following recovery plan has been prepared:

- National Recovery Plan for the Swift Parrot (*Lathamus discolor*) (Saunders et al. 2011)

Known or priority swift parrot habitat will not be impacted by the project and therefore objectives of the National Recovery Plan are not likely to be contravened. It is considered unlikely that the project will interfere with the recovery of a *population* of the swift parrot throughout Australia.

Conclusion

The project is unlikely to result in a significant impact on the population of the swift parrot. Although the Project area provides potential foraging habitat for this species, the swift parrot (*Lathamus discolor*) has not been recorded within the Project area and a low number of key feed trees will be impacted.

A.10 Migratory Species under International Conventions

The black-faced monarch (*Monarcha melanopsis*) is considered to potentially occur in the Project area and is considered in the following assessment of impacts on migratory species.

An area of important habitat is:

- **habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species; or**
- **habitat utilised by a migratory species which is at the limit of the species range; or**
- **habitat within an area where the species is declining.**

The Draft Referral Guideline for 14 Birds Listed as Migratory Species under the EPBC Act (DoE 2015) defines important habitat for the black-faced monarch which includes rainforests and wet sclerophyll forests (DoE 2015). The habitats within the Project area for migratory species listed under international conventions is not considered to meet the criteria listed above, and where individual species may occur, *important habitat* is not likely to occur.

The Proposed Action is considered likely to result in a significant impact on migratory species if there is a real chance or possibility that it will:

- **substantially modify and/or destroy an area of important habitat for a migratory species;**
- **seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species; and/or**
- **result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species.**

The Project area is not considered to comprise *important habitat* for the black-faced monarch, and therefore the proposed project is not likely to substantially modify or destroy important migratory species habitat. Similarly, the proposed project will not seriously disrupt the lifecycle of an ecologically significant proportion of the population of a migratory species; or result in an invasive species that is harmful to migratory species becoming established within the Project area.

The proposed project is not likely to result in a significant impact on any migratory species listed under the EPBC Act or international conventions.

