# BIODIVERSITY DEVELOPMENT ASSESSMENT REPORT

## THRUMSTER WASTEWATER SCHEME

**CLIENT:** Port Macquarie-Hastings Council

**DATE:** 24 July 2024

**PREPARED BY:** Robert Scanlon, Alan Midgley, Bayley Holborow, Lauren Cockbain, Satem Longchar and Oliver Broun

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# SUMMMARY

de Witt Ecology was commissioned by Ramboll/Beca Hunter H2O on behalf of Port Macquarie-Hastings Council to assess the Thrumster Wastewater Scheme (herewith described as the project). This assessment has been completed in accordance with the Biodiversity Assessment Method (BAM). The assessment identified areas of the following Plant Community Types (PCT) within the Subject Land:

- PCT 3167 Northern Hinterland Blackbutt-Forest Oak Wet Forest in the following conditions:
  - Low condition.
  - Moderate condition.
- PCT 3250 Northern Foothills Blackbutt Grassy Forest in following conditions:
  - Low condition.
  - Moderate-Good condition.
- PCT 3544 Coastal Sands Apple-Blackbutt Forest in the following condition:
  - Low condition.
  - Moderate condition
- PCT 3967 Northern Lower Floodplain *Eleocharis* Wetland in the following condition:
  - Good condition.
- PCT 4006 Northern Paperbark-Swamp Mahogany Saw-sedge Forest in the following condition:
  - Moderate Condition.
- Disturbed exotic grassland (PCT 3544 Exotic grassland).
- Existing structures

The total area within the Subject Land that is vegetated is 22.61 ha. Of this, a total of 3.43 ha was assessed as having a Vegetation Integrity Score >15, representing a considerable utilisation of low Vegetation Integrity areas by the project. Of the native vegetation, the following PCTs were associated with a Threatened Ecological Community (TEC) under the *Biodiversity Conservation Act 2016* (BC Act) or Threatened Community (TC) under the *Environmental Protection Biodiversity Conservation Act 1999* (EPBC Act).

- PCT 3967 Northern Lower Floodplain Eleocharis Wetland in Good condition:
  - Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (Endangered – BC Act).
- PCT 4006 Northern Paperbark-Swamp Mahogany Saw-sedge Forest in Moderate condition:
  - Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (Endangered – BC Act).
  - Coastal Swamp Sclerophyll Forest of New south Wales and South East Queensland (High Condition Class A) (Endangered – EPBC Act).

Threatened flora and fauna were recorded within the Subject Land during the field investigation undertaken, or assumed present in accordance with the BAM including:

- Small Pale Grass-lily (*Caesia parviflora var. minor*) (species credit),
- Wallum Froglet (*Crinia tinnula*) (species credit),
- Leafless Tongue Orchid (*Cryptostylis hutneriana*) (species credit),
- Spider Orchid (*Dendrobium melaleucaphilum*) (species credit),
- Black-necked Stork (*Ephippiorhynchus asiaticus*) (ecosystem credit),
- White-bellied Sea-eagle (*Haliaeetus leucogaster*) (ecosystem credit),
- Swift Parrot (*Lathamus discolor*) (species credit),
- Green-thighed Frog (*Litoria brevipalmata*) (species credit),
- Slender Marsdenia (*Marsdenia longiloba*) (species credit),
- Eastern Coastal Free-tailed Bat (*Micronomus norfolkensis*) (ecosystem credit),
- Little Bent-winged Bat (*Miniopterus australis*) (ecosystem credit),
- Large Bent-winged Bat (*Miniopterus orianae oceanensis*) (ecosystem credit),
- Southern Myotis (*Myotis macropus*) (species credit),
- Giant Dragonfly (*Petalura gigantea*) (species credit),

- Squirrel Glider (*Petaurus norfolcensis*) (species credit),
- Koala (*Phascolarctos cinereus*) (species credit),
- Eastern Grass Owl (*Tyto longimembris*) (ecosystem credit),
- Eastern Cave Bat (*Vespadelus troughtoni*) (species credit),

Measures to mitigate potential indirect impacts to biodiversity values are detailed in Section 8.8.

Assessment was made for entities listed under the EPBC Act. Given the proposal is unlikely to have a significant residual impact on any EPBC Act listed fauna or flora species or communities, referrals to the Commonwealth Minister for the Environment relating to this BDAR were not deemed necessary for the current proposal (refer to section 12.1 and Appendix 4 for further details).

The proposed development has been assessed in consideration of Serious and Irreversible Impacts to Swift Parrot and Giant Dragonfly as outlined in Section 10.2 of the BAM (refer to Section 9.0 and Appendix 5 of this report for further details).

Residual impacts to native vegetation will require retirement of 105 ecosystem credits and 895 species credits in accordance with the Biodiversity Offsets Scheme, as outlined in Tables E1 and E2 below.

Table E1 Impacts that require an offset – ecosystem credits

| Vegetation zone | Plant Community Type | Impact area (ha) | Ecosystem credits required |
|---|---|---|---|
| VZ1 | PCT 3167 Northern Hinterland Blackbutt-Forest Oak Wet Forest (Low Condition) | 0.18 | 4 |
| VZ2 | PCT 3167 Northern Hinterland Blackbutt-Forest Oak Wet Forest (Moderate Condition) | 0.6 | 17 |
| VZ3 | PCT 3250 Northern Foothills Blackbutt Grassy Forest (Low Condition) | 0.12 | 2 |
| VZ4 | PCT 3250 Northern Foothills Blackbutt Grassy Forest (Moderate - Good Condition) | 0.61 | 19 |
| VZ5 | Exotic Vegetation | 17.57 | - |
| VZ6 | PCT 3544 Coastal Sands Apple-Blackbutt Forest (Low Condition) | 1.61 | - |
| VZ7 | PCT 3544 Coastal Sands Apple-Blackbutt Forest (Moderate Condition) | 0.21 | 4 |
| VZ8 | PCT 3967 Northern Lower Floodplain Eleocharis Wetland (Good Condition) | 1.67 | 58 |
| VZ9 | PCT 4006 Northern Paperbark-Swamp Mahogany Saw-sedge Forest (Moderate Condition) | 0.04 | 1 |
| Total | | 22.61 | 105 |

Table E2 Impacts that require an offset – species credits

| Common name | Scientific name | Loss of habitat (ha) | Species credits required |
|---|---|---|---|
| Small Pale Grass-lily | *Caesia parviflora* var. *minor* | 0.73 | 28 |
| Wallum Froglet | *Crinia tinnula* | 4.2 | 51 |
| Leafless Tongue Orchid | *Cryptostylis hunteriana* | 2.32 | 24 |
| Spider Orchid | *Dendrobium melaleucaphilum* | 0.73 | 28 |
| Swift Parrot | *Lathamus discolor* | 1.07 | 22 |
| Green-thighed Frog | *Litoria brevipalmata* | 0.76 | 21 |
| Slender Marsdenia | *Marsdenia longiloba* | 1.11 | 41 |
| Southern Myotis | *Myotis Macropus* | 11.26 | 112 |
| Giant Dragonfly | *Petalura gigantea* | 14.32 | 187 |
| Squirrel Glider | *Petaurus norfolcensis* | 1.87 | 64 |
| Koala | *Phascolarctos cinereus* | 1.87 | 64 |
| Eastern Cave Bat | *Vespadelus troughtoni* | 22.61 | 253 |

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GLOSSARY

| | |
|---|---|
| APZ | Asset Protection Zone |
| BAM | Biodiversity Assessment Method |
| BAM-C | Biodiversity Assessment Method Calculator |
| BC Act | *Biodiversity Conservation Act 2016* (NSW) |
| BC Regulation | Biodiversity Conservation Regulation 2017 (NSW) |
| BCD | Biodiversity Conservation Division |
| BCT | Biodiversity Conservation Trust |
| BDAR | Biodiversity Development Assessment Report |
| Biosecurity Act | NSW *Biosecurity Act 2015* |
| BOAMS | Biodiversity Offsets and Agreement Management System |
| BoM | Bureau of Meteorology |
| BOS | Biodiversity Offsets Scheme |
| CEEC | Critically Endangered Ecological Community |
| Council | Port Macquarie-Hastings Council |
| DAWE | Department of Agriculture, Water and the Environment |
| DBH | Diameter at Breast Height over bark |
| DCCEEW (NSW) | NSW Department of Climate Change, Energy, the Environment and Water |
| DCCEEW (Commonwealth) | Commonwealth Department of Climate Change, Energy, the Environment and Water |
| DEE | Commonwealth Department of the Environment and Energy |
| BOS | Biodiversity Offsets Scheme |
| DPE | NSW Department of Planning and Environment |
| DPI | NSW Department of Primary Industries |
| DPIE | NSW Department of Planning, Industry and Environment |
| DTDB | Digital topographic databases |
| Ecosystem credit species | A measurement of the value of EECs, CEECs and threatened species habitat for species that can be reliably predicted to occur with PCT. Ecosystem credits measure the loss in biodiversity values at a development. |
| EEC | Endangered Ecological Community |
| EIS | Environmental Impact Statement |
| EP&A Act | *Environmental Planning and Assessment Act 1979* (NSW) |
| EPBC Act | *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth) |
| FM Act | *Fisheries Management Act 1994* (NSW) |
| GIS | Geographic information system |
| ha | Hectares |
| HBT | Hollow-bearing Tree |
| HDD | Horizontal Directional Drilling |
| HTW | High Threat Weed |
| IBRA | Interim Biogeographical Regionalisation for Australia |
| LEP | Local Environment Plan |
| LGA | Local Government Area |
| LLS Act | *Local Land Services Act 2013* (NSW) |
| Locality | Area located within 5 kilometres radius from the study area |
| MNES | Matters of National Environmental Significance |
| NPW Act | *National Parks and Wildlife Act 1974* (NSW) |
| NPWS | NSW National Parks and Wildlife Service |
| NSW | New South Wales |
| OEH | NSW Office of Environment and Heritage |
| PCT | Plant Community Type |
| PMHC | Port Macquarie-Hastings Council |
| SAII | Serious and irreversible impact |
| BDAR | Biodiversity Development Assessment Report |
| SEARs | Secretary's Environmental Assessment Requirements |
| SEPP | State Environmental Planning Policy |
| SPS | Sewer Pump Station |
| SSI | State Significant Infrastructure |

| | |
|---|---|
| Study Area | Situated within the site boundary where biodiversity field surveys were undertaken to inform the biodiversity assessment |
| Subject Land | The outer extent of predicted direct impacts associated with the proposed works |
| TBDC | Threatened Biodiversity Data Collection |
| TEC | Threatened Ecological Community |
| The Scheme | Thrumster wastewater scheme - includes a new wastewater treatment plant, associated pipelines and infrastructure that includes a water recycling plant at Thrumster, a suburb of Port Macquarie on the NSW mid north coast. |
| VEC | Vulnerable Ecological Community |
| VIS | NSW Vegetation Information System |
| VMP | Vegetation Management Plan |
| WWTP | Wastewater treatment plant - Refers to the WWTP as a whole including the recycled water treatment plant. |

# DECLARATIONS

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

In preparing this assessment I have acted in accordance with the Accredited BAM ASSESSOR Code of Conduct.

This BDAR has been prepared to meet the requirements of BAM 2020. Appendix 5 provides an assessment of compliance with the minimum information requirements outlined in BAM Appendix K.

Robert Scanlon
Signature:

Date: 24/07/2024

BAM Assessor Accreditation no: BAAS24011

# DETAILS AND EXPERIENCE OF AUTHORS AND CONTRIBUTORS

| NAME | BAM ASSESSOR ACCREDITATION NO. | POSITION / PROJECT ROLE | TASKS PERFORMED | QUALIFICATIONS | RELEVANT EXPERIENCE |
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| Robert Scanlon | BAAS24011 | Senior Ecologist | Field surveys, GIS and Reporting | Doctor of Philosophy (PhD) B.Sc (Hons) Accredited BAM Assessor | 7+ years |
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# CONFLICT OF INTEREST

I declare that I have considered the circumstances and there is no actual, perceived or potential conflict of interest.

This declaration has been made in the interests of full disclosure to the decision-maker.

Full disclosure has also been provided to the client.

Robert Scanlon
Signature:

Date: 24/07/2024
BAM Assessor Accreditation no: BAAS24011

# STAGE 1: BIODIVERSITY ASSESSMENT

# 1.0 INTRODUCTION

## 1.1 PROPOSED DEVELOPMENT

### *1.1.1 Development Overview*

de Witt Ecology was commissioned by Ramboll/Beca Hunter H2O on behalf of Port Macquarie-Hastings Council to assess the Thrumster Wastewater Scheme (herewith described as the project). The project is within the Port Macquarie-Hastings Local Government Area (LGA) and will be comprised of the development of a new Wastewater Treatment Plant (WWTP), associated mains and infrastructure to support the project.

Assessment of the project will occur under Part 5, Division 5.2 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) as State Significant Infrastructure. As part of the Environmental Impact Statement (EIS) and as specified by the SEARs for the project, submission of the BDAR will be required.

### *1.1.2 Location*

The Project will occur across multiple suburbs including Thrumster, Fernbank Creek, and Port Macquarie. The WWTP is located west of Port Macquarie Airport and is located on Lot 14 DP1139180. Both the Sewer Rising Main and Recycled Water Main will follow linear alignments through the Port Macquarie Airport to land near Port Macquarie Race Club, as well as along Oxley Highway, John Oxley Drive, The Binnacle, Kemp Street, Hastings River Drive, Fernhill Road, Acacia Avenue, Barton Cresent and Thrumster Street (Figure 1 - Figure 13). The Subject Land is within the Birpai Local Aboriginal Land Council.

A general overview of the locations used for this project are included in Section 3.0.

### *1.1.3 Proposed Development on the Subject Land*

This project will involve construction of a new WWTP, pump stations, Sewer Rising Main and Recycled Water Main (Figure 8 - Figure 13). Key features of the project include:

- Construction of a new WWTP at Thrumster including Recycled Water Treatment Plant.
- Construction of a new sewer pump stations (SPSs),
- Construction of new sewer rising mains (SRM) and recycled water mains (RWM) (referred to collectively as 'SRMs & RWMs').
- Upgrade works at identified existing Sewer Pump Stations to reduce the current load on the existing system.
- Improvements to site access and electricity supply.
- Laydown and Compound areas.

The WWTP will encompass an area of approximately 6.26 ha (361 m x 175 m) (Figure 8) and will be constructed in a location referred to as the 'sand plain' (Plate 1). Connecting the WWTP to existing facilities and discharge point are Sewer Rising Mains and Recycled Water Mains. Two new roads will be constructed, one of which being an all-weather access road. The WWTP and associated infrastructure will require the establishment and maintenance of an asset protection zone (APZ). To reduce the risk from flood, there will be a substantial import of fill to the WWTP and its roads. The construction of the project is expected to take place over three years. Construction activities will include: two months, mobilisation and site establishment including laydown areas, four months civil works, 24 months construction of the WWTP and RWTP, six months testing and commissioning and 1-2 months site demobilisation and surface rehabilitation.

Along the SRMs & RWMs alignment, the EIS is considering a 20 m wide Project Area. Within this area, to reduce impacts to native vegetation and avoid private property, the Subject Land has been refined where possible to a 10 m wide disturbance footprint. Where there were areas of extensive exotic or non-vegetated areas, the Subject Land has been expanded to encompass the full width of the 20 m Project Area, allowing greater areas to facilitate heavy machinery and horizontal directional drilling. It is anticipated that all direct impacts will occur within the Subject Land. The Subject Land therefore includes the WWTP, roads and electricity supply upgrade areas, a 10 m wide corridor (increasing to 20 m wide where suitable) along the SRMs & RWMs, and laydown / compound areas (Figure 8 - Figure 13).

Substantial areas of the project will use existing facilities (such as existing SRMs) or implement Horizontal Directional Drilling (HDD) to avoid impacts on native vegetation and reduce inconvenience on the general public. These areas are not included within the Subject Land (see Figure 8, Figure 12 and Figure 14, as well as Plate 28 and Plate 29).

The connection between the WWTP and the Subject Land for the SRMs & RWMs is a combination of HDD and trenching through areas that do not require assessment. The "Order conferring biodiversity certification - Port Macquarie Airport and surrounding lands" under section 126H of the *Threatened Species Conservation Act 1995* was delivered on 9 August 2018. This established Biodiversity Certified land and land for conservation measures through a biobanking agreement (Figure 14). To cross from the WWTP to the Bio-certified Land to the east, the project will perform HDD to avoid any impacts to biodiversity values. Once inside the Bio- certified Land within the Port Macquarie Airport area, trenching will be implemented within identified easements to ensure they occur within the impact areas identified under the BioBanking Agreements (BA487) and the federal EPBC approval (EPBC2016/7842). In the east of the Port Macquarie Biobanking land, the trenches follow existing roads to exit the airport area. This is discussed further in Section 8.2.

The completed WWTP will require two release points for treated effluent. The primary release will be to Kooloonbung Creek, north east of the intersection of Ocean Drive and Lake Road Port Macquarie (Figure 13). An emergency release from the facility will be established that directs overflow to the wetland (Figure 8). The emergency overflow will involve a weir with a stopboard at the WWTP for emergency discharge and use the natural swale of the ground to direct the emergency discharge to the existing drain within Wetland A, upstream of the Hydraulic gate on the Partridge Creek (Plate 1). The release of effluent is considered further within Section 8.1.

The Subject Land is identified as bushfire prone land (Vegetation Category 1, 2 and 3 with vegetation buffer) and occurs across multiple land zonings including, R1: General Residential, R2: Low density Residential, R5: Large Lot Residential, RU1: Primary Production, RE1: Public recreation, RE2: Private Recreation, E3: Productivity Support, E4: General Industrial; C2: Environmental Conservation, C3: Environmental Management, C4: Environmental Living, SP2: Infrastructure and SP4: Enterprise.

Plate 1 Location of key features surrounding the site selected for the wastewater treatment plant.

## 1.2 PURPOSE OF CURRENT ASSESSMENT

This BDAR includes, but is not limited to:

- Review and consideration of previous ecological investigations undertaken in proximity to the project;
- Address the BAM and the BOS;
- Mapping of Plant Community Types (PCTs) impacted by the project;
- Identify how the proponent proposes to avoid and minimise impacts to biodiversity;
- Identification of biodiversity impact avoidance, minimisation, mitigation and management measures as required;
- Identify any potential impact that could be classified as prescribed or serious and irreversible (SAII) consistent with the BAM;
- Outline offset obligations necessary to compensate for any biodiversity impacts that cannot be avoided resulting from the project; and
- Describe and assess the significance of potential impacts to MNES in accordance with the EPBC Act.

Completion of biodiversity assessments are in accordance with the BAM. This BDAR has been prepared by Accredited Assessors Alan Midgley (BAAS17094) and Robert Scanlon (BAAS24011) with review by Accredited Assessor Alejandro Barreto (BAAS18057). Support has been provided by Bayley Holborow (BSc), Lauren Cockbain (BSc) and Satem Longchar (PhD, MSc) and Oliver Broun (B. Dev Stud).

## 1.3 BIODIVERSITY OFFSETS SCHEME ENTRY

State Significant Development (SSD) and State Significant Infrastructure (SSI) are regulated under the Environmental Planning and Assessment Act 1979, which requires proponents to apply to the Minister of Planning for development consent or infrastructure approval, supported by an environmental impact statement (EIS). These applications are also subject to biodiversity assessment requirements under the *Biodiversity Conservation Act 2016* (BC Act). The BC Act requires that an SSD or SSI application must be accompanied by a Biodiversity Development Assessment Report (BDAR) unless the Planning Agency Head (or delegate) and the Environment Agency Head (or delegate) determine that the project is not likely to have any significant impact on biodiversity values.

As the project is State Significant Infrastructure, and entry into the BOS has been triggered, this necessitates the need for a BDAR. In accordance with the BC Act, assessment of the project was performed in line with the NSW Biodiversity Assessment Method (BAM) (Department of Planning, Industry and Environment DPIE, 2020a)). The BDAR also addresses the assessment requirements of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), specifically, consideration of potential impacts to Matters of National Environmental Significance (MNES)

The study area intersects land included on the Biodiversity Values Map (Figure 15).

## 1.4 EXCLUDED IMPACTS

Land in the study area contains a small area of Category 1 – Exempt Land, in the vicinity of the WWTP, based on the Draft Native Vegetation Regulatory Map (DPE 2023). Assessment under the BAM has been performed for these areas due to the potential to significantly impact threatened species utilising the Category 1 – Exempt Land area.

## 1.5 MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

A general referral has been submitted under the EPBC Act (application number 01878) to provide broad details of the project and allow the minister to consider if the project is considered as a controlled action. Matters of National Environmental Significance will be considered throughout this document. Specific Matters of National Environmental Significance will be discussed in Section 12.1.

## 1.6 INFORMATION SOURCES

Sources of information used in the assessment include relevant databases, spatial data, literature and previous site reports. In order to provide a context for the subject land, records of flora and fauna from within 10 kilometres (the 'locality') were collated from the following databases and were reviewed:

- NSW BioNet Threatened Biodiversity Profile Data Collection (TBDC).
- Department of Climate Change, Energy, the Environment and Water (DCCEEW) Protected Matters Search Tool, for matters protected by the EPBC Act (DCCEW 2022).
- NSW BioNet - the database for the BioNet Atlas and BioNet Vegetation Classification (NSW Department of Planning and Environment (DPE 2022b).
- NSW Department of Primary Industries (DPI) Spatial Data Portal for NSW *Fisheries Management Act 1994* listed threatened species, populations and communities (DPI 2022).
- PlantNET (Royal Botanic Gardens and Domain Trust 2013).
- BirdLife Australia, the New Atlas of Australian Birds 1998-2013.

Other sources of biodiversity information included:

- Relevant vegetation mapping, including vegetation mapping of Port Macquarie-Hastings area (State Government of NSW & NSW DCCEEW, 2022, Phillips et al, 2013).
- Groundwater Dependent Ecosystems Atlas (BoM 2022).
- Previous reports including
    - GHD (2023) Thrumster Wastewater Scheme, Scoping Report – State Significant Infrastructure.
    - de Witt Ecology (2022) Biodiversity Constraints Report – Proposed Wastewater Treatment Plant.

Mapping was assisted by hand-held (uncorrected) GPS units (EPSG 28356: GDA1994, MGA Zone 56), mobile tablet computers running QField and aerial photo interpretation. The accuracy of this mapping is therefore subject to the accuracy of the GPS units (generally ± 5 metres) and dependent on the limitations of aerial photo rectification and registration.

Basemap data was obtained from NSW Department of Customer Services (DCS) Spatial Services containing a selection of LANDSAT® satellite imagery as well as from MetroMap by Aerometrex. Cadastral data was obtained from LPI digital cadastral database.

The following spatial datasets were utilised during the development of this report:

- Mitchell Landscapes Version 3.0.
- Interim Biogeographic Regionalisation of Australia (IBRA) Version 7.
- Directory of Important Wetlands (DIWA).
- NSW Soil and Land Information System (SALIS), accessed via eSPADE.

## 1.7 COMPLIANCE WITH SEARS, CONTROLLED ACTION AND REQUESTS FOR INFORMATION

To inform the development of this BDAR, local, state and federal government organisation have contributed requests for further and specific assessments or consideration to support the progression of the Project. Details of the requests are specified below to assist the reviewer in confirming that all relevant information is being provided.

### *1.7.1 Port Macquarie-Hastings Council*

Groundwater dependant ecosystem assessment: presented in Sections 3.2.3, 6.0 and 8.7.

### *1.7.2 Planning Secretary's Environmental Assessment Requirements*

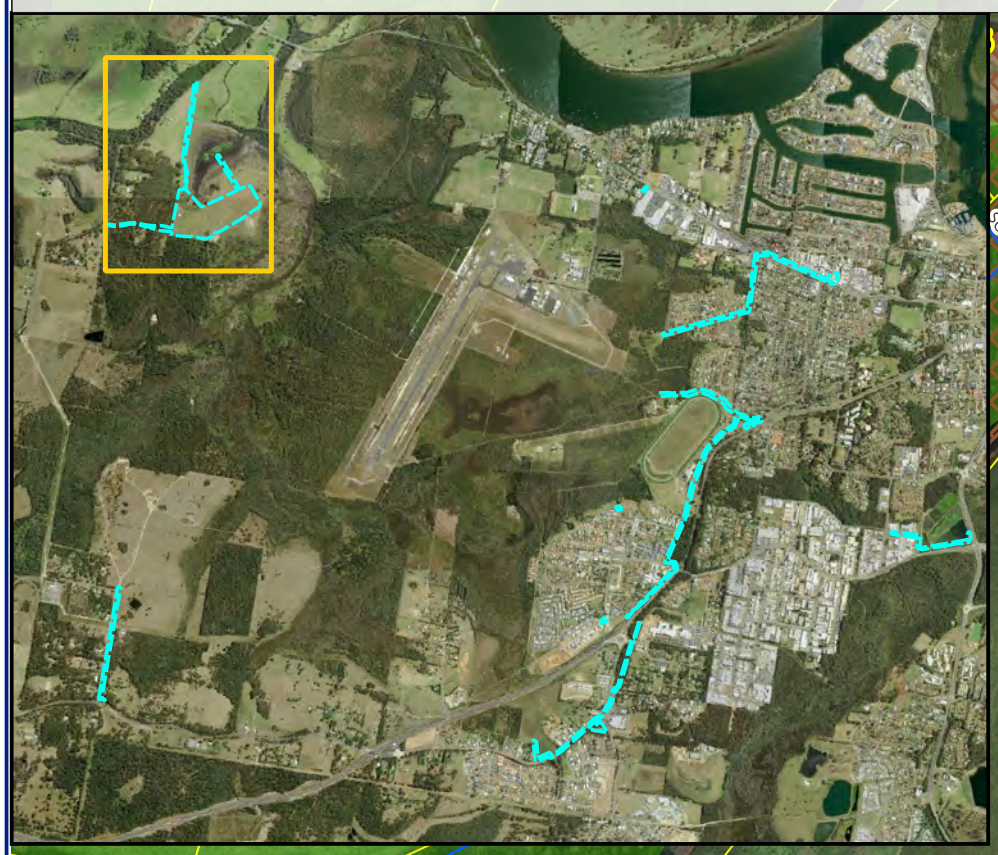
The following are excerpts from the Planning Secretary's Environmental Assessment Requirements dated 28/04/2023 (Table 1).

Table 1 Key issues in to be considered based on the Secretary's Environmental Assessment Requirements.

| Key Issue - Biodiversity | Response |
|---|---|
| 27. The EIS must assess biodiversity impacts related to the project in accordance with Section 7.9 of the Biodiversity Conservation Act 2017 using the Biodiversity Assessment Method (BAM) and must document this assessment in a Biodiversity Development Assessment Report (BDAR). The BDAR must include information in the form detailed in the *Biodiversity Conservation Act 2016 (s6.12), Biodiversity Conservation Regulation 2017 (s6.8)* and the BAM, unless the Biodiversity and Conservation Division and Planning and Assessment Group determine that the project is not likely to have any significant impacts on biodiversity values. | This document, a BDAR, has been designed based on the NSW BDAR template. It has considered all requirements identified in the *Biodiversity Conservation Act 2016*, the Biodiversity Conservation Regulation 2017, the BAM, TBDC, as well as associated guidelines and support documents. |
| 28. The BDAR must document the application of the avoid, minimise and offset framework including assessing all direct, indirect and prescribed impacts in accordance with the BAM. | Avoid and minimise has been a key component of this project and primary mechanisms utilised are discussed in Section 7.0. Direct and indirect impacts were assessed as part of presenting the information relevant to Stage 1 of the BAM, particularly in Sections 3.0 to 6.0 of this BDAR. Specific direct, indirect and prescribed impacts identified in the BDAR are presented in Sections 8.5, 8.6 and 8.7 respectively. |
| 29. The BDAR must include details of the measures proposed to address the offset obligation as follows:<br>o The total number and classes of biodiversity credits required to be retired for the project.<br>o The number and classes of like-for-like biodiversity credits proposed to be retired.<br>o The number and classes of biodiversity credits proposed to be retired in accordance with the variation rules.<br>o Any proposal to fund a biodiversity conservation action.<br>o Any proposal to conduct ecological rehabilitation.<br>o Any proposal to make a payment to the Biodiversity Conservation Fund. | The number and classes of biodiversity credits required to be retired for the project are detailed in Section 10.0 and Section 11.0. The proponent is considering options to apply for a biodiversity stewardship agreement, however these are yet to be confirmed. The proponent intends to acquire credits from a combination of sources, including from within existing resources, the open market, and the Biodiversity Conservation Fund. |
| 30. If seeking approval to use the variation rules, the BDAR must contain details of the reasonable steps that have been taken to obtain requisite like-for-like biodiversity credits. | The proponent does not intend to utilise the variation rules. |
| 31. The BDAR must be submitted with all spatial data associated with the survey and assessment as per Appendix 11 of the BAM.. | All relevant spatial data will be submitted as part of the project. |
| 32. The BDAR must be prepared by a person accredited in accordance with the Accreditation Scheme for the Application of the Biodiversity Assessment Method Order 2017 under s6.10 of the *Biodiversity Conservation Act 2016* | This BDAR has been prepared by Dr Robert Scanlon who has received a Certificate Of Accreditation as a Biodiversity Assessment Method Assessor under the *Biodiversity Conservation Act 2016* (NSW) with the Accreditation number BAAS24011.<br>Robert has been supported by Dr Alan Midgley (BAAS17094) and the BDAR has been reviewed by Alejandro Barreto (BAAS18057). |

| Key Issue - Biodiversity | Response |
|---|---|
| 33. The EIS should identify the existing hydrological functioning of coastal wetlands mapped by the State Environmental Planning Policy (Resilience and Hazards) 2021 (SEPP) in the vicinity of the proposal, and address the range of potential impacts including, construction impacts, changes to hydrology, any vegetation removal required for the construction and/or maintenance of access tracks, flooding, activation of acid sulfate soils and the potential for effluent to be discharged into any of the mapped wetlands due to the failure of the sewer network. In particular, the EIS should identify how the proposed effluent disposal area will be accessed during the construction and operational phases of the project. | This BDAR outlines the location of coastal wetlands in Figure 6 and discusses local hydrology in Section 3.2.3.<br>This BDAR has performed detailed mapping of wetland communities within the Subject Land (see Section, 4.2.5, Section 4.2.6 and Figure 38 - Figure 43) and considered impacts to groundwater dependant ecosystems by the Project in Section 3.2.2, Section 6.0 and Section 8.7.<br>The project considers and addresses potential impacts from the project in Section 8.5, Section 8.6, Section 8.7, Section 8.8 and Section 8.9. |
| 34. The EIS should consider strategies and actions to avoid and minimise potential impacts on threatened entities and their habitats (including remnant vegetation) occurring on and/or adjoining the site. | Numerous surveys have been performed for threatened entities within and adjoining the Subject Land (see Sections 0, 4.0 and 5.0).The Project has taken multiple steps to avoid threatened entities and their habitat where possible, which has been detailed in Section 7.0. Where the project has been unable to avoid or minimise impacts on threatened entities, mitigation measures have been put in place (see Section 8.8 and Section 8.9). |
| 35. The EIS and BDAR should assess the impact of the project on any shorebird foraging and/or roosting habitat located within and/or adjoining the development site for both construction and operational stages of the project. | Consideration of risks to shorebirds was made, including assessing the distance from areas of Important Habitat Maps for migratory shorebirds. Additional consideration of specific species is described in Section 5.1 of this BDAR. |
| 36. The EIS should assess the impact of the project on any wildlife corridors in the locality of the project. | The project identifies current habitat connectivity with in 3.2.4 and considers the impact of habitat connectivity within Section 6.0 and Section 8.7. Consideration is also made specifically for threatened species either assumed present or identified during surveys for this BDAR in Appendix 4 and Appendix 5. |
| 37. Provide an up-to-date coastal erosion and recession study for the effluent disposal area. The updated study must consider the latest IPCC projections and NSW Coastal Management Manual 2018 requirements of a probabilistic assessment over multiple probabilities and planning horizons. | Please refer to Technical Report 1a Water Resources Assessment (GHD, 2024) and 1b Water Quality Impact Assessment (Intrawater, 2024). |

Whilst every care is taken to ensure the accuracy of this data de Witt Ecology makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaims all responsibility and all liability for all expenses, losses or damages which might incur as a result of the data being inaccurate or incomplete in any way and for any reason.



## LEGEND

- Subject Land
- EIS Project Area
- Habitat Connectivity
- Cadastre
- Hydrolines
- Mitchell Landscaspe v3.1

*Vegetation Type*

- Native Vegetation

*Groundwater Dependent Ecosystems*

- High Potential GDE

Lot 1 | DP250725
Lot 1 | DP1005995
Lot 2 | DP1140746
Lot 1 | DP1140746
Lot 2 | DP811351
Lot 4 | DP738164
Lot 1 | DP734943
Lot 13 | DP1139180
Lot 1 | DP1221154
Lot 10 | DP1089078
Lot 4 | DP1089078
Manning - Macleay Coastal Alluvial Plains
Lot 14 | DP1139180
Lot 1 | DP1089078
SO1
SO2
SO4+
SO4

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| | | | | | |
|---|---|---|---|---|---|
| FIGURE 1 | **SITE MAP** | | | | |
| JOB ADDRESS: | PORT MACQUARIE-HASTINGS COUNCIL AREA | | | | |
| CLIENT: | PORT MACQUARIE-HASTINGS COUNCIL | | | | |
| A3 SCALE: | 1:3,900 | DRAWN: | BH | JOB REF: | EC217 |
| PLAN DATE: | 11/07/2024 | CHECKED: | RS | ISSUE: | 02 |

0 100 200 300 400 m

N

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## LEGEND

- Subject Land
- EIS Project Area
- Habitat Connectivity
- Cadastre
- Hydrolines
- Mitchell Landscaspe v3.1

*Vegetation Type*

- Native Vegetation

*Groundwater Dependent Ecosystems*

- High Potential GDE

Lot 1 | DP999487
Lot 2 | DP1240162
Lot 2 | DP788535
Lot 3 | DP788535
Lot 1 | DP10873
Lot 4 | DP788535
Lot 1 | DP1240162
Lot 5 | DP788535
Manning - Macleay Coastal Alluvial Plains
Lot 3 | DP611526
Lot 8 | DP788535
Lot 7 | DP788535
Lot 6 | DP788535
Lot 1 | DP701760
SO2
Lot 14 | DP788535
Wauchope Coastal Foothills
SO1
Lot 2 | DP611526
Lot 2 | DP701760
Lot 1 | DP1245588
Lot 1 | DP611526
Lot 16 | DP788535
Lot 17 | DP788535
Lot 15 | DP788535
Lot 1 | DP565437
Lot 2 | DP613304
Lot 4 | DP221913
Lot 1 | DP505954
Lot 1 | DP574816

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|---|---|---|---|---|---|
| FIGURE 2 | **SITE MAP** | | | | |
| JOB ADDRESS: | PORT MACQUARIE-HASTINGS COUNCIL AREA | | | | |
| CLIENT: | PORT MACQUARIE-HASTINGS COUNCIL | | | | |
| A3 SCALE: | 1:2,500 | DRAWN: | BH | JOB REF: | EC217 |
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0 50 100 150 200 250 m

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## LEGEND

- Subject Land
- EIS Project Area
- Habitat Connectivity
- Cadastre
- Hydrolines
- Mitchell Landscapes v3.1

Vegetation Type

- Native Vegetation

Groundwater Dependent Ecosystems

- High Potential GDE

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FIGURE 3

**SITE MAP**

0 75 150 225 300 m

| | | | | | |
|---|---|---|---|---|---|
| JOB ADDRESS: | PORT MACQUARIE-HASTINGS COUNCIL AREA<br>NSW \| AUSTRALIA | | | | |
| CLIENT: | PORT MACQUARIE-HASTINGS COUNCIL | | | | |
| A3 SCALE: | 1:3,200 | DRAWN: | BH | JOB REF: | EC217 |
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## LEGEND

- Subject Land
- EIS Project Area
- Habitat Connectivity
- Cadastre
- Mitchell Landscaspe v3.1

*Vegetation Type*

- Native Vegetation

*Groundwater Dependent Ecosystems*

- High Potential GDE

Manning - Macleay Coastal Alluvial Plains

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| | | | | | |
|---|---|---|---|---|---|
| FIGURE 4 | **SITE MAP** | | | | |
| JOB ADDRESS: | PORT MACQUARIE-HASTINGS COUNCIL AREA | | | | |
| CLIENT: | PORT MACQUARIE-HASTINGS COUNCIL | | | | |
| A3 SCALE: | 1:4,000 | DRAWN: | BH | JOB REF: | EC217 |
| PLAN DATE: | 11/07/2024 | CHECKED: | RS | ISSUE: | 02 |

0 100 200 300 400 m

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Manning - Macleay Coastal Alluvial Plains

Manning - Macleay Coastal Alluvial Plains

SO1

SO1

**LEGEND**

- Subject Land
- EIS Project Area
- Habitat Connectivity
- Cadastre
- Hydrolines
- Mitchell Landscaspe v3.1

*Vegetation Type*

- Native Vegetation

*Groundwater Dependent Ecosystems*

- High Potential GDE

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| | | | | | |
|---|---|---|---|---|---|
| FIGURE 5 | **SITE MAP** | | | | |
| JOB ADDRESS: | PORT MACQUARIE-HASTINGS COUNCIL AREA | | | | |
| CLIENT: | PORT MACQUARIE-HASTINGS COUNCIL | | | | |
| A3 SCALE: | 1:4,200 | DRAWN: | BH | JOB REF: | EC217 |
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0 100 200 300 400 m

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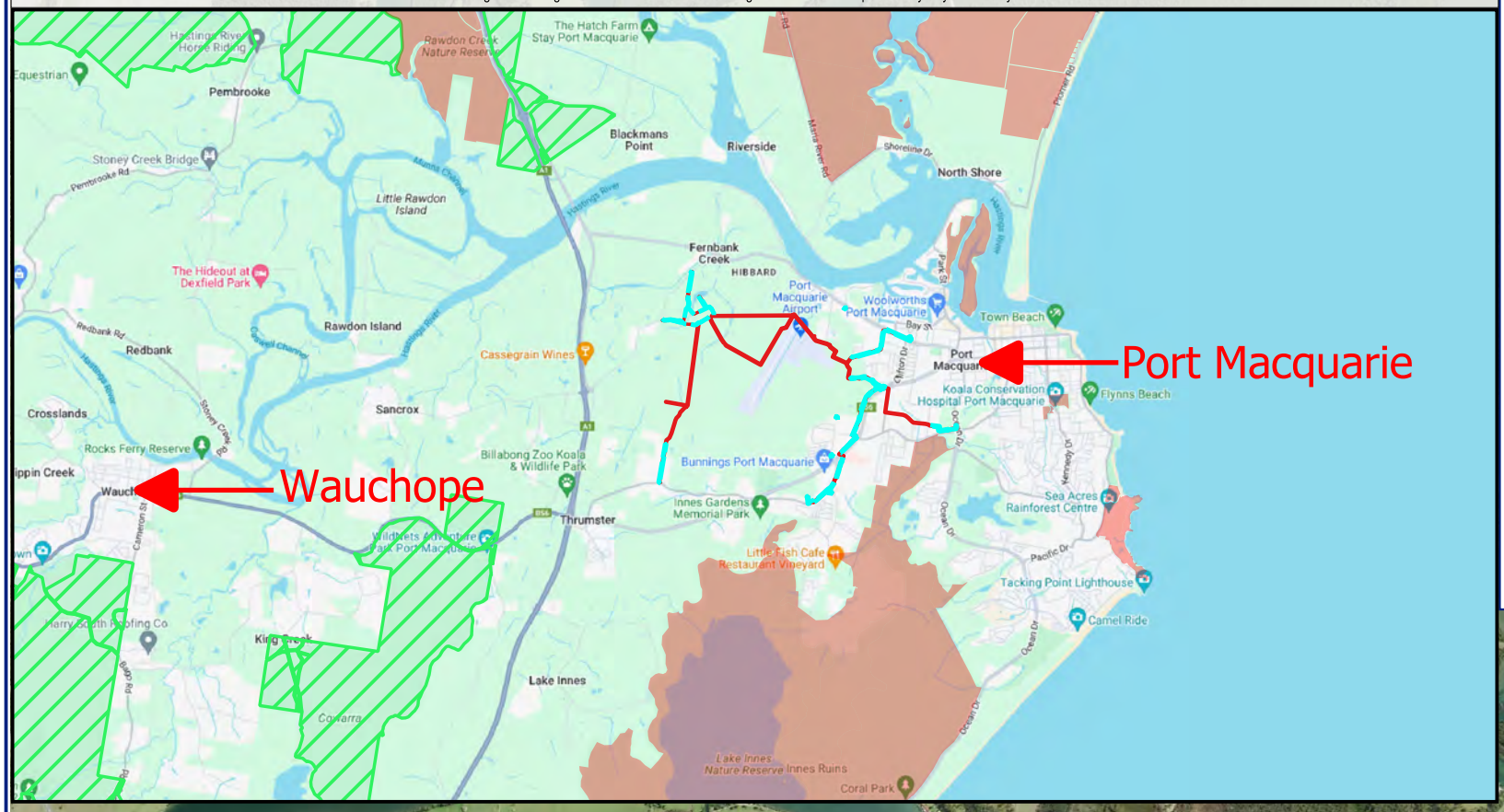


## LEGEND

- Subject Land
- EIS Project Area
- Assessment Area

*Vegetation Type*

- Native
- Human-made structures or non-native vegetation

*Naturally Occuring Asbestos Potential*

- High
- Low

***Inset Map Specific Layers***

- State Forests
- National Park

The borders of the IBRA region and IBRA subregion are beyond the view of the Subject Land. The Subject Land forms part of the "NSW North Coast IBRA Region" and the "Macleay Hastings IBRA Subregion"

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| | | | | | |
|---|---|---|---|---|---|
| FIGURE 6 | **LOCATION MAP** | | | | |
| JOB ADDRESS: | PORT MACQUARIE-HASTINGS COUNCIL AREA | | | | |
| CLIENT: | PORT MACQUARIE-HASTINGS COUNCIL | | | | |
| A3 SCALE: | 1:32,000 | DRAWN: | BH | JOB REF: | EC217 |
| PLAN DATE: | 11/07/2024 | CHECKED: | RS | ISSUE: | 02 |

0 0.75 1.5 2.25 3 km

N

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## LEGEND

- Subject Land
- EIS Project Area
- Assessment Area
- SEPP Coastal Wetland Buffer (100 m)
- SEPP Coastal Wetlands

***Inset Map Specific Layers***

- Acid Sulphate Soils



The borders of the IBRA region and IBRA subregion are beyond the view of the Subject Land. The Subject Land forms part of the "NSW North Coast IBRA Region" and the "Macleay Hastings IBRA Subregion"

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|---|---|---|---|---|---|
| FIGURE 7 | **LOCATION MAP** | | | | |
| JOB ADDRESS: | PORT MACQUARIE-HASTINGS COUNCIL AREA | | | | |
| CLIENT: | PORT MACQUARIE-HASTINGS COUNCIL | | | | |
| A3 SCALE: | 1:32,000 | DRAWN: | BH | JOB REF: | EC217 |
| PLAN DATE: | 11/07/2024 | CHECKED: | RS | ISSUE: | 01 |

0 0.75 1.5 2.25 3 km

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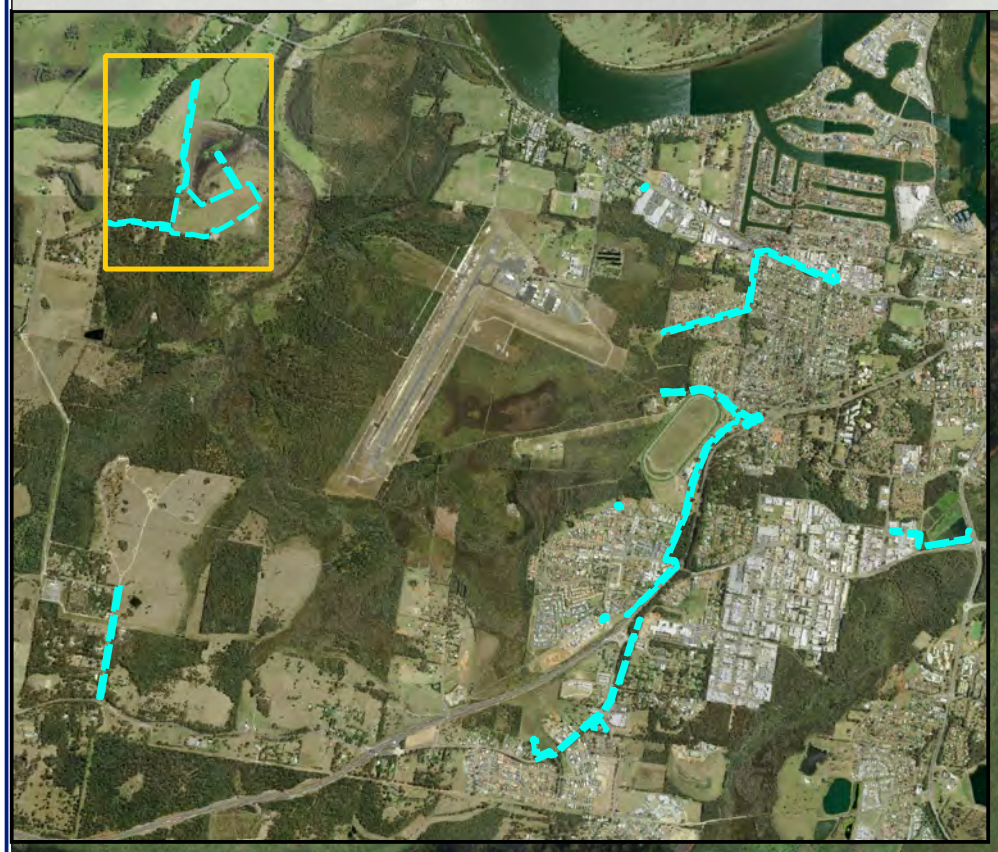

## LEGEND

- Subject Land
- Waste Water Treatment Plant (WWTP) Design

*Pipeline Alignment*

- Emergency Discharge
- Power&Communication (HDD)
- Recycled Water (HDD)
- Return Effluent to Kooloonbung Creek (HDD)
- Sewer Rising Main (HDD)
- Water Main (HDD)

Access Road

Emergency Access Road

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| | | | | | |
|---|---|---|---|---|---|
| FIGURE 8 | **DEVELOPMENT LAYOUT** | | | | |
| JOB ADDRESS: | PORT MACQUARIE-HASTINGS COUNCIL AREA | | | | |
| CLIENT: | PORT MACQUARIE-HASTINGS COUNCIL | | | | |
| A3 SCALE: | 1:3,900 | DRAWN: | BH | JOB REF: | EC217 |
| PLAN DATE: | 18/07/2024 | CHECKED: | RS | ISSUE: | 02 |

0 100 200 300 400 m

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**LEGEND**

- Subject Land
- Construction Compound

*Pipeline Alignment*

- Recycled Water (Trenching)

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| | | | | | |
|---|---|---|---|---|---|
| FIGURE 9 | **DEVELOPMENT LAYOUT** | | | | |
| JOB ADDRESS: | PORT MACQUARIE-HASTINGS COUNCIL AREA | | | | |
| CLIENT: | PORT MACQUARIE-HASTINGS COUNCIL | | | | |
| A3 SCALE: | 1:2,500 | DRAWN: | BH | JOB REF: | EC217 |
| PLAN DATE: | 18/07/2024 | CHECKED: | RS | ISSUE: | 02 |

0 50 100 150 200 250 m

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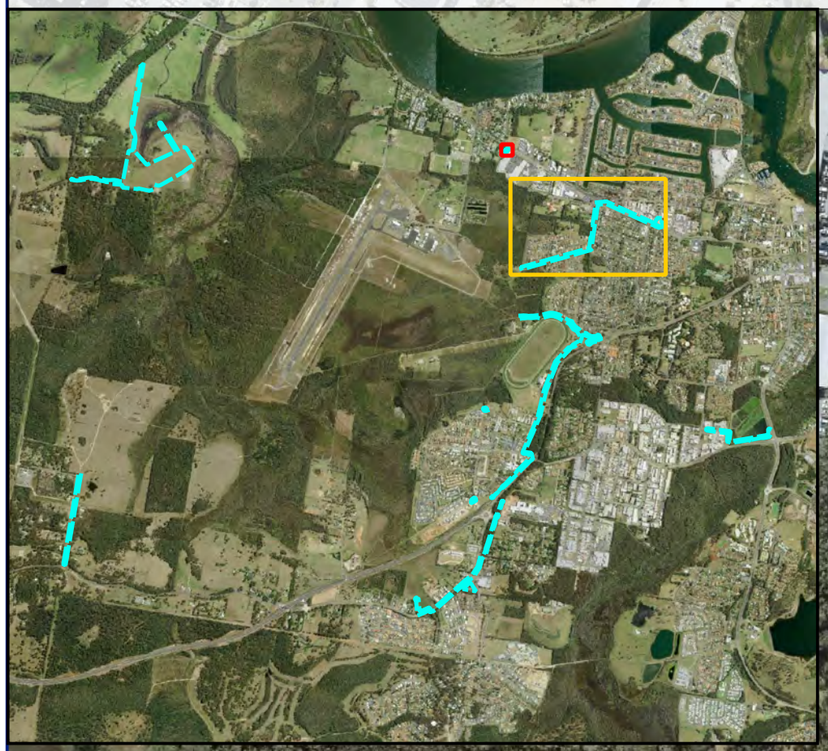

**LEGEND**

- Subject Land
- Construction Compounds

Pipeline Alignment

- Sewer Rising Main (Trenching)

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FIGURE 10

## DEVELOPMENT LAYOUT

0 75 150 225 300 m

| | | | | | |
|---|---|---|---|---|---|
| JOB ADDRESS: | PORT MACQUARIE-HASTINGS COUNCIL AREA<br>NSW \| AUSTRALIA | | | | |
| CLIENT: | PORT MACQUARIE-HASTINGS COUNCIL | | | | |
| A3 SCALE: | 1:3,200 | DRAWN: | BH | JOB REF: | EC217 |
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## LEGEND

- Subject Land
- Construction Compound

*Pipeline Alignment*

- Return Effluent to Kooloonbung Creek (HDD)
- Return Effluent to Kooloonbung Creek (Trenching)
- Sewer Rising Main (Trenching)
- Water Main (Trenching)

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| | | | | | |
|---|---|---|---|---|---|
| FIGURE 11 | **DEVELOPMENT LAYOUT** | | | | |
| JOB ADDRESS: | PORT MACQUARIE-HASTINGS COUNCIL AREA | | | | |
| CLIENT: | PORT MACQUARIE-HASTINGS COUNCIL | | | | |
| A3 SCALE: | 1:4,000 | DRAWN: | BH | JOB REF: | EC217 |
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0 100 200 300 400 m

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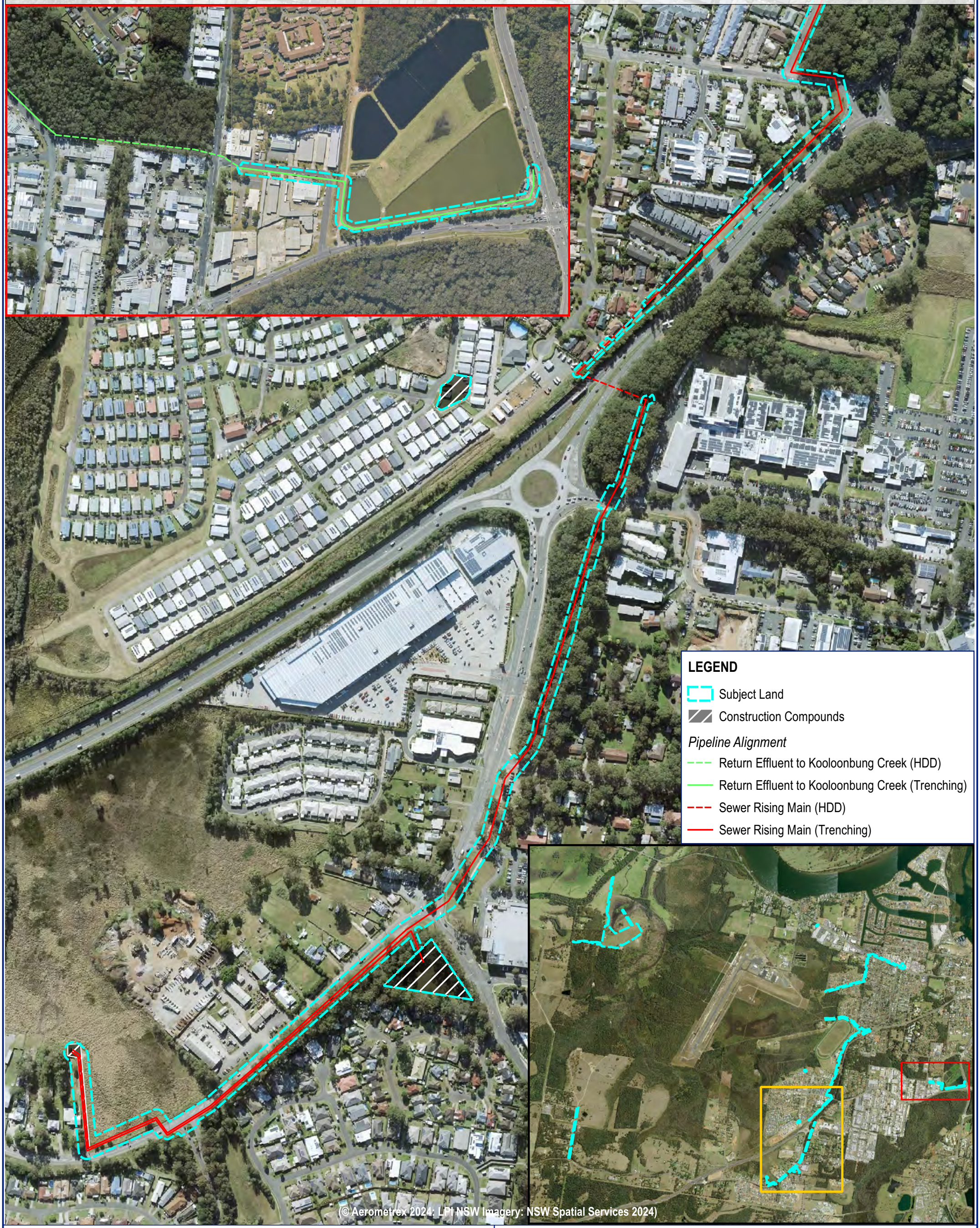


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| FIGURE 12 | **DEVELOPMENT LAYOUT** | | | | |
| JOB ADDRESS: | PORT MACQUARIE-HASTINGS COUNCIL AREA | | | | |
| CLIENT: | PORT MACQUARIE-HASTINGS COUNCIL | | | | |
| A3 SCALE: | 1:4,200 | DRAWN: | BH | JOB REF: | EC217 |
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0 100 200 300 400 m

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## LEGEND

Subject Land

*Pipeline Alignment*

Return Effluent to Kooloonbung Creek (Trenching)

Kooloonbung Creek

Effluent discharged into Kooloonbung Creek

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|---|---|---|---|---|---|
| FIGURE 13 | **DEVELOPMENT LAYOUT - KOOLOONBUNG CREEK** | | | | |
| JOB ADDRESS: | PORT MACQUARIE-HASTINGS COUNCIL AREA | | | | |
| CLIENT: | PORT MACQUARIE-HASTINGS COUNCIL | | | | |
| A3 SCALE: | 1:5,500 | DRAWN: | BH | JOB REF: | EC217 |
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0 150 300 450 600 m

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## LEGEND

Subject Land

*Port Macquarie Airport Biodiversity Certification*

Bio-certified Land

Biobanking Agreement

*Pipeline Alignment*

Horizontal Directional Drilling

Trench

Existing Management Road

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FIGURE 14

# BIOCERTIFIED AND BIOBANKING LAND

0 0.6 1.2 1.8 2.4 km

| | | | | | |
|---|---|---|---|---|---|
| JOB ADDRESS: | PORT MACQUARIE-HASTINGS COUNCIL AREA<br>NEW SOUTH WALES \| AUSTRALIA | | | | |
| CLIENT: | PORT MACQUARIE-HASTINGS COUNCIL | | | | |
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## LEGEND

- Subject Land
- Biodiversity Values Map v16.10

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| | | | | | |
|---|---|---|---|---|---|
| FIGURE 15 | **BIODIVERSITY VALUES MAP** | | | | |
| JOB ADDRESS: | PORT MACQUARIE-HASTINGS COUNCIL AREA | | | | |
| CLIENT: | PORT MACQUARIE-HASTINGS COUNCIL | | | | |
| A3 SCALE: | 1:22,000 | DRAWN: | BH | JOB REF: | EC217 |
| PLAN DATE: | 18/07/2024 | CHECKED: | RS | ISSUE: | 02 |

0 0.5 1 1.5 2 km

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# 2.0 METHODOLOGY

## 2.1 SITE CONTEXT METHODS

### *2.1.1 Landscape Features*

Landscape features described below were identified through desktop analysis and confirmed during several field assessments including, 31 October – 1 November 2022, 21- 22 June 2023, 19- 23 February 2024, 8-12 April 2024 and 29 April 2024.

### *2.1.2 Native Vegetation Cover*

Aerial imagery interpretation (imagery dated 07/03/2024, 19/08/2023, 25/09/2022, 17/06/2022, 20/09/2021, 4/5/2020 and 10/01/2014) with existing vegetation mapping was used to identify native vegetation cover on the subject land prior to the field assessment (Figure 1 - Figure 6). Field assessments confirmed the presence of native vegetation within the Subject Land. The details of the analysis are described further in Section 3.3, the analysis determined a native vegetation cover class of >30-70%.

## 2.2 NATIVE VEGETATION, THREATENED ECOLOGICAL COMMUNITIES (TEC) AND VEGETATION INTEGRITY METHODS

### *2.2.1 Existing Information*

Regional vegetation mapping (NSW State Vegetation Type Map (SVTM) (NSW DCCEEW, 2023); Vegetation of the Port Macquarie Hastings Local Government Area (Phillips et al, 2013)) and database searches (See Section 1.6) were reviewed to inform the site investigations. Based on the results of the background review and the requirements of the BAM with respect to this BDAR, appropriate surveys were designed for the study area and Subject Land.

### *2.2.2 Mapping Native Vegetation Extent*

A detailed ecological assessment was undertaken by qualified and experienced ecologists on the following dates and by the following personnel:

- Dr Robert Scanlon and Bayley Holborow between 31 October – 1 November 2022,
- Dr Alan Midgley and Lauren Cockbain between 21- 22 June 2023,
- Dr Robert Scanlon and Oliver Broun between 19- 23 February 2024,
- Dr Alan Midgley and Oliver Broun between 8-12 April 2024,
- Dr Robert Scanlon and Dr Satem Longchar on 29 April 2024.

The study area was surveyed in accordance with the BAM (DPIE 2020a) and random meander methods (Cropper 1993), which involved:

- Ground truthing of existing vegetation mapping.
- Determining the type and condition of vegetation present within the Subject Land.
- The identification and mapping of PCTs according to the NSW BioNet Vegetation Classification database.
- The identification of native and exotic plant species, according to the Flora of NSW (Harden 1992, 1993, 2000, 2002), with reference to recent taxonomic changes.
- Incidental flora observations using the “random meander” method (Cropper 1993).
- An assessment of the natural resilience of the vegetation of the site.

Previous and current factors threatening the ecological function and survival of native vegetation within and adjacent to the study area were identified.

Detailed mapping of PCTs was conducted using hand-held (uncorrected) tablet units (Samsung Galaxy Tab A7) using the QField application and aerial photo interpretation (© MetroMap: Aerometrex; LPI NSW Imagery: NSW Spatial Services 2024).

Areas of native vegetation for which a PCT could validly be assigned were identified and delineated in the field, and their condition determined. Identification of PCTs within the study area was confirmed with reference to the community profile descriptors (and diagnostic species tests) held within the NSW BioNet Vegetation Classification database.

A list of flora species recorded within the subject land was compiled, and records of all flora species will be submitted to NSW DCCEEW for incorporation into the NSW BioNet.

### *2.2.3 Plot-Based Vegetation Survey*

Flora plots were carried out in accordance with the BAM (Section 4.2.1) to assess the composition, structure and function components of vegetation integrity. BAM plots were placed in a manner that best reflected the biological character of the vegetation zone being assessed by avoiding placement of plots near ecotones and disturbed boundaries where possible. Species within plots were identified to the most detailed taxonomic level possible.

Detailed mapping included the completion of the requisite number of vegetation integrity survey plots within each broad condition state of each mapped PCT, in accordance with the BAM. The locations of surveyed plots are shown in Figure 16, Figure 17, Figure 18, Figure 19, and Figure 20.

### *2.2.4 Vegetation Integrity Survey*

Vegetation integrity was assessed following Section 4.3 of BAM (DPIE 2020a). This method involves measuring vegetation composition, structure and function to calculate vegetation integrity within 20 m x 50 m plot. The attributes considered are summarised in Table 2.

Table 2 BAM Method Growth form groups and attributes

| Growth forms | Attributes |
|---|---|
| Tree | Number of large trees |
| Shrub | Tree regeneration |
| Grass and grass like | Tree stem size class |
| Forb | Total length of fallen logs |
| Fern | Litter cover (based on five 1 $m^2$ sub-plots) |
| Other | High threat exotic vegetation cover |
| | Hollow bearing trees |

Vegetation condition scores (Composition condition score; Structure condition score; Function condition score and Vegetation Integrity Score) were calculated using the BAM Calculator (BAM-C).

The minimum number of BAM plots per vegetation zone was determined through application of Table 4 of the BAM (DPIE 2020a). Ultimately, a total of 12 BAM plots were utilised for this assessment of 22 BAM plots performed for the project (further plot findings are in Appendix 1 and Appendix 2). An assessment of vegetation integrity was undertaken using benchmark data collected as outlined in Subsection 4.3.3 of the BAM. No additional local data was used for this assessment.

## 2.3 THREATENED FLORA SURVEY METHODS

### *2.3.1 Review of Existing Information*

Existing databases were reviewed for threatened species records and predicted presence within the locality.

- NSW BioNet Threatened Biodiversity Profile Data Collection (TBDC)
- Department of Climate Change, Energy, the Environment and Water (DCCEEW) Protected Matters Search Tool, for matters protected by the EPBC Act (Commonwealth DCCEEW 2024).
- NSW BioNet - the database for the BioNet Atlas and BioNet Vegetation Classification (NSW DCCEEW (NSW DCCEEW, 2024b).
- Biodiversity Values Map and Threshold Tool (NSW DCCEEW 2024c).
- NSW Department of Primary Industries (DPI) Spatial Data Portal for NSW *Fisheries Management Act* 1994 listed threatened species, populations and communities (DPI 2024).
- PlantNET (Royal Botanic Gardens and Domain Trust 2013).

- Surveying threatened plants and their habitats - NSW survey guide for the Biodiversity Assessment Method (DPIE 2020b).
- Relevant vegetation mapping, including SVTM (State Government of NSW & NSW DCCEEW 2023) and Vegetation of the Port Macquarie Hastings Local Government Area Version 1.08. (Phillips et al, 2013).
- Matters of National Environmental Significance (CoA 2013).

The conservation significance of plant species and plant communities was determined according to:

- BC Act for significance within NSW.
- EPBC Act for significance within Australia.

### *2.3.2 Habitat Constraints Assessment*

Habitat constraints and microhabitats present on the site were identified during the field survey by searching for features such as:

- Soil type.
- Weed disturbance.
- Vegetation structure and type.
- Intertidal zones.
- Semi-permanent / ephemeral wet areas.
- Swamps.
- Water bodies.
- Other potential constraints.

### *2.3.3 Field Surveys*

Despite past disturbances within the study area, the Subject Land is considered to be habitat for threatened flora. Historical and ongoing disturbance in the form of vegetation removal, has degraded some of the habitat elements present. However, potential habitat can be found in the forested and less disturbed areas within the Subject Land.

Threatened flora surveys of the subject land were undertaken in accordance with the Surveying threatened plants and their habitats NSW survey guide for the Biodiversity Assessment Method (DPIE 2020b). This included a comprehensive survey of all vegetation zones within the Subject Land as relevant to each species. Survey effort is graphically represented in Figure 16 - Figure 20

Table 3 Surveys performed for threatened flora species.

| Scientific name | Common name | Survey Period | Survey Timing | Maximum separation |
|---|---|---|---|---|
| *Acronychia littoralis* | Scented Acronychia | All Year | 27/09/2023<br>28/09/2023<br>20/11/2023 - 24/11/2023<br>09/04/2024<br>29/04/2024 | 5 m |
| *Alexfloydia repens* | Floyd's Grass | August-March | 27/09/2023 | 5 m |
| *Allocasuarina defungens* | Dwarf Heath Casuarina | All Year | 27/09/2023<br>28/09/2023<br>20/11/2023 - 24/11/2023<br>09/04/2024<br>29/04/2024 | 10 m |
| *Allocasuarina simulans* | Nabiac Casuarina | All Year | 27/09/2023<br>28/09/2023<br>20/11/2023 - 24/11/2023<br>09/04/2024<br>29/04/2024 | 10 m |

| Scientific name | Common name | Survey Period | Survey Timing | Maximum separation |
|---|---|---|---|---|
| *Caesia parviflora var. minor* | Small Pale Grass-lily | October - February | 20/11/2023 - 24/11/2023 | 10 m |
| *Callistemon linearifolius* | Netted Bottle Brush | October - Jaunary | 20/11/2023 - 24/11/2023<br>09/04/2024<br>29/04/2024 | 10 m |
| *Cryptostylis hunteriana* | Leafless Tongue Orchid | November-January | 20/11/2023 - 24/11/2023 | 10 m |
| *Cynanchum elegans* | White-flowered Wax Plant | All Year | 27/09/2023<br>28/09/2023<br>20/11/2023 - 24/11/2023<br>09/04/2024<br>29/04/2024 | 5 m |
| *Dendrobium melaleucaphilum* | Spider orchid | August-September | 27/09/2023<br>28/09/2023 | 5 m |
| *Hibbertia hexandra* | Tree Guinea Flower | All Year | 27/09/2023<br>28/09/2023<br>20/11/2023 - 24/11/2023<br>09/04/2024<br>29/04/2024 | 5 m |
| *Lindernia alsinoides* | Noah's False Chickweed | November-February | 20/11/2023 - 24/11/2023<br>9/04/2024<br>10/04/2024 | 10 m |
| *Marsdenia longiloba* | Slender Marsdenia | November-February | 27/09/2023<br>28/09/2023<br>20/11/2023 - 24/11/2023<br>09/04/2024<br>29/04/2024 | 5 m |
| *Maundia triglochinoides* | - | November-March | 20/11/2023 - 24/11/2023<br>26/03/2024 | 10 m |
| *Melaleuca biconvexa* | Biconvex Paperbark | All Year | 27/09/2023<br>28/09/2023<br>20/11/2023 - 24/11/2023<br>09/04/2024<br>29/04/2024 | 10 m |
| *Melaleuca groveana* | Grove's Paperbark | All Year | 27/09/2023<br>28/09/2023<br>20/11/2023 - 24/11/2023<br>09/04/2024<br>29/04/2024 | 10 m |
| *Niemeyera whitei* | Rusty Plum | All Year | 27/09/2023<br>28/09/2023<br>20/11/2023 - 24/11/2023<br>09/04/2024<br>29/04/2024 | 5 m |
| *Oberonia titania* | Red-flowered King of the Fairies | All Year | 27/09/2023<br>28/09/2023<br>20/11/2023 - 24/11/2023<br>09/04/2024<br>29/04/2024 | 10 m |
| *Parsonsia dorrigoensis* | Milky Silkpod | All Year | 27/09/2023<br>28/09/2023<br>20/11/2023 - 24/11/2023<br>09/04/2024<br>29/04/2024 | 10 m |
| *Peristeranthus hillii* | Brown Fairy-chain Orchid | September-October | 27/09/2023 | 10 m |

| Scientific name | Common name | Survey Period | Survey Timing | Maximum separation |
|---|---|---|---|---|
| *Phaius australis* | Southern Swamp Orchid | September-October | 27/09/2023<br>28/09/2023<br>9/04/2024<br>10/04/2024 | 10 m |
| *Pomaderris queenslandica* | Scant Pomaderris | All Year | 27/09/2023<br>28/09/2023<br>20/11/2023 - 24/11/2023<br>09/04/2024<br>29/04/2024 | 10 m |
| *Rhodamnia rubescens* | Scrub Turpentine | All Year | 27/09/2023<br>28/09/2023<br>20/11/2023 - 24/11/2023<br>09/04/2024<br>29/04/2024 | 10 m |
| *Rhodomyrtus psidioides* | Native Guava | All Year | 27/09/2023<br>28/09/2023<br>20/11/2023 - 24/11/2023<br>09/04/2024<br>29/04/2024 | 10 m |
| *Senna acclinis* | Rainforest Cassia | All Year | 27/09/2023<br>28/09/2023<br>20/11/2023 - 24/11/2023<br>09/04/2024<br>29/04/2024 | 10 m |
| *Solanum sulphureum* | Manning Yellow Solanum | All Year | 27/09/2023<br>28/09/2023<br>20/11/2023 - 24/11/2023<br>09/04/2024<br>29/04/2024 | 10 m |
| *Syzygium paniculatum* | Magenta Lilly Pilly | April – June | 27/09/2023<br>28/09/2023<br>20/11/2023 - 24/11/2023<br>09/04/2024<br>29/04/2024 | 10 m |
| *Thesium australe* | Austral Toadflax | November - February | 20/11/2023 - 24/11/2023<br>09/04/2024<br>29/04/2024 | 10 m |
| *Tylophora woollsii* | Cryptic Forest Twiner | January-April | 24/01/2024<br>25/01/2024<br>2/04/24 – 5/04/2024 | 10 m |

Targeted surveys were performed for candidate flora species credit species identified in Table 24.

## 2.4 THREATENED FAUNA SURVEY METHODS

### *2.4.1 Review of Existing Information*

Existing databases were reviewed for threatened species records and predicted presence within the locality.

- NSW BioNet Threatened Biodiversity Profile Data Collection (TBDC).
- Department of Climate Change, Energy, the Environment and Water (DCCEEW) Protected Matters Search Tool, for matters protected by the EPBC Act (Commonwealth DCCEEW, 2024).
- NSW BioNet - the database for the BioNet Atlas and BioNet Vegetation Classification (NSW DCCEEW (NSW DCCEEW, 2024b).
- NSW Department of Primary Industries (DPI) Spatial Data Portal for NSW *Fisheries Management Act* 1994 listed threatened species, populations and communities.
- BirdLife Australia, the New Atlas of Australian Birds 1998-2013.

- Relevant vegetation mapping, including SVTM (State Government of NSW & NSW DCCEEW 2023) and Vegetation of the Port Macquarie Hastings Local Government Area Version 1.08. (Phillips et al, 2013).
- Survey Guide for Threatened Frogs: A guide for the survey of threatened frogs and their habitats for the Biodiversity Assessment Method (DPIE 2020c).
- 'Species credit' threatened bats and their habitats – NSW survey guide for the Biodiversity Assessment Method (NSW DPIE, 2021).
- Threatened Reptiles Biodiversity Assessment Method Survey Guide (DPE 2022e).
- Koala (*Phascolarctos cinereus*) Biodiversity Assessment Method Survey Guide) (DPE 2022f).
- Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (DEC 2004).
- Matters of National Environmental Significance (CoA 2013).
- Port Stephens Council Comprehensive Koala Plan of Management (KPOM) (PSC 2002).
- Survey guidelines for Australia's threatened bats (CoA 2010a).
- Survey guidelines for Australia's threatened birds (CoA 2010b).
- Survey guidelines for Australia's threatened fish (CoA 2011a).
- Survey guidelines for Australia's threatened frogs (CoA 2010c).
- Survey guidelines for Australia's threatened mammals (CoA 2011b).
- Survey guidelines for Australia's threatened reptiles (CoA 2011c).
- The Spot Assessment Technique: determining the importance of habitat utilisation by Koalas (*Phascolarctos cinereus*) (Phillips and Callaghan 2011).
- The Wetland Habitats, biogeography and population dynamics of *Petalura gigantea* (Odonata: Petaluridae) in the Blue Mountains of New South Wales PhD thesis (Baird 2012).

### *2.4.2 Habitat Constraints Assessment*

Habitat constraints and microhabitats present on the site were identified during the field survey by searching for features such as:

- Burrows.
- Caves.
- Claypans.
- Cliffs.
- Dunes.
- Epiphytes.
- Escarpments.
- Fallen / standing dead timber including logs.
- Hollow bearing trees.
- Intertidal zones.
- Rocky areas.
- Semi-permanent / ephemeral wet areas.
- Swamps.
- Water bodies.
- Termite mounds.
- Other potential constraints.

### *2.4.3 Field Surveys*

The study area was investigated, as discussed in Section 2.1, to determine its values for fauna. These were determined primarily on the basis of the types and qualities of habitats present. Opportunistic sightings of fauna species observed during the assessment were recorded and active searching for fauna was also undertaken.

This included direct observation, examination of tracks and scats, identifying calls and recording other signs of animal activity (e.g. nests, burrows, hollow utilisation, scratches and diggings). Particular attention was

given to searching for threatened biota and their habitats. Fauna species were recorded with a view to characterising the values of the site and the investigation was not intended to provide a comprehensive survey of all fauna that has potential to utilise the site over time.

To address threatened fauna potentially utilising the site, the protocols listed in Table 4 below were implemented. Survey effort for fauna is represented in Figure 21 - Figure 32.

Table 4 Surveys techniques and relevant guidelines implemented to detect threatened fauna

| Species | Survey Technique | Relevant Guidelines | Date |
|---|---|---|---|
| Eastern Cave Bat (Vespadelus troughtoni) | Ultrasonic Recording | 'Species credit' threatened bats and their habitats – NSW survey guide for the Biodiversity Assessment Method (NSW OEH 2018) | 14/11/2023 - 17/11/2023 |
| Southern Myotis (*Myotis Macropus*) | | | |
| Pale Headed Snake (*Hoplocephalus bitorquatus*) | Funnel Traps<br><br>Spot lighting | Threatened Reptiles Biodiversity Assessment Method Survey Guide (DPE 2022d) | |
| Three-toed Snake-tooth Skink (*Coeranoscincus reticulatus*) | Pitfall Traps, reptile habitat surveys | | |
| Common Planigale (*Planigale maculate*) | | Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (DEC 2004). | |
| Eastern Pygmy-possum (Cercartetus nanus) | Arboreal trapping<br><br>Spotlighting | Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (DEC 2004) | 13/11/2023 – 17/11/2023<br><br>19/02/2024-22/02/2024 |
| Southern Greater Glider (*Petauroides volans*) | | | |
| Squirrel Glider (*Petaurus norfolcensis*) | | | |
| Brush-tailed Phascogale (*Phascogale tapoatafa*) | | | |
| Green and Golden Bell Frog (*Litoria aurea*) | Frog Transects | NSW Survey Guide for Threatened Frogs (DPIE 2020c) | 6/11/2023-14/11/2023 |
| Stuttering Frog (*Mixophyes balbus*) | | | |
| Giant Barred Frog (*Mixophyes iteratus*) | | | |
| Green-Thighed Frog (*Litoria brevipalmata*) | | | 20/02/2024-21/02/2024 |
| Laced Fritillary (*Argynnis hyperbius*) | Species food resource searches Meandering surveys | Conservation Advice *Argynnis hyperbius inconstans.* Threatened Species Scientific Committee. Environment Protection and Biodiversity Conservation Act 1999. | 21/06/2023, 22/06/2023, 11/08/2023, 28/09/2023, 30/10/2023 |

| Species | Survey Technique | Relevant Guidelines | Date |
|---|---|---|---|
| Giant Dragonfly (*Petalura gigantea*) | 10m Transect Survey / Random Meander | Saving our Species strategy. Biodiversity Conservation Act 2016.<br><br>Baird, I. R. (2012). The wetland habitats, biogeography and population dynamics of *Petalura gigantea* (Odonata: Petaluridae) in the Blue Mountains of New South Wales (Doctoral dissertation, University of Western Sydney (Australia)). | 24/01/2024<br><br>25/01/2024 |
| Bush Stone-curlew (*Burhinus grallarius*) | Spot lighting and call playback | Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (DEC 2004). | 19/02/2024<br><br>20/02/2024<br><br>21/02/2024<br><br>22/02/2024 |
| Glossy Black-Cockatoo (*Calyptorhynchus lathami*) | Aural-visual Survey | Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (DEC 2004). | 27/09/2023<br><br>28/09/2023<br><br>02/04/2024<br><br>03/04/2024<br><br>04/04/2024 |
| White-bellied Sea-eagle (*Haliaeetus leucogaster*) | | | |
| Little Eagle (*Hieraaetus morphnoides*) | | | |
| Swift Parrot (*Lathamus discolor*) | | | |
| Square-tailed Kite (*Lophoictinia isura*) | | | |
| Eastern Osprey (*Pandion cristatus*) | | | |
| Wallum Froglet *(Crinia tinnula)* | Frog transect | NSW Survey Guide for Threatened Frogs (DPIE 2020c) | 25-28/03/2024 |
| Stephens Banded Snake (*Hoplocephalus stephensii)* | Spot lighting | Threatened Reptiles Biodiversity Assessment Method Survey Guide (DPE 2022d) | 19/02/2024<br><br>20/02/2024<br><br>21/02/2024<br><br>22/02/2024 |
| Koala (*Phascolarctos cinereus*) | Aural-visual SurveyRef | Koala (Phascolarctos cinereus) Biodiversity Assessment Method Survey Guide. DPE (2022f). | All survey period |

| Species | Survey Technique | Relevant Guidelines | Date |
|---|---|---|---|
| Long-nosed Potoroo (*Potorous tridactylus*) | Terrestrial<br><br>Remote Camera Survey | Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (DEC 2004). | 21/02/2024 to<br><br>11/03/2024 |
| Rufous Bettong (*Aepyprymnus rufescens*) | | | |
| Red-backed Button-quail (*Turnix maculosus*) | Spot lighting | Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (DEC 2004). | 19/02/2024-22/02/2024 |

Fauna records will be submitted to DPE for incorporation into the NSW BioNet Wildlife Atlas.

## 2.5 WEATHER CONDITIONS

Targeted flora and fauna surveys of the study area were undertaken on throughout the year, aligning with species activity and ecology. Weather observations drawn from Port Macquarie NSW (station number 060139) for each survey date are shown in Table 5.

Table 5 Environmental Conditions during threatened species surveys (Port Macquarie NSW).

| Survey Undertaken | Date | Temperature (°C) | | Wind | Rainfall (mm) |
|---|---|---|---|---|---|
| | | Min | Max | | |
| 2022 | | | | | |
| Vegetation mapping Fieldwork | 31/10/22 | 15.5 | 26.9 | SE – 15km/h | 0 |
| | 01/11/22 | 19.4 | 26.2 | ESE – 19km/h | 9.0 |
| 2023 | | | | | |
| *Argynnis hyperbius* Laced Fritillary food resource searches | 21/06/23 | 2.4 | 18.4 | W-SSW - 13km/h | 0 |
| | 22/06/23 | 4.1 | 19.5 | WNW - 9km/h | 0 |
| Vegetation mapping Fieldwork | 25/07/23 | 8.6 | 19.9 | W - 13km/h | 5.4 |
| Vegetation mapping Fieldwork | 26/07/23 | 10.4 | 20.9 | W – 15km/h | 0 |
| Vegetation mapping Fieldwork | 27/07/23 | 5.4 | 21.4 | WNW - 11km/h | 0 |
| Vegetation mapping Fieldwork | 07/08/23 | 11.4 | 18.8 | WSW – 9km/h | 21.6 |
| Vegetation mapping Fieldwork | 08/08/23 | 6.6 | 19.7 | WSW – 13km/h | 4.2 |
| Vegetation mapping Fieldwork | 09/08/23 | 9.0 | 20.1 | W – 11km/h | 0 |
| Vegetation mapping Fieldwork | 10/08/23 | 4.5 | 22.7 | NW – 11km/h | 0 |
| *Argynnis hyperbius* Laced Fritillary Meandering surveys | 11/08/23 | 6.1 | 19.7 | NW – 9km/h | 0 |
| Parallel Flora transects | 27/09/23 | 8.8 | 26.8 | N – 7km/h | 0 |
| *Argynnis hyperbius* Laced Fritillary Meandering surveys | 28/09/23 | 16.3 | 23.7 | ESE – 9km/h | 3.2 |
| Parallel Flora transects | | | | | |
| *Argynnis hyperbius* Laced Fritillary Meandering surveys | 30/10/23 | 11.8 | 27.7 | NNE – 17km/h | 0 |
| Frog survey- transect | 06/11/23 | 15.1 | 19.8 | WSW – 11km/h | 32.6 |
| Frog survey- transect | 07/11/23 | 13.4 | 23.0 | W – 4km/h | 0.4 |
| Frog survey- transect | 08/11/23 | 11.8 | 25.3 | NNE – 13km/h | 0 |

| Survey Undertaken | Date | Temperature (°C) | | Wind | Rainfall (mm) |
|---|---|---|---|---|---|
| | | Min | Max | | |
| Bat detector installation | 9/11/23 | 18.1 | 25.3 | NNE - 22km/h | 0 |
| Arboreal trapping and spot lighting | 13/11/23 | 19.4 | 24.7 | S – 28km/h | 0 |
| Bat detector installation | | | | | |
| Frog survey- transect | 14/11/23 | 13.1 | 24.9 | NNE – 15km/h | 0 |
| Arboreal trapping and spot lighting | | | | | |
| Pitfall traps, Funnel trap and Reptile Habitat Survey. | | | | | |
| Bat detector installation. | | | | | |
| Arboreal trapping and spot lighting. | 15/11/23 | 18.9 | 26.5 | W – 9km/h | 0 |
| Arboreal trapping and spot lighting. | 16/11/23 | 16.8 | 26.5 | SSW – 13km/h | 0 |
| Arboreal trapping and spot lighting. | 17/11/23 | 17.4 | 22.0 | SSW – 20km/h | 7.8 |
| Pitfall traps, Funnel trap and Reptile Habitat Survey. | | | | | |
| Flora Survey | 20/11/23 | 19.9 | 23.0 | N – 11km/h | 0 |
| Flora Survey | 21/11/23 | 17.5 | 26.5 | NNE – 20km/h | 4.2 |
| Flora Survey | 22/11/23 | 18.5 | 23.0 | SSE – 11km/h | 0 |
| Flora Survey | 23/11/23 | 19.0 | 25.9 | SW – 13km/h | 0.6 |
| Flora Survey | 24/11/23 | 19.2 | 25.3 | ENE – 7km/h | 0.6 |
| *Petalura* Survey and tadpole Survey | 04/12/23 | 17.4 | 25.5 | S – 17km/h | 5.2 |
| *Petalura* Survey and tadpole Survey | 05/12/23 | 13.0 | 26.8 | N – 13km/h | 0 |
| 2024 | | | | | |
| *Petalura* Survey- 10m Transect/ Random meander. | 24/01/24 | 17.0 | 27.9 | N – 17km/h | 0 |
| Cryptic Forest Twiner (*Tylophora woollsii*)- 10m Transect/ Random meander | | | | | |
| *Petalura* Survey- 10m Transect/ Random meander. | 25/01/24 | 17.9 | 34.5 | N – 7km/h | 0 |
| Cryptic Forest Twiner (*Tylophora woollsii*)- 10m Transect/ Random meander | | | | | |
| Spot lighting and call playback. | 19/02/24 | 20.7 | 29.2 | WSW - 35km/h | 0 |
| Spot lighting and call playback. | 20/02/24 | 18.4 | 26.7 | E – 12km/h | 34.4 |
| Arboreal and Terrestrial Remote camera trap survey. | 21/02/24 | 19.3 | 28.3 | S - 31km/h | 14.8 |
| Arboreal and Terrestrial Remote camera trap survey | 22/02/24 | 19.1 | 29.0 | E - 20km/h | 5.2 |
| Arboreal and Terrestrial Remote camera trap survey | 23/02/24 | 20.6 | 34.3 | NE - 30km/h | 2.2 |
| Bait Replenishment and Terrestrial Remote Camera retrieval | 11/03/24 | 17.3 | 28.2 | ENE - 30km/h | 0.4 |
| Frog transect | 25/03/24 | 14.2 | 26.8 | E - 30km/h | 0 |
| Arboreal Remote Camera Retrieval | 26/03/24 | 13.9 | 27.8 | ENE - 28km/h | 0 |
| Frog transect | | | | | |
| Targeted flora- *Maundia triglochinoides* | | | | | |
| Arboreal Remote Camera Retrieval | 27/03/24 | 15.0 | 26.4 | S - 28km/h | 0 |
| Frog transect | | | | | |
| Targeted flora- Native guava | | | | | |
| Frog survey | 28/03/24 | 16.6 | 26.8 | SSE 30km/h | 0 |
| Targeted Flora | 2/04/24 | 14.2 | 31.0 | SW -44km/h | 0 |
| Targeted Flora | 3/04/24 | 16.8 | 26.4 | SSW - 26km/h | 9.4 |
| Targeted Flora | 4/04/24 | 15.4 | 21.7 | W - 24km/h | 0 |
| Targeted Flora | 5/04/24 | 17.8 | 23.1 | ENE -63km/h | 78.2 |
| Vegetation mapping Targeted Flora | 8/04/24 | 16.1 | 25.8 | WSW – 26km/h | 5.0 |
| Targeted Flora | 9/04/24 | 16.5 | 26.0 | WSW -44KM/h | 0 |

| Survey Undertaken | Date | Temperature (°C) | | Wind | Rainfall (mm) |
|---|---|---|---|---|---|
| | | Min | Max | | |
| Vegetation mapping<br>Targeted Flora | 10/04/24 | 13.4 | 21.4 | WSW – 36km/h | 9.2 |
| Vegetation mapping<br>Targeted Flora | 11/04/24 | 14.7 | 24.7 | SW – 20km/h | 0 |
| Vegetation mapping<br>Targeted Flora | 12/04/24 | 14.8 | 24.5 | WSW – 16km/h | 0 |
| Vegetation mapping<br>Targeted Flora | 29/04/2024 | 12.8 | 25.5 | NE – 30KM/h | 0.2 |

## 2.6 LIMITATIONS

Ecological surveys provide a sampling of flora and fauna at a given time and season. There are a number of reasons why not all species will be detected at a site during survey, such as species dormancy, seasonal conditions, ephemeral status of waterbodies, and migration and breeding behaviours of some fauna. In many cases these factors do not present a significant limitation to assessing the overall ecological values of a site.

The current biodiversity assessment was conducted across all seasons of the year, with dense surveys in the peak seasons of spring and summer. Overall, the survey effort was sufficient to assess the general ecological values of the study area. Database searches, and associated conclusions on the likelihood of threatened species to occur within the study area, are reliant upon external data sources and information managed by third parties. This report relies on the presented findings of other consultants to assess other components of this large project, our results consider our own findings and our interpretation of the implications of others work. At the time of delivery of this report, some other reports were still to be finalised, therefore there may have been new or updated information delivered that has not been incorporated into this report.

The following licences were required to undertake flora and fauna surveys mentioned above:

- BioNet Sensitive Species Data Licence. Licence No: 1631.
- NSW Scientific Licence. Licence No: SL102551.
- Animal Research Authority (Fauna Surveys) and Animal Ethics Certificate. CSB RVF21/1037.

# 3.0 SITE CONTEXT

## 3.1 ASSESSMENT AREA

The assessment area was developed in two parts.

1. A 500 m buffer was placed around the Subject Land of all SRMs & RWMs.
2. A 1500 m buffer was placed around the Subject Land of the WWTP and laydown /compound areas.

These two buffers were then merged to create the assessment area (Figure 6). The 500-metre buffer is applicable as the SRMs & RWMs are classified as a linear; the 1500-metre buffer is applicable as the remaining parts are non-linear. The assessment area consists of a variety of developed land, disturbed exotic grassland and native vegetation

## 3.2 LANDSCAPE FEATURES

Landscape features identified within the subject land and assessment area are shown on Figure 1 through to Figure 5 (Site Map) and Figure 6 (Location Map), respectively. A discussion of relevant landscape features is provided below.

### *3.2.1 General Landscape Features*

The project area generally is being performed at a low elevation with the WWTP approximately 2-4 m above sea level. The SRMs & RWMs are generally low in elevation, with most of the alignment below 25 m above sea level.

The hydrology in the vicinity includes established wetlands to the north, east, and south of the Subject Land. Partridge Creek is located to the east of the Subject Land flows from south to north, while Fernbank Creek is located to the north west and flows northwards, both creeks enter the Hastings River.

The project area is a mix of Alluvial Plain and Coastal Barrier Systems (Hashimoto & Troedson, 2007). The sand plain is likely part of the Coastal Barrier System, featuring Pleistocene dune with marine sand and indurated sand. The wetlands and Partridge Creek are likely part of the Alluvial Plain System, including a Holocene levee of fluvial sand, silt and clay. Travelling from the WWTP, the SRMs & RWMs will cross into the airport area which is generally within the Coastal Barrier System, before exiting into the Alluvial Plain in the urban areas of Port Macquarie. The effluent will be released into Kooloonbung Creek, which is an Estuarine Plain System featuring a Holocene tidal-delta flat with marine sand, silt, clay, shell and gravel.

Soil types in the study areas feature Podosols at the sand plain, Hydrosols in the wetlands and a mix of Ferrosols, Hydrosols, Kandosols, natric Kurosols, and Podosols.

### *3.2.2 IBRA Bioregions and IBRA Subregions*

The study area is located within the NSW North Coast IBRA region (Macleay Hastings IBRA subregion). The NSW North Coast Bioregion extends from just north of Newcastle to just south of the border of Queensland with a total area 5,924,130 ha, including 7.11% of NSW. The IBRA regions are not mapped in the figures as the Subject Land as the nearest boundary is 29 km away from the Subject Land.

### *3.2.3 Rivers, Streams and Wetlands*

The 'Sand Plain' that the WWTP will be based on has a long history anthropogenic modification. The Sand Plain and surrounding wetlands was cleared prior to 1956 with the intention of cropping and promoting improved pastures (Aaso, et al, 2003) (Plate 2). It is suggested that these areas continued to be subject to flooding and high water as artificial drainage works were constructed between 1890 and 1989 (Aaso, et al, 2003). The drains directed water towards Partridge Creek (Plate 3 and Plate 4), which flows generally south to north on the eastern side of the WWTP. These drains are implicated as contributing to a lowering of the water level and the exposure of acid sulfate soils, causing a lowering of pH and releasing iron and aluminium into Hastings River and the surrounding floodplain (Aaso, et al, 2003) (Figure 6).

Partridge Creek was identified as an acid sulfate soil hot spot, covering a 540 ha area, and was having economic consequences for the local oyster and fishery industries, as well as causing the degradation of the local estuarine ecosystem. Remediation included creating an embankment and installing weir gates in the norther section of Partridge Creek. This inundated significant areas around the sand plain and has generated significant areas of wetland habitat. It is unclear on the extent that the remediation would have restored wetlands present prior to land clearing, though Pre-1750 SVTM mapping indicates that the area was likely a wetland. Partridge Creek still has potential to release significantly acidic water, with Council monitoring between 2013 and 2017 indicating that this creek can have pH ranging from 3.4 to 6.7.

Current conditions on the sand plain include a first order waterways passing through the Subject Land, and entering an established waterbody to the north of the Subject Land (referred to as Wetland A) (Plate 1, Figure 1). Wetland A varies in depth from 3 cm through to 130 cm, increasing in depth towards the central waterline where depth increases suddenly can be >160 cm deep with has limited vegetation. Land to the east and south (Wetland B) is generally flooded between 3 cm and 115 cm depth, with increased depths at the channels identified earlier in this section. There is a small embankment between Partridge Creek and Wetland B (Plate 1), but the water level is often higher than this embankment. To the north of the sand plain is Fern Bank Creek, a third order stream (Figure 1).

Significant areas of wetland have been avoided through the use of HDD, which avoided significant wetlands and conservation areas to the south and east (Figure 1, Figure 3, Figure 4, Figure 6). Due to this avoidance, the trenching required for the SRMs & RWMs do not cross established waterways, with the exception of in the south where a first order waterways is intersected by a Sewer Rising Main. (Figure 5).

Within the assessment area, there are mapped wetlands (Figure 6). Wetlands surrounding and intersecting the Subject Land and in the LGA are not identified as being of international importance (Ramsar Wetlands). An area identified as a Coastal Wetlands under the SEPP (Resilience and Hazards - Chapter 2: Coastal Management) 2018 is within the WWTP Subject Land and a small section of the SRMs & RWMs, east of the Port Macquarie Airport (1.1 ha) (Figure 6). An area identified as a Coastal Wetlands Proximity Area under the SEPP (Resilience and Hazards - Chapter 2: Coastal Management) 2021 is within the WWTP Subject Land and a small section of the SRMs & RWMs (8.4 ha). The Coastal Use Area is intersected in several areas of the Subject Land; Areas within the WWTP, Sewer Rising Main and the return effluent pipeline near Kooloonbung Creek (2.7 ha).

The Groundwater Dependent Ecosystems (GDE) Atlas did identify GDE within the Subject Land. High potential GDE, moderate and low are mapped within the Subject Land and within the assessment area. Albeit, Probable GDE vegetation mapping (DPE 2022g) identified two potential GDE within the study area (i.e. Wetland – Freshwater wetland and Terrestrial – Forested wetland). Additional probable GDE within the mapped buffers include;

- Wetland – Freshwater wetland.
- Terrestrial – Forested wetlands.
- Terrestrial – Heathland.

GDEs are further discussed in Section 6.0 and 8.7.

Plate 2 Aerial imagery from 1 April 1956. The location of the WWTP Subject Land has been approximately georeferenced onto the historic imagery.

Plate 3 Aerial imagery from 21 July 1979. The location of the WWTP Subject Land has been approximately georeferenced onto the historic imagery in light blue dashed line. Red arrows point to what may be artificially constructed or manipulated drains.

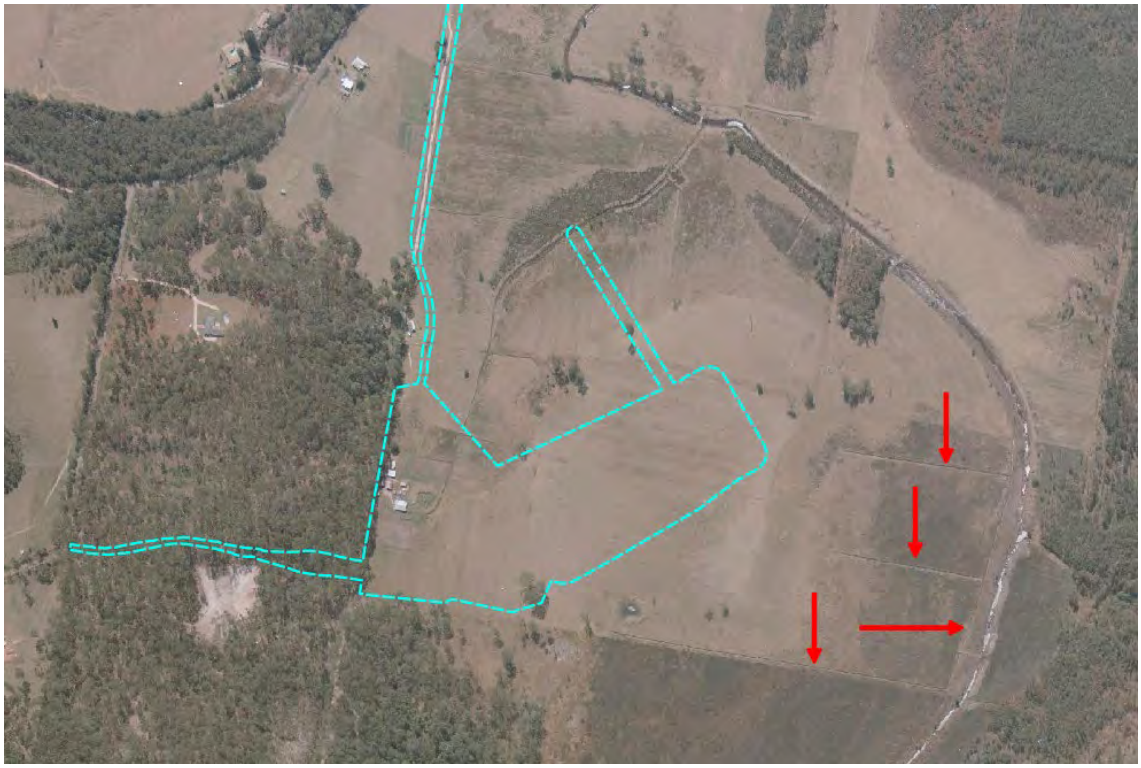

Plate 4 Aerial imagery from 12 September 1991. The location of the WWTP Subject Land has been approximately georeferenced onto the historic imagery in light blue dashed line. Red arrows point to what may be artificially constructed or manipulated drains.

### 3.2.4 Habitat Connectivity

The Subject Land sits within a mosaic of managed, disturbed and natural landscapes. The WWTP is within a sand plain dominated by exotic grasses that has a disturbance history dating back to the 1890s (Aaso, et al, 2003). To the west and south of the WWTP are forested lands, which are particularly extensive in the south. Native wetlands have re-established and boarder the sand plain to the west, south and east. Land to the south and east is protected under a Biobanking agreement. Overall though the WWTP Subject Land is itself dominated by exotic species, it is surrounded by a diversity of habitats that could facilitate dispersal for a wide range of species.

The SRMs & RWMs Subject Land are within the more central parts of the Port Macquarie suburbia, and are dominated by exotic vegetation with some areas of moderate condition native vegetation. The area of PCT4006 in Moderate condition, north west of the Port Macquarie Race Club is partially disconnected from other areas of its habitat by an existing powerline corridor. Native vegetation near Port Macquarie Base Hospital and Lake Innes Village are partially degraded by existing tracks with regular public use, and are separated from other large areas of vegetation by roads and suburbia.

### 3.2.5 Karst, Caves, Crevices, Cliffs, Rocks or Other Geological Features of Significance

There were no recorded karst, caves, crevices, cliffs or other areas of geological significance within the subject land or within its locality (DECC and NPWS 2010).

### 3.2.6 Areas of Outstanding Biodiversity Value

Areas of Outstanding Biodiversity Value are special areas with irreplaceable biodiversity values that are important to the whole of New South Wales, Australia or globally. Of the four entities listed on the Area of Outstanding Biodiversity Value Register, none occur within the Subject Land or the locality of the project.

### 3.2.7 NSW (Mitchell) Landscape

The Subject Land occurs within the NSW North Coast Coastal Barriers Bioregion *Manning Macleay Alluvial Plains* NSW Landscape. Described as housing wide valleys, channels, floodplains, swamps terraces and coastal streams on Quaternary alluvium. Elevation ranges between 0 to 50 metres and a local relief of 15 metres. The landscape contains a variety of soils including, dark organic loams and silty clays on floodplains, gradational brown loams and yellow-brown texture-contrast soil on terraces, and organic silty mud in swamps.

### 3.2.8 Additional Landscape Features Identified in SEARs

SEARs have been provided for this project (Application Number SSI-56980459, Date of Issue 24/04/2023) and are further discussed in Section 1.7. No additional landscape features were considered relevant to this BDAR.

### 3.2.9 Soil Hazard Features

The Subject Land is shown to contain Class 2, Class 3 and Class 5 Acid sulfate soils (Department of Planning and Environment, 2018). The sand plain where the WWTP occurs has a history of acid sulfate soils exposure and risk (see a description of the history in Section 3.2.3) (Figure 6).

Potential asbestos areas have been mapped to occur within the Subject Land (4.1 ha) (Figure 6). These areas have a low potential of asbestos and are spread across segments of SRMs & RWMs between Lady Nelson Drive, Fernhill Road, Tulloch Road, Sherwood Road, the Oxley Highway, and John Oxley Drive. There is also a small section at the southern extent of Thrumster Street.

### 3.2.10 Existing Vegetation

Assessment of the SVTM indicates that the primary vegetation formations in the project area consist of Forested wetlands, Freshwater wetlands, Wet sclerophyll Forests and Dry sclerophyll forests. The WWTP has been centred on areas not classified under the SVTM, likely indicating exotic vegetation. The WWTP is

surrounded by wetlands associated with PCT3959 Coast Sands *Baumea articulata* Sedgeland to the north south and east, while the hill to the west is mapped to contain PCT3166 Northern Escarpment Brush Box-Tallowwood-Maple Wet Forest and PCT3250 Northern Foothills Blackbutt Grassy Forest. Significant portions of the SRMs & RWMs also pass through areas that have not been classified under the SVTM. Other areas indicate dominant mapping of PCT3166. There are small areas of PCT3549 Lower North Sandplain Heathy Forest and PCT4004 Northern *Melaleuca quinquenervia* Swamp Forest. The small section of recycled water along Thrumster street is mostly PCT3250 and a small area of PCT3166.

Previous vegetation mapping (Phillips et al, 2013) indicates that there are no areas of direct impact within existing TEC mapping. However, the wetlands surrounding the WWTP that are associated with Freshwater Wetlands on Coastal Floodplains, Swamp Sclerophyll Forest on Coastal Floodplains and Swamp Oak Floodplain Forest. The SRMs & RWMs are close to areas of Swamp Sclerophyll Forest on Coastal Floodplains in areas near Kemp Street and Kooloonbung Creek.

## 3.3 NATIVE VEGETATION COVER

Native vegetation cover within the assessment area was assessed using aerial photographic interpretation, field survey results and existing vegetation mapping (NSW DCCEEW, 2023). Approximately 44% of the assessment area is occupied by native vegetation. Table 6 and Figure 6 show a summary of native vegetation cover and native vegetation extent within the assessment area.

Table 6: Native Vegetation cover in the assessment area

| | |
|---|---|
| Assessment Area (ha) | 3543.90 |
| Total Area of Native Vegetation Cover (ha) | 1561.32 |
| Percentage of Native Vegetation Cover (%) | 44.06 |
| Class (0-10, >10-30, >30-70, or >70%) | >30-70 |

# 4.0 NATIVE VEGETATION, THREATENED ECOLOGICAL COMMUNITIES AND VEGETATION INTEGRITY

The extent of native vegetation, threatened ecological communities and vegetation integrity within the Subject Land was determined by analysing aerial photography, existing vegetation mapping and field survey data. The Subject Land has a total area of 28.37 ha and ranges in condition from cleared land, built structures, and exotic dominated vegetation to good condition vegetation. Of this area, 5.76 ha are associated only with built structures and cleared land. The remaining 22.61 ha contains 17.57 ha of exotic dominated vegetation and 5.04 ha that was aligned with native vegetation PCTs. The total area of each vegetation zone and their VI Scores are discussed below.

## 4.1 NATIVE VEGETATION EXTENT

### *4.1.1 Changes to the Mapped Native Vegetation Extent*

The native vegetation extent recorded within the Subject Land, as assessed during field investigations (described in Section 2.2), included all areas of native vegetation (native ground cover and areas with canopy) and low condition areas that used to be part of the adjacent native vegetation or displayed a Vegetation Integrity Score (VIS) equal to or greater than 15. Areas not meeting these criteria may not be included for further assessment in accordance with Section 4.1.2 of the BAM (DPIE 2020a).

The ground-truthing of vegetation on site and the utilisation of aerial imagery resulted in native vegetation extent refinement from the regionally mapped vegetation (NSW DCCEEW, 2023). The updated native vegetation extent is shown in Figure 33– Figure 37.

### *4.1.2 Areas That Are Not Native Vegetation*

Areas considered to be non-native (exotic vegetation) are shown in Figure 33– Figure 37. These areas were classified as exotic vegetation if they contained a clear predominantly exotic species and recorded a VIS of less than 15 (as per Section 9.2.1 of the BAM). These areas were assessed under PCT 3544 (Exotic Vegetation) (VZ5) (further described in Section 4.2.7).

Similarly, although VZ6 PCT3544 Coastal Sands Apple-Blackbutt Forest in Low Condition, visually displayed a notable presence of native flora species, ultimately, low structure and / or function condition scores contributed to a VI Score of less than 15.

With the exception of where these areas provide habitat for threatened species, these areas were not included for further assessment in accordance with Section 4.1.2 of the BAM (DPIE 2020a).

### *4.1.3 Previous Vegetation Mapping*

The primary background data used to inform potential communities that may be present include the regional vegetation mapping from the NSW State Vegetation Type Map (SVTM) (NSW DCCEEW, 2023) and Vegetation of the Port Macquarie Hastings Local Government Area (Phillips et al, 2013). Older ecological studies of the site, such as HWR Ecological (2005) were used to guide where the assessment. Information from other databases was also considered, such as the SEPP Coastal Wetland mapping.

Broadly, the previous mapping highlighted the extensive areas of non-native vegetation within the suburbs of Port Macquarie, as well as numerous TECs in the locality. The main TEC in close proximity to the project was Freshwater Wetlands on Coastal Floodplains, which largely surrounded the WWTP. There are also areas of Swamp Sclerophyll Forest on Coastal Floodplains and Swamp Oak Floodplain Forest near the WWTP. Kooloonbung Creek contains both Coastal Saltmarsh as well as Swamp Sclerophyll Forest TECs

## 4.2 PLANT COMMUNITY TYPES

### *4.2.1 Overview*

Vegetation within the Subject Land has been assessed as aligning with the BioNet Vegetation Classification PCTs identified within Table 7 and their extent is shown in Figure 38 to Figure 43. Detailed descriptions of each PCT are provided in the following subsections.

Table 7: PCTs identified within the Subject Land

| PCT ID | PCT Name | Condition Class | Vegetation zone | Subject Land area (ha) |
|---|---|---|---|---|
| 3167 | Northern Hinterland Blackbutt-Forest Oak Wet Forest | Low | VZ1 | 0.18 |
| 3167 | Northern Hinterland Blackbutt-Forest Oak Wet Forest | Moderate | VZ2 | 0.6 |
| 3250 | Northern Foothills Blackbutt Grassy Forest | Low | VZ3 | 0.12 |
| 3250 | Northern Foothills Blackbutt Grassy Forest | Moderate-Good | VZ4 | 0.61 |
| 3544* | Coastal Sands Apple-Blackbutt Forest* | Exotic | VZ5 | 17.57 |
| 3544 | Coastal Sands Apple-Blackbutt Forest | Low | VZ6 | 1.61 |
| 3544 | Coastal Sands Apple-Blackbutt Forest | Moderate | VZ7 | 0.21 |
| 3967 | Northern Lower Floodplain Eleocharis Wetland | Good | VZ8 | 1.67 |
| 4006 | Northern Paperbark-Swamp Mahogany Saw-sedge Forest | Moderate | VZ9 | 0.04 |
| Total | | | | 22.61 |

* VZ5 represents vegetation that is dominated by exotic vegetation, this VZ has been assessed for vegetation integrity against PCT3544 Coastal Sands Apple-Blackbutt Forest.

### *4.2.2 PCT 3167 Northern Hinterland Blackbutt-Forest Oak Wet Forest*

#### *4.2.2.1 PCT Overview*

Table 8 PCT 3167 Northern Hinterland Blackbutt-Forest Oak Wet Forest

| PCT 3167 Northern Hinterland Blackbutt-Forest Oak Wet Forest | |
|---|---|
| PCT (DCCEEW 2024) | Northern Hinterland Blackbutt-Forest Oak Wet Forest |
| PCT ID | 3167 |
| Vegetation Formation | Wet Sclerophyll Forests (Shrubby sub-formation) |
| Vegetation Class | Northern Hinterland Wet Sclerophyll Forests |
| Per cent cleared value (%) | 7 |
| Extent Within Subject Land (ha) | 0.79 ha |

#### *4.2.2.2 Condition State*

PCT 3167 was observed as being of low (VZ1) and moderate (VZ2) condition throughout the subject land. Detail on these condition zones is provided in the following sections.

##### 4.2.2.2.1 Low Condition (VZ1)

The low condition form (VZ1) of PCT 3167 was comprised primarily of native species, albeit, with substantial exotic species coverage and abundance (Plate 5). Dominant native species included Common Lilly Pilly (*Acmena smithii*), Tallowwood (*Eucalyptus microcorys*), Grey Gum (*Eucalyptus propinqua*), Red Bloodwood (*Corymbia gummifera*), Broad-leaved Paperbark (*Melaleuca quinquenervia*), *Oplismenus imbecillis* and Weeping Grass (*Microlaena stipoides*).

Dominant exotic species observed with VZ1 included Buffalo Grass (*Stenotaphrum secundatum*), Ochna (*Ochna serrulata*) and Green Cestrum (*Cestrum parqui*). VZ1 is likely to have been subjected to considerable historical disturbance, evidenced by the thinned canopy cover and exotic species incursion.

Plate 5 Representative photograph of the low condition form of PCT 3167.

#### 4.2.2.2.2 Moderate Condition (VZ2)

The moderate condition form (VZ2) of PCT 3167 was comprised primarily of native vegetation, exhibiting high native species composition and overall structural habitat complexity (Plate 6). Dominant native species observed included Blackbutt (*Eucalyptus pilularis*), Scentless Rosewood (*Synoum glandulosum*), Bolwarra (*Eupomatia laurina*), Illawarra Flame Tree (*Brachychiton acerifolius*), Red Ash (*Alphitonia excelsa*), Hairy Clerodendrum (*Clerodendrum tomentosum*), Cheese Tree (*Glochidion ferdinandi*) and Sweet Sarsparilla (*Smilax glyciphylla*).

Although predominantly native, exotic species were observed within VZ1, including Camphor Laurel (*Cinnamomum camphora*), Lantana (*Lantana camara*), Broadleaf Paspalum (*Paspalum mandiocanum*) and Mickey Mouse Plant (*Ochna serrulata*). Whilst the condition of VZ2 was generally good, areas of historic disturbance and exotic species incursion were also observed.

Plate 6 Representative photograph of the moderate condition form of PCT 3167.

#### *4.2.2.3 Justification of PCT Selection*

The characteristic species from the PCT 3167 vegetation description include Blackbutt (*Eucalyptus pilularis*) and Tallowwood (*Eucalyptus microcorys*) in the canopy. Turpentine (*Syncarpia glomulifera*) was also recorded nearby to the location of BAM plots within this PCT, which is also a characteristic species. The characteristic species from the PCT 3167 vegetation description in the mid-storey include Forest Oak (*Allocasuarina torulosa*) and Scentless Rosewood (*Synoum glandulosum*).

More broadly, vegetation was found to be commensurate with PCT 3167 based on a comparison of BAM plot data and field personnel observations with the BioNet Vegetation Classification database. Commensurate species were represented throughout all stratum as identified in Table  below.

Table 9 PCT 3167 commensurate species recorded in each stratum

| Upper Stratum Flora Species | Mid Stratum Flora Species | Ground Stratum Flora Species |
|---|---|---|
| Red Bloodwood (*Corymbia gummifera*), Tallowwood (*Eucalyptus microcorys*), Blackbutt (*Eucalyptus pilularis*), Small-fruited Grey Gum (*Eucalyptus propinqua*) | Illawarra Flame Tree (*Brachychiton acerifolius*), Wild Quince (*Alectryon subcinereus*), *Acacia* spp., Lilly Pilly (*Acmena smithii*), Black She-Oak (*Allocasuarina littoralis*), Forest Oak (*Allocasuarina torulosa*), Red Ash (*Alphitonia excelsa*), Tuckeroo (*Cupaniopsis anacardioides*), *Ficus* spp., Cheese Tree (*Glochidion ferdinandi*), Sweet Pittosporum (*Pittosporum undulatum*), Scentless Rosewood (*Synoum glandulosum*), Native Peach (*Trema tomentosa*) | Rough Maidenhair (*Adiantum hispidulum*), Coffee Bush (*Breynia oblongifolia*), Hairy Clerodendrum (*Clerodendrum tomentosum*), Narrow-leaved Palm Lily (*Cordyline stricta*), *Dianella caerulea* var. *producta,* Kidney Weed (*Dichondra repens*), Bordered Panic (*Entolasia marginata*), Bolwarra (*Eupomatia laurina*), Wombat Berry (*Eustrephus latifolius*), Black Fruit Saw-sedge (*Gahnia melanocarpa*), Scrambling Lily (*Geitonoplesium cymosum*), Settler's Twine (*Gymnostachys anceps*), Twining Guinea Flower (*Hibbertia dentata*), Blady Grass (*Imperata cylindrica*), Whiteroot (*Lobelia purpurascens*), Spiny-headed Mat-rush (*Lomandra longifolia*), Many-flowered Mat-rush (*Lomandra multiflora*), Milk Vine (*Marsdenia rostrata*), *Oplismenus imbecillis*, *Oxalis* spp., Wonga Wonga Vine (*Pandorea pandorana*), Bracken (*Pteridium esculentum*), Molucca Bramble (*Rubus moluccanus*), Rose-leaf Bramble (*Rubus rosifolius*), Pearl Vine (*Sarcopetalum harveyanum*), Sweet Sarsparilla (*Smilax glyciphylla*), Snake vine (*Stephania japonica*), *Viola banksia* |

As noted in the PCT 3167 vegetation description, it occurs as part of a mosaic with other wet sclerophyll forests (e.g. PCT 3248) and may grade into one of several rainforest PCTs (e.g. PCT 3021) in gullies or on more sheltered slopes. Both PCT 3167 and PCT 3248 are within the vegetation formation of Wet Sclerophyll Forests (Grassy sub-formation). While it was observed that the grass dominance varied, a more mesic understorey was generally observed in the Subject Land and adjoining areas, which is more consistent with PCT 3167.

PCT 3021 is classified as being within the vegetation formation Rainforest, which typically has Bangalow Palm (*Archontophoenix cunninghamiana*) as the most dominant canopy species, which is not an attribute consistent within this vegetation zone. Similarly, PCT 3166 which has been previously mapped in the immediate locality (NSW State Vegetation Type Map (SVTM) (NSW DCCEEW, 2023) was also discounted as this PCT occurs at mid-high elevations (350-390m asl) and does not characteristically exhibit Blackbutt (*Eucalyptus pilularis*).

#### *4.2.2.4 Alignment with TECs*

There is no associated TEC with PCT 3167.

#### *4.2.2.5 Alignment with EPBC Act Listed Ecological Communities*

There is no associated TEC with PCT 3167.

### 4.2.3 PCT 3250 Northern Foothills Blackbutt Grassy Forest

#### 4.2.3.1 PCT Overview

Table 10 PCT 3250 Northern Foothills Blackbutt Grassy Forest

| PCT 3250 Northern Foothills Blackbutt Grassy Forest | |
|---|---|
| PCT (DCCEEW 2024) | Northern Foothills Blackbutt Grassy Forest |
| PCT ID | 3250 |
| Vegetation Formation | Wet Sclerophyll Forests (Grassy sub-formation) |
| Vegetation Class | Northern Hinterland Wet Sclerophyll Forests |
| Per cent cleared value (%) | 30 |
| Extent Within Subject Land (ha) | 0.73 ha |

#### 4.2.3.2 Condition State

PCT 3250 was observed as being of low (VZ3) and moderate-good (VZ4) condition throughout the subject land. Detail on these condition zones is provided in the following sections.

##### 4.2.3.2.1 Low Condition (VZ3)

The low condition form (VZ3) of PCT 3250 was comprised primarily of native species, albeit, with substantial exotic species coverage and abundance (Plate 7). Dominant native species included Blackbutt (*Eucalyptus pilularis*),
Blady Grass (*Imperata cylindrica*), Tallowwood (*Eucalyptus microcorys*), *Desmodium rhytidophyllum*, Whiteroot (*Lobelia purpurascens*), Spiny-headed Mat-rush (*Lomandra longifolia*) and *Viola banksii*. Dominant exotic species observed with VZ3 included Broadleaf Paspalum (*Paspalum mandiocanum*), *Setaria parviflora*, Prickly Sowthistle (*Sonchus asper*) and Balloon Cotton Bush (*Gomphocarpus physocarpus*).

Plate 7 Representative photograph of the low condition form of PCT 3250.

#### 4.2.3.2.2 Moderate-good Condition (VZ4)

The moderate-good condition form (VZ4) of PCT 3250 was comprised primarily of native vegetation, exhibiting high native species composition and overall structural habitat complexity (Plate 8). Dominant native species observed included Blady Grass (*Imperata cylindrica*), Blackbutt (*Eucalyptus pilularis*), Bordered Panic (*Entolasia marginata*), Pink Bloodwood (*Corymbia intermedia*) and *Hydrocotyle sibthorpioides*. Although predominantly native, exotic species were observed within VZ4, including Broadleaf Paspalum (*Paspalum mandiocanum*), Lantana (*Lantana camara*), *Polygala myrtifolia* and Camphor Laurel (*Cinnamomum camphora*).

Plate 8 Representative photograph of the moderate-good condition form of PCT 3250.

#### *4.2.3.3 Justification of PCT Selection*

The characteristic species from the PCT 3250 vegetation description include Blackbutt (*Eucalyptus pilularis*), Tallowwood (*Eucalyptus microcorys*) and Pink Bloodwood (*Corymbia intermedia*) in the canopy. The characteristic species from the PCT 3250 vegetation description in the mid-ground storey include *Allocasuarina torulosa* (Forest Oak), Elderberry Panax (*Polyscias sambucifolia*), Blady Grass (*Imperata cylindrica*), Bracken (*Pteridium esculentum*) and Spiny-headed Mat-rush (*Lomandra longifolia*).

More broadly, vegetation was found to be commensurate with PCT 3250 based on a comparison of BAM plot data and field personnel observations with the BioNet Vegetation Classification database. Commensurate species were represented throughout all stratum as identified in Table below.

Table 11 PCT 3250 commensurate species recorded in each stratum

| Upper Stratum Flora Species | Mid Stratum Flora Species | Ground Stratum Flora Species |
|---|---|---|
| Blackbutt (*Eucalyptus pilularis*), Pink Bloodwood (*Corymbia intermedia*) and Tallowwood (*Eucalyptus microcorys*). | Brush Box (*Lophostemon confertus*), Forest Oak (*Allocasuarina torulosa*), White Sally (*Acacia floribunda*) and Blueberry Ash (*Elaeocarpus reticulatus*). | Blady Grass (*Imperata cylindrica*), Bordered Panic (*Entolasia marginata*), *Hydrocotyle sibthorpioides*, Spiny-headed Mat-rush (*Lomandra longifolia*), *Viola banksii*, Native Raspberry (*Rubus parvifolius*), Narrow-leaved Palm Lily (*Cordyline stricta*), *Hydrocotyle acutiloba*, Coffee Bush (*Breynia oblongifolia*), *Dianella caerulea* var. *producta*, Wombat Berry (*Eustrephus latifolius*), False Sarsaparilla (*Hardenbergia violacea*), Small-flowered Finger Grass (*Digitaria parviflora*), Corkwood (*Duboisia myoporoides*), Elderberry Panax (*Polyscias sambucifolia*), Tuckeroo (*Cupaniopsis anacardioides*), Variable Glycine (*Glycine tabacina*), Long-leaf Wattle (*Acacia longissima*), *Desmodium rhytidophyllum*, Cheese Tree (*Glochidion ferdinandi*), |

| Upper Stratum Flora Species | Mid Stratum Flora Species | Ground Stratum Flora Species |
|---|---|---|
| | | Prickly Beard-heath (*Leucopogon juniperinus*), Large Mock-olive (*Notelaea longifolia*), Snowgrass (*Poa sieberiana*), Bracken (*Pteridium esculentum*), Pearl Vine (*Sarcopetalum harveyanum*), Sweet Sarsparilla (*Smilax glyciphylla*), Red Ash (*Alphitonia excelsa*), Tall Sedge (*Carex appressa*), Kidney Weed (*Dichondra repens*), Forest Hedgehog Grass (*Echinopogon ovatus*), *Ficus* spp., Scrambling Lily (*Geitonoplesium cymosum*), Native Geranium (*Geranium solanderi*), Twining glycine (*Glycine clandestina*), Climbing Guinea Flower (*Hibbertia scandens*), Wattle Matt-rush (*Lomandra filiformis*), *Oplismenus aemulus*, *Oxalis* spp., Pastel Flower (*Pseuderanthemum variabile*), Indian Weed (*Sigesbeckia orientalis*), Hairy Clerodendrum (*Clerodendrum tomentosum*), Whiteroot (*Lobelia purpurascens*), Wonga Wonga Vine (*Pandorea pandorana*) and Native Violet (*Viola betonicifolia*). |

As noted in the PCT 3250 vegetation description, its range overlaps with that of PCT 3248. Both PCT 3250 and PCT 3248 are within the vegetation formation of Wet Sclerophyll Forests (Grassy sub-formation). While variation occurred, a less mesic understorey was generally observed in the Subject Land and adjoining areas, which is more consistent with PCT 3250.

Similarly, PCT 3166 which has been previously mapped in the immediate locality (NSW State Vegetation Type Map (SVTM) (NSW DCCEEW, 2023) was also discounted as this PCT occurs at mid-high elevations (350-390m asl), does not characteristically exhibit Blackbutt (*Eucalyptus pilularis*), has a more mesic understorey and belongs to the vegetation formation Wet Sclerophyll Forests (Shrubby sub-formation).

#### *4.2.3.4 Alignment with TECs*

There is no associated TEC with PCT 3250.

#### *4.2.3.5 Alignment with EPBC Act Listed Ecological Communities*

There is no associated TEC with PCT 3250.

### 4.2.4 PCT 3544 Coastal Sands Apple-Blackbutt Forest

#### 4.2.4.1 PCT Overview

Table 12 PCT 3544 Coastal Sands Apple-Blackbutt Forest

| PCT 3544 Coastal Sands Apple-Blackbutt Forest | |
|---|---|
| PCT (DCCEEW 2024) | Coastal Sands Apple-Blackbutt Forest |
| PCT ID | 3544 |
| Vegetation Formation | Dry Sclerophyll Forests (Grassy sub-formation) |
| Vegetation Class | Coastal Dune Dry Sclerophyll Forests |
| Per cent cleared value (%) | 22 |
| Extent Within Subject Land (ha) | 1.82 |

#### 4.2.4.2 Condition States

PCT 3544 was observed as being of Low (VZ6) and Moderate (VZ7) condition, throughout the subject land. Detail on these condition zones is provided in the following sections.

##### 4.2.4.2.1 Low Condition (VZ6)

The low condition form (VZ6) of PCT 3544 was comprised primarily of native species coverage. Dominant native species included Blady Grass (*Imperata cylindrica*) and Bracken (*Pteridium esculentum*) (Plate 9).

VZ6 was considered to be of low condition throughout the Subject Land due to the low native flora species diversity and the absence of native flora species in the mid-upper stratum levels. Similarly, observations of exotic flora species were occasionally evident; including the following species; Whisky Grass (*Andropogon virginicus*), Narrow-leafed Carpet Grass (*Axonopus fissifolius*), *Conyza* spp., Vasey Grass (*Paspalum urvillei*), Fireweed (*Senecio madagascariensis*), South African Pigeon Grass (*Setaria sphacelata*), Veined Verbena (*Verbena rigida*) and Gin Case (*Verbena* x *brasiliensis*).

Plate 9 Representative photograph of the low condition form of PCT 3544.

##### 4.2.4.2.2 Moderate Condition (VZ7)

The moderate condition form (VZ7) of PCT 3544 was comprised primarily of native species (Plate 10). The mid-upper storey consisted of Tallowwood (*Eucalyptus microcorys*) and Blackbutt (*Eucalyptus pilularis*). Groundcover species included Blady Grass (*Imperata cylindrica*), Weeping Grass (*Microlaena stipoides*), Spiny-headed Mat-rush (*Lomandra longifolia*), Bracken (*Pteridium esculentum*), Brown's Lovegrass (*Eragrostis brownii*) and Harsh Ground Fern (*Hypolepis muelleri*).

Moderate condition was assigned to these areas of PCT 3544, as minor weed incursion was evident, including the following species; Whisky Grass (*Andropogon virginicus*), Camphor Laurel (*Cinnamomum camphora*), Kikuyu Grass (*Cenchrus clandestinus*) and Narrow-leafed Carpet Grass (*Axonopus fissifolius*).

Plate 10 Representative photograph of the moderate condition form of PCT 3544.

#### *4.2.4.3 Justification of PCT selection*

The characteristic species from the PCT 3544 vegetation description include Blackbutt (*Eucalyptus pilularis*) and Red Bloodwood (*Corymbia gummifera*) in the canopy. The characteristic species from the PCT 3544 vegetation description in the ground storey include Blady Grass (*Imperata cylindrica*), Bracken (*Pteridium esculentum*) and Spiny-headed Mat-rush (*Lomandra longifolia*).

More broadly, vegetation was found to be commensurate with PCT 3544 based on a comparison of BAM plot data and field personnel observations with the BioNet Vegetation Classification database. Commensurate species were represented including the following (Note that *Eucalyptus* species were limited to the Moderate Condition (VZ7) area of PCT 3544).

Table 13 PCT 3544 commensurate species recorded in each stratum

| Upper Stratum Flora Species | Mid Stratum Flora Species | Ground Stratum Flora Species |
|---|---|---|
| Red Bloodwood (*Corymbia gummifera*), Tallowwood (*Eucalyptus microcorys*), Blackbutt (*Eucalyptus pilularis*) | Red Ash (*Alphitonia excelsa*), Corkwood (*Duboisia myoporoides*), Cheese Tree (*Glochidion ferdinandii*) | Indian Pennywort (*Centella asiatica*), Native Wandering Jew (*Commelina cyanea*), Common Couch (*Cynodon dactylon*), *Dianella caerulea* var. *producta* Shorthair Plumegrass (*Dichelachne micrantha*), Brown's Lovegrass (*Eragrostis brownii*), Wombat Berry (*Eustrephus latifolius*), Scrambling Lily (*Geitonoplesium cymosum*), Variable |

| Upper Stratum Flora Species | Mid Stratum Flora Species | Ground Stratum Flora Species |
|---|---|---|
| | | Glycine (*Glycine tabacina*), *Hydrocotyle sibthorpioides*, Blady Grass (*Imperata cylindrica*), Whiteroot (*Lobelia purpurascens*), Spiny-headed Mat-rush (*Lomandra longifolia*), Weeping Grass (*Microlaena stipoides*), Bracken (*Pteridium esculentum*), Stinking Pennywort (*Hydrocotyle laxiflora*), Broad-leaved Geebung (*Persoonia levis*), Native Raspberry (*Rubus parvifolius*). |

As noted in the PCT 3544 vegetation description, this PCT grades into northern sand plain forest PCT 3552 around Port Macquarie and into PCT 3545 or PCT 3549 on older podsolised dunes. These alternative PCTs all belong to the vegetation formation Dry Sclerophyll Forests (Shrubby sub-formation).

PCT 3549 which has been previously mapped in the nearby locality (NSW State Vegetation Type Map (SVTM) (NSW DCCEEW, 2023) was discounted as this PCT does not include Blady Grass (*Imperata cylindrica*) as being characteristically dominant and it does not exhibit Blackbutt (*Eucalyptus pilularis*) as being characteristically dominant in the canopy.

PCT 3552 was discounted as this PCT does not include Blady Grass (*Imperata cylindrica*) as being characteristically dominant and other characteristic species of this PCT e.g. Needlebark Stringybark (*Eucalyptus planchoniana*), Port Jackson Pine (*Callitris rhomboidei*) and Johnson's Grass Tree (*Xanthorrhoea johnsonii*) were not observed.

PCT 3545 was discounted as this PCT does not exhibit Blackbutt (*Eucalyptus pilularis*) as being characteristically dominant in the canopy.

#### *4.2.4.4 Alignment with TECs*

There is no associated TEC with PCT 3544.

#### *4.2.4.5 Alignment with EPBC Act Listed Ecological Communities*

There is no associated TEC with PCT 3544.

### 4.2.5 PCT 3967 Northern Lower Floodplain Eleocharis Wetland

#### 4.2.5.1 PCT Overview

Table 14 PCT 3967 Northern Lower Floodplain Eleocharis Wetland

| PCT 3967 Northern Lower Floodplain Eleocharis Wetland | |
|---|---|
| PCT (DCCEEW 2024) | Northern Lower Floodplain Eleocharis Wetland |
| PCT ID | 3967 |
| Vegetation Formation | Freshwater Wetlands |
| Vegetation Class | Coastal Freshwater Lagoons |
| Per cent cleared value (%) | 83 |
| Extent Within Subject Land (ha) | 1.67 |

#### 4.2.5.2 Condition State

PCT 3967 was observed as being of good (VZ8) condition throughout the subject land. Detail on this condition zone is provided in the following section.

##### 4.2.5.2.1 Good Condition (VZ8)

Good condition (VZ8) PCT 3967 was comprised almost wholly of native species (Plate 11). Dominant native species included *Eleocharis equisetina*, *Lepironia articulata*, Jointed Twig-rush (*Baumea articulata*), *Carex gaudichaudiana*, *Persicaria strigosa*, Tall Sedge (*Carex appressa*), *Juncus usitatus*, Pithy Sword-sedge (*Lepidosperma longitudinale*) and Frogsmouth (*Philydrum lanuginosum*).

Plate 11 Representative photograph of the good condition form of PCT 3967.

#### 4.2.5.3 Justification of PCT Selection

Initial vegetation stratification of these wetland areas separated Wetland A into PCT3959 and Wetland B into PCT3961. This was partly due to the higher abundance in plot BAM10 of Jointed twig-rush (*Baumea articulata*) in Wetland A and PCT3959, and abundance of *Lepironia articulata* in Wetland B and PCT3961 (as well as the presence of other commensurate species). It was also based on our assessment of the abiotic environment at that time, which inferred similar sand based soil characteristics as the central sand plain. It was noted at this time that TECs could not be associated with these PCTs. However, based on site characteristics the occurrence of the Freshwater Wetlands on Coastal Floodplains TEC required consideration.

Following a discussion with representatives from NSW DCCEEW we undertook a wholistic review of the history of the Subject Land, performed further examination of the soil characteristics, considered data from other consultants and reassessed the landscape.

Soils around the wetland areas are much higher in clay and silt than either of the Quaternary sand soil landscapes described in the characteristics of PCT3959 or PCT3961. Instead, when combined with the effect from the weir gates, it better matches the muddy, poorly draining Quaternary alluvial backswamps of PCT3967, particularly Wetland B which is adjoining but somewhat separated from Partridge Creek by a shallow levee. The consideration of species across both Wetland A and B indicated that they both match better in terms of similarity to PCT3967, particularly with the dominance of *Eleocharis equisetina* across all plots (BAM5, BAM6, BAM10 and BAM11) and low abundance of *Phragmities australis*. The comment in the general description of this PCT, that it often occurs in disturbed environments further cements that it is the most correct PCT to assign.

Species that occur in the vegetation zone that are commensurate with PCT 3967 include, *Eleocharis equisetina*, Jointed Twig-rush (*Baumea articulata*), *Persicaria strigosa*, *Juncus usitatus*, Frogsmouth (*Philydrum lanuginosum*), *Cycnogeton procerum*, Common Reed (*Phragmites australis*), Matgrass (*Hemarthria uncinata*), Swamp Oak (*Casuarina glauca*) and Broad-leaved Paperbark (*Melaleuca quinquinervia*).

#### *4.2.5.4 Alignment with TECs*

Associated TECs listed under the BC Act include:

- Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (Endangered).

Key diagnostic characteristics were observed within the vegetation condition of PCT 3967, and condition thresholds were met, including:

- Occurrence in an associated bioregion (North Coast).
- Location consistency with Final Determination (NSW TSSC 2021) – *'occur on silts, muds or humic loams in depressions, flats, drainage lines, backswamps, lagoons and lakes associated with coastal floodplains.'*
- Predictive mapping of the pre-1750 vegetation indicates that PCT3959 may have been present across areas mapped as PCT3967, indicating that pre-disturbance this location would have likely been a similar wetland community. Therefore, the wetland where PCT 3967 is located is not considered an artificial wetland (which would exclude it as this TEC). Rather the wetland is considered a variant of this TEC that has been significantly disturbed in the last century (e.g. attempts to drain through construction of artificial channels).
- Vegetation composition consistent with Final Determination (NSW TSSC 2021) - *'scarcity or complete absence of woody plant species and the presence of amphibious, emergent, floating or submerged aquatic forbs, grasses or sedges.'*
- Occurs below 20m ASL (approx. 2m).

A comparison of BAM plot species data with species outlined in the final determination for the Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions TEC (NSW TSSC 2021), indicated the presence of several species commensurate with the TEC including *Eleocharis equisetina*, *Lepironia articulata*, Jointed Twig-rush (*Baumea articulata*), *Persicaria strigosa*, Tall Sedge (*Carex appressa*), *Juncus usitatus*, Matgrass (*Hemarthria uncinata*), Common Reed (*Phragmites australis*), *Cycnogeton procerum* and Frogsmouth (*Philydrum lanuginosum*).

Due to PCT 3967 vegetation being consistent with the TEC and other key diagnostic features, it has been concluded that PCT 3967 will fall into the classification of Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions.

#### *4.2.5.5 Alignment with EPBC Act Listed Ecological Communities*

There is no federally-listed TEC associated with PCT 3967.

### 4.2.6 PCT 4006 Northern Paperbark-Swamp Mahogany Saw-sedge Forest

#### 4.2.6.1 PCT Overview

Table 15 PCT 4006 Northern Paperbark-Swamp Mahogany Saw-sedge Forest

| PCT 4006 Northern Paperbark-Swamp Mahogany Saw-sedge Forest | |
|---|---|
| PCT (DCCEEW 2024) | Northern Paperbark-Swamp Mahogany Saw-sedge Forest |
| PCT ID | 4006 |
| Vegetation Formation | Forested Wetlands |
| Vegetation Class | Coastal Swamp Forests |
| Per cent cleared value (%) | 23 |
| Extent Within Subject Land (ha) | 0.04 ha |

#### 4.2.6.2 Condition State

PCT 4006 was observed as being of moderate (VZ9) condition throughout the subject land. Detail on this condition zone is provided in the following section.

#### 4.2.6.3 Moderate Condition (VZ9)

The moderate condition form (VZ9) of PCT 4006 was comprised primarily of native vegetation, exhibiting high native species composition and overall structural habitat complexity (Plate 12). Dominant native species observed included Broad-leaved Paperbark (*Melaleuca quinquenervia*), Tall Saw-sedge (*Gahnia clarkei*), Harsh Ground Fern (*Hypolepis muelleri*), Common Silkpod (*Parsonsia straminea*), Flax-leaved Paperbark (*Melaleuca linariifolia*), Bangalow Palm (*Archontophoenix cunninghamiana*) and Creek Sandpaper Fig (*Ficus coronata*).

Although predominantly native, exotic species were observed within VZ9, including Coral tree (*Erythrina* x *sykesii*), Morning Glory (*Ipomoea indica*), *Senna pendula* and *Ageratum houstonianum*.

Plate 12 Representative photograph of the moderate condition form of PCT 4006.

#### *4.2.6.4 Justification of PCT Selection*

The characteristic species from the PCT 4006 vegetation description include Broad-leaved Paperbark (*Melaleuca quinquenervia*) and Swamp Mahogany (*Eucalyptus robusta*).

The characteristic species from the PCT 4006 vegetation description in the mid-ground storey include Common Silkpod (*Parsonsia straminea*), Cheese Tree (*Glochidion ferdinandii*) and Flax-leaved Paperbark (*Melaleuca linariifolia*), Tall Saw-sedge (*Gahnia clarkei*), Swamp Water Fern (*Telmatoblechnum indicum*), Harsh Ground Fern (*Hypolepis muelleri*) and Bordered Panic (*Entolasia marginata*).

More broadly, vegetation was found to be commensurate with PCT 4006 based on a comparison of BAM plot data and field personnel observations with the BioNet Vegetation Classification database. Commensurate species were represented throughout all stratum as identified in Table 16 below.

Table 16 PCT 4006 commensurate species recorded in each stratum

| Upper Stratum Flora Species | Mid Stratum Flora Species | Ground Stratum Flora Species |
|---|---|---|
| Broad-leaved Paperbark (*Melaleuca quinquenervia*) and Swamp Mahogany (*Eucalyptus robusta*). | Blueberry Ash (*Elaeocarpus reticulatus*), Creek Sandpaper Fig (*Ficus coronata*), Cheese Tree (*Glochidion ferdinandii*), Flax-leaved Paperbark (*Melaleuca linariifolia*) and Common Silkpod (*Parsonsia straminea*). | Lesser Joyweed (*Alternanthera denticulata*), Bangalow Palm (*Archontophoenix cunninghamiana*), *Baumea juncea*, *Baumea rubiginosa*, Indian Pennywort (*Centella asiatica*), Native Wandering Jew (*Commelina cyanea*), Tuckeroo (*Cupaniopsis anacardioides*), Bordered Panic (*Entolasia marginata*), Tall Saw-sedge (*Gahnia clarkei*), *Hydrocotyle sibthorpioides*, Harsh Ground Fern (*Hypolepis muelleri*), *Oplismenus aemulus*, *Persicaria strigosa*, Indian Weed (*Sigesbeckia orientalis*), Swamp Water Fern (*Telmatoblechnum indicum*), *Viola banksia* and Ivy-leaved Violet (*Viola hederacea*). |

PCT 4004 which has been previously mapped in the immediate locality (NSW State Vegetation Type Map (SVTM) (NSW DCCEEW, 2023) was discounted as this PCT does not typically contain Bangalow Palm (*Archontophoenix cunninghamiana*), but this species was present in the broader patch.

#### *4.2.6.5 Alignment with TECs*

Associated TECs listed under the BC Act include:

- Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (Endangered).

Key diagnostic characteristics were observed within vegetation conditions of PCT 4006, and condition thresholds were met, including:

- Occurrence in an associated LGA (Port Macquarie-Hastings).
- Waterlogged soils adjoining lithic substrates or coastal sandplains.
- Dense canopy cover dominated by *Melaleuca quinquenervia*, with a sub-dominance of *Eucalyptus robusta*.
- Occurs below 20m ASL (approx. 2m).

A comparison of BAM plot species data with species outlined in the final determination for the Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions TEC (NSW TSSC 2011), indicated the presence of several species commensurate with the TEC. Broad-leaved Paperbark (*Melaleuca quinquenervia*) is the dominant species present within the canopy, with a sub-dominance of Swamp Mahogany (*Eucalyptus robusta*), which is consistent with the TEC, as well as commensurate sub-canopy species including Flax-leaved Paperbark (*Melaleuca linariifolia*), Blueberry Ash (*Elaeocarpus reticulatus*), Creek Sandpaper Fig (*Ficus coronata*) and Cheese Tree (*Glochidion ferdinandi*).

The presence of ground species *Baumea juncea*, Swamp Water Fern (*Telmatoblechnum indicum*), Indian Pennywort (*Centella asiatica*), Bordered Panic (*Entolasia marginata*), Tall Saw-sedge (*Gahnia clarkei*), Harsh Ground Fern (*Hypolepis muelleri*), *Oplismenus aemulus*, Common Silkpod (*Parsonsia straminea*), *Viola banksia* and Ivy-leaved Violet (*Viola hederacea*) within the study area are consistent with characteristic species of this TEC. Due to PCT 4006 vegetation being consistent with the TEC and other key diagnostic features, it has been concluded that PCT 4006 will fall into the classification of Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions.

#### *4.2.6.6 Alignment with EPBC Act Listed Ecological Communities*

Associated TECs listed under the EPBC Act include:

- Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland (Endangered).

Key diagnostic characteristics were observed within vegetation conditions of PCT 4006, and condition thresholds were met, including:

- Occurs within 20km (approx. 4.75km) of the coast.
- Occurs below 20m ASL (approx. 6m)
- Above 10% minimum crown cover (approx. 41%).

A comparison of BAM plot species data with species outlined in the Approved Conservation Advice for the Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland TEC (DAWE 2021), indicated the presence of several species commensurate with the TEC. Broad-leaved Paperbark (*Melaleuca quinquenervia*) is the dominant species present within the canopy, with a sub-dominance of Swamp Mahogany (*Eucalyptus robusta*), which is consistent with the TEC, as well as commensurate sub canopy species including Flax-leaved Paperbark (*Melaleuca linariifolia*), Blueberry Ash (*Elaeocarpus reticulatus*), Creek Sandpaper Fig (*Ficus coronata*),Cheese Tree (*Glochidion ferdinandi*) and Tuckeroo (*Cupaniopsis anacardioides*).

The presence of ground species *Baumea juncea*, Swamp Water Fern (*Telmatoblechnum indicum*), Indian Pennywort (*Centella asiatica*), Bordered Panic (*Entolasia marginata*), Tall Saw-sedge (*Gahnia clarkei*), Harsh Ground Fern (*Hypolepis muelleri*), *Oplismenus aemulus*, Common Silkpod (*Parsonsia straminea*), *Viola banksia*, Ivy-leaved Violet (*Viola hederacea*), *Baumea rubiginosa* and Native Wandering Jew (*Commelina cyanea*) within the study area are consistent with characteristic species of this TEC.

It was therefore concluded that the criteria were met to classify PCT 4006 vegetation as Coastal Swamp Sclerophyll Forest of New south Wales and South East Queensland under the EPBC Act (High Condition Class A).

### 4.2.7 Exotic Vegetation

#### 4.2.7.1 PCT Overview

Table 17 Exotic Vegetation

| Exotic Vegetation | |
|---|---|
| PCT (DCCEEW 2024) | N/A |
| PCT ID | 3544 (Assigned for BAM-C Assessment) |
| Vegetation Formation | N/A |
| Vegetation Class | N/A |
| Per cent cleared value (%) | 22 (Assigned for BAM-C Assessment) |
| Extent Within Subject Land (ha) | 17.57 |

#### 4.2.7.2 Condition State

The Exotic Vegetation condition state (VZ5) was assigned due to a number of factors including, predominate absence of any overstorey or mid-storey vegetation, managed understorey with exotic vegetation and low native flora species diversity (Plate 13). Dominant exotic flora species included Whisky Grass (*Andropogon virginicus*), Narrow-leafed Carpet Grass (*Axonopus fissifolius*), *Conyza* spp., Fireweed (*Senecio madagascariensis*), *Chamaesyce maculata*, Kikuyu Grass (*Cenchrus clandestinus*), Catsear (*Hypochaeris radicata*) and *Hydrocotyle bonariensis*.

Occasional native flora species with a lower coverage included species such as Common Couch (*Cynodon dactylon*) and *Juncus* spp. However, canopy and shrubs are prevented from recovering in this area due to regular management such as mowing. Very occasional native canopy species were observed, including Forest Red Gum (*Eucalyptus tereticornis*).

Plate 13 Representative photograph of the exotic vegetation form of PCT 3544.

#### 4.2.7.3 Justification of PCT Selection

Through analysis of BAM plot data vegetation was found to be predominantly exotic. PCT 3544 was selected as it typically contains a similar substrate to much of the VZ and is common within the Port Macquarie area, often in vegetation adjacent to mapped areas across the Subject Land.

#### 4.2.7.4 Alignment with TECs

There is no TEC with associated with exotic vegetation.

## 4.3 KOOLOONBUNG CREEK

Kooloonbung Creek is not within the footprint of the Subject Land, however, the project will discharge effluent to Kooloonbung Creek. Therefore, initial vegetation mapping was performed of Kooloonbung Creek to identify potential ecological risks within the downstream catchment.

Five PCTs, in predominantly good condition, and four TECs were recorded below the Kooloonbung Creek outflow (Figure 43, Figure 45), including:

- PCT 4004 Northern *Melaleuca quinquenervia* Swamp Forest (Good condition):
    - Associated with the TECs Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions (Endangered; BC Act) and Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland (Endangered; EPBC Act)
- PCT 3171 Northern Lowland Viney Wet Forest (Low and Good condition)
- PCT 4091 Grey Mangrove-River Mangrove Forest (Good condition)
- PCT 4103 *Sporobolus virginicus* Saltmarsh (Good condition):
    - Associated with the TECs Coastal Saltmarsh in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (Endangered; BC Act) and Subtropical and Temperate Coastal Saltmarsh (Vulnerable; EPBC Act)
- PCT 4047 Northern Swamp Mahogany-Bottlebrush Swamp Forest (Low condition)
- Exotic Vegetation.

Where practicable and GPS accuracy permitted, the location of threatened flora was confirmed as present below the Kooloonbung Creek outflow including Scrub Turpentine (*Rhodamnia rubescens*) and Scented Acronychia (*Acronychia littoralis*) (Figure 59). A cluster of four new specimens of *A. littoralis* not identified in BioNet Records was identified during the surveys. BioNet records of Native Guava (*Rhodomyrtus psidioides*) below the Kooloonbung Creek outflow could not be located during the survey, but this does not discount their potential presence.

### 4.3.1 PCT 4004 Northern Melaleuca quinquenervia Swamp Forest

Approximately 21.18 ha of PCT 4004 was mapped below the Kooloonbung Creek outflow in good condition. The canopy of PCT 4004 was dominated by Broad-leaved Paperbark (*Melaleuca quinquenervia*) and occasional Swamp Oak (*Casuarina glauca*). The mid-storey of PCT 4004 was dominated by Common Silkpod (*Parsonsia straminea*), Bangalow Palm (*Archontophoenix cunninghamiana*), Blueberry Ash (*Elaeocarpus reticulatus*) and Willow Bottlebrush (*Callistemon salignus*). The ground layer was dominated by Tall Saw-sedge (*Gahnia clarkei*), Common Silkpod (*Parsonsia straminea*), Spiny-headed Mat-rush (*Lomandra longifolia*), Harsh Ground Fern (*Hypolepis muelleri*), Bordered Panic (*Entolasia marginata*) and Common Cotula (*Cotula australis*).

The example of this PCT below the Kooloonbung Creek outflow is associated with the TECs Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions (Endangered; BC Act) and Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland (Endangered; EPBC Act) (High Condition Class A).

Plate 14 Representative photograph of the PCT 4004 below the Kooloonbung Creek outflow.

### *4.3.2 PCT 3171 Northern Lowland Viney Wet Forest*

Approximately 8.20 ha of PCT 3171 was mapped below the Kooloonbung Creek outflow in low (1.30 ha) and good (6.90 ha) condition. Where PCT 3171 occurred in good condition the canopy was dominated by Tallowwood (*Eucalyptus microcorys*), Sydney Blue Gum (*Eucalyptus saligna*), Pink Bloodwood (*Corymbia intermedia*) and Blackbutt (*Eucalyptus pilularis*). The mid-layer was dominated by Red Ash (*Alphitonia excelsa*), Scentless Rosewood (*Synoum glandulosum*), Blueberry Ash (*Elaeocarpus reticulatus*), Bangalow Palm (*Archontophoenix cunninghamiana*), Broad-leaved Paperbark (*Melaleuca quinquenervia*) and Sandpaper Fig (*Ficus coronata*). The ground layer was diverse containing species such as Rainbow Fern (*Calochlaena dubia*), Lawyer Vine (*Smilax australis*), Molucca Bramble (*Rubus moluccanus*), Native Ginger (*Alpinia caerulea*), Weeping Grass (*Microlaena stipoides*), Creeping Beard Grass (*Oplismenus imbecillis*) Sweet Sarsaparilla (*Smilax glyciphylla*), Narrow-leaved Palm Lily (*Cordyline stricta*), Scrambling Lily (*Geitonoplesium cymosum*), Bleeding Heart (*Homalanthus populifolius*), Water Vine (*Cissus hypoglauca*), Snake Vine (*Stephania japonica*), Trad (*Tradescantia fluminensis*) and Scentless Rosewood (*Synoum glandulosum*).

Plate 15 Representative photograph of PCT 3171 (Good condition) below the Kooloonbung Creek outflow.

Where PCT 3171 occurred in low condition the canopy infrequently contained Brush Box (*Lophostemon confertus*), Swamp Mahogany (*Eucalyptus robusta*) and *Liquidambar* spp. The mid-layer contained occasional species such as Lawyer Vine (*Smilax australis*). The ground layer is partially managed with native flora species including Sydney Golden Wattle (*Acacia longifolia*), Weeping Grass (*Microlaena stipoides*), Whiteroot (*Lobelia purpurascens*), Native Ginger (*Alpinia caerulea*), Spiny-headed Mat-rush (*Lomandra longifolia*) and *Dianella caerulea* var. *producta*. Interspersed within the ground layer were exotic flora species including Broadleaf Paspalum (*Paspalum mandiocanum*), *Oxalis* spp. and Narrow-leafed Carpet Grass (*Axonopus fissifolius*).

Plate 16 Representative photograph of PCT 3171 (Low condition) below the Kooloonbung Creek outflow.

### *4.3.3 PCT 4091 Grey Mangrove-River Mangrove Forest*

Approximately 9.85 ha of PCT 4091 was mapped below the Kooloonbung Creek outflow in good condition.

In PCT 4091, the canopy, mid-layer and ground layer was dominated by Grey Mangrove (*Avicennia marina* subsp. *australasica*) and River Mangrove (*Aegiceras corniculatum*).

Plate 17 Representative photograph of PCT 4091 below the Kooloonbung Creek outflow.

### *4.3.4 PCT 4103 Sporobolus virginicus Saltmarsh*

Approximately 2.62 ha of PCT 4103 was mapped below the Kooloonbung Creek outflow in good condition.

In PCT 4103, the canopy exhibited very occasional Swamp Oak (*Casuarina glauca*) and a very occasional mid-layer of Grey Mangrove (*Avicennia marina* subsp. *australasica*). The ground layer was almost exclusively dominated by Sea Rush (*Juncus kraussii* subsp. *australiensis*), with very occasional Bare Twig-rush (*Machaerina juncea*) and Common Reed (*Phragmites australis*).

The example of this PCT below the Kooloonbung Creek outflow is associated with the TECs Coastal Saltmarsh in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (Endangered; BC Act) and Subtropical and Temperate Coastal Saltmarsh (Vulnerable; EPBC Act).

Plate 18 Representative photograph of PCT 4103 below the Kooloonbung Creek outflow.

### *4.3.5 PCT 4047 Northern Swamp Mahogany-Bottlebrush Swamp Forest*

Approximately 0.55 ha of PCT 4047 was mapped below the Kooloonbung Creek outflow in good condition.

In PCT 4047, the canopy was dominated by planted Swamp Mahogany (*Eucalyptus robusta*), Blackbutt (*Eucalyptus pilularis*) and Forest Red Gum (*Eucalyptus pilularis*). The mid-storey and ground storey are managed with a ground storey domination by Broadleaf Paspalum (*Paspalum mandiocanum*) and Couch (*Cynodon dactylon*).

The example of this PCT below the Kooloonbung Creek outflow was considered for association with the TECs Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions (Endangered; BC Act) and Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland (Endangered; EPBC Act). However, based on the managed weedy understorey and absence of features consistent with these TECs, PCT 4047 was ultimately considered not to align with these TECs.

Plate 19 Representative photograph of PCT 4047 below the Kooloonbung Creek outflow.

### *4.3.6 Exotic Vegetation*

Approximately 4.13 ha of exotic vegetation was mapped below the Kooloonbung Creek outflow.

Canopy cover was predominantly absent, however occasional Brush Box (*Lophostemon confertus*) and Red Cedar (*Toona ciliata*) did occur. The ground layer consisted of predominantly exotic species including Torpedo Grass (*Panicum repens*), Couch (*Cynodon dactylon*) and Kikuyu Grass (*Cenchrus clandestinus*). Occasional native flora species were observed in the ground layer including Indian Pennywort (*Centella asiatica*).

Plate 20 Representative photograph of the exotic vegetation below the Kooloonbung Creek outflow.

## 4.4 THREATENED ECOLOGICAL COMMUNITIES

The TECs identified within the subject land is listed in Table 18 and its extent is shown on Figure 44 and Figure 45.

Table 18 TEC within the Subject land

| TEC Name | Profile ID (from TBDC) | BC Act status | EPBC Act status | Vegetation zones within the Subject Land | Area within Subject Land (ha) |
|---|---|---|---|---|---|
| Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions | 10786 | Endangered | Not listed | VZ9 | 0.04 |
| Coastal Swamp Sclerophyll Forest of New south Wales and South East Queensland | - | Not listed | Endangered | | |
| Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions | 10929 | Not listed | Endangered | VZ8 | 1.67 |

## 4.5 VEGETATION ZONES

Vegetation zones were determined based on the PCTs within the subject land and are stratified based on broad condition state. This resulted in nine vegetation zones being identified within the Subject Land (Table 19, Figure 38 - Figure 43). As the BAM Calculator requires the assignment of a PCT type to a vegetation zone, regardless of condition class, exotic vegetation is entered under PCT 3544 for the purposes of calculator entry to obtain a Vegetation Integrity Score.

Patch size classes were calculated by adding native vegetation that is within 100 metres from each other (or less than 30m metres form non-woody ecosystems) in accordance with Section 4.3.2 of the BAM.

Table 19 Vegetation zones mapped within the subject land

| Vegetation Zone ID | PCT ID number and name | Condition / other defining feature | Area (ha) | Patch size class | No. vegetation integrity plots required | No. vegetation integrity plots completed | No. vegetation integrity plots used in assessment | Plot IDs of vegetation integrity plots used in assessment |
|---|---|---|---|---|---|---|---|---|
| VZ1 | 3167 Northern Hinterland Blackbutt-Forest Oak Wet Forest | Low | 0.18 | ☐ <5 ha<br>☐ 5-24 ha<br>☐ 25-100 ha<br>☒ >100 ha | 1 | 1 | 1 | BAM13 |
| VZ2 | 3167 Northern Hinterland Blackbutt-Forest Oak Wet Forest | Moderate | 0.6 | ☐ <5 ha<br>☐ 5-24 ha<br>☐ 25-100 ha<br>☒ >100 ha | 1 | 2 | 1 | BAM19 |
| VZ3 | 3250 Northern Foothills Blackbutt Grassy Forest | Low | 0.13 | ☐ <5 ha<br>☐ 5-24 ha<br>☐ 25-100 ha<br>☒ >100 ha | 1 | 1 | 1 | BAM22 |
| VZ4 | 3250 Northern Foothills Blackbutt Grassy Forest | Moderate - Good | 0.61 | ☐ <5 ha<br>☐ 5-24 ha<br>☐ 25-100 ha<br>☒ >100 ha | 1 | 1 | 1 | BAM17 |
| VZ5 | 3544 Coastal Sands Apple-Blackbutt Forest | Exotic | 17.5 | ☐ <5 ha<br>☐ 5-24 ha<br>☐ 25-100 ha<br>☒ >100 ha | 4 | 4 | 4 | BAM2, BAM3, BAM14, BAM20, |
| VZ6 | 3544 Coastal Sands Apple-Blackbutt Forest | Low | 1.61 | ☐ <5 ha<br>☐ 5-24 ha<br>☐ 25-100 ha<br>☒ >100 ha | 1 | 2 | 1 | BAM15 |
| VZ7 | 3544 Coastal Sands Apple-Blackbutt Forest | Moderate | 0.21 | ☐ <5 ha<br>☐ 5-24 ha<br>☐ 25-100 ha<br>☒ >100 ha | 1 | 2 | 1 | BAM21 |
| VZ8 | 3967 - Northern Lower Floodplain Eleocharis Wetland | Good | 1.67 | ☐ <5 ha<br>☐ 5-24 ha<br>☐ 25-100 ha<br>☒ >100 ha | 1 | 4 | 1 | BAM10 |
| VZ9 | 4006 Northern Paperbark-Swamp Mahogany Saw-sedge Forest | Low | 0.04 | ☐ <5 ha<br>☐ 5-24 ha<br>☐ 25-100 ha<br>☒ >100 ha | 1 | 1 | 1 | BAM19 |

## 4.6 VEGETATION INTEGRITY ASSESSMENT

### *4.6.1 Vegetation Integrity Scores*

Plot data were entered into the BAM calculator to determine vegetation integrity score. Plot data are presented in Appendix 1 and Appendix 2. Vegetation integrity scores were calculated for each vegetation zone and are provided in Table 20.

Table 20 Vegetation zone integrity score

| Vegetation Zone ID | Composition condition score | Structure condition score | Function condition score | Vegetation integrity score | Hollow bearing trees present (Y/N) |
|---|---|---|---|---|---|
| VZ1 | 73.2 | 32.6 | 80.1 | 57.6 | N |
| VZ2 | 70.6 | 76.1 | 80 | 75.5 | Y |
| VZ3 | 41.3 | 55.3 | 56 | 50.4 | N |
| VZ4 | 95.1 | 75.8 | 80.1 | 83.3 | N |
| VZ5 | 7.6 | 1.6 | 5.7 | 4.1 | Y |
| VZ6 | 6.9 | 23.4 | 15 | 13.4 | N |
| VZ7 | 59.7 | 43.1 | 68.5 | 56.1 | N |
| VZ8 | 48.9 | 100 | - | 70 | N |
| VZ9 | 75.5 | 45 | 65.5 | 60.6 | N |

As outlined in Section 9.2 of the BAM, an offset is required for impacts to native vegetation where the vegetation integrity score is:

- ≥15 where the PCT is representative of an endangered or critically endangered ecological community.
- ≥17 where the PCT is associated with threatened species habitat (as represented by ecosystem credits), or is representative of a vulnerable ecological community.
- ≥20 where the PCT is not representative of a TEC or associated with threatened species habitat.

### *4.6.2 Use of Benchmark Data*

PCT benchmark data used to assess vegetation integrity attributes was attained from BioNet Vegetation Classification (accessed May 2024).

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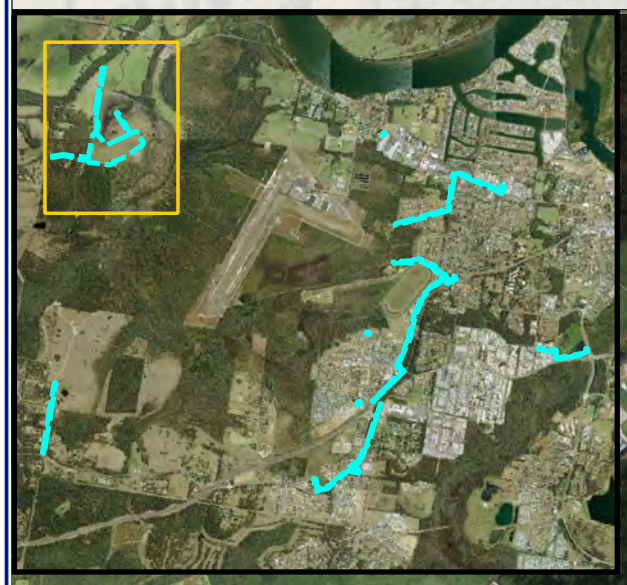

## LEGEND

- Subject Land

***BAM Plot Surveys***

- BAM Plot (20x20 m)
- BAM Plot Transect (50 m)

***Threatened Species Surveys***

- Threatened Flora Species Survey - March
- Threatened Flora Species Survey - April
- Threatened Flora Species Survey - September
- Threatened Flora Species Survey - November

BAM Plot 11
BAM Plot 8
BAM Plot 9
BAM Plot 7
BAM Plot 4
BAM Plot 5
BAM Plot 17
BAM Plot 3
BAM Plot 10
BAM Plot 15
BAM Plot 22
BAM Plot 2
BAM Plot 21
BAM Plot 1
BAM Plot 6

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| | | | | | |
|---|---|---|---|---|---|
| FIGURE 16 | **FIELD SURVEY LOCATIONS - FLORA** | | | | |
| JOB ADDRESS: | PORT MACQUARIE-HASTINGS COUNCIL AREA | | | | |
| CLIENT: | PORT MACQUARIE-HASTINGS COUNCIL | | | | |
| A3 SCALE: | 1:5,000 | DRAWN: | BH | JOB REF: | EC217 |
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0 125 250 375 500 m

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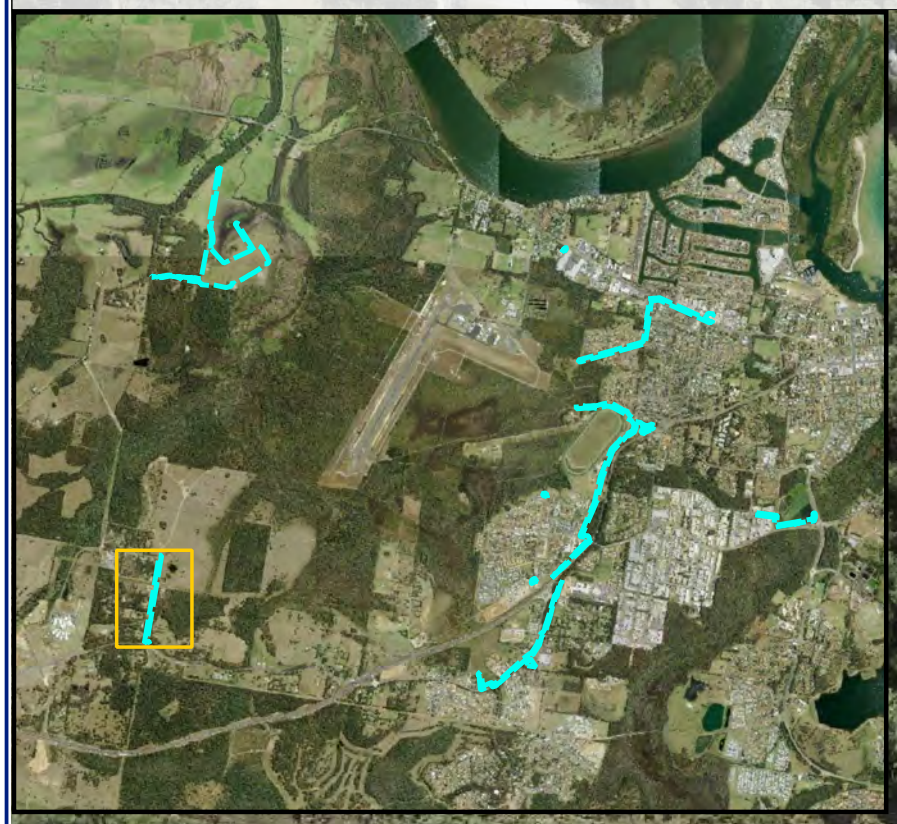

## LEGEND

Subject Land

***Threatened Species Surveys***

Threatened Flora Species Survey - November

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| FIGURE 17 | **FIELD SURVEY LOCATIONS - FLORA** | | | | |
| JOB ADDRESS: | PORT MACQUARIE-HASTINGS COUNCIL AREA | | | | |
| CLIENT: | PORT MACQUARIE-HASTINGS COUNCIL | | | | |
| A3 SCALE: | 1:2,300 | DRAWN: | BH | JOB REF: | EC217 |
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0 50 100 150 200 250 m

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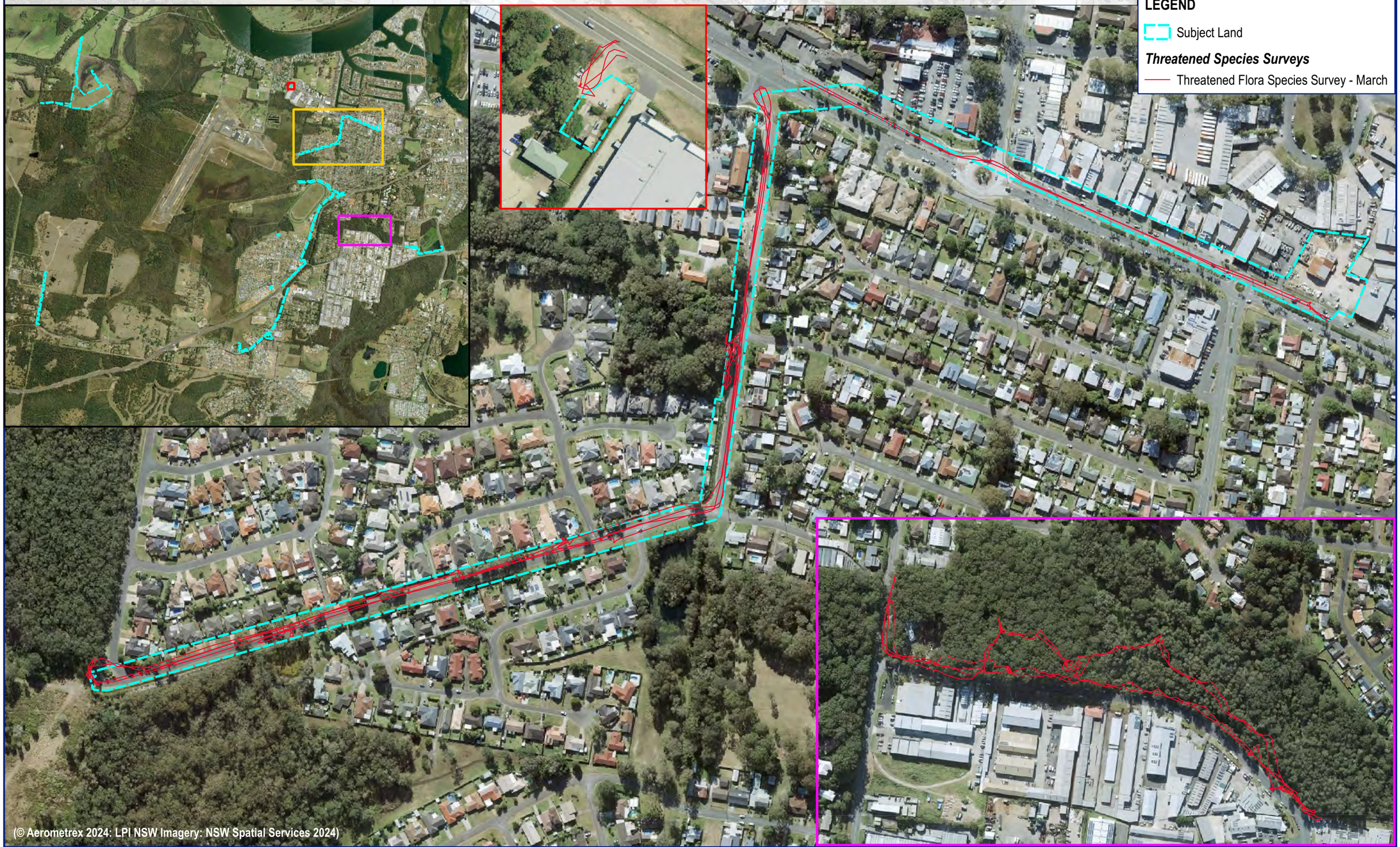


## LEGEND

Subject Land

***Threatened Species Surveys***

Threatened Flora Species Survey - March

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FIGURE 18

# FIELD SURVEY LOCATIONS - FLORA

0 75 150 225 300 m

| | | | | | |
|---|---|---|---|---|---|
| JOB ADDRESS: | PORT MACQUARIE-HASTINGS COUNCIL AREA<br>NSW \| AUSTRALIA | | | | |
| CLIENT: | PORT MACQUARIE-HASTINGS COUNCIL | | | | |
| A3 SCALE: | 1:3,200 | DRAWN: | BH | JOB REF: | EC217 |
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## LEGEND

- Subject Land

***BAM Plot Surveys***

- BAM Plot (20 x 20 m & 40 x 10 m)
- BAM Plot Transect (50 m & 100 m)

***Threatened Species Surveys***

- Threatened Flora Species Survey - March
- Threatened Flora Species Survey - April
- Threatened Flora Species Survey - November
- Threatened Flora Species Survey - September

BAM Plot 18
BAM Plot 14
BAM Plot 13
BAM Plot 16
BAM Plot 12

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| FIGURE 19 | **FIELD SURVEY LOCATIONS - FLORA** | | | | |
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## LEGEND

Subject Land

***BAM Plot Surveys***

BAM Plot (20 x 20 m)

BAM Plot Transect (50 m)

***Threatened Species Surveys***

Threatened Flora Species Survey - April

Threatened Flora Species Survey - September

Threatened Flora Species Survey - November

BAM Plot 20

BAM Plot 19

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| FIGURE 20 | **FIELD SURVEY LOCATIONS - FLORA** | | | | |
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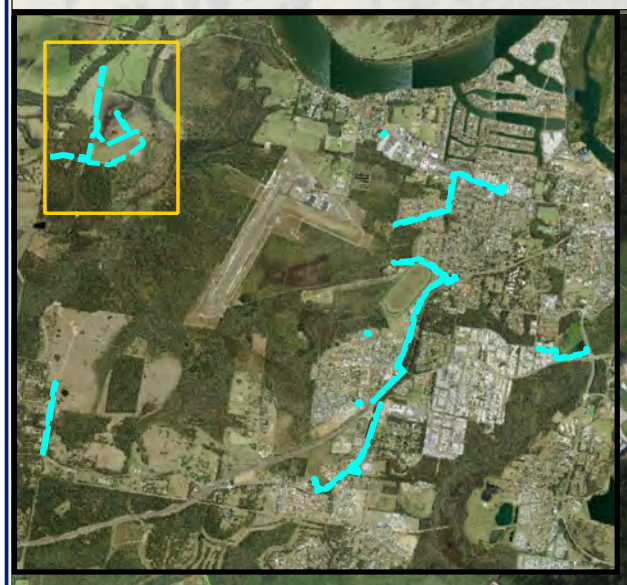

## LEGEND

- Subject Land

***Threatened Species Surveys***

- Threatened Frog Survey - November
- Threatened Reptile Survey - November
- Glossy Black Cockatoo Survey
- Green Thighed Frog Survey

*Call Playback / Aural Listening Point*

- Green-thighed Frog
- Frogs (November Surveys)

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| FIGURE 21 | **FIELD SURVEY LOCATIONS - FAUNA** | | | | |
| JOB ADDRESS: | PORT MACQUARIE-HASTINGS COUNCIL AREA | | | | |
| CLIENT: | PORT MACQUARIE-HASTINGS COUNCIL | | | | |
| A3 SCALE: | 1:5,000 | DRAWN: | BH | JOB REF: | EC217 |
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## LEGEND

Subject Land

***Threatened Species Surveys***

Glossy Black Cockatoo Survey

Green Thigh Frog Survey

***Call Playback / Aural Listening Point***

Green-thighed Frog

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| FIGURE 22 | **FIELD SURVEY LOCATIONS - FAUNA** | | | | |
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## LEGEND

Subject Land

***Threatened Species Surveys***

Glossy Black Cockatoo Survey

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|---|---|---|---|---|---|
| FIGURE 23 | **FIELD SURVEY LOCATIONS - FAUNA** | | | | |
| JOB ADDRESS: | PORT MACQUARIE-HASTINGS COUNCIL AREA | | | | |
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## LEGEND

Subject Land

***Threatened Species Surveys***

Glossy Black Cockatoo Survey

Threatened Frog Survey - March

***Call Playback / Aural Listening Point***

Frogs (March Surveys)

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|---|---|---|---|---|---|
| FIGURE 24 | **FIELD SURVEY LOCATIONS - FAUNA** | | | | |
| JOB ADDRESS: | PORT MACQUARIE-HASTINGS COUNCIL AREA | | | | |
| CLIENT: | PORT MACQUARIE-HASTINGS COUNCIL | | | | |
| A3 SCALE: | 1:3,500 | DRAWN: | BH | JOB REF: | EC217 |
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0 100 200 300 400 m

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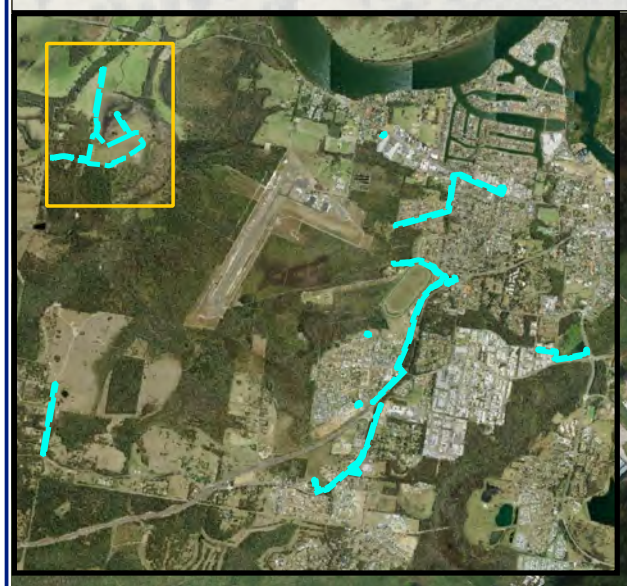

## LEGEND

- Subject Land

***Threatened Species Surveys***

- Threatened Fauna Survey - Spotlighting
- Threatened Fauna Survey - Trap Checks (Arboreal / Pitfall)

***Trap Locations***

- Arboreal Trap (Elliott B)

*Remote Camera Traps*

- Arboreal
- Terrestrial

*Pitfall Trap / Funnel Trap*

- Pitfall & Funnel Traps Present
- Pitfall Trap Only

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|---|---|---|---|---|---|
| FIGURE 25 | **FIELD SURVEY LOCATIONS - FAUNA** | | | | |
| JOB ADDRESS: | PORT MACQUARIE-HASTINGS COUNCIL AREA | | | | |
| CLIENT: | PORT MACQUARIE-HASTINGS COUNCIL | | | | |
| A3 SCALE: | 1:4,750 | DRAWN: | BH | JOB REF: | EC217 |
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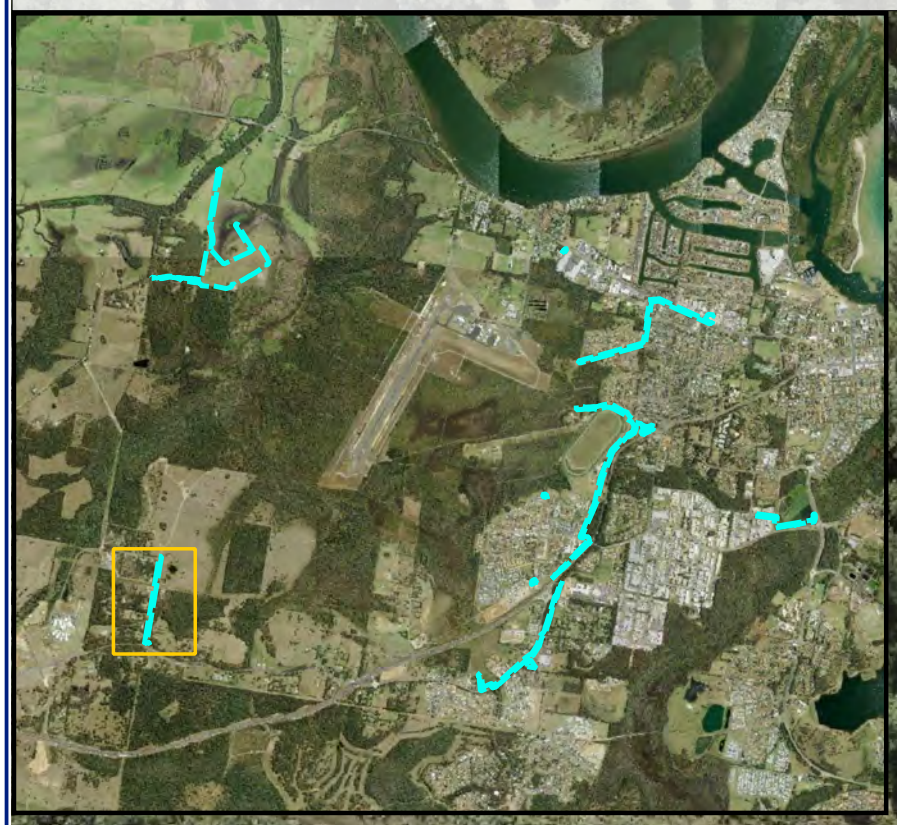

## LEGEND

Subject Land

***Threatened Species Surveys***

Threatened Fauna Survey - Spotlighting

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| FIGURE 26 | **FIELD SURVEY LOCATIONS - FAUNA** | | | | |
| JOB ADDRESS: | PORT MACQUARIE-HASTINGS COUNCIL AREA | | | | |
| CLIENT: | PORT MACQUARIE-HASTINGS COUNCIL | | | | |
| A3 SCALE: | 1:2,500 | DRAWN: | BH | JOB REF: | EC217 |
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0 50 100 150 200 250 m

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## LEGEND

Subject Land

***Threatened Species Surveys***

Threatened Fauna Survey - Spotlighting

Threatened Fauna Survey - Trap Checks (Arboreal)

***Trap Locations***

Arboreal Trap (Elliott B)

*Remote Camera Trap*

Arboreal

Terrestrial

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|---|---|---|---|---|---|
| FIGURE 27 | **FIELD SURVEY LOCATIONS - FAUNA** | | | | |
| JOB ADDRESS: | PORT MACQUARIE-HASTINGS COUNCIL AREA | | | | |
| CLIENT: | PORT MACQUARIE-HASTINGS COUNCIL | | | | |
| A3 SCALE: | 1:4,200 | DRAWN: | BH | JOB REF: | EC217 |
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## LEGEND

Subject Land

***Threatened Species Surveys***

Threatened Fauna Survey - Spotlighting

Threatened Fauna Survey - Trap Checks (Arboreal)

***Trap Locations***

Arboreal Trap (Elliott B)

*Remote Camera Traps*

Arboreal

Terrestrial

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| FIGURE 28 | **FIELD SURVEY LOCATIONS - FAUNA** | | | | |
| JOB ADDRESS: | PORT MACQUARIE-HASTINGS COUNCIL AREA | | | | |
| CLIENT: | PORT MACQUARIE-HASTINGS COUNCIL | | | | |
| A3 SCALE: | 1:4,500 | DRAWN: | BH | JOB REF: | EC217 |
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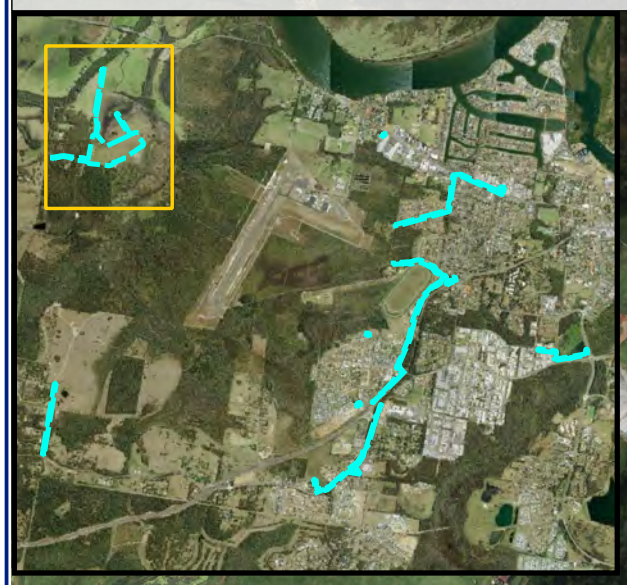

## LEGEND

- Subject Land

***Threatened Species Surveys***

- Laced Fritillary Survey - Phase 1 (June)
- Laced Fritillary Survey - Phase 2 (Sept - Oct)
- Giant Dragonfly Survey (January)

***Call Playback / Aural Listening Point***

- Bush-stone Curlew

***Trap Locations***

- Ultrasonic Bat Detectors

BAT 4

BAT 1

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| FIGURE 29 | **FIELD SURVEY LOCATIONS - FAUNA** | | | | |
| JOB ADDRESS: | PORT MACQUARIE-HASTINGS COUNCIL AREA | | | | |
| CLIENT: | PORT MACQUARIE-HASTINGS COUNCIL | | | | |
| A3 SCALE: | 1:4,750 | DRAWN: | BH | JOB REF: | EC217 |
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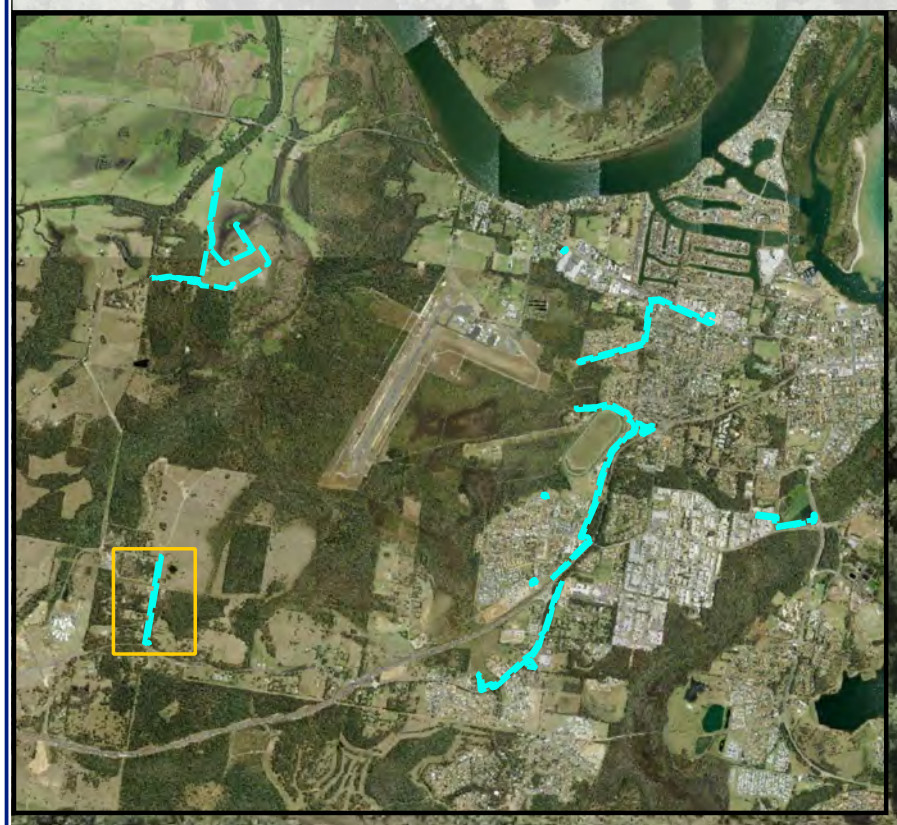

## LEGEND

Subject Land

***Threatened Species Surveys***

Laced Fritillary Survey - Phase 1 (June)

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| FIGURE 30 | **FIELD SURVEY LOCATIONS - FAUNA** | | | | |
| JOB ADDRESS: | PORT MACQUARIE-HASTINGS COUNCIL AREA | | | | |
| CLIENT: | PORT MACQUARIE-HASTINGS COUNCIL | | | | |
| A3 SCALE: | 1:2,500 | DRAWN: | BH | JOB REF: | EC217 |
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## LEGEND

Subject Land

***Threatened Species Surveys***

Laced Fritillary Survey - Phase 1 (June)

Laced Fritillary Survey - Phase 2 (Sept - Oct)

***Call Playback / Aural Listening Point***

Bush-stone Curlew

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| FIGURE 31 | **FIELD SURVEY LOCATIONS - FAUNA** | | | | |
| JOB ADDRESS: | PORT MACQUARIE-HASTINGS COUNCIL AREA | | | | |
| CLIENT: | PORT MACQUARIE-HASTINGS COUNCIL | | | | |
| A3 SCALE: | 1:4,200 | DRAWN: | BH | JOB REF: | EC217 |
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## LEGEND

Subject Land

***Threatened Species Surveys***

Laced Fritillary Survey - Phase 1 (June)

Laced Fritillary Survey - Phase 2 (Sept - Oct)

***Trap Locations***

Ultrasonic Bat Detectors

BAT 2

BAT 3

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| FIGURE 32 | **FIELD SURVEY LOCATIONS - FAUNA** | | | | |
| JOB ADDRESS: | PORT MACQUARIE-HASTINGS COUNCIL AREA | | | | |
| CLIENT: | PORT MACQUARIE-HASTINGS COUNCIL | | | | |
| A3 SCALE: | 1:4,500 | DRAWN: | BH | JOB REF: | EC217 |
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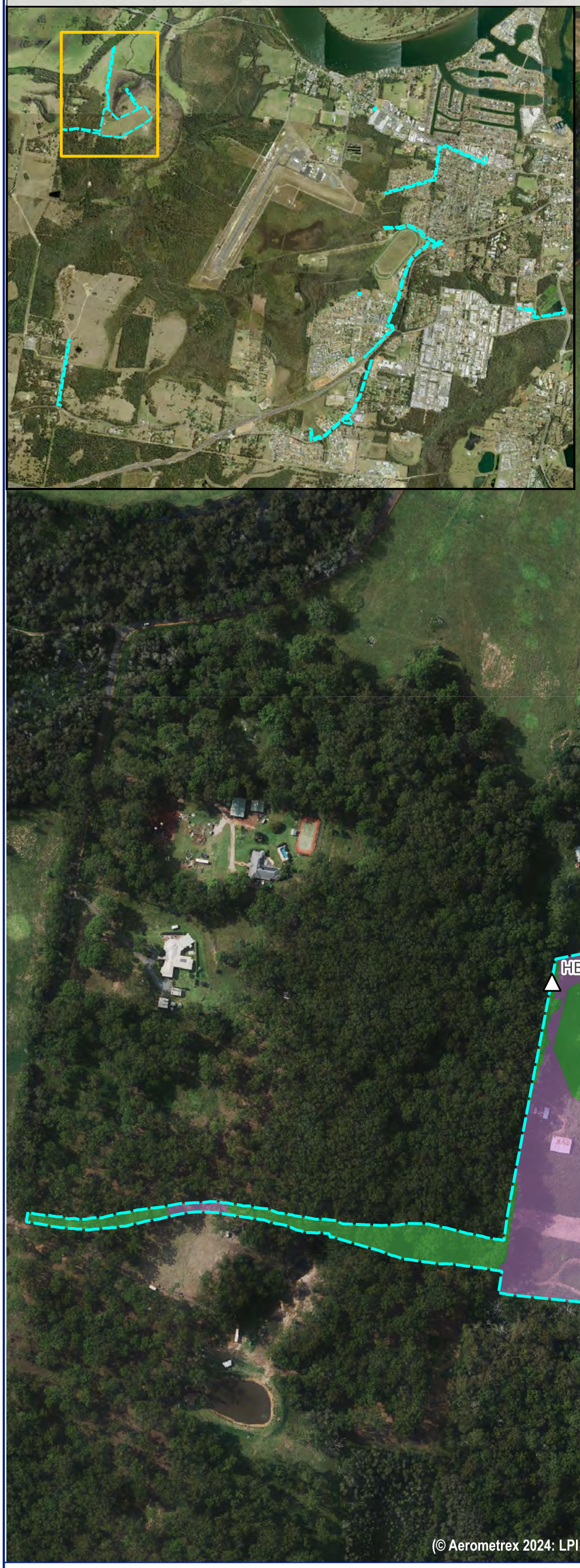


**LEGEND**

- Subject Land
- Hollow Bearing Trees

*Native Vegetation Extent*

- Native
- Exotic
- Roads / Cleared / Structures

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| FIGURE 33 | **NATIVE VEGETATION EXTENT** | | | | |
| JOB ADDRESS: | PORT MACQUARIE-HASTINGS COUNCIL AREA | | | | |
| CLIENT: | PORT MACQUARIE-HASTINGS COUNCIL | | | | |
| A3 SCALE: | 1:3,900 | DRAWN: | BH | JOB REF: | EC217 |
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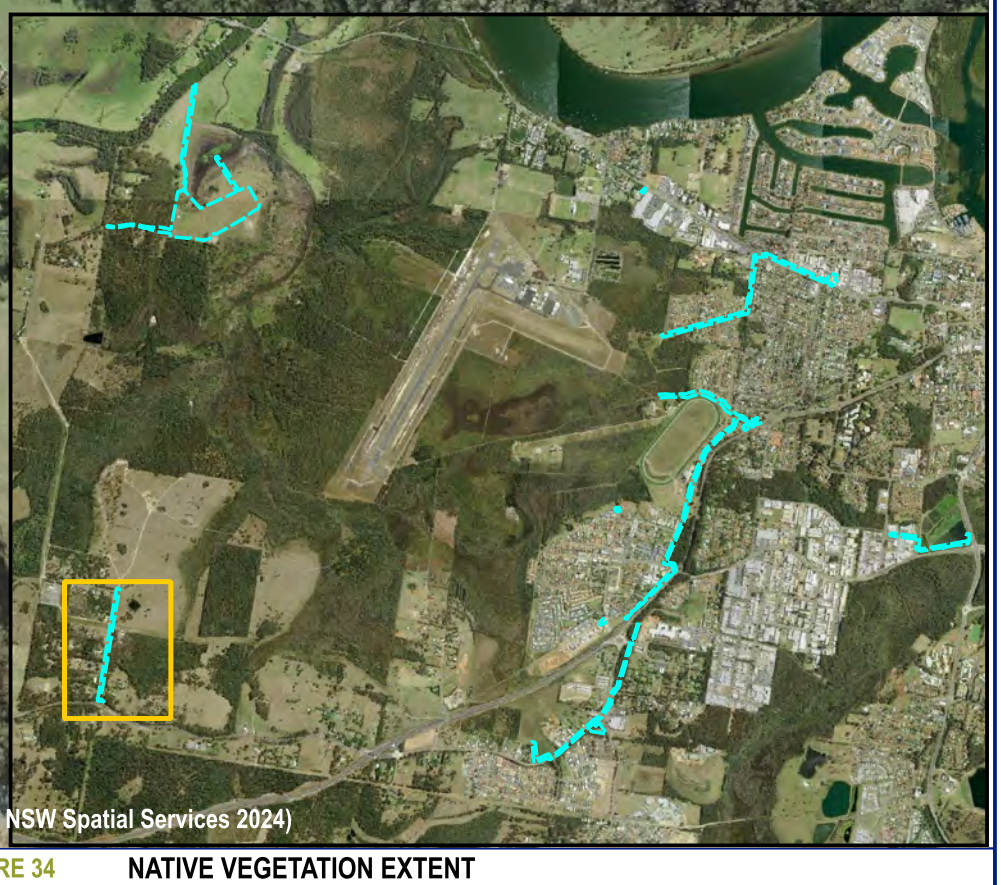
**LEGEND**

- Subject Land

*Native Vegetation Extent*

- Exotic
- Roads / Cleared / Structures



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| FIGURE 34 | **NATIVE VEGETATION EXTENT** | | | | |
| JOB ADDRESS: | PORT MACQUARIE-HASTINGS COUNCIL AREA | | | | |
| CLIENT: | PORT MACQUARIE-HASTINGS COUNCIL | | | | |
| A3 SCALE: | 1:2,500 | DRAWN: | BH | JOB REF: | EC217 |
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0 50 100 150 200 250 m

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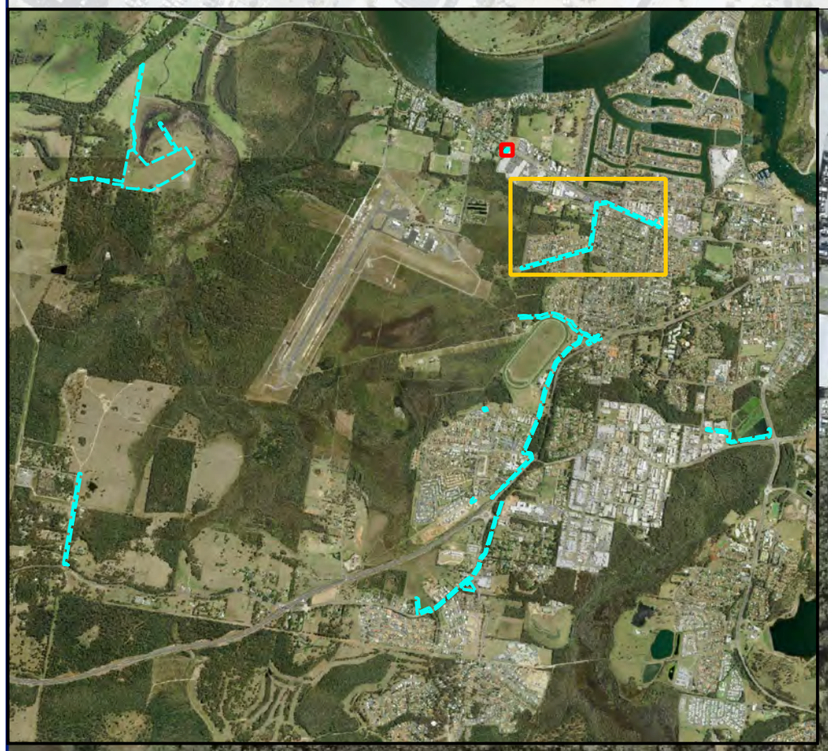

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FIGURE 35

## NATIVE VEGETATION EXTENT

0 75 150 225 300 m

| | | | | | |
|---|---|---|---|---|---|
| JOB ADDRESS: | PORT MACQUARIE-HASTINGS COUNCIL AREA<br>NSW \| AUSTRALIA | | | | |
| CLIENT: | PORT MACQUARIE-HASTINGS COUNCIL | | | | |
| A3 SCALE: | 1:3,200 | DRAWN: | BH | JOB REF: | EC217 |
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## LEGEND

- Subject Land
- Hollow Bearing Trees

*Native Vegetation Extent*

- Native
- Exotic
- Roads / Cleared / Structures

HBT 5

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|---|---|---|---|---|---|
| FIGURE 36 | **NATIVE VEGETATION EXTENT** | | | | |
| JOB ADDRESS: | PORT MACQUARIE-HASTINGS COUNCIL AREA | | | | |
| CLIENT: | PORT MACQUARIE-HASTINGS COUNCIL | | | | |
| A3 SCALE: | 1:4,000 | DRAWN: | BH | JOB REF: | EC217 |
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## LEGEND

- Subject Land
- Hollow Bearing Trees

*Native Vegetation Extent*

- Native
- Exotic
- Roads / Cleared / Structures

HBT 1
HBT 2
HBT 3
HBT 4
HBT 7

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| FIGURE 37 | **NATIVE VEGETATION EXTENT** | | | | |
| JOB ADDRESS: | PORT MACQUARIE-HASTINGS COUNCIL AREA | | | | |
| CLIENT: | PORT MACQUARIE-HASTINGS COUNCIL | | | | |
| A3 SCALE: | 1:4,200 | DRAWN: | BH | JOB REF: | EC217 |
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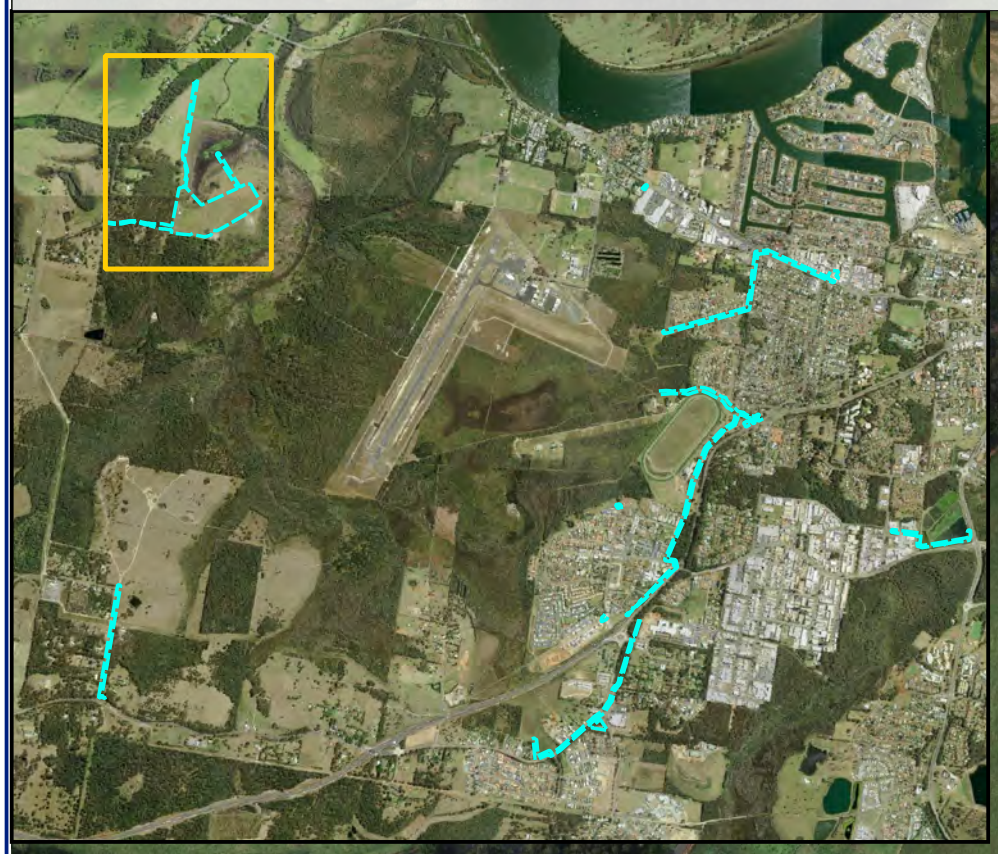

## LEGEND

- Subject Land

*Plant Community Type (Vegetation Zone)*

- PCT 3250 Northern Foothills Blackbutt Grassy Forest (Low) (VZ 3)
- PCT 3250 Northern Foothills Blackbutt Grassy Forest (Moderate-Good) (VZ 4)
- PCT 3544 Coastal Sands Apple-Blackbutt Forest (Low) (VZ 6)
- PCT 3544 Coastal Sands Apple-Blackbutt Forest (Moderate) (VZ 7)
- PCT 3967 Northern Lower Floodplain Eleocharis Wetland (Good) (VZ 8)
- Exotic (VZ 5)
- Roads / Cleared Structures

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| FIGURE 38 | **PLANT COMMUNITY TYPE & VEGETATION ZONE** | | | | |
| JOB ADDRESS: | PORT MACQUARIE-HASTINGS COUNCIL AREA | | | | |
| CLIENT: | PORT MACQUARIE-HASTINGS COUNCIL | | | | |
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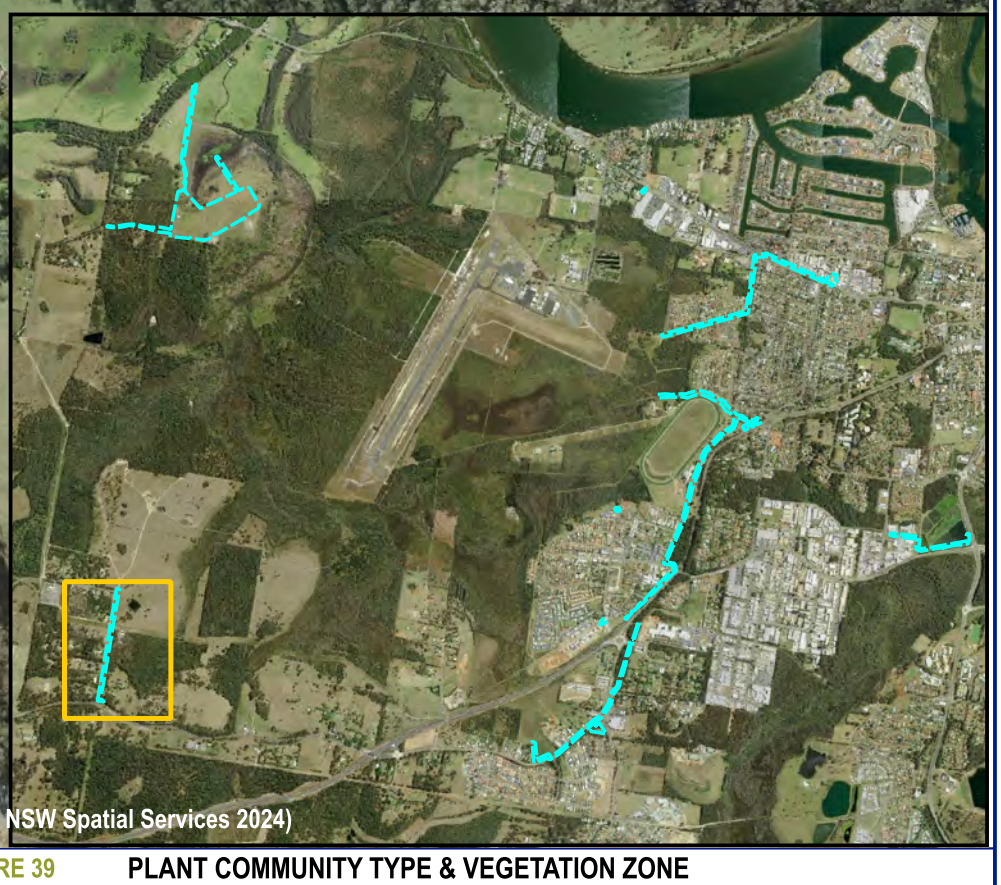
## LEGEND

Subject Land

*Plant Community Type (Vegetation Zone)*

Exotic (VZ 5)

Roads / Cleared Structures



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| | | | | | |
|---|---|---|---|---|---|
| FIGURE 39 | **PLANT COMMUNITY TYPE & VEGETATION ZONE** | | | | |
| JOB ADDRESS: | PORT MACQUARIE-HASTINGS COUNCIL AREA | | | | |
| CLIENT: | PORT MACQUARIE-HASTINGS COUNCIL | | | | |
| A3 SCALE: | 1:2,500 | DRAWN: | BH | JOB REF: | EC217 |
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0 50 100 150 200 250 m

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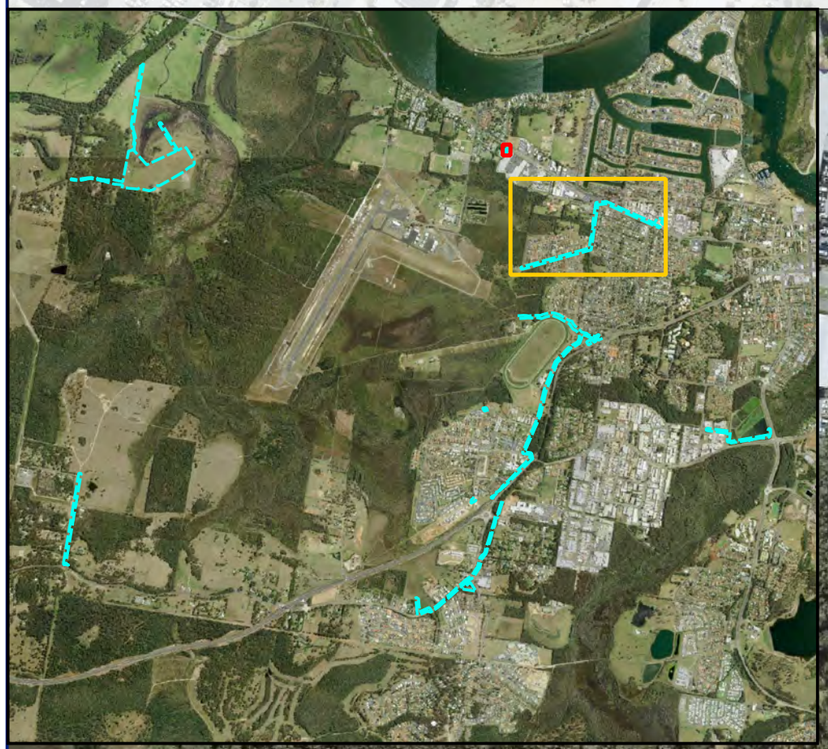

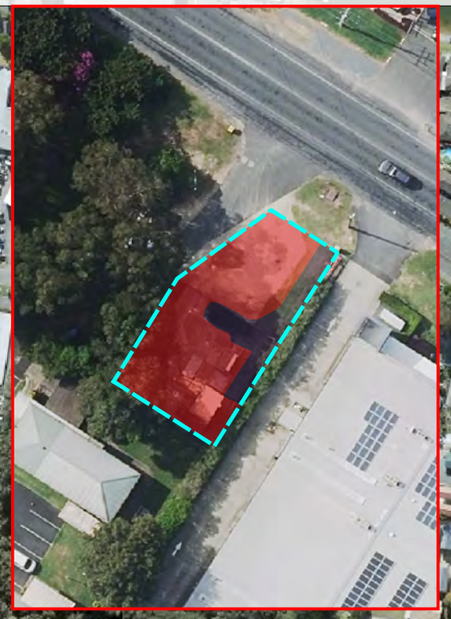

## LEGEND

- Subject Land

Plant Community Type (Vegetation Zones)

- Exotic (VZ 5)
- Roads / Cleared Structures

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FIGURE 40

# PLANT COMMUNITY TYPE & VEGETATION ZONE

0 75 150 225 300 m

| | | | | | |
|---|---|---|---|---|---|
| JOB ADDRESS: | PORT MACQUARIE-HASTINGS COUNCIL AREA<br>NSW \| AUSTRALIA | | | | |
| CLIENT: | PORT MACQUARIE-HASTINGS COUNCIL | | | | |
| A3 SCALE: | 1:3,200 | DRAWN: | BH | JOB REF: | EC217 |
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## LEGEND

Subject Land

*Plant Community Type (Vegetation Zone)*

- PCT 3167 Northern Hinterland Blackbutt-Forest Oak Wet Forest (VZ 1)
- PCT 4006 Northern Paperbark-Swamp Mahogany Saw-sedge Forest (VZ 9)
- Exotic (VZ 5)
- Roads / Cleared / Structures

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| | | | | | |
|---|---|---|---|---|---|
| FIGURE 41 | **PLANT COMMUNITY TYPE & VEGETATION ZONE** | | | | |
| JOB ADDRESS: | PORT MACQUARIE-HASTINGS COUNCIL AREA | | | | |
| CLIENT: | PORT MACQUARIE-HASTINGS COUNCIL | | | | |
| A3 SCALE: | 1:4,000 | DRAWN: | BH | JOB REF: | EC217 |
| PLAN DATE: | 18/07/2024 | CHECKED: | RS | ISSUE: | 02 |

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## LEGEND

- Subject Land

*Plant Community Type (Vegetation Zone)*

- PCT 3167 Northern Hinterland Blackbutt-Forest Oak Wet Forest (Low) (VZ 1)
- PCT 3167 Northern Hinterland Blackbutt-Forest Oak Wet Forest (Moderate) (VZ 2)
- Exotic (VZ 5)
- Roads / Cleared Structures

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| | | | | | |
|---|---|---|---|---|---|
| FIGURE 42 | **PLANT COMMUNITY TYPE & VEGETATION ZONE** | | | | |
| JOB ADDRESS: | PORT MACQUARIE-HASTINGS COUNCIL AREA | | | | |
| CLIENT: | PORT MACQUARIE-HASTINGS COUNCIL | | | | |
| A3 SCALE: | 1:4,200 | DRAWN: | BH | JOB REF: | EC217 |
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## LEGEND

- Subject Land

*Plant Community Type*

- Exotic
- PCT 3171 - Northern Lowland Viney Wet Forest (Good)
- PCT 3171 - Northern Lowland Viney Wet Forest (Low)
- PCT 4004 - Northern *Melaleuca quinquenervia* Swamp Forest (Good)
- PCT 4047 - Northern Swamp Mahogany-Bottlebrush Swamp Forest (Low)
- PCT 4091 - Grey Mangrove-River Mangrove Forest (Good)
- PCT 4103 - *Sporobolus virginicus* Saltmarsh (Good)
- Roads / Cleared Structures

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| | | | | | |
|---|---|---|---|---|---|
| FIGURE 43 | **PLANT COMMUNITY TYPE & VEGETATION ZONE** | | | | |
| JOB ADDRESS: | PORT MACQUARIE-HASTINGS COUNCIL AREA | | | | |
| CLIENT: | PORT MACQUARIE-HASTINGS COUNCIL | | | | |
| A3 SCALE: | 1:5,000 | DRAWN: | BH | JOB REF: | EC217 |
| PLAN DATE: | 18/07/2024 | CHECKED: | RS | ISSUE: | 02 |

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## LEGEND

Subject Land

*Threatened Ecological Communities*

Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (BC Act)

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| | | | | | |
|---|---|---|---|---|---|
| FIGURE 44 | **THREATENED ECOLOGICAL COMMUNITIES** | | | | |
| JOB ADDRESS: | PORT MACQUARIE-HASTINGS COUNCIL AREA | | | | |
| CLIENT: | PORT MACQUARIE-HASTINGS COUNCIL | | | | |
| A3 SCALE: | 1:2,200 | DRAWN: | BH | JOB REF: | EC217 |
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## LEGEND

Subject Land

*Threatened Ecological Communities*

- Coastal Saltmarsh in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (BC Act)
- Subtropical and Temperate Coastal Saltmarsh (EPBC Act)

- Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (BC Act)
- Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland (High Cond Class A) (EPBC Act)

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|---|---|---|---|---|---|
| FIGURE 45 | **THREATENED ECOLOGICAL COMMUNITIES** | | | | |
| JOB ADDRESS: | PORT MACQUARIE-HASTINGS COUNCIL AREA | | | | |
| CLIENT: | PORT MACQUARIE-HASTINGS COUNCIL | | | | |
| A3 SCALE: | 1:5,000 | DRAWN: | BH | JOB REF: | EC217 |
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# 5.0 HABITAT SUITABILITY FOR THREATENED SPECIES

## 5.1 IDENTIFICATION OF THREATENED SPECIES FOR ASSESSMENT

### *5.1.1 Ecosystem Credit Species*

Species reliably predicted to occur based on PCTs present within the Subject Land (i.e. ecosystem credit species) and information obtained from the Threatened Biodiversity Data Collection, were returned from the BAM Offsets Calculator and refined as per Section 5 of the BAM (DPIE 2020a). Impacts to these species require consideration but targeted survey is not required.

Table 21 Predicted ecosystem credit species

| Common Name | Scientific Name | Listing status | | Dual credit species | Sources | Retained for further Assessment | Reason for exclusion | Vegetation zone ID | Sensitivity to gain class |
|---|---|---|---|---|---|---|---|---|---|
| | | BC Act | EPBC Act | | | | | | |
| Pale-vented Bush-hen | *Amaurornis moluccana* | V | - | No | BAM-C, TBDC | No | Species excluded for Geographical Limitations | - | High Sensitivity to Gain |
| Magpie Goose | *Anseranas semipalmata* | V | - | No | BAM-C, TBDC | Yes | Species not excluded | VZ8 | Moderate Sensitivity to Gain |
| Regent Honeyeater | *Anthochaera phrygia* | CE | CE | Yes | BAM-C, TBDC | Yes | Species not excluded | VZ5, VZ6, VZ7, VZ9 | High Sensitivity to Gain |
| Dusky Woodswallow | *Artamus cyanopterus cyanopterus* | V | - | No | BAM-C, TBDC | Yes | Species not excluded | VZ1,VZ2, VZ3, VZ4, VZ6, VZ7, VZ8, VZ9 | Moderate Sensitivity to Gain |
| Australasian Bittern | *Botaurus poiciloptilus* | E | E | No | BAM-C, TBDC | Yes | Species not excluded | VZ8, VZ9 | Moderate Sensitivity to Gain |
| Sanderling | *Calidris alba* | V | - | Yes | BAM-C, TBDC | Yes | Species not excluded | VZ8, VZ9 | High Sensitivity to Gain |
| Red Knot | *Calidris canutus* | - | E | Yes | BAM-C, TBDC | Yes | Species not excluded | VZ8, VZ9 | High Sensitivity to Gain |
| Curlew Sandpiper | *Calidris ferruginea* | E | CE | Yes | BAM-C, TBDC | Yes | Species not excluded | VZ8, VZ9 | High Sensitivity to Gain |

| Common Name | Scientific Name | Listing status | | Dual credit species | Sources | Retained for further Assessment | Reason for exclusion | Vegetation zone ID | Sensitivity to gain class |
|---|---|---|---|---|---|---|---|---|---|
| | | BC Act | EPBC Act | | | | | | |
| Great Knot | *Calidris tenuirostris* | V | V | Yes | BAM-C, TBDC | Yes | Species not excluded | VZ8, VZ9 | High Sensitivity to Gain |
| Glossy Black-Cockatoo | *Calyptorhynchus lathami* | V | V | Yes | BAM-C, TBDC | Yes | Species not excluded | VZ1,VZ2, VZ3, VZ4, VZ6, VZ7, VZ9 | High Sensitivity to Gain |
| Hoary Wattled Bat | *Chalinolobus nigrogriseus* | V | - | No | BAM-C, TBDC | Yes | Species not excluded | VZ1, VZ2, VZ3, VZ4 | High Sensitivity to Gain |
| Greater Sand-plover | *Charadrius leschenaultii* | V | V | Yes | BAM-C, TBDC | Yes | Species not excluded | VZ8, VZ9 | High Sensitivity to Gain |
| Lesser Sand-plover | *Charadrius mongolus* | V | E | Yes | BAM-C, TBDC | Yes | Species not excluded | VZ8, VZ9 | High Sensitivity to Gain |
| Speckled Warbler | *Chthonicola sagittata* | V | - | No | BAM-C, TBDC | Yes | Species not excluded | VZ3, VZ4, VZ6, VZ7 | High Sensitivity to Gain |
| Spotted Harrier | *Circus assimilis* | V | - | No | BAM-C, TBDC | Yes | Species not excluded | VZ6, VZ7, VZ8, VZ9 | Moderate Sensitivity to Gain |
| Brown Treecreeper (eastern subspecies) | *Climacteris picumnus victoriae* | V | V | No | BAM-C, TBDC | Yes | Species not excluded | VZ1,VZ2, VZ3, VZ4, VZ6, VZ7, VZ9 | High Sensitivity to Gain |
| Barred Cuckoo-shrike | *Coracina lineata* | V | - | No | BAM-C, TBDC | Yes | Species not excluded | VZ1, VZ2, VZ3, VZ4, VZ9 | Moderate Sensitivity to Gain |
| Varied Sittella | *Daphoenositta chrysoptera* | V | - | No | BAM-C, TBDC | Yes | Species not excluded | VZ1,VZ2, VZ3, VZ4, VZ6, VZ7, VZ8, VZ9 | Moderate Sensitivity to Gain |

| Common Name | Scientific Name | Listing status | | Dual credit species | Sources | Retained for further Assessment | Reason for exclusion | Vegetation zone ID | Sensitivity to gain class |
|---|---|---|---|---|---|---|---|---|---|
| | | BC Act | EPBC Act | | | | | | |
| Spotted-tailed Quoll | *Dasyurus maculatus* | V | E | No | BAM-C, TBDC | Yes | Species not excluded | VZ1,VZ2, VZ3, VZ4, VZ6, VZ7, VZ8, VZ9 | High Sensitivity to Gain |
| Black-necked Stork | *Ephippiorhynchus asiaticus* | E | - | No | BAM-C, TBDC | Yes | Species not excluded | VZ1, VZ2, VZ3, VZ4, VZ5, VZ6, VZ7, VZ8, VZ9 | Moderate Sensitivity to Gain |
| White-fronted Chat | *Epthianura albifrons* | V | - | No | BAM-C, TBDC | Yes | Species not excluded | VZ8 | Moderate Sensitivity to Gain |
| Beach Stone-curlew | *Esacus magnirostris* | CE | - | Yes | BAM-C, TBDC | Yes | Species not excluded | VZ3, VZ4, VZ5, VZ6, VZ7 | High Sensitivity to Gain |
| Eastern False Pipistrelle | *Falsistrellus tasmaniensis* | V | - | No | BAM-C, TBDC | Yes | Species not excluded | VZ1 VZ2, VZ3, VZ4, VZ5, VZ6, VZ7, VZ8, VZ9 | High Sensitivity to Gain |
| Little Lorikeet | *Glossopsitta pusilla* | V | - | No | BAM-C, TBDC | Yes | Species not excluded | VZ1,VZ2, VZ3, VZ4, VZ5, VZ6, VZ7, VZ9 | High Sensitivity to Gain |
| Brolga | *Grus rubicunda* | V | - | No | BAM-C, TBDC | Yes | Species not excluded | VZ8 | Moderate Sensitivity to Gain |
| White-bellied Sea-Eagle | *Haliaeetus leucogaster* | V | - | Yes | BAM-C, TBDC | Yes | Species not excluded | VZ1,VZ2, VZ3, VZ4, VZ6, VZ7, VZ8, VZ9 | High Sensitivity to Gain |
| Little Eagle | *Hieraaetus morphnoides* | V | - | Yes | BAM-C, | Yes | Species not excluded | VZ3, VZ4, VZ5, VZ6, VZ7, VZ8, VZ9 | Moderate Sensitivity to Gain |
| White-throated Needletail | *Hirundapus caudacutus* | - | V | No | BAM-C, TBDC | Yes | Species not excluded | VZ1,VZ2, VZ3, VZ4, VZ5, VZ6, VZ7, VZ8, VZ9 | High Sensitivity to Gain |

| Common Name | Scientific Name | Listing status | | Dual credit species | Sources | Retained for further Assessment | Reason for exclusion | Vegetation zone ID | Sensitivity to gain class |
|---|---|---|---|---|---|---|---|---|---|
| | | BC Act | EPBC Act | | | | | | |
| Comb-crested Jacana | *Irediparra gallinacea* | V | - | No | BAM-C, TBDC | Yes | Species not excluded | VZ8 | Moderate Sensitivity to Gain |
| Black Bittern | *Ixobrychus flavicollis* | V | - | No | BAM-C, TBDC | Yes | Species not excluded | VZ1, VZ2, VZ3, VZ4, VZ8, VZ9 | Moderate Sensitivity to Gain |
| Swift Parrot | *Lathamus discolor* | E | CE | Yes | BAM-C, TBDC | Yes | Species not excluded | VZ1,VZ2, VZ3, VZ5, VZ6, VZ7, VZ9 | Moderate Sensitivity to Gain |
| Bar-tailed Godwit (baueri) | *Limosa lapponica baueri* | - | V | Yes | BAM-C, TBDC | Yes | Species not excluded | VZ8, VZ9 | High Sensitivity to Gain |
| Black-tailed Godwit | *Limosa limosa* | V | E | Yes | BAM-C, TBDC | Yes | Species not excluded | VZ8 | High Sensitivity to Gain |
| Square-tailed Kite | *Lophoictinia isura* | V | - | Yes | BAMC, TBDC | Yes | Species not excluded | VZ1,VZ2, VZ3, VZ4, VZ5, VZ6, VZ7, VZ8, VZ9 | Moderate Sensitivity to Gain |
| Hooded Robin (south-eastern form) | *Melanodryas cucullata cucullata* | E | E | No | BAM-C, TBDC | Yes | Species not excluded | VZ3, VZ4, VZ9 | Moderate Sensitivity to Gain |
| Eastern Coastal Free-tailed Bat | *Micronomus norfolkensis* | V | - | No | BAM-C, TBDC | Yes | Species not excluded | VZ3, VZ4, VZ5, VZ6, VZ7, VZ8, VZ9 | High Sensitivity to Gain |
| Little Bent-winged Bat | *Miniopterus australis* | V | - | Yes | BAM-C, TBDC | Yes | Species not excluded | VZ1,VZ2, VZ3, VZ4, VZ5, VZ6, VZ7, VZ8, VZ9 | High Sensitivity to Gain |
| Large Bent-winged Bat | *Miniopterus orianae oceanensis* | V | - | Yes | BAM-C, TBDC | Yes | Species not excluded | VZ1,VZ2, VZ3, VZ4, VZ5, VZ6, VZ7, VZ8, VZ9 | High Sensitivity to Gain |

| Common Name | Scientific Name | Listing status | | Dual credit species | Sources | Retained for further Assessment | Reason for exclusion | Vegetation zone ID | Sensitivity to gain class |
|---|---|---|---|---|---|---|---|---|---|
| | | BC Act | EPBC Act | | | | | | |
| Eastern Curlew | *Numenius madagascariensis* | - | CE | Yes | BAM-C, TBDC | Yes | Species not Excluded | VZ8, VZ9 | High Sensitivity to Gain |
| Blue-billed Duck | *Oxyura australis* | V | - | No | BAM-C, TBDC | Yes | Species not Excluded | VZ8 | Moderate Sensitivity to Gain |
| Olive Whistler | *Pachycephala olivacea* | V | - | No | BAM-C, TBDC | Yes | Species not Excluded | VZ1, VZ2, VZ3, VZ4 | Moderate Sensitivity to Gain |
| Eastern Osprey | *Pandion cristatus* | V | - | Yes | BAM-C, TBDC | Yes | Species not Excluded | VZ1,VZ2, VZ3, VZ4, VZ5, VZ6, VZ7, VZ8, VZ9 | Moderate Sensitivity to Gain |
| Yellow-bellied Glider | *Petaurus australis* | V | V | No | BAM-C, TBDC | Yes | Species not Excluded | VZ1, VZ2, VZ3, VZ4, VZ6, VZ7 | High Sensitivity to Gain |
| Scarlet Robin | *Petroica boodang* | V | - | No | BAM-C, TBDC | Yes | Species not Excluded | VZ3, VZ4, VZ5, VZ6, VZ7 | Moderate Sensitivity to Gain |
| Flame Robin | *Petroica phoenicea* | V | - | No | BAM-C, TBDC | Yes | Species not Excluded | VZ1, VZ2, VZ3, VZ4 | Moderate Sensitivity to Gain |
| Golden-tipped Bat | *Phoniscus papuensis* | V | - | No | BAM-C, TBDC | Yes | Species not Excluded | VZ1, VZ2, VZ3, VZ4, VZ5, VZ6, VZ7, VZ9 | High Sensitivity to Gain |
| Eastern Chestnut Mouse | *Pseudomys gracilicaudatus* | V | - | No | BAM-C, TBDC | Yes | Species not Excluded | VZ8, VZ9 | High Sensitivity to Gain |
| New Holland Mouse | *Pseudomys novaehollandiae* | - | V | No | BAM-C, TBDC | Yes | Species not excluded | VZ1, VZ2, VZ3, VZ4, VZ5, VZ6 ,VZ7, VZ9 | High Sensitivity to Gain |
| Grey-headed Flying-fox | *Pteropus poliocephalus* | V | V | Yes | BAM-C, TBDC | Yes | Species not Excluded | VZ1,VZ2, VZ3, VZ4, VZ6, VZ7, VZ8, VZ9 | High Sensitivity to Gain |

| Common Name | Scientific Name | Listing status | | Dual credit species | Sources | Retained for further Assessment | Reason for exclusion | Vegetation zone ID | Sensitivity to gain class |
|---|---|---|---|---|---|---|---|---|---|
| | | BC Act | EPBC Act | | | | | | |
| Wompoo Fruit-Dove | *Ptilinopus magnificus* | V | - | No | BAM-C, TBDC | Yes | Species not Excluded | VZ1, VZ2, VZ3, VZ4, VZ9 | Moderate Sensitivity to Gain |
| Rose-crowned Fruit-Dove | *Ptilinopus regina* | V | - | No | BAM-C, TBDC | Yes | Species not Excluded | VZ1, VZ2, VZ3, VZ4, VZ9 | Moderate Sensitivity to Gain |
| Superb Fruit-Dove | *Ptilinopus superbus* | V | - | No | BAM-C, TBDC | Yes | Species not Excluded | VZ1,VZ2, VZ3, VZ4, VZ5, VZ6, VZ7 | Moderate Sensitivity to Gain |
| Australian Painted Snipe | *Rostratula australis* | E | E | No | BAM-C, TBDC | Yes | Species not Excluded | VZ8, VZ9 | Moderate Sensitivity to Gain |
| Yellow-bellied Sheathtail-bat | *Saccolaimus flaviventris* | V | - | No | BAM-C, TBDC | Yes | Species not Excluded | VZ3, VZ4, VZ5, VZ6, VZ7, VZ9 | High Sensitivity to Gain |
| Greater Broad-nosed Bat | *Scoteanax rueppellii* | V | - | No | BAM-C, TBDC | Yes | Species not Excluded | VZ2, VZ3, VZ4, VZ5, VZ6, VZ7, VZ9 | High Sensitivity to Gain |
| Diamond Firetail | *Stagonopleura guttata* | V | V | No | BAM-C, TBDC | No | Species excluded by geographical limitations | - | Moderate Sensitivity to Gain |
| Freckled Duck | *Stictonetta naevosa* | V | - | No | BAM-C, TBDC | Yes | Species not Excluded | VZ8 | Moderate Sensitivity to Gain |
| Common Blossom-bat | *Syconycteris australis* | V | - | No | BAM-C, TBDC | Yes | Species not Excluded | VZ1,VZ2, VZ3, VZ4, VZ5, VZ6, VZ7, VZ9 | High Sensitivity to Gain |
| Red-legged Pademelon | *Thylogale stigmatica* | V | - | No | BAM-C, TBDC | Yes | Species not Excluded | VZ1, VZ2, VZ3, VZ4 | High Sensitivity to Gain |
| Eastern Grass Owl | *Tyto longimembris* | V | - | No | BAM-C, TBDC | Yes | Species not Excluded | VZ3, VZ4, VZ8* | Moderate Sensitivity to Gain |

| Common Name | Scientific Name | Listing status | | Dual credit species | Sources | Retained for further Assessment | Reason for exclusion | Vegetation zone ID | Sensitivity to gain class |
|---|---|---|---|---|---|---|---|---|---|
| | | BC Act | EPBC Act | | | | | | |
| Terek Sandpiper | *Xenus cinereus* | V | V | Yes | BAM-C, TBDC | Yes | Species not Excluded | VZ7, VZ8 | High Sensitivity to Gain |

* The Eastern Grass Owl was observed in exotic vegetation (VZ5) but we are unable to manually add this to the BAM-C. The only vegetation zones available for consideration of Eastern Grass Owl were VZ3, VZ4 and VZ8.

The presence of species outlined in above (Table 21) could not be discounted using the methodology outlined in Step 1 and Step 2 of Section 5.2 of the BAM. It was therefore assumed that these species may occur within the subject land.

### *5.1.2 Species Credit Species*

A list of all species credit species predicted to occur within the Subject Land was generated in accordance with Section 5.2 of the BAM, including information obtained from the Threatened Biodiversity Data Collection. An assessment of whether suitable habitat occurs within the Subject Land, and therefore whether a species is to be considered a candidate flora and fauna species credit species is also provided (Table 22 and Table 23, respectively). The identification of candidate species credit species was assessed in accordance with Sections 5.2 and 5.3 of the BAM.

Table 22: Predicted flora species credit species

| Common Name | Scientific Name | Listing status | | Sources | Confirmed Candidate species? | Reason for exclusion |
|---|---|---|---|---|---|---|
| | | BC Act | EPBC Act | | | |
| North Brother Wattle | *Acacia courtii* | V | V | BAM-C, TBDC, Current Survey | No | Geographic limitations, species only occurs within Queens Lake (Laurieton) to Johns River |
| Scented Acronychia | *Acronychia littoralis* | E | E | BAM-C, TBDC, Current Survey | Yes | Not applicable |
| Nabiac Casuarina | *Allocasuarina simulans* | V | V | BAM-C, TBDC, Current Survey | Yes | Not applicable |
| *Banksia conferta* | *Banksia conferta* | CE | - | BAM-C, TBDC, Current Survey | No | Geographical limitations. Species occurs west of the Pacific Highway, south of Oxley Highway and south and east of the Wauchope to Wingham Road |

| Common Name | Scientific Name | Listing status | | Sources | Confirmed Candidate species? | Reason for exclusion |
|---|---|---|---|---|---|---|
| | | BC Act | EPBC Act | | | |
| Small Pale Grass-lily | *Caesia parviflora* var. *minor* | E | - | BAM-C, TBDC, Current Survey | Yes | Not applicable |
| Netted Bottle Brush | *Callistemon linearifolius* | V | - | BAM-C, TBDC, Current Survey | Yes | Not applicable |
| Red Helmet Orchid | *Corybas dowlingii* | E | - | BAM-C, TBDC, Current Survey | No | Suitable habitat is not present for this species. Though this species can occur within PCT3167, PCT3250 and PCT3544 the environments within these areas have limited sheltered areas, and those that are sheltered are east facing without well-draining soils. |
| Leafless Tongue Orchid | *Cryptostylis hunteriana* | V | V | BAM-C, TBDC, Current Survey | Yes | Not applicable |
| White-flowered Wax Plant | *Cynanchum elegans* | E | E | BAM-C, TBDC, Current Survey | Yes | Not Applicable |
| Spider Orchid | *Dendrobium melaleucaphilum* | E | - | BAM-C, TBDC, Current Survey | Yes | Not Applicable |
| *Eucalyptus seeana* population in the Greater Taree local government area | *Eucalyptus seeana - endangered population* | EP | - | BAM-C, TBDC, Current Survey | No | This endangered population occurs within the greater Taree LGA. This is at or near its southern-most occurrence of the species. The Subject Land is located within the Port Macquarie LGA, hence outside the endangered population's distribution. |
| Big Nellie Hakea | *Hakea archaeoides* | V | V | BAM-C, TBDC, Current Survey | No | Species has geographical limitations of 2 disjunct populations (West of Pacific Highway and either (1) South of Macleay River and Dungay Creek and north of Oxley and Papinbarra rivers, or (2) South of Oxley Highway and south and east of Wauchope to Wingham Road). The Subject Land is located east of Pacific highway and south of Oxley Highway |
| Tree Guinea Flower | *Hibbertia hexandra* | E | - | BAM-C, TBDC, Current Survey | Yes | Not Applicable |
| Noah's False Chickweed | *Lindernia alsinoides* | E | - | BAM-C, TBDC, Current Survey | Yes | Not applicable |

| Common Name | Scientific Name | Listing status | | Sources | Confirmed Candidate species? | Reason for exclusion |
|---|---|---|---|---|---|---|
| | | BC Act | EPBC Act | | | |
| Slender Marsdenia | *Marsdenia longiloba* | E | V | BAM-C, TBDC, Current Survey | Yes | Not Applicable |
| *Maundia triglochinoides* | *Maundia triglochinoides* | V | - | BAM-C, TBDC, Current Survey | Yes | Not applicable |
| Biconvex Paperbark | *Melaleuca biconvexa* | V | V | BAM-C, TBDC, Current Survey | Yes | Not applicable |
| Grove's Paperbark | *Melaleuca groveana* | V | - | BAM-C, TBDC, Current Survey | Yes | Not applicable |
| Rusty Plum | *Niemeyera whitei* | V | - | BAM-C, TBDC, Current Survey | Yes | Not applicable |
| Red-flowered King of Fairies | *Oberonia titania* | V | - | BAM-C, TBDC, Current Survey | Yes | Not applicable |
| Milky Silkpod | *Parsonsia dorrigoensis* | V | E | BAM-C, TBDC, Current Survey | Yes | Not applicable |
| Southern Swamp Orchid | *Phaius australis* | E | E | BAM-C, TBDC, Current Survey | Yes | Not applicable |
| Scant Pomaderris | *Pomaderris queenslandica* | E | - | BAM-C, TBDC, Current Survey | Yes | Not applicable |
| Scrub Turpentine | *Rhodamnia rubescens* | CE | CE | BAM-C, TBDC, Current Survey | Yes | Not applicable |
| Native Guava | *Rhodomyrtus psidioides* | CE | CE | BAM-C, TBDC, Current Survey | Yes | Not applicable |
| Rainforest Cassia | *Senna acclinis* | E | - | BAM-C, TBDC, Current Survey | Yes | Not applicable |

| Common Name | Scientific Name | Listing status | | Sources | Confirmed Candidate species? | Reason for exclusion |
|---|---|---|---|---|---|---|
| | | BC Act | EPBC Act | | | |
| Manning Yellow Solanum | *Solanum sulphureum* | E | | BAM-C, TBDC, Current Survey | Yes | Not applicable |
| Magenta Lilly Pilly | *Syzgium paniculatum* | E | V | BAM-C, TBDC, Current Survey | Yes | Not applicable |
| Austral Toadflax | *Thesium austral* | V | V | BAM-C, TBDC, Current Survey | Yes | Not applicable |
| Cryptic Forest Twiner | *Tylophora woollsii* | E | E | BAM-C, TBDC, Current Survey | Yes | Not applicable |

Table 23 Predicted fauna species credit species

| Common Name | Scientific Name | Listing status | | Sources | Confirmed Candidate species? | Reason for exclusion |
|---|---|---|---|---|---|---|
| | | BC Act | EPBC Act | | | |
| Rufous Bettong | *Aepyprymnus rufescens* | V | - | BAM-C, TBDC, Current Survey | Yes | Not Applicable |
| Regent Honeyeater | *Anthochaera phrygia* | CE | CE | BAM-C, TBDC, Current Survey | No | There are three known key breeding areas, two of them in NSW – Capertee Valley and Bundarra-Barraba regions. The study area is not within either region. The study area is not mapped as an important area for the species. |
| Laced fritallary | *Argynnis hyperbius* | E | CE | BAM-C, TBDC, Current Survey | Yes | Not applicable |
| Rufous Scrub-bird | *Atrichornis rufescens* | V | E | BAM-C, TBDC, Current Survey | No | Geographic limitation, all parts of the project area are at lower than 600 m altitude |
| Bush Stone-curlew | *Burhinus grallarius* | E | - | BAM-C, TBDC, Current Survey | Yes | Not applicable |

| Common Name | Scientific Name | Listing status | | Sources | Confirmed Candidate species? | Reason for exclusion |
|---|---|---|---|---|---|---|
| | | BC Act | EPBC Act | | | |
| Sanderling | *Calidris alba* | V | - | BAM-C, TBDC, Current Survey | No | Species needs breeding ground within 2km of coastline. Study Area is within 15km. |
| Red Knot | *Calidris canutus* | - | E | BAM-C, TBDC, Current Survey | No | Important habitat map is not within the Study Area |
| Curlew Sandpiper | *Calidris ferruginea* | E | CE | BAM-C, TBDC, Current Survey | No | Important habitat map is not within the Study Area |
| Great Knot | *Calidris tenuirostris* | V | CE | BAM-C, TBDC, Current Survey | No | Although site is within 5km of coastal or tidal influenced water bodies, no Important habitat mapping is present in the Study Area |
| Glossy Black-Cockatoo | *Calyptorhynchus lathami* | V | V | BAM-C, TBDC, Current Survey | Yes | Not Applicable |
| White-eared Monarch | *Carterornis leucotis* | V | - | BAM-C, TBDC, Current Survey | Yes | Not Applicable |
| Eastern Pygmy-possum | *Cercartetus nanus* | V | - | BAM-C, TBDC, Current Survey | Yes | Not applicable |
| Greater Sand-plover | *Charadrius leschenaultia* | V | V | BAM-C, TBDC, Current Survey | No | Although site is within 5km of coast, no important habitat mapping is present in the Study Area |
| Lesser Sand-plover | *Charadrius mongolus* | V | E | BAM-C, TBDC, Current Survey | No | Although site is within 5km of coast, no important habitat mapping is present in the Study Area |
| Three-toed Snake-tooth Skink | *Coeranoscincus reticulatus* | V | V | BAM-C, TBDC, Current Survey | Yes | Not applicable |
| Wallum Froglet | *Crinia tinnula* | V | - | BAM-C, TBDC, Current Survey | Yes | Not applicable |
| Beach Stone-curlew | *Esacus magnirostris* | CE | - | BAM-C, TBDC, Current Survey | No | Study Area is outside the requirement of being within 2km of the coast |

| Common Name | Scientific Name | Listing status | | Sources | Confirmed Candidate species? | Reason for exclusion |
|---|---|---|---|---|---|---|
| | | BC Act | EPBC Act | | | |
| Pied Oystercatcher | *Haematopus longirostris* | E | - | BAM-C, TBDC, Current Survey | No | Although the Study Area is within 5km of coast, it is not within 100m of estuarine areas and the ocean |
| White-bellied Sea-Eagle | *Haliaeetus leucogaster* | V | - | BAM-C, TBDC, Current Survey | Yes | Not applicable |
| Little Eagle | *Hieraaetus morphnoides* | V | - | BAM-C, TBDC, Current Survey | Yes | Not applicable |
| Pale-headed Snake | *Hoplocephalus bitorquatus* | V | - | BAM-C, TBDC, Current Survey | Yes | Not applicable |
| Stephens' banded Snake | *Hoplocephalus bitorquatus* | V | - | BAM-C, TBDC, Current Survey | Yes | Not applicable |
| Swift Parrot | *Lathamus discolor* | E | CE | BAM-C, TBDC, Current Survey | Yes | Areas of the subject land are mapped as an important area for the species. |
| Bar-tailed Godwit (baueri) | *Limosa lapponica baueri* | - | V | BAM-C, TBDC, Current Survey | No | Important habitat map is not within the Study Area |
| Black-tailed Godwit | *Limosa limosa* | V | - | BAM-C, TBDC, Current Survey | No | Important habitat map is not within the Study Area |
| Green and Golden Bell Frog | *Litoria aurea* | E | V | BAM-C, TBDC, Current Survey | Yes | Not applicable |
| Green-thighed Frog | *Litoria brevipalmata* | V | - | BAM-C, TBDC, Current Survey | Yes | Not applicable |
| Square-tailed Kite | *Lophoictinia isura* | V | - | BAM-C, TBDC, Current Survey | Yes | Not applicable |
| Little Bent-winged Bat | *Miniopterus australis* | V | - | BAM-C, TBDC, Current Survey | No | Suitable reproductive habitat (i.e. caves, tunnels, mines, culvert bridges or sometimes buildings) were absent within the Subject Land. |

| Common Name | Scientific Name | Listing status | | Sources | Confirmed Candidate species? | Reason for exclusion |
|---|---|---|---|---|---|---|
| | | BC Act | EPBC Act | | | |
| Large Bent-winged Bat | *Miniopterus orianae oceanensis* | V | - | BAM-C, TBDC, Current Survey | No | Suitable reproductive habitat (i.e. caves, tunnels, mines, culvert bridges or sometimes buildings) were absent within the Subject Land. |
| Stuttering Frog | *Mixophyes balbus* | E | V | BAM-C, TBDC, Current Survey | Yes | Not applicable |
| Giant Barred Frog | *Mixophyes iteratus* | E | E | BAM-C, TBDC, Current Survey | Yes | Not applicable |
| Southern Myotis | *Myotis macropus* | V | - | BAM-C, TBDC, Current Survey | Yes | Not applicable |
| Barking Owl | *Ninox connivens* | V | - | BAM-C, TBDC, Current Survey | No | Suitable reproductive habitat (i.e. hollow bearing trees, living or dead with a hollow greater than 20cm diameter and greater than 4m above the ground were absent within the Subject Land. |
| Powerful Owl | *Ninox strenua* | V | - | BAM-C, TBDC, Current Survey | No | Suitable reproductive habitat (i.e. hollow bearing trees, living or dead with a hollow greater than 20cm diameter) were absent within the Subject Land. |
| Parma Wallaby | *Notamacropus parma* | V | - | BAM-C, TBDC, Current Survey | Yes | Not Applicable |
| Eastern Curlew | *Numenius madagascariensis* | - | CE | BAM-C, TBDC, Current Survey | No | Important habitat map is not within the Study Area |
| Black Grass-dart Butterfly | *Ocybadistes knightorum* | E | - | Important habitat map is not within the Study Area | Yes | Not applicable |
| Eastern Osprey | *Pandion cristatus* | V | - | BAM-C, TBDC, Current Survey | No | Habitat constraint, the Subject Land and surrounding area lacks suitable nesting habitat. Specifically, it lacks the presence of stick-nests in living and dead trees (>15 m) or artificial structures within 100 m of a floodplain. |
| Giant Dragonfly | *Petalura gigantea* | E | - | BAM-C, TBDC, Current Survey | Yes | Not applicable |

| Common Name | Scientific Name | Listing status | | Sources | Confirmed Candidate species? | Reason for exclusion |
|---|---|---|---|---|---|---|
| | | BC Act | EPBC Act | | | |
| Southern Greater Glider | *Petauroides volans* | E | E | BAM-C, TBDC, Current Survey | Yes | Not Applicable |
| Squirrel Glider | *Petaurus norfolcensis* | V | - | BAM-C, TBDC, Current Survey | Yes | Not applicable |
| Brush-tailed Rock-wallaby | *Petrogale penicillata* | E | V | BAM-C, TBDC, Current Survey | No | The Subject Land is not located within 1km of rocky escarpments, gorgers, steep slopes, boulder piles, rock outcrops or cliff lines. |
| Brush-tailed Phascogale | *Phascogale tapoatafa* | V | - | BAM-C, TBDC, Current Survey | Yes | Not applicable |
| Koala | *Phascolarctos cinereus* | E | E | BAM-C, TBDC, Current Survey | Yes | Not applicable |
| Sphagnum Frog | *Philoria sphagnicolus* | V | V | BAM-C, TBDC, Current Survey | No | Suitable habitat is not present. This species relies upon Sphagnum Moss beds or seepages on steep slopes, often in rainforest. Though there are wet sclerophyll forest PCTs within the Subject Land, none of these have sufficient moisture to produce moss beds of any significant size. |
| Common Planigale | *Planigale maculata* | V | - | BAM-C, TBDC, Current Survey | Yes | Not applicable |
| Long-nosed Potoroo | *Potorous tridactylus* | V | V | BAM-C, TBDC, Current Survey | Yes | Not applicable |
| Grey-headed Flying-fox | *Pteropus poliocephalus* | V | V | BAM-C, TBDC, Current Survey | No | Breeding camps were absent within the Subject Land. |
| Red-backed button quail | *Turnix maculosus* | V | - | BAM-C, TBDC, Current Survey | Yes | Not applicable |
| Sooty Owl | *Tyto tenebricosa* | V | - | BAM-C, TBDC, Current Survey | No | Suitable reproductive habitat (i.e. caves, cliffs, cliff lines, ledges, escarpments, ledges, living or dead trees with hollows greater than 20cm diameter) were absent within the Subject Land. |
| Masked Owl | *Tyto novaehollandiae* | V | - | BAM-C, TBDC, Current Survey | No | Suitable reproductive habitat (i.e. living or dead trees with hollows greater than 20cm diameter) were absent within the Subject Land. |

| Common Name | Scientific Name | Listing status | | Sources | Confirmed Candidate species? | Reason for exclusion |
|---|---|---|---|---|---|---|
| | | BC Act | EPBC Act | | | |
| Eastern Cave Bat | *Vespadelus troughtoni* | V | - | BAM-C, TBDC, Current Survey | Yes | Not applicable |
| Terek Sandpiper | *Xenus cinereus* | V | - | BAM-C, TBDC, Current Survey | No | Although Study Area has tidal influenced water bodies within 15km of coast, the waterbodies are not tidal due to the weir gates. There is no important habitat mapping for this species in the Subject Land. |

## 5.2 PRESENCE OF CANDIDATE SPECIES CREDIT SPECIES

A list of species credit species potentially occurring within the Subject Land was generated in accordance with Section 5.2 of the BAM, including information obtained from the Threatened Biodiversity Data Collection. A list of the identified species determined to be present within the Subject Land is provided (Table 24).

Table 24 Candidate species credit species present within the Subject Land. The symbol '*' Denotes species observed but not within the Subject Land.

| Common Name | Scientific Name | Listing status | | Method used to determine presence | Present | Further assessment required? (BAM Subsections 5.2.5 and 5.2.6) |
|---|---|---|---|---|---|---|
| | | BC Act | EPBC Act | | | |
| Scented Acronychia | *Acronychia littoralis* | E | E | Targeted Flora Transects | No* | No |
| Rufous Bettong | *Aepyprymnus rufescens* | V | - | Terrestrial Remote camera survey | No | No |
| Floyd's Grass | *Alexfloydia repens* | E | - | Targeted Flora Transects | No | No |
| Dwarf heath Casuarina | *Allocasuarina defungens* | E | E | Targeted Flora Transects | No | No |
| Nabiac Casuarina | *Allocasuarina simulans* | V | V | Targeted Flora Transects | No | No |
| Laced Fritillary | *Argynnis hyperbius* | E | CE | Species food resource searches, Meandering surveys | No | No |
| Bush Stone-curlew | *Burhinus grallarius* | E | - | Spotlighting and Call Playback | No | No |
| Small Pale Grass-lilly | *Caesia parviflora var. minor* | | | Targeted Flora Transects/ Assumed Present | Partially Assumed | Yes |
| Netted Bottle Brush | *Callistemon linearifolius* | V | - | Targeted Flora Transects | No | No |
| Glossy Black-Cockatoo | *Calyptorhynchus lathami* | V | V | Targeted Flora Transects, Nest Searches | No | No |
| White-eared Monarch | *Carterornis leucotis* | V | - | Targeted Flora Transects | No | No |
| Eastern Pygmy-possum | *Cercartetus nanus* | V | - | Arboreal trapping and spotlighting | No | No |
| Three-toed Snake-tooth Skink | *Coeranoscincus reticulatus* | V | V | Pitfall Traps Reptile Habitat Surveys | No | No |
| Wallum Froglet | *Crinia tinnula* | V | - | Opportunistically and Frog Transects | Yes | Yes |
| Leafless Tongue Orchid | *Cryptostylis hunteriana* | V | V | Assumed Presence/ Assumed Present | Partially Assumed | Yes |
| White-flowered Wax Plant | *Cynanchum elegans* | E | E | Targeted Flora Transects | No | No |
| Spider Orchid | *Dendrobium melaleucaphilum* | E | - | Targeted Flora Transects/ Assumed Present | Partially Assumed | Yes |

| Common Name | Scientific Name | Listing status | | Method used to determine presence | Present | Further assessment required? (BAM Subsections 5.2.5 and 5.2.6) |
|---|---|---|---|---|---|---|
| | | BC Act | EPBC Act | | | |
| White-bellied Sea-Eagle | *Haliaeetus leucogaster* | V | - | Opportunistic, Targeted Flora Transects, Nest Searches | Yes | No - Ecosystem Credit |
| Tree Guinea Flower | *Hibbertia hexandra* | E | - | Targeted Flora Transects | No | No |
| Little Eagle | *Hieraaetus morphnoides* | V | - | Targeted Flora Transects, Nest Searches | No | No |
| Pale-headed Snake | *Hoplocephalus bitorquatus* | V | - | Spotlighting, Funnel traps | No | No |
| Stephens' banded Snake | *Hoplocephalus bitorquatus* | V | - | Spotlighting | No | No |
| Swift Parrot | *Lathamus discolor* | E | CE | Assumed Present (Important Area Mapping) | Assumed | Yes |
| Noah's False Chickweed | *Lindernia alsinoides* | E | - | Targeted Flora Transects | No | No |
| Green and Golden Bell Frog | *Litoria aurea* | E | V | Call Playback, spotlighting, Frog transects | No | No |
| Green-thighed Frog | *Litoria brevipalmata* | V | - | Call Playback, spotlighting, Frog transects | Assumed | Yes |
| Square-tailed Kite | *Lophoictinia isura* | V | - | Targeted Flora Transects, Nest Searches | No | No |
| Slender Marsdenia | *Marsdenia longiloba* | E | V | Targeted Flora Transects/ Assumed Present | Partially Assumed | Yes |
| Maundia triglochinoides | *Maundia triglochinoides* | V | - | Targeted Flora Transects | No | No |
| Biconvex Paperbark | *Melaleuca biconvexa* | V | V | Targeted Flora Transects | No | No |
| Groves Paperbark | *Melaleuca groveana* | | | Targeted Flora Transects | No | No |
| Stuttering Frog | *Mixophyes balbus* | E | V | Call Playback, spotlighting, Frog transects | No | No |
| Giant Barred Frog | *Mixophyes iteratus* | E | E | Call Playback, spotlighting, Frog transects | No | No |
| Southern Myotis | *Myotis macropus* | V | - | Ultrasonic Bat Detector | Yes | Yes |
| Rusty Plum | *Niemeyera whitei* | V | - | Targeted Flora Transects | No | No |
| Parma Wallaby | *Notamacropus parma* | V | - | Terrestrial Remote camera survey | No | No |

| Common Name | Scientific Name | Listing status | | Method used to determine presence | Present | Further assessment required? (BAM Subsections 5.2.5 and 5.2.6) |
|---|---|---|---|---|---|---|
| | | BC Act | EPBC Act | | | |
| Red-flowered King of Fairies | *Oberonia titania* | V | - | Targeted Flora Transects | No | No |
| Black Grass-dart Butterfly | *Ocybadistes knightorum* | E | - | Targeted Flora Transects | No | No |
| Milky Silkpod | *Parsonsia dorrigoensis* | V | E | Targeted Flora Transects | No | No |
| Brown fairy-chain Orchid | *Peristeranthus hillii* | V | - | Targeted Flora Transects | No | No |
| Giant Dragonfly | *Petalura gigantea* | E | - | Opportunistic, Targeted Flora Transects, Burrow Searches | Yes | Yes |
| Southern Greater Glider | *Petauroides volans* | E | E | Arboreal trapping and spotlighting | No | No |
| Squirrel Glider | *Petaurus norfolcensis* | V | - | Arboreal trapping and spotlighting | Yes | Yes |
| Southern Swamp Orchid | *Phaius australis* | E | E | Targeted Flora Transects | No | No |
| Brush-tailed Phascogale | *Phascogale tapoatafa* | V | - | Arboreal trapping and spotlighting | No | No |
| Koala | *Phascolarctos cinereus* | E | E | Assumed Presence | Yes | Yes |
| Common Planigale | *Planigale maculata* | V | - | Pitfall Traps | No | No |
| Scant Pomaderris | *Pomaderris queenslandica* | E | - | Targeted Flora Transects | No | No |
| Long-nosed Potoroo | *Potorous tridactylus* | V | V | Terrestrial Remote camera survey | No | No |
| Scrub Turpentine | *Rhodamnia rubescens* | CE | CE | Targeted Flora Transects | No* | No |
| Native Guava | *Rhodomyrtus psidioides* | CE | CE | Targeted Flora Transects | No* | No |
| Rainforest Cassia | *Senna acclinis* | E | - | Targeted Flora Transects | No | No |
| Manning Yellow Solanum | *Solanum sulphureum* | E | E | Targeted Flora Transects | No | No |
| Magenta Lilly Pilly | *Syzgium paniculatum* | E | V | Targeted Flora Transects | No | No |
| Austral Toadflax | *Thesium australe* | V | V | Targeted Flora Transects | No | No |
| Red-backed button quail | *Turnix maculosus* | V | - | Spotlighting and Call Playback | No | No |
| Cryptic Forest Twiner | *Tylophora woollsii* | E | E | Targeted Flora Transects | No | No |

| Common Name | Scientific Name | Listing status | | Method used to determine presence | Present | Further assessment required? (BAM Subsections 5.2.5 and 5.2.6) |
|---|---|---|---|---|---|---|
| | | BC Act | EPBC Act | | | |
| Eastern Cave Bat | *Vespadelus troughtoni* | V | - | Ultrasonic Bat Detector | Yes | Yes |

## 5.3 THREATENED SPECIES SURVEYS

The Subject Land is considered to be habitat for threatened species. Vegetation condition ranged from exotic to good, providing a range of structural habitat complexity throughout all vegetation zones. Albeit, reproductive habitat (i.e. caves, HBT etc) for threatened fauna species was generally absent from the Subject Land. Native vegetation within the Subject Land was likely used for foraging purposes only. Suitable habitat for flora species was observed throughout the subject land. Table 25 provides a list of the species targeted during the threatened species surveys.

Table 25 Threatened species surveys for candidate species credit species on the Subject Land. The symbol '*' Denotes species observed but not within the Subject Land.

| Common Name | Scientific Name | Threatened Species Survey | | | Present? | Further assessment required? |
|---|---|---|---|---|---|---|
| | | Survey method | Timing within BAM-C/TBDC period? | Effort | | |
| Scented Acronychia | *Acronychia littoralis* | Parallel Transects | Yes<br>27/09/2023<br>28/09/2023<br>20/11/2023 - 24/11/2023<br>09/04/2024<br>29/04/2024 | 76.25 (hours for two people) | No* | No |
| Rufous Bettong | *Aepyprymnus rufescens* | Terrestrial Remote camera survey | Yes<br>21/02/2024 to 11/03/2024 (20 days) | 420 survey nights | No | No |
| Floyd's Grass | *Alexfloydia repens* | Parallel Transects | Yes<br>27/09/2023 | 5 (hours for two people) | No | No |
| Dwarf heath Casuarina | *Allocasuarina defungens* | Parallel Transects | Yes<br>27/09/2023<br>28/09/2023<br>20/11/2023 - 24/11/2023<br>09/04/2024<br>29/04/2024 | 76.25 (hours for two people) | No | No |
| Nabiac Casuarina | *Allocasuarina simulans* | Parallel Transects | Yes<br>27/09/2023<br>28/09/2023 | 76.25 (hours for two people) | No | No |

| Common Name | Scientific Name | Threatened Species Survey | | | Present? | Further assessment required? |
|---|---|---|---|---|---|---|
| | | Survey method | Timing within BAM-C/TBDC period? | Effort | | |
| | | | 20/11/2023 - 24/11/2023<br>09/04/2024<br>29/04/2024 | | | |
| Laced fritillary | *Argynnis hyperbius* | Species food resource searches<br>Meandering surveys | Yes<br>21/06/2023<br>22/06/2023<br>11/08/2023<br>28/09/2023<br>30/10/2023 | 12.25 (hours for two people) | No | No |
| Bush Stone-curlew | *Burhinus grallarius* | Spotlighting, call playback | 19/02/2024<br>20/02/2024<br>21/02/2024<br>22/02/2024 | 11.6 (hours for two people) | No | No |
| Small Pale Grass-lily | *Caesia parviflora var. minor* | Parallel Transects | 20/11/2023 - 24/11/2023 | 49.75 (hours for two people) | Survey of species potential habitat was incomplete. No individuals were observed. | Yes |
| Netted Bottle Brush | *Callistemon linearifolius* | Parallel Transects | Partially,<br>20/11/2023 - 24/11/2023<br>09/04/2024<br>29/04/2024 | 63.25 (hours for two people) | No. Survey performed outside of survey period (April)did not observe any similar species. Survey was performed by ecologist familiar with the species. | No |
| Glossy Black-Cockatoo | *Calyptorhynchus lathami* | Parallel Transects | Yes<br>20/11/2023 - 24/11/2023<br>09/04/2024<br>29/04/2024 | 63.25 (hours for two people) | No | No |

| Common Name | Scientific Name | Threatened Species Survey | | | Present? | Further assessment required? |
|---|---|---|---|---|---|---|
| | | Survey method | Timing within BAM-C/TBDC period? | Effort | | |
| White-eared Monarch | *Carterornis leucotis* | Parallel Transects | Yes<br>27/09/2023<br>28/09/2023<br>20/11/2023 - 24/11/2023<br>02/04/2024<br>03/04/2024<br>04/04/2024 | 76.25 (hours for two people) | No. Survey performed across the year and would have likely observed the species if present. | No |
| Eastern Pygmy-possum | *Cercartetus nanus* | Elliot Trapping, Spotlighting and Arboreal Remote Camera Survey | Yes<br>13/11/2023 - 17/11/2023<br>19/02/2024<br>20/02/2024<br>21/02/2024 - 26/03/2024 | Spotlighting 35.6 (hours for two people)<br>Camera and Elliot Trapping 420 trap nights | No | No |
| Three-toed Snake-tooth Skink | *Coeranoscincus reticulatus* | Reptile Habitat Survey | Yes<br>14/11/2023 - 17/11/2023 | 56 (hours<br>for two people) | No | No |
| Wallum Froglet | *Crinia tinnula* | Frog Transects<br>Opportunistic | Yes<br>25/03/2024 - 28/03/2024<br>06/11/2023 - 08/11/2023<br>14/11/2023 | 37.5 (hours<br>for two people) | Yes (opportunistically heard at WWTP) | Yes |
| Leafless Tongue Orchid | *Cryptostylis hunteriana* | Parallel Transects | Yes<br>20/11/2023 - 24/11/2023 | 49.75 (hours<br>for two people) | Survey of species potential habitat was incomplete. No individuals were observed. | Yes |
| White-flowered Wax Plant | *Cynanchum elegans* | Parallel Transects | Yes<br>27/09/2023<br>28/09/2023<br>20/11/2023 - 24/11/2023<br>09/04/2024 | 76.25 (hours for two people) | No | No |

| Common Name | Scientific Name | Threatened Species Survey | | | Present? | Further assessment required? |
|---|---|---|---|---|---|---|
| | | Survey method | Timing within BAM-C/TBDC period? | Effort | | |
| | | | 29/04/2024 | | | |
| Spider Orchid | *Dendrobium melaleucaphilum* | Parallel Transects | Yes<br>27/09/2023<br>28/09/2023 | 13 (hours for two people) | Survey of species potential habitat was incomplete. No individuals were observed. | Yes |
| Black-necked Stork | *Ephippiorhynchus asiaticus* | Opportunistic | NA | NA | Yes | No – Ecosystem Credit Species |
| White-bellied Sea-Eagle | *Haliaeetus leucogaster* | Searching for breeding habitat, the presence of male and female individuals, adults with nesting material, or pairs duetting / courtship behaviour | Yes<br>27/09/2023<br>28/09/2023<br>13/11/2023 - 17/11/2023<br>20/11/2023 - 24/11/2024 | 63.75 | Yes | No – Ecosystem Credit Species |
| Tree Guinea Flower | *Hibbertia hexandra* | Parallel Transects | Yes<br>27/09/2023<br>28/09/2023<br>20/11/2023 - 24/11/2023<br>09/04/2024<br>29/04/2024 | 68 (hours for two people) | No | No |
| Little Eagle | *Hieraaetus morphnoides* | Searching for breeding habitat, the presence of male and female individuals, adults with nesting material, or pairs | Yes<br>13/11/2023 - 17/11/2023<br>20/11/2023 - 24/11/2024 | 24 (hours for two people) | No | No |

| Common Name | Scientific Name | Threatened Species Survey | | | Present? | Further assessment required? |
|---|---|---|---|---|---|---|
| | | Survey method | Timing within BAM-C/TBDC period? | Effort | | |
| | | duetting / courtship behaviour | | | | |
| Pale-headed Snake | *Hoplocephalus bitorquatus* | Funnel Traps<br>Spotlighting<br>Reptile Habitat Surveys | Yes<br>Funnel Traps 14/11/2023 - 17/11/2023<br><br>Spotlighting<br>19/02/2024 - 22/02/2024 | 67.6 (hours for two people) | No | No |
| Stephens' banded Snake | *Hoplocephalus bitorquatus* | Spotlighting | Yes<br>19/02/2024 - 22/02/2024 | 23.2 (hours for two people) | No | No |
| Swift Parrot | *Lathamus discolor* | Aural Visual Survey | Yes<br>Important habitat mapping | NA | No | Yes |
| Noah's False Chickweed | *Lindernia alsinoides* | Parallel Transects | Partially,<br>20/11/2023 - 24/11/2023<br>9/04/2024<br>10/04/2024 | 53 (hours for two people) | No. The majority of suitable habitat for this species was assessed within the November Survey. Survey in April was targeted to PCT4006 where habitat was poor for the species and no similar species were observed. | No. |
| Green and Golden Bell Frog | *Litoria aurea* | Parallel Frog Transects | Yes<br>6/11/2023<br>7/11/2023<br>8/11/2023<br>14/11/2023<br>25/03/2024 - 28/03/2024 | 37.5 (hours for two people) | No | No |
| Green-thighed Frog | *Litoria brevipalmata* | | No<br>6/11/2023 | 23.5 (hours for two people) | No | Yes |

| Common Name | Scientific Name | Threatened Species Survey | | | Present? | Further assessment required? |
|---|---|---|---|---|---|---|
| | | Survey method | Timing within BAM-C/TBDC period? | Effort | | |
| | | | 7/11/2023<br>8/11/2023<br>14/11/2023<br>20/02/2024<br>21/02/2024 | | | |
| Square-tailed Kite | *Lophoictinia isura* | Aural Visual Parallel Transects | Yes<br>27/09/2023<br>28/09/2023<br>20/11/2023 – 24/11/2023 | 56.25 (hours for two people) | No | No |
| Slender Marsdenia | *Marsdenia longiloba* | Parallel Transects | No<br>27/09/2023<br>28/09/2023<br>20/11/2023 - 24/11/2023<br>09/04/2024<br>29/04/2024 | 76.25 (hours for two people) | Survey of species potential habitat within the survey period was incomplete. No individuals were observed. | Yes |
| *Maundia triglochinoides* | *Maundia triglochinoides* | Parallel Transects | Yes<br>20/11/2023 - 24/11/2023<br>26/03/2024 | 50.25 (hours for two people) | No | No |
| Biconvex Paperbark | *Melaleuca biconvexa* | Parallel Transects | Yes<br>27/09/2023<br>28/09/2023<br>20/11/2023 - 24/11/2023<br>09/04/2024<br>29/04/2024 | 76.25 (hours for two people) | Yes* | No |
| Grove's Paperbark | *Melaleuca groveana* | Parallel Transects | Yes<br>27/09/2023 | 76.25 (hours for two people) | Yes | No |

| Common Name | Scientific Name | Threatened Species Survey | | | Present? | Further assessment required? |
|---|---|---|---|---|---|---|
| | | Survey method | Timing within BAM-C/TBDC period? | Effort | | |
| | | | 28/09/2023<br>20/11/2023 - 24/11/2023<br>09/04/2024<br>29/04/2024 | | | |
| Eastern Coastal Free-tailed Bat | *Micronomus norfolkensis* | Ultrasonic Bat Detector Survey | Yes<br>9/11/2023 - 23/11/2023 | 33 (trap nights) | Yes | No – Ecosystem Credit Species |
| Little Bent-winged Bat | *Miniopterus australis* | Ultrasonic Bat Detector Survey | Yes<br>9/11/2023 - 23/11/2023 | 33 (trap nights) | Yes | No – Ecosystem Credit Species |
| Large Bent-winged Bat | *Miniopterus orianae oceanensis* | Ultrasonic Bat Detector Survey | Yes<br>9/11/2023 - 23/11/2023 | 33 (trap nights) | Yes | No – Ecosystem Credit Species |
| Stuttering Frog | *Mixophyes balbus* | Parallel Frog Transects | Yes<br>6/11/2023<br>7/11/2023<br>8/11/2023<br>14/11/2023 | 23 (hours for two people) | No | No |
| Giant Barred Frog | *Mixophyes iteratus* | | | | | |
| Southern Myotis | *Myotis macropus* | Ultrasonic Bat Detector Survey | Yes<br>9/11/2023 - 23/11/2023 | 33 (trap nights) | Yes | Yes |
| Rusty Plum | *Niemeyera whitei* | Parallel Transects | Yes<br>27/09/2023<br>28/09/2023<br>20/11/2023 - 24/11/2023<br>09/04/2024<br>29/04/2024 | 76.25 (hours for two people) | No | No |

| Common Name | Scientific Name | Threatened Species Survey | | | Present? | Further assessment required? |
|---|---|---|---|---|---|---|
| | | Survey method | Timing within BAM-C/TBDC period? | Effort | | |
| Red-flowered King of Fairies | *Oberonia titania* | Parallel Transects | Yes<br>27/09/2023<br>28/09/2023<br>20/11/2023 - 24/11/2023<br>09/04/2024<br>29/04/2024 | 76.25 (hours for two people) | No | No |
| Black Grass-dart Butterfly | *Ocybadistes knightorum* | Parallel Transects | Partially,<br>27/09/2023<br>28/09/2023<br>20/11/2023 - 24/11/2023<br>09/04/2024<br>29/04/2024 | 76.25 (hours for two people) | No. The species is heavily reliant on Floyd's Grass which was not observed during the surveys and can be identified year round by a skilled botanist. | No |
| Milky Silkpod | *Parsonsia dorrigoensis* | Parallel Transects | Yes<br>27/09/2023<br>28/09/2023<br>20/11/2023 - 24/11/2023<br>09/04/2024<br>29/04/2024 | 76.25 (hours for two people) | No | No |
| Brown fairy-chain Orchid | *Peristeranthus hillii* | Parallel Transects | Yes<br>27/09/2023 | 8 (hours for two people) | No. Surveys outside the survey period did not observe any suitable habitat for the species. | No |
| Giant Dragonfly | *Petalura gigantea* | 10m Transect Survey / Random Meander | Yes<br>24/01/2024<br>25/01/2024 | 13.5 (hours for two people) | Yes | Yes |
| Southern Greater Glider | *Petauroides volans* | Elliot Trapping, Spotlighting, | Yes | 35.6 (hours | No | No |

| Common Name | Scientific Name | Threatened Species Survey | | | Present? | Further assessment required? |
|---|---|---|---|---|---|---|
| | | Survey method | Timing within BAM-C/TBDC period? | Effort | | |
| Squirrel Glider | *Petaurus norfolcensis* | Arboreal Remote Camera Survey | Arboreal Elliot B trapping<br>13/11/2023 - 17/11/2023<br><br>Spotlight<br>19/02/2024<br>20/02/2024<br>21/02/2024<br>22/02/2024<br><br>Camera trap<br>21/02/2024 – 27/03/2024 | for two people)<br>420 trap nights | Yes | Yes |
| Southern Swamp Orchid | *Phaius australis* | Parallel Transects | Partially,<br>27/09/2023<br>28/09/2023<br>9/04/2024<br>10/04/202 | 17 (hours<br>for two people) | No, though survey in PCT4006 was performed outside the survey period for this species, it is sufficiently distinctive and present within the surveyed area.no similar species are | No |
| Brush-tailed Phascogale | *Phascogale tapoatafa* | Elliot Trapping<br>Spotlighting<br>Terrestrial Remote Camera Survey | Yes<br>Arboreal Elliot B trapping (performed before the survey period but not part of formal method)<br>13/11/2023 - 17/11/2023<br><br>Spotlight<br>19/02/2024<br>20/02/2024<br>21/02/2024<br>22/02/2024 | 35.6 (hours<br>for two people)<br>420 nights | No | No |

| Common Name | Scientific Name | Threatened Species Survey | | | Present? | Further assessment required? |
|---|---|---|---|---|---|---|
| | | Survey method | Timing within BAM-C/TBDC period? | Effort | | |
| | | | Camera trap<br>21/02/2024 – 27/03/2024 | | | |
| Koala | *Phascolarctos cinereus* | Assumed Presence | - | - | Yes | Yes |
| Common Planigale | *Planigale maculata* | Pitfall Traps | Yes<br>14/11/2023 - 17/11/2023 | 4 (trap day / nights) | No | No |
| Scant Pomaderris | *Pomaderris queenslandica* | Parallel Transects | Yes<br>27/09/2023<br>28/09/2023<br>20/11/2023 - 24/11/2023<br>09/04/2024<br>29/04/2024 | 76.25 (hours for two people) | No | No |
| Long-nosed Potoroo | *Potorous tridactylus* | Terrestrial<br>Remote Camera Survey | Yes<br>21/02/2024 to 11/03/2024 (20 day / nights) | 420 survey nights | No | No |
| Scrub Turpentine | *Rhodamnia rubescens* | Parallel Transects | Yes<br>27/09/2023<br>28/09/2023<br>20/11/2023 - 24/11/2023<br>09/04/2024<br>29/04/2024 | 76.25 (hours for two people) | No* | No |
| Native Guava | *Rhodomyrtus psidioides* | Parallel Transects | Yes<br>27/09/2023<br>28/09/2023<br>20/11/2023 - 24/11/2023<br>09/04/2024 | 76.25 (hours for two people) | No* | No |

| Common Name | Scientific Name | Threatened Species Survey | | | Present? | Further assessment required? |
|---|---|---|---|---|---|---|
| | | Survey method | Timing within BAM-C/TBDC period? | Effort | | |
| | | | 29/04/2024 | | | |
| Rainforest Cassia | *Senna acclinis* | Parallel Transects | Yes<br>27/09/2023<br>28/09/2023<br>20/11/2023 - 24/11/2023<br>09/04/2024<br>29/04/2024 | 76.25 (hours for two people) | No | No |
| Manning Yellow Solanum | *Solanum sulphureum* | Parallel Transects | Yes<br>27/09/2023<br>28/09/2023<br>20/11/2023 - 24/11/2023<br>09/04/2024<br>29/04/2024 | 76.25 (hours for two people) | No | No |
| Magenta Lilly Pilly | *Syzgium paniculatum* | Parallel Transects | Yes<br>27/09/2023<br>28/09/2023<br>20/11/2023 - 24/11/2023<br>09/04/2024<br>29/04/2024 | 76.25 (hours for two people) | No. There were no similar species identified during the surveys. | No |
| Austral Toadflax | *Thesium australe* | Parallel Transects | Partially,<br>20/11/2023 - 24/11/2023<br>09/04/2024<br>29/04/2024 | 63.25 (hours for two people) | No Surveys performed outside of the survey period did not identify suitable host species particularly Kangaroo Grass | No |
| Red-backed button quail | *Turnix maculosus* | Spotlighting and call Playback | Yes<br>19/02/2024 - 22/02/2024 | 11.6 (hours for two people) | No | No |

| Common Name | Scientific Name | Threatened Species Survey | | | Present? | Further assessment required? |
|---|---|---|---|---|---|---|
| | | Survey method | Timing within BAM-C/TBDC period? | Effort | | |
| Cryptic Forest Twiner | *Tylophora woollsii* | 10m Transect Survey / Random Meander | Yes<br>24/01/2024<br>25/01/2024<br>2/04/24 – 5/04/2024 | 20.25 (hours for two people) | No | No |
| Eastern Grass Owl | *Tyto longimembris* | NA | NA | NA | Yes | No – Ecosystem Credit Species |
| Eastern Cave Bat | *Vespadelus troughtoni* | Ultrasonic Bat Detector Survey | Yes<br>9/11/2023 - 23/11/2023 | 33 (trap nights) | Yes | Yes |

* Denotes species observed but not within the Subject Land.

### 5.3.1 Observed species credit species

For relevant threatened species where, targeted survey was undertaken (i.e. those not assumed present), the following specific guidelines and survey requirements were adhered to:

- NSW BioNet Threatened Biodiversity Profile Data Collection (TBDC).
- Surveying threatened plants and their habitats NSW survey guide for the Biodiversity Assessment Method (DPIE 2020b).
- Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (DEC 2004).
- Survey Guide for Threatened Frogs: A guide for the survey of threatened frogs and their habitats for the Biodiversity Assessment Method (DPIE 2020c).
- 'Species credit' threatened bats and their habitats – NSW survey guide for the Biodiversity Assessment Method (NSW DPIE 2021).
- Threatened Reptiles Biodiversity Assessment Method Survey Guide (DPE 2022e).
- Koala (*Phascolarctos cinereus*) Biodiversity Assessment Method Survey Guide) (DPE 2022f).
- The Wetland Habitats, biogeography and population dynamics of *Petalura gigantea* (Odonata: Petaluridae) in the Blue Mountains of New South Wales PhD thesis (Baird 2012).
- Survey guidelines for Australia's threatened birds (CoA 2010b).
- Survey guidelines for Australia's threatened mammals (CoA 2011b).
- The Spot Assessment Technique: determining the importance of habitat utilisation by Koalas (*Phascolarctos cinereus*) (Phillips and Callaghan 2011).
- *Argynnis hyperbius inconstans* (Australian fritillary) Conservation Advice, (DDCEEW 2017)
- The Australian Dragonflies: a guide to the identification, distributions and habitats of Australian Odonata. CSIRO, Canberra & Melbourne (1991).
- NSW Scientific Committee (1998) Giant dragonfly - Endangered species determination - final. DEC (NSW), Sydney.
- The wetland habitats, biogeography and population dynamics of *Petalura gigantea* (Odonata: Petaluridae) in the Blue Mountains of New South Wales (Doctoral dissertation, University of Western Sydney (Australia)) Baird, I. R. (2012).
- The complete field guide to Dragonflies of Australia. Orr, Albert, Günther Theischinger, and John Hawking. Csiro Publishing, 2021.

Where there was variation between guidelines methodology, surveys were performed in line with the NSW BioNet TBDC.

### 5.3.2 Flora

Threatened flora surveys of the Subject Land were undertaken in accordance with the Surveying threatened plants and their habitats NSW survey guide for the Biodiversity Assessment Method (DPIE 2020b) (Figure 16 - Figure 20). This included a comprehensive survey of all vegetation zones within the subject land as relevant.

Parallel transect was conducted for the target survey within the appropriate survey period for these species between 20th November 2023 - 29th April 2024. Two threatened flora species were recorded nearby or on the Subject Land.

- Biconvex Paperbark (*Melaleuca biconvexa*). (Vulnerable; BC Act) A single plant was observed from parallel transect survey in between the Oxley Highway and Lady Nelson Drive (Figure 58).

Given the proximity of the Subject Land to records of Critically Endangered Species, a combination of transects and meander surveys were performed to confirm the location of other threatened species including,

- Native Guava (*Rhodomyrtus psidioides*). (Critically Endangered; BC Act; EPBC Act). A juvenile individual was confirmed near Acacia Avenue (Figure 58) but further targeted surveys did not identify any further individuals (Figure 18). Individuals are not within or immediately adjoining the Subject Land.

- Scrub Turpentine (*Rhodamnia rubescens*) (Critically Endangered; BC Act; EPBC Act). Observed within Kooloonbung Creek (Figure 59). Individuals are not within or immediately adjoining the Subject Land.
- Scented Acronychia (*Acronychia littoralis*) (Endangered; BC Act; EPBC Act). Observed within Kooloonbung Creek (Figure 59). Individuals are not within or immediately adjoining the Subject Land.

### *5.3.3 Frog surveys*

According to the frog survey guidelines, conducting aural-visual surveys involves listening for frog calls and visually searching for individuals along a designated transect.

Each survey night lasts at least 120 minutes, with 5 minutes allocated for each surveying frogs, and includes visual searches for frog 'eyeshine' along a 500-meter transect in breeding habitat near waterbodies. The survey also includes playing calls of threatened frogs using a loudspeaker every 50 meters (11 points for a 500-meter transect or six points for 250 meters of habitat). The overall survey process is repeated every 50 meters of the transect.

Two aural visual transects were performed in the wetlands around the sand plain between 6th November 2023 to 14th November 2023 (Figure 21). This survey confirmed the known presence of Wallum Froglet (*Crinia tinnula*), which was most abundant to the south of the sand plain in the stewardship area (Figure 46).

Due to discharge into Kooloonbung Creek, an aural visual survey was performed from the outlet location along the direction of water flow between the 25 and 28 March 2024 (Figure 24). This survey targeted Green and Golden Bell Frog (*Litoria aurea*) and Wallum Froglet but did not confirm the presence of either of these species. A brief assessment of habitat suitability for Wallum Froglet found that the water pH was typically 7, which is higher than normally required for breeding and non-breeding habitat of this species (preferring pH <5.5) (DPIE 2020c).

The survey period for Green-thighed Frog is from September to April and surveys can only be performed within the 1 or 2 nights during or immediately after flooding (>50 mm in 24 hours). Following the flooding event, the species will not typically call within the following three months. Based assessment of the Port Macquarie Airport data, it is likely that the suitable windows for survey of Green-thighed Frog would have been Saturday 27 October 2023 (87.4 mm) and Sunday 11 February 2024 (52.6 mm). However, surveys were unable to be performed within this extremely narrow window of opportunity. Further heavy flooding rains were recorded on 20 February 2024 (34.4 mm) and opportunistic Green-thighed Frog surveys were performed on 20 and 21 February 2024 (Figure 21). The opportunistic surveys were performed in areas that balanced a midpoint between the WWTP and potential habitat for Green-thighed Frog.

### *5.3.4 Threatened bat survey*

Four ultrasonic bat detectors were deployed on fringing forested vegetation on 9th, 13th and 14th Nov 2023 and retrieval on 16th and 23rd Nov 2023 (Figure 29 - Figure 32). The Subject Land was detected have use by a number of threatened species including those listed below:

- *Micronomus norfolkensis* (Eastern Coastal Free-tailed Bat) (Vulnerable [BC Act])
  - Recorded at detector locations 1, 3 and 4.
  - Call confidence – 'definite' (detector 3); 'Probable' (detector 2).
- *Miniopterus australis* (Little Bent-winged Bat) (Vulnerable [BC Act])
  - Recorded at all detector locations.
  - Call confidence – 'definite'.
- *Miniopterus orianae oceanensis* (Large Bent-winged Bat) (Vulnerable [BC Act])
  - Recorded at detector locations 1, 3 and 4
  - Call confidence – 'Probable' and 'Possible'. There is significant overlap in the calls detected with *Vespadelus* sp and *Chalinolobus morio,*. Therefore, *M. orianae oceanensis* cannot be excluded.
- *Vespadelus troughtoni* (Eastern Cave Bat)
  - Recorded at all detector locations.

- Call confidence- 'possible'. The calls were recorded as *Vespadelus vulturnus* (probable) / *Vespadelus pumilus* (possible) / *Vespadelus troughtoni* (possible), as these species have significant overlap in call characteristics. Hence *Vespadelus troughtoni* cannot be excluded.

### 5.3.5 Spotlighting survey

Spot lighting survey was conducted on 19th to 22nd February 2024 for Southern Greater Glider (*Petauroides volans*), Squirrel Glider (*Petaurus norfolcensis*), Eastern Pygmy-possum (*Cercartetus nanus*), Brush-tailed Phascogale (*Phascogale tapoatafa*) Pale-headed Snake, (*Hoplocephalus bitorquatus*), Stephens' Banded Snake (*Hoplocephalus stephensii*) and Red-backed Button-quail (*Turnix maculosus*) (Figure 25 - Figure 28).

The surveys identified a pair of Squirrel Gliders to the west of the WWTP and a Koala was spotted in managed land south of Kooloonbung Close.

### 5.3.6 Meandering survey

This survey was conducted for Giant Dragonfly (*Petalura gigantea*) and Laced Fritillary (*Argynnis hyperbius)*. The Laced Fritillary survey was divided into two phrases which was survey for food resource searches (phrase 1) and meandering surveys (phrase 2). Phase 1 conducted on June 21st and 22nd, 2023, confirmed the presence of *Viola betonicifolia*, which serves as the main food source for butterfly (Figure 29 - Figure 32). Approximately 200 *Viola betonicifolia* individuals were found. Phase 2 was conducted on 11 August 2023, 28 September 2023 and 30 October 2023, leaf browsing was observed, but no caterpillars or adults of this butterfly were seen in this area.

Giant dragonfly was opportunistically recorded in the Subject Land on 22nd November 2023, that initiated the survey on 24 and 25 January 2024. A random meandering survey was conducted along the wetland perimeter and a 10-meter transect surveys were conducted, specifically searching for burrows. No burrows, exuviae, or Giant Dragonflies were discovered during this survey.

### 5.3.7 Remote cameras

Camera traps exercise was conducted for threatened mammal species between 21st February to 27th March 2024. Forty-one cameras were deployed for arboreal threatened species (19 cameras) targeting Southern Greater Glider (*Petauroides volans*), Squirrel Glider (*Petaurus norfolcensis*), Eastern Pygmy-possum (*Cercartetus nanus*), Brush-tailed Phascogale (*Phascogale tapoatafa*), and terrestrial species (22 cameras) for Long-nosed Potoroo (*Potorous tridactylus*), Rufous Bettong (*Aepyprymnus rufescens*) Figure 25 - Figure 28).

A potential sub-adult Squirrel Glider was observed. No other threatened species were photographed on the camera traps.

### 5.3.8 Threatened Fauna Habitat

All areas were assessed for fauna habitat with a particular focus on features that could be used by local threatened species.

Particular focus was placed on performing detailed hollow-bearing tree mapping to ensure that these resources were understood and could be replaced. Previous vegetation and hollow-bearing tree assessment was performed as part of the John Oxley Drive Upgrade (Niche, 2020), which indicates approximately 18 trees within the Subject Land between Wrights Road and The Ruins Way in Port Macquarie. However, de Witt Ecology could not verify the majority of those hollows, particularly with reference to requirements in the BAM (2020) glossary, which specify that the entrance should be visible and that the hollow should have depth. Therefore, in the same area that had previously had 18 hollow-bearing trees mapped, we have mapped 5 hollow-bearing trees (see Figure 37 Native Vegetation Extent). The same approach has been taken throughout the survey for hollow-bearing trees in this BDAR.

## 5.4 EXPERT REPORTS

Expert reports were not used as part of this assessment.

## 5.5 MORE APPROPRIATE LOCAL DATA

More appropriate local data was not used as part of this assessment, therefore, written confirmation from the decision-maker was not sought.

## 5.6 AREA OR COUNT, AND LOCATION OF SUITABLE HABITAT FOR A SPECIES CREDIT SPECIES (A SPECIES POLYGON)

Threatened species polygons have been prepared for the following species credit species for the subject land: The method for calculating species polygons is outlined in Table 26.

Species polygons have been prepared for all flora and fauna species credit species that are assumed to be present, or are likely to use the suitable habitat at the subject land (DPIE 2020a). The species polygons identify the areas of suitable habitat for a species credit species on the subject land.

The species polygons were mapped following the protocols for each species listed in the Threatened Biodiversity Data Collection in accordance with the BAM. The methods for calculating the species polygons for the species credit species recorded within the subject land are provided in Table 26 below.

Refer to Section 11.0 of this BDAR for biodiversity credit requirements.

Table 26 Results for present species

| Common Name | Scientific Name | Risk weight | SAII entity | Habitat constraints /microhabitats present on the Subject Land / Vegetation Zone | Abundance of Individuals present on Subject Land | Extent (ha) of suitable habitat present on site | TBDC species specific recommendations e.g. buffers, general comments (where relevant) | Habitat condition (Vegetation integrity score for each VZ in the polygon) | Size of Polygon in each VZ (ha) |
|---|---|---|---|---|---|---|---|---|---|
| Scented Acronychia | *Acronychia littoralis* | 3 | Yes | - | - | - | Observed within Kooloonbung Creek (outside of Subject Land) | - | NA |
| Small Pale Grass-lily | *Caesia parviflora var. minor* | 2 | No | | - | 0.73 | Assumed present in areas with insufficient survey. | VZ3 = 50.4<br>VZ4 = 83.3 | VZ3 = 0.12<br>VZ4 = 0.61 |
| Wallum Froglet | *Crinia tinnula* | 1.5 | No | Acidic swamps | N/A | 4.2 | Heard during regularly while at the sand plain | VZ4 = 83.3<br>VZ5 = 4.1<br>VZ6 = 13.4<br>VZ8 = 70 | VZ4 = 0.07<br>VZ5 = 2.08<br>VZ6 = 0.38<br>VZ8 = 1.67 |
| Leafless Tongue Orchid | *Cryptostylis hutneriana* | 1.5 | No | - | - | 2.32 | Assumed present in areas with insufficient survey. | VZ3 = 50.4<br>VZ4 = 83.3<br>VZ5 = 4.1<br>VZ6 = 56.1 | VZ3 = 0.12<br>VZ4 = 0.6<br>VZ5 = 1.4<br>VZ6 = 0.2 |
| Spider Orchid | *Dendrobium melaleucaphilum* | 2 | No | - | - | 0.73 | Assumed present in areas with insufficient survey. | VZ3 = 50.4<br>VZ4 = 83.3 | VZ3 = 0.12<br>VZ4 = 0.61 |
| Black-necked Stork | *Ephippiorhynchus asiaticus* | NA | No | Swamps: Shallow, open freshwater or saline wetlands or shallow edges of deeper wetlands within 300m of these swamps.<br>Waterbodies: Shallow lakes, lake margins and estuaries within 300m of these waterbodies | - | - | Observed regularly in and around Wetland A.<br>Ecosystem Credit | - | N/A |

| Common Name | Scientific Name | Risk weight | SAII entity | Habitat constraints /microhabitats present on the Subject Land / Vegetation Zone | Abundance of Individuals present on Subject Land | Extent (ha) of suitable habitat present on site | TBDC species specific recommendations e.g. buffers, general comments (where relevant) | Habitat condition (Vegetation integrity score for each VZ in the polygon) | Size of Polygon in each VZ (ha) |
|---|---|---|---|---|---|---|---|---|---|
| White-Bellied Sea-Eagle | *Haliaeetus leucogaster* | 2 | No | Within 1km of a rivers, lakes, large dams or creeks, wetlands and coastlines<br>Living or dead mature trees within suitable vegetation within 1km of a rivers, lakes, large dams or creeks, wetlands and coastlines | - | - | Observed 'flyover' event during unrelated ecology surveys. Spotted over PCT 3250 in south west corner of WWTP project area.<br>Ecosystem Credit | - | N/A |
| Swift Parrot | *Lathamus discolor* | 3 | Yes | As per Important Habitat Map | - | 1.07 | The BAM species polygon has been created based on the Swift Parrot Important Area mapped within the Subject Land (Figure 47, Figure 48). | VZ1 = 57.6<br>VZ2 = 75.5<br>VZ5 = 4.1<br>VZ9 = 60.6 | VZ1 = 0.03<br>VZ2 = 0.31<br>VZ5 = 0.71<br>VZ9 = 0.02 |
| Green-thighed Frog | *Litoria brevipalmata* | 1.5 | No | Swamps, Waterbodies | - | 0.76 | Assumed present due to insufficient survey.<br>Guidelines<br>Suitable breeding habitat is any semi-permanent or ephemeral waterbody of >25 square metres in surface area located within native vegetation or immediately adjacent to or within 10 metres of native vegetation. Non-breeding habitat is native vegetation adjacent to the breeding habitat. | VZ4 = 83.3<br>VZ7 = 56.1<br>VZ9 = 60.6 | VZ4 = 0.51<br>VZ7 = 0.21<br>VZ9 = 0.04 |

| Common Name | Scientific Name | Risk weight | SAII entity | Habitat constraints /microhabitats present on the Subject Land / Vegetation Zone | Abundance of Individuals present on Subject Land | Extent (ha) of suitable habitat present on site | TBDC species specific recommendations e.g. buffers, general comments (where relevant) | Habitat condition (Vegetation integrity score for each VZ in the polygon) | Size of Polygon in each VZ (ha) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | The species polygon boundary should align with aquatic habitats linked directly to the record and a buffer, incorporating the PCTs with which the species is associated, of 100 metres radius from the top of bank.<br>For this BDAR<br>Areas where suitable waterbodies could occur within suitable habitat were mapped within and surrounding the Subject Land. A 100 m buffer was then applied to these suitable waterbodies. Inclusion in the species polygon was considered for PCTs that contained canopy species and moderate levels of leaf litter, this included,<br>• VZ1<br>• VZ2<br>• VZ3<br>• VZ4<br>• VZ7<br>• VZ9 | | |
| Slender Marsdenia | *Marsdenia longiloba* | 2 | No | - | - | 1.11 | Assumed present in areas with insufficient survey. | VZ1 = 57.6<br>VZ2 = 75.5<br>VZ3 = 50.4<br>VZ4 = 83.3 | VZ1 = 0.12<br>VZ2 = 0.27<br>VZ3 = 0.12<br>VZ4 = 0.6 |

| Common Name | Scientific Name | Risk weight | SAII entity | Habitat constraints /microhabitats present on the Subject Land / Vegetation Zone | Abundance of Individuals present on Subject Land | Extent (ha) of suitable habitat present on site | TBDC species specific recommendations e.g. buffers, general comments (where relevant) | Habitat condition (Vegetation integrity score for each VZ in the polygon) | Size of Polygon in each VZ (ha) |
|---|---|---|---|---|---|---|---|---|---|
| Biconvex Paperbark | *Melaleuca biconvexa* | 2 | No | - | 0 | - | Located east of the Port Macquarie Race Club track, in close proximity but not within the Subject Land | - | NA |
| Eastern Coastal Free-tailed Bat | *Micronomus norfolkensis* | - | No | - | Call confidence 'Definite' at Bat1, Bat3, Bat4. Call confidence 'Possible' at Bat2 | - | Call analysis resulted in definitive calls on Bat1, Bat3 and Bat 4 and possible calls on Bat2.<br>Ecosystem credit | - | N/A |
| Little Bent-winged Bat | *Miniopterus australis* | 3 | Yes | Cave, tunnel, mine, culvert or other structure known or suspected to be used for breeding including species records in BioNet with microhabitat code 'IC – in cave'; observation type code 'E nest-roost'; with numbers of individuals >500; or from the scientific literature. | Call confidence recorded as Definite on Bat1, Bat2, Bat3 and Bat4, with very high activity recorded on Bat2 and Bat4. | - | No structures known or suspected to be used for breeding are present.<br>Ecosystem credit | - | N/A |
| Large Bent-winged Bat | *Miniopterus orianae oceanensis* | 3 | Yes | Cave, tunnel, mine, culvert or other structure known or suspected to be used for breeding including species records with microhabitat code "IC - in cave;" observation type code "E nest-roost;" with | Call confidence recorded as Probable on Bat1, and possible on Bat3 and Bat4 | - | No structures known or suspected to be used for breeding are present.<br>Ecosystem credit | - | N/A |

| Common Name | Scientific Name | Risk weight | SAII entity | Habitat constraints /microhabitats present on the Subject Land / Vegetation Zone | Abundance of Individuals present on Subject Land | Extent (ha) of suitable habitat present on site | TBDC species specific recommendations e.g. buffers, general comments (where relevant) | Habitat condition (Vegetation integrity score for each VZ in the polygon) | Size of Polygon in each VZ (ha) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | numbers of individuals >500 | | | | | |
| Southern Myotis | *Myotis macropus* | 2 | No | Waterbodies with permanent pools/stretches 3m or wider, including rivers, large creeks, billabongs, lagoons, estuaries, dams and other waterbodies, on or within 200m of the site. | One or more of *Nyctophilus geoffroyi, Nyctophilus gouldi*, and *Myotis macropus* made passes at Bat1 and Bat4 | 11.26 | TBDC: 'Species credit' threatened bats and their habitats: All PCTs associated with the species (as per the TBDC) within 200 metres of the bank of any medium to large permanent creeks, rivers, lakes or other waterways (i.e. with pools/ stretches 3 metres or wider) on the subject land<br>For this BDAR:<br>All vegetation within the Subject Land including exotic vegetation (VZ5), that is within 200 m of a waterbody or 2nd order waterway, have been included in the species polygon. | VZ3 = 50.4<br>VZ4 = 83.3<br>VZ5 = 4.1<br>VZ6 = 13.4<br>VZ7 = 56.1<br>VZ8 = 70 | VZ3 = 0.1<br>VZ4 = 0.61<br>VZ5 = 7.67<br>VZ6 = 1.1<br>VZ7 = 0.11<br>VZ8 = 1.67 |
| Giant Dragonfly | *Petalura gigantea* | 3 | Yes | Swamps: Within 500 m of swamps | N/A | 14.32 | BOS Help Desk Team<br>"The BOS Subject Matter Officer has provided the following response to your enquiry:<br>Where presence on the subject land is confirmed, the species polygon should be drawn in | VZ3 = 50.4<br>VZ4 = 83.3<br>VZ5 = 4.1<br>VZ6 = 13.4<br>VZ7 = 56.1<br>VZ8 = 70 | VZ3 = 0.12<br>VZ4 = 0.61<br>VZ5 = 10.1<br>VZ6 = 1.61<br>VZ7 = 0.2<br>VZ8 = 1.67 |

| Common Name | Scientific Name | Risk weight | SAII entity | Habitat constraints /microhabitats present on the Subject Land / Vegetation Zone | Abundance of Individuals present on Subject Land | Extent (ha) of suitable habitat present on site | TBDC species specific recommendations e.g. buffers, general comments (where relevant) | Habitat condition (Vegetation integrity score for each VZ in the polygon) | Size of Polygon in each VZ (ha) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | accordance with Box 2 of the BAM to include the area of suitable habitat within the subject land. This incorporates the habitat constraint for the species, swamp and a 500m radius buffer area around the swamp as specified in the TBDC. Please note the Department has not yet published a BAM survey guide addressing this species, this advice may be subject to change in future."<br>For this BDAR:<br>All areas of swamp at the sand plain and a 500 m buffer around this swamp have been included in the species polygon. | | |
| Squirrel Glider | *Petaurus norfolcensis* | 2 | No | - | N/A | 1.87 | TBDC:<br>No specific comment on species polygon<br>For this BDAR:<br>All PCTs that are associated with the species were considered. Vegetation Zones without canopy species were excluded.: | VZ1 = 57.6<br>VZ2 = 75.5<br>VZ3 = 50.4<br>VZ4 = 83.3<br>VZ6 = 13.4<br>VZ7 = 56.1<br>VZ8 = 70 | VZ1 =0.18<br>VZ2 =0.6<br>VZ3 =0.12<br>VZ4 =0.61<br>VZ6 = 0.11<br>VZ7 = 0.21<br>VZ9 = 0.04 |
| Koala | *Phascolarctos cinereus* | 2 | No | Presence of koala use trees – full description in | Koala recorded south of | 1.87 | TBDC: | VZ1 = 57.6<br>VZ2 = 75.5 | VZ1 =0.18<br>VZ2 =0.6 |

| Common Name | Scientific Name | Risk weight | SAII entity | Habitat constraints /microhabitats present on the Subject Land / Vegetation Zone | Abundance of Individuals present on Subject Land | Extent (ha) of suitable habitat present on site | TBDC species specific recommendations e.g. buffers, general comments (where relevant) | Habitat condition (Vegetation integrity score for each VZ in the polygon) | Size of Polygon in each VZ (ha) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | the document Koala (Phascolarctos cinereus): Biodiversity Assessment Method Survey Guide | Kooloonbung Close, within Swamp Mahogany. | | Where koala presence is confirmed, begin by mapping the vegetation zone in which the species was detected as the species polygon. All vegetation zones that are continuous suitable habitat with this vegetation zone should be included. If areas of suitable habitat are discontinuous, koala presence must be confirmed in each by targeted survey, for inclusion in the species polygon.<br>For this BDAR:<br>Koala has been assumed present in all vegetation zones that are associated with the species in the TBDC. Koala was excluded from exotic vegetation (VZ5) due to lack of canopy species. | VZ3 = 50.4<br>VZ4 = 83.3<br>VZ6 = 13.4<br>VZ7 = 56.1<br>VZ9 = 60.6 | VZ3 =0.12<br>VZ4 =0.61<br>VZ6 = 0.11<br>VZ7 = 0.21<br>VZ9 = 0.04 |
| Scrub Turpentine | *Rhodamnia rubescens* | 3 | Yes | - | - | - | Observed within Kooloonbung Creek. Species does not occur within the Subject Land | - | - |
| Native Guava | *Rhodomyrtus psidioides* | 3 | Yes | - | - | | Individuals found opposite along Acacia Avenue. Species not located within the Subject Land | - | - |

| Common Name | Scientific Name | Risk weight | SAII entity | Habitat constraints /microhabitats present on the Subject Land / Vegetation Zone | Abundance of Individuals present on Subject Land | Extent (ha) of suitable habitat present on site | TBDC species specific recommendations e.g. buffers, general comments (where relevant) | Habitat condition (Vegetation integrity score for each VZ in the polygon) | Size of Polygon in each VZ (ha) |
|---|---|---|---|---|---|---|---|---|---|
| Eastern Grass owl | *Tyto longimembris* | NA | No | - | - | - | Observed in and around the sand plain area.<br>Ecosystem Credit | - | |
| Eastern Cave Bat | *Vespadelus troughtoni* | 3 | Yes | Within two kilometres of rocky areas containing caves, overhangs, escarpments, outcrops, crevices or boulder piles, or within two kilometres of old mines, tunnels, old buildings or sheds.<br><br>There is a quarry located 1.9 km west of Subject Land located at lot 353 DP 754434. Aerial imagery shows cliff faces present on side bordering native vegetation. | Call confidence – 'possible' at all detector locations | 22.61 | TBDC:<br>'Species credit' threatened bats and their habitats: The species polygon boundary should align with all PCTs on the subject land that are within 2 kilometres of identified potential roost habitat features, and with which the species is associated (as listed in the TBDC).<br>For this BDAR:<br>As the species was possibly identified at all detectors, all vegetation, including exotic vegetation (VZ5) has been included in the species polygon.<br><br>The quarry is beyond the extent to which potential breeding habitat for the species needs to be considered (100 m). | VZ1 = 57.6<br>VZ2 = 75.5<br>VZ3 = 50.4<br>VZ4 = 83.3<br>VZ5 = 4.1<br>VZ6 = 13.4<br>VZ7 = 56.1<br>VZ8 = 70<br>VZ9 = 60.6 | VZ1 = 0.18<br>VZ2 = 0.6<br>VZ3 = 0.12<br>VZ4 = 0.61<br>VZ5 = 17.57<br>VZ6 = 1.61<br>VZ7 = 0.21<br>VZ8 = 1.67<br>VZ9 = 0.04 |

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## LEGEND

Subject Land

***Species Polygons***

Giant Dragonfly Species Polygon

Southern Myotis Species Polygon

Wallum Froglet Species Polygon

*Threatened Species Recorded*

Wallum Froglet (*Crinia tinnula*) (Vulnerable; BC Act 2016)

Giant Dragonfly (*Petalura gigantea*) (Endangered (SAII); BC Act 2016)

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| | | | | | |
|---|---|---|---|---|---|
| FIGURE 46 | **FAUNA SPECIES POLYGONS** | | | | |
| JOB ADDRESS: | PORT-MACQUARIE HASTINGS COUNCIL AREA | | | | |
| CLIENT: | PORT-MACQUARIE HASTINGS COUNCIL | | | | |
| A3 SCALE: | 1:4,000 | DRAWN: | BH | JOB REF: | EC217 |
| PLAN DATE: | 18/07/2024 | CHECKED: | RS | ISSUE: | 02 |

0 100 200 300 400 m

N

L:\SYNERGY\Projects\EC217\GIS\Figures\Workspaces\Species Polygons

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## LEGEND

- Subject Land
- Swift Parrot Species Polygon

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| | | | | | |
|---|---|---|---|---|---|
| FIGURE 47 | **FAUNA SPECIES SPECIES POLYGON** | | | | |
| JOB ADDRESS: | PORT MACQUARIE-HASTINGS COUNCIL AREA | | | | |
| CLIENT: | PORT MACQUARIE-HASTINGS COUNCIL | | | | |
| A3 SCALE: | 1:5,000 | DRAWN: | BH | JOB REF: | EC217 |
| PLAN DATE: | 18/07/2024 | CHECKED: | RS | ISSUE: | 02 |

0 125 250 375 500 m

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## LEGEND

- Subject Land
- Green Thighed Frog Potential Breeding Habitat

***Species Polygon***

- Swift Parrot Species Polygon
- Green Thighed Frog Species Polygon

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| | | | | | |
|---|---|---|---|---|---|
| FIGURE 48 | **FAUNA SPECIES POLYGON** | | | | |
| JOB ADDRESS: | PORT MACQUARIE-HASTINGS COUNCIL AREA | | | | |
| CLIENT: | PORT MACQUARIE-HASTINGS COUNCIL | | | | |
| A3 SCALE: | 1:5,000 | DRAWN: | BH | JOB REF: | EC217 |
| PLAN DATE: | 18/07/2024 | CHECKED: | RS | ISSUE: | 02 |

0 125 250 375 500 m

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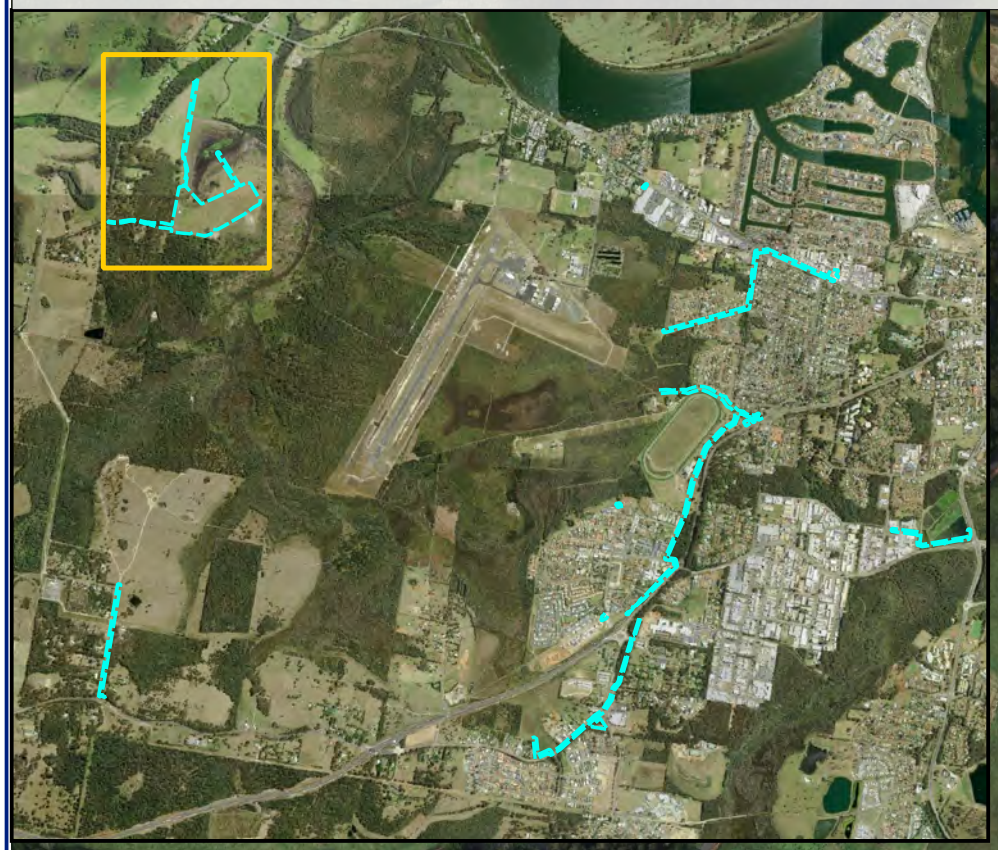

## LEGEND

Subject Land

***Threatened Species Recorded***

Squirrel Glider (*Petaurus norfolcensis*) (Vulnerable; BC Act 2016)

***Species Polygon***

Eastern Cave Bat Species Polygon

Koala & Squirrel Glider Species Polygon

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| | | | | | |
|---|---|---|---|---|---|
| FIGURE 49 | **FAUNA SPECIES POLYGON** | | | | |
| JOB ADDRESS: | PORT MACQUARIE-HASTINGS COUNCIL AREA | | | | |
| CLIENT: | PORT MACQUARIE-HASTINGS COUNCIL | | | | |
| A3 SCALE: | 1:3,900 | DRAWN: | BH | JOB REF: | EC217 |
| PLAN DATE: | 18/07/2024 | CHECKED: | RS | ISSUE: | 02 |

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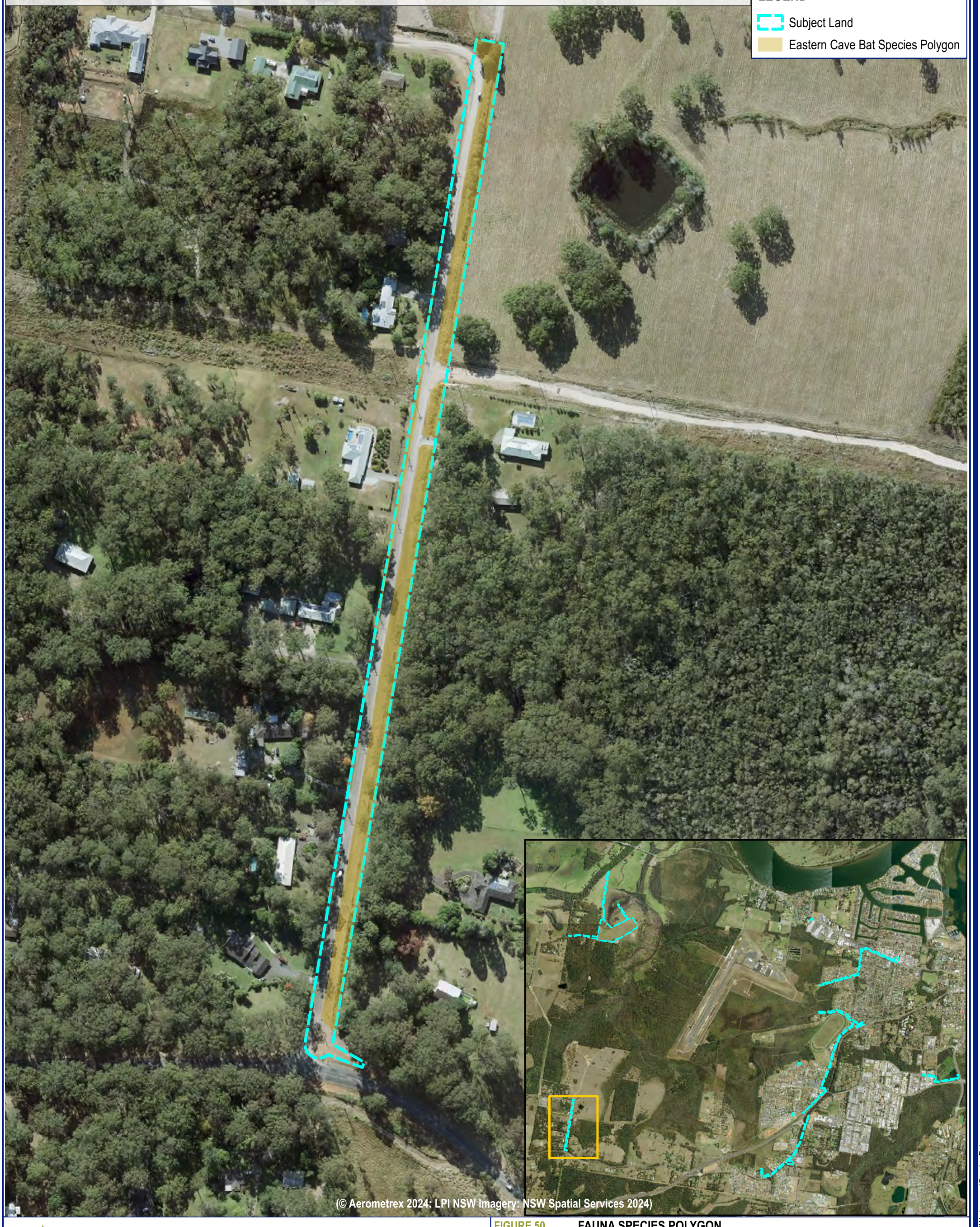
**LEGEND**

- Subject Land
- Eastern Cave Bat Species Polygon



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| | | | | | |
|---|---|---|---|---|---|
| FIGURE 50 | **FAUNA SPECIES POLYGON** | | | | |
| JOB ADDRESS: | PORT MACQUARIE-HASTINGS COUNCIL AREA | | | | |
| CLIENT: | PORT MACQUARIE-HASTINGS COUNCIL | | | | |
| A3 SCALE: | 1:2,500 | DRAWN: | BH | JOB REF: | EC217 |
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0 50 100 150 200 250 m

N

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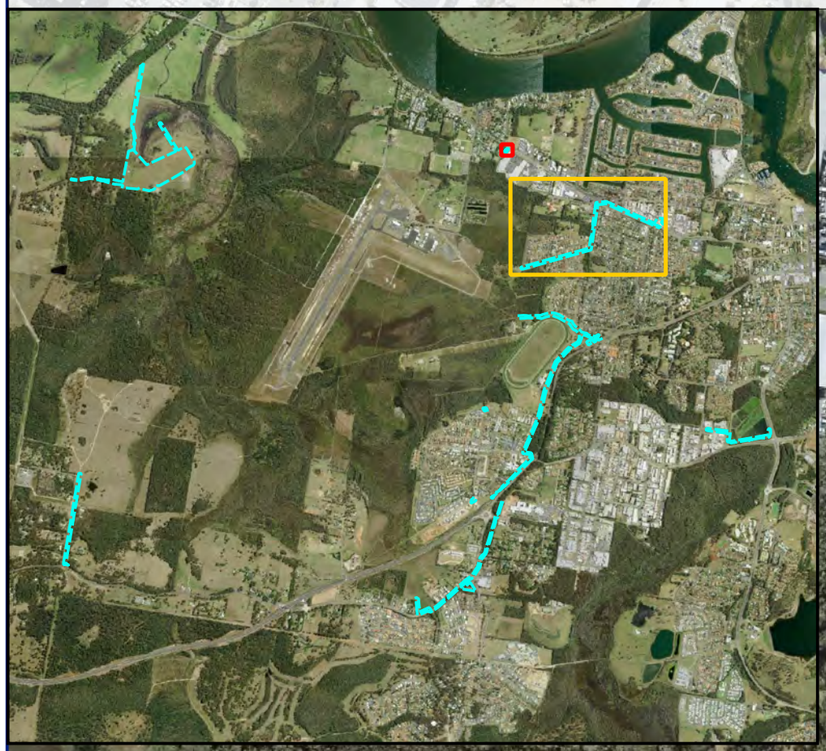

**LEGEND**

- Subject Land
- Eastern Cave Bat Species Polygon

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FIGURE 51

## FAUNA SPECIES POLYGON

0 75 150 225 300 m

| | | | | | |
|---|---|---|---|---|---|
| JOB ADDRESS: | PORT MACQUARIE-HASTINGS COUNCIL AREA<br>NSW \| AUSTRALIA | | | | |
| CLIENT: | PORT MACQUARIE-HASTINGS COUNCIL | | | | |
| A3 SCALE: | 1:3,200 | DRAWN: | BH | JOB REF: | EC217 |
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**LEGEND**

- Subject Land
- Eastern Cave Bat Species Polygon
- Koala & Squirrel Glider Species Polygon

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| | | | | | |
|---|---|---|---|---|---|
| FIGURE 52 | **FAUNA SPECIES POLYGON** | | | | |
| JOB ADDRESS: | PORT MACQUARIE-HASTINGS COUNCIL AREA | | | | |
| CLIENT: | PORT MACQUARIE-HASTINGS COUNCIL | | | | |
| A3 SCALE: | 1:4,000 | DRAWN: | BH | JOB REF: | EC217 |
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0 100 200 300 400 m

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## LEGEND

Subject Land

***Threatened Species Recorded***

Koala (*Phascolarctos cinereus*) (Endangered; BC Act 2016; EPBC Act 1999)

***Species Polygon***

Eastern Cave Bat Species Polygon

Koala & Squirrel Glider Species Polygon

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| | | | | | |
|---|---|---|---|---|---|
| FIGURE 53 | **FAUNA SPECIES POLYGON** | | | | |
| JOB ADDRESS: | PORT MACQUARIE-HASTINGS COUNCIL AREA | | | | |
| CLIENT: | PORT MACQUARIE-HASTINGS COUNCIL | | | | |
| A3 SCALE: | 1:4,200 | DRAWN: | BH | JOB REF: | EC217 |
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## LEGEND

- Subject Land
- Leafless Tongue-orchid Species Polygon
- Slender Marsdenia Species Polygon
- Pale Grass-Lily & Spider Orchid Species Polygon

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| | | | | | |
|---|---|---|---|---|---|
| FIGURE 54 | **FLORA SPECIES POLYGON** | | | | |
| JOB ADDRESS: | PORT MACQUARIE-HASTINGS COUNCIL AREA | | | | |
| CLIENT: | PORT MACQUARIE-HASTINGS COUNCIL | | | | |
| A3 SCALE: | 1:3,900 | DRAWN: | BH | JOB REF: | EC217 |
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## LEGEND

- Subject Land
- Slender Marsdenia Species Polygon

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| | | | | | |
|---|---|---|---|---|---|
| FIGURE 55 | **FLORA SPECIES POLYGON** | | | | |
| JOB ADDRESS: | PORT MACQUARIE-HASTINGS COUNCIL AREA | | | | |
| CLIENT: | PORT MACQUARIE-HASTINGS COUNCIL | | | | |
| A3 SCALE: | 1:4,000 | DRAWN: | BH | JOB REF: | EC217 |
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## LEGEND

- Subject Land
- Slender Marsdenia Species Polygon

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| | | | | | |
|---|---|---|---|---|---|
| FIGURE 56 | **FLORA SPECIES POLYGON** | | | | |
| JOB ADDRESS: | PORT MACQUARIE-HASTINGS COUNCIL AREA | | | | |
| CLIENT: | PORT MACQUARIE-HASTINGS COUNCIL | | | | |
| A3 SCALE: | 1:4,200 | DRAWN: | BH | JOB REF: | EC217 |
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## LEGEND

Subject Land

*Other Threatened Species Recorded*

- White-bellied Sea Eagle (*Haliaeetus leucogaster*) (Vulnerable; BC Act 2016)
- Black-necked Stork (*Ephippiorhynchus asiaticus*) (Endangered; BC Act 2016)
- Grass Owl (*Tyto longimembris*) (Vulnerable; BC Act 2016)

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| | | | | | |
|---|---|---|---|---|---|
| FIGURE 57 | **OTHER THREATENED SPECIES RECORDED** | | | | |
| JOB ADDRESS: | PORT MACQUARIE-HASTINGS COUNCIL AREA | | | | |
| CLIENT: | PORT MACQUARIE-HASTINGS COUNCIL | | | | |
| A3 SCALE: | 1:3,900 | DRAWN: | BH | JOB REF: | EC217 |
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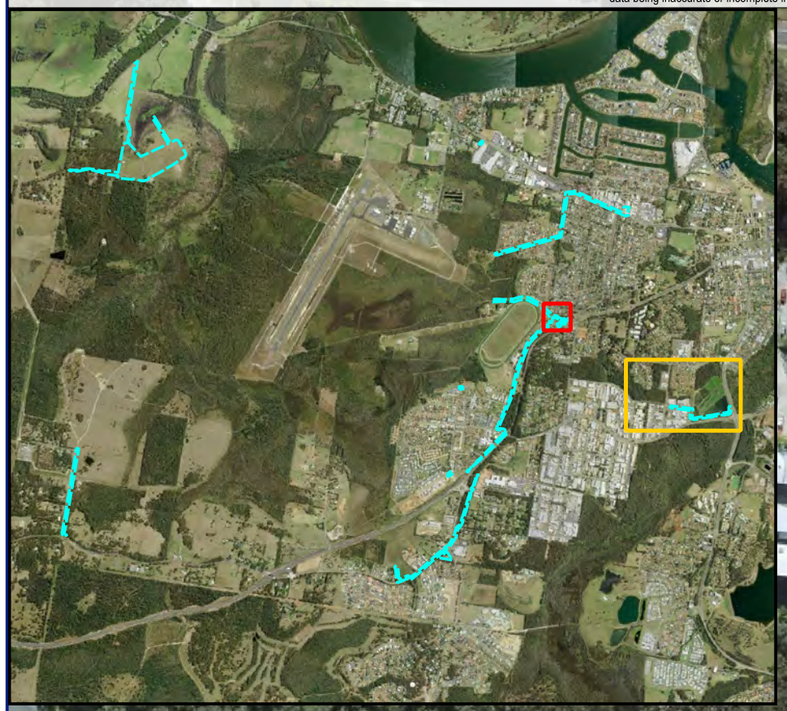

## LEGEND

Subject Land

Bionet Threatened Species Records

- Native Guava (*Rhodomyrtus psidioides*) (Critically Endangered; BC Act 2016; EPBC Act 1999)

Other Threatened Species Recorded

- Biconvex paperbark (*Melaleuca biconvexa*) (Vulnerable; BC Act 2016)
- Native Guava (*Rhodomyrtus psidioides*) (Critically Endangered; BC Act 2016; EPBC Act 1999)

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FIGURE 58

# OTHER THREATENED SPECIES RECORDED

0 75 150 225 300 m

| | | | | | |
|---|---|---|---|---|---|
| JOB ADDRESS: | PORT MACQUARIE-HASTINGS COUNCIL AREA<br>NSW \| AUSTRALIA | | | | |
| CLIENT: | PORT MACQUARIE-HASTINGS COUNCIL | | | | |
| A3 SCALE: | 1:2,500 | DRAWN: | BH | JOB REF: | EC217 |
| PLAN DATE: | 18/07/2024 | CHECKED: | RS | ISSUE: | 02 |

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## LEGEND

Subject Land

*Bionet Threatened Species Record*

- Native Guava (*Rhodomyrtus psidioides*) (Critically Endangered; BC Act 2016; EPBC Act 1999)

*Other Threatened Species Recorded*

- Flying Fox (*Pteropus poliocephalus*) (Vulnerable; BC Act 2016; EPBC Act 1999)
- Scrub Turpentine (*Rhodamnia rubescens*) (Critically Endangered; BC Act 2016; EPBC Act 1999)
- Scented Acronychia (*Acronychia littoralis*) (Endangered; BC Act 2016; EPBC Act 1999)

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| | | | | | |
|---|---|---|---|---|---|
| FIGURE 59 | **OTHER THREATENED SPECIES RECORDED** | | | | |
| JOB ADDRESS: | PORT MACQUARIE-HASTINGS COUNCIL AREA | | | | |
| CLIENT: | PORT MACQUARIE-HASTINGS COUNCIL | | | | |
| A3 SCALE: | 1:5,000 | DRAWN: | BH | JOB REF: | EC217 |
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## 6.0 IDENTIFY PRESCRIBED IMPACTS

Prescribed impacts relevant to the Subject Land are identified in Table 27.

Table 27 Identification of prescribed impacts

| Feature | Present | Description of feature characteristics and location | Threatened entities that use, are likely to use, or are part of the habitat feature. Where relevant, threatened species or fauna that are part of a TEC or EC, that are at risk of vehicle strike |
|---|---|---|---|
| Karst, caves, crevices, cliffs, rocks and other geological features of significance | ☐Yes / ☒No | No karst, caves, crevices, cliffs and other features of geological significance were identified in the desktop or field studies. There are no plans by the project that will impact on these features.<br><br>No bush rock will be impacted by the proposed works. | Although cave-dwelling threatened microbat species associated with these features was recorded during the assessment, these features do not occur nearby to the site and will not be impacted upon as part of the proposal. |
| Human-made structures or non-native vegetation | ☒Yes / ☐No | A human-made structure will be impacted by the project.<br><br>An old house and other dilapidated infrastructure occur in the western most part of the site. The house sits empty with multiple entry points and roosting habitat. Field inspection of the structures did not indicate the presence or evidence of previous presence of microbats.<br><br>The non-native vegetation within the SRMs & RWMs of the Subject Land housed were often maintained and would present a reduced habitat for threatened species.<br><br>The exotic grassland located on the WWTP site at the sand plain varies based on management and season, with different grasses dominating at different times of the year and based on different management strategies. Regardless, the exotic vegetation within the WWTP site was where numerous threatened species were observed such as Giant Dragonfly, Eastern Grass Owl, and White-Bellied Sea-Eagle. | The exotic vegetation within the WWTP site at the sand plain had several threatened species recorded during appropriate survey timelines. Observed species include the Eastern Grass Owl, the Giant Dragonfly, and the White-bellied Sea-eagle.<br><br>An adult Giant Dragonfly as observed, with follow up surveys not locating burrows or exuviae located. Therefore, the grassland has been observed as a suitable foraging habitat.<br><br>A White-bellied Sea-eagle was observed as a flyover of the site, with the grassland's conditions suitable as an occasional foraging habitat for this species.<br><br>The Eastern Grass Owl has a long history on the sand plain, with surveys in 2002 confirming its presence (Environmental Resources Management Australia, 2002).<br><br>It is likely that recorded microbats, Eastern Coastal Free-tailed Bat, Little Bent-winged Bat, Large Bent-winged Bat, Southern Myotis and Eastern Cave Bat also forage in these areas as they were recorded in nearby bat detectors. |

| Feature | Present | Description of feature characteristics and location | Threatened entities that use, are likely to use, or are part of the habitat feature. Where relevant, threatened species or fauna that are part of a TEC or EC, that are at risk of vehicle strike |
|---|---|---|---|
| Habitat connectivity | ☒Yes / ☐No | The existing habitat connectivity of the Subject Land is described in Section 3.2.4. The project will target the WWTP to a sand plain that is predominantly exotic vegetation. The WWTP will have two access roads that may provide a reduction in connectivity to some species. The SRMs & RWMs have been aligned in areas that currently host existing roads and walking paths to reduce impact on habitat connectivity. The restoration of habitat along the SRMs & RWMs following the construction process will partially restore losses to habitat connectivity. | The positioning of the WWTP within an area that is already cleared will reduce its impact on habitat connectivity as impacts to canopy has been reduced. The increase in elevation of the WWTP will mean that species utilising the sand plain will have difficulty crossing the facility. The Eastern Grass Owl will loose habitat due to the project. The size of the facility will likely break its foraging habitat within the sand plain, with the high elevation required of the WWTP potentially exacerbating the loss in habitat connectivity. The Eastern Grass Owl was observed foraging within the wetlands to the south of the WWTP, it is anticipated that this mobile species would still be able to move throughout the landscape, though suitable breeding habitat in the locality for this species is limited.<br><br>The roads to access the WWTP will provide a break in habitat connectivity for some species.<br><br>Where the SRMs & RWMs impact on habitat connectivity, this will generally be by increasing breaks in habitat connectivity, such as next to road sides. While the project will exacerbate existing breaks for species such as Koala and Squirrel Glider, these contributions are likely to be small.<br><br>Majority of the native vegetation being impacted is along roadsides, with only small areas being affected. |
| Water bodies, water quality and hydrological processes | ☒Yes / ☐No | A detailed description of the water bodies and hydrology of the locality is provided in Section 3.2.3. The WWTP will be focused on areas of exotic dominated vegetation. There are impacts to wetlands, floodplains and swamp in the laydown areas and roads to facilitate the WWTP.<br><br>There are wetlands which intersect with a portion of the emergency outlet from the WWTP, see Section 8.1 for full details. A first order stream does connect the wetlands to the southern exotic vegetation. | Threatened species observed during the project that could potentially utilise water bodies for breeding and / or foraging and would be impacted by the project include but are not limited to, Wallum Froglet (*Crinia tinnula*), Southern Myotis (*Myotis macropus*), Eastern Coastal Free-tailed Bat (*Micronomus norfolkensis*), Little Bent-winged Bat (*Miniopterus australis*), Large Bent-winged Bat (*Miniopterus orianae oceanensis*), and Giant Dragonfly (*Petalura gigantea*). There is similar habitat within the |

| Feature | Present | Description of feature characteristics and location | Threatened entities that use, are likely to use, or are part of the habitat feature. Where relevant, threatened species or fauna that are part of a TEC or EC, that are at risk of vehicle strike |
|---|---|---|---|
| | | The SRMs & RWMs are generally distant from existing hydrolines. A first order hydroline crosses the SRM in the south, in predominantly exotic vegetation. The SRMs & RWMs adjoining to the airport are in an area where groundwater levels may be elevated, with many swamps and wetlands in the locality.<br><br>Following review of the Groundwater Dependant Ecosystems (GDE) Atlas, many of the local communities are likely to utilise groundwater to some extent. In particular, the swamps surrounding the WWTP and some treed vegetation to the south of the WWTP are likely to regularly utilise ground water. Within the Subject Land, PCT3967 and PCT4006 are associated with TECs that may be dependent on GDEs. The construction of the emergency storage pond may intercept groundwater leading to a drawdown in groundwater such that it could have a prescribed impact on a small area of Freshwater Wetlands on Coastal Floodplains TEC.<br><br>The trenching to implement the SRMs & RWMs may have localised impact on groundwater availability.<br><br>The increase in elevation of the WWTP may temporarily increase the risk from erosion and sedimentation from the project, though mitigation measures will be implemented.<br><br>The release of effluent into Kooloonbung Creek will alter the characteristics of the creek, see Section 8.4 for full details.<br><br>There are significant areas of SEPP Coastal Wetlands within the Subject Land and in the Assessment Area. It is noted that SEPP (Resilience and Hazards) 2021 Chapter 2 Part 2.7 (4) indicates that a consent authority must not grant consent for development unless the consent authority is satisfied that sufficient measures have been or will be taken to protect, and | assessment area with a 3rd order stream situated NW of site, and the Hastings River within 1500m of site potentially providing drinking and foraging habitat to microbats. More acidic wetlands are south of site within 500m and likely preferred habitat for Wallum Froglet and Giant Dragonfly.<br><br>It is possible that the emergency outlet could cause a prescribed impact on vegetation associated with PCT3967 and Freshwater Wetlands on Coastal Floodplains as well has habitat for the Wallum Froglet, Southern Myotis, Giant Dragonfly and Black-necked Stork. A broader discussion of the potential impact from the emergency overflow is included in Section 8.1.<br><br>Only a temporary impact to a small area (0.02 ha) of Freshwater Wetland on Coastal Floodplains GDE is expected due to groundwater drawdown<br><br>The SRMs & RWMs are generally distant from existing waterways. A first order stream crosses the SRM in the south, in predominantly exotic vegetation. The SRMs & RWMs adjoining to the airport are in an area where groundwater levels may be elevated, with many swamps and wetlands in the locality. It is possible that the trenching will exhibit localised changes to groundwater during the construction period but these should be largely restored by infilling the trenches at the conclusion of the construction period.<br><br>Kooloonbung Creek contains a nationally significant camp of Grey-headed Flying-fox. Though it is possible that the release of effluent to Kooloonbung Creek, the camp is generally located >1.4 km from the outlet where there is greater influence from the tide. As vegetation impacts are not anticipated, it is not anticipated that there will be an |

| Feature | Present | Description of feature characteristics and location | Threatened entities that use, are likely to use, or are part of the habitat feature. Where relevant, threatened species or fauna that are part of a TEC or EC, that are at risk of vehicle strike |
|---|---|---|---|
| | | where possible enhance, the biophysical, hydrological and ecological integrity of the coastal wetland. This report and others associated with the EIS demonstrate this projects commitment to enhance and protect the integrity of coastal wetlands. | impact to Grey-headed Flying-fox, this is discussed in full within Section 8.4.<br><br>Increased erosion and sedimentation could impact the Eastern Grass Owl and Wallum Froglet. |
| Wind turbine strikes | ☐Yes /<br><br>☒No | The project does not include operation of wind turbines. | N/A |
| Vehicle strikes | ☐Yes /<br><br>☒No | The project will result in increased vehicle movements within the Subject Land, during construction works. However, vehicle speed limits will be implemented as part of the mitigation measures. As a result, it is unlikely that this would present any significant risk to fauna. Majority of the SRMs & RWMs will be within urban areas with significant traffic flow | Fauna is at risk in respect to their level of mobility, though it is unlikely that the threatened fauna observed during the surveys (e.g. Squirrel Glider) would be impacted by vehicle movement with appropriate mitigation measure in place. Fauna located along urban areas may potentially be at risk of vehicle strike during construction works. However, if appropriate mitigation measures are in place, then it is unlikely that fauna or threatened species will be at risk. |

# STAGE 2: IMPACT ASSESSMENT (BIODIVERSITY VALUES AND PRESCRIBED IMPACTS)

# 7.0 AVOID AND MINIMISE IMPACTS

This section identifies the potential impacts of project on the biodiversity values of the Subject Land and broader locality and describes measures to avoid and minimise impacts on those biodiversity values.

## 7.1 AVOID AND MINIMISE DIRECT AND INDIRECT IMPACTS

The main way to reduce impacts on biodiversity values within the study area is to avoid and minimise removal of native vegetation and associated habitat for threatened species. Additional measures to minimise and mitigate indirect and off-site or downstream impacts during construction and operation of the project have also been identified.

### *7.1.1 Need for the Project*

Port Macquarie has been identified as one of the fastest growing regional cities in NSW with projections of an additional 9100 new homes required to meet the anticipated growth projections outlined in the NSW North Coast Regional Plan 2041. The expansion in population is similarly large with an expected 14,200 additional people anticipated to be living in Port Macquarie over the next 20 years. A previous EIS proposed a similar scheme in 2005 (CH2MHILL, 2005), but it was never developed. The existing Port Macquarie WWTP is near capacity and requires expansion to meet existing and future demands.

The project is intended to deliver a WWTP and recycled water supply to existing and proposed residences of Thrumster, Sancrox and Fernbank Creek areas of Port Macquarie. The project would support the growth of urban and industrial areas in these suburbs. This project will provide the required redundancy for Council's sewage treatment and reticulation network with the following benefits:

- Provide sewage treatment capacity for population growth and construction of industrial units.
- Avoid excessive loading of Port Macquarie wastewater treatment plant beyond its design capacity by redirecting a proportion of the sewer from Port Macquarie wastewater treatment plant to Thrumster wastewater treatment plant.
- Provide recycled water for reuse scheme across Thrumster.
- Minimise the environmental impact of wastewater management by reduction of discharged effluent to downstream watercourses through reuse and recycled water schemes.
- Provide redundancy for sewerage treatment assets across the Port Macquarie LGA.

The Thrumster Wastewater Scheme has been identified as State Significant Infrastructure and is a priority project for the Council to ensure communities have access to necessary resources in a safe and reliable manner.

The do-nothing option will result in continued pressure on the existing Port Macquarie WWTP which is already operating at, and in heavy rainfall events, beyond its design capacity. Existing system studies have identified that the do-nothing option is not a feasible forward option (GHD, 2023).

### *7.1.2 Project Location*

#### *7.1.2.1 Wastewater Treatment Plant*

The 2005 EIS identifies four potential locations for the WWTP, including the sand plain (current locations) and three locations south of the Port Macquarie Airport (Plate 21). The consideration at the time excluded Sites A, B and C due to a combination of features including, Aboriginal artefacts, lack of support from indigenous groups, airport proximity, potential for threatened species habitat, space limitation, conflicts with future land use and alternate beneficial uses of land. The sand plain was confirmed as the most desirable location during that assessment.

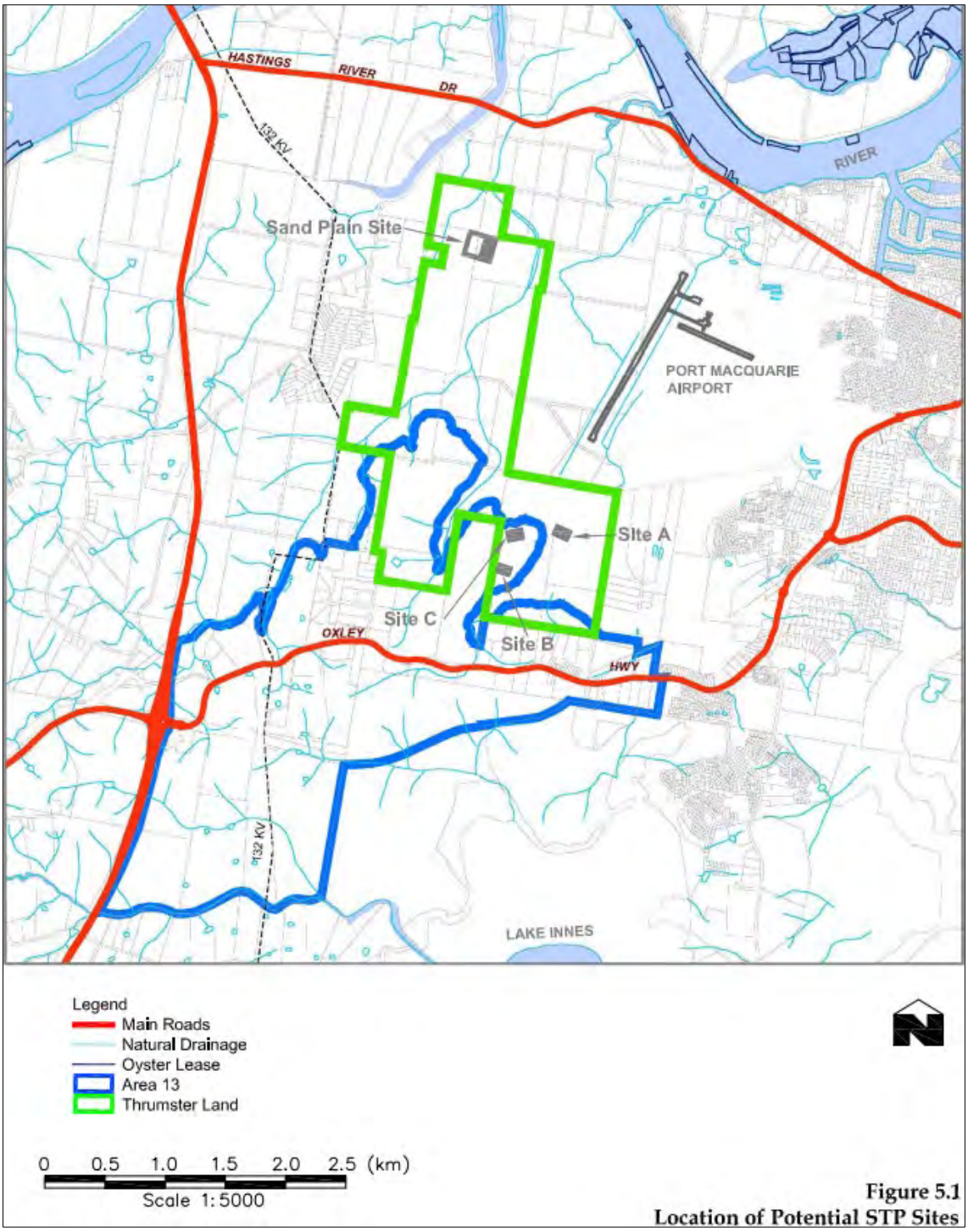


Plate 21 Excerpt from the 2005 EIS (CH2MHILL, 2005), indicating the locations that were previously considered by the project (Sand Plain Site, Site A , B C and D).

When the project was reconsidered, another broad assessment was performed to consider the potential locations for use (PMHC, 2022). This involved again considering Sites A, B, C and the Sand Plain Site, as well as adding two additional sites (Plate 22), one to the north of the Hastings River in The Hatch (Site E) and another to the south of the Oxley Highway(Site F). Under this analysis, Sites A, B and C failed due to similar major risks with sites E and F failing due to threatened species risks, bushfire hazard, site access, land acquisition, risks from the Hastings River, distance from the existing facilities and discharge locations and soil erosion.

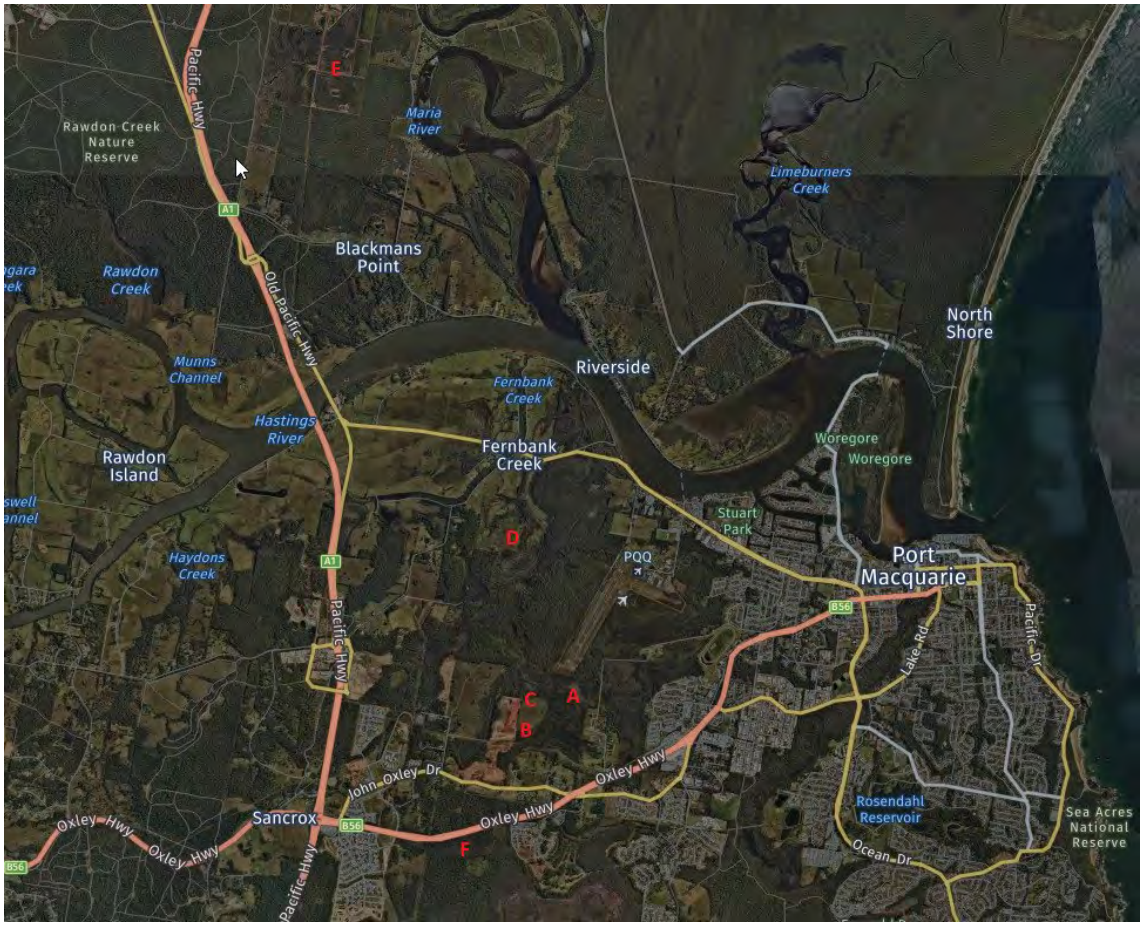


Plate 22 Excerpt from a site location option evaluation (PMHC, 2022), indicating the pipeline routes that were previously considered by the project. New sites, E and F were added as part of this assessment.

In designing the WWTP, the specific location of the facilities within the Sand Plain Site has been modified over time, this is discussed below in section 7.1.3.

In November 2023, surveys by de Witt Ecology identified Giant Dragonfly (*Petalura gigantea*) foraging within the Sand Plain Site (Plate 23). Due to this species threat status and nomination as a potential species at risk of Serious and Irreversible Impacts, major project reconsiderations were made.

Another reassessment of the potential locations to place the WWTP was made at a Strategic Management Plan Review Workshop on 15 December 2023. This workshop reconsidered the previously considered options and considered "blue-sky options" of alternative site locations utilising a GIS based multi-criteria analysis tool utilised (Plate 24) GHD, 2024). The type of GIS assessment is known as the InDeGO Method (Infrastructure Development – Geospatial Options) to quantitatively evaluate potential siting locations based upon existing available GIS data. Additional sites identified by the InDeGO method included Port Macquarie Golf course, Rural zoned land south of the airport, near Innes Gardens Memorial Park, Northwest of Lake Innes Nature Reserve and Rural site west of the Pacific Highway.

The multi-criteria analysis decreased the use of the sand plains site for the WWTP due to biodiversity risks and poor geotechnical conditions, however, the sand plains site was still evaluated as being the best option for the proposal. The other sites considered were excluded based on flood risk, distance from effluent discharge, small size, conflicting current and future land uses, land ownership, emergency overflow constraints (surrounded by sensitive environmental lands), proximity to residential land, core Koala habitat and steep terrain.

Plate 23 Giant Dragonfly (*Petalura gigantea*) identified foraging within the Subject Land in November 2023. See location in Figure 46

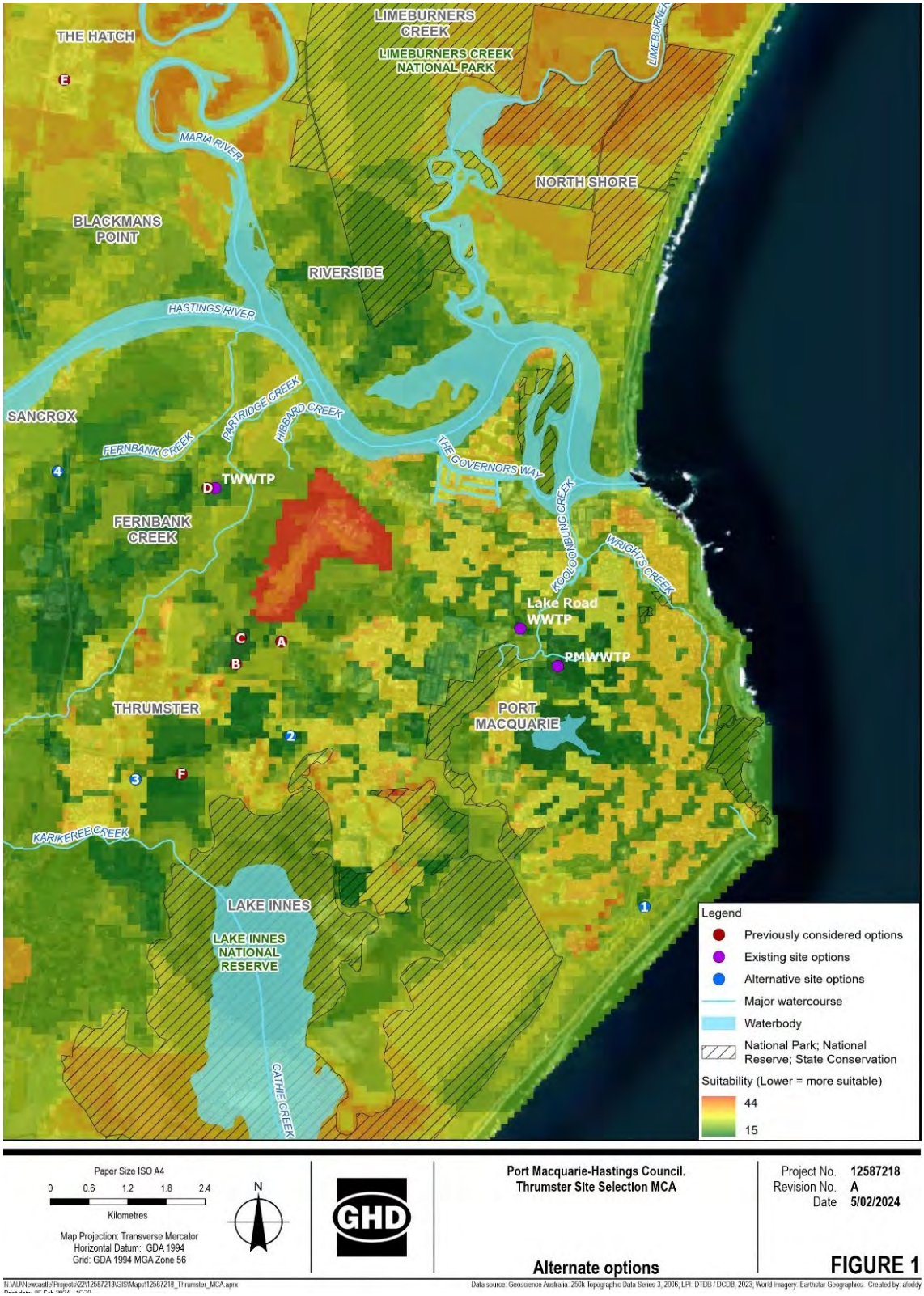


Plate 24 The results of a GIS based multi-criteria analysis using the InDeGO Method (Infrastructure Development – Geospatial Options) to quantitatively evaluate potential siting locations based upon existing available GIS data. The sand plain site is identified as option D.

Though it is acknowledged that the sand plain site is constrained by a number of major factors, including biodiversity, multiple iterations of location selection assessments have consistently returned it as the preferred location. The project has considered biodiversity risks as part of its design (discussed below).

### 7.1.2.2 *Effluent Discharge Options*

There were two effluent discharge routes considered in 2005, one directing south to the Oxley Highway and another north to Hastings River Drive (Plate 25). Due to statutory, community and environmental considerations, the Oxley Highway Route (Southern Route) was determined to be the preferred option, impacting 10.6 km along the side of existing roads and through easements.

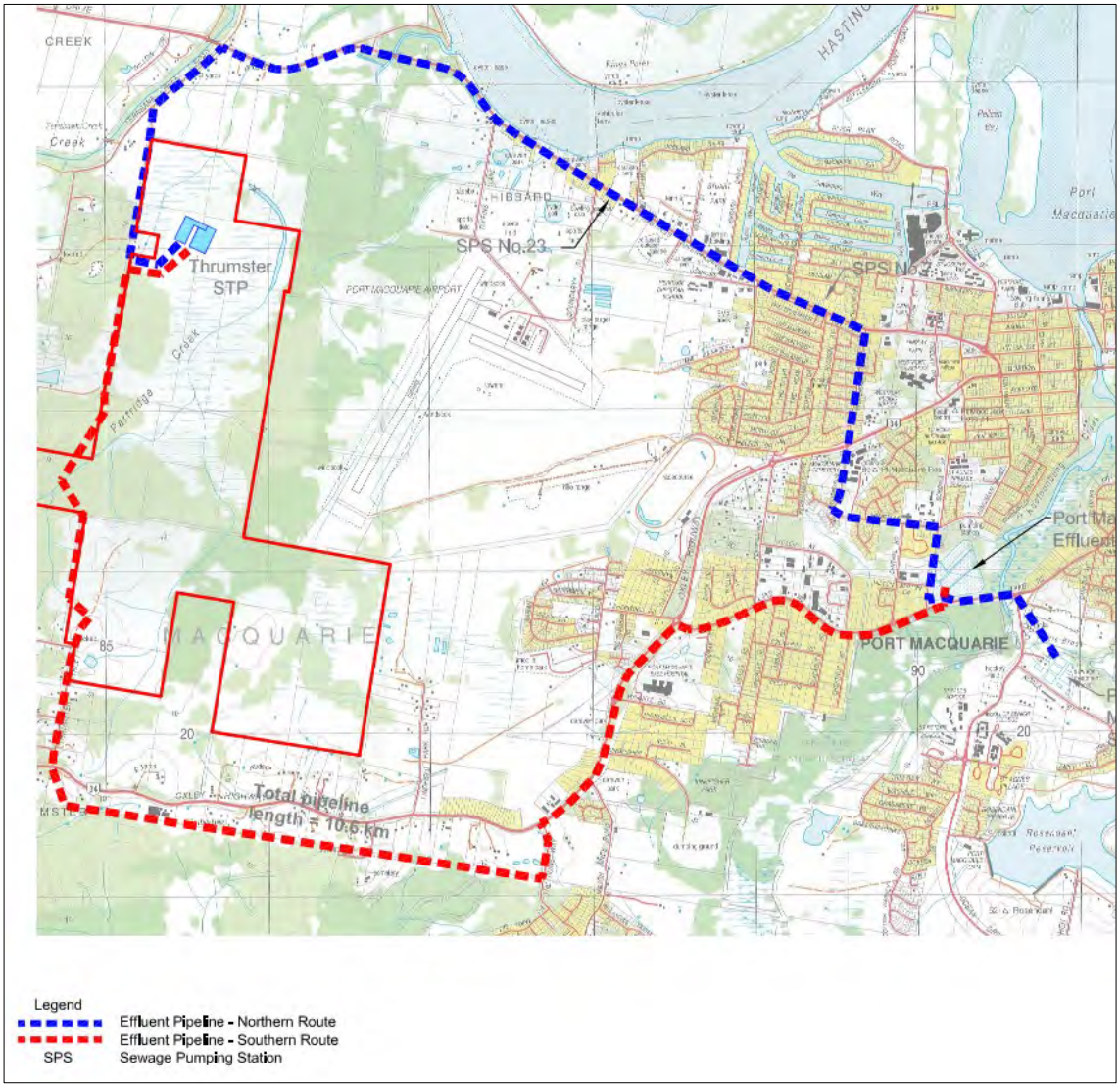


Plate 25 Excerpt from the 2005 EIS (CH2MHILL, 2005), indicating the pipeline routes that were previously considered by the project.

When the project was revisited around 2022, opportunities had opened up to reduce the length of SRMs & RWMs required by the project. Further consideration of the pathway for the SRMs & RWMs was made including releasing directly to Partridge Creek (upstream of the hydraulic gate), releasing directly to the Hastings River (downstream of the Maria River confluence), and releasing at Kooloonbung Creek (either directly or via the Lake Road lagoons) (Plate 26). Assessment by Ramboll (2022) found that release directly to the Hastings River would have a negative impact on aquaculture sites due to their proximity of the discharge location in the river, as well as consequences for exceeding discharge criteria or water quality objectives.

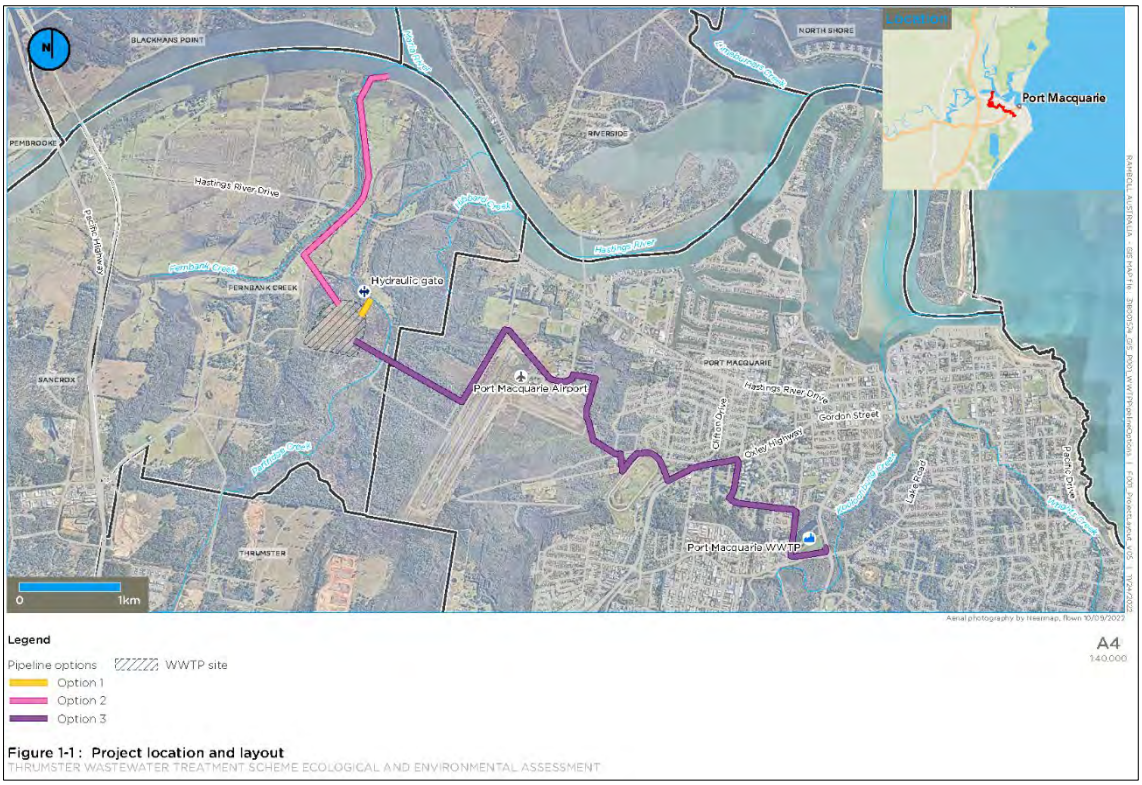


Figure 1-1 : Project location and layout
THRUMSTER WASTEWATER TREATMENT SCHEME ECOLOGICAL AND ENVIRONMENTAL ASSESSMENT

Plate 26 The three options detailed in Ramboll (2022). Option 1 (yellow) release directly to Partridge Creek (upstream of the hydraulic gate), Option 2 (Pink) release directly to the Hastings River (downstream of the Maria River confluence), and Option 3 (Purple) release at Kooloonbung Creek (either directly or via the Lake Road lagoons)

Further assessment was performed in in 2023 through a series of stake holder meetings and option assessments. A long list of options considered included,

- Effluent reuse as recycled water for dual reticulation.
- Effluent reuse as recycled water for agricultural reuse.
- Evaporation.
- Direct discharge to Partridge Creek.
- Discharge to Partridge and Fernbank Creeks via a treatment wetland.
- Discharge to the Hastings River using a shoreline diffuser.
- Discharge to the Hastings River using a deep-water diffuser.
- Direct discharge to Kooloonbung Creek.
- Discharge to the Hastings River mouth as an ebb tide discharge.
- Discharge to the Ocean using a deep-water outfall from the North Shore.

These options were then shortened to,

- Option 1 – Discharge to Partridge Creek via a treatment wetland.
- Option 2 – Discharge to the Hastings River via a deep-water diffuser outfall.
- Option 3 – Discharge to Kooloonbung Creek via a shoreline outlet.

During the review of these options and discussion with stakeholders, two additional options were added:

- Option 4 – Discharge to the mouth of the Hastings River via a deep-water diffuser outfall on an ebb tide.
- Option 5 – Discharge to the ocean via deep sea outfall from the North shore.

These options are summarised in Plate 27

Plate 27 The five options considered for effluent discharge during reviews in 2023 (BECA HunterH2O, 2023). Option 1 is a release to the wetlands around the WWTP. Option 2 Discharge to Hastings River using a deep-water diffuser. Option 3 Discharge to Kooloonbung Creek at the current discharge location for the Port Macquarie WWTP. Option 4 Ebb tide discharge to the Hastings River where the entire discharge is released on the outgoing tide. Option 5 Ocean outfall discharge from the North Shore using an outfall and diffuser system at adequate depth and distance from the shore.

The five options were considered through a multi-criteria analysis technique that considered both cost and non-cost aspects of each option. There were ten non-cost criteria considered, of which environmental, ecological and heritage impacts during construction was the highest weighting at 20%, all other criteria either had 10% or 5% weightings.

Through a series of workshops, Option 2 was excluded due to concerns from Food Authority and oyster growers about the proximity to oyster growing areas as well as complexity in location of diffuser, conflict with large boats and water body closures for construction and maintenance. Option 4 is excluded based on high construction and ongoing costs as well access restrictions. Option 5 is excluded due to potentially high construction, ongoing and offsetting costs.

The workshops concluded that Option 1 (discharge to the wetland area) was the preferred option with Option 3 (discharge to Kooloonbung Creek) as a backup option. Further details of the full consideration of Option 1 are described in Section 7.1.3.2. Ultimately, discharge to Kooloonbung Creek was decided upon as the preferred discharge location. While there are numerous uncertainties in both Option 1 and Option 3, Koooonbung Creek appears to have fewer threatened entities that would be impacted by the proposal and there are less concerns of impacts to nearby conservation areas. The specific entity of concern was the Giant Dragonfly; designing an effluent release system that would not impact on the local hydrology of Partridge Creek such that it would lead to SAII risks for Giant Dragonfly would have been challenging.

#### *7.1.2.3 Compound Locations*

Compound locations have been selected to target areas of completely cleared land or land that already contains built structures. The locations have been placed across the Subject Land such that locations require minimal impact to surrounding land.

### 7.1.3 Project Design

#### 7.1.3.1 Wastewater Treatment Plant

The selection of the Sand Plains Site involves known threatened species recorded in the area, in particular the Wallum Froglet and Grass Owl. In addition, previous reports had indicated historical usage in the nearby locality by Black-necked Stork, Eastern Chestnut Mouse, Koala, Squirrel Glider and Little Bent-winged Bat (HWR Ecological, 2005). It was also known that there were threatened ecological communities surrounding the sand plain and a stewardship site to the east and south.

Initial site investigations determined the sand plains site was comprised of a central area featuring disturbed exotic grassland with exotic flora species incursion, surrounded by native vegetation, ranging from low to good condition,. The site is bounded to the west by a large patch of contiguous vegetation and Freshwater Wetlands on Coastal Floodplains TEC to the north, east and south.

Key factors when considering the location of the WWTP on the sand plain site was to limit direct impacts to exotic vegetation. The ability of the WWTP to avoid all native vegetation was constrained by its size, with priority given to retaining higher condition vegetation where possible.

#### 7.1.3.2 Effluent Discharge Refinement

Further exploration of the concept to discharge treated effluent to Partridge Creek was to use constructed wetlands as part of further improvement in water quality. The construction of polishing wetlands was initially proposed to give an environmental benefit while reducing the resources required to treat the wastewater, the benefits from this were anticipated to include:

- Naturalise treated effluent from the WWTP, through biodiversity uptake of nutrients, pH buffering and evapotranspiration.
- Further remediation of Acid Sulphate Soils through isolating and maintaining appropriate water levels in the floodplain
- Rehabilitation of the existing wetlands
- Maximising wetland biodiversity
- Significant evapotranspiration of treated effluent within the wetlands
- Significant bushfire reduction on the floodplain.

However, further assessment of this concept raised concerns around the management of key biodiversity factors, including:

- The initial proposal also included utilising a portion of the land subject to an existing Biobanking agreement directly to the south and a small amount to the east of the sand plain within wetland B. The hydrology changes would also likely have implications for surrounding land that was also subject to Biobanking agreement.
- The existing Freshwater Wetlands on Coastal Floodplains TEC may be degraded in species richness due to the site becoming densely planted with rushes to the exclusion of other species, such that there was no open water within the system. This could impact the TEC status of the system.
- Removal of breeding habitat for Wallum Froglet within the polishing wetlands due to the increased pH.
- Altered water level may impact on the viability of surrounding treed TECs, such as Swamp Sclerophyll Forest and Swamp Oak Floodplain Forest.
- Disruption of local hydrology due to berm construction, impacting on surrounding TECs that are hydrology dependent.
- Temporary removal of vegetation to implement the design.
- Reduction in foraging habitat of known threatened species such as the Grass Owl and Black-necked Stork. Exclusion of wetland birds was specifically mentioned as a desirable outcome to support the reduction of pathogens in the system.
- The potential for hydrological disturbance by the project, which is listed as the primary threat for the Giant Dragonfly

While the concept of a polishing wetland was considered, it was ultimately excluded from the design as the presence of Giant Dragonfly, a potential species at risk of SAII, meant that impacts to hydrology and functioning of the wetlands by the project needed to be reduced.

In the consideration of effluent discharge locations, discharge to Partridge Creek became a less ideal consideration due to uncertainties on the impacts to Giant Dragonfly. This made discharge to Kooloonbung Creek (an area where existing effluent discharge is already occurring) the preferred discharge location.

#### *7.1.3.3 Sewer Rising Mains and Recycled Water Mains*

The project has implemented a major utilisation of Horizontal Directional Drilling (HDD) to avoid impacts on the wetlands and conservation areas surrounding the WWTP (Plate 28), as well as avoiding critically endangered species and Koala habitat between Acacia Avenue and Central Road, Port Macquarie (Plate 29). This will implement four areas of HDD with lengths totalling over 4.2 km. Potential impacts from the use of HDD are discussed in Section 8.2.2.

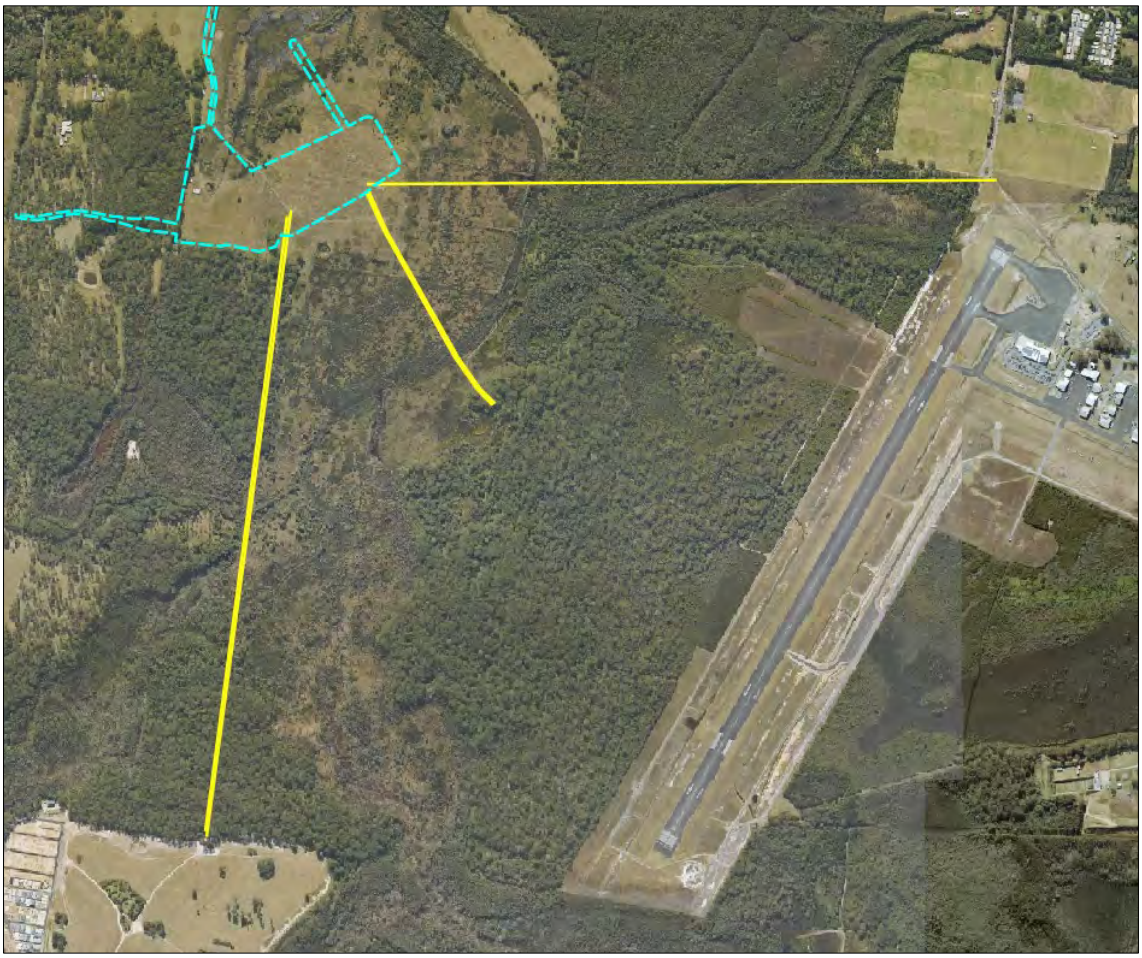

Plate 28. The yellow lines indicate areas where Horizontal Directional Drilling has been used to avoid impacts to wetlands and conservation areas around the WWTP. The Subject Land for the WWTP is illustrated in dashed light blue lines.

Plate 29. The yellow line indicates an area where Horizontal Direction Drilling has been used to avoid impacts to an area where there are numerous records of Native Guava (*Rhodomyrtus psidioides*), a critically endangered species. This area also adjoins the Central Road Koala Plan of Management (Figure 73).

Transport of effluent across the SRMs & RWMs has sought to use direct paths where possible to reduce the distance required and therefore reduce the area impacted by the project. This has meant that the alignment of the SRMs & RWMs follows through the Bio- certified Land within the Port Macquarie Airport, where impact is restricted to a narrow stretch of land that does not require further assessment under the BAM.

In addition, there were several areas where the SRMs & RWMs avoids other biodiversity values, including:

- Avoiding a Biconvex Paperbark individual (Figure 58)
- Avoiding KPoM areas where possible, specifically along Fernhill Road and Acacia Avenue (Figure 73),
- Utilising roads, roadsides and existing walking paths where possible.
- Utilisation of existing exotic vegetation and built structures where possible.

The Subject Land along the SRMs & RWMs also varies in width to balance the needs of the project in particular areas. The minimum corridor width required was 10 m, however it became clear in the design phase that construction would be greatly facilitated if the corridor could be expanded to 20 m where possible. Therefore, in areas of exotic vegetation or public built structures, the corridor was widened to 20 m, in all other locations the corridor was restricted to 10 m width to reduce impacts on biodiversity. This allowed for location specific consideration of the degree of impact and specific reduction in impact to biodiversity values in areas required.

## 7.2 AVOID AND MINIMISE PRESCRIBED IMPACTS

### *7.2.1 Project Location*

The project is not expected to impact on any Karst, caves, crevices, cliffs, rocks and other geological features, or to result in wind turbine strikes. Similarly, the risk of increased vehicle strikes or changes in vehicle strike patterns by the project is very small, with mitigation measures recommended during the construction phase (see Section 8.8).

A key consideration throughout the design of this project has been around what actions would have a negative impact on water bodies, water quality and hydrological processes. This is particularly relevant as the Sand Plains location chosen to host the WWTP is surrounded by wetlands (including those under

conservation agreements), and the effluent output from the WWTP will need to be discharged to a water body. Consideration has been made on whether utilisation of the surrounding wetlands to treat the effluent would lead to a better ecological outcome (see Section 7.1.3.2). Following discovery of the Giant Dragonfly, the avoidance of wetlands with a buffer to allow for their potential breeding habitat (even though no evidence of burrows were found), was a priority for this project. Therefore, location and design measures were implemented so that the WWTP avoids wetland habitat wherever possible. There is a small area of Swamp Sclerophyll Forest TEC (0.04 ha) and Freshwater Wetland on Coastal Floodplains TEC (1.67 ha) that will be impacted by the construction of the SRMs & RWMs and construction compounds but these will be revegetated following the project construction where possible.

The project will produce effluent that is discharged to Kooloonbung Creek. Other options for discharge were considered and this option was determined as likely to have the least ecological impact overall. As treated effluent is already flowing to Kooloonbung Creek, the impacts of this additional discharge on the hydrology of the locality was considered to be less than other alternatives.

The design has specifically placed the WWTP and SRMs & RWMs within exotic dominated vegetation where possible, limiting the overall impact on native species, including those that are not listed as threatened by the BC Act and EPBC Act. There are some highly mobile threatened species that utilise exotic vegetation within the Subject Land, in particular the Eastern Grass Owl, White-bellied Sea-eagle, Giant Dragonfly, and likely the microbats including Eastern Coastal Free-tailed Bat, Little Bent-winged Bat, Large Bent-winged Bat, Southern Myotis and Eastern Cave Bat.

With the exception of the Eastern Grass Owl (further discussed below), all of these species will use the exotic dominated vegetation as foraging habitat. Within the local landscape there are other areas of exotic and managed vegetation. Though loss of potential foraging habitat for a threatened species is not ideal, the project has sought to preserve native vegetation which also provides significant habitat for many threatened and non-threatened species.

The project will have two potential prescribed impacts on the Eastern Grass Owl, the removal exotic, grassland and a potentially break in habitat connectivity due to the elevation of the WWTP and associated roads to above the flooding levels. The Eastern Grass Owl has been recorded on the sand plains site for at least 20 years (HWR Ecological, 2005, and is likely actively foraging within the exotic vegetation for species such as the Swamp rat (*Rattus lutreolus*) that was identified in the south-west of the sand plain. A review of the scientific literature provided very little information on how Eastern Grass Owl utilise their habitat, only that

- they can be both nomadic and sedentary (Clulow et al, 2011),
- will travel to specific areas to target pulses in food availability (Beranek, 2020),
- can live in areas that contain wheat crops (Dahlem, 2015), and
- can utilise land that has been grazed (though this may not be preferred habitat) (Antos & Dann, 2014).

The size of WWTP facility required is the primary reason that a substantial area of exotic vegetation is being utilised by this project. Consideration was given to the placement of the WWTP on the sand plain, and the chosen location avoids substantial areas of native vegetation, including most of the surrounding TECs. Further discussion was given to alignment of the access roads, as it considered that the elevation of these may reduce habitat connectivity for a bird that is adapted to foraging in grassland. The roads and WWTP have been centred on the sand plain such that the interface between exotic and native vegetation allows for species to move between and around the landscape where possible.

### *7.2.2 Project Design*

The project design has been developed to minimise prescribed impacts to natural hydrological processes where practicable, particularly designing to avoid impacts to surrounding wetlands and conservation areas.

Three options were considered for the emergency discharge, which considered impacts to surrounding native vegetation, non-native vegetation and hydrological processes. The purpose of the emergency discharge is to allow for release of the WWTP weir during peak events, it is not intended to be the standard

release method of effluent. It is likely that releases during peak events would go into already flooded systems and be rapidly diluted (Intrawater, 2024). The design considerations included,

a) discharge through a weir using the natural swale of the ground to direct emergency discharge,
b) a series of berms in three direction around the pond to dissipate the energy of overflow,
c) discharge via rip rap to minimize the energy of the discharge for gentle dispersion to the sand plain
d) Discharge via a pipeline to the existing drain upstream of the hydraulic gate (within Wetland A)

Option d) was considered to have high construction impact on the native vegetation, non-native vegetation and TECs, and could be ineffective during a 95-99% discharge event. Options b) and c) were considered to reduce low in erosion risk but were limited in ability to contain and monitor the discharge event. Ultimately option a) was selected as the preferred method of emergency discharge as it contains the discharge to a swale, requires minimal disturbance to native and non-native vegetation and enables the monitoring of emergency discharge.

## 7.3 OTHER MEASURES CONSIDERED

The Project has considered methods to avoid ecological and biodiversity impacts through the design process and where possible adopted these measures. No other measures were evaluated but not selected for implementation based on biodiversity values.

## 7.4 SUMMARY OF MEASURES TO AVOID AND MINIMISE IMPACTS

The Subject Land was modified in design during stages of the project when key biodiversity constraints were identified. This included subject land shift to:

- Undertake multiple rounds of assessment across the development of the project for the sites that will provide the least impact on biodiversity values.
- Avoid TEC wetlands including considering and ultimately rejecting the use of polishing wetlands in favour of effluent discharge to Kooloonbung Creek.
- Use of HDD to avoid impacts to TEC wetlands, critically endangered Native Guava (*Rhodomyrtus psidioides*), Koala habitat, and protecting the conservation areas adjacent to the project.
- Avoid hydrological changes to prevent impacts to Wallum Froglet (*Crinia tinnula)*, Black-necked Stork (*Ephippiorhynchus asiaticus*), White-bellied Sea-eagle (*Haliaeetus leucogaster)*, and Giant Dragonfly (*Petalura gigantea*) foraging or breeding habitat, where practicable.
- Avoid impacts on Biconvex Paperbark (*Melaleuca biconvexa*) individuals.
- Avoid surface impact by limiting areas to exotic vegetation where practicable.
- Reduce impact on non-native vegetation where it supports threatened species such as the Eastern Grass Owl
- Avoiding KPoM areas where possible, specifically along Fernhill Road and Acacia Avenue,
- Utilising roads, roadsides and existing walking paths where possible.
- Targeting existing exotic vegetation and built structures where possible.

## 8.0 IMPACT ASSESSMENT

Assessment of direct and indirect impacts unable to be avoided has been undertaken in accordance with the BAM (DPIE 2020a). The following direct and indirect impacts are unable to be avoided in progressing the project.

### 8.1 EMERGENCY OVERFLOW

Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands is a key threatening process listed under the BC Act. As discussed in Section 7.2.2, the emergency overflow will release effluent to a swale to the north west of the WWTP in the sand plain. The effluent will then be filtered by a mix of scour protection, native and exotic vegetation along the swale towards Partridge Creek. This overflow is only anticipated to be used during emergency situations, with regular release of the discharge being directed to Kooloonbung Creek. Modelling presented in Intrawater (2024) indicated the two major rainfall events would have produced significant overflow events between 2012 and 2022, both of which involved cumulative rainfall of between 400 and 500 mm over 8 to 9 consecutive days. It is possible that the entire area would be flooded during these scenarios.

Modelling by Intrawater (2024) of the impact of an emergency overflow scenario considered impacts from the hydraulic gate into Partridge Creek, with no consideration of any treatment by vegetation in the swale or the wetland. As the hydraulic gate is likely to be opened by Council during flooding and overflow events, it is assumed that any release due to the emergency overflow will travel from the WWTP, along the swale, into Wetland A, and then into Partridge Creek at the hydraulic gate, with no impact upstream on lands that are identified under the BioBanking Agreements (BA487) and the federal EPBC approval (EPBC2016/7842). It is possible that the emergency released effluent will pool in localised areas within Wetland A, these areas would likely have less flushing ability and be local 'traps' for the effluent. It is possible that localised traps would have increased biological oxygen demand due to this eutrophication.

Intrawater (2024) concluded that the flushing of Partridge Creek would mean that 100 m downstream of the hydraulic gates the impact would dissipate upon cessation of overflow and return to background levels. This suggests that impacts on the broader locality of Coastal Wetlands (as identified under the SEPP (Resilience and Hazards) 2021) are likely to be temporary and transitory. It is unclear whether the same dissipation effect would occur within Wetland A.

The modelling indicated that peak increases in concentration within Partridge Creek during an event would include,

- Total Nitrogen: ~0.37 mg/L increase relative to background conditions
- Inorganic Nitrogen: ~0.30 mg/L increase relative to background conditions
- Total Phosphorus: ~0.07 mg/L increase relative to background conditions
- Inorganic Phosphorus: ~0.05 mg/L increase relative to background conditions

The results indicated that Enterococci would have a peak increase of ~750 cfu (colony forming units) / 100 mL during an event, this would be an increase of approximately 3% on the background rate of 20,000 cfu / 100 mL. There is again uncertainty regarding the impact of this increase in Enterococci within Wetland A, though it will be flushed quickly within Partridge Creek.

The Water Resources Assessment (GHD, 2024) indicated that the emergency overflow may cause an increase in local erosion. However, the swale will be lined for scour protection and vegetated where possible, and the discharge would only occur during major flood events. The events are not anticipated to result in impacts to groundwater.

Lands that the emergency overflow will travel through vegetation associated with PCT3967 and Freshwater Wetlands on Coastal Floodplains as well has habitat for the Wallum Froglet (*Crinia tinnula*), Southern Myotis (*Myotis macropus*), Giant Dragonfly (*Petalura gigantea*) and Black-necked Stork (*Ephippiohynchus*

*asiaticus*). Though there are minimal construction requirements of this approach, and the release of effluent is mostly a temporary prescribed impact, an area of direct impacts and associated credits has been included within the Subject Land due to the uncertainty of impacts and to allow for some small level of disturbance to these areas due to the release of effluent.

## 8.2 BIO-CERTIFIED LAND AND CONSERVATION LAND

### *8.2.1 Bio-certified Land*

The "Order conferring biodiversity certification - Port Macquarie Airport and surrounding lands" under section 126H of the Threatened Species Conservation Act 1995 was delivered on 9 August 2018. This established Biodiversity Certified land and land for conservation measures through a biobanking agreement. As this land has been assessed under a biodiversity certification assessment, no further assessment is required within the biodiversity certification area. Nevertheless, ecological advice was sought and provided to ensure that impacts to biodiversity values were avoided within the biodiversity certification area and surrounding conservation areas.

Within the Bio-certified Land, the alignment will follow an existing maintained track between conservation areas to lay the sewer, water and power & communications infrastructure. It is acknowledged that the initial entry from the west will be a narrow pathway between the conservation areas, however the mitigation measures put in place will ensure that impacts to conservation areas are avoided.

Within the airport, large areas of the project will be following existing infrastructure such as roads where possible.

There is a small area in the east where the SRM & RWM appear to pass through conservation areas, however this is passing along an existing management road and alternative pathways would have likely resulted in additional loss of native vegetation.

### *8.2.2 Conservation Land*

Extensive areas of land to the east and south of the WWTP are identified under the BioBanking Agreements (BA487) and the federal EPBC approval (EPBC2016/7842). These areas are also generally included under mapping of the SEPP Coastal Wetlands, contain high probability GDEs, and contain threatened ecological communities including Freshwater Wetlands and Swamp Sclerophyll Forest TECs. The project has taken great consideration of these areas and is not proposing to directly impact on any biodiversity values within these lands.

To reduce the impacts on vegetation from trenching along an alternate route that completely avoids all conservation lands, horizontal directional drilling underneath the conservation lands is proposed. The Water Resources Assessment noted that there were two key risks to this approach,

- Localised disruption of surface water and groundwater connectivity
- Failure of the HDD, resulting in the release of drilling muds and / or the collapse of the piolet drill-hole.

The proponent indicated that they will be following pipeline design in accordance with both the International Erosion Control Associations guideline for *Land-based pipeline construction* and the Australian Pipelines and Gas Associations *Code of Environmental Practice – Onshore Pipelines*. Due to the characteristics of the local geology, it is anticipated that drilling will likely occur to a significant depth to ensure stability of the hole. The proponent is prepared to and intend to invest in drilling mud that, in the unlikely event that the HDD were to fail, would be relatively inert within the environment. As the drilling is anticipated to commence from either the Subject Land or within the Bio-certified Lands, the potential of impacts to groundwater relevant to the conservation lands is anticipated to be negligible.

There are no impacts proposed for biodiversity within conservation lands by the project.

## 8.3 ASSET PROTECTION ZONE

The Bushfire assessment of the WWTP concluded that an APZ width of 20 m would be suitable for the project. It then also notes that this width, measured from the nearest part of built structures to the nearest point of grassland, will be fully incorporated within the Subject Land. Therefore, further consideration of APZ is required for this project.

## 8.4 KOOLOONBUNG CREEK

### *8.4.1 Water Resource and Quality Impacts*

Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands is a key threatening process listed under the BC Act. The project is expected to increase effluent discharge to Kooloonbung Creek compared to the current discharge. A hydrology assessment (Intrawater, 2024) has been conducted to model the water quality impacts within Kooloonbung Creek, along with a comprehensive water resource assessment (GHD, 2024). It is noted that there are inherent uncertainties in modelling future events, particularly around the rate and degree of sea level rise. It is possible that changes in sea level rise will not match the gradual increase in effluent discharge described in the model, which predicted changes for 2058. It is also possible that other changes will occur in the locality that will influence effluent and riparian behaviour. Regardless of the limitations, the current modelling presents an informed estimate to base assessments risk.

The water quality report indicates that, without the introduction of effluent consistent with the background scenario, there would be a long-term rise in salinity within Kooloonbung Creek due to sea level rise. However, the addition of low-salinity effluent discharge from the Thrumster WWTP is expected to return salinity levels to their baseline. Salinity has been identified as a significant factor in reducing Chytridiomycosis transmission in the threatened Green and Golden Bell Frog (Litoria aurea) (Clulow et al., 2018). Even relatively small increases in salinity (e.g., from 1 ppt to 6 ppt) could potentially mitigate the effects of the Chytrid pathogen (Callen et al., 2023).

There is a risk that the release of low-salinity effluent could increase Chytrid transmission. However, data from Intrawater (2024) indicates that median salinity concentrations upstream of Lake Road, Port Macquarie, are 0.4 g/L, and H2O Consulting (2024) describes the area as freshwater, indicating already low salinity levels where the discharge is likely to occur. Therefore, the likely effect of the effluent discharge is to maintain the existing salinity regime within Kooloonbung Creek over time, rather than reduce it, thereby not significantly altering the risk of Chytrid transmission in the long term.

The Intrawater (2024) report indicated that predicted median concentrations of total nitrogen and total phosphorus in water was predicted to decrease under the background scenario but the addition of the effluent from the WWTP would increase concentrations. The net outcome would be a total nitrogen maintaining similar or slightly higher levels to baseline (current) conditions and total phosphorus being slightly lower than baseline conditions. The exception to this being upstream of the effluent discharge point where total nitrogen will be elevated and at the confluence with Wrights Creek where concentrations of both total nitrogen and total phosphorus may be elevated. Throughout Kooloonbung Creek, nutrient levels are currently and will remain above recommended guideline levels. This means that there is ongoing risk of eutrophication within the water.

Chlorophyll *a* and Enterococci levels were both predicted by Intrawater (2024) to be reduced by the effluent discharge. However, there is potential for localised cumulative increases in algal biomass due to higher nutrient loading. The Intrawater (2024) report also assessed toxicity from Nitrate and Ammonia release, both of these can be toxic to aquatic organisms, including amphibians and aquatic plants. The report considered that to achieve a target toxicant level below the 95% Level of Species Protection toxicant default guideline value, a mixing zone of 200 m upstream and 800 m downstream from the outlet would be required to maintain. If a 90% Level of Species Protection toxicant default guideline value was targeted, there would not be a mixing zone required. Ammonia is a particular concern with the potential for discharges that have a pH between 8.0 and 8.5 increasing the toxicity. The pH of the effluent is expected to be between 6.5 and 8.5, it is likely that this will maintain the overall pH within Kooloonbung Creek at approximately 7.0 (H2O Consulting, 2024). The Intrawater (2024) report indicates the potential risk of toxicity in the creek has been

classified as low, though this suggests that nitrate and ammonia levels in Kooloonbung Creek from the project could impact highly sensitive species.

The water resources report (GHD, 2024) identified Kooloonbung Creek as currently being adapted to the existing effluent discharge regime. It was acknowledged that there was the risk of riparian vegetation die-off from the discharge and increased bank saturation / instability. However, as the proposal is to slowly increase the discharge of treated effluent, the water resources report anticipated that the lagoon and wetlands would likely absorb the additional effluent and with a small to negligible overall impact.

The water resources report (GHD, 2024) also indicated that Kooloonbung Creek contained high priority GDEs within 40 m of the Return Effluent pipeline. The report indicates that minimal groundwater extraction will be required during the pipeline trenching process, and therefore it is not anticipated that there will be an impact to the GDEs.

### *8.4.2 Threatened Entity Habitat*

As discussed above, the project has potential for changes in salinity, nitrogen, phosphorus ammonia and nitrate. The primary point of impact appears to be at the discharge point, upstream of the discharge point and the confluence of Wrights Creek. The creek receives regular care from a local volunteer community group, the Friends of Kooloonbung Creek Nature Park, who assist in maintaining the area, including weed management, installation of deer guards and rubbish collection.

Targeted surveys for amphibians were performed in Kooloonbung Creek from the discharge point downstream. No threatened species were detected during surveys for Green and Golden Bell Frog and Wallum Froglet, with only Eastern Dwarf Tree Frog (*Litoria fallax*) and Striped Marsh Frog (*Limnodynastes peronii*) being observed / heard. Due to the pH of approximately 7 in Kooloonbung Creek, it is unlikely that there would be habitat for Wallum Froglet. Additional nutrients have mixed responses for anura species including being implicated in increased disease (Johnson et al, 2007) and having complicated relationships for development (Rowland et al, 2007). As no threatened frog species has been identified, it is unlikely that they will be impacted by the proposal. The impacts on non-threatened species are uncertain but were impacts to occur these would likely be restricted to areas near the discharge and possibly related to exposure to ammonia or increased biological oxygen demand due to eutrophication.

Three threatened flora species have been identified within the Kooloonbung Creek area. Both Scrub Turpentine (*Rhodamnia rubescens*) (critically endangered BC Act and EPBC Act) and Scented Acronychia (*Acronychia littoralis*) (endangered BC Act and EPBC Act) were confirmed in the area. There are previous Bionet records of Native Guava (*Rhodomyrtus psidioides*) (critically endangered BC Act and EPBC Act) but they could not be confirmed. Both of the confirmed threatened species are located approximately 55 m from the edge of the high bank of Kooloonbung Creek. Though there may be groundwater flow from the creek towards these individuals, it is unlikely that any of the changes in the creek nutrient content or flow will deliver a change the conditions experienced by these threatened species due to their distance away and the thick vegetation between them and the creek.

A substantial portion of Kooloonbung Creek is composed of vegetation including,

- PCT 4004 Northern *Melaleuca quinquenervia* Swamp Forest
    - associated with Swamp Sclerophyll Forest on Coastal Floodplains BC Act
    - associated with Coastal Swamp Sclerophyll Forest (Class A) EPBC Act
- PCT4103 *Sporobolus virginicus* Saltmarsh
    - Associated with Coastal Saltmarsh BC Act
    - Subtropical and Temperate Coastal Saltmarsh (EPBC Act)

Within Kooloonbung Creek the effluent discharge will occur in an area dominated by PCT4004 and its associated threatened entities. The conservation advice and final determinations for these entities highlight that the vegetation characteristic of these communities is influenced by the frequency and duration of water inundation and salinity content of the soils. At this stage it is uncertain how the vegetation will respond but the current conditions, which include flows from an existing wastewater treatment facility, seem to be supporting PCT4004 to maintain in good condition. The increased flow of water into Kooloonbung Creek is proposed to happen gradually over time, which is expected to allow for a gradual adaptation to the changed

flow regime. It is possible that this will lead to increased inundation, thought this would possibly also occur with sea level rise. There may be a small increase in total nitrogen, which may increase the locations susceptibility to weed invasion.

Water levels already contain high nutrient levels and the area remains generally free of weeds, though the actions of the local community group Friends of Kooloonbung Creek have likely assisted in maintaining low weed levels. Climate change is listed as a threat facing this community with the potential for sea level rise to change the salinity of the community and the vegetation that can be supported by the environment. Modelling by Intrawater (2024) indicated that the effluent discharge would assist in maintaining the salinity levels at baseline (current) conditions. The Aquatic Ecology report (H2O Consulting, 2024) indicated that the mangroves that fringe much of PCT4004 are likely to assist in absorbing some of the excess nutrients, though vegetation die-back was included as being possible (GHD,2024). Overall, there are uncertainties regarding if PCT4004 will be impacted by the project, however the available evidence suggests that any impacts will be relatively minor alterations to the current regime that is supporting vegetation in good condition.

The primary threats to saltmarsh communities such as PCT4103 include altering hydrology, invasive species, climate change, mangrove encroachment, pollution and eutrophication. Most of the areas of PCT4103 in Kooloonbung Creek are not directly adjacent to the main creek line, with vegetation from either PCT4004 or PCT4091 (Grey Mangrove - River Mangrove Forest) protecting PCT4103. The areas of PCT4103 are also further downstream, with the nearest example adjacent to the creek approximately 270 m from the discharge point. The project will increase the waterflow into ecosystem gradually, adding to water level rises associated with climate change, however this is to occur gradually over time to allow some degree of adaptation and the distance from the discharge point means that its effect is reduced.

Though the areas of PCT4103 seem stable at the present, it is possible that increases in nitrogen within the system may facilitate the establishment of non-saltmarsh species. The mechanisms for mangrove encroachment are varied and include changes in temperature, rainfall, sedimentation and possibly nutrients. The Aquatic Ecology Report (H2O Consulting, 2024) indicated that there was the possibility of mangrove encroachment, however, there remains uncertainty about this as the reduced salinity may offset the changes in water level.

A Nationally Important maternity camp of Grey-headed Flying-fox (vulnerable BC Act and EPBC Act) is located in the northern extent of Kooloonbung Creek, generally near the confluence with Wrights Creek. This camp is heavily reliant on the vegetation within Kooloonbung Creek to support its ongoing use and may also use the creek to help keep themselves cool in hot weather by skimming the surface and licking their wet bodies. The camp is near the confluence of Kooloonbung Creek and the Hastings river, between 500 m and 1 km from the Hastings River. The influence of the discharge to this section of Kooloonbung Creek is greatly reduced, with dilution of nitrate and ammonia to below threshold levels.

Intrawater (2024) do model minor differences in Total Nitrogen 1 km upstream from the Hastings River confluence, however, overall levels in the creek are substantially reduced from the discharge point. The majority of the use by the Grey-headed Flying-fox camp is likely to be in the taller vegetation surrounding the creek, which is elevated above the water level, though there may be individuals that come down into the mangroves during hot weather or peak camp use. Based on the dilution factor, and the greater influence of the tide near the flying-fox camp, it is unlikely that there will be any significant impact on the vegetation supporting the Grey-headed Flying-foxes. As flying-fox direct interaction with the water and consumption of the water is likely to be limited and in the diluted area, beyond where nitrate and ammonia are possible to occur above guidelines, it is unlikely that the effluent from the WWTP will impact on the Grey-headed Flying-fox camp.

Overall, consideration of the vegetation and species within Kooloonbung Creek there remains uncertainty about how the release of effluent from the WWTP will impact the community. However, evidence from the effect of the current effluent discharge on the community, the proposed gradual introduction of effluent and the likely long-term increase in sea level will all contribute to reducing the impacts from the effluent release. Direct impacts for threatened and non-threatened entities are unlikely from the project, rather a mix of prescribed and indirect impacts are possible, though unlikely to occur. Ongoing monitoring within Kooloonbung Creek as part of the VMP will be needed to ensure that if an impact does occur it can be

remediated. The good health of Kooloonbung Creek can be partially attributed to the Friends of Kooloonbung Creek Nature Park group, continued engagement with this volunteer group will help ensure a good outcome for this environment.

## 8.5 DIRECT IMPACTS

Direct impacts will occur on site with removal of vegetation and species habitat. This section outlines the direct impacts to biodiversity through summarising impacts by PCT and specifying the impacts on listed threatened species.

### *8.5.1 Residual Direct Impacts*

A detailed list documenting residual impacts likely to occur is shown on Figure 60 - Figure 64 and Table 28 below.

Table 28 Summary of residual direct impacts. Ecosystem credit species have been included in this table for clarity but have an extent that is specific to the vegetation zones that they are associated with, see Table 21 for associated vegetation zones.

| Direct Impact | BC Act status | EPBC Act status | SAII Entity | Project Phase / timing of impact | Extent (ha) |
|---|---|---|---|---|---|
| Removal of VZ1 PCT 3167 Northern Hinterland Blackbutt Forest Oak Wet Forest – Low Condition | Not Listed | Not Listed | No | During pre-construction clearing. | 0.18 |
| Removal of VZ2 PCT 3167 Northern Hinterland Blackbutt Forest Oak Wet Forest – Moderate Condition | Not Listed | Not Listed | No | | 0.6 |
| Removal of VZ3 PCT 3250 Northern Foothills Blackbutt Grassy Forest – Low Condition | Not Listed | Not Listed | No | | 0.12 |
| Removal of VZ4 PCT 3250 Northern Foothills Blackbutt Grassy Forest – Moderate to Good Condition | Not Listed | Not Listed | No | | 0.60 |
| Removal of VZ5 Exotic Vegetation | Not Listed | Not Listed | No | | 17.57 |
| Removal of VZ6 PCT 3544 Coastal Sands Apple-Blackbutt Forest – Low Condition | Not Listed | Not Listed | No | | 1.61 |
| Removal of VZ7 PCT 3544 Coastal Sands Apple-Blackbutt Forest – Moderate Condition | Not Listed | Not Listed | No | | 0.21 |
| Removal of VZ8 PCT 3967 Northern Lower Floodplain Eleocharis Wetland – Good Condition | Endangered Ecological Community | Not Listed | No | | 1.67 |
| Removal of VZ9 PCT 4006 Northern Paperbark-Swamp Mahogany Saw-sedge Forest – Moderate Condition | Endangered Ecological Community | Endangered Ecological Community | No | | 0.04 |
| Removal of habitat for Black-necked Stork (*Ephippiorhynchus asiaticus*) | Endangered | Not Listed | No | | Ecosystem Credit |
| Removal of habitat for White-bellied Sea Eagle (*Haliaeetus leucogaster*) | Vulnerable | Not Listed | No | | Ecosystem Credit |

| Direct Impact | BC Act status | EPBC Act status | SAII Entity | Project Phase / timing of impact | Extent (ha) |
|---|---|---|---|---|---|
| Removal of habitat for Eastern Coastal Free-tailed Bat (*Micronomus norfolkensis*) | Vulnerable | Not Listed | No | During pre-construction clearing. | Ecosystem Credit |
| Removal of habitat for Little Bent-winged Bat (*Miniopterus australis*) | Vulnerable | Not Listed | No, as breeding habitat will not be impacted as part of the project. | | Ecosystem Credit |
| Removal of habitat for Large Bent-winged Bat (*Miniopterus orianae oceanensis*) | Vulnerable | Not Listed | No, as breeding habitat will not be impacted as part of the project. | | Ecosystem Credit |
| Removal of habitat for Eastern Grass Owl (*Tyto longimembris*) | Vulnerable | Not Listed | No | | Ecosystem Credit |
| Removal of potential habitat for Smale Pale Grass-Lilly (*Caesia parviflora var. minor*) | Endangered | Not Listed | No | | 0.73 |
| Removal of habitat for Wallum Froglet (*Crinia tinnula*) | Vulnerable | Not Listed | No | | 4.2 |
| Removal of potential habitat for Leafless Tongue Orchid (*Cryptostylis hutneriana*) | Vulnerable | Vulnerable | No | | 2.32 |
| Removal of potential habitat for Spider Orchid (*Dendrobium melaleucaphilum*) | Endangered | Not Listed | No | | 0.73 |
| Removal of mapped important habitat for Swift Parrot (*Lathamus discolor*) | Endangered | Critically Endangered | Yes | | 1.07 |
| Removal of potential habitat for Green-thighed Frog (*Litoria brevipalmata*) | Vulnerable | Not Listed | No | | 0.76 |
| Removal of potential habitat for Slender Marsdenia (*Marsdenia longiloba*) | Endangered | Vulnerable | No | | 1.11 |
| Removal of habitat for Southern Myotis (*Myotis Macropus)* | Vulnerable | Not Listed | No | | 11.26 |
| Removal of foraging habitat for Giant Dragonfly (*Petalura gigantea*) | Endangered | Not Listed | No, as breeding habitat will not be impacted as part of the project. | | 14.32 |
| Removal of habitat for Squirrel Glider (*Petaurus norfolcensis*) | Vulnerable | Not Listed | No | | 1.87 |
| Removal of habitat for Koala (*Phascolarctos cinereus*) | Endangered | Endangered | No | | 1.87 |
| Removal of potential habitat for Eastern Cave Bat (*Vespadelus troughtoni*) | Vulnerable | Not Listed | No, as breeding habitat will not be impacted as part of the project. | | 22.61 |
| Removal of habitat features including 4 hollow-bearing trees containing 7 hollows | - | - | - | | - |

In addition to this, there will be a direct impact to hollow bearing trees (Figure 33 - Figure 37), specifically four trees containing seven hollows between them.

- HBT 3 and HBT 4 are both *Eucalyptus teriticornis* containing one small (5-10 cm) hollow each. These HBTs are both located near the intersection of John Oxley Drive and Major Innes Road.
- HBT 7 is a *Eucalyptus teriticornis* containing two small (5-10 cm) hollows and 2 medium (10-20 cm) hollows. This HBT is located off John Oxley Drive, near Lake Innes Village.
- HBT 9 is a *Eucalyptus pilularis* containing one medium (10-20 cm) hollow. This HBT is located near the access road to the WWTP.

These impacts will be permanent, will occur from the outset of the development and represent the result of efforts to avoid and minimise impacts at the project design phase. Mitigation measures outlined in Section 8.8 will help to minimise the potential impacts to biodiversity values that remain present within the study area.

### *8.5.2 Change in Vegetation Integrity Score*

As outlined in Section 9.2.1 of the BAM, an offset is not required for impacts on native vegetation where the vegetation integrity score is:

- ≥15 where the PCT is representative of an endangered or critically endangered ecological community.
- ≥17 where the PCT is associated with threatened species habitat (as represented by ecosystem credits), or is representative of a vulnerable ecological community.
- ≥20 where the PCT is not representative of a TEC or associated with threatened species habitat.

The effect of direct impacts on vegetation integrity of native vegetation within the subject land is summarised in Table 29.

Table 29 Impacts to vegetation integrity

| Vegetation Zone | PCT ID | Management zone | Area (ha) | Before development (Current) | | | | After development (Future) | | | | Change in Vegetation Integrity Score / Vegetation Integrity Loss |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Composition | Structure | Function | Vegetation Integrity Score | Comp | Structure | Function | Vegetation Integrity Score | |
| VZ1 | 3167 | MZ1 | 0.18 | 73.2 | 32.6 | 80.1 | 57.6 | - | - | - | - | -57.6 |
| VZ2 | 3167 | MZ2 | 0.6 | 70.6 | 76.1 | 80 | 75.5 | - | - | - | - | -75.5 |
| VZ3 | 3250 | MZ3 | 0.12 | 41.3 | 55.3 | 56 | 50.4 | - | - | - | - | -50.4 |
| VZ4 | 3250 | MZ4 | 0.61 | 95.1 | 75.8 | 80.1 | 83.3 | - | - | - | - | -83.3 |
| VZ5 | 3544 (Exotic) | MZ5 | 17.57 | 7.6 | 1.6 | 5.7 | 4.1 | - | - | - | - | -4.1 |
| VZ6 | 3544 | MZ6 | 1.61 | 6.9 | 23.4 | 15 | 13.4 | - | - | - | - | -13.4 |
| VZ7 | 3544 | MZ7 | 0.21 | 59.7 | 43.1 | 68.5 | 56.1 | - | - | - | - | -56.1 |
| VZ8 | 3967 | MZ8 | 1.67 | 48.9 | 100 | | 70 | - | - | - | - | -70 |
| VZ9 | 4006 | MZ9 | 0.04 | 75.5 | 45 | 65.5 | 60.6 | - | - | - | - | -60.6 |

## 8.6 INDIRECT IMPACTS

Potential indirect impacts predicted from the project are outlined and assessed in Table 30 below. Consideration of indirect impacts was undertaken across the assessment area buffer around the Subject Land and included consideration of the project within the Subject Land.

Table 30 Assessment of indirect impacts

| Indirect impact | Impacted entities | Extent | Frequency | Duration | Project Phase / Timing of Impact | Assessment / likelihood of occurrence |
|---|---|---|---|---|---|---|
| Inadvertent impacts on adjacent habitat or vegetation. | Vegetation immediately surrounding the Subject Land. | Immediately adjacent to the Subject Land | Individual events | Short term | During removal of vegetation and construction. | The project will be performed next to native vegetation, including areas that contain TECs, habitat for threatened species, and are identified conservation areas. Consideration of these biodiversity values has been made throughout the design process.<br>The project is unlikely to result in inadvertent impacts on adjacent retained habitat or vegetation. Mitigation measures implemented during the construction of the project will ensure no encroachment to |

| Indirect impact | Impacted entities | Extent | Frequency | Duration | Project Phase / Timing of Impact | Assessment / likelihood of occurrence |
|---|---|---|---|---|---|---|
| | | | | | | adjacent vegetation and habitat by construction workers. |
| Reduced viability of adjacent habitat due to edge effects. | Vegetation immediately surrounding the Subject Land. | Immediately adjacent to the Subject Land | - | Long term | From the time that vegetation is removed onwards, until the trench is remediated. | The project will be performed next to native vegetation, including areas that contain TECs, habitat for threatened species, and are identified conservation areas. Consideration of these biodiversity values has been made throughout the design process.<br>The project is not anticipated to result in a significant increase in edge effects impacting upon the retained vegetation. This is because the locations chosen for the project are generally in already disturbed areas. The WWTP will be restricted to disturbed exotic dominated areas. The SRM & RWM will be generally placed within exotic dominated areas, as well as focusing along existing paths through native vegetation areas. The emergency access road will pass through an area of vegetation that has been less impacted, but it is a relatively small area. Though there will be an increase in edge effects in some areas, these are small in comparison to the size of the project. |
| Reduced viability of adjacent habitat due to noise and dust. | Flora and fauna immediately surrounding the Subject Land. | Immediately adjacent to the Subject Land | Individual events | Short term | During removal of vegetation and construction. | Mitigation measures outlined in Section 8.8 and standard construction environmental controls will ensure potential impacts are minimised. |
| Transport of weeds and pathogens from the subject land to adjacent vegetation. | Flora and fauna immediately surrounding the Subject Land. | Immediately adjacent to the Subject Land | Individual events | Short term | During removal of vegetation and construction. | The potential introduction and spread of weeds and pathogens will be managed through implementation of weed hygiene controls during the construction phase (see mitigation measures in Section 8.8). |
| Increased risk of starvation, exposure and loss of shade or shelter. | Fauna and shade adapted flora within the Subject Land | Immediately adjacent to the Subject Land | - | Long term | From the time that vegetation is removed onwards. | In the vicinity of the WWTP, there is significant native vegetation in the surrounding landscape that has been secured in the long term through a conservation agreement. |

| Indirect impact | Impacted entities | Extent | Frequency | Duration | Project Phase / Timing of Impact | Assessment / likelihood of occurrence |
|---|---|---|---|---|---|---|
| Loss of breeding habitats. | Fauna within the Subject Land | Within and immediately adjacent to the Subject Land | - | Long term | From the time that vegetation is removed onwards. | The project will impact on native trees, of which four contain hollows. This is a relatively small number for the size of the project, and other hollow-bearing trees will not be impacted by the project, remaining surrounding the Subject Land.<br><br>The project will impact on terrestrial dry sclerophyll forest, forested wetlands, wetlands and exotic grasslands. Threatened fauna recorded within the Subject Land that are likely to utilise these environments as breeding environments include Wallum Froglet and Eastern Grass Owl. Surveys did not identify any burrows suitable for breeding by Giant Dragonfly. Mitigation measures outlined in Section 8.8 would ensure potential impacts outside the Subject Land are avoided, which will protect the substantial areas of suitable breeding habitat for Wallum Froglet in the surrounding conservation areas. It is likely that the area of suitable breeding habitat for the Eastern Grass Owl will be reduced. |
| Inhibition of nitrogen fixation and increased soil salinity. | Vegetation within and immediately surrounding the Subject Land. | Within and immediately adjacent to the Subject Land | - | Long term | From the time that vegetation is removed onwards. | Nitrogen fixation can occur through free living microbiota as well as in mutual relationship between plants and bacteria. The typical flora species that are associated with nitrogen fixation are members of the Fabaceae family, such as members of the *Acacia* genus. Some species of grass have also been found to have relationships with nitrogen fixing bacteria.<br><br>There are very few members of the Fabaceae family within the Subject Land across the project area. Though grasses occur across the Subject Land, with many exotic species occurring, particularly in the vicinity of the WWTP, it is unclear how many of these species would contribute to supporting nitrogen fixation. It is also unlikely that the removal of these individuals these will lead to a significant reduction in nitrogen fixation in a way that would impact the surrounding landscape as the sand would not support the holding of nitrogen in the soil.<br><br>The trenching activity may disturb nitrogen fixation, but the restoration of the soil and revegetation following the trenching would likely restore that activity. |

| Indirect impact | Impacted entities | Extent | Frequency | Duration | Project Phase / Timing of Impact | Assessment / likelihood of occurrence |
|---|---|---|---|---|---|---|
| Fertiliser drift | - | Immediately adjacent to the Subject Land | Once during revegetation | Short term | - | Fertiliser application may be made during the revegetation process but this would be targeted and applied by professional regenerators and landscapers. |
| Rubbish dumping. | General environment | Immediately adjacent to the Subject Land | - | Short term | All phases | The construction contractor (Section 8.8) will clearly set out waste management areas and procedures during the proposed works. |
| Wood collection. | - | - | - | - | - | There will be no retained woody vegetation within the Subject Land. |
| Removal and disturbance of rocks, including bush rock | - | - | - | - | - | No bush rocks were identified during surveys. |
| Increase in predatory species populations. | Native flora and fauna | Immediately adjacent to the Subject Land | - | Long term | - | Waste management measures outlined in Section 8.8 will mitigate the potential increase in predator species populations. |
| Increase in pest animal populations. | - | Immediately adjacent to the Subject Land | - | Long term | - | Pest animals are currently being controlled within the sand plain, particularly deer. The project is unlikely to result in an increase in pest animals. |
| Change in fire regimes | - | Immediately adjacent to the Subject Land | - | Long term | - | The project will not significantly impact on the bushfire rating within the area. |
| Disturbance to specialist breeding and foraging habitat. | - | Immediately adjacent to the Subject Land | - | Long term | - | It is likely that the Eastern Grass Owl is using the sand plain as a foraging and possibly breeding habitat. Giant Dragonfly was identified foraging within the Subject Land. The impact of this project on vegetation types does not completely remove any form of habitat from the surrounding landscape. There will, therefore, be other opportunities for species to forage and breed in the surrounding landscape, though they may not be as ideal as the sand plain currently is for these species. Assuming that the mitigation measures outlined in Section 8.8 are implemented, indirect impacts on specialist breeding and foraging habitat by the project will be reduced. |

| Indirect impact | Impacted entities | Extent | Frequency | Duration | Project Phase / Timing of Impact | Assessment / likelihood of occurrence |
|---|---|---|---|---|---|---|
| Fragmentation of movement corridors and riparian zone. | Flora and fauna | Immediately adjacent to the Subject Land | - | Long term | From the time that vegetation is removed onwards, until the trench is rehabilitated. | Construction of the project will involve the use of a 10 m corridor in native vegetation areas to construct the SRM & RWM. The SRM & RWM have generally been placed in areas where there is already fragmentation of vegetation, to reduce the impacts of fragmentation.<br><br>The emergency access road will cause a small amount of fragmentation that may impact less mobile arboreal species, however there will not be fences along the roads, so access across these areas will still be possible.<br><br>The WWTP has been placed within the sand plain such that it impacts on less native vegetation, including the surrounding TECs and forested areas. While the WWTP will reduce connectivity within the sand plain, the Eastern Grass Owl is a highly mobile species that will likely still be able to navigate the available habitat. Additionally, mitigation measures outlined in Section 8.8, outline revegetation is to occur where areas of TEC occur within the Subject Land.<br><br>It is noted that impediments to movement such as minor roads / tracks and managed exotic grassland, currently exist within the Subject Land. |
| Contamination to adjacent waterways | Vegetation immediately surrounding the Subject Land. | Immediately adjacent to the Subject Land | Individual events | Short term | During removal of vegetation and construction. | The project will produce treated effluent that will enter Kooloonbung Creek, this effluent will be managed and controlled where possible to not negatively impact on Kooloonbung Creek.<br><br>The WWTP will have an emergency overflow that will release partially treated effluent during peak periods of flow. These periods will likely correspond to peaks in rain and flooding that will dilute any released effluent. The emergency discharge will release to an existing swale where the flow can be monitored.<br><br>Accidental runoff contamination originating from construction within the Subject Land can be avoided, minimised and mitigated by implementing sedimentation and erosion control measures (Section 8.8). |

| Indirect impact | Impacted entities | Extent | Frequency | Duration | Project Phase / Timing of Impact | Assessment / likelihood of occurrence |
|---|---|---|---|---|---|---|
| Land use pattern change disrupting biodiversity | Vegetation within and immediately surrounding the Subject Land | Immediately adjacent to the Subject Land | - | Long Term | During and after removal of vegetation and construction | Repurposing of land through clearing or landscape changes can deteriorate biodiversity value by removal or runoff effects. Mitigation measures discussed in Section 8.8 highlight protocols to further reduce the impacts on biodiversity. A Vegetation Management Plan will be in use to support an increase in ecological values in designated zones to reduce the permanent change in landscape for the WWTP and SRM & RWM. |

## 8.7 PRESCRIBED IMPACTS

Assessment of prescribed biodiversity impacts are outlined and addressed in Table 31 below and identified on Section 6.0. The following prescribed impacts were assessed in Section 6.0 to not require further assessment,

- Karst, caves, crevices, cliffs, rocks and other geological features of significance
- Wind turbine strikes
- Vehicle strikes

Table 31 Assessment of prescribed impacts

| Prescribed impact | Nature of Impact | Extent of Impact | Duration of Impact | Consequence of Impact |
|---|---|---|---|---|
| Human-made structures or non-native vegetation | A human made structure located to the west of the WWTP along the border of the study area is observed as being a potential habitat for bats, though none were identified during surveys. | The human made structure is a dilapidated house with small wooden shed. This structure may require removal. | Duration for the construction of the WWTP and access roads would be from clearing into the future. The SRM & RWM will be re-vegetated with species from PCTs within the locality. | Displacement of species that rely on structures for habitat and non-native vegetation for habitat and foraging grounds. |
| | The non-native and degraded vegetation within the sand plain currently provides habitat for some threatened species, in particular the Eastern Grass Owl, White-bellied Sea-eagle, Giant Dragonfly, and likely the microbats including Eastern Coastal Free-tailed Bat, Little Bent-winged Bat, Large Bent-winged Bat, Southern Myotis and Eastern Cave Bat. This habitat does prove suitable for a variety of insect species, which is a beneficial food source for microbats and other native species. | The project will impact 17.57 ha of exotic dominated vegetation, of which 10.05 ha occur within the sand plain. | | This will likely reduce the availability of foraging habitat for threatened species that utilise the exotic vegetation, and may impact on the breeding habitat of a population of Eastern Grass Owl. |

| Prescribed impact | Nature of Impact | Extent of Impact | Duration of Impact | Consequence of Impact |
|---|---|---|---|---|
| Habitat connectivity | The project has endeavoured to reduce impacts to native vegetation and will generally be placed along existing lines of fragmentation. This may cause a small increase in fragmentation and minor reduction in habitat connectivity but many of the species impacted by this, such as Squirrel Glider and Koala, are relatively mobile and are unlikely to be significantly impacted by the project. | Impacts to canopy will occur in the emergency access road and along the SRM & RWM. | WWTP will be a permanent feature. | There may be a small increase in the gaps of canopy within the SRM & RWM, the project will implement measures to reduce impacts, further described in Section 8.8. Revegetation using shallow rooting plants will occur along the SRM & RWM, therefore impacts will be reduced. |
| | The WWTP will occupy a large portion of the sand plains exotic dominated grassland. While selecting this location has reduced the impacts on habitat connectivity to many other native species, it may impact on the habitat connectivity of the Eastern Grass Owl and foraging habitat for Giant Dragonfly.<br><br>Wetland connectivity is not anticipated to be affected and it is anticipated that threatened species such as the Wallum Froglet will continue utilising all parts of the wetland. | The position of the WWTP may impact grassland connectivity. The connectivity is not severed, but reduced as species such as the Eastern Grass Owl and Giant Dragonfly can still move around the WWTP to the other vegetated areas. | Where possible, SRM & RWM will be restored with shallow rooting native species. | The WWTP will reduce the connectivity present in the sand plain for the Eastern Grass Owl and Giant Dragonfly. However, these are both mobile species that will be likely to not experience a break in habitat connectivity. |

| Prescribed impact | Nature of Impact | Extent of Impact | Duration of Impact | Consequence of Impact |
|---|---|---|---|---|
| Water bodies, water quality and hydrological processes | The project will produce treated effluent that will enter Kooloonbung Creek, this effluent will be managed and controlled where possible to not negatively impact on Kooloonbung Creek. Potential impacts considered due to this include to threatened flora, threatened ecological communities, and a nationally significant Flying-fox camp. See Section 8.4 for a full description of the potential impacts. | Effluent in Kooloonbong Creek is anticipated to be primarily within the local area to the effluent discharge point, with the effluent mixing with the existing effluent discharge and the ocean tide to dilute into the creek. It is not expected that there will be impacts on threatened flora or the Flying-fox camp. There are uncertainties regarding the influence of the effluent on threatened ecological communities, which can be partially mitigated under a VMP. | The effluent release to Kooloonbong Creek will be ongoing. | Monitoring of Kooloonbong Creek through a VMP will address some uncertainties on the impact on the creek, water quality and hydrological processes. (Section 8.4) |
| | The WWTP will have an emergency overflow that will release partially treated effluent during peak periods of flow. These periods will likely correspond to peaks in rain and flooding that will dilute any released effluent. The emergency discharge will release to an existing swale where the flow can be monitored. The release will temporarily increase total nitrogen, phosphorus and Enterococci. This has potential to influence habitat for Freshwater Wetlands on Coastal Floodplains TEC as well has habitat for the Wallum Froglet, Southern Myotis, Giant Dragonfly and Black-necked Stork. See Section 8.1 for a full description of impacts during an overflow event. | The emergency discharge will be localised to a swale immediately adjacent to the WWTP. The emergency discharge will flow through the swale to Wetland A and into Partridge Creek where it is expected to be flushed very quickly. | The emergency discharge will occur during peak events only. Modelling has indicated that impacts to Partridge Creek will cease very quickly after the overflow event. | The emergency discharge will only be discharging for a short period of time that corresponds with major rainfall and likely flooding events. It is likely that there will be significant flushing involved in this event though it is acknowledged that there are uncertainties associated with this. It is expected to be a temporary event.<br><br>Due to the high flows at the time of overflow, it is assumed that there will be no impact on lands that are identified under the BioBanking Agreements (BA487) and the federal EPBC approval (EPBC2016/7842). |

| Prescribed impact | Nature of Impact | Extent of Impact | Duration of Impact | Consequence of Impact |
|---|---|---|---|---|
| Water bodies, water quality and hydrological processes | There will be a small area of wetland habitat directly impacted by the project, including 1.67 ha of PCT3967 in good condition and 0.04 ha of PCT4006 in moderate condition. Both of these communities are associated with TECs and are likely GDEs. As the impact to PCT3967 in good condition will occur in the upper section of the path of water flow, there will be an impact to downstream waterways. However, these impacts can be reduced through appropriate management of sedimentation and erosion control measures (Section 8.8). | Impacts to PCT 3967 in good condition and PCT4006 in moderate condition would be restricted to the Subject Land. | Impacts to PCT3967 in good condition and PCT4006 in moderate condition will occur during construction and, in some areas, may be revegetated following the construction process. | Removal of PCT3967 in good condition and PCT4006 in moderate condition may make a minor alteration to hydrological processes in the surrounding wetlands, particularly wetland A. |
| | There is the potential for a prescribed impact to groundwater associated with the construction of the emergency storage pond, which could intercept groundwater (Figure 60). | The Water Resources Assessment (GHD, 2024) indicated that the interception of groundwater would generate an inflow rate of 0.11 cubic meters per day and have a drawdown of 48.8 m radius. Our mapping indicates that this may intercept a small (0.02 ha) area of PCT3967 associated with Freshwater Wetlands on Coastal Floodplains TEC. | The impact is anticipated to be temporary, only lasting during construction. Once construction of the emergency storage pond has completed, it is expected that groundwater drawdown will be negligible. | Temporary reduction in water availability to a small section of Freshwater Wetlands on Coastal Floodplains TEC. The vegetation will be monitored as part of the VMP such that it can be restored following the impacts if needed. As restoration will be performed in the event that an impact is realised, credits are not considered necessary for this prescribed impact. |

| Prescribed impact | Nature of Impact | Extent of Impact | Duration of Impact | Consequence of Impact |
|---|---|---|---|---|
| Water bodies, water quality and hydrological processes | There will be minor interceptions of groundwater through the construction of trenches for the SRM & RWM. | Dewatering of the trench would result in localised groundwater drawdown. | For the duration of the trenching activity | The Water Resources Assessment has recommended that a Trigger Action Response Plan approach be implemented to minimise and respond to any groundwater inception such that impacts to existing groundwater are minimised. |
| | Accidental runoff contamination originating from construction within the Subject Land can be avoided, minimised and mitigated by implementing sedimentation and erosion control measures (Section 8.8). | Accidental runoff will be managed throughout the project to ensure it does not occur any further than the Subject Land boundary | Accidental runoff may occur during the construction period. | Runoff will be minimised during the project and restricted to the Subject Land. |

## 8.8 MITIGATING RESIDUAL IMPACTS – MANAGEMENT MEASURES AND IMPLEMENTATION

The mitigation and management measures listed in Table 32, are to be implemented in order to mitigate and manage potential direct and indirect impacts during construction. Where there is residual risk beyond these adaptive management strategies, these have been addressed as part of the Adaptive Management Strategy in Section 8.9 below.

Table 32 Summary of proposed mitigation and management measures for residual impacts (direct, indirect and prescribed)

| Impact | Mitigation | Ideal Outcome | Timing | Frequency | Responsibility |
|---|---|---|---|---|---|
| General | All workers are to be provided with an environmental induction prior to starting work on site. This would include information on the ecological values of the site, protection measures to be implemented to protect biodiversity and penalties for breaches. | Educated workforce with no ecological breaches. | Prior to clearing/construction works. | Once off for every worker | Construction contractor |
| | A Vegetation Management Plan (VMP) will be required for a duration of 5 years in order to guide the restoration or rehabilitation of the SRM & RWM and construction compounds. The VMP will incorporate information and requirements from this BDAR as well as the aquatic ecology assessment (H2O Consulting, 2024)<br>All areas of the SRM & RWM shall be revegetated with shallow rooted species of the PCT mapped in the area by this BDAR. Where exotic vegetation is indicated in this BDAR, the restoration may be with suitable native species of a local PCT or suitable exotic species that are not listed on the High Threat Weed list ((NSW DPE, 2022) as per Dorrough, Oliver and Wall (2018)).<br>If areas of nearby conservation lands are impacted, they shall be added to the VMP. | Revegetation of cleared or disturbed areas with increasing ecological values. | Prior to clearing/construction works/up to and including 5 years beyond construction completion. | Implemented over a single 5-year period. | Qualified ecologist or suitable council representative |
| | Consideration shall be given to selecting machinery that will produced the least impact on the environment, particularly in areas that have been identified as containing wetlands | Minimal impact to the environment | During construction | Prior to works commencing and during construction works. | Construction contractor |
| | The contact details for the nearest Koala Hospital shall be kept at each site office during construction | Koala Hospital not contacted due to no injuries, introduced stress or fatalities | Prior to clearing/construction works and during construction works. | Contact details installed at beginning and reinstalled if dilapidated | Construction contractor |

| Impact | Mitigation | Ideal Outcome | Timing | Frequency | Responsibility |
|---|---|---|---|---|---|
| Vegetation clearing | Limit disturbance of vegetation to the minimum necessary to undertake the project. Where possible in the implementation stage, undertake further refinement of the infrastructure such as the SRM & RWM to avoid impacts to biodiversity values including native vegetation, particularly Koala feed trees of the species Forest Red Gum (*Eucalyptus tereticornis*), Swamp Mahogany (*E. robusta*), Grey Gum (*E. propinqua*) Tallowwood (*E. microcorys*) and Bastard Mahogany (*E. paterntinervis* (a hybrid of *E. robusta and E. tereticornis*)). | Project alignment to avoid biodiversity values including native vegetation | Prior to works commencing. | Prior to works commencing and during construction works. | Construction contractor and Project Ecologist |
| | Fencing and signage must be maintained for the duration of the construction period. Fencing should be designed to allow fauna to exit the site during clearing activities. | Project alignment to avoid biodiversity values including native vegetation | Prior to works commencing. | Prior to works commencing and during construction works. | Construction contractor and Project Ecologist |
| | Signage should be placed at the entrance to sites warning of the potential of Koala's to be present. The signs should contain details of the nearest Koala Hospital to facilitate prompt reporting of sick or injured Koalas. | No injuries to Koalas | Prior to works commencing. | Prior to works commencing and during construction works. | Construction contractor and Project Ecologist |
| | Native vegetation to be retained on site is to be protected in accordance with *Development Control Plan 2014 Guidelines – Tree Preservation and Native Vegetation Management Guidelines (Section 6)* and the *Australian Standard AS4970-2009 – Protection of Trees on Development Sites.* | Project alignment to avoid biodiversity values including native vegetation | Prior to works commencing. | Prior to works commencing and during construction works. | Construction contractor and Project Ecologist |
| | Stockpiles of soil, vegetation etc should be placed within existing cleared areas (and not within areas of adjoining native vegetation). | No pathogenic or invasive species introduced or spread during clearing, construction and completion maintenance | Prior to clearing/ construction works. | On-going | Construction contractor |
| | Sedimentation and erosion control measures including silt fencing, sediment traps, etc. to prevent sediment-laden stormwater exiting the construction areas and to prevent scouring and erosion of land beyond the development footprint. All erosion and sediment control measures are to be constructed and installed in accordance with relevant guidelines, are to be regularly | No geological impacts to the Subject Land and surrounds | Prior to clearing/ construction works. | On-going | Construction contractor |

| Impact | Mitigation | Ideal Outcome | Timing | Frequency | Responsibility |
|---|---|---|---|---|---|
| | maintained for the duration of the construction period and are to be carefully removed at completion of works.<br>Sediment and erosion control measures should follow recommendations of The Blue Book – Managing Urban Stormwater: Soils and Construction (Landcom 2004). Dust suppression measures to ensure dust deposition beyond the construction area is minimised. | | | | |
| | In line with the Area 13 Koala KPOM (Figure 73), where koala food trees are removed, compensation should be provided by way of a minimum of four replacement trees (that are also preferred koala food trees) for every preferred koala food tree that is to be removed, such trees to be planted within a 100m radius of those to be removed, and shall comply with Part 3(G)(iv) of the plan. Pre & post clearing reports are to be submitted to Council by the project ecologist for any significant vegetation removal. | Impacts to Koala feed trees are minimised. | During construction works. | On-going | Construction contractor and qualified ecologist |
| Introduction of Weeds and Pathogens | Develop a weed management approach to manage weeds and pathogens during the construction and operational phase of the project. Beginning at project construction, regular weed control shall be performed by a qualified individual. Weed control shall be performed regularly throughout the project. The location of significant environmental or priority weed infestations would also be identified and communicated to the contractor. | No weeds or pathogens introduced during the clearing, construction or management phase. | Prior to clearing/ construction works/project lifespan. | On-going | Construction contractor |
| | The introduction and spread of weed species will be minimised by restricting access to areas of native vegetation and communicating the responsibilities of all Project personnel at site inductions and during regular toolbox meetings.<br>All priority weeds identified on the site will be controlled and removed in accordance with the requirements of the *Biosecurity Act 2016* and Council's relevant Weed Control Manuals. Due to the sensitive nature of the lands to be impacted (surrounding wetland TECs and the possible contamination in the water treatment facilities by herbicide chemicals), weed control is not to involve the use of herbicides. Ongoing weed management shall be performed for at least five years following the project. All priority and environmental weeds will be cleared and stockpiled separately to all other vegetation, removed from site and disposed of at an appropriately licenced disposal facility. When transporting weed waste from the site to the waste facility, trucks must be covered to avoid the spread of weed-contaminated material. | No weeds or pathogens introduced when clearing, construction or management phase is in action. | Prior to clearing/ construction works. | On-going | Construction contractor |

| Impact | Mitigation | Ideal Outcome | Timing | Frequency | Responsibility |
|---|---|---|---|---|---|
| | Disposal must be documented, and evidence of appropriate disposal must be kept. Waste management areas and processes are to be clearly identified | | | | |
| | All machinery entering the site must be appropriately washed down and disinfected prior to work on site to prevent the potential spread of weeds, Cinnamon Fungus (Phytophthora cinnamomi), Myrtle Rust (Austropuccinia psidii) and Amphibian Chytrid Fungus (Batrachochytrium dendrobatidis) in accordance with the NSW hygiene guidelines for Phytophthora, Myrtle Rust and Amphibian Chytrid Fungus (NSW DPIE, 2020) for hygiene control. | No weeds or pathogens introduced when clearing, construction or management phase is in action. | Prior to any plant or machinery being brought onto the site. | On-going | Construction contractor |
| | Incorporate control measures in the design of the project to limit the spread of weed propagules downstream of subject land. Sediment control devices, such as silt fences, would assist in reducing the potential for spreading weeds. | No weeds or pathogens introduced during the clearing, construction or management phase. | Prior to clearing/ throughout construction works. | On-going | Construction contractor |
| | Construction activities will be managed through standard practices to avoid further spread of weeds and pests such as ensuring equipment and clothing are free of soil and vegetative matter prior to being brought to site, establishing vehicle cleaning stations with high pressure water hoses and brushes to remove soils, weeds and seeds; conducting regular vehicle inspections and restricting vehicle access zones and designated entry; ensure erosion controls are in place to minimize the spread of weed from run off (NSW Transport 2019). | No weeds or pathogens introduced during the clearing, construction or management phase. | Prior to clearing/ throughout construction works. | On-going | Construction contractor |
| | Develop a weed management approach to manage weeds and pathogens during the construction and operational phase of the project. Beginning at project construction, regular weed control shall be performed by a qualified individual. Weed control shall be performed regularly throughout the project. The location of significant environmental or priority weed infestations would also be identified and communicated to the contractor. | No weeds or pathogens introduced during the clearing, construction or management phase. | Prior to clearing/ construction works/project lifespan. | On-going | Construction contractor |
| Removal of fauna habitat | Protocols to prevent introduction or spread of chytrid fungus should be implemented following Office of Environment and Heritage Hygiene protocol for the control of disease in frogs (DECC, 2008b). | Chytrid fungus not introduced and any on site controlled | Prior to clearing throughout construction works. | On-going | Construction contractor |

| Impact | Mitigation | Ideal Outcome | Timing | Frequency | Responsibility |
|---|---|---|---|---|---|
| | Staged vegetation clearing shall be performed, commencing with the exotic dominated vegetation to increase the opportunity for fauna to vacate the site and disperse into areas of adjoining habitat to evade injury. Where higher condition vegetation is to be cleared, this shall be performed such that fauna species are directed away from threats such as roads and developed areas. Staged clearing should avoid creating an 'island' of habitat that is isolated from adjoining habitat. | No fauna injuries or fatalities | During clearing phase. | On-going | Construction contractor |
| | Pre-clearance fauna surveys, undertaken in accordance with the following procedure:<br>Land shall be broken into small units to stage the clearing activities such that a pre-clearing survey can clear the area with minimal time for mobile fauna (such as the Eastern Grass Owl, Giant Dragonfly and Swift Parrot) to re-establish within an area. The pre-clearing survey should be performed with the intention of flushing all fauna from the unit of land to be cleared within the Subject Land. Habitat features such as logs should also be checked.<br>Pre-clearing surveys shall ensure that habitat features, such as hollow-bearing trees are clearly identified. | No fauna injuries or fatalities. Relocation encouraged to be fauna led limiting handling and further stress | Prior to and during clearing works. | On-going | Qualified ecologist |
| | Clearing of hollow-bearing trees procedure. If possible, tree hollows should be inspected directly prior to felling. Before felling, the HBTs should be tapped along the trunk by heavy machinery to substantially shake the tree, with the intention of causing fauna to exit. Shaking should stop if fauna is observed to be leaving the tree. Where safe to do so, take the HBT down in stages, beginning with no-hollow bearing branches before moving towards the hollow. Where safe to do so, hollows should be cut around such that they remain intact and can be gently lowered to the ground. Hollows should be thoroughly checked following felling to ensure no fauna have become trapped or injured during operations. | No fauna injuries or fatalities. Relocation encouraged to be fauna led limiting handling and further stress | Prior to and during clearing works | On-going | Qualified ecologist and construction contractor |
| | Trees should be felled into an already disturbed area to avoid damaging adjacent vegetation | No fauna injuries or fatalities. | During clearing works. | On-going | Qualified ecologist and construction contractor |
| | Consistent with the Area13 KPoM, the clearing of native vegetation and/or earthworks or for any other purpose must be temporarily suspended within a range of 25m from any tree that is occupied by a Koala and must not resume until the koala has moved from the tree of its own volition. If a Koala does not | No fauna injuries or fatalities. Relocation encouraged to be fauna led limiting | Prior to and during clearing works. | On-going | Qualified ecologist |

| Impact | Mitigation | Ideal Outcome | Timing | Frequency | Responsibility |
|---|---|---|---|---|---|
| | voluntarily move on, it is to be removed by Port Macquarie Koala Hospital staff. | handling and further stress | | | |
| | Where appropriate, native vegetation cleared from the Subject Land should be moved into the retained vegetation as habitat or mulched for re-use on the site, to stabilise bare ground.<br>Hollows may be reused elsewhere on site if suitable. | Reuse of vegetative products where possible. | During clearing phase. | On-going | Construction contractor |
| | A suitably qualified and appropriately licenced ecologist is to be present during clearing of all native vegetation to ensure felling of trees is limited to the least extent and carried out in an appropriate manner, and that any fauna present can be rescued and relocated. Appropriate fauna 'capture and release' techniques will be implemented. | Relocation limited to only where required for the safety of the animal and site staff, with a preference for fauna self-relocating themselves. Fauna stress kept to a minimal. | During clearing phase. | On-going | Qualified ecologist |
| | A suitably qualified and appropriately licenced ecologist will be present during the clearance of all native vegetation and/or fauna habitats. Animals that require handling must not be approached or handled until the ecologist is present, unless in an emergency (e.g. when there are both no authorised persons present and where the failure to immediately intervene would place the animal at significant risk). In such an emergency, the site manager may obtain over the phone instructions from the project ecologist to ameliorate the situation. A wildlife rescue organisation (e.g. FAWNA or Koala Conservation Hospital Port Macquarie) should be made aware of operations in case any injured fauna is found. | No fauna injuries, or fatalities. | During clearing phase. | On-going | Qualified ecologist |
| | Security lighting within the construction site is to be minimised and where required, is to be oriented such that light spill beyond the Subject Land and into patches of retained vegetation is minimised. | No light pollution within retained vegetation where possible | During clearing phase. | On-going | Construction contractor |
| | A reduced speed limit should be implemented in the development area, accompanied by appropriate signage indicating the speed limit within the | No near misses, or vehicle strikes on | Prior to clearing/ construction | On-going | Construction contractor |

| Impact | Mitigation | Ideal Outcome | Timing | Frequency | Responsibility |
|---|---|---|---|---|---|
| | Subject Land. The speed limit determined should be appropriate for the area and potential risk to Koalas from vehicle strike. | Koalas or other fauna. | works/up to and project lifespan | | |
| | All animals encountered will be treated humanely, ethically, and in accordance with relevant codes under the *NSW Prevention of Cruelty to Animals Act 1979*, including:<br>• Australian code of practice for the care of animals for scientific purposes (NHMRC, 2013).<br>• Code of practice for the welfare of wildlife during rehabilitation (Victoria, 2001).<br>• Animal ethics considerations and protocols outlined in this document.<br>• If the project ecologist considers an animal is at risk of injury or undue stress, it is to be gently directed into secure adjoining habitat. Where deemed necessary by the project ecologist, the animal may be required to be captured and released. Capture and release operations will proceed via the following protocols:<br>• All construction activities that are considered by the project ecologist be likely to increase the risk of injury, mortality or stress to the animal will be halted until the animal has been removed, which will be enforced with the co-operation of the Contractor. Construction activities that do not contribute to the risk of injury, mortality or stress to the animal can continue (as determined by the project ecologist).<br>• Only qualified ecologists or wildlife carers are authorised to handle animals.<br>• Animals will be captured (if required) by the project ecologist using a safe and ethical technique, as is appropriate for the particular species. Native animals that are unable to depart of their own accord will be captured and held in a receptacle appropriate for that species until release. All captive-held animals will be provided with food, water and warmth as is appropriate for the species. Each receptacle will only hold one animal at a time and will be cleaned and disinfected between use to avoid the spread of disease.<br>Any fauna relocated from trees, shrubs or other areas would be recorded. | Fauna managed humanely. Fauna handling limited to cases needing it, but self-relocation is preferred to limit stress | During clearing phase. | On-going | Qualified ecologist |

| Impact | Mitigation | Ideal Outcome | Timing | Frequency | Responsibility |
|---|---|---|---|---|---|
| | The construction contractor is to contact the Project ecologist for advice if any unexpected fauna is found during the construction period (i.e. following clearing of native vegetation when the Project ecologist is no longer on site). | No fauna injuries or fatalities. | During clearing phase. | On-going | Construction contractor |
| | • In line with the Port Macquarie Airport Koala Plan of Management, any branches removed from the following species should be offered to a Koala Hospital or other Koala preservation groups.<br>• Tallowwood (*Eucalyptus microcorys*)<br>• Grey Gum (*Eucalyptus propinqua*)<br>• Forest Red Gum (Eucalyptus tereticornis)<br>• Swamp Mahogany (Eucalyptus robusta)<br>• The hybrid of Forest Red Gum and Swamp Mahogany, referred to as *Eucalyptus patentinervis* | Increased food opportunities for Koalas | During clearing and construction phases | Prior to works commencing and during construction works. | Construction contractor and Project Ecologist |
| Water Quality and aquatic habitats | Erosion and sediment control plans should be prepared in accordance with The Blue Book – Managing Urban Stormwater: Soils and Construction (Landcom 2004). The erosion and sediment control plans would be established prior to the commencement of construction and be updated and managed throughout as relevant to the activities during the construction phase. | Prevention of sediment and erosion successful | Prior to construction commencing. | On-going | Construction contractor |
| | Soil stockpiles are to be placed away from, and ideally downslope of, receiving water bodies and drainage lines. | No erosion or sedimentation issues on or off site. | During clearing phase. | On-going | Construction contractor |
| | Erosion and sediment control controls would be regularly inspected, particularly following rainfall events, to ensure their ongoing functionality. | Prevention of sediment and erosion | Weekly during construction phase or after any significant rainfall event. | On-going | Construction contractor |
| | Stabilised surfaces should be reinstated as quickly as practicable after construction. | Prevention of sediment and erosion | Immediately following clearing. | Once off | Construction contractor |
| | Appropriate speeds are to be enforced to limit dust generation and minimise chances of fauna mortality through vehicle strike. | Minimal dust generation.<br>No near misses, or vehicle strikes on | During construction. | On-going | Construction contractor |

| Impact | Mitigation | Ideal Outcome | Timing | Frequency | Responsibility |
|---|---|---|---|---|---|
| | | Koalas or other fauna. | | | |
| | Ensure vehicle and equipment parking areas and stockpile areas are identified and positioned to avoid areas containing ecological value. | Prevention of sediment and erosion as well as dust | Prior to clearing / construction works | On-going | Construction contractor |
| | All stockpiled material should be stored in bunded areas and, where practicable, kept away from waterways to avoid sediment or contaminants entering the waterway. | Prevention of sediment and erosion | During construction. | On-going | Construction contractor |
| | Spill kits would be made available to construction vehicles. A management protocol for accidental spills would be put in place. | No spills recorded/ spills limited and cleaned up thoroughly | During construction. | On-going | Construction contractor |

## 8.9 ADAPTIVE MANAGEMENT STRATEGY

In order to appropriately address the potential impacts of the project on biodiversity as discussed in Sections 7.0 and 8.0, the mitigation and management measures outlined in Table 32 would be implemented for the site. The adaptive management strategy in Table 33 has been prepared with reference to section 9.3 of the BAM and includes an assessment of both uncertain impacts and where there is risk of these mitigation measures not succeeding to address any consequences.

If unexpected biological, ecological or environmental outcomes are realised then all project works shall cease until the relevant industry experts have been consulted.

Table 33 Adaptive Management Strategy measures

| Impact | Risk and Mitigation | Timing | Responsibility | Risk | Adaptive Management Response |
|---|---|---|---|---|---|
| Subject Land weed management | Enforcement of legal obligations to control priority weeds within the Subject Land to prevent the spread of propagules into adjacent areas of native vegetation. | In perpetuity | Land owner/s<br>Relevant contractor/s | Increased extent or cover of priority weeds. | Periodic monitoring and adaption and/or intensification of weed control activities. |
| Revegetation | Success of revegetation will be measured through a VMP. | For 5 years following construction completion | Land owners/s<br>Relevant contractor/s | Loss of native vegetation and | Revegetate from the mapped PCT to restore density. |

| Impact | Risk and Mitigation | Timing | Responsibility | Risk | Adaptive Management Response |
|---|---|---|---|---|---|
| | | | | threatened species habitat | |
| Subject Land Light Spill | In consideration of the Australian Standard for street lighting, street lighting and security lighting is to be designed to direct light away from adjoining bushland areas and to limit the impacts of light spill on native fauna habitats where practicable. Lighting design must identify and adopt technologies that are least likely to adversely affect fauna use of habitat through impacts such as disruption of microbat foraging. This should consider light colour and intensity, provision of light shields and other measures as appropriate to the position of lighting relative to offsite habitats. | In perpetuity | Land owner/s | Disruption of fauna use of habitat. | Modification of lighting design. |
| Hydrological changes to Wetlands and surrounding vegetation | Regular monitoring of hydrological changes control devices, as well as surrounding vegetation to ensure there is no dramatic fluctuation in surrounding vegetation that is beyond what would be expected for the climate of that period. The monitoring should be in reference to the data presented in this BDAR as well as other reports that support the EIS.<br>If there is any indication to changes in the release of acid sulfate soils then an investigation should be initiated. | During construction and for 5 years following as part of VMP.<br>As needed by the project | Land owners/s<br>Relevant contractor/s | Loss of native vegetation and threatened species habitat. Further impacts to threatened species than considered including Wallum Froglet and Giant Dragonfly | Upgrade or reinstate hydrology devices if persistent unexpected fluctuation is continuing to be observed in surrounding vegetation |
| Additional Threatened Species found within Subject Land | Stop works and ensure safety of species | During construction | Project Ecologist | Risk to threatened species | Consider species mobility and likelihood of having important habitat (such as breeding habitat) within the Subject Land. Consider the need for BDAR reassessment. |

| Impact | Risk and Mitigation | Timing | Responsibility | Risk | Adaptive Management Response |
|---|---|---|---|---|---|
| Pathogen introductions | Regular monitoring of flora and fauna for pathogens such as phytophthora (*Phytophthora cinnamomi*), myrtle rust (*Uredo rangelii*) and chytrid fungus (*Batrachochytrium dendrobatidis*) | During construction and for 5 years following as part of VMP | Construction contractor and project ecologist | Loss of native vegetation, threatened species and their habitat | Periodic monitoring and adaption and/or intensification of pathogenic control activities. |
| Increased sediment or erosion within and around Subject Land | Regular monitoring of sedimentation and erosion control devices, as well as surrounding vegetation to ensure there is no increase in sedimentation in and around the Subject Land | During construction and for 5 years following as part of VMP | Land owners/s<br>Relevant contractor/s | Loss of native vegetation and threatened species habitat | Upgrade or reinstate erosion and sedimentation devices if sedimentation is continuing to be observed in surrounding vegetation |
| Alignment of native vegetation and the Subject Land | If the project identifies additional measures to avoid biodiversity values, including koala feed trees, then small adjustments to the alignment that reduce impacts to biodiversity should be implemented. | During construction | Construction contractor and project ecologist | Risk to native vegetation and threatened species | Continue micro-locating the Subject Land to reduce native vegetation loss. |
| Impacts to conservation areas | If an impact occurs to a conservation area, then the VMP shall be revised to ensure the conservation area is restored. Regulators from the Biodiversity Conservation Trust should be notified. The assessment of the degree of impact should be in reference to the data presented in this BDAR as well as other reports that support the EIS. | As applicable | Construction contractor and project ecologist | Risk to native vegetation, native species and threatened entities. Risk to security of conservation agreements | Revegetate where appropriate and seek advice on further management required. |
| Invasion of mangroves into areas of saltmarsh | Changes to Kooloonbung Creek hydrology may encourage the encroachment of mangroves into areas that are currently saltmarsh. If this occurs then an assessment of other contributing factors should be initiated and a review of the best response measure should be performed. Removal of mangroves may not be the best response and should be considered against other options. | During construction and for 5 years following as part of VMP | Construction contractor and project ecologist | Risk to reduction in extent of a threatened entity. | Review possible contributing factors such as rainfall, temperature, sedimentation, and this project. Review literature on possible solutions. |

## 8.10 COMPONENTS OF THE VEGETATION MANAGEMENT PLAN

The Vegetation Management Plan (VMP) should perform a mix of monitoring and ecosystem restoration. The tasks summarised in Table 34 are not conclusive and other tasks from the Aquatic Ecology assessment and Water Resources Assessment may be required.

The VMP will be required for a duration of 5 years in order to guide the restoration or rehabilitation of the SRM & RWM and construction compounds.

If areas of nearby conservation lands are impacted, they shall be added to the VMP.

Table 34 Key monitoring and ecosystem restoration tasks of the VMP

| Key monitoring tasks | Key restoration tasks |
|---|---|
| Liaise with Friends of Kooloonbung Creek Nature Park | Restoration of Koala Feed Trees removed by the project at a ratio of three additional trees for each tree removed. Trees should be monitored and replaced if planting fails. |
| Assessment of prescribed impact due to water drawdown from the creation of the emergency storage pond (see Figure 60). | Revegetation of SRM & RWM trenches with shallow rooted species. All areas of the SRM & RWM shall be revegetated with shallow rooted species of the PCT mapped in the area by this BDAR. Where exotic vegetation is indicated in this BDAR, the restoration may be with suitable native species of a local PCT or suitable exotic species that are not listed on the High Threat Weed list ((NSW DPE, 2022) as per Dorrough, Oliver and Wall (2018)). |
| Assessment of Prescribed impact along trenched areas. | Revegetation of Construction Compound locations shall be performed with the full component of species from relevant PCTs that were impacted. |
| Assessment of PCT 4004 Northern *Melaleuca quinquenervia* Swamp Forest for degradation. | Land in a 5 m buffer around the Emergency Overflow Swale will be revegetated with native species. |
| Assessment of PCT4103 *Sporobolus virginicus* Saltmarsh for degradation and invasion by Mangroves. | Monitoring and treatment of exotic species within restoration areas and immediately adjoining areas of impact. |
| Assessment of threatened flora species records identified in this BDAR. | Replacement of Hollow-bearing Trees. Hollows will ideally be replaced with suitable nesting boxes, salvaged hollows or artificial hollows. |
| Assessment of lands under conservation title for impacts related to HDD | Utilise any cut material suitable for Koala feeding by donating foliage to a Koala Hospital or local Koala preservation groups; |
| Monitoring of amphibian populations within Kooloonbung Creek including aural-visual and tadpole surveys from the discharge point to Gordon Street Bridge. | |

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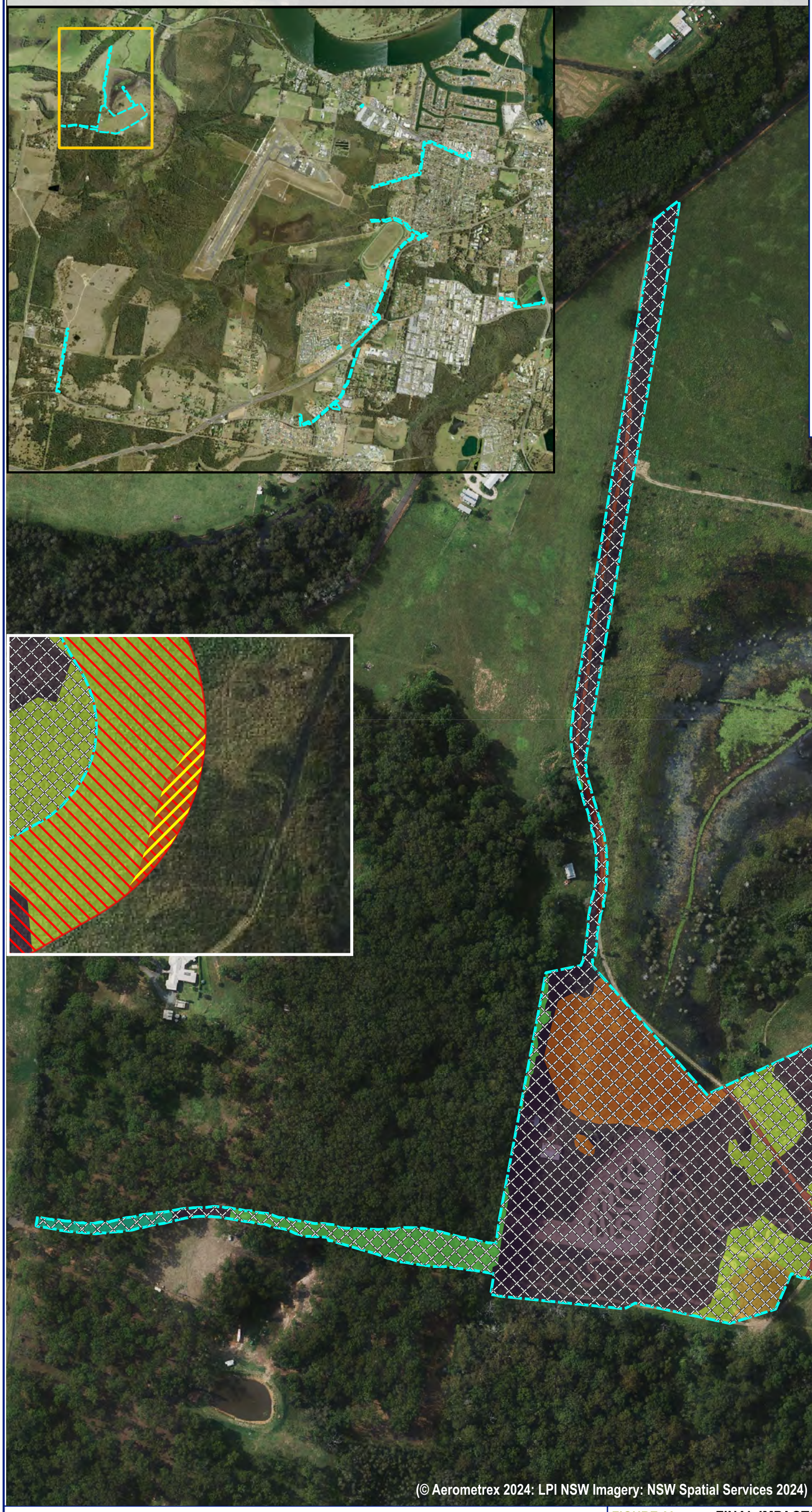

## LEGEND

- Subject Land
- Extent of Direct Impacts
- Prescribed Impact Area
- Threatened Ecological Community within Prescribed Impact Area

***Plant Community Type (Vegetation Zone)***

- PCT 3250 Northern Foothills Blackbutt Grassy Forest (Low) (VZ 3)
- PCT 3250 Northern Foothills Blackbutt Grassy Forest (Moderate-Good) (VZ 4)
- PCT 3544 Coastal Sands Apple-Blackbutt Forest (Low) (VZ 6)
- PCT 3544 Coastal Sands Apple-Blackbutt Forest (Moderate) (VZ 7)
- PCT 3967 Northern Lower Floodplain Eleocharis Wetland (Good) (VZ 8)
- Exotic (VZ 5)
- Roads / Cleared Structures

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| | | | | | |
|---|---|---|---|---|---|
| FIGURE 60 | **FINAL IMPACTS** | | | | |
| JOB ADDRESS: | PORT MACQUARIE-HASTINGS COUNCIL AREA | | | | |
| CLIENT: | PORT MACQUARIE-HASTINGS COUNCIL | | | | |
| A3 SCALE: | 1:3,900 | DRAWN: | BH | JOB REF: | EC217 |
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## LEGEND

- Subject Land
- Extent of Direct Impacts

***Plant Community Type (Vegetation Zone)***

- Exotic (VZ 5)
- Roads / Cleared Structures

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| | | | | | |
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| FIGURE 61 | **FINAL IMPACTS** | | | | |
| JOB ADDRESS: | PORT MACQUARIE-HASTINGS COUNCIL AREA | | | | |
| CLIENT: | PORT MACQUARIE-HASTINGS COUNCIL | | | | |
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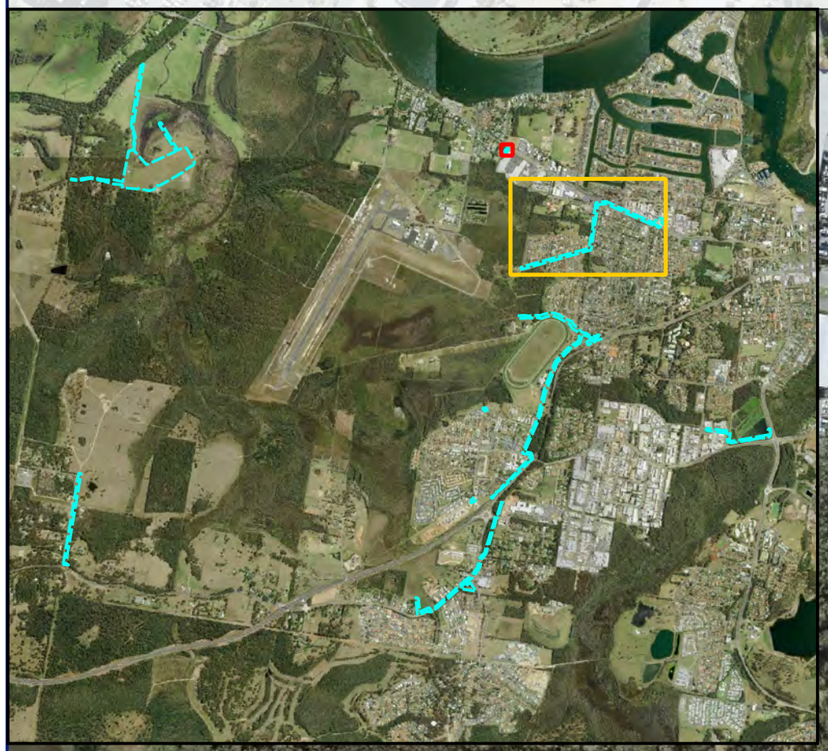

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FIGURE 62

## FINAL IMPACTS

0 75 150 225 300 m

| | | | | | |
|---|---|---|---|---|---|
| JOB ADDRESS: | PORT MACQUARIE-HASTINGS COUNCIL AREA<br>NSW \| AUSTRALIA | | | | |
| CLIENT: | PORT MACQUARIE-HASTINGS COUNCIL | | | | |
| A3 SCALE: | 1:3,200 | DRAWN: | BH | JOB REF: | EC217 |
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## LEGEND

- Subject Land
- Extent of Direct Impacts

***Plant Community Type (Vegetation Zone)***

- Exotic (VZ 5)
- PCT 3167 Northern Hinterland Blackbutt-Forest Oak Wet Forest (Low) (VZ 1)
- PCT 4006 Northern Paperbark-Swamp Mahogany Saw-sedge Forest (Moderate) (VZ 9)
- Roads / Cleared Structures

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| FIGURE 63 | **FINAL IMPACTS** | | | | |
| JOB ADDRESS: | PORT MACQUARIE-HASTINGS COUNCIL AREA | | | | |
| CLIENT: | PORT MACQUARIE-HASTINGS COUNCIL | | | | |
| A3 SCALE: | 1:4,000 | DRAWN: | BH | JOB REF: | EC217 |
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## LEGEND

- Subject Land
- Extent of Direct Impacts

***Thresholds***

- PCT 3167 Northern Hinterland Blackbutt-Forest Oak Wet Forest (Low) (VZ 1)
- PCT 3167 Northern Hinterland Blackbutt-Forest Oak Wet Forest (Moderate) (VZ 2)
- Roads / Cleared Structures
- Exotic (VZ 5)

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| | | | | | |
|---|---|---|---|---|---|
| FIGURE 64 | **FINAL IMPACTS** | | | | |
| JOB ADDRESS: | PORT MACQUARIE-HASTINGS COUNCIL AREA | | | | |
| CLIENT: | PORT MACQUARIE-HASTINGS COUNCIL | | | | |
| A3 SCALE: | 1:4,200 | DRAWN: | BH | JOB REF: | EC217 |
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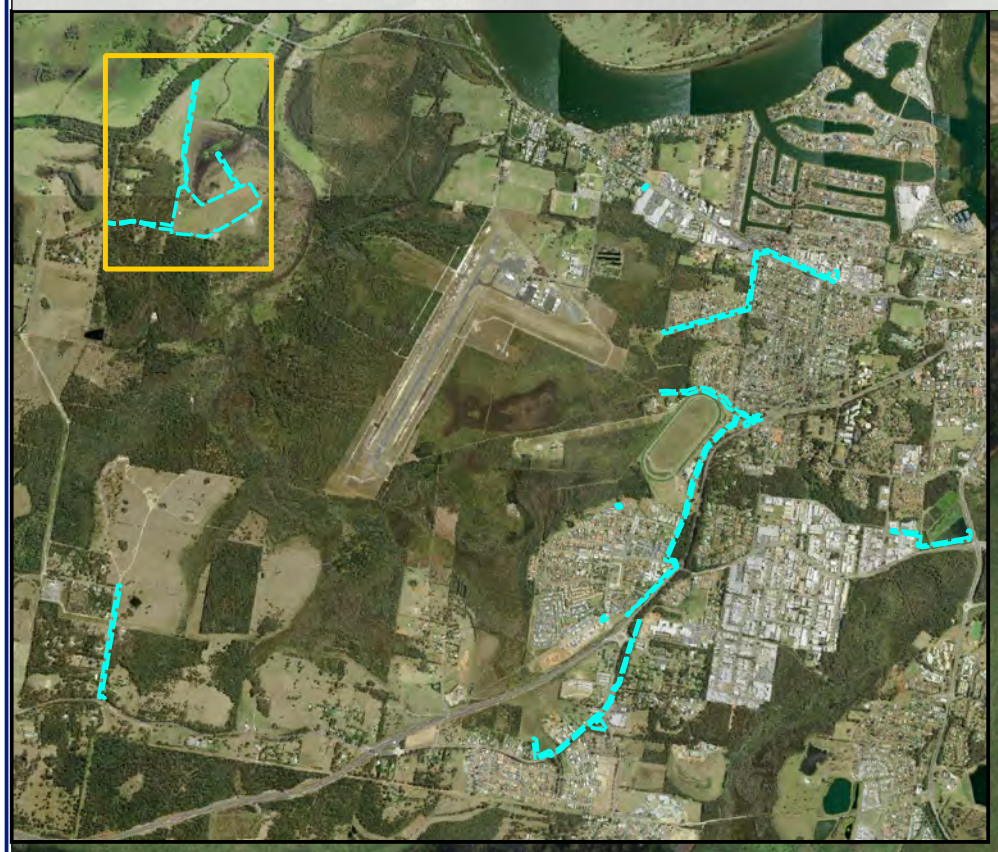

## LEGEND

Subject Land

***Thresholds***

Areas Not Requiring Offset / Areas Not Requiring Assessment

Areas Requiring An Offset

***SAII Entities***

Giant Dragonfly Species Polygon

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| FIGURE 65 | THRESHOLDS FOR ASSESSING AND OFFSETTING IMPACTS | | | | |
| JOB ADDRESS: | PORT MACQUARIE-HASTINGS COUNCIL AREA | | | | |
| CLIENT: | PORT MACQUARIE-HASTINGS COUNCIL | | | | |
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## LEGEND

Subject Land

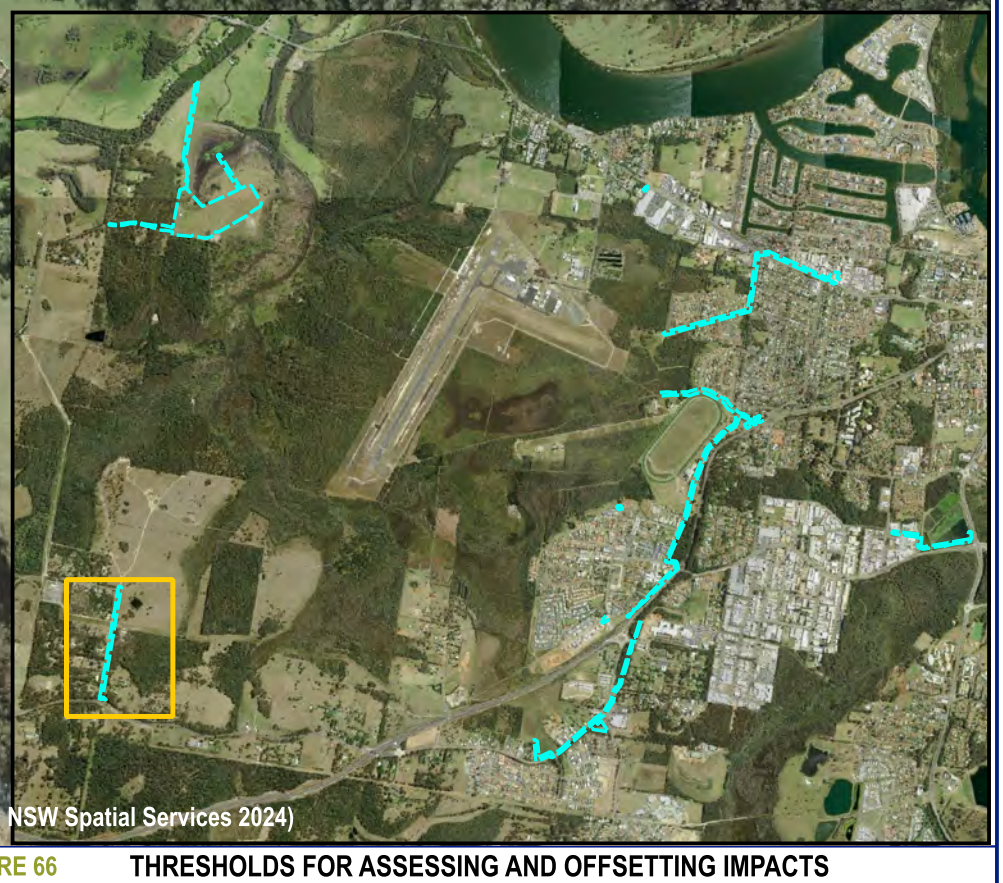
***Thresholds***

Areas Not Requiring Offset / Areas Not Requiring Assessment

Areas Requiring An Offset

***SAII Entities***

Swift Parrot Species Polygon



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| FIGURE 66 | THRESHOLDS FOR ASSESSING AND OFFSETTING IMPACTS | | | | |
| JOB ADDRESS: | PORT MACQUARIE-HASTINGS COUNCIL AREA | | | | |
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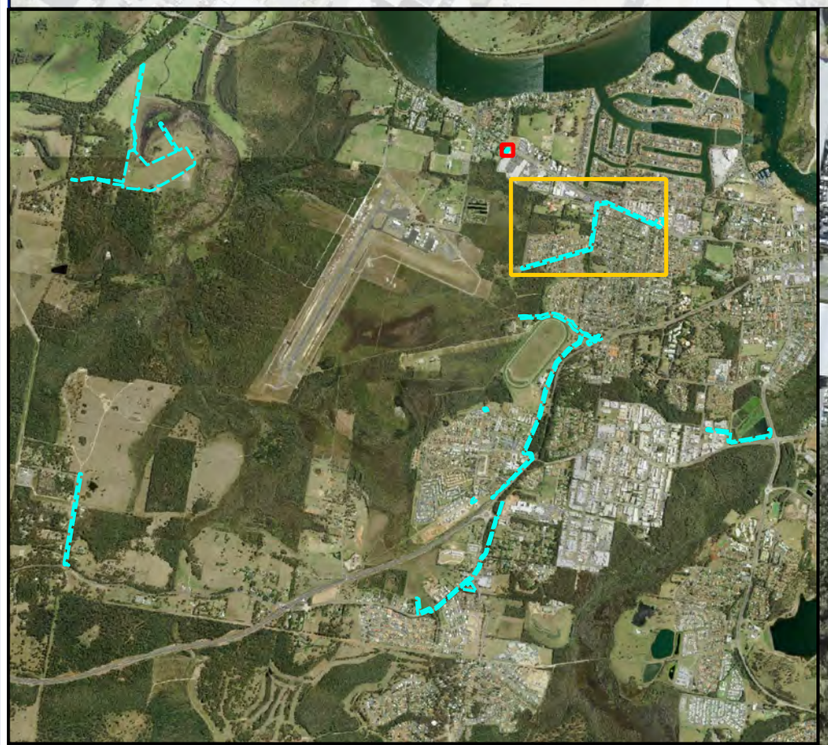

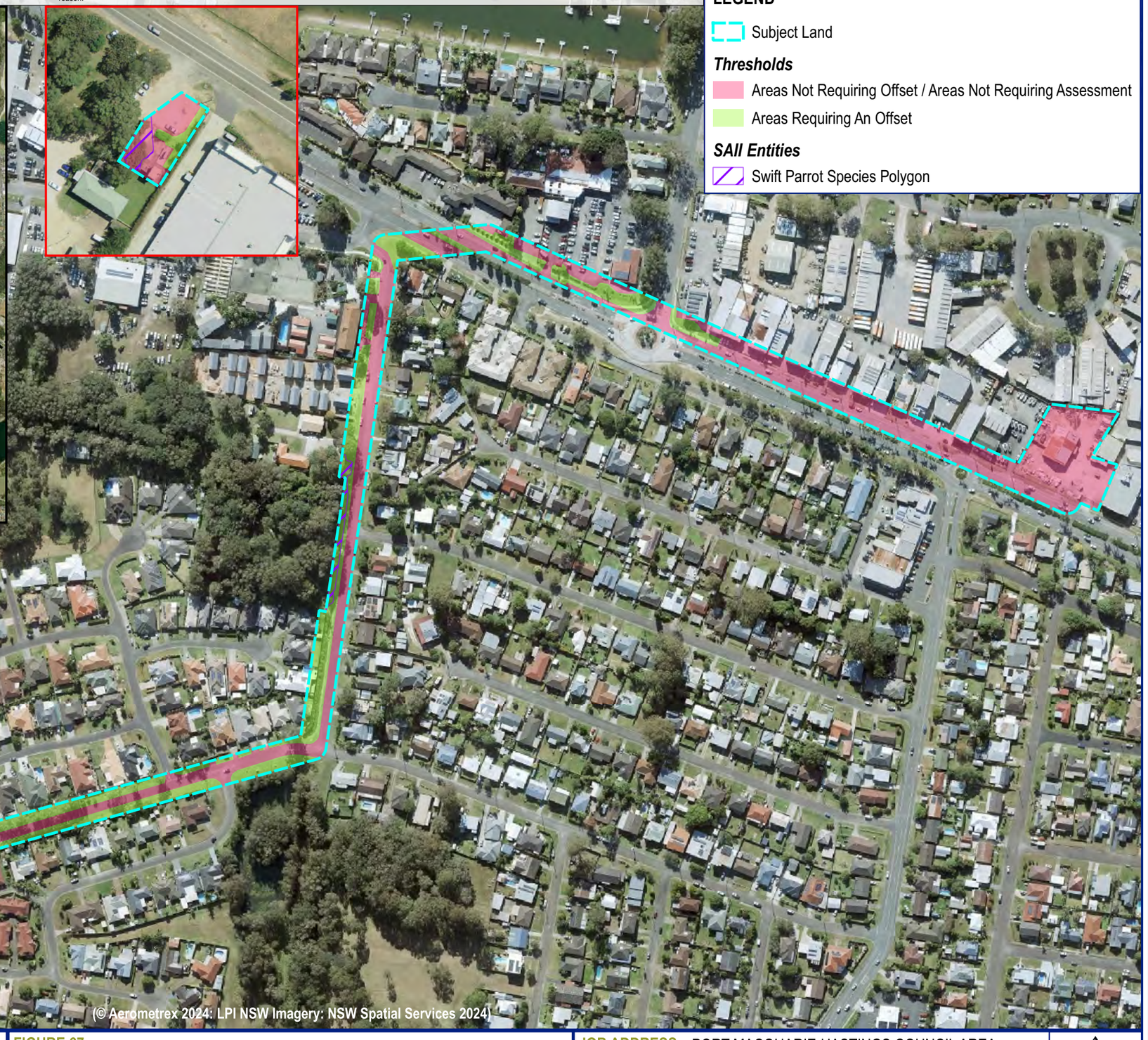


**LEGEND**

Subject Land

***Thresholds***

Areas Not Requiring Offset / Areas Not Requiring Assessment

Areas Requiring An Offset

***SAII Entities***

Swift Parrot Species Polygon

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FIGURE 67

## THRESHOLDS FOR ASSESSING AND OFFSETTING IMPACTS

0 75 150 225 300 m

| | | | | | |
|---|---|---|---|---|---|
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| CLIENT: | PORT MACQUARIE-HASTINGS COUNCIL | | | | |
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**LEGEND**

Subject Land

***Thresholds***

Areas Not Requiring Offset / Areas Not Requiring Assessment

Areas Requiring An Offset

***SAII Entities***

Swift Parrot Species Polygon

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| | | | | | |
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| FIGURE 68 | **THRESHOLDS FOR ASSESSING AND OFFSETTING IMPACTS** | | | | |
| JOB ADDRESS: | PORT MACQUARIE-HASTINGS COUNCIL AREA | | | | |
| CLIENT: | PORT MACQUARIE-HASTINGS COUNCIL | | | | |
| A3 SCALE: | 1:4,000 | DRAWN: | BH | JOB REF: | EC217 |
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## LEGEND

Subject Land

***Thresholds***

Areas Not Requiring Offset / Areas Not Requiring Assessment

Areas Requiring An Offset

***SAII Entities***

Swift Parrot Species Polygon

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| | | | | | |
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| FIGURE 69 | **THRESHOLDS FOR ASSESSING AND OFFSETTING IMPACTS** | | | | |
| JOB ADDRESS: | PORT MACQUARIE-HASTINGS COUNCIL AREA | | | | |
| CLIENT: | PORT MACQUARIE-HASTINGS COUNCIL | | | | |
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# 9.0 SERIOUS AND IRREVERSIBLE IMPACTS

## 9.1 ASSESSMENT FOR SERIOUS AND IRREVERSIBLE IMPACTS ON BIODIVERSITY VALUES

This section outlines the thresholds for assessment and offsetting in accordance with Section 9 of the BAM. Under the BC Act, a determination of whether an impact is serious and irreversible must be made in accordance with the principles set out in Section 6.7 of the BC Regulation.

The principles are aimed at capturing impacts which are likely to contribute significantly to the risk of extinction of a threatened species or ecological community in New South Wales. These include 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
- 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.

A set of criteria have been developed and are included in the DPIE Guidelines to assist a decision-maker to determine a serious and irreversible impact (SAII) (DPIE 2019). Threatened biota that meet the criteria under one or more of the above principles have been identified as SAII entities and are listed in the fore mentioned document. Each potential SAII entity has an impact threshold identified which can be used to help determine if a development will result in SAII.

The criteria for identifying potential SAII entities based on consideration of these principles are listed in Appendix 1 of the Guidance to assist a decision-maker to determine a serious and irreversible impact (DPIE 2019). The threatened entities which were recorded on site were considered against the principles and criteria.

Five threatened species, the Swift Parrot (*Lathamus discolor*) Giant Dragonfly (*Petalura gigantea*), Little Bent-winged Bat (*Miniopterus australis*), Large Bent-winged Bat (*Miniopterus orianae oceanensis*) and Eastern Cave Bat (*Vespadelus troughtoni*) were identified during surveys and are species that have been identified as potentially being at risk of SAII. These discussed further below.

### *9.1.1 Swift Parrot*

The Swift Parrot (*Lathamus discolor*) meets principle 1 (evidence of rapid decline) listed on the Serious and Irreversible Impacts webpage (DPIE 2019). The area of habitat for Swift Parrot has been identified based on the Swift Parrot Important Area map. Based on this mapping, the Swift Parrot is presumed to potentially utilise part of the Subject Land for foraging.

An assessment of impacts on this SAII entity is included in Appendix 5 in accordance with the 'additional impact assessment provisions for threatened species listed in section 9.1.2 of the BAM. The project would result in a relatively small area of habitat, 1.07 ha, associated with important area. Of this, the majority (0.71 ha) is exotic dominated vegetation, with the remaining occurring in low and moderate condition vegetation (0.36 ha). Mitigation measures will be implemented prior to construction within the area shown on the Swift Parrot Important Area map, see Section 8.8 for mitigation details.

### *9.1.2 Giant Dragonfly*

The Giant Dragonfly (*Petalura gigantea*) meets principle 4 (unlikely to respond to habitat improvement) listed on the Serious and Irreversible webpage (DPIE 2019). An individual of this species was identified foraging within the WWTP footprint in November 2023. Further surveys were conducted in January 2024 along the wetland perimeter and a 10-meter interval transect surveys within the WWTP footprint, specifically searching for burrows. No burrows, exuviae, or Giant Dragonflies were recorded during the January 2024 survey.

An assessment of impacts on this SAII entity is included in Appendix 5 in accordance with the 'additional impact assessment provisions for threatened species listed in section 9.1.2 of the BAM. The project underwent significant reconsideration to address avoid and minimise considerations with the identification of this species (see Section 7.1.2.1). Mitigation measures will be implemented prior to construction within the area, see Section 8.8 for mitigation details

### *9.1.3 Little Bent-winged Bat and Large Bent-winged Bat*

Both the Little Bent-winged Bat (*Miniopterus australis*) and Large Bent-winged Bat (*Miniopterus orianae oceanensis*) meet principle 4 (unlikely to respond to habitat improvement) listed on the Serious and Irreversible webpage (DPIE 2019). These species were detected using ultrasonic bat detectors with Little-Bent-winged Bat recorded as definite at all locations. Large Bent-winged Bat was recorded as 'Probable' and 'Possible' at detector locations 1, 3 and 4. There is significant overlap in the calls detected with *Vespadelus sp* and *Chalinolobus morio*, sounding very similar to the Large Bent-winged Bat, therefore it cannot be excluded from consideration.

The guideline '*Species credit' threatened bats and their habitats* (DPIE, 2021) makes the following clarification for both Little Bent-winged Bat and Large Bent-winged Bat:

*"Note: The foraging habitat of this species is assessed as an ecosystem credit; only breeding habitat generates species credits."*

Suitable breeding habitat for these species includes caves, tunnels, mines or other structures known or suspected to be used by the species, including species records in the NSW BioNet Atlas with microhabitat code 'IC – in cave'; observation type code 'E nest-roost'; with numbers of individuals >500; or from the scientific literature (DPIE, 2021).

As none of the above features are present within the Subject Land or the Assessment Area, no further consideration of Little Bent-winged Bat or Large Bent-winged Bat as an SAII entity is required.

### *9.1.4 Eastern Cave Bat*

The Eastern Cave Bat (*Vespadelus troughtoni*) meets principle 4 (species being unlikely to respond to management) listed on the Serious and Irreversible Impacts webpage (DPIE 2019). In accordance with the TBDC and guidelines described in 'Species credit' threatened bats and their habitats (DPIE, 2021), the presence of potential breeding habitat was considered for SAII.

Potential breeding habitat for the Eastern Cave Bat includes "All potential habitat on the Subject Land where the Subject Land is within 100 metres of caves, scarps, cliffs, rock overhangs and disused mines" (DPIE, 2021).

As none of the above features are present within the Subject Land or the Assessment Area, no further consideration of Eastern Cave Bat as an SAII entity is required.

### *9.1.5 Species Outside the Subject Land*

Individuals of Native Guava (*Rhodomyrtus psidioides*), Scrub Turpentine (*Rhodamnia rubescens*) and Scented Acronychia (*Acronychia littoralis*) were identified during surveys for this project (see Figure 58 & Figure 59). These species are outside the footprint of this project and are unlikely to be impacted by the project. Therefore, no further consideration of these species is required.

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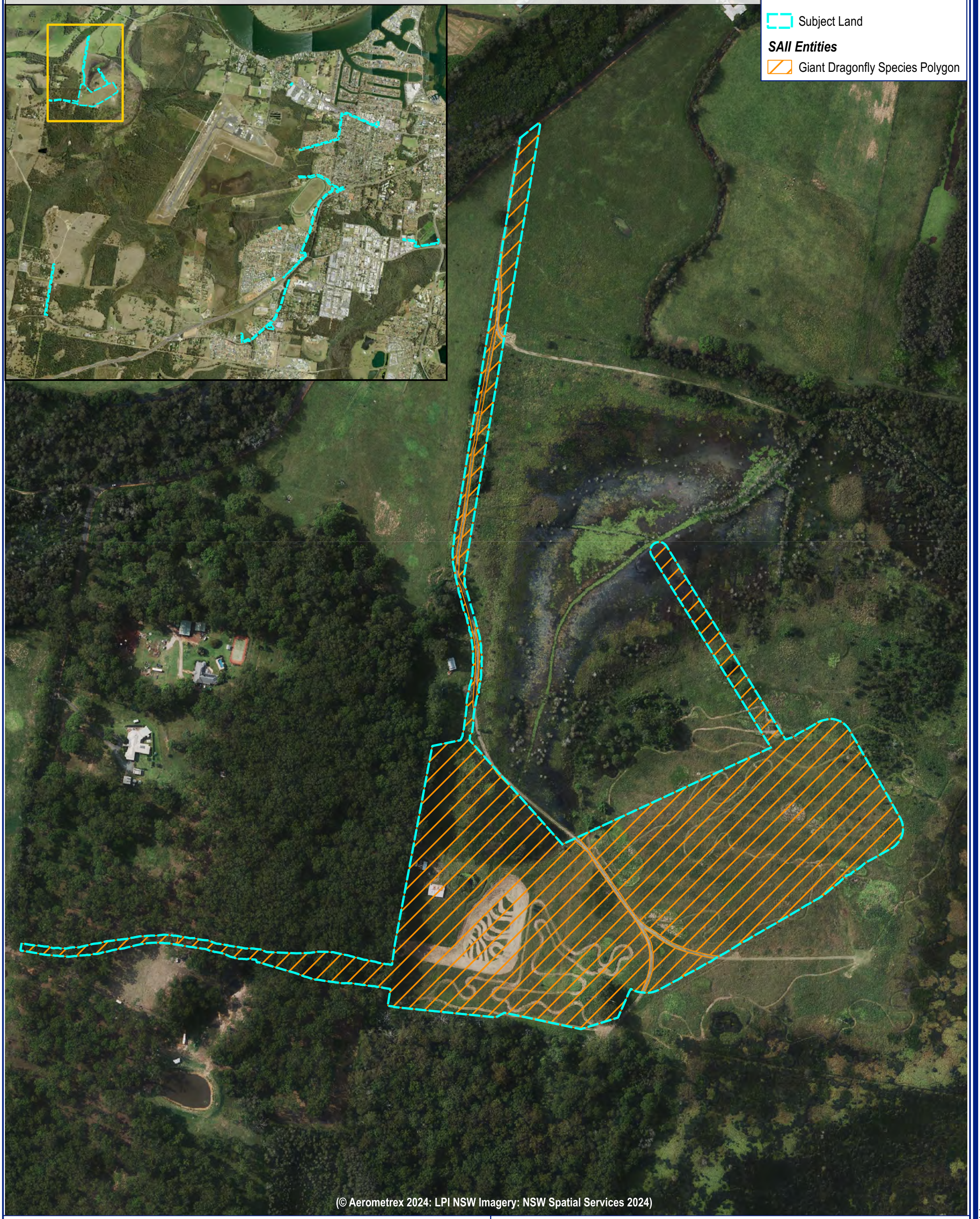


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| | | | | | |
|---|---|---|---|---|---|
| FIGURE 70 | SERIOUS AND IRREVERSIBLE IMPACTS (SAII) | | | | |
| JOB ADDRESS: | PORT MACQUARIE-HASTINGS COUNCIL AREA | | | | |
| CLIENT: | PORT MACQUARIE-HASTINGS COUNCIL | | | | |
| A3 SCALE: | 1:3,900 | DRAWN: | BH | JOB REF: | EC217 |
| PLAN DATE: | 18/07/2024 | CHECKED: | RS | ISSUE: | 02 |

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**LEGEND**

Subject Land

***SAII Entities***

Swift Parrot Species Polygon

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| | | | | | |
|---|---|---|---|---|---|
| FIGURE 71 | **SERIOUS AND IRREVERSIBLE IMPACTS (SAII)** | | | | |
| JOB ADDRESS: | PORT MACQUARIE-HASTINGS COUNCIL AREA | | | | |
| CLIENT: | PORT MACQUARIE-HASTINGS COUNCIL | | | | |
| A3 SCALE: | 1:5,000 | DRAWN: | BH | JOB REF: | EC217 |
| PLAN DATE: | 18/07/2024 | CHECKED: | RS | ISSUE: | 02 |

0 125 250 375 500 m

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**LEGEND**

Subject Land

***SAII Entities***

Swift Parrot Species Polygon

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| | | | | | |
|---|---|---|---|---|---|
| FIGURE 72 | **SERIOUS AND IRREVERSIBLE IMPACTS (SAII)** | | | | |
| JOB ADDRESS: | PORT MACQUARIE-HASTINGS COUNCIL AREA | | | | |
| CLIENT: | PORT MACQUARIE-HASTINGS COUNCIL | | | | |
| A3 SCALE: | 1:5,000 | DRAWN: | BH | JOB REF: | EC217 |
| PLAN DATE: | 18/07/2024 | CHECKED: | RS | ISSUE: | 02 |

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# 10.0 IMPACT SUMMARY

## 10.1 DETERMINE AN OFFSET REQUIREMENT FOR IMPACTS

### *10.1.1 Impacts on Native Vegetation and TECs or Ecological Communities (Ecosystem Credits)*

Table 35 Impacts that do not require offset – ecosystem credits

| Vegetation Zone | Plant community type name | TEC | Impact Area (ha) | Entity at Risk of SAII? | Current Vegetation Integrity Score |
|---|---|---|---|---|---|
| VZ5 | PCT 3544 Coastal Sands Apple-Blackbutt Forest (Disturbed Exotic Grassland) | - | 17.6 | No | 4.1 |
| VZ6 | PCT 3544 Coastal Sands Apple-Blackbutt Forest (Low Condition) | - | 1.61 | No | 13.4 |

Table 36 Impacts that require an offset – ecosystem credits

| Vegetation zone | Plant community type name | TEC | Impact Area (ha) | Current VI score | Future VI Score | Change in VI score | Biodiversity Risk Weighting | Number of ecosystem credits required |
|---|---|---|---|---|---|---|---|---|
| VZ1 | PCT 3167 Northern Hinterland Blackbutt-Forest Oak Wet Forest (Low Condition) | - | 0.18 | 57.6 | 0 | -57.6 | 1.5 | 4 |
| VZ2 | PCT 3167 Northern Hinterland Blackbutt-Forest Oak Wet Forest (Moderate Condition) | - | 0.6 | 75.5 | 0 | -75.5 | 1.5 | 17 |
| VZ3 | PCT 3250 Northern Foothills Blackbutt Grassy Forest (Low Condition) | - | 0.12 | 50.4 | 0 | -50.4 | 1.5 | 2 |
| VZ4 | PCT 3250 Northern Foothills Blackbutt Grassy Forest (Moderate -Good Condition) | - | 0.61 | 83.3 | 0 | -83.3 | 1.5 | 19 |
| VZ7 | PCT 3544 Coastal Sands Apple-Blackbutt Forest (Moderate Condition) | - | 0.21 | 56.1 | 0 | -56.1 | 1.5 | 4 |
| VZ8 | PCT 3967 Northern Lower Floodplain Eleocharis Wetland (Good Condition) | Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (BC | 1.7* | 70 | 0 | -70 | 2 | 58* |

| Vegetation zone | Plant community type name | TEC | Impact Area (ha) | Current VI score | Future VI Score | Change in VI score | Biodiversity Risk Weighting | Number of ecosystem credits required |
|---|---|---|---|---|---|---|---|---|
| | | Act) | | | | | | |
| VZ9 | PCT 4006 Northern Paperbark-Swamp Mahogany Saw-sedge Forest (Moderate Condition) | Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (BC Act),<br>Coastal Swamp Sclerophyll Forest of New south Wales and South East Queensland (EPBC Act) | 0.04 | 60.6 | 0 | -60.6 | 2 | 1 |
| | | | | | | | Total ecosystem credits | 105 |

* It was noted that BAM-C rounded up the area of VZ8 from 1.67 ha to 1.7 ha. It appears that the BAM-C is still using 1.67 ha to calculate the credit output as 1.67 ha would generate 58.45 credits while 1.7 ha would generate 59.5 credits.

### *10.1.2 Impacts on Threatened Species and their Habitat (Species Credits)*

Table 37 Summary of species credits for all vegetation zones

| Common Name | Scientific Name | BC Act Status | EPBC Act Status | Loss of Habitat (ha) | Biodiversity risk weighting | Number of Species Credits Required |
|---|---|---|---|---|---|---|
| Small Pale Grass-lily | *Caesia parviflora* var. *minor* | Endangered | - | 0.73 | 2 | 28 |
| Wallum Froglet | *Crinia tinnula* | Vulnerable | - | 6.2* | 1.5 | 51 |
| Leafless Tongue Orchid | *Cryptostylis hunteriana* | Vulnerable | Vulnerable | 2.32 | 1.5 | 24 |
| Spider Orchid | *Dendrobium melaleucaphilum* | Endangered | - | 0.73 | 2 | 28 |
| Swift Parrot | *Lathamus discolor* | Endangered | Critically Endangered | 1.07 | 3 | 22 |
| Green-thighed Frog | *Litoria brevipalmata* | Vulnerable | - | 0.76 | 1.5 | 21 |
| Slender Marsdenia | *Marsdenia longiloba* | Endangered | Vulnerable | 1.11 | 2 | 41 |
| Southern Myotis | *Myotis Macropus* | Vulnerable | - | 11.26* | 2 | 112 |
| Giant Dragonfly | *Petalura gigantea* | Endangered | - | 14.32* | 3 | 187 |
| Squirrel Glider | *Petaurus norfolcensis* | Vulnerable | - | 1.87* | 2 | 64 |
| Koala | *Phascolarctos cinereus* | Endangered | Endangered | 1.87* | 2 | 64 |
| Eastern Cave Bat | *Vespadelus troughtoni* | Vulnerable | - | 22.61* | 3 | 253 |
| | | | | | Total species credits | 895 |

* Similar to Table 36, the BAM-C has performed rounding in presenting its area values. This BDAR presents the area values as the sum of areas input to the BAM-C, which is what the credit calculation is based on.

## 10.2 IMPACTS THAT DO NOT NEED FURTHER ASSESSMENT

The following areas of land had a VI Score below 15 and were not considered native vegetation

- VZ5 PCT 3544 Coastal Sands Apple-Blackbutt Forest (Disturbed Exotic Grassland)
- VZ6 PCT 3544 Coastal Sands Apple-Blackbutt Forest (Low Condition)
- Roads / Cleared / Structures

Therefore, these areas only need consideration in relation to the presence of threatened species credits (Figure 65 - Figure 69).

## 11.0 BIODIVERSITY CREDIT REPORT

This section provides a summary of biodiversity credits required for impacts on the biodiversity values within the subject land, following consideration of measures to avoid, minimise and mitigate impacts. The full credit profile is provided in Appendix 3.

### 11.1 ECOSYSTEM CREDITS

Table 38 Ecosystem credit class and matching credit profile

| Vegetation Zone | Ecosystem Credit | Attributes shared with matching credits | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | PCT name | PCT vegetation class | PCT vegetation formation | Associated TEC or EC | Offset trading group | Hollow bearing trees present? | IBRA subregion (in which project is located) |
| 1 | 4 | 3167 Northern Hinterland Blackbutt-Forest Oak Wet Forest | Northern Hinterland Wet Sclerophyll Forests | Wet Sclerophyll Forests (Grassy sub-formation) | - | Northern Hinterland Wet Sclerophyll Forests - < 50% cleared group (including Tier 4 or higher threat status). | No | Macleay Hastings, Carrai Plateau, Coffs Coast and Escarpment, Comboyne Plateau, Karuah Manning, Macleay Gorges, Mummel Escarpment and Upper Manning.<br>or<br>Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site. |
| 2 | 17 | 3167 Northern Hinterland Blackbutt-Forest Oak Wet Forest | Northern Hinterland Wet Sclerophyll Forests | Wet Sclerophyll Forests (Grassy sub-formation) | - | Northern Hinterland Wet Sclerophyll Forests - < 50% cleared group (including Tier 4 or higher threat status). | Yes | |
| 3 | 2 | 3250 Northern Foothills Blackbutt Grassy Forest | Northern Hinterland Wet Sclerophyll Forests | Wet Sclerophyll Forests (Grassy sub-formation) | - | Northern Hinterland Wet Sclerophyll Forests - < 50% cleared group (including Tier 4 or higher threat status). | No | |
| 4 | 19 | 3250 Northern Foothills Blackbutt Grassy Forest | Northern Hinterland Wet Sclerophyll Forests | Wet Sclerophyll Forests (Grassy sub-formation) | - | Northern Hinterland Wet Sclerophyll Forests - < 50% cleared group (including Tier 4 or higher threat status). | No | |
| 5 | 0 | 3544 Coastal Sands Apple-Blackbutt Forest | Coastal Dune Dry Sclerophyll Forests | Dry Sclerophyll Forests (Shrubby sub-formation) | - | Coastal Dune Dry Sclerophyll Forests - < 50% cleared group (including Tier 4 or higher threat status). | Yes | |

| Vegetation Zone | Ecosystem Credit | Attributes shared with matching credits | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | PCT name | PCT vegetation class | PCT vegetation formation | Associated TEC or EC | Offset trading group | Hollow bearing trees present? | IBRA subregion (in which project is located) |
| 6 | 0 | 3544 Coastal Sands Apple-Blackbutt Forest | Coastal Dune Dry Sclerophyll Forests | Dry Sclerophyll Forests (Shrubby sub-formation) | - | Coastal Dune Dry Sclerophyll Forests - < 50% cleared group (including Tier 4 or higher threat status). | No | |
| 7 | 4 | 3544 Coastal Sands Apple-Blackbutt Forest | Coastal Dune Dry Sclerophyll Forests | Dry Sclerophyll Forests (Shrubby sub-formation) | - | Coastal Dune Dry Sclerophyll Forests - < 50% cleared group (including Tier 4 or higher threat status). | No | |
| 8 | 58 | 3967 Northern Lower Floodplain Eleocharis Wetland | Coastal Freshwater Lagoons | Freshwater Wetlands | Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions | Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions | No | |
| 9 | 1 | 4006 Northern Paperbark-Swamp Mahogany Saw-sedge Forest | Coastal Floodplain Wetlands | Forested Wetlands | Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (Endangered [BC Act 2016]).<br>Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland (Endangered [EPBC Act 1999]). | Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions | No | |

## 11.2 SPECIES CREDITS

Table 39 Species credit class and matching credit profile

| Species credit | Attributes shared and matching credit profile | | | | |
|---|---|---|---|---|---|
| | Name of threatened species | Kingdom | BC Act status | EPBC Act status | IBRA region |
| 28 | Small Pale Grass-lilly (*Caesia parviflora var. minor*) | Plant | Endangered | - | Any in NSW |
| 51 | Wallum Froglet (*Crinia tinnula*) | Animal | Vulnerable | - | Any in NSW |
| 24 | Leafless Tongue Orchid (*Cryptostylis hunteriana*) | Plant | Vulnerable | Vulnerable | Any in NSW |
| 28 | Spider Orchid (*Dendrobium melaleucaphilum*) | Plant | Endangered | - | Any in NSW |
| 22 | Swift Parrot (*Lathamus discolor*) | Animal | Endangered | Critically Endangered | Any in NSW |
| 21 | Green-thighed Frog (*Litoria brevipalmata)* | Animal | Vulnerable | - | Any in NSW |
| 41 | Slender Marsdenia (*Marsdenia longiloba*) | Plant | Endangered | Vulnerable | Any in NSW |
| 112 | Southern Myotis (*Myotis Macropus*) | Animal | Vulnerable | - | Any in NSW |
| 187 | Giant Dragonfly (*Petalura gigantus)* | Animal | Endangered | - | Any in NSW |
| 64 | Squirrel Glider (*Petaurus norfolcensis*) | Animal | Vulnerable | - | Any in NSW |
| 64 | Koala (*Phascolarctos cinereus*) | Animal | Endangered | Endangered | Any in NSW |
| 254 | Eastern Cave Bat (*Vespadelus troughtoni*) | Animal | Vulnerable | - | Any in NSW |

# 12.0 ASSESSMENT AGAINST BIODIVERSITY LEGISLATION AND POLICIES

## 12.1 ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999

An assessment of the impacts of the project on Matters of NES, against heads of consideration outlined in Commonwealth of Australia (2013) was prepared to determine whether referral of the project to the commonwealth minister for the environment is required. Matters of NES relevant to the project are summarised in Table 40.

Table 40 Assessment of the project against the Matters of NES and the EPBC Act

| Matter of NES | Project specifics | Potential for significant impact |
|---|---|---|
| Threatened species | 18 flora species and 63 fauna species listed under the EPBC Act have been recorded or are predicted to occur in the Assessment Area.<br>The following threatened species, were not recorded within the Subject Land, however, were assumed to be present in certain areas:<br>• Swift Parrot (*Lathamus discolor*)<br>• Leafless Tongue Orchid (*Cryptostylis hunteriana*)<br>• Slender Marsdenia (*Marsdenia longiloba*)<br>• Koala (*Phascolarctos cinereus*)<br>The following species were identified during works undertaken for this project but are not considered to be at risk for this project.<br>• Scented Acronychia (*Acronychia littoralis*)<br>• Biconvex Paperbark (*Melaleuca biconvexa*)<br>• Scrub Turpentine (*Rhodamnia rubescens*)<br>• Native Guava (*Rhodomyrtus psidioides*)<br>Previous reports noted the presence of Eastern Chestnut Mouse (*Pseudomys gracilicaudatus*) around the sand plain (HWR Ecological, 2005). The TBDC notes that this species was allocated to 'ecosystem credit' species due to its 'boom and bust' life cycle. Surveys within the Subject Land did not detect Eastern Chestnut Mouse but did identify the similar Swamp rat (*Rattus lutreolus*). | The following species were assumed present within the Subject Land and are at risk of impact:<br>• Swift Parrot (*Lathamus discolor*)<br>• Leafless Tongue Orchid (*Cryptostylis hunteriana*)<br>• Slender Marsdenia (*Marsdenia longiloba*)<br>• Koala (*Phascolarctos cinereus*)<br>Assessments against the Significant Impact Criteria (Commonwealth of Australia 2013) have been prepared for these species and concluded that a significant impact was not likely to result from the project, provided appropriate mitigation measures are adopted as outlined in Section 8.8. See Appendix 4 for the full details.<br>Based on the level of disturbance and the nature of the project, the habitat present within the Subject Land does not constitute limiting habitat for the above threatened species. Therefore, a referral is not required. |
| Threatened ecological communities | Based on meeting the minimum condition thresholds (High Condition Class A), one endangered ecological community, Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland, was recorded within the Subject Land and Kooloonbung Creek.<br>The Protected Matters Search Tool identified four other threatened ecological communities that could occur within the Subject Land. Each of these was considered as part of the survey process and excluded based on the conditions within the Vegetation Zone. | An assessment against the Significant Impact Criteria (Commonwealth of Australia 2013) has been prepared for this TEC (see Appendix 4). There is also discussion related to the community within Kooloonbung Creek in Section 8.4 of this BDAR.<br>With the proposed mitigation measures, VMP and adaptive management strategies to be adopted, it is not anticipated that the proposed action will significantly impact Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland and a referral is therefore not required. |
| Migratory species | 57 migratory species have been recorded or are predicted to occur in the locality.<br>Surveys of the Subject Land did not detect any of these species | These species are unlikely to be impacted by the project. Many of the species identified in the Protected Matters search would only have marginal foraging habitat within the Subject Land, such as Wandering Albatross (*Diomedea* |

| Matter of NES | Project specifics | Potential for significant impact |
|---|---|---|
| | | *exulans*) and Far Eastern Curlew (*Numenius madagascariensis*). |
| Wetlands of international importance (Ramsar sites) | The nearest Ramsar is approximately 113 km away and will not be impacted by the project. | During the field investigation, wetlands were observed within the Subject Land. The closest Ramsar site is within the Mid-Coast local government area approximately 115km south of the Subject Land. Due to the location of the Subject Land, there will be no impact on Wetlands of international importance (Ramsar). |

## 12.2 STATE ENVIRONMENTAL PLANNING POLICY (KOALA HABITAT PROTECTION) 2021

Currently, the State Environmental Planning Policy (Biodiversity and Conservation) 2021 identifies two relevant Chapters in relation to Koala habitat protection in NSW:

- Chapter 3 Koala Habitat Protection 2020, which largely reinstates the policy framework of SEPP 44, and
- Chapter 4 Koala Habitat Protection 2021, which largely reinstates the policy framework of the 2019 Koala SEPP.

The Chapter that applies is determined by the relevant LGA and land use zone. The 2020 SEPP applies to RU1, RU2 and RU3 zoned land within the Port Macquarie-Hastings Council Local Government Area. The 2021 SEPP applies to all remaining land use zones within the Port Macquarie-Hastings Council Local Government Area.

The Subject Land traverses multiple land zonings, which are covered by different Koala SEPPs. The different land use zones and applicable SEPP is identified in Table 41 below: The definition of core Koala habitat also differs between the chapters and is summarised in Table 42 below.

Table 41 Applicable Koala habitat protection Chapter of State Environmental Planning Policy (Biodiversity And Conservation) 2021

| Applicable Chapter of SEPP | Land Zoning | Area within Subject Land (ha) |
|---|---|---|
| Chapter 3 Koala Habitat Protection 2020 | RU1 Primary Production | 15.75 |
| Chapter 4 Koala Habitat Protection 2021 | C2 Environmental Conservation | 1.22 |
| | E3 Productivity Support | 1.09 |
| | R1 General Residential | 6.23 |
| | R2 Low Density Residential | 0.08 |
| | R5 Large Lot Residential | 0.66 |
| | RE1 Public Recreation | 0.25 |
| | RE2 Private Recreation | 2.27 |
| | SP2 Infrastructure | 0.82 |

Table 42 Definition of highly suitable habitat and core Koala habitat under each Chapter in the context of the Subject Land

| Applicable Chapter of SEPP | Definition of potential OR highly suitable Koala habitat | Definition of core Koala habitat | Presence within Subject Land |
|---|---|---|---|
| Chapter 3 Koala Habitat Protection 2020 | *"potential koala habitat means areas of native vegetation where trees of the types listed in Schedule 1 constitute at least 15% of the total number of trees in the upper or lower strata of the tree component."* | *"an area of land with a resident population of koalas, evidenced by attributes such as breeding females, being females with young, and recent sightings of and historical records of a population."* | As Koala feed trees listed in Schedule 1 do not constitute at least 15% of the total number of trees in the upper or lower strata of the tree component, potential Koala habitat is not considered present.<br><br>There are 8282 records of Koala within ten kilometres of the Subject Land (the locality) including records within and immediately adjacent to the Subject Land, with the most recent record within the locality from 2023. As such, core Koala habitat defined by the Koala SEPP 2020 is present within the Subject Land, however, due a lack of treed vegetation, this land is likely used as transitional habitat. |
| Chapter 4 Koala Habitat Protection 2021 | Highly suitable habitat is defined as *"areas of native vegetation where trees of the types listed in Schedule 3 constitute at least 15% of the total number of trees in the upper or lower stratum of the tree component"* | *a) "an area of land which has been assessed by a suitably qualified and experienced person as being highly suitable koala habitat and where koalas are recorded as being present at the time of assessment of the land as highly suitable koala habitat, or*<br><br>*b) an area of land which has been assessed by a suitably qualified and experienced person as being highly suitable koala habitat and where koalas have been recorded as being present in the previous 18 years"* | As greater than 15% of the total number of trees in the upper or lower stratum of the tree component are listed under Schedule 3, highly suitable Koala habitat is considered present.<br><br>As highly suitable Koala habitat is present, Koala was observed during Subject Land surveys and 8282 records of Koala occur within ten kilometres of the Subject Land (the locality) including recent records within and immediately adjacent to the Subject Land, core Koala habitat defined by the Koala SEPP 2021 is considered present within the Subject Land. |

The Subject Land passes through two Koala Plans of Management (KPoM), Area 13 and Link Road. Outside of the Subject Land area there will be additional effluent contributions into Kooloonbung Creek; part of the Kooloonbung Creek KPoM (GeoLINK 2012) (Figure 73). The project will impact in areas covered under the Port Macquarie Hastings Council Port Macquarie Airport KPoM. This KPoM was developed to manage the impact to vegetation caused by the creation of the obstacle limitation surface for the airport. It is noted that the Airport KPoM generally lines up with areas associated with the Bio-certified land. Compliance of the project with the provisions of these KPoMs would constitute compliance with Chapter 4 Koala Habitat Protection 2021.

It is noted that the project may impact on Koala Feed Trees that were established as part of a private KPoM (see Figure 73). Due to this, Section 8.10 involves the replacement of each Koala Feed Tree removed at a ration of 3 new trees for each tree removed.

The project alignment will pass very close to the Central Road KPoM (Emergency Services Centre) along Acacia Avenue, however there are no impacts anticipated within this KPoM area.

### *12.2.1 Kooloonbung Creek KPoM*

This KPoM was prepared to support an EIS Impact Statement (EIS) which addresses management actions for the establishment of buffers between residents and roosting flying-foxes as part of the Kooloonbung Creek Nature Park Plan of Management. Ecological Assessments performed by GeoLINK (2012) indicated that the area supports *State Environmental Planning Policy (SEPP) No.44 – Koala Habitat Protection* defined core Koala habitat.

For the Kooloonbung Creek KPoM, the project was assessed against the respective management aim and objectives outlined in Part 1.3 of the KPoM.

*Identify preferred feed trees and the extent of resources available within the study area;*

As identified in the KPoM, feed trees defined by Chapter 4 SEPP 2021 identified by GeoLINK (2012) within the Kooloonbung Creek area include *Eucalyptus microcorys* (Tallowwood), *Eucalyptus tereticornis* (Forest Red Gum), *Eucalyptus robusta* (Swamp Mahogany), *Eucalyptus propinqua* (Small-fruited Grey Gum), *Eucalyptus signata* (Scribbly Gum), *Eucalyptus pilularis* (Blackbutt), *Eucalyptus grandis* (Flooded Gum) and *Corymbia intermedia* (Pink Bloodwood). Further species recorded by de Witt Ecology (2024), that align with Chapter 4 SEPP 2021 include *Melaleuca quinquenervia* (Broad-leaved Paperbark), *Casuarina glauca (*Swamp Oak) and *Eucalyptus saligna* (Sydney Blue Gum)

Vegetation within the Kooloonbung Creek area has been mapped by de Witt Ecology, shown in Figure 43. Plant Community Types (PCT) that occur across the area include:

- Exotic Vegetation
- PCT 3171 – Northern Lowland Viney Wet Forest
- PCT 4004 – Northern Melaleuca quinquenervia Swamp Forest
- PCT 4047 – Northern Swamp Mahogany-Bottlebrush Swamp Forest
- PCT 4091 – Grey Mangrove-River Forest
- PCT 4103 – Sporobolus virginicus Saltmarsh

PCT 3171, PCT 4004 and PCT 4047 provide the majority of the resources needed to support the Koala population within the Kooloonbung Creek area, contributing to approximately 69% of the total area of the de Witt Ecology mapped area within the Reserve. de Witt Ecology has identified feed tree species as defined in Chapter 4 SEPP 2021 in each of these PCTs. PCT 3171 occupies an area of approximately 8.2 hectares, largely dominated by the feed tree species *Eucalyptus microcorys* (Tallowwood), *Eucalyptus pilularis* (Blackbutt), *Eucalyptus robusta* (Swamp Mahogany), *Corymbia intermedia* (Pink Bloodwood) and *Eucalyptus saligna* (Sydney Blue Gum). PCT 4004 (28.18 ha) consisted of a significant number of *Melaleuca quinquenervia* (Broad-leaved Paperbark) and *Casuarina glauca* (Swamp Oak) and PCT 4047 (0.55 ha) featured the aforementioned *Eucalyptus robusta* (Swamp Mahogany), *Eucalyptus pilularis* (Blackbutt) as well as *Eucalyptus tereticornis* (Forest Red-Gum). Other PCTs within the site feature low number of feed trees for the species (≤1%) and are likely to not contribute significant resources to sustain the population within the Reserve. These PCTs are likely used as transitional zones as Koalas move between foraging areas.

*Assess the regional and local distribution of Koalas;*

Biolink (2012) performed Koala habitat mapping throughout the Port Macquarie-Hastings LGA, identifying several Koala population cells within the region. These populations included:

- Significant population cell in the Lake Innes area, extending across south and east through the Christmas Bell Plain and into urban Port Macquarie. Koalas within Kooloonbung Creek Reserve are associated with this population cell.
- Several coastal populations around the south-western edges of Lake Cathie, Bonny Hills area and the South-western extent of Lake Innes Nature Reserve.
- Populations in the land surrounding Port Macquarie Airport, with significant activity within the Thrumster, Fernbank Creek and Sancrox areas.
- Small populations at Riverside on the north bank of the Hastings River and another south of the Camden Haven River at Dunbogan.

BioNet records indicate that 8282 Koalas have been recorded within the locality (10km radius of the study area), with numerous records throughout Kooloonbung Creek Reserve. Data supplied by council also indicated that Koala activity occurs across the alignment. The large number of records indicates that there is sufficient habitat available locally to support the movement of Koalas across the general locality of the study area in all directions.

*Identify the extent of Koala habitat in the study area;*

Port Macquarie-Hastings Council provided data indicating that a large proportion of the Kooloonbung Creek area is recognized as potential Koala habitat. Both Geolink (2012) and de Witt Ecology confirmed that feed species are prevalent.

Under SEPP 2021 core Koala habitat has been defined as:

> *a) "an area of land which has been assessed by a suitably qualified and experienced person as being highly suitable koala habitat and where koalas are recorded as being present at the time of assessment of the land as highly suitable koala habitat, or*
>
> *b) an area of land which has been assessed by a suitably qualified and experienced person as being highly suitable koala habitat and where koalas have been recorded as being present in the previous 18 years"*

de Witt Ecology recorded significant (≥15%) cover of Koala feed tree species across approximately 70% of the Kooloonbung Creek area, with exception for mangrove, saltmarsh and exotic vegetation communities. If the species within this list constitute at least 15% of the total number of trees in the upper or lower strata of the tree component, the area is defined as potential Koala habitat, as defined within Chapter 4 SEPP 2021. As aforementioned numerous Koala individuals have been recorded within the Reserve, with BioNet records indicating the most recent record in 2023. During field investigations performed by de Witt Ecology, an individual was recorded at the southern extent of the Reserve.

Therefore, a significant area (approx. 70%) of Kooloonbung Creek Reserve is consistent with Chapter 4 SEPP 2021 definition of core Koala habitat and constitutes Koala habitat within Kooloonbung Creek.

*Identify linkages of core Koala habitat and strategies to enhance and manage these corridors;*

The broader locality comprises a mosaic of urban housing, remnant patches of native vegetation within the surrounding urban area (including reserves such as Kooloonbung Creek Nature Park along drainage lines and in swampy areas), cleared grazing lands, and a significant remnant of native vegetation centred on Lake Innes and Christmas Bell Plains to the south. The Koala is a moderately mobile species and able to disperse across grasslands and within urban environments. It is not anticipated that the project will impact the ability of Koalas to migrate across the landscape or may impede individuals ability to traverse the environment into adjacent areas of foraging habitat. The main local Koala habitat linkage associated with the study area for the Koala consists of the contiguous vegetation that extends south-west from Kooloonbung Creek Nature Park into the key Koala population area within Lake Innes Nature Reserve (Biolink 2012). Less significant potential habitat linkages exists to the south and east of the study area along the Port Macquarie regional corridor, and to the north-west of the site along the Limeburners regional corridor. Local movements would mainly be between Kooloonbung Creek Nature Park and Lake Innes Nature Reserve to the south-west (via fauna underpasses associated with Lake Road / the Link Road ERM 2002), as well as urban trees and remnant to the east and west.

*Identify opportunities to maintain and protect existing key Koala habitat features;*

All vegetation within the KPoM area is expected to be retained, as such, key Koala habitat features will not be affected.

*Identify threats to Koalas and their habitat posed by the Proposal;*

The Kooloonbung Creek KPoM identifies threats to be consistent with those outlines within the Koala Recovery Plan (DECC 2008). The threats include:

- Habitat loss and fragmentation
- Habitat degradation
- Road kills
- Dog attacks
- Fire
- Logging

- Disease
- Severe weather conditions
- Swimming pools (drowning)
- Over browsing

Vegetation is not being removed from the area as part of the project, as such, no immediate habitat loss is expected for the species. The project, where treated effluent is discharged into Kooloonbung Creek Reserve, is unlikely to have any direct on potential habitat. However, indirect effects are likely, and may diffuse over the entirety of the Reserve.

Kooloonbung Creek currently experiences an inflow of treated effluent as part of the PMHC wastewater treatment process. Currently there is very little observable change in floristic community composition change around the outlet that cannot be explained by minor changes in elevation. As such, provided treated effluent discharge practices are consistent with previous processes, habitat degradation of preferred Koala habitat of a significant extent is not expected to occur. Provided mitigation measures, as outlined in Section 8.8, are followed other risks that can contribute to habitat degradation, such as weed invasion are unlikely to occur.

The study area is surrounding by residential development and local roads, and therefore there is currently an existing threat of road kill to the local Koala population. The management actions would not result in an increase to the traffic collision risk either on site or locally (through incremental increases in traffic volume). Similarly, the management actions are unlikely to significantly modify Koala movement within the study area, and consequently the risk of road kill would remain the same during ongoing effluent discharge. Mitigation measures are presented in Section 8.8.

The study area is surrounding by residential dwellings, and therefore there would currently be some negative impacts on the local Koala population by way of attacks from stray and domestic dogs. However, the nature of the project consisting of increased treated effluent inflow into the area would not result in an increased risk of predation by domestic dogs.

DECC (2008) notes that high-intensity fires burn the canopy and can cause the death or injury of Koalas and a reduction in the availability of foraging habitat. In addition, fast-moving fires fanned by strong winds reduce the ability for Koalas to escape to refuge areas. Bushfire mitigation measures including identification and management of fire exclusion zones and asset protection zones within the park are contained within the Kooloonbung Creek Nature Park PoM (PMHC 2012). As the works do not involve any direct impacts to vegetation within the Reserve, but ongoing inflow of treated effluent, the current level of risk of high-intensity fire burning within Kooloonbung Creek Reserve would remain unchanged post-works.

Koala populations in NSW carry the pathogens *Chlamydia spp*. However, clinical signs (commonly conjunctivitis and urogential tract infections) of this infection, chlamydiosis, are expressed when animals are exposed to environmental stresses, such as loss of habitat, harassment by predators, nutritional stress or overcrowding (Canfield, 1990a; Canfield, 1990b; Hume, 1990; Reed & Lunney, 1990; Phillips, 1997; Melzer et. al., 2000; Phillips, 2000). Chlamydiosis weakens Koalas, making them more vulnerable to death from other causes, in particular dog attack and severe weather conditions. The treated effluent discharge into the Reserve has the potential to increase stress to the species, where increased water levels from which are currently observed are experienced. This is unlikely, as current discharge into the Reserve has not produced observable change. Thus, provided current discharge processes are continued, change in preferred habitat is unlikely to occur, leading to little increase in stress and susceptibility to or severity of disease, more then which already occurs.

As the project does not involve removal of vegetation within the Reserve, it is unlikely to increase the risk of injury or mortality more then which already occurs.

*Provide mitigation measures to alleviate these threats; and*

The current proposal, which involves indirect impacts in the Kooloonbung Creek KPoM area addresses threats to Koalas and provides mitigation measures in 8.8. The measures do not address dog attacks as it is not anticipated alter the risk of this threat.

*Provide for effective implementation and monitoring of this KPoM.*

This proposal is likely to be consistent with the original objectives of the Kooloonbung Creek KPoM (2012). An adaptive management strategy is presented in Section 8.9 to address risks of unexpected events from this project.

### *12.2.2 Area 13 KPoM*

This KPoM constitutes the final stage of a project to develop an integrated Structure Plan/KPoM for the Area 13 Urban Investigation Area to the west of Port Macquarie, NSW. Conditionally approved by the Department of Planning on 10th January 2008, the KPoM remains in force for a period of 20 years unless otherwise amended or superseded. Indeed, a formal review of this KPoM (PMHC 2023) noted that given the specified monitoring and reporting components were never met, the KPoM became non-compliant.

Nevertheless, the primary aim of the plan is to accommodate development whilst also facilitating, to the maximum extent possible, an increase in size of the koala population.

The formal review of this KPoM (PMHC 2023) identified that between 2008 and 2022 a total of 1,167 development applications have occurred within the Area 13 KPoM area. The Subject Land generally traverses between the footprint of these development applications.

The project has been assessed against the respective management aim and objectives outlined in Part 2 of the KPoM below.

*(i) Minimise disturbance to currently mapped areas of Core Koala Habitat*

The KPoM identifies that important source populations are located within the High Use areas of Core Koala Habitat, several cells of which have been identified within the KPoM area (Biolink 2008). The KPoM notes that such areas should ideally be protected from adverse disturbance and – when vegetated - are generally not suitable for intensive development such as that normally associated with high-density residential subdivisions. Accordingly, tree retention should be maximised such that there is no net loss of vegetation cover, diversity and/or structural complexity.

The KPoM identifies that medium (normal) use areas of Core Koala Habitat likely serve as both source and sink areas where the population parameters of births and immigration are arguably balanced by deaths and emigration. As evidenced by the ongoing persistence of koala within the town of Port Macquarie, such areas commonly occur within urban environments where management should ideally be focused on measures designed to minimise the potential for negative impact (Biolink 2008).

The KPoM identifies that low use areas often coincide with areas of Potential Koala Habitat that are not Core Koala Habitat by virtue of the fact that they are not currently supporting a resident koala population. Nonetheless, such areas provide auxiliary habitat for more transient members of koala society while also providing for longer-term population expansion. Another function of these areas is to provide linkages between current Core Koala Habitat areas in order to facilitate dispersal and recruitment processes within the larger population. Development within such linkage areas should therefore aim for retention of vegetation with particular emphasis on the retention of preferred food tree species (Biolink 2008).

The KPoM identifies that planning should thus endeavour to minimise the potential for adverse impact within known areas of Core Koala Habitat, while at the same time ensuring that adequate linkages are maintained in order to assist ongoing processes of recruitment and dispersal (Biolink 2008).

The KPoM identifies that a population of approximately 80 koalas inhabits the Area 13 KPoM area, the greater proportion of which occur within mapped boundaries of Core Koala Habitat (Biolink 2008). However, the formal review of this KPoM (PMHC 2023) noted that results of the Koala Detection Dog survey and BioNet records indicate that the Koala population in Area 13 may no longer be present within the central areas of Core Koala Habitat, while development is only approximately 50% complete. Linkages are now critical to enable continued movement through the broader area to ensure the population does not become isolated.

Indeed, in 2008, the KPoM mapped 245 hectares of Potential Koala Habitat with 81.7ha of Core Koala Habitat noting a presence of high activity across the central contour areas. Local Government Area wide koala habitat mapping was introduced in 2014, reflecting further survey and soil type aggregation. It produced a far more accurate base area of 199 hectares of Potential Koala Habitat within the Area 13 KPoM boundary, thereby reducing habitat within the core contours to approximately 76ha (PMHC 2023). An analysis of the existing mapping determined that 35ha of habitat has been cleared, including 5.2ha hectares of Core

Koala Habitat due to residential zoning (PMHC 2023). As a primary objective of this KPoM is to minimise disturbance to mapped areas of core, Council's 2023 review (PMHC 2023) of the clearing indicates the Area 13 KPoM is failing. Of the Core Koala Habitat that remains, 40ha (60%) is currently at considerable risk from development as a result of its zoning.

Where the Subject Land of the project traverses the Area 13 KPoM area it bisects mapped areas of medium (normal) use and high use core Koala habitat as defined in the KPoM (Biolink 2008). However, the formal review of this KPoM (PMHC 2023) noted that results of the Koala Detection Dog survey and BioNet records indicate that the Koala population in Area 13 may no longer be present within the central areas of Core Koala Habitat, while development is only approximately 50% complete.

In any case, the pipeline trenching to occur through this area (Figure 8), has been refined to avoid impacts to treed vegetation where practicable, with exotic mown vegetation being the predominate vegetation type to be impacted (0.85 ha). The project avoids treed vegetation where possible, with very minimal impact to treed vegetation at northern extent of the impact area within the Area 13 KPoM. A singular *Corymbia gummifera* (Bloodwood) individual will potentially be impacted as part of the proposal, as well as several regrowth *Allocasuarina littoralis* (Black Sheoak). The Area 13 KPoM denotes that the feeding ecology of Koalas within this area is specifically focused upon four *Eucalyptus* spp. – Forest Red Gum, Swamp Mahogany (*E. robusta*), Grey Gum (*E. propinqua*) and Tallowwood. These results were unequivocal in their challenge to an alternate view that species such as Broad-leaved Paperbark (*Melaleuca quinquenervia*) and Blackbutt (amongst others) serve as a significant food resource for koalas within the Area 13 KPoM area. The KPoM highlights that while there is no argument that species such as these will be browsed by koalas, the need to distinguish between those tree species that are fundamental to the survival of koalas and those that are of lesser importance is a necessary precursor for effective management. Thus, maximising retention of the Forest Red Gum, Swamp Mahogany, Tallowwood and Grey Gum food resource within the KPoM area should be seen as a primary consideration in terms of koala habitat management.

As such, the project has the does not impact upon the Koala preferred feed tree species within areas mapped as core Koala habitat (Medium [normal] use) in the Area 13 KPoM. In consideration of the recent Council review of this KPoM (PMHC 2023), the status of this area as core Koala habitat has likely diminished due to adjoining clearing and associated development. As such, the proposal is likely to have minimal impact to preferred feed trees within core Koala habitat, with the short-term impact of trenching in exotic mown vegetation expected to be marginal.

Consistent with the Area 13 KPoM, the clearing of native vegetation and/or earthworks or for any other purpose must be temporarily suspended within a range of 25m from any tree that is occupied by a Koala and must not resume until the koala has moved from the tree of its own volition (see Section 8.5).

*(ii) Minimise the potential for koala mortalities on all major roads required to service future developments within the study area*

The Area 13 KPoM identifies that over a ten-year period (1994-2003), the NSW Koala Preservation Society attended to 30 reported Koala/motor vehicle incidents along the section of the Oxley Highway that traverses the Area 13 KPoM area. From this data the following observations were made:

- There is a strong seasonal bias in Koala road mortalities with 43% of the reported cases occurring during Spring (September – October).
- 87% of the reported cases resulted in Koala mortality.
- 62% of reported incidents occurred in the immediate vicinity (± 750metres) of Thrumster Drive.

Ongoing road mortalities, particularly as the area undergoes future development, was identified as a key issue for Koala management. Since the Area 13 KPoM came into force, PMHC (2023) noted that 15 additional incidents had been reported to BioNet or the Port Macquarie Koala Hospital within the KPoM area. Of these, five were Koala road kill events.

The project will necessitate increased vehicle traffic flow on roads within the Area 13 KPoM area, to complete trenching works. The works are likely to occur over the short to mid-term. The mitigation measures section of this report (see Section 8.5), highlight strategies to reduce the likelihood of fauna mortality during the works.

*(iii) Create, embellish and/or maintain habitat linkages/corridors and koala friendly precincts throughout the study area*

The Area 13 KPoM (Biolink 2008) identified that planning should endeavour to minimise the potential for adverse impact within known areas of Core Koala Habitat, while at the same time ensuring that adequate linkages are maintained in order to assist ongoing processes of Koala recruitment and dispersal.

The Area 13 KPoM identified that:

- Habitat linkages must have an average width of 60 m, inclusive of up to a maximum of 15 m of any Outer Protection Area (OPA) that may be required for the purposes of Bushfire Protection.
- Habitat buffers must be a minimum of 30 m wide, inclusive of up to a maximum of 15m any OPA that may be required for the purposes of Bushfire Protection.
- All habitat buffers in the Subject Land (including areas requiring habitat restoration) must be identified by an appropriate land use zoning that emphasises their ecological importance.
- Where a reduction in canopy cover is required for the purposes of creating a APZ adjacent to a habitat linkage or buffer, retention of preferred koala food trees must be maximised.
- Habitat restoration works must be implemented in the Habitat Linkages and buffers as illustrated in KPoM.
- Habitat restoration works must be detailed in an environmental management plan, the format of which is to be drafted by the Consent Authority and agreed to by Department of Planning (DoP).
- Preferred koala food trees must comprise a minimum of 50% of native tree species that are planted for the purposes of habitat restoration.
- Where habitat restoration works as illustrated in Figure 6 of the plan are required on land to which a Development Application applies, restoration works must be completed prior to the issue of a subdivision certificate.
- Preferred koala food trees planted for the purpose of habitat restoration must be selected so as to maximise their viability through the establishment phase. The plants should have a minimum height of 600mm at the time of planting and be nurtured for a minimum period of 24 months with any dead plants being replaced.

The 2023 formal review of the Area 13 KPoM (PMHC 2023) noted that while significant amounts of Core Koala Habitat remain within residential zoning, none of the habitat linkages or restoration within the buffer zones have been completed. As such, opportunities remain to ensure that movement between source populations is strengthened through the implementation of appropriate designs and that areas of core habitat are extended.

PMHC (2023) also note that there was a significant time lag between approval and monitoring survey for presence of koalas (15 years or almost three koala generations). Evidence of koalas was recorded within the three largest remaining undeveloped Lots surveyed, within both southern Core Koala Habitat contours and the high use Core contour in the north. As koalas appear to be currently absent across the central area of core, further investigation and on-going monitoring is required to determine whether lack of immigration or isolation may be evidencing a population decline across the KPoM area.

The Subject Land is situated within the central area of mapped core Koala habitat (Biolink 2008), which has been more recently identified as an area with an apparent absence of Koalas (PMHC 2023). As such, the project has the potential to impact upon trees within areas mapped as core Koala habitat (Medium [normal] use) in the Area 13 KPoM. In consideration of the recent Council review of this KPoM (PMHC 2023), the status of this area as core Koala habitat has likely diminished due to adjoining clearing and associated development. Nevertheless, the impacts of the project, even if marginal, are still likely to result in the removal of non-preferred feed trees, thereby reducing habitat connectivity for Koalas in the landscape. The short-term impact of trenching in exotic mown vegetation is expected to be marginal.

Beyond the trenching and re-instatement of the topsoil, PMHC have advised that seeding will occur (as required) for revegetation purposes. However, it is not practicable to include deep-rooted *Eucalyptus* spp. in the seeding mix along the SRM & RWM route as they could damage the SRM & RWM. In any case, PMHC (2023) advise that planting of food trees must be away from main roads and infrastructure and not be positioned towards threats created by urban development.

*(iv) Minimise koala mortalities currently associated with the existing alignment of the Oxley Highway through the study area*

The Area 13 KPoM (Biolink 2008) identifies that a number of processes currently threaten population stability, including ongoing road mortalities and yet to be realised impacts of recent land clearing activities in the central and northern parts of the Subject Land; some loss to dog attack is also likely in rural residential areas.

The Area 13 KPoM (Biolink 2008) identifies in relation to roads:

- Where major roads are proposed that are required to traverse vegetated areas of Core Koala Habitat or a habitat linkage/buffer, or a designated Koala Release Area and are predicted to accommodate in excess of 500 vehicle movements/day the following provisions will apply:
    - 1200mm high floppy-top or other approved wildlife exclusion fencing must be installed along both sides of the road, the lower half of which must be clad with galvanised tin sheeting on the outside face.
    - cattle grids or other approved devices must be installed at fence-ends and/or any driveways or other access points to prevent koala access to major roads.
    - where possible, koala underpasses comprising a minimum of 1.2m X 1.0m Reinforced Concrete Box Culverts must be installed at regular intervals that approximate 1 underpass/150m of exclusion fencing.
- In areas where the installation of exclusion fencing and underpasses is not possible due to topographical or engineering constraints, signage, street lighting and appropriate vehicle calming devices must be deployed.
- Detailed design for areas affected by provision (i) and (ii) above must be prepared in consultation with a suitably qualified and/or accredited koala specialist

The 2023 formal review of the Area 13 KPoM (PMHC 2023) advised that in 2008, koala management within the urban landscape focussed on allowing free movement of koalas through residential areas and across roads. It is now recognised that road strike and dog attack are significant threats that must be considered across all levels of planning. For instance, corridors that allow movement must also be free of threats such as those posed by potential flood and fire events. Planting of food trees must be away from main roads and infrastructure and not be positioned towards threats created by urban development.

The project will necessitate increased vehicle traffic flow on roads within the Area 13 KPoM area and immediate surrounds, to complete trenching works. The works are likely to occur over the short to mid-term. The mitigation measures section of this report (see Section 8.5), highlight strategies to reduce the likelihood of fauna mortality during the works.

*(v) Maximise opportunities for safe passage of koalas beneath the route of the proposed realignment of the Oxley Highway*

The project necessitates trenching within the Area 13 KPoM area. The works are likely to occur over the short to mid-term. It is not anticipated that the works will influence the safe passage of Koalas beneath the route of the Oxley Highway.

*(vi) Maximise retention of preferred koala food trees in all areas of Potential Koala Habitat*

The trenching to occur through the Area 13 KPoM area (Figure 8), has been refined to avoid impacts to treed vegetation where practicable, with exotic mown vegetation being the predominate vegetation type to be impacted (0.85 ha). Indeed, the project has been micro-located to avoid native vegetation, although there are some impacts to non-preferred treed vegetation within a broader exotic component. A singular *Corymbia gummifera* (Bloodwood) individual will potentially be impacted as part of the proposal, as well as several regrowth *Allocasuarina littoralis* (Black Sheoak). The Area 13 KPoM denotes that the feeding ecology of Koalas within this area is specifically focused upon four *Eucalyptus* spp. – Forest Red Gum, Swamp Mahogany (*E. robusta*), Grey Gum (*E. propinqua*) and Tallowwood. These results were unequivocal in their challenge to an alternate view that species such as Broad-leaved Paperbark (*Melaleuca quinquenervia*) and Blackbutt (amongst others) serve as a significant food resource for koalas within the Area 13 KPoM area. The KPoM highlights that while there is no argument that species such as these will be browsed by koalas, the need to distinguish between those tree species that are fundamental to the survival of koalas and those that are of lesser importance is a necessary precursor for effective management. Thus, maximising retention of the Forest Red Gum, Swamp Mahogany, Tallowwood and Grey Gum food resource within the KPoM area should be seen as a primary consideration in terms of koala habitat management.

As such, the project has the does not impact upon the Koala preferred feed tree species within areas mapped as core Koala habitat (Medium [normal] use) in the Area 13 KPoM. In consideration of the recent Council review of this KPoM (PMHC 2023), the status of this area as core Koala habitat has likely diminished due to adjoining clearing and associated development. As such, the proposal is likely to have minimal impact to preferred feed trees within core Koala habitat, with the short-term impact of trenching in exotic mown vegetation expected to be marginal.

Consistent with the Area 13 KPoM, the clearing of native vegetation and/or earthworks or for any other purpose must be temporarily suspended within a range of 25m from any tree that is occupied by a Koala and must not resume until the koala has moved from the tree of its own volition.

Beyond the trenching and re-instatement of the topsoil, PMHC have advised that seeding will occur (as required) for revegetation purposes. However, it is not practicable to include deep-rooted *Eucalyptus* spp. in the seeding mix along the pipeline route as they could damage the SRM & RWM. In any case, PMHC (2023) advise that planting of food trees must be away from main roads and infrastructure and not be positioned towards threats created by urban development.

The Area 13 KPoM states that any koala food trees unable to be avoided and required to be removed should be offset on the same site to maintain the biodiversity values specific to the site. If such offsetting is unable to be achieved on the site, then the project must be re-designed to avoid the impacts. The proposal does not impact any of the 4 species of Koala feed trees as listed in the Area 13 KPoM, and as such, will not require an offset.

*(vii) Assist recruitment processes through identification of suitable areas of Potential Koala Habitat in which koalas can be released by the NSWKPS*

Within the Area 13 KPoM area, the works involves pipeline trenching. The project will not include identification of suitable areas of Potential Koala Habitat in which koalas can be released.

*(viii) Creation of a development process that is linked to positive performance indicators*

The performance criteria outlined in the Area 13 KPoM, identified that it will be deemed successful if:

- Habitat restoration works have been completed in accord with the criteria and scheduling detailed in Part 3(G).
- Either or both the proportion of Core Koala Habitat within the Subject Land and/or the mean population size estimate of the number of koalas inhabiting the Subject Land following completion of each two yearly monitoring program has increased.

As a primary objective of this KPoM is to minimise disturbance to mapped areas of core, Council's 2023 review (PMHC 2023) of the clearing indicates the Area 13 KPoM is failing. Of the Core Koala Habitat that remains, 40ha (60%) is currently at considerable risk from development as a result of its zoning.

The trenching to occur through the Area 13 KPoM area (Figure 8), has been refined to avoid impacts to treed vegetation where practicable, with exotic mown vegetation being the predominate vegetation type to be impacted (0.85 ha). Indeed, the project has been microsited to avoid native vegetation, although there are some impacts to non-preferred treed vegetation within a broader exotic component. A singular *Corymbia gummifera* (Bloodwood) individual will potentially be impacted as part of the proposal, as well as several regrowth *Allocasuarina littoralis* (Black Sheoak). The Area 13 KPoM denotes that the feeding ecology of Koalas within this area is specifically focused upon four *Eucalyptus* spp. – Forest Red Gum, Swamp Mahogany (*E. robusta*), Grey Gum (*E. propinqua*) and Tallowwood. These results were unequivocal in their challenge to an alternate view that species such as Broad-leaved Paperbark (*Melaleuca quinquenervia*) and Blackbutt (amongst others) serve as a significant food resource for koalas within the Area 13 KPoM area. The KPoM highlights that while there is no argument that species such as these will be browsed by koalas, the need to distinguish between those tree species that are fundamental to the survival of koalas and those that are of lesser importance is a necessary precursor for effective management. Thus, maximising retention of the Forest Red Gum, Swamp Mahogany, Tallowwood and Grey Gum food resource within the KPoM area should be seen as a primary consideration in terms of koala habitat management.

As such, the project has the does not impact upon the Koala preferred feed tree species within areas mapped as core Koala habitat (Medium [normal] use) in the Area 13 KPoM. In consideration of the recent Council review of this KPoM (PMHC 2023), the status of this area as core Koala habitat has likely diminished due to adjoining clearing and associated development. As such, the proposal is likely to have minimal impact to preferred feed trees within core Koala habitat, with the short-term impact of trenching in exotic mown vegetation expected to be marginal.

Beyond the trenching and re-instatement of the topsoil, PMHC have advised that seeding will occur (as required) for revegetation purposes. However, it is not practicable to include deep-rooted *Eucalyptus* spp. in the seeding mix along the

pipeline route as they could damage the SRM & RWM. In any case, PMHC (2023) advise that planting of food trees must be away from main roads and infrastructure and not be positioned towards threats created by urban development.

The Area 13 KPoM states that any koala food trees unable to be avoided and required to be removed should be offset on the same site to maintain the biodiversity values specific to the site. If such offsetting is unable to be achieved on the site, then the project must be re-designed to avoid the impacts. The proposal does not impact any of the 4 Koala feed trees as listed in the Area 13 KPoM, and as such, will not require an offset.

### *12.2.3 Link Road KPoM*

In 2002 Port Macquarie - Hastings Council engaged ERM Australia to develop a Plan of Management for the Link Road (ERM, 2012). This Plan was adopted by the Department of Planning and Port Macquarie Hastings Council in 2002. Due to operational changes since the adoption of this Plan, Council cannot complete the original offset planting areas. To this end a new Plan of Management has been provided (this plan) from which alternative areas for offset planting are proposed. This plan heavily uses the original content in the ERM KPoM (ERM, 2012). The construction of the Link Road was completed in 2007.

The study area for the EIS associated with the KPoM included all land within 100 metres either side of the centreline of the proposed Ring Road. The study area was also increased to encompass the dry open forest habitat abutting Hindman Street due to the potential barrier effect that the proposed Link Road may have on this area.

For the purpose of the Koala Plan of Management (KPoM), the Link Road KPoM study area has been expanded to enable a more thorough assessment of koala activity in adjacent forested areas that are likely to provide habitat or corridor function for koalas in the vicinity of the proposed road easement.

*Minimise impacts associated with the Link Road construction using local sources of information regarding koala habitat use and threats in the vicinity of the study area;*

The Subject Land transects the Link Road KPoM (2014) at the intersection of Ocean Drive and Lake Road, limited to a thin strip of exotic vegetation (0.19 ha), PCT 3167 Northern Hinterland Blackbutt-Forest Oak Wet Forest (0.01 ha) and cleared area confined by the sewage treatment centre exclusion fence. This area falls within the Preferred Koala Habitat zone. Habitat removal includes one *Melaleuca quinquenervia* (Broad-leaved Paperbark) individual, however, this is not recognised as a high-use tree species within the KPoM area.

The Link Road KPoM forms part of a local link between Lake Innes Nature Reserve (NR) and remnant vegetation that extends along Kooloonbung Creek to the Gordon Street/Lake Road intersection. This link may be locally important as it enables koalas to move between highly developed urban areas and the larger tract of vegetation surrounding Lake Innes.

Scat searches conducted for this original KPoM also indicate potential koala movement east west through the southern portion of the study area between Lake Innes NR and remnant vegetation along Cattle Brook Creek. This remnant vegetation extends south east between Koala Street and Hamlyn Drive, and may form a potential movement corridor for koalas through to remnant vegetation at Transit Hill.

ERM (2000b) also detected relatively high levels of koala activity in sparse stands of trees between the Koala Street/Ocean Drive intersection and remnant vegetation around the water supply dam to the south of the study area.

The Koala Preservation Society has also identified a movement corridor for koalas east west between remnant vegetation around the water storage dam and vegetation west of the McKillop Senior High School via Lochinvar Place and Greenmeadows Drive (M. Crowley Koala Preservation Society pers. comm.)

Connell Wagner (2000b) identified additional local links between forest and urban areas of Port Macquarie to the east and west of the study area. The local link to the east of the study area also provides koalas with the opportunity to move between Lake Innes NR and urban areas within Port Macquarie.

ERM Australia original field investigations performed in 2002 indicate that the majority of koala activity occurs in two main areas within the Link Road KPoM area. These areas include:

- the moist open forest and swamp forest habitats along the southern bank of Kooloonbung Creek and adjacent to Cattle Brook Creek; and
- dry open forest and swamp forest habitats north and north east of the sewage treatment ponds

The Subject Land impact is confined by exclusion fencing surrounding the sewage treatment ponds, and does not feature preferred feed species as outlined by the KPoM. Whilst complete disuse of the Subject Land isn't definite, in lieu of better quality habitat adjacent and the relative ease of access to these areas, the Subject Land is not expected to be of high use by Koalas.

There are a number of threatening processes acting within the vicinity of the study area that are recognised as affecting the local koala population. The major threatening processes acting within the locality include:

- habitat removal and development;
- disease (conjunctivitis and uro-genital tract infection);
- road strike; and
- dog attack.

An indication of the impact of disease, road strike, and dog attacks on koalas in Port Macquarie can be obtained by reviewing the records kept by the Koala Preservation Society (KPS) since 1973. Based on the KPoM, published in 2012, utilising content from the original KPoM (2002), records for the KPoM area have been summarised by Wilkes and Snowden (1997), and Connell Wagner (2000b). The greatest known risk to koalas in Port Macquarie appears to be from collisions with vehicles. Since 1973, 469 koalas have been admitted to the Port Macquarie Koala hospital (Connell Wagner 2000b). The mortality rate associated with vehicle collisions is 64.5 percent.

Connell Wagner (2000b) identified five koala blackspots, which are areas where a high proportion of collisions with motor vehicles have occurred. One of these blackspots, the intersection of Lake Road and Ocean Drive, is situated in close proximity to the Subject Land (Figure 8). At least ten collisions between vehicles and koalas have been reported from this area (Connell Wagner 2000b). The project may slightly increase the risk of road-strike within the area during works, due to an increase of vehicle movement during trenching, however, provided mitigation measures outlined in Section 8.8 are followed, this risk should be minimised.

Records from the KPS summarised by Connell Wagner (2000b) show that 118 records of dog attacks were reported to the koala hospital between 1975-1999, 51 percent of which died. In Port Macquarie disease appears to represent a less serious threat to koalas than human related causes. Since 1973 there have been 70 reported cases of koalas with obvious signs of Chlamydia, and a further 80 cases of koalas with eye disease or injury (Connell Wagner 2000b).

The impact of habitat removal and associated development on the local koala population has not been quantified. However, as only one individual non-preferred tree (*Melaleuca quinquenervia*) is being impacted, it is unlikely that habitat removal will contribute to an increase in the risk of disease, dog attack and road strike, more then which already occurs.

*Improve the quality of koala habitat and the extent of food resources in the vicinity of the proposed road; and*

The preferred feed tree species identified within the KPoM were *Eucalyptus robusta* (Swamp Mahogany), *Eucalyptus signata* (Scribbly Gum), *Corymbia intermedia* (Pink Bloodwood) and *Eucalyptus grandis* (Flooded Gum), with lower levels of use recorded for, *Eucalyptus pilularis* (Blackbutt), *Corymbia gummifera* (Red Bloodwood) and *Melaleuca quinquenervia* (Broad-leaved Paperbark). These results are comparable to those recorded during an assessment of koala habitat use conducted for the coastal area of Hastings LGA (including the study area) by Connell Wagner (2000). The Hastings LGA study recorded the highest use rate for *Eucalyptus robusta* (Swamp Mahogany), followed by *Eucalyptus signata* (Scribbly Gum), *Eucalyptus grandis* (Flooded Gum), *Eucalyptus propinqua* (Grey Gum), *Eucalyptus microcorys* (Tallowwood), *Eucalyptus pilularis* (Blackbutt) and *Melaleuca quinquenervia* (Broad-leaved Paperbark). Connell Wagner (2000b) also recorded some use of *Corymbia intermedia* (Pink Bloodwood).

The Subject Land being impacted as part of the pipeline trenching works involves the removal of one isolated Koala use tree, *Melaleuca quinquenervia*, which is defined by the KPoM as a low use level species for the area. Beyond the trenching and re-instatement of the topsoil, PMHC have advised that seeding will occur (as required) for revegetation purposes. However, it is not practicable to include deep-rooted Eucalyptus spp. in the seeding mix along the pipeline route as they could damage the SRM & RWM. In any case, PMHC (2023) advise that planting of food trees must be away from main roads and infrastructure and not be positioned towards threats created by urban development.

Therefore, the quality of koala habitat within the KPoM area is expected to remain equivalent or slightly decrease in comparison to pre trenching habitat. However, it is unlikely that koalas utilise the Subject Land within the KPoM area, as it is located within exclusion fencing surrounding the pre-existing sewage treatment ponds, does not provide a linkage corridor, and adjoins higher quality treed vegetation.

*Provide guidelines for ongoing monitoring of koalas, maintenance of koala habitat, and impact mitigation structures.*

The Link Road KPoM identifies three mitigation measures specifically to reduce impacts on koalas within the Link Road KPoM area. These mitigation measures include:

- Enhancement of koala habitat
- Reducing mortality during construction
- Fauna reporting and injury care

The Link Road KPoM involved dedicated areas to plant preferred koala feed trees, offsetting construction impacts to the KPoM area. The offset area was determined by a 1:3.2 ha ratio, with an offset planting ratio of five koala preferred feed trees for every individual removed. These offsets were utilised to broaden koala movement corridors north along Kooloonbung Creek and east along Cattle Brook Creek.

For the project, beyond the trenching and re-instatement of the topsoil, PMHC have advised that seeding will occur (as required) for revegetation purposes. However, it is not practicable to include deep-rooted Eucalyptus spp. in the seeding mix along the pipeline route as they could damage the SRM & RWM. In any case, PMHC (2023) advise that planting of food trees must be away from main roads and infrastructure and not be positioned towards threats created by urban development.

Mitigation measures relating to the increased risk of road strike as a result of the project are outlined in Section 8.8.

Consistent with the Link Road KPoM, pre-clearance surveys will be conducted immediately prior to vegetation removal. Koalas will be a priority species during pre-clearing surveys. The full mitigation measures are presented in Section 8.8.

Consistent with Link Road KPoM, koalas sighted by construction staff during the construction and ongoing maintenance periods will be reported to the construction manager and relevant parties. See mitigation measures outlined in Section 8.8.

### *12.2.4 Port Macquarie Airport Obstacle Limitation Surface KPoM*

The primary aim of the KPoM is to allow the safe management and cropping of the vegetation protruding into the OLS areas associated with the Port Macquarie Airport. This project was assessed against the objectives of the KPoM.

Minimise disturbance to areas currently mapped as Core Koala Habitat;

Data of potential Koala habitat within the vicinity of the Airport presented by Council indicates that the SRMs & RWMs will be constructed in very close proximity land mapped as potential Koala habitat. However, it will be aligned to progress along existing roads and the edges of existing vegetation.

There is an area in the north east of the Airport lands where 200 koala feed trees were planted following recommendations of the KPoM, these areas will not be impacted as the SRMs & RWMs will traverse along existing roads in this area (Figure 73).

Minimise the potential for koala mortalities during cropping activities;

Appropriate mitigation measures, including vehicle restrictions have been recommended by this BDAR, see Section 8.8.

Minimise impacts to preferred Koala food trees in all areas of Potential Koala Habitat by cropping only the minimum amount required during each cropping 'run';

Impacts will only occur to trees that have been considered under the Bio-certification process. Alignments target existing cleared areas and roads.

Utilise any cut material suitable for Koala feeding by donating foliage to local Koala preservation groups;

This recommendation has been incorporated into mitigation measures and the VMP.

Creation of an approval process under PMHC's DCP - Tree Management that is linked to positive performance indicators.

The project can be performed in line with the Tree Management sections presented in Part B of Councils DCP.

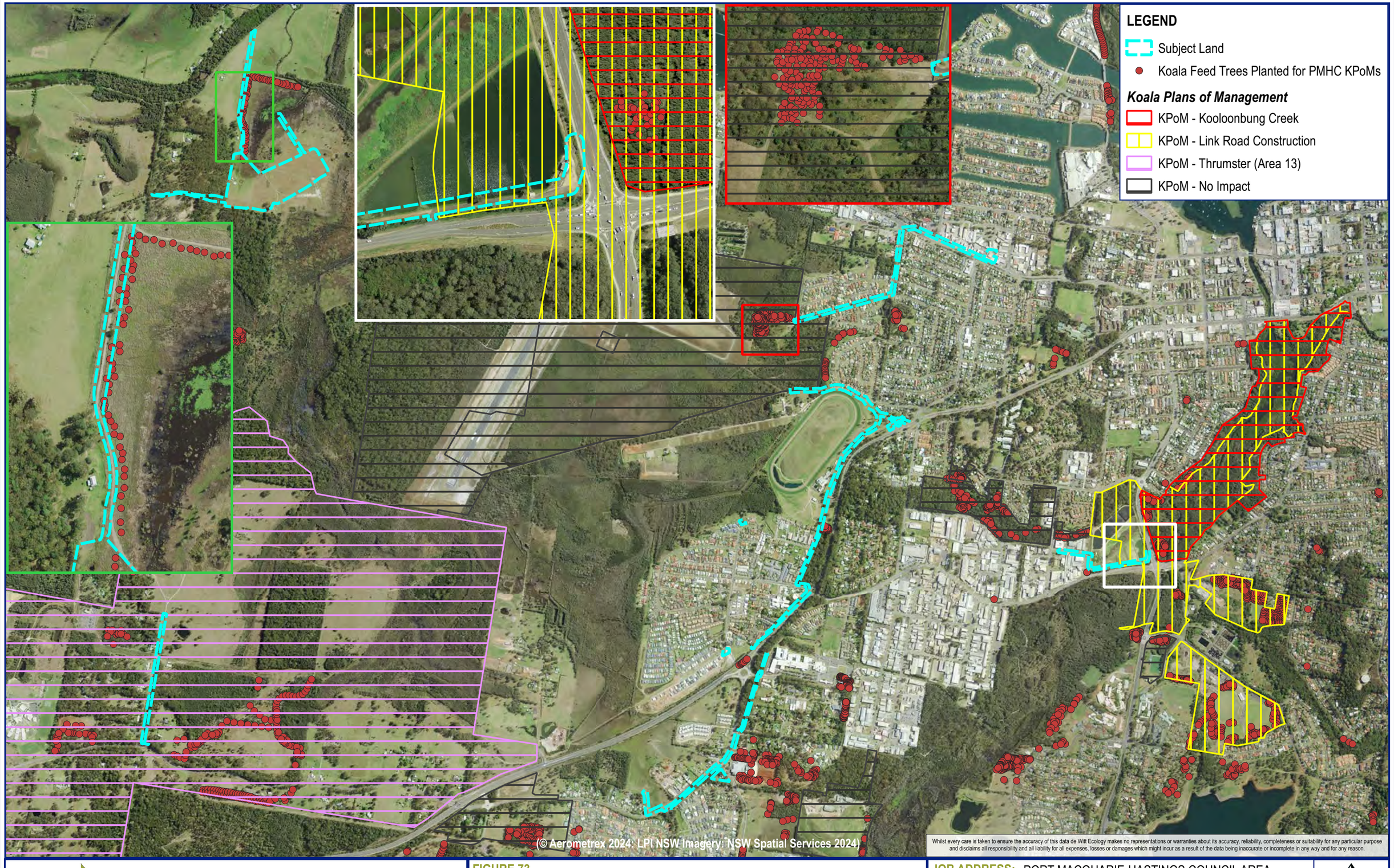


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FIGURE 73

## KOALA PLANS OF MANAGEMENT

0 500 1,000 1,500 2,000 m

| | | | | | |
|---|---|---|---|---|---|
| JOB ADDRESS: | PORT MACQUARIE-HASTINGS COUNCIL AREA<br>NEW SOUTH WALES \| AUSTRALIA | | | | |
| CLIENT: | PORT MACQUARIE-HASTINGS COUNCIL | | | | |
| A3 SCALE: | 1:20,000 | DRAWN: | BH | JOB REF: | EC217 |
| PLAN DATE: | 18/07/2024 | CHECKED: | RS | ISSUE: | 02 |

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# APPENDICES

# APPENDIX 1 – BAM PLOT DATA

Table A. 1 Flora species identified within each BAM plot with their cover and abundance. Column header 'N, E, HTE' stands for Native, Exotic, High Threat Exotic. BC Act refers to the *Biodiversity Conservation Act 2016*, EPBC Act refers to the *Environment Protection and Biodiversity Conservation Act 1999*.

| Family | Scientific Name | Common Name | N, E, HTE | BC Act Status | EPBC Act Status | BAM Growth Form Group | Cover | Abundance |
|---|---|---|---|---|---|---|---|---|
| BAM 1 | | | | | | | | |
| Poaceae | *Andropogon virginicus* | Whisky Grass | HTE | Not Listed | Not Listed | | 4 | 200 |
| Poaceae | *Axonopus fissifolius* | Narrow-leafed Carpet Grass | HTE | Not Listed | Not Listed | | 6 | 400 |
| Myrtaceae | *Callistemon salignus* | Willow Bottlebrush | N | Not Listed | Not Listed | Shrub (SG) | 0.4 | 2 |
| Apiaceae | *Centella asiatica* | Indian Pennywort | N | Not Listed | Not Listed | Forb (FG) | 0.4 | 200 |
| Asteraceae | *Cirsium vulgare* | Spear Thistle | E | Not Listed | Not Listed | | 0.2 | 2 |
| Asteraceae | *Conyza spp.* | | E | Not Listed | Not Listed | | 1.6 | 200 |
| Fumariaceae | *Fumaria spp.* | Fumitory | E | Not Listed | Not Listed | | 0.2 | 2 |
| Apiaceae | *Hydrocotyle laxiflora* | Stinking Pennywort | N | Not Listed | Not Listed | Forb (FG) | 0.4 | 100 |
| Apiaceae | *Hydrocotyle sibthorpioides* | | N | Not Listed | Not Listed | Forb (FG) | 0.4 | 400 |
| Asteraceae | *Hypochaeris radicata* | Catsear | E | Not Listed | Not Listed | | 0.4 | 40 |
| Dennstaedtiaceae | *Hypolepis muelleri* | Harsh Ground Fern | N | Not Listed | Not Listed | Fern (EG) | 0.2 | 2 |
| Poaceae | *Imperata cylindrica* | Blady Grass | N | Not Listed | Not Listed | Grass & grasslike (GG) | 160 | 10000 |
| Campanulaceae | *Lobelia purpurascens* | Whiteroot | N | Not Listed | Not Listed | Forb (FG) | 0.2 | 2 |
| Oxalidaceae | *Oxalis spp.* | | N | Not Listed | Not Listed | Forb (FG) | 0.4 | 100 |
| Poaceae | *Paspalum urvillei* | Vasey Grass | HTE | Not Listed | Not Listed | | 2 | 60 |
| Polygonaceae | *Persicaria strigosa* | | N | Not Listed | Not Listed | Forb (FG) | 0.2 | 4 |
| Proteaceae | *Persoonia levis* | Broad-leaved Geebung | N | Not Listed | Not Listed | Shrub (SG) | 0.2 | 2 |
| Plantaginaceae | *Plantago lanceolata* | Lamb's Tongues | E | Not Listed | Not Listed | | 0.2 | 4 |
| Dennstaedtiaceae | *Pteridium esculentum* | Bracken | N | Not Listed | Not Listed | Fern (EG) | 60 | 1000 |
| Rosaceae | *Rubus fruticosus sp. agg.* | Blackberry complex | HTE | Not Listed | Not Listed | | 0.6 | 4 |

| Family | Scientific Name | Common Name | N, E, HTE | BC Act Status | EPBC Act Status | BAM Growth Form Group | Cover | Abundance |
|---|---|---|---|---|---|---|---|---|
| Polygonaceae | *Rumex acetosella* | Sheep Sorrel | E | Not Listed | Not Listed | | 0.6 | 100 |
| Asteraceae | *Senecio madagascariensis* | Fireweed | HTE | Not Listed | Not Listed | | 2 | 100 |
| Poaceae | *Setaria sphacelata* | South African Pigeon Grass | E | Not Listed | Not Listed | | 2 | 40 |
| Poaceae | *Sporobolus africanus* | Parramatta Grass | E | Not Listed | Not Listed | | 0.4 | 6 |
| Verbenaceae | *Verbena rigida* | Veined Verbena | E | Not Listed | Not Listed | | 1 | 200 |
| Verbenaceae | *Verbena x brasiliensis* | Gin Case | E | Not Listed | Not Listed | | 1 | 60 |
| BAM 2 | | | | | | | | |
| Poaceae | *Andropogon virginicus* | Whisky Grass | HTE | Not Listed | Not Listed | | 70 | 2000 |
| Poaceae | *Axonopus fissifolius* | Narrow-leafed Carpet Grass | HTE | Not Listed | Not Listed | | 5 | 500 |
| Asteraceae | *Conyza spp.* | | E | Not Listed | Not Listed | | 40 | 2000 |
| Poaceae | *Cynodon dactylon* | Common Couch | N | Not Listed | Not Listed | Grass & grasslike (GG) | 3 | 200 |
| Cyperaceae | *Cyperus polystachyos* | | N | Not Listed | Not Listed | Grass & grasslike (GG) | 0.1 | 10 |
| Poaceae | *Eragrostis brownii* | Brown's Lovegrass | N | Not Listed | Not Listed | Grass & grasslike (GG) | 0.1 | 1 |
| Asteraceae | *Hypochaeris radicata* | Catsear | E | Not Listed | Not Listed | | 1 | 50 |
| Juncaceae | *Juncus spp.* | | N | Not Listed | Not Listed | Grass & grasslike (GG) | 0.3 | 30 |
| Asteraceae | *Senecio madagascariensis* | Fireweed | HTE | Not Listed | Not Listed | | 6 | 500 |
| Fabaceae (Faboideae) | *Trifolium repens* | White Clover | E | Not Listed | Not Listed | | 0.1 | 10 |
| Verbenaceae | *Verbena rigida* | Veined Verbena | E | Not Listed | Not Listed | | 0.8 | 30 |
| BAM 3 | | | | | | | | |
| Poaceae | *Andropogon virginicus* | Whisky Grass | HTE | Not Listed | Not Listed | | 180 | 10000 |
| Poaceae | *Axonopus fissifolius* | Narrow-leafed Carpet Grass | HTE | Not Listed | Not Listed | | 20 | 2000 |
| Myrtaceae | *Callistemon salignus* | Willow Bottlebrush | N | Not Listed | Not Listed | Shrub (SG) | 0.4 | 10 |
| Apiaceae | *Centella asiatica* | Indian Pennywort | N | Not Listed | Not Listed | Forb (FG) | 0.2 | 40 |
| Poaceae | *Cynodon dactylon* | Common Couch | N | Not Listed | Not Listed | Grass & grasslike (GG) | 4 | 100 |
| Cyperaceae | *Cyperus polystachyos* | | N | Not Listed | Not Listed | Grass & grasslike (GG) | 0.2 | 20 |

| Family | Scientific Name | Common Name | N, E, HTE | BC Act Status | EPBC Act Status | BAM Growth Form Group | Cover | Abundance |
|---|---|---|---|---|---|---|---|---|
| Cyperaceae | *Fimbristylis dichotoma* | Common Fringe-sedge | N | Not Listed | Not Listed | Grass & grasslike (GG) | 0.4 | 40 |
| Asteraceae | *Hypochaeris radicata* | Catsear | E | Not Listed | Not Listed | | 2 | 100 |
| Juncaceae | *Juncus spp.* | | N | Not Listed | Not Listed | Grass & grasslike (GG) | 0.6 | 60 |
| Myrtaceae | *Leptospermum juniperinum* | Prickly Tea-tree | N | Not Listed | Not Listed | Shrub (SG) | 0.2 | 2 |
| Philydraceae | *Philydrum lanuginosum* | Frogsmouth | N | Not Listed | Not Listed | Forb (FG) | 0.4 | 4 |
| Asteraceae | *Senecio madagascariensis* | Fireweed | HTE | Not Listed | Not Listed | | 6 | 600 |
| Verbenaceae | *Verbena rigida* | Veined Verbena | E | Not Listed | Not Listed | | 2 | 200 |
| BAM 4 | | | | | | | | |
| Poaceae | *Axonopus fissifolius* | Narrow-leafed Carpet Grass | HTE | Not Listed | Not Listed | | 0.2 | 30 |
| Cyperaceae | *Carex appressa* | Tall Sedge | N | Not Listed | Not Listed | Grass & grasslike (GG) | 50 | 500 |
| Cyperaceae | *Carex gaudichaudiana* | | N | Not Listed | Not Listed | Grass & grasslike (GG) | 8 | 100 |
| Casuarinaceae | *Casuarina glauca* | Swamp Oak | N | Not Listed | Not Listed | Tree (TG) | 0.2 | 1 |
| Apiaceae | *Centella asiatica* | Indian Pennywort | N | Not Listed | Not Listed | Forb (FG) | 0.2 | 20 |
| Lauraceae | *Cinnamomum camphora* | Camphor Laurel | HTE | Not Listed | Not Listed | | 0.1 | 1 |
| Asteraceae | *Conyza spp.* | | E | Not Listed | Not Listed | | 0.1 | 1 |
| Sapindaceae | *Cupaniopsis anacardioides* | Tuckeroo | N | Not Listed | Not Listed | Tree (TG) | 0.1 | 1 |
| Phormiaceae | *Dianella caerulea var. producta* | | N | Not Listed | Not Listed | Forb (FG) | 0.2 | 3 |
| Poaceae | *Entolasia marginata* | Bordered Panic | N | Not Listed | Not Listed | Grass & grasslike (GG) | 3 | 200 |
| Moraceae | *Ficus spp.* | | N | Not Listed | Not Listed | Tree (TG) | 1 | 1 |
| Cyperaceae | *Gahnia clarkei* | Tall Saw-sedge | N | Not Listed | Not Listed | Grass & grasslike (GG) | 2 | 8 |
| Poaceae | *Hemarthria uncinata* | Matgrass | N | Not Listed | Not Listed | Grass & grasslike (GG) | 1 | 100 |
| Apiaceae | *Hydrocotyle sibthorpioides* | | N | Not Listed | Not Listed | Forb (FG) | 0.1 | 5 |
| Cyperaceae | *Isolepis inundata* | Club-rush | N | Not Listed | Not Listed | Grass & grasslike (GG) | 3 | 1000 |
| Juncaceae | *Juncus usitatus* | | N | Not Listed | Not Listed | Grass & grasslike (GG) | 0.5 | 20 |
| Myrtaceae | *Melaleuca quinquenervia* | Broad-leaved Paperbark | N | Not Listed | Not Listed | Tree (TG) | 30 | 50 |

| Family | Scientific Name | Common Name | N, E, HTE | BC Act Status | EPBC Act Status | BAM Growth Form Group | Cover | Abundance |
|---|---|---|---|---|---|---|---|---|
| Poaceae | *Panicum effusum* | Hairy Panic | N | Not Listed | Not Listed | Grass & grasslike (GG) | 0.2 | 10 |
| Apocynaceae | *Parsonsia straminea* | Common Silkpod | N | Not Listed | Not Listed | Other (OG) | 0.1 | 1 |
| Poaceae | *Paspalum mandiocanum* | Broadleaf Paspalum | HTE | Not Listed | Not Listed | | 2 | 200 |
| Polygonaceae | *Persicaria decipiens* | Slender Knotweed | N | Not Listed | Not Listed | Forb (FG) | 0.5 | 100 |
| Polygonaceae | *Persicaria strigosa* | | N | Not Listed | Not Listed | Forb (FG) | 2 | 500 |
| Philydraceae | *Philydrum lanuginosum* | Frogsmouth | N | Not Listed | Not Listed | Forb (FG) | 0.3 | 3 |
| Ranunculaceae | *Ranunculus inundatus* | River Buttercup | N | Not Listed | Not Listed | Forb (FG) | 0.1 | 2 |
| Poaceae | *Setaria sphacelata* | South African Pigeon Grass | E | Not Listed | Not Listed | | 25 | 200 |
| Blechnaceae | *Telmatoblechnum indicum* | Swamp Water Fern | N | Not Listed | Not Listed | Fern (EG) | 2 | 80 |
| BAM 5 | | | | | | | | |
| Cyperaceae | *Baumea articulata* | Jointed Twig-rush | N | Not Listed | Not Listed | Grass & grasslike (GG) | 4 | 100 |
| Cyperaceae | *Carex gaudichaudiana* | | N | Not Listed | Not Listed | Grass & grasslike (GG) | 1 | 50 |
| Cyperaceae | *Eleocharis equisetina* | | N | Not Listed | Not Listed | Grass & grasslike (GG) | 80 | 10000 |
| Cyperaceae | *Isolepis inundata* | Club-rush | N | Not Listed | Not Listed | Grass & grasslike (GG) | 0.5 | 20 |
| Juncaceae | *Juncus fockei* | | N | Not Listed | Not Listed | Grass & grasslike (GG) | 0.2 | 2 |
| Juncaceae | *Juncus usitatus* | | N | Not Listed | Not Listed | Grass & grasslike (GG) | 4 | 200 |
| Cyperaceae | *Lepidosperma longitudinale* | Pithy Sword-sedge | N | Not Listed | Not Listed | Grass & grasslike (GG) | 0.3 | 10 |
| Cyperaceae | *Lepironia articulata* | | N | Not Listed | Not Listed | Grass & grasslike (GG) | 25 | 700 |
| Polygonaceae | *Persicaria strigosa* | | N | Not Listed | Not Listed | Forb (FG) | 0.8 | 50 |
| Philydraceae | *Philydrum lanuginosum* | Frogsmouth | N | Not Listed | Not Listed | Forb (FG) | 1 | 20 |
| BAM 6 | | | | | | | | |
| Cyperaceae | *Carex gaudichaudiana* | | N | Not Listed | Not Listed | Grass & grasslike (GG) | 4 | 200 |
| Cyperaceae | *Eleocharis equisetina* | | N | Not Listed | Not Listed | Grass & grasslike (GG) | 70 | 20000 |
| Poaceae | *Hemarthria uncinata* | Matgrass | N | Not Listed | Not Listed | Grass & grasslike (GG) | 0.1 | 5 |
| Cyperaceae | *Isolepis inundata* | Club-rush | N | Not Listed | Not Listed | Grass & grasslike (GG) | 0.2 | 10 |

| Family | Scientific Name | Common Name | N, E, HTE | BC Act Status | EPBC Act Status | BAM Growth Form Group | Cover | Abundance |
|---|---|---|---|---|---|---|---|---|
| Juncaceae | *Juncus usitatus* | | N | Not Listed | Not Listed | Grass & grasslike (GG) | 3 | 200 |
| Cyperaceae | *Lepidosperma longitudinale* | Pithy Sword-sedge | N | Not Listed | Not Listed | Grass & grasslike (GG) | 0.2 | 10 |
| Cyperaceae | *Lepironia articulata* | | N | Not Listed | Not Listed | Grass & grasslike (GG) | 40 | 5000 |
| Polygonaceae | *Persicaria strigosa* | | N | Not Listed | Not Listed | Forb (FG) | 0.5 | 50 |
| BAM 7 | | | | | | | | |
| Fabaceae (Mimosoideae) | *Acacia longissima* | Long-leaf Wattle | N | Not Listed | Not Listed | Shrub (SG) | 0.2 | 1 |
| Pteridaceae | *Adiantum aethiopicum* | Common Maidenhair | N | Not Listed | Not Listed | Fern (EG) | 0.5 | 20 |
| Rhamnaceae | *Alphitonia excelsa* | Red Ash | N | Not Listed | Not Listed | Tree (TG) | 0.1 | 1 |
| Poaceae | *Andropogon virginicus* | Whisky Grass | HTE | Not Listed | Not Listed | | 3 | 100 |
| Asparagaceae | *Asparagus aethiopicus* | Asparagus Fern | HTE | Not Listed | Not Listed | | 0.2 | 2 |
| Poaceae | *Axonopus fissifolius* | Narrow-leafed Carpet Grass | HTE | Not Listed | Not Listed | | 1 | 100 |
| Asteraceae | *Bidens pilosa* | Cobbler's Pegs | HTE | Not Listed | Not Listed | | 0.2 | 10 |
| Poaceae | *Briza minor* | Shivery Grass | E | Not Listed | Not Listed | | 0.1 | 1 |
| Poaceae | *Cenchrus clandestinus* | Kikuyu Grass | HTE | Not Listed | Not Listed | | 0.5 | 30 |
| Apiaceae | *Centella asiatica* | Indian Pennywort | N | Not Listed | Not Listed | Forb (FG) | 0.2 | 20 |
| Lauraceae | *Cinnamomum camphora* | Camphor Laurel | HTE | Not Listed | Not Listed | | 1 | 50 |
| Commelinaceae | *Commelina cyanea* | Native Wandering Jew | N | Not Listed | Not Listed | Forb (FG) | 0.2 | 20 |
| Asteraceae | *Conyza spp.* | | E | Not Listed | Not Listed | | 0.1 | 2 |
| Myrtaceae | *Corymbia gummifera* | Red Bloodwood | N | Not Listed | Not Listed | Tree (TG) | 0.5 | 1 |
| Malaceae | *Cotoneaster pannosus* | | HTE | Not Listed | Not Listed | | 0.2 | 4 |
| Poaceae | *Cynodon dactylon* | Common Couch | N | Not Listed | Not Listed | Grass & grasslike (GG) | 0.2 | 10 |
| Phormiaceae | *Dianella caerulea var. producta* | | N | Not Listed | Not Listed | Forb (FG) | 2 | 50 |
| Poaceae | *Dichelachne micrantha* | Shorthair Plumegrass | N | Not Listed | Not Listed | Grass & grasslike (GG) | 0.1 | 2 |
| Solanaceae | *Duboisia myoporoides* | Corkwood | N | Not Listed | Not Listed | Shrub (SG) | 2 | 8 |
| Poaceae | *Eragrostis brownii* | Brown's Lovegrass | N | Not Listed | Not Listed | Grass & grasslike (GG) | 4 | 300 |

| Family | Scientific Name | Common Name | N, E, HTE | BC Act Status | EPBC Act Status | BAM Growth Form Group | Cover | Abundance |
|---|---|---|---|---|---|---|---|---|
| Myrtaceae | *Eucalyptus microcorys* | Tallowwood | N | Not Listed | Not Listed | Tree (TG) | 30 | 10 |
| Myrtaceae | *Eucalyptus pilularis* | Blackbutt | N | Not Listed | Not Listed | Tree (TG) | 25 | 12 |
| Luzuriagaceae | *Eustrephus latifolius* | Wombat Berry | N | Not Listed | Not Listed | Other (OG) | 0.2 | 3 |
| Luzuriagaceae | *Geitonoplesium cymosum* | Scrambling Lily | N | Not Listed | Not Listed | Other (OG) | 0.3 | 20 |
| Phyllanthaceae | *Glochidion ferdinandii* | Cheese Tree | N | Not Listed | Not Listed | Tree (TG) | 0.2 | 5 |
| Fabaceae (Faboideae) | *Glycine tabacina* | Variable Glycine | N | Not Listed | Not Listed | Other (OG) | 0.4 | 50 |
| Apiaceae | *Hydrocotyle acutiloba* | | N | Not Listed | Not Listed | Forb (FG) | 0.1 | 20 |
| Apiaceae | *Hydrocotyle sibthorpioides* | | N | Not Listed | Not Listed | Forb (FG) | 0.5 | 500 |
| Poaceae | *Hyparrhenia hirta* | Coolatai Grass | HTE | Not Listed | Not Listed | | 0.3 | 10 |
| Asteraceae | *Hypochaeris radicata* | Catsear | E | Not Listed | Not Listed | | 0.3 | 30 |
| Dennstaedtiaceae | *Hypolepis muelleri* | Harsh Ground Fern | N | Not Listed | Not Listed | Fern (EG) | 3 | 50 |
| Poaceae | *Imperata cylindrica* | Blady Grass | N | Not Listed | Not Listed | Grass & grasslike (GG) | 50 | 20000 |
| Juncaceae | *Juncus usitatus* | | N | Not Listed | Not Listed | Grass & grasslike (GG) | 0.3 | 10 |
| Verbenaceae | *Lantana camara* | Lantana | HTE | Not Listed | Not Listed | | 0.3 | 2 |
| Campanulaceae | *Lobelia purpurascens* | whiteroot | N | Not Listed | Not Listed | Forb (FG) | 0.2 | 30 |
| Lomandraceae | *Lomandra longifolia* | Spiny-headed Mat-rush | N | Not Listed | Not Listed | Grass & grasslike (GG) | 6 | 20 |
| Poaceae | *Microlaena stipoides* | Weeping Grass | N | Not Listed | Not Listed | Grass & grasslike (GG) | 30 | 2000 |
| Proteaceae | *Persoonia stradbrokensis* | | N | Not Listed | Not Listed | Shrub (SG) | 0.4 | 10 |
| Plantaginaceae | *Plantago lanceolata* | Lamb's Tongues | E | Not Listed | Not Listed | | 0.2 | 5 |
| Dennstaedtiaceae | *Pteridium esculentum* | Bracken | N | Not Listed | Not Listed | Fern (EG) | 5 | 60 |
| Rosaceae | *Rubus rosifolius* | Rose-leaf Bramble | N | Not Listed | Not Listed | Shrub (SG) | 0.5 | 50 |
| Asteraceae | *Senecio madagascariensis* | Fireweed | HTE | Not Listed | Not Listed | | 0.2 | 20 |
| Poaceae | *Setaria sphacelata* | South African Pigeon Grass | E | Not Listed | Not Listed | | 0.3 | 20 |
| Malvaceae | *Sida rhombifolia* | Paddy's Lucerne | E | Not Listed | Not Listed | | 0.1 | 5 |
| Verbenaceae | *Verbena rigida* | Veined Verbena | E | Not Listed | Not Listed | | 0.1 | 5 |

| Family | Scientific Name | Common Name | N, E, HTE | BC Act Status | EPBC Act Status | BAM Growth Form Group | Cover | Abundance |
|---|---|---|---|---|---|---|---|---|
| BAM 8 | | | | | | | | |
| Poaceae | *Andropogon virginicus* | Whisky Grass | HTE | Not Listed | Not Listed | | 0.5 | 10 |
| Poaceae | *Axonopus fissifolius* | Narrow-leafed Carpet Grass | HTE | Not Listed | Not Listed | | 0.4 | 30 |
| Cyperaceae | *Carex appressa* | Tall Sedge | N | Not Listed | Not Listed | Grass & grasslike (GG) | 4 | 30 |
| Cyperaceae | *Carex gaudichaudiana* | | N | Not Listed | Not Listed | Grass & grasslike (GG) | 30 | 1000 |
| Cyperaceae | *Carex maculata* | | N | Not Listed | Not Listed | Grass & grasslike (GG) | 3 | 50 |
| Casuarinaceae | *Casuarina glauca* | Swamp Oak | N | Not Listed | Not Listed | Tree (TG) | 10 | 100 |
| Apiaceae | *Centella asiatica* | Indian Pennywort | N | Not Listed | Not Listed | Forb (FG) | 0.1 | 50 |
| Poaceae | *Entolasia marginata* | Bordered Panic | N | Not Listed | Not Listed | Grass & grasslike (GG) | 0.1 | 10 |
| Poaceae | *Hemarthria uncinata* | Matgrass | N | Not Listed | Not Listed | Grass & grasslike (GG) | 5 | 500 |
| Apiaceae | *Hydrocotyle laxiflora* | Stinking Pennywort | N | Not Listed | Not Listed | Forb (FG) | 0.1 | 100 |
| Poaceae | *Imperata cylindrica* | Blady Grass | N | Not Listed | Not Listed | Grass & grasslike (GG) | 3 | 200 |
| Poaceae | *Ischaemum australe* | | N | Not Listed | Not Listed | Grass & grasslike (GG) | 50 | 500 |
| Cyperaceae | *Isolepis inundata* | Club-rush | N | Not Listed | Not Listed | Grass & grasslike (GG) | 0.2 | 200 |
| Juncaceae | *Juncus fockei* | | N | Not Listed | Not Listed | Grass & grasslike (GG) | 0.2 | 10 |
| Juncaceae | *Juncus planifolius* | | N | Not Listed | Not Listed | Grass & grasslike (GG) | 0.8 | 30 |
| Juncaceae | *Juncus usitatus* | | N | Not Listed | Not Listed | Grass & grasslike (GG) | 3 | 100 |
| Apocynaceae | *Parsonsia straminea* | Common Silkpod | N | Not Listed | Not Listed | Other (OG) | 0.1 | 1 |
| Polygonaceae | *Persicaria strigosa* | | N | Not Listed | Not Listed | Forb (FG) | 5 | 1000 |
| Philydraceae | *Philydrum lanuginosum* | Frogsmouth | N | Not Listed | Not Listed | Forb (FG) | 0.3 | 2 |
| Ranunculaceae | *Ranunculus inundatus* | River Buttercup | N | Not Listed | Not Listed | Forb (FG) | 0.1 | 50 |
| Poaceae | *Setaria sphacelata* | South African Pigeon Grass | E | Not Listed | Not Listed | | 0.8 | 20 |
| Violaceae | *Viola hederacea* | Ivy-leaved Violet | N | Not Listed | Not Listed | Forb (FG) | 0.1 | 100 |
| BAM 9 | | | | | | | | |
| Poaceae | *Axonopus fissifolius* | Narrow-leafed Carpet Grass | HTE | Not Listed | Not Listed | | 0.2 | 30 |

| Family | Scientific Name | Common Name | N, E, HTE | BC Act Status | EPBC Act Status | BAM Growth Form Group | Cover | Abundance |
|---|---|---|---|---|---|---|---|---|
| Cyperaceae | *Baumea articulata* | Jointed Twig-rush | N | Not Listed | Not Listed | Grass & grasslike (GG) | 20 | 2000 |
| Cyperaceae | *Baumea rubiginosa* | | N | Not Listed | Not Listed | Grass & grasslike (GG) | 0.1 | 2 |
| Cyperaceae | *Carex appressa* | Tall Sedge | N | Not Listed | Not Listed | Grass & grasslike (GG) | 0.3 | 10 |
| Cyperaceae | *Carex gaudichaudiana* | | N | Not Listed | Not Listed | Grass & grasslike (GG) | 25 | 2000 |
| Casuarinaceae | *Casuarina glauca* | Swamp Oak | N | Not Listed | Not Listed | Tree (TG) | 20 | 400 |
| Apiaceae | *Centella asiatica* | Indian Pennywort | N | Not Listed | Not Listed | Forb (FG) | 0.2 | 50 |
| Poaceae | *Entolasia marginata* | Bordered Panic | N | Not Listed | Not Listed | Grass & grasslike (GG) | 0.3 | 20 |
| Phyllanthaceae | *Glochidion ferdinandi* | Cheese Tree | N | Not Listed | Not Listed | Tree (TG) | 0.1 | 2 |
| Fabaceae (Faboideae) | *Glycine tabacina* | Variable Glycine | N | Not Listed | Not Listed | Other (OG) | 0.1 | 3 |
| Poaceae | *Hemarthria uncinata* | Matgrass | N | Not Listed | Not Listed | Grass & grasslike (GG) | 2 | 200 |
| Apiaceae | *Hydrocotyle laxiflora* | Stinking Pennywort | N | Not Listed | Not Listed | Forb (FG) | 0.2 | 100 |
| Apiaceae | *Hydrocotyle sibthorpioides* | | N | Not Listed | Not Listed | Forb (FG) | 0.2 | 50 |
| Poaceae | *Ischaemum australe* | | N | Not Listed | Not Listed | Grass & grasslike (GG) | 30 | 2000 |
| Cyperaceae | *Isolepis inundata* | Club-rush | N | Not Listed | Not Listed | Grass & grasslike (GG) | 1 | 100 |
| Juncaceae | *Juncus fockei* | | N | Not Listed | Not Listed | Grass & grasslike (GG) | 0.3 | 20 |
| Juncaceae | *Juncus planifolius* | | N | Not Listed | Not Listed | Grass & grasslike (GG) | 1 | 50 |
| Myrtaceae | *Melaleuca quinquenervia* | Broad-leaved Paperbark | N | Not Listed | Not Listed | Tree (TG) | 0.3 | 2 |
| Apocynaceae | *Parsonsia straminea* | Common Silkpod | N | Not Listed | Not Listed | Other (OG) | 0.1 | 1 |
| Poaceae | *Paspalum orbiculare* | Ditch Millet | N | Not Listed | Not Listed | Grass & grasslike (GG) | 0.5 | 20 |
| Polygonaceae | *Persicaria strigosa* | | N | Not Listed | Not Listed | Forb (FG) | 2 | 200 |
| Ranunculaceae | *Ranunculus inundatus* | River Buttercup | N | Not Listed | Not Listed | Forb (FG) | 0.1 | 30 |
| Blechnaceae | *Telmatoblechnum indicum* | Swamp Water Fern | N | Not Listed | Not Listed | Fern (EG) | 3 | 200 |
| Violaceae | *Viola hederacea* | Ivy-leaved Violet | N | Not Listed | Not Listed | Forb (FG) | 0.3 | 300 |
| BAM 10 | | | | | | | | |
| Cyperaceae | *Baumea articulata* | Jointed Twig-rush | N | Not Listed | Not Listed | Grass & grasslike (GG) | 50 | 2000 |

| Family | Scientific Name | Common Name | N, E, HTE | BC Act Status | EPBC Act Status | BAM Growth Form Group | Cover | Abundance |
|---|---|---|---|---|---|---|---|---|
| Cyperaceae | *Carex gaudichaudiana* | | N | Not Listed | Not Listed | Grass & grasslike (GG) | 30 | 2000 |
| Cyperaceae | *Eleocharis equisetina* | | N | Not Listed | Not Listed | Grass & grasslike (GG) | 25 | 5000 |
| Poaceae | *Ischaemum australe* | | N | Not Listed | Not Listed | Grass & grasslike (GG) | 0.2 | 5 |
| Juncaceae | *Juncus fockei* | | N | Not Listed | Not Listed | Grass & grasslike (GG) | 0.2 | 10 |
| Juncaceae | *Juncus usitatus* | | N | Not Listed | Not Listed | Grass & grasslike (GG) | 1 | 20 |
| Polygonaceae | *Persicaria strigosa* | | N | Not Listed | Not Listed | Forb (FG) | 5 | 500 |
| Philydraceae | *Philydrum lanuginosum* | Frogsmouth | N | Not Listed | Not Listed | Forb (FG) | 5 | 100 |
| BAM 11 | | | | | | | | |
| Casuarinaceae | *Casuarina glauca* | Swamp Oak | N | Not Listed | Not Listed | Tree (TG) | 0.3 | 2 |
| Juncaginaceae | *Cycnogeton procerum* | | E | Not Listed | Not Listed | | 0.3 | 20 |
| Cyperaceae | *Eleocharis equisetina* | | N | Not Listed | Not Listed | Grass & grasslike (GG) | 90 | 20000 |
| Poaceae | *Hemarthria uncinata* | Matgrass | N | Not Listed | Not Listed | Grass & grasslike (GG) | 2 | 500 |
| Juncaceae | *Juncus usitatus* | | N | Not Listed | Not Listed | Grass & grasslike (GG) | 4 | 50 |
| Polygonaceae | *Persicaria strigosa* | | N | Not Listed | Not Listed | Forb (FG) | 20 | 1000 |
| BAM 12 | | | | | | | | |
| Fabaceae (Mimosoideae) | *Acacia spp.* | Wattle | N | Not Listed | Not Listed | Shrub (SG) | 0.5 | 2 |
| Pteridaceae | *Adiantum hispidulum* | Rough Maidenhair | N | Not Listed | Not Listed | Fern (EG) | 0.3 | 5 |
| Sapindaceae | *Alectryon subcinereus* | Wild Quince | N | Not Listed | Not Listed | Shrub (SG) | 2 | 3 |
| Casuarinaceae | *Allocasuarina torulosa* | Forest Oak | N | Not Listed | Not Listed | Tree (TG) | 0.8 | 2 |
| Rhamnaceae | *Alphitonia excelsa* | Red Ash | N | Not Listed | Not Listed | Tree (TG) | 4 | 10 |
| Asteraceae | *Ambrosia tenuifolia* | Lacy Ragweed | E | Not Listed | Not Listed | | 0.1 | 1 |
| Asparagaceae | *Asparagus aethiopicus* | Asparagus Fern | HTE | Not Listed | Not Listed | | 0.2 | 5 |
| Malvaceae | *Brachychiton acerifolius* | Illawarra Flame Tree | N | Not Listed | Not Listed | Tree (TG) | 5 | 5 |
| Phyllanthaceae | *Breynia oblongifolia* | Coffee Bush | N | Not Listed | Not Listed | Shrub (SG) | 0.4 | 5 |
| Lauraceae | *Cinnamomum camphora* | Camphor Laurel | HTE | Not Listed | Not Listed | | 10 | 50 |

| Family | Scientific Name | Common Name | N, E, HTE | BC Act Status | EPBC Act Status | BAM Growth Form Group | Cover | Abundance |
|---|---|---|---|---|---|---|---|---|
| Lamiaceae | *Clerodendrum tomentosum* | Hairy Clerodendrum | N | Not Listed | Not Listed | Tree (TG) | 3 | 20 |
| Sapindaceae | *Cupaniopsis anacardioides* | Tuckeroo | N | Not Listed | Not Listed | Tree (TG) | 2 | 10 |
| Phormiaceae | *Dianella caerulea var. producta* | | N | Not Listed | Not Listed | Forb (FG) | 0.2 | 10 |
| Myrtaceae | *Eucalyptus pilularis* | Blackbutt | N | Not Listed | Not Listed | Tree (TG) | 40 | 12 |
| Eupomatiaceae | *Eupomatia laurina* | Bolwarra | N | Not Listed | Not Listed | Shrub (SG) | 5 | 30 |
| Cyperaceae | *Gahnia melanocarpa* | Black Fruit Saw-sedge | N | Not Listed | Not Listed | Grass & grasslike (GG) | 0.5 | 2 |
| Luzuriagaceae | *Geitonoplesium cymosum* | Scrambling Lily | N | Not Listed | Not Listed | Other (OG) | 1 | 30 |
| Phyllanthaceae | *Glochidion ferdinandi* | Cheese Tree | N | Not Listed | Not Listed | Tree (TG) | 3 | 20 |
| Araceae | *Gymnostachys anceps* | Settler's Twine | N | Not Listed | Not Listed | Forb (FG) | 0.3 | 5 |
| Dilleniaceae | *Hibbertia dentata* | Twining Guinea Flower | N | Not Listed | Not Listed | Other (OG) | 0.5 | 20 |
| Dennstaedtiaceae | *Hypolepis muelleri* | Harsh Ground Fern | N | Not Listed | Not Listed | Fern (EG) | 0.2 | 3 |
| Poaceae | *Imperata cylindrica* | Blady Grass | N | Not Listed | Not Listed | Grass & grasslike (GG) | 0.1 | 2 |
| Bignoniaceae | *Jacaranda mimosifolia* | Jacaranda | E | Not Listed | Not Listed | | 0.3 | 3 |
| Verbenaceae | *Lantana camara* | Lantana | HTE | Not Listed | Not Listed | | 3 | 20 |
| Oleaceae | *Ligustrum sinense* | Small-leaved Privet | HTE | Not Listed | Not Listed | | 0.2 | 5 |
| Lomandraceae | *Lomandra longifolia* | Spiny-headed Mat-rush | N | Not Listed | Not Listed | Grass & grasslike (GG) | 1 | 10 |
| Apocynaceae | *Marsdenia rostrata* | Milk Vine | N | Not Listed | Not Listed | Other (OG) | 0.2 | 2 |
| Oleaceae | *Notelaea ovata* | | N | Not Listed | Not Listed | Shrub (SG) | 0.3 | 3 |
| Ochnaceae | *Ochna serrulata* | Mickey Mouse Plant | HTE | Not Listed | Not Listed | | 3 | 100 |
| Poaceae | *Oplismenus imbecillis* | | N | Not Listed | Not Listed | Grass & grasslike (GG) | 2 | 200 |
| Bignoniaceae | *Pandorea pandorana* | Wonga Wonga Vine | N | Not Listed | Not Listed | Other (OG) | 1 | 20 |
| Poaceae | *Paspalum mandiocanum* | Broadleaf Paspalum | HTE | Not Listed | Not Listed | | 4 | 100 |
| Pittosporaceae | *Pittosporum undulatum* | Sweet Pittosporum | N | Not Listed | Not Listed | Shrub (SG) | 0.3 | 2 |
| Dennstaedtiaceae | *Pteridium esculentum* | Bracken | N | Not Listed | Not Listed | Fern (EG) | 0.3 | 5 |
| Rosaceae | *Rubus moluccanus* | Molucca Bramble | N | Not Listed | Not Listed | Shrub (SG) | 0.5 | 20 |

| Family | Scientific Name | Common Name | N, E, HTE | BC Act Status | EPBC Act Status | BAM Growth Form Group | Cover | Abundance |
|---|---|---|---|---|---|---|---|---|
| Rosaceae | *Rubus rosifolius* | Rose-leaf Bramble | N | Not Listed | Not Listed | Shrub (SG) | 0.3 | 5 |
| Menispermaceae | *Sarcopetalum harveyanum* | Pearl Vine | N | Not Listed | Not Listed | Other (OG) | 0.2 | 5 |
| Cyperaceae | *Scleria mackaviensis* | | N | Not Listed | Not Listed | Grass & grasslike (GG) | 0.1 | 1 |
| Fabaceae (Caesalpinioideae) | *Senna pendula* | | E | Not Listed | Not Listed | | 0.8 | 5 |
| Smilacaceae | *Smilax glyciphylla* | Sweet Sarsparilla | N | Not Listed | Not Listed | Other (OG) | 3 | 200 |
| Solanaceae | *Solanum mauritianum* | Wild Tobacco Bush | E | Not Listed | Not Listed | | 0.1 | 1 |
| Menispermaceae | *Stephania japonica* | Snake vine | N | Not Listed | Not Listed | Other (OG) | 0.8 | 20 |
| Meliaceae | *Synoum glandulosum* | Scentless Rosewood | N | Not Listed | Not Listed | Shrub (SG) | 5 | 30 |
| Ulmaceae | *Trema tomentosa* | Native Peach | N | Not Listed | Not Listed | Shrub (SG) | 0.4 | 5 |
| Violaceae | *Viola banksii* | | N | Not Listed | Not Listed | Forb (FG) | 0.2 | 50 |
| BAM 13 | | | | | | | | |
| Myrtaceae | *Acmena smithii* | Lilly Pilly | N | Not Listed | Not Listed | Tree (TG) | 30 | 2 |
| Casuarinaceae | *Allocasuarina littoralis* | Black She-Oak | N | Not Listed | Not Listed | Tree (TG) | 2 | 1 |
| Rhamnaceae | *Alphitonia excelsa* | Red Ash | N | Not Listed | Not Listed | Tree (TG) | 1 | 1 |
| Asparagaceae | *Asparagus aethiopicus* | Asparagus Fern | HTE | Not Listed | Not Listed | | 0.3 | 5 |
| Poaceae | *Axonopus fissifolius* | Narrow-leafed Carpet Grass | HTE | Not Listed | Not Listed | | 0.3 | 30 |
| Asteraceae | *Bidens pilosa* | Cobbler's Pegs | HTE | Not Listed | Not Listed | | 0.3 | 50 |
| Casuarinaceae | *Casuarina glauca* | Swamp Oak | N | Not Listed | Not Listed | Tree (TG) | 0.2 | 1 |
| Apiaceae | *Centella asiatica* | Indian Pennywort | N | Not Listed | Not Listed | Forb (FG) | 0.1 | 10 |
| Solanaceae | *Cestrum parqui* | Green Cestrum | HTE | Not Listed | Not Listed | | 2 | 20 |
| Lauraceae | *Cinnamomum camphora* | Camphor Laurel | HTE | Not Listed | Not Listed | | 1 | 5 |
| Asteraceae | *Conyza spp.* | | E | Not Listed | Not Listed | | 0.1 | 1 |
| Asteliaceae | *Cordyline stricta* | Narrow-leaved Palm Lily | N | Not Listed | Not Listed | Other (OG) | 0.3 | 2 |
| Myrtaceae | *Corymbia gummifera* | Red Bloodwood | N | Not Listed | Not Listed | Tree (TG) | 4 | 2 |

| Family | Scientific Name | Common Name | N, E, HTE | BC Act Status | EPBC Act Status | BAM Growth Form Group | Cover | Abundance |
|---|---|---|---|---|---|---|---|---|
| Poaceae | *Cynodon dactylon* | Common Couch | N | Not Listed | Not Listed | Grass & grasslike (GG) | 0.3 | 20 |
| Phormiaceae | *Dianella caerulea var. producta* | | N | Not Listed | Not Listed | Forb (FG) | 0.2 | 5 |
| Convolvulaceae | *Dichondra repens* | Kidney Weed | N | Not Listed | Not Listed | Forb (FG) | 1 | 1000 |
| Poaceae | *Echinopogon ovatus* | Forest Hedgehog Grass | N | Not Listed | Not Listed | Grass & grasslike (GG) | 0.1 | 4 |
| Poaceae | *Ehrharta erecta* | Panic Veldtgrass | HTE | Not Listed | Not Listed | | 1 | 200 |
| Poaceae | *Entolasia marginata* | Bordered Panic | N | Not Listed | Not Listed | Grass & grasslike (GG) | 0.1 | 2 |
| Myrtaceae | *Eucalyptus microcorys* | Tallowwood | N | Not Listed | Not Listed | Tree (TG) | 20 | 2 |
| Myrtaceae | *Eucalyptus propinqua* | Small-fruited Grey Gum | N | Not Listed | Not Listed | Tree (TG) | 5 | 3 |
| Luzuriagaceae | *Eustrephus latifolius* | Wombat Berry | N | Not Listed | Not Listed | Other (OG) | 0.2 | 3 |
| Moraceae | *Ficus spp.* | | N | Not Listed | Not Listed | Tree (TG) | 1 | 1 |
| Luzuriagaceae | *Geitonoplesium cymosum* | Scrambling Lily | N | Not Listed | Not Listed | Other (OG) | 0.2 | 2 |
| Asteraceae | *Hypochaeris radicata* | Catsear | E | Not Listed | Not Listed | | 0.5 | 100 |
| Campanulaceae | *Lobelia purpurascens* | Whiteroot | N | Not Listed | Not Listed | Forb (FG) | 0.1 | 20 |
| Lomandraceae | *Lomandra longifolia* | Spiny-headed Mat-rush | N | Not Listed | Not Listed | Grass & grasslike (GG) | 0.3 | 3 |
| Lomandraceae | *Lomandra multiflora* | Many-flowered Mat-rush | N | Not Listed | Not Listed | Grass & grasslike (GG) | 0.1 | 1 |
| Myrtaceae | *Melaleuca biconvexa* | Biconvex Paperbark | N | Vulnerable | Vulnerable | Shrub (SG) | 0.3 | 1 |
| Myrtaceae | *Melaleuca quinquenervia* | Broad-leaved Paperbark | N | Not Listed | Not Listed | Tree (TG) | 8 | 2 |
| Poaceae | *Microlaena stipoides* | Weeping Grass | N | Not Listed | Not Listed | Grass & grasslike (GG) | 15 | 1000 |
| Ochnaceae | *Ochna serrulata* | Mickey Mouse Plant | HTE | Not Listed | Not Listed | | 2 | 30 |
| Poaceae | *Oplismenus imbecillis* | | N | Not Listed | Not Listed | Grass & grasslike (GG) | 15 | 1000 |
| Oxalidaceae | *Oxalis spp.* | | N | Not Listed | Not Listed | Forb (FG) | 0.1 | 50 |
| Plantaginaceae | *Plantago lanceolata* | Lamb's Tongues | E | Not Listed | Not Listed | | 0.2 | 10 |
| Araliaceae | *Schefflera actinophylla* | Umbrella Tree | HTE | Not Listed | Not Listed | | 0.8 | 1 |
| Malvaceae | *Sida rhombifolia* | Paddy's Lucerne | E | Not Listed | Not Listed | | 0.1 | 5 |
| Poaceae | *Sporobolus africanus* | Parramatta Grass | E | Not Listed | Not Listed | | 0.2 | 10 |

| Family | Scientific Name | Common Name | N, E, HTE | BC Act Status | EPBC Act Status | BAM Growth Form Group | Cover | Abundance |
|---|---|---|---|---|---|---|---|---|
| Poaceae | *Stenotaphrum secundatum* | Buffalo Grass | HTE | Not Listed | Not Listed | | 30 | 2000 |
| Arecaceae | *Syagrus romanzoffiana* | Cocos Palm | E | Not Listed | Not Listed | | 2 | 6 |
| Asteraceae | *Taraxacum officinale* | Dandelion | E | Not Listed | Not Listed | | 0.2 | 10 |
| BAM 14 | | | | | | | | |
| Poaceae | *Axonopus fissifolius* | Narrow-leafed Carpet Grass | HTE | Not Listed | Not Listed | | 90 | 10000 |
| Poaceae | *Cenchrus clandestinus* | Kikuyu Grass | HTE | Not Listed | Not Listed | | 8 | 500 |
| Poaceae | *Cynodon dactylon* | Common Couch | N | Not Listed | Not Listed | Grass & grasslike (GG) | 2 | 100 |
| Apiaceae | *Hydrocotyle bonariensis* | | E | Not Listed | Not Listed | | 4 | 1000 |
| Asteraceae | *Hypochaeris glabra* | Smooth Catsear | E | Not Listed | Not Listed | | 0.2 | 10 |
| Asteraceae | *Hypochaeris radicata* | Catsear | E | Not Listed | Not Listed | | 4 | 1000 |
| Fabaceae (Faboideae) | *Medicago polymorpha* | Burr Medic | E | Not Listed | Not Listed | | 0.1 | 5 |
| Plantaginaceae | *Plantago lanceolata* | Lamb's Tongues | E | Not Listed | Not Listed | | 0.3 | 20 |
| Asteraceae | *Senecio madagascariensis* | Fireweed | HTE | Not Listed | Not Listed | | 0.2 | 10 |
| Poaceae | *Sporobolus africanus* | Parramatta Grass | E | Not Listed | Not Listed | | 1 | 50 |
| Poaceae | *Stenotaphrum secundatum* | Buffalo Grass | HTE | Not Listed | Not Listed | | 3 | 50 |
| BAM 15 | | | | | | | | |
| Asteraceae | *Aster subulatus* | Wild Aster | E | Not Listed | Not Listed | | 0.1 | 1 |
| Asteraceae | *Conyza spp.* | | E | Not Listed | Not Listed | | 0.3 | 20 |
| Asteraceae | *Hypochaeris radicata* | Catsear | E | Not Listed | Not Listed | | 0.2 | 50 |
| Poaceae | *Imperata cylindrica* | Blady Grass | N | Not Listed | Not Listed | Grass & grasslike (GG) | 70 | 5000 |
| Juncaceae | *Juncus usitatus* | | N | Not Listed | Not Listed | Grass & grasslike (GG) | 0.2 | 2 |
| Dennstaedtiaceae | *Pteridium esculentum* | Bracken | N | Not Listed | Not Listed | Fern (EG) | 40 | 1000 |
| Rosaceae | *Rubus fruticosus sp. agg.* | Blackberry complex | HTE | Not Listed | Not Listed | | 0.3 | 5 |
| Rosaceae | *Rubus parvifolius* | Native Raspberry | N | Not Listed | Not Listed | Shrub (SG) | 0.5 | 30 |
| Asteraceae | *Senecio madagascariensis* | Fireweed | HTE | Not Listed | Not Listed | | 2 | 100 |

| Family | Scientific Name | Common Name | N, E, HTE | BC Act Status | EPBC Act Status | BAM Growth Form Group | Cover | Abundance |
|---|---|---|---|---|---|---|---|---|
| Verbenaceae | *Verbena rigida* | Veined Verbena | E | Not Listed | Not Listed | | 0.3 | 20 |
| BAM 16 | | | | | | | | |
| Fabaceae (Mimosoideae) | *Acacia floribunda* | White Sally | N | Not Listed | Not Listed | Shrub (SG) | 5 | 3 |
| Asparagaceae | *Asparagus aethiopicus* | Asparagus Fern | HTE | Not Listed | Not Listed | | 0.2 | 2 |
| Asteraceae | *Bidens pilosa* | Cobbler's Pegs | HTE | Not Listed | Not Listed | | 0.2 | 20 |
| Apiaceae | *Centella asiatica* | Indian Pennywort | N | Not Listed | Not Listed | Forb (FG) | 1 | 20 |
| Poaceae | *Chloris gayana* | Rhodes Grass | HTE | Not Listed | Not Listed | | 25 | 300 |
| Commelinaceae | *Commelina cyanea* | Native Wandering Jew | N | Not Listed | Not Listed | Forb (FG) | 1.5 | 20 |
| Poaceae | *Cymbopogon refractus* | Barbed Wire Grass | N | Not Listed | Not Listed | Grass & grasslike (GG) | 0.3 | 1 |
| Poaceae | *Cynodon dactylon* | Common Couch | N | Not Listed | Not Listed | Grass & grasslike (GG) | 15 | 100 |
| Poaceae | *Dichanthium sericeum* | Queensland Bluegrass | N | Not Listed | Not Listed | Grass & grasslike (GG) | 5 | 100 |
| Poaceae | *Eragrostis tenuifolia* | Elastic Grass | E | Not Listed | Not Listed | | 10 | 200 |
| Myrtaceae | *Eucalyptus microcorys* | Tallowwood | N | Not Listed | Not Listed | Tree (TG) | 10 | 2 |
| Myrtaceae | *Eucalyptus propinqua* | Small-fruited Grey Gum | N | Not Listed | Not Listed | Tree (TG) | 30 | 10 |
| Myrtaceae | *Eucalyptus resinifera* | Red Mahogany | N | Not Listed | Not Listed | Tree (TG) | 3 | 1 |
| Myrtaceae | *Eucalyptus siderophloia* | Grey Ironbark | N | Not Listed | Not Listed | Tree (TG) | 2 | 1 |
| Fabaceae (Faboideae) | *Glycine latifolia* | | N | Not Listed | Not Listed | Other (OG) | 0.1 | 3 |
| Amaranthaceae | *Gomphrena celosioides* | Gomphrena Weed | E | Not Listed | Not Listed | | 0.3 | 10 |
| Poaceae | *Imperata cylindrica* | Blady Grass | N | Not Listed | Not Listed | Grass & grasslike (GG) | 5 | 50 |
| Convolvulaceae | *Ipomoea cairica* | | HTE | Not Listed | Not Listed | | 25 | 100 |
| Verbenaceae | *Lantana camara* | Lantana | HTE | Not Listed | Not Listed | | 0.4 | 5 |
| Lomandraceae | *Lomandra longifolia* | Spiny-headed Mat-rush | N | Not Listed | Not Listed | Grass & grasslike (GG) | 1 | 1 |
| Poaceae | *Paspalum dilatatum* | Paspalum | HTE | Not Listed | Not Listed | | 2 | 30 |
| Plantaginaceae | *Plantago lanceolata* | Lamb's Tongues | E | Not Listed | Not Listed | | 0.5 | 30 |
| Campanulaceae | *Pratia purpurascens* | Whiteroot | N | Not Listed | Not Listed | Forb (FG) | 0.5 | 20 |

| Family | Scientific Name | Common Name | N, E, HTE | BC Act Status | EPBC Act Status | BAM Growth Form Group | Cover | Abundance |
|---|---|---|---|---|---|---|---|---|
| Rubiaceae | *Richardia stellaris* | | E | Not Listed | Not Listed | | 0.4 | 5 |
| Fabaceae (Caesalpinioideae) | *Senna pendula* | | E | Not Listed | Not Listed | | 6 | 5 |
| Malvaceae | *Sida rhombifolia* | Paddy's Lucerne | E | Not Listed | Not Listed | | 0.3 | 10 |
| Poaceae | *Sporobolus fertilis* | Giant Parramatta Grass | HTE | Not Listed | Not Listed | | 10 | 300 |
| Verbenaceae | *Verbena rigida* | Veined Verbena | E | Not Listed | Not Listed | | 0.2 | 5 |
| BAM 17 | | | | | | | | |
| Fabaceae (Mimosoideae) | *Acacia floribunda* | White Sally | N | Not Listed | Not Listed | Shrub (SG) | 0.3 | 1 |
| Fabaceae (Mimosoideae) | *Acacia longissima* | Long-leaf Wattle | N | Not Listed | Not Listed | Shrub (SG) | 0.3 | 3 |
| Casuarinaceae | *Allocasuarina torulosa* | Forest Oak | N | Not Listed | Not Listed | Tree (TG) | 1 | 1 |
| Rhamnaceae | *Alphitonia excelsa* | Red Ash | N | Not Listed | Not Listed | Tree (TG) | 0.2 | 3 |
| Asteraceae | *Bidens pilosa* | Cobbler's Pegs | HTE | Not Listed | Not Listed | | 0.2 | 5 |
| Phyllanthaceae | *Breynia oblongifolia* | Coffee Bush | N | Not Listed | Not Listed | Shrub (SG) | 0.8 | 20 |
| Cyperaceae | *Carex appressa* | Tall Sedge | N | Not Listed | Not Listed | Grass & grasslike (GG) | 0.2 | 1 |
| Lauraceae | *Cinnamomum camphora* | Camphor Laurel | HTE | Not Listed | Not Listed | | 0.3 | 1 |
| Rutaceae | *Citrus spp.* | | N | Not Listed | Not Listed | Shrub (SG) | 1 | 5 |
| Lamiaceae | *Clerodendrum tomentosum* | Hairy Clerodendrum | N | Not Listed | Not Listed | Tree (TG) | 0.1 | 1 |
| Asteliaceae | *Cordyline stricta* | Narrow-leaved Palm Lily | N | Not Listed | Not Listed | Other (OG) | 1 | 10 |
| Myrtaceae | *Corymbia intermedia* | Pink Bloodwood | N | Not Listed | Not Listed | Tree (TG) | 15 | 2 |
| Sapindaceae | *Cupaniopsis anacardioides* | Tuckeroo | N | Not Listed | Not Listed | Tree (TG) | 0.4 | 3 |
| Fabaceae (Faboideae) | *Desmodium rhytidophyllum* | | N | Not Listed | Not Listed | Forb (FG) | 0.3 | 10 |
| Phormiaceae | *Dianella caerulea var. producta* | | N | Not Listed | Not Listed | Forb (FG) | 0.8 | 20 |
| Convolvulaceae | *Dichondra repens* | Kidney Weed | N | Not Listed | Not Listed | Forb (FG) | 0.2 | 300 |
| Poaceae | *Digitaria parviflora* | Small-flowered Finger Grass | N | Not Listed | Not Listed | Grass & grasslike (GG) | 0.6 | 5 |
| Flacourtiaceae | *Dovyalis caffra* | Kei Apple | E | Not Listed | Not Listed | | 0.1 | 3 |

| Family | Scientific Name | Common Name | N, E, HTE | BC Act Status | EPBC Act Status | BAM Growth Form Group | Cover | Abundance |
|---|---|---|---|---|---|---|---|---|
| Solanaceae | *Duboisia myoporoides* | Corkwood | N | Not Listed | Not Listed | Shrub (SG) | 0.5 | 5 |
| Poaceae | *Echinopogon ovatus* | Forest Hedgehog Grass | N | Not Listed | Not Listed | Grass & grasslike (GG) | 0.2 | 10 |
| Elaeocarpaceae | *Elaeocarpus reticulatus* | Blueberry Ash | N | Not Listed | Not Listed | Shrub (SG) | 0.3 | 3 |
| Poaceae | *Entolasia marginata* | Bordered Panic | N | Not Listed | Not Listed | Grass & grasslike (GG) | 25 | 2000 |
| Myrtaceae | *Eucalyptus microcorys* | Tallowwood | N | Not Listed | Not Listed | Tree (TG) | 1 | 1 |
| Myrtaceae | *Eucalyptus pilularis* | Blackbutt | N | Not Listed | Not Listed | Tree (TG) | 30 | 8 |
| Luzuriagaceae | *Eustrephus latifolius* | Wombat Berry | N | Not Listed | Not Listed | Other (OG) | 0.8 | 20 |
| Moraceae | *Ficus spp.* | | N | Not Listed | Not Listed | Tree (TG) | 0.2 | 1 |
| Luzuriagaceae | *Geitonoplesium cymosum* | Scrambling Lily | N | Not Listed | Not Listed | Other (OG) | 0.2 | 10 |
| Geraniaceae | *Geranium solanderi* | Native Geranium | N | Not Listed | Not Listed | Forb (FG) | 0.2 | 15 |
| Phyllanthaceae | *Glochidion ferdinandi* | Cheese Tree | N | Not Listed | Not Listed | Tree (TG) | 0.3 | 10 |
| Fabaceae (Faboideae) | *Glycine clandestina* | Twining glycine | N | Not Listed | Not Listed | Other (OG) | 0.2 | 10 |
| Fabaceae (Faboideae) | *Glycine tabacina* | Variable Glycine | N | Not Listed | Not Listed | Other (OG) | 0.4 | 30 |
| Fabaceae (Faboideae) | *Hardenbergia violacea* | False Sarsaparilla | N | Not Listed | Not Listed | Other (OG) | 0.8 | 30 |
| Dilleniaceae | *Hibbertia scandens* | Climbing Guinea Flower | N | Not Listed | Not Listed | Other (OG) | 0.2 | 5 |
| Apiaceae | *Hydrocotyle acutiloba* | | N | Not Listed | Not Listed | Forb (FG) | 1 | 200 |
| Apiaceae | *Hydrocotyle sibthorpioides* | | N | Not Listed | Not Listed | Forb (FG) | 10 | 5000 |
| Asteraceae | *Hypochaeris radicata* | Catsear | E | Not Listed | Not Listed | | 0.1 | 5 |
| Poaceae | *Imperata cylindrica* | Blady Grass | N | Not Listed | Not Listed | Grass & grasslike (GG) | 80 | 5000 |
| Verbenaceae | *Lantana camara* | Lantana | HTE | Not Listed | Not Listed | | 0.8 | 20 |
| Ericaceae | *Leucopogon juniperinus* | Prickly Beard-heath | N | Not Listed | Not Listed | Shrub (SG) | 0.3 | 1 |
| Campanulaceae | *Lobelia purpurascens* | Whiteroot | N | Not Listed | Not Listed | Forb (FG) | 0.1 | 30 |
| Lomandraceae | *Lomandra filiformis* | Wattle Matt-rush | N | Not Listed | Not Listed | Grass & grasslike (GG) | 0.2 | 3 |
| Lomandraceae | *Lomandra longifolia* | Spiny-headed Mat-rush | N | Not Listed | Not Listed | Grass & grasslike (GG) | 5 | 50 |
| Myrtaceae | *Lophostemon confertus* | Brush Box | N | Not Listed | Not Listed | Tree (TG) | 2 | 2 |

| Family | Scientific Name | Common Name | N, E, HTE | BC Act Status | EPBC Act Status | BAM Growth Form Group | Cover | Abundance |
|---|---|---|---|---|---|---|---|---|
| Oleaceae | *Notelaea longifolia* | Large Mock-olive | N | Not Listed | Not Listed | Tree (TG) | 0.3 | 3 |
| Poaceae | *Oplismenus aemulus* | | N | Not Listed | Not Listed | Grass & grasslike (GG) | 0.2 | 30 |
| Oxalidaceae | *Oxalis spp.* | | N | Not Listed | Not Listed | Forb (FG) | 0.2 | 30 |
| Bignoniaceae | *Pandorea pandorana* | Wonga Wonga Vine | N | Not Listed | Not Listed | Other (OG) | 0.1 | 1 |
| Poaceae | *Paspalum mandiocanum* | Broadleaf Paspalum | HTE | Not Listed | Not Listed | | 3 | 50 |
| Poaceae | *Poa sieberiana* | Snowgrass | N | Not Listed | Not Listed | Grass & grasslike (GG) | 0.3 | 4 |
| Polygalaceae | *Polygala myrtifolia* | | HTE | Not Listed | Not Listed | | 0.4 | 10 |
| Araliaceae | *Polyscias sambucifolia* | Elderberry Panax | N | Not Listed | Not Listed | Shrub (SG) | 0.5 | 20 |
| Acanthaceae | *Pseuderanthemum variabile* | Pastel Flower | N | Not Listed | Not Listed | Forb (FG) | 0.2 | 10 |
| Dennstaedtiaceae | *Pteridium esculentum* | Bracken | N | Not Listed | Not Listed | Fern (EG) | 0.3 | 10 |
| Rosaceae | *Rubus parvifolius* | Native Raspberry | N | Not Listed | Not Listed | Shrub (SG) | 2 | 50 |
| Menispermaceae | *Sarcopetalum harveyanum* | Pearl Vine | N | Not Listed | Not Listed | Other (OG) | 0.3 | 3 |
| Malvaceae | *Sida rhombifolia* | Paddy's Lucerne | E | Not Listed | Not Listed | | 0.1 | 3 |
| Asteraceae | *Sigesbeckia orientalis* | Indian Weed | N | Not Listed | Not Listed | Forb (FG) | 0.2 | 1 |
| Smilacaceae | *Smilax glyciphylla* | Sweet Sarsparilla | N | Not Listed | Not Listed | Other (OG) | 0.3 | 10 |
| Violaceae | *Viola banksii* | | N | Not Listed | Not Listed | Forb (FG) | 5 | 1000 |
| Violaceae | *Viola betonicifolia* | Native Violet | N | Not Listed | Not Listed | Forb (FG) | 0.1 | 5 |
| BAM 18 | | | | | | | | |
| Asteraceae | *Ageratum houstonianum* | | E | Not Listed | Not Listed | | 1 | 30 |
| Amaranthaceae | *Alternanthera denticulata* | Lesser Joyweed | N | Not Listed | Not Listed | Forb (FG) | 0.2 | 10 |
| Apocynaceae | *Araujia sericifera* | Moth Vine | HTE | Not Listed | Not Listed | | 0.2 | 5 |
| Arecaceae | *Archontophoenix cunninghamiana* | Bangalow Palm | N | Not Listed | Not Listed | Other (OG) | 2 | 10 |
| Cyperaceae | *Baumea juncea* | | N | Not Listed | Not Listed | Grass & grasslike (GG) | 0.3 | 10 |
| Cyperaceae | *Baumea rubiginosa* | | N | Not Listed | Not Listed | Grass & grasslike (GG) | 1 | 20 |

| Family | Scientific Name | Common Name | N, E, HTE | BC Act Status | EPBC Act Status | BAM Growth Form Group | Cover | Abundance |
|---|---|---|---|---|---|---|---|---|
| Asteraceae | *Bidens pilosa* | Cobbler's Pegs | HTE | Not Listed | Not Listed | | 0.2 | 20 |
| Sapindaceae | *Cardiospermum grandiflorum* | Balloon Vine | HTE | Not Listed | Not Listed | | 0.5 | 30 |
| Apiaceae | *Centella asiatica* | Indian Pennywort | N | Not Listed | Not Listed | Forb (FG) | 0.1 | 10 |
| Commelinaceae | *Commelina cyanea* | Native Wandering Jew | N | Not Listed | Not Listed | Forb (FG) | 0.3 | 50 |
| Sapindaceae | *Cupaniopsis anacardioides* | Tuckeroo | N | Not Listed | Not Listed | Tree (TG) | 0.4 | 3 |
| Elaeocarpaceae | *Elaeocarpus reticulatus* | Blueberry Ash | N | Not Listed | Not Listed | Shrub (SG) | 0.3 | 1 |
| Poaceae | *Entolasia marginata* | Bordered Panic | N | Not Listed | Not Listed | Grass & grasslike (GG) | 1 | 100 |
| Fabaceae (Faboideae) | *Erythrina x sykesii* | Coral tree | HTE | Not Listed | Not Listed | | 5 | 10 |
| Myrtaceae | *Eucalyptus robusta* | Swamp Mahogany | N | Not Listed | Not Listed | Tree (TG) | 1 | 1 |
| Moraceae | *Ficus coronata* | Creek Sandpaper Fig | N | Not Listed | Not Listed | Shrub (SG) | 2 | 1 |
| Cyperaceae | *Gahnia clarkei* | Tall Saw-sedge | N | Not Listed | Not Listed | Grass & grasslike (GG) | 15 | 100 |
| Phyllanthaceae | *Glochidion ferdinandii* | Cheese Tree | N | Not Listed | Not Listed | Tree (TG) | 0.3 | 5 |
| Apiaceae | *Hydrocotyle sibthorpioides* | | N | Not Listed | Not Listed | Forb (FG) | 0.2 | 100 |
| Dennstaedtiaceae | *Hypolepis muelleri* | Harsh Ground Fern | N | Not Listed | Not Listed | Fern (EG) | 3 | 100 |
| Convolvulaceae | *Ipomoea cairica* | | HTE | Not Listed | Not Listed | | 1 | 100 |
| Convolvulaceae | *Ipomoea indica* | Morning Glory | HTE | Not Listed | Not Listed | | 4 | 100 |
| Verbenaceae | *Lantana camara* | Lantana | HTE | Not Listed | Not Listed | | 5 | 30 |
| Myrtaceae | *Melaleuca linariifolia* | Flax-leaved Paperbark | N | Not Listed | Not Listed | Shrub (SG) | 2 | 3 |
| Myrtaceae | *Melaleuca quinquenervia* | Broad-leaved Paperbark | N | Not Listed | Not Listed | Tree (TG) | 40 | 60 |
| Poaceae | *Oplismenus aemulus* | | N | Not Listed | Not Listed | Grass & grasslike (GG) | 0.8 | 100 |
| Apocynaceae | *Parsonsia straminea* | Common Silkpod | N | Not Listed | Not Listed | Other (OG) | 3 | 30 |
| Poaceae | *Paspalum mandiocanum* | Broadleaf Paspalum | HTE | Not Listed | Not Listed | | 0.1 | 5 |
| Polygonaceae | *Persicaria hydropiper* | Water Pepper | N | Not Listed | Not Listed | Forb (FG) | 0.3 | 10 |
| Polygonaceae | *Persicaria strigosa* | | N | Not Listed | Not Listed | Forb (FG) | 0.2 | 5 |
| Ranunculaceae | *Ranunculus inundatus* | River Buttercup | N | Not Listed | Not Listed | Forb (FG) | 0.5 | 30 |

| Family | Scientific Name | Common Name | N, E, HTE | BC Act Status | EPBC Act Status | BAM Growth Form Group | Cover | Abundance |
|---|---|---|---|---|---|---|---|---|
| Fabaceae (Caesalpinioideae) | *Senna pendula* | | E | Not Listed | Not Listed | | 2 | 5 |
| Asteraceae | *Sigesbeckia orientalis* | Indian Weed | N | Not Listed | Not Listed | Forb (FG) | 0.2 | 5 |
| Blechnaceae | *Telmatoblechnum indicum* | Swamp Water Fern | N | Not Listed | Not Listed | Fern (EG) | 0.3 | 20 |
| Commelinaceae | *Tradescantia albiflora* | Wandering Jew | E | Not Listed | Not Listed | | 0.5 | 30 |
| Violaceae | *Viola banksii* | | N | Not Listed | Not Listed | Forb (FG) | 0.5 | 1000 |
| Violaceae | *Viola hederacea* | Ivy-leaved Violet | N | Not Listed | Not Listed | Forb (FG) | 1 | 1000 |
| Asteraceae | *Xanthium occidentale* | Noogoora Burr | HTE | Not Listed | Not Listed | | 0.1 | 1 |
| BAM 19 | | | | | | | | |
| Casuarinaceae | *Allocasuarina littoralis* | Black She-Oak | N | Not Listed | Not Listed | Tree (TG) | 2 | 5 |
| Rhamnaceae | *Alphitonia excelsa* | Red Ash | N | Not Listed | Not Listed | Tree (TG) | 2 | 5 |
| Myrtaceae | *Angophora floribunda* | Rough-barked Apple | N | Not Listed | Not Listed | Tree (TG) | 2 | 4 |
| Asparagaceae | *Asparagus aethiopicus* | Asparagus Fern | HTE | Not Listed | Not Listed | | 15 | 50 |
| Phyllanthaceae | *Breynia oblongifolia* | Coffee Bush | N | Not Listed | Not Listed | Shrub (SG) | 0.5 | 10 |
| Myrtaceae | *Callistemon salignus* | Willow Bottlebrush | N | Not Listed | Not Listed | Shrub (SG) | 5 | 5 |
| Cyperaceae | *Carex appressa* | Tall Sedge | N | Not Listed | Not Listed | Grass & grasslike (GG) | 0.1 | 1 |
| Vitaceae | *Cayratia clematidea* | Native Grape | N | Not Listed | Not Listed | Other (OG) | 0.2 | 2 |
| Apiaceae | *Centella asiatica* | Indian Pennywort | N | Not Listed | Not Listed | Forb (FG) | 0.3 | 100 |
| Poaceae | *Chloris gayana* | Rhodes Grass | HTE | Not Listed | Not Listed | | 0.2 | 2 |
| Lauraceae | *Cinnamomum camphora* | Camphor Laurel | HTE | Not Listed | Not Listed | | 1 | 5 |
| Myrtaceae | *Corymbia intermedia* | Pink Bloodwood | N | Not Listed | Not Listed | Tree (TG) | 8 | 3 |
| Asteraceae | *Crassocephalum crepidioides* | Thickhead | E | Not Listed | Not Listed | | 0.2 | 1 |
| Sapindaceae | *Cupaniopsis anacardioides* | Tuckeroo | N | Not Listed | Not Listed | Tree (TG) | 0.5 | 10 |
| Poaceae | *Digitaria parviflora* | Small-flowered Finger Grass | N | Not Listed | Not Listed | Grass & grasslike (GG) | 0.2 | 1 |
| Poaceae | *Entolasia marginata* | Bordered Panic | N | Not Listed | Not Listed | Grass & grasslike (GG) | 25 | 2000 |

| Family | Scientific Name | Common Name | N, E, HTE | BC Act Status | EPBC Act Status | BAM Growth Form Group | Cover | Abundance |
|---|---|---|---|---|---|---|---|---|
| Orchidaceae | *Epidendrum radicans x secundum hybrid complex* | Crucifix Orchid | E | Not Listed | Not Listed | | 0.2 | 2 |
| Malaceae | *Eriobotrya japonica* | Loquat | E | Not Listed | Not Listed | | 0.8 | 1 |
| Myrtaceae | *Eucalyptus microcorys* | Tallowwood | N | Not Listed | Not Listed | Tree (TG) | 15 | 8 |
| Myrtaceae | *Eucalyptus siderophloia* | Grey Ironbark | N | Not Listed | Not Listed | Tree (TG) | 15 | 3 |
| Myrtaceae | *Eucalyptus tereticornis* | Forest Red Gum | N | Not Listed | Not Listed | Tree (TG) | 10 | 2 |
| Luzuriagaceae | *Eustrephus latifolius* | Wombat Berry | N | Not Listed | Not Listed | Other (OG) | 0.3 | 10 |
| Luzuriagaceae | *Geitonoplesium cymosum* | Scrambling Lily | N | Not Listed | Not Listed | Other (OG) | 0.8 | 50 |
| Phyllanthaceae | *Glochidion ferdinandi* | Cheese Tree | N | Not Listed | Not Listed | Tree (TG) | 3 | 20 |
| Fabaceae (Faboideae) | *Glycine clandestina* | Twining glycine | N | Not Listed | Not Listed | Other (OG) | 0.2 | 20 |
| Dilleniaceae | *Hibbertia scandens* | Climbing Guinea Flower | N | Not Listed | Not Listed | Other (OG) | 0.5 | 3 |
| Poaceae | *Imperata cylindrica* | Blady Grass | N | Not Listed | Not Listed | Grass & grasslike (GG) | 25 | 500 |
| Crassulaceae | *Kalanchoe pinnata* | Resurrection Plant | E | Not Listed | Not Listed | | 0.1 | 1 |
| Verbenaceae | *Lantana camara* | Lantana | HTE | Not Listed | Not Listed | | 0.5 | 15 |
| Oleaceae | *Ligustrum sinense* | Small-leaved Privet | HTE | Not Listed | Not Listed | | 0.2 | 1 |
| Campanulaceae | *Lobelia purpurascens* | Whiteroot | N | Not Listed | Not Listed | Forb (FG) | 0.3 | 100 |
| Lomandraceae | *Lomandra filiformis* | Wattle Matt-rush | N | Not Listed | Not Listed | Grass & grasslike (GG) | 0.1 | 1 |
| Lomandraceae | *Lomandra longifolia* | Spiny-headed Mat-rush | N | Not Listed | Not Listed | Grass & grasslike (GG) | 0.5 | 3 |
| Myrtaceae | *Melaleuca linariifolia* | Flax-leaved Paperbark | N | Not Listed | Not Listed | Shrub (SG) | 1 | 2 |
| Poaceae | *Microlaena stipoides* | Weeping Grass | N | Not Listed | Not Listed | Grass & grasslike (GG) | 0.3 | 20 |
| Primulaceae | *Myrsine variabilis* | | N | Not Listed | Not Listed | Shrub (SG) | 0.4 | 1 |
| Ochnaceae | *Ochna serrulata* | Mickey Mouse Plant | HTE | Not Listed | Not Listed | | 1 | 20 |
| Poaceae | *Oplismenus aemulus* | | N | Not Listed | Not Listed | Grass & grasslike (GG) | 0.5 | 50 |
| Oxalidaceae | *Oxalis perennans* | | N | Not Listed | Not Listed | Forb (FG) | 0.1 | 5 |
| Apocynaceae | *Parsonsia straminea* | Common Silkpod | N | Not Listed | Not Listed | Other (OG) | 1 | 20 |

| Family | Scientific Name | Common Name | N, E, HTE | BC Act Status | EPBC Act Status | BAM Growth Form Group | Cover | Abundance |
|---|---|---|---|---|---|---|---|---|
| Poaceae | *Paspalum mandiocanum* | Broadleaf Paspalum | HTE | Not Listed | Not Listed | | 20 | 200 |
| Polypodiaceae | *Platycerium bifurcatum* | Elkhorn Fern | N | Not Listed | Not Listed | Fern (EG) | 0.2 | 1 |
| Rosaceae | *Rubus fruticosus sp. agg.* | Blackberry complex | HTE | Not Listed | Not Listed | | 0.2 | 2 |
| Rosaceae | *Rubus parvifolius* | Native Raspberry | N | Not Listed | Not Listed | Shrub (SG) | 0.5 | 20 |
| Fabaceae (Caesalpinioideae) | *Senna septemtrionalis* | Arsenic Bush | E | Not Listed | Not Listed | | 0.5 | 10 |
| Solanaceae | *Solanum mauritianum* | Wild Tobacco Bush | E | Not Listed | Not Listed | | 0.1 | 1 |
| Solanaceae | *Solanum nigrum* | Black-berry Nightshade | E | Not Listed | Not Listed | | 0.1 | 1 |
| Ulmaceae | *Trema tomentosa* | Native Peach | N | Not Listed | Not Listed | Shrub (SG) | 0.1 | 1 |
| Verbenaceae | *Verbena spp.* | | N | Not Listed | Not Listed | Forb (FG) | 0.1 | 5 |
| Iridaceae | *Watsonia spp.* | | E | Not Listed | Not Listed | | 0.2 | 10 |
| BAM 20 | | | | | | | | |
| Poaceae | *Axonopus fissifolius* | Narrow-leafed Carpet Grass | HTE | Not Listed | Not Listed | | 80 | 2000 |
| Euphorbiaceae | *Chamaesyce maculata* | | E | Not Listed | Not Listed | | 10 | 200 |
| Poaceae | *Cynodon dactylon* | Common Couch | N | Not Listed | Not Listed | Grass & grasslike (GG) | 10 | 500 |
| Myrtaceae | *Eucalyptus tereticornis* | Forest Red Gum | N | Not Listed | Not Listed | Tree (TG) | 15 | 1 |
| Asteraceae | *Gamochaeta purpurea* | Purple Cudweed | E | Not Listed | Not Listed | | 0.1 | 1 |
| Fabaceae (Faboideae) | *Glycine tabacina* | Variable Glycine | N | Not Listed | Not Listed | Other (OG) | 0.2 | 10 |
| Asteraceae | *Hypochaeris radicata* | Catsear | E | Not Listed | Not Listed | | 0.3 | 10 |
| Poaceae | *Paspalum distichum* | Water Couch | N | Not Listed | Not Listed | Grass & grasslike (GG) | 0.3 | 30 |
| Plantaginaceae | *Plantago lanceolata* | Lamb's Tongues | E | Not Listed | Not Listed | | 0.2 | 2 |
| Rubiaceae | *Richardia humistrata* | | E | Not Listed | Not Listed | | 1 | 50 |
| Asteraceae | *Taraxacum officinale* | Dandelion | E | Not Listed | Not Listed | | 0.1 | 5 |
| Verbenaceae | *Verbena rigida* | Veined Verbena | E | Not Listed | Not Listed | | 0.1 | 1 |
| BAM 21 | | | | | | | | |

| Family | Scientific Name | Common Name | N, E, HTE | BC Act Status | EPBC Act Status | BAM Growth Form Group | Cover | Abundance |
|---|---|---|---|---|---|---|---|---|
| Fabaceae (Mimosoideae) | *Acacia longifolia* | | N | Not Listed | Not Listed | Shrub (SG) | 3 | 7 |
| Rhamnaceae | *Alphitonia excelsa* | Red Ash | N | Not Listed | Not Listed | Tree (TG) | 0.3 | 2 |
| Poaceae | *Andropogon virginicus* | Whisky Grass | HTE | Not Listed | Not Listed | | 0.4 | 20 |
| Poaceae | *Axonopus fissifolius* | Narrow-leafed Carpet Grass | HTE | Not Listed | Not Listed | | 0.3 | 10 |
| Lauraceae | *Cinnamomum camphora* | Camphor Laurel | HTE | Not Listed | Not Listed | | 0.4 | 2 |
| Commelinaceae | *Commelina cyanea* | Native Wandering Jew | N | Not Listed | Not Listed | Forb (FG) | 0.2 | 10 |
| Asteraceae | *Cyanthillium cinereum* | | N | Not Listed | Not Listed | Forb (FG) | 0.2 | 30 |
| Poaceae | *Cynodon dactylon* | Common Couch | N | Not Listed | Not Listed | Grass & grasslike (GG) | 0.2 | 100 |
| Cyperaceae | *Cyperus polystachyos* | | N | Not Listed | Not Listed | Grass & grasslike (GG) | 0.1 | 1 |
| Phormiaceae | *Dianella caerulea var. producta* | | N | Not Listed | Not Listed | Forb (FG) | 2 | 100 |
| Solanaceae | *Duboisia myoporoides* | Corkwood | N | Not Listed | Not Listed | Shrub (SG) | 0.8 | 4 |
| Poaceae | *Entolasia marginata* | Bordered Panic | N | Not Listed | Not Listed | Grass & grasslike (GG) | 2 | 200 |
| Myrtaceae | *Eucalyptus pilularis* | Blackbutt | N | Not Listed | Not Listed | Tree (TG) | 20 | 30 |
| Luzuriagaceae | *Geitonoplesium cymosum* | Scrambling Lily | N | Not Listed | Not Listed | Other (OG) | 0.2 | 2 |
| Phyllanthaceae | *Glochidion ferdinandi* | Cheese Tree | N | Not Listed | Not Listed | Tree (TG) | 0.3 | 5 |
| Fabaceae (Faboideae) | *Glycine clandestina* | Twining glycine | N | Not Listed | Not Listed | Other (OG) | 0.3 | 10 |
| Dilleniaceae | *Hibbertia scandens* | Climbing Guinea Flower | N | Not Listed | Not Listed | Other (OG) | 0.4 | 2 |
| Asteraceae | *Hypochaeris radicata* | Catsear | E | Not Listed | Not Listed | | 0.2 | 10 |
| Poaceae | *Imperata cylindrica* | Blady Grass | N | Not Listed | Not Listed | Grass & grasslike (GG) | 50 | 2000 |
| Poaceae | *Ischaemum australe* | | N | Not Listed | Not Listed | Grass & grasslike (GG) | 0.2 | 5 |
| Verbenaceae | *Lantana camara* | Lantana | HTE | Not Listed | Not Listed | | 0.5 | 2 |
| Myrtaceae | *Leptospermum juniperinum* | Prickly Tea-tree | N | Not Listed | Not Listed | Shrub (SG) | 0.2 | 2 |
| Campanulaceae | *Lobelia purpurascens* | Whiteroot | N | Not Listed | Not Listed | Forb (FG) | 0.2 | 10 |
| Lomandraceae | *Lomandra longifolia* | Spiny-headed Mat-rush | N | Not Listed | Not Listed | Grass & grasslike (GG) | 0.8 | 2 |
| Apocynaceae | *Marsdenia rostrata* | Milk Vine | N | Not Listed | Not Listed | Other (OG) | 0.5 | 3 |

| Family | Scientific Name | Common Name | N, E, HTE | BC Act Status | EPBC Act Status | BAM Growth Form Group | Cover | Abundance |
|---|---|---|---|---|---|---|---|---|
| Poaceae | *Paspalum mandiocanum* | Broadleaf Paspalum | HTE | Not Listed | Not Listed | | 0.3 | 5 |
| Poaceae | *Paspalum orbiculare* | Ditch Millet | N | Not Listed | Not Listed | Grass & grasslike (GG) | 0.2 | 1 |
| Poaceae | *Paspalum urvillei* | Vasey Grass | HTE | Not Listed | Not Listed | | 0.3 | 5 |
| Proteaceae | *Persoonia stradbrokensis* | | N | Not Listed | Not Listed | Shrub (SG) | 2 | 2 |
| Phytolaccaceae | *Phytolacca octandra* | Inkweed | E | Not Listed | Not Listed | | 0.2 | 1 |
| Araliaceae | *Polyscias sambucifolia* | Elderberry Panax | N | Not Listed | Not Listed | Shrub (SG) | 0.4 | 10 |
| Rubiaceae | *Pomax umbellata* | Pomax | N | Not Listed | Not Listed | Forb (FG) | 2 | 200 |
| Dennstaedtiaceae | *Pteridium esculentum* | Bracken | N | Not Listed | Not Listed | Fern (EG) | 15 | 200 |
| Poaceae | *Setaria sphacelata* | South African Pigeon Grass | E | Not Listed | Not Listed | | 0.2 | 10 |
| Smilacaceae | *Smilax glyciphylla* | Sweet Sarsparilla | N | Not Listed | Not Listed | Other (OG) | 0.5 | 5 |
| BAM 22 | | | | | | | | |
| Fabaceae (Mimosoideae) | *Acacia floribunda* | White Sally | N | Not Listed | Not Listed | Shrub (SG) | 0.3 | 1 |
| Asteraceae | *Cirsium vulgare* | Spear Thistle | E | Not Listed | Not Listed | | 0.1 | 2 |
| Commelinaceae | *Commelina cyanea* | Native Wandering Jew | N | Not Listed | Not Listed | Forb (FG) | 0.1 | 2 |
| Poaceae | *Cymbopogon refractus* | Barbed Wire Grass | N | Not Listed | Not Listed | Grass & grasslike (GG) | 0.3 | 10 |
| Fabaceae (Faboideae) | *Desmodium rhytidophyllum* | | N | Not Listed | Not Listed | Forb (FG) | 15 | 300 |
| Poaceae | *Digitaria parviflora* | Small-flowered Finger Grass | N | Not Listed | Not Listed | Grass & grasslike (GG) | 0.5 | 4 |
| Myrtaceae | *Eucalyptus microcorys* | Tallowwood | N | Not Listed | Not Listed | Tree (TG) | 20 | 4 |
| Myrtaceae | *Eucalyptus pilularis* | Blackbutt | N | Not Listed | Not Listed | Tree (TG) | 35 | 10 |
| Fabaceae (Faboideae) | *Hardenbergia violacea* | False Sarsaparilla | N | Not Listed | Not Listed | Other (OG) | 0.4 | 40 |
| Dilleniaceae | *Hibbertia scandens* | Climbing Guinea Flower | N | Not Listed | Not Listed | Other (OG) | 0.5 | 20 |
| Poaceae | *Imperata cylindrica* | Blady Grass | N | Not Listed | Not Listed | Grass & grasslike (GG) | 20 | 500 |
| Ericaceae | *Leucopogon juniperinus* | Prickly Beard-heath | N | Not Listed | Not Listed | Shrub (SG) | 0.2 | 3 |
| Campanulaceae | *Lobelia purpurascens* | whiteroot | N | Not Listed | Not Listed | Forb (FG) | 10 | 300 |
| Oxalidaceae | *Oxalis perennans* | | N | Not Listed | Not Listed | Forb (FG) | 0.2 | 5 |

| Family | Scientific Name | Common Name | N, E, HTE | BC Act Status | EPBC Act Status | BAM Growth Form Group | Cover | Abundance |
|---|---|---|---|---|---|---|---|---|
| Poaceae | *Paspalum mandiocanum* | Broadleaf Paspalum | HTE | Not Listed | Not Listed | | 20 | 100 |
| Proteaceae | *Persoonia stradbrokensis* | | N | Not Listed | Not Listed | Shrub (SG) | 0.7 | 1 |
| Dennstaedtiaceae | *Pteridium esculentum* | Bracken | N | Not Listed | Not Listed | Fern (EG) | 1.5 | 50 |
| Rosaceae | *Rubus fruticosus sp. agg.* | Blackberry complex | HTE | Not Listed | Not Listed | | 0.3 | 2 |
| Rosaceae | *Rubus parvifolius* | Native Raspberry | N | Not Listed | Not Listed | Shrub (SG) | 0.1 | 3 |
| Asteraceae | *Senecio madagascariensis* | Fireweed | HTE | Not Listed | Not Listed | | 0.3 | 40 |
| Poaceae | *Sporobolus africanus* | Parramatta Grass | E | Not Listed | Not Listed | | 0.3 | 10 |
| Poaceae | *Aristida vagans* | Threeawn Speargrass | N | Not Listed | Not Listed | Grass & grasslike (GG) | 0.3 | 5 |
| Sapindaceae | *Dodonaea triquetra* | Large-leaf Hop-bush | N | Not Listed | Not Listed | Shrub (SG) | 0.5 | 10 |
| Poaceae | *Entolasia stricta* | Wiry Panic | N | Not Listed | Not Listed | Grass & grasslike (GG) | 0.5 | 5 |
| Apocynaceae | *Gomphocarpus physocarpus* | Balloon Cotton Bush | E | Not Listed | Not Listed | | 0.5 | 5 |
| Asteraceae | *Ozothamnus diosmifolius* | White Dogwood | N | Not Listed | Not Listed | Shrub (SG) | 0.2 | 5 |
| Pittosporaceae | *Pittosporum revolutum* | Rough Fruit Pittosporum | N | Not Listed | Not Listed | Shrub (SG) | 0.4 | 7 |
| Rhamnaceae | *Pomaderris spp.* | | N | Not Listed | Not Listed | Shrub (SG) | 0.1 | 1 |
| Poaceae | *Setaria parviflora* | | E | Not Listed | Not Listed | | 5 | 100 |
| Asteraceae | *Sonchus asper* | Prickly Sowthistle | E | Not Listed | Not Listed | | 1 | 50 |

# APPENDIX 2 – VEGETATION SURVEY DATA

| plot | pct | area (ha) | patchsize | conditionclass | zone | easting | northing | bearing | compTree | compShrub | compGrass | compForbs | compFerns | compOther | strucTree | strucShrub | strucGrass | strucForbs | strucFerns | strucOther | funLargeTrees | funHollowtrees | funLitterCover | funLenFallenLogs | funTreeStem5to9 | funTreeStem10to19 | funTreeStem20to29 | funTreeStem30to49 | funTreeStem50to79 | funTreeRegen | funHighThreatExotic |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BAM 1 | 3544 | 1.61 | 101 | Low | 56 | 485622 | 6522891 | 104 | 0 | 2 | 1 | 6 | 2 | 0 | 0 | 0.6 | 160 | 2 | 60.2 | 0 | 0 | 0 | 27 | 43 | 0 | 0 | 0 | 0 | 0 | 0 | 14.6 |
| BAM 2 | 3544 | 17.57 | 101 | Exotic | 56 | 485295 | 6522954 | 269 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 3.5 | 0 | 0 | 0 | 0 | 0 | 3.8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 81 |
| BAM 3 | 3544 | 17.57 | 101 | Exotic | 56 | 485507 | 6523103 | 105 | 0 | 2 | 4 | 2 | 0 | 0 | 0 | 0.6 | 5.2 | 0.6 | 0 | 0 | 0 | 0 | 5.2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 206 |
| BAM 4 | 4004 | 0 | 101 | Good | 56 | 485845 | 6523177 | 54 | 4 | 0 | 8 | 7 | 1 | 1 | 31.3 | 0 | 67.7 | 3.4 | 2 | 0.1 | 6 | 0 | 89 | 25 | 0 | 0 | 0 | 1 | 1 | 0 | 2.3 |
| BAM 5 | 3967 | 1.67 | 101 | Good | 56 | 485965 | 6523155 | 77 | 0 | 0 | 8 | 2 | 0 | 0 | 0 | 0 | 115 | 1.8 | 0 | 0 | 0 | 0 | 75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| BAM 6 | 3967 | 1.67 | 101 | Good | 56 | 485865 | 6522860 | 7 | 0 | 0 | 7 | 1 | 0 | 0 | 0 | 0 | 117.5 | 0.5 | 0 | 0 | 0 | 0 | 78 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| BAM 7 | 3544 | 0.21 | 101 | Moderate | 56 | 485467 | 6523186 | 311 | 5 | 4 | 7 | 6 | 3 | 3 | 55.8 | 3.1 | 90.6 | 3.2 | 8.5 | 0.9 | 6 | 1 | 62 | 27 | 1 | 1 | 0 | 0 | 0 | 1 | 6.9 |
| BAM 8 | 4048 | 0 | 101 | Good | 56 | 485688 | 6523387 | 308 | 1 | 0 | 11 | 6 | 0 | 1 | 10 | 0 | 99.3 | 5.7 | 0 | 0.1 | 0 | 0 | 77 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 0.9 |
| BAM 9 | 4048 | 0 | 101 | Good | 56 | 485359 | 6523197 | 17 | 3 | 0 | 11 | 6 | 1 | 2 | 20.4 | 0 | 80.5 | 3 | 3 | 0.2 | 0 | 0 | 79 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 0.2 |
| BAM 10 | 3967 | 1.67 | 101 | Good | 56 | 485329 | 6523085 | 207 | 0 | 0 | 6 | 2 | 0 | 0 | 0 | 0 | 106.4 | 10 | 0 | 0 | 0 | 0 | 81 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| BAM 11 | 3967 | 1.67 | 101 | Good | 56 | 485347 | 6523480 | 55 | 1 | 0 | 3 | 1 | 0 | 0 | 0.3 | 0 | 96 | 20 | 0 | 0 | 0 | 0 | 89 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| BAM 12 | 3167 | 0.6 | 101 | Moderate | 56 | 488580 | 6520906 | 359 | 7 | 10 | 5 | 3 | 3 | 7 | 57.8 | 14.7 | 3.7 | 0.7 | 0.8 | 6.7 | 22 | 0 | 84 | 6 | 1 | 1 | 1 | 1 | 1 | 1 | 20.4 |
| BAM 13 | 3167 | 0.18 | 101 | Low | 56 | 488939 | 6521693 | 111 | 7 | 10 | 5 | 3 | 3 | 7 | 21 | 43.7 | 18.3 | 2.4 | 0 | 7.1 | 17 | 0 | 60 | 13 | 0 | 1 | 1 | 1 | 1 | 1 | 51.2 |
| BAM 14 | 3544 | 17.57 | 101 | Exotic | 56 | 488853 | 6521706 | 300 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 32 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 101.2 |
| BAM 15 | 3544 | 1.61 | 101 | Low | 56 | 485424 | 6523037 | 349 | 0 | 1 | 2 | 0 | 1 | 0 | 0 | 0.5 | 70.2 | 0 | 40 | 0 | 0 | 0 | 76 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2.3 |

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BAM 16 | 3160 | 0 | 101 | Low-moderate | 56 | 489005 | 6521595 | 0 | 4 | 1 | 5 | 3 | 0 | 1 | 45 | 5 | 26.3 | 3 | 0 | 0.1 | 5 | 0 | 94.8 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 62.8 |
| BAM 17 | 3250 | 0.61 | 101 | Moderate-Good | 56 | 485173 | 6523100 | 357 | 11 | 9 | 9 | 12 | 1 | 10 | 50.5 | 6 | 111.7 | 18.3 | 0.3 | 4.3 | 4 | 0 | 98.4 | 4 | 1 | 1 | 1 | 1 | 1 | 1 | 4.7 |
| BAM 18 | 4006 | 0.04 | 101 | Moderate | 56 | 488534 | 6521815 | 243 | 4 | 3 | 5 | 10 | 2 | 2 | 41.7 | 4.3 | 18.1 | 3.5 | 3.3 | 5 | 1 | 0 | 96.4 | 30 | 1 | 1 | 1 | 1 | 1 | 1 | 16.1 |
| BAM 19 | 3167 | 0.6 | 101 | Moderate | 56 | 487951 | 6519667 | 108 | 9 | 6 | 8 | 4 | 1 | 6 | 57.5 | 7.5 | 51.7 | 0.8 | 0.2 | 3 | 4 | 2 | 97.2 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 38.1 |
| BAM 20 | 3544 | 17.57 | 101 | Exotic | 56 | 488034 | 6519765 | 200 | 1 | 0 | 2 | 0 | 0 | 1 | 15 | 0 | 10.3 | 0 | 0 | 0.2 | 3 | 1 | 44 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 80 |
| BAM 21 | 3544 | 0.21 | 101 | Moderate | 56 | 485398 | 6522865 | 355 | 3 | 5 | 7 | 5 | 1 | 5 | 20.6 | 6.4 | 53.5 | 4.6 | 15 | 1.9 | 2 | 0 | 95.4 | 60 | 1 | 1 | 0 | 0 | 0 | 1 | 2.2 |
| BAM 22 | 3250 | 0.12 | 101 | Low | 56 | 484835 | 6522950 | 264 | 2 | 8 | 5 | 4 | 1 | 2 | 55 | 2.5 | 21.6 | 25.3 | 1.5 | 0.9 | 11 | 0 | 77 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 20.6 |

# APPENDIX 3 – BIODIVERSITY CREDIT REPORT

# BAM Credit Summary Report

## Proposal Details

Assessment Id
00047273/BAAS17094/24/00047274

Proposal Name
State Significant_WF_RS_240607

BAM data last updated *
14/03/2024

Assessor Name

Report Created
24/07/2024

BAM Data version *
67

Assessor Number
BAAS24011

BAM Case Status
Finalised

Date Finalised
24/07/2024

Assessment Revision
6

Assessment Type
Major Projects

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

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

| Zone | Vegetation zone name | TEC name | Current Vegetation integrity score | Change in Vegetation integrity (loss / gain) | Area (ha) | Sensitivity to loss (Justification) | Species sensitivity to gain class | BC Act Listing status | EPBC Act listing status | Biodiversity risk weighting | Potential SAII | Ecosystem credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Coastal Sands Apple-Blackbutt Forest** | | | | | | | | | | | | |
| 5 | 3544_Exotic | Not a TEC | 4.1 | 4.1 | 17.6 | PCT Cleared - 22% | High Sensitivity to Gain | | | 1.50 | | 0 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6 | 3544_Low | Not a TEC | 13.4 | 13.4 | 1.6 | PCT Cleared - 22% | High Sensitivity to Gain | | | 1.50 | | 0 |
| 7 | 3544_Moderate | Not a TEC | 56.1 | 56.1 | 0.21 | PCT Cleared - 22% | High Sensitivity to Gain | | | 1.50 | | 4 |
| | | | | | | | | | | | **Subtotal** | **4** |
| **Northern Foothills Blackbutt Grassy Forest** | | | | | | | | | | | | |
| 3 | 3250_Low | Not a TEC | 50.4 | 50.4 | 0.12 | PCT Cleared - 30% | High Sensitivity to Gain | | | 1.50 | | 2 |
| 4 | 3250_Moderate-Good | Not a TEC | 83.3 | 83.3 | 0.61 | PCT Cleared - 30% | High Sensitivity to Gain | | | 1.50 | | 19 |
| | | | | | | | | | | | **Subtotal** | **21** |
| **Northern Hinterland Blackbutt-Forest Oak Wet Forest** | | | | | | | | | | | | |
| 1 | 3167_Low | Not a TEC | 57.6 | 57.6 | 0.18 | PCT Cleared - 7% | High Sensitivity to Gain | | | 1.50 | | 4 |
| 2 | 3167_Moderate | Not a TEC | 75.5 | 75.5 | 0.6 | PCT Cleared - 7% | High Sensitivity to Gain | | | 1.50 | | 17 |
| | | | | | | | | | | | **Subtotal** | **21** |

| Northern Lower Floodplain Eleocharis Wetland | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8 | 3967_Good | Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions | 70 | 70.0 | 1.7 | Biodiversity Conservation Act listing status | High Sensitivity to Gain | Endangered Ecological Community | Not Listed | 2.00 | | 58 |
| | | | | | | | | | | | **Subtotal** | **58** |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Northern Paperbark-Swamp Mahogany Saw-sedge Forest** | | | | | | | | | | | | |
| 9 | 4006_Moderate | Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions | 60.6 | 60.6 | 0.04 | Biodiversity Conservation Act listing status | High Sensitivity to Gain | Endangered Ecological Community | Not Listed | 2.00 | | 1 |
| | | | | | | | | | | | **Subtotal** | **1** |
| | | | | | | | | | | | **Total** | **105** |

## Species credits for threatened species

| Vegetation zone name | Habitat condition (Vegetation Integrity) | Change in habitat condition | Area (ha)/Count (no. individuals) | Sensitivity to loss (Justification) | Sensitivity to gain (Justification) | BC Act Listing status | EPBC Act listing status | Potential SAII | Species credits |
|---|---|---|---|---|---|---|---|---|---|
| ***Caesia parviflora var. minor / Small Pale Grass-lily ( Flora )*** | | | | | | | | | |
| 3250_Low | 50.4 | 50.4 | 0.12 | Biodiversity Conservation Act listing status | Ability to colonise improved habitat | Endangered | Not Listed | False | 3 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 3250_Moderate-Good | 83.3 | 83.3 | 0.61 | Biodiversity Conservation Act listing status | Ability to colonise improved habitat | Endangered | Not Listed | False | 25 |
| | | | | | | | | **Subtotal** | **28** |
| ***Crinia tinnula / Wallum Froglet ( Fauna )*** | | | | | | | | | |
| 3250_Moderate-Good | 83.3 | 83.3 | 0.07 | Biodiversity Conservation Act listing status | Effectiveness of management in controlling threats | Vulnerable | Not Listed | False | 2 |
| 3544_Exotic | 4.1 | 4.1 | 2.1 | Biodiversity Conservation Act listing status | Effectiveness of management in controlling threats | Vulnerable | Not Listed | False | 3 |
| 3544_Low | 13.4 | 13.4 | 0.38 | Biodiversity Conservation Act listing status | Effectiveness of management in controlling threats | Vulnerable | Not Listed | False | 2 |
| 3967_Good | 70.0 | 70.0 | 1.7 | Biodiversity Conservation Act listing status | Effectiveness of management in controlling threats | Vulnerable | Not Listed | False | 44 |
| | | | | | | | | **Subtotal** | **51** |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ***Cryptostylis hunteriana / Leafless Tongue Orchid ( Flora )*** | | | | | | | | | |
| 3250_Low | 50.4 | 50.4 | 0.12 | Biodiversity Conservation Act listing status | Ability to colonise improved habitat | Vulnerable | Vulnerable | False | 2 |
| 3250_Moderate-Good | 83.3 | 83.3 | 0.6 | Biodiversity Conservation Act listing status | Ability to colonise improved habitat | Vulnerable | Vulnerable | False | 19 |
| 3544_Exotic | 4.1 | 4.1 | 1.4 | Biodiversity Conservation Act listing status | Ability to colonise improved habitat | Vulnerable | Vulnerable | False | 2 |
| 3544_Low | 13.4 | 13.4 | 0.2 | Biodiversity Conservation Act listing status | Ability to colonise improved habitat | Vulnerable | Vulnerable | False | 1 |
| | | | | | | | | **Subtotal** | **24** |
| ***Dendrobium melaleucaphilum / Spider orchid ( Flora )*** | | | | | | | | | |
| 3250_Low | 50.4 | 50.4 | 0.12 | Biodiversity Conservation Act listing status | Seedbank Persistence | Endangered | Not Listed | False | 3 |
| 3250_Moderate-Good | 83.3 | 83.3 | 0.61 | Biodiversity Conservation Act listing status | Seedbank Persistence | Endangered | Not Listed | False | 25 |
| | | | | | | | | **Subtotal** | **28** |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ***Lathamus discolor / Swift Parrot ( Fauna )*** | | | | | | | | | |
| 3167_Low | 57.6 | 57.6 | 0.03 | Environment Protection and Conservation Act listing status | Effectiveness of management in controlling threats | Endangered | Critically Endangered | True | 1 |
| 3167_Moderate | 75.5 | 75.5 | 0.31 | Environment Protection and Conservation Act listing status | Effectiveness of management in controlling threats | Endangered | Critically Endangered | True | 18 |
| 3544_Exotic | 4.1 | 4.1 | 0.71 | Environment Protection and Conservation Act listing status | Effectiveness of management in controlling threats | Endangered | Critically Endangered | True | 2 |
| 4006_Moderate | 60.6 | 60.6 | 0.02 | Environment Protection and Conservation Act listing status | Effectiveness of management in controlling threats | Endangered | Critically Endangered | True | 1 |
| | | | | | | | | **Subtotal** | **22** |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ***Litoria brevipalmata / Green-thighed Frog ( Fauna )*** | | | | | | | | | |
| 3250_Moderate-Good | 83.3 | 83.3 | 0.51 | Biodiversity Conservation Act listing status | Effectiveness of management in controlling threats | Vulnerable | Not Listed | False | 16 |
| 3544_Moderate | 56.1 | 56.1 | 0.21 | Biodiversity Conservation Act listing status | Effectiveness of management in controlling threats | Vulnerable | Not Listed | False | 4 |
| 4006_Moderate | 60.6 | 60.6 | 0.04 | Biodiversity Conservation Act listing status | Effectiveness of management in controlling threats | Vulnerable | Not Listed | False | 1 |
| | | | | | | | | **Subtotal** | **21** |
| ***Marsdenia longiloba / Slender Marsdenia ( Flora )*** | | | | | | | | | |
| 3167_Low | 57.6 | 57.6 | 0.12 | Biodiversity Conservation Act listing status | Effectiveness of management in controlling threats | Endangered | Vulnerable | False | 3 |
| 3167_Moderate | 75.5 | 75.5 | 0.27 | Biodiversity Conservation Act listing status | Effectiveness of management in controlling threats | Endangered | Vulnerable | False | 10 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 3250_Low | 50.4 | 50.4 | 0.12 | Biodiversity Conservation Act listing status | Effectiveness of management in controlling threats | Endangered | Vulnerable | False | 3 |
| 3250_Moderate-Good | 83.3 | 83.3 | 0.6 | Biodiversity Conservation Act listing status | Effectiveness of management in controlling threats | Endangered | Vulnerable | False | 25 |
| | | | | | | | | **Subtotal** | **41** |
| ***Myotis macropus / Southern Myotis ( Fauna )*** | | | | | | | | | |
| 3250_Low | 50.4 | 50.4 | 0.1 | Biodiversity Conservation Act listing status | Species dependent on habitat attributes | Vulnerable | Not Listed | False | 3 |
| 3250_Moderate-Good | 83.3 | 83.3 | 0.61 | Biodiversity Conservation Act listing status | Species dependent on habitat attributes | Vulnerable | Not Listed | False | 25 |
| 3544_Exotic | 4.1 | 4.1 | 7.7 | Biodiversity Conservation Act listing status | Species dependent on habitat attributes | Vulnerable | Not Listed | False | 16 |
| 3544_Low | 13.4 | 13.4 | 1.1 | Biodiversity Conservation Act listing status | Species dependent on habitat attributes | Vulnerable | Not Listed | False | 7 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 3544_Moderate | 56.1 | 56.1 | 0.11 | Biodiversity Conservation Act listing status | Species dependent on habitat attributes | Vulnerable | Not Listed | False | 3 |
| 3967_Good | 70.0 | 70.0 | 1.7 | Biodiversity Conservation Act listing status | Species dependent on habitat attributes | Vulnerable | Not Listed | False | 58 |
| | | | | | | | | **Subtotal** | **112** |
| ***Petalura gigantea / Giant Dragonfly ( Fauna )*** | | | | | | | | | |
| 3250_Low | 50.4 | 50.4 | 0.12 | Biodiversity Conservation Act listing status | Species dependent on habitat attributes | Endangered | Not Listed | True | 5 |
| 3250_Moderate-Good | 83.3 | 83.3 | 0.61 | Biodiversity Conservation Act listing status | Species dependent on habitat attributes | Endangered | Not Listed | True | 38 |
| 3544_Exotic | 4.1 | 4.1 | 10.1 | Biodiversity Conservation Act listing status | Species dependent on habitat attributes | Endangered | Not Listed | True | 31 |
| 3544_Low | 13.4 | 13.4 | 1.6 | Biodiversity Conservation Act listing status | Species dependent on habitat attributes | Endangered | Not Listed | True | 16 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 3544_Moderate | 56.1 | 56.1 | 0.21 | Biodiversity Conservation Act listing status | Species dependent on habitat attributes | Endangered | Not Listed | True | 9 |
| 3967_Good | 70.0 | 70.0 | 1.7 | Biodiversity Conservation Act listing status | Species dependent on habitat attributes | Endangered | Not Listed | True | 88 |
| | | | | | | | | **Subtotal** | **187** |
| ***Petaurus norfolcensis / Squirrel Glider ( Fauna )*** | | | | | | | | | |
| 3167_Low | 57.6 | 57.6 | 0.18 | Biodiversity Conservation Act listing status | Species dependent on habitat attributes | Vulnerable | Not Listed | False | 5 |
| 3167_Moderate | 75.5 | 75.5 | 0.6 | Biodiversity Conservation Act listing status | Species dependent on habitat attributes | Vulnerable | Not Listed | False | 23 |
| 3250_Low | 50.4 | 50.4 | 0.12 | Biodiversity Conservation Act listing status | Species dependent on habitat attributes | Vulnerable | Not Listed | False | 3 |
| 3250_Moderate-Good | 83.3 | 83.3 | 0.61 | Biodiversity Conservation Act listing status | Species dependent on habitat attributes | Vulnerable | Not Listed | False | 25 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 3544_Low | 13.4 | 13.4 | 0.11 | Biodiversity Conservation Act listing status | Species dependent on habitat attributes | Vulnerable | Not Listed | False | 1 |
| 3544_Moderate | 56.1 | 56.1 | 0.21 | Biodiversity Conservation Act listing status | Species dependent on habitat attributes | Vulnerable | Not Listed | False | 6 |
| 4006_Moderate | 60.6 | 60.6 | 0.04 | Biodiversity Conservation Act listing status | Species dependent on habitat attributes | Vulnerable | Not Listed | False | 1 |
| | | | | | | | | **Subtotal** | **64** |
| ***Phascolarctos cinereus / Koala ( Fauna )*** | | | | | | | | | |
| 3167_Low | 57.6 | 57.6 | 0.18 | Biodiversity Conservation Act listing status | Effectiveness of management in controlling threats | Endangered | Endangered | False | 5 |
| 3167_Moderate | 75.5 | 75.5 | 0.6 | Biodiversity Conservation Act listing status | Effectiveness of management in controlling threats | Endangered | Endangered | False | 23 |
| 3250_Low | 50.4 | 50.4 | 0.12 | Biodiversity Conservation Act listing status | Effectiveness of management in controlling threats | Endangered | Endangered | False | 3 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 3250_Moderate-Good | 83.3 | 83.3 | 0.61 | Biodiversity Conservation Act listing status | Effectiveness of management in controlling threats | Endangered | Endangered | False | 25 |
| 3544_Low | 13.4 | 13.4 | 0.11 | Biodiversity Conservation Act listing status | Effectiveness of management in controlling threats | Endangered | Endangered | False | 1 |
| 3544_Moderate | 56.1 | 56.1 | 0.21 | Biodiversity Conservation Act listing status | Effectiveness of management in controlling threats | Endangered | Endangered | False | 6 |
| 4006_Moderate | 60.6 | 60.6 | 0.04 | Biodiversity Conservation Act listing status | Effectiveness of management in controlling threats | Endangered | Endangered | False | 1 |
| | | | | | | | | **Subtotal** | **64** |
| ***Vespadelus troughtoni / Eastern Cave Bat ( Fauna )*** | | | | | | | | | |
| 3167_Low | 57.6 | 57.6 | 0.18 | Biodiversity Conservation Act listing status | Species dependent on habitat attributes | Vulnerable | Not Listed | True | 8 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 3167_Moderate | 75.5 | 75.5 | 0.6 | Biodiversity Conservation Act listing status | Species dependent on habitat attributes | Vulnerable | Not Listed | True | 34 |
| 3250_Low | 50.4 | 50.4 | 0.12 | Biodiversity Conservation Act listing status | Species dependent on habitat attributes | Vulnerable | Not Listed | True | 5 |
| 3250_Moderate-Good | 83.3 | 83.3 | 0.61 | Biodiversity Conservation Act listing status | Species dependent on habitat attributes | Vulnerable | Not Listed | True | 38 |
| 3544_Exotic | 4.1 | 4.1 | 17.6 | Biodiversity Conservation Act listing status | Species dependent on habitat attributes | Vulnerable | Not Listed | True | 53 |
| 3544_Low | 13.4 | 13.4 | 1.6 | Biodiversity Conservation Act listing status | Species dependent on habitat attributes | Vulnerable | Not Listed | True | 16 |
| 3544_Moderate | 56.1 | 56.1 | 0.21 | Biodiversity Conservation Act listing status | Species dependent on habitat attributes | Vulnerable | Not Listed | True | 9 |
| 3967_Good | 70.0 | 70.0 | 1.7 | Biodiversity Conservation Act listing status | Species dependent on habitat attributes | Vulnerable | Not Listed | True | 88 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 4006_Moderate | 60.6 | 60.6 | 0.04 | Biodiversity Conservation Act listing status | Species dependent on habitat attributes | Vulnerable | Not Listed | True | 2 |
| | | | | | | | | **Subtotal** | **253** |

# BAM Biodiversity Credit Report (Like for like)

## Proposal Details

Assessment Id
00047273/BAAS17094/24/00047274

Proposal Name
State Significant_WF_RS_240607

BAM data last updated *
14/03/2024

Assessor Name

Assessor Number
BAAS24011

BAM Data version *
67

Proponent Names
Ali Ranjbartoreh, Ali Ranjbartoreh

Report Created
24/07/2024

BAM Case Status
Finalised

Assessment Revision
6

Assessment Type
Major Projects

Date Finalised
24/07/2024

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

## Potential Serious and Irreversible Impacts

| Name of threatened ecological community | Listing status | Name of Plant Community Type/ID |
|---|---|---|
| **Nil** | | |
| Species | | |
| **Lathamus discolor** / Swift Parrot | | |
| **Vespadelus troughtoni** / Eastern Cave Bat | | |
| **Petalura gigantea** / Giant Dragonfly | | |

## Additional Information for Approval

PCT Outside Ibra Added

None added

PCTs With Customized Benchmarks

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

Predicted Threatened Species Not On Site

| Name |
| --- |
| **Amaurornis moluccana /** Pale-vented Bush-hen |
| **Stagonopleura guttata /** Diamond Firetail |

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

# BAM Biodiversity Credit Report (Like for like)

| Name of Plant Community Type/ID | Name of threatened ecological community | Area of impact | HBT Cr | No HBT Cr | Total credits to be retired |
|---|---|---|---|---|---|
| 3167-Northern Hinterland Blackbutt-Forest Oak Wet Forest | Not a TEC | 0.8 | 17 | 4 | 21 |
| 3250-Northern Foothills Blackbutt Grassy Forest | Not a TEC | 0.7 | 0 | 21 | 21 |
| 3544-Coastal Sands Apple-Blackbutt Forest | Not a TEC | 19.4 | 0 | 4 | 4 |
| 3967-Northern Lower Floodplain Eleocharis Wetland | Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions | 1.7 | 0 | 58 | 58 |
| 4006-Northern Paperbark-Swamp Mahogany Saw-sedge Forest | Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions | 0.0 | 0 | 1 | 1 |

**3167-Northern Hinterland Blackbutt-Forest Oak Wet Forest**

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

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

| | | | | | | |
|---|---|---|---|---|---|---|
| | Northern Hinterland Wet Sclerophyll Forests This includes PCT's: 3063, 3069, 3094, 3115, 3144, 3152, 3155, 3167, 3170, 3179, 3230, 3231, 3232, 3233, 3234, 3235, 3236, 3237, 3238, 3239, 3240, 3241, 3242, 3243, 3244, 3245, 3246, 3247, 3248, 3249, 3250, 3251, 3252, 3253, 3254, 3255, 3256, 3257, 3258, 3259, 3260, 3261, 3262, 3263, 3264, 3285, 4109 | Northern Hinterland Wet Sclerophyll Forests <50% | 3167_Low | No | 4 | Macleay Hastings, Carrai Plateau, Coffs Coast and Escarpment, Comboyne Plateau, Karuah Manning, Macleay Gorges, Mummel Escarpment and Upper Manning.<br>or<br>Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site. |

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| | Northern Hinterland Wet Sclerophyll Forests This includes PCT's: 3063, 3069, 3094, 3115, 3144, 3152, 3155, 3167, 3170, 3179, 3230, 3231, 3232, 3233, 3234, 3235, 3236, 3237, 3238, 3239, 3240, 3241, 3242, 3243, 3244, 3245, 3246, 3247, 3248, 3249, 3250, 3251, 3252, 3253, 3254, 3255, 3256, 3257, 3258, 3259, 3260, 3261, 3262, 3263, 3264, 3285, 4109 | Northern Hinterland Wet Sclerophyll Forests <50% | 3167_Moderate | Yes | 17 | Macleay Hastings, Carrai Plateau, Coffs Coast and Escarpment, Comboyne Plateau, Karuah Manning, Macleay Gorges, Mummel Escarpment and Upper Manning. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site. |
| **3250-Northern Foothills Blackbutt Grassy Forest** | **Like-for-like credit retirement options** | | | | | |
| | Class | Trading group | Zone | HBT | Credits | IBRA region |

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|---|---|---|---|---|---|---|
| | Northern Hinterland Wet Sclerophyll Forests This includes PCT's: 3063, 3069, 3094, 3115, 3144, 3152, 3155, 3167, 3170, 3179, 3230, 3231, 3232, 3233, 3234, 3235, 3236, 3237, 3238, 3239, 3240, 3241, 3242, 3243, 3244, 3245, 3246, 3247, 3248, 3249, 3250, 3251, 3252, 3253, 3254, 3255, 3256, 3257, 3258, 3259, 3260, 3261, 3262, 3263, 3264, 3285, 4109 | Northern Hinterland Wet Sclerophyll Forests <50% | 3250_Low | No | 2 | Macleay Hastings, Carrai Plateau, Coffs Coast and Escarpment, Comboyne Plateau, Karuah Manning, Macleay Gorges, Mummel Escarpment and Upper Manning.<br>or<br>Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site. |

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|---|---|---|---|---|---|---|
| | Northern Hinterland Wet Sclerophyll Forests This includes PCT's: 3063, 3069, 3094, 3115, 3144, 3152, 3155, 3167, 3170, 3179, 3230, 3231, 3232, 3233, 3234, 3235, 3236, 3237, 3238, 3239, 3240, 3241, 3242, 3243, 3244, 3245, 3246, 3247, 3248, 3249, 3250, 3251, 3252, 3253, 3254, 3255, 3256, 3257, 3258, 3259, 3260, 3261, 3262, 3263, 3264, 3285, 4109 | Northern Hinterland Wet Sclerophyll Forests <50% | 3250_Moderate-Good | No | 19 | Macleay Hastings, Carrai Plateau, Coffs Coast and Escarpment, Comboyne Plateau, Karuah Manning, Macleay Gorges, Mummel Escarpment and Upper Manning.<br>or<br>Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site. |

| **3544-Coastal Sands Apple-Blackbutt Forest** | **Like-for-like credit retirement options** | | | | | |
|---|---|---|---|---|---|---|
| | Class | Trading group | Zone | HBT | Credits | IBRA region |

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|---|---|---|---|---|---|---|
| | Coastal Dune Dry Sclerophyll Forests This includes PCT's: 3544, 3545, 3546, 3547, 3548, 3549, 3550, 3551, 3552, 3553, 3554, 3555, 3556 | Coastal Dune Dry Sclerophyll Forests <50% | 3544_Exotic | Yes | 0 | Macleay Hastings, Carrai Plateau, Coffs Coast and Escarpment, Comboyne Plateau, Karuah Manning, Macleay Gorges, Mummel Escarpment and Upper Manning. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site. |
| | Coastal Dune Dry Sclerophyll Forests This includes PCT's: 3544, 3545, 3546, 3547, 3548, 3549, 3550, 3551, 3552, 3553, 3554, 3555, 3556 | Coastal Dune Dry Sclerophyll Forests <50% | 3544_Low | No | 0 | Macleay Hastings, Carrai Plateau, Coffs Coast and Escarpment, Comboyne Plateau, Karuah Manning, Macleay Gorges, Mummel Escarpment and Upper Manning. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site. |

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|---|---|---|---|---|---|---|
| | Coastal Dune Dry Sclerophyll Forests This includes PCT's: 3544, 3545, 3546, 3547, 3548, 3549, 3550, 3551, 3552, 3553, 3554, 3555, 3556 | Coastal Dune Dry Sclerophyll Forests <50% | 3544_Moderate | No | 4 | Macleay Hastings, Carrai Plateau, Coffs Coast and Escarpment, Comboyne Plateau, Karuah Manning, Macleay Gorges, Mummel Escarpment and Upper Manning. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site. |
| | | | | | | |
| **3967-Northern Lower Floodplain Eleocharis Wetland** | **Like-for-like credit retirement options** | | | | | |
| | Name of offset trading group | Trading group | Zone | HBT | Credits | IBRA region |
| | Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions This includes PCT's: 1738, 3958, 3959, 3962, 3964, 3965, 3967, 3971, 3973, 3975, 3976 | - | 3967_Good | No | 58 | Macleay Hastings, Carrai Plateau, Coffs Coast and Escarpment, Comboyne Plateau, Karuah Manning, Macleay Gorges, Mummel Escarpment and Upper Manning. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site. |

**3967-Northern Lower Floodplain Eleocharis Wetland**

**4006-Northern Paperbark-Swamp Mahogany Saw-sedge Forest**

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

| Name of offset trading group | Trading group | Zone | HBT | Credits | IBRA region |
|---|---|---|---|---|---|
| Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions<br>This includes PCT's: 3272, 3906, 3983, 3985, 3986, 3988, 3989, 3990, 3995, 3997, 3998, 4000, 4001, 4004, 4006, 4009, 4013, 4019, 4020, 4021, 4044, 4047, 4057 | - | 4006_Moderate | No | 1 | Macleay Hastings, Carrai Plateau, Coffs Coast and Escarpment, Comboyne Plateau, Karuah Manning, Macleay Gorges, Mummel Escarpment and Upper Manning.<br>or<br>Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site. |

## Species Credit Summary

# BAM Biodiversity Credit Report (Like for like)

| Species | Vegetation Zone/s | Area / Count | Credits |
|---|---|---|---|
| **Caesia parviflora var. minor** / Small Pale Grass-lily | **3250_Low, 3250_Moderate-Good** | 0.7 | 28.00 |
| **Crinia tinnula** / Wallum Froglet | **3250_Moderate-Good, 3544_Exotic, 3544_Low, 3967_Good** | 4.2 | 51.00 |
| **Cryptostylis hunteriana** / Leafless Tongue Orchid | **3250_Low, 3250_Moderate-Good, 3544_Exotic, 3544_Low** | 2.3 | 24.00 |
| **Dendrobium melaleucaphilum** / Spider orchid | **3250_Low, 3250_Moderate-Good** | 0.7 | 28.00 |
| **Lathamus discolor** / Swift Parrot | **3167_Low, 3167_Moderate, 3544_Exotic, 4006_Moderate** | 1.1 | 22.00 |
| **Litoria brevipalmata** / Green-thighed Frog | **3250_Moderate-Good, 3544_Moderate, 4006_Moderate** | 0.8 | 21.00 |
| **Marsdenia longiloba** / Slender Marsdenia | **3167_Low, 3167_Moderate, 3250_Low, 3250_Moderate-Good** | 1.1 | 41.00 |
| **Myotis macropus** / Southern Myotis | **3250_Low, 3250_Moderate-Good, 3544_Exotic, 3544_Low, 3544_Moderate, 3967_Good** | 11.3 | 112.00 |

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|---|---|---|---|
| **Petalura gigantea** / Giant Dragonfly | **3250_Low, 3250_Moderate-Good, 3544_Exotic, 3544_Low, 3544_Moderate, 3967_Good** | 14.3 | 187.00 |
| **Petaurus norfolcensis** / Squirrel Glider | **3167_Low, 3167_Moderate, 3250_Low, 3250_Moderate-Good, 3544_Low, 3544_Moderate, 4006_Moderate** | 1.9 | 64.00 |
| **Phascolarctos cinereus** / Koala | **3167_Low, 3167_Moderate, 3250_Low, 3250_Moderate-Good, 3544_Low, 3544_Moderate, 4006_Moderate** | 1.9 | 64.00 |
| **Vespadelus troughtoni** / Eastern Cave Bat | **3167_Low, 3167_Moderate, 3250_Low, 3250_Moderate-Good, 3544_Exotic, 3544_Low, 3544_Moderate, 3967_Good, 4006_Moderate** | 22.6 | 253.00 |

## Credit Retirement Options

Like-for-like credit retirement options

| | | |
|---|---|---|
| **Caesia parviflora var. minor** / Small Pale Grass-lily | Spp | IBRA subregion |
| | **Caesia parviflora var. minor /** Small Pale Grass-lily | Any in NSW |

| | | |
|---|---|---|
| **Crinia tinnula** / Wallum Froglet | Spp | IBRA subregion |
| | **Crinia tinnula /** Wallum Froglet | Any in NSW |
| **Cryptostylis hunteriana** / Leafless Tongue Orchid | Spp | IBRA subregion |
| | **Cryptostylis hunteriana /** Leafless Tongue Orchid | Any in NSW |
| **Dendrobium melaleucaphilum** / Spider orchid | Spp | IBRA subregion |
| | **Dendrobium melaleucaphilum /** Spider orchid | Any in NSW |
| **Lathamus discolor** / Swift Parrot | Spp | IBRA subregion |
| | **Lathamus discolor /** Swift Parrot | Any in NSW |
| **Litoria brevipalmata** / Green-thighed Frog | Spp | IBRA subregion |
| | **Litoria brevipalmata /** Green-thighed Frog | Any in NSW |
| **Marsdenia longiloba** / Slender Marsdenia | Spp | IBRA subregion |
| | **Marsdenia longiloba /** Slender Marsdenia | Any in NSW |
| **Myotis macropus** / Southern Myotis | Spp | IBRA subregion |

| | | |
|---|---|---|
| | **Myotis macropus /** Southern Myotis | Any in NSW |
| **Petalura gigantea** / Giant Dragonfly | Spp | IBRA subregion |
| | **Petalura gigantea /** Giant Dragonfly | Any in NSW |
| **Petaurus norfolcensis** / Squirrel Glider | Spp | IBRA subregion |
| | **Petaurus norfolcensis /** Squirrel Glider | Any in NSW |
| **Phascolarctos cinereus** / Koala | Spp | IBRA subregion |
| | **Phascolarctos cinereus /** Koala | Any in NSW |
| **Vespadelus troughtoni** / Eastern Cave Bat | Spp | IBRA subregion |
| | **Vespadelus troughtoni /** Eastern Cave Bat | Any in NSW |

# BAM Candidate Species Report

## Proposal Details

| | | |
|---|---|---|
| Assessment Id<br>00047273/BAAS17094/24/00047274 | Proposal Name<br>State Significant_WF_RS_240607 | BAM data last updated *<br>14/03/2024 |
| Assessor Name | Report Created<br>24/07/2024 | BAM Data version *<br>67 |
| Assessor Number<br>BAAS24011 | Assessment Type<br>Major Projects | BAM Case Status<br>Finalised |
| Assessment Revision<br>6 | Date Finalised<br>24/07/2024 | |

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

## List of Species Requiring Survey

| Name | Presence | Survey Months |
|---|---|---|
| ***Acronychia littoralis***<br>Scented Acronychia | No (surveyed) | ☐ Jan ☐ Feb ☐ Mar ☑ Apr<br>☐ May ☐ Jun ☐ Jul ☐ Aug<br>☑ Sep ☐ Oct ☑ Nov ☐ Dec<br>☐ Survey month outside the specified months? |
| ***Aepyprymnus rufescens***<br>Rufous Bettong | No (surveyed) | ☐ Jan ☑ Feb ☑ Mar ☐ Apr<br>☐ May ☐ Jun ☐ Jul ☐ Aug<br>☐ Sep ☐ Oct ☐ Nov ☐ Dec<br>☐ Survey month outside the specified months? |
| ***Allocasuarina simulans***<br>Nabiac Casuarina | No (surveyed) | ☐ Jan ☐ Feb ☐ Mar ☑ Apr<br>☐ May ☐ Jun ☐ Jul ☐ Aug<br>☑ Sep ☐ Oct ☑ Nov ☐ Dec<br>☐ Survey month outside the specified months? |

| | | |
|---|---|---|
| ***Argynnis hyperbius***<br>Laced Fritillary | No (surveyed)<br>*Survey months are outside of the months specified in Bionet. | ☐ Jan ☐ Feb ☐ Mar ☐ Apr<br>☐ May ☑ Jun ☐ Jul ☑ Aug<br>☑ Sep ☑ Oct ☐ Nov ☐ Dec<br>☑ Survey month outside the specified months? |
| ***Burhinus grallarius***<br>Bush Stone-curlew | No (surveyed) | ☐ Jan ☑ Feb ☐ Mar ☐ Apr<br>☐ May ☐ Jun ☐ Jul ☐ Aug<br>☐ Sep ☐ Oct ☐ Nov ☐ Dec<br>☐ Survey month outside the specified months? |
| ***Caesia parviflora var. minor***<br>Small Pale Grass-lily | Yes (assumed present) | ☐ Jan ☐ Feb ☐ Mar ☐ Apr<br>☐ May ☐ Jun ☐ Jul ☐ Aug<br>☐ Sep ☐ Oct ☐ Nov ☐ Dec<br>☐ Survey month outside the specified months? |
| ***Callistemon linearifolius***<br>Netted Bottle Brush | No (surveyed)<br>*Survey months are outside of the months specified in Bionet. | ☐ Jan ☐ Feb ☐ Mar ☑ Apr<br>☐ May ☐ Jun ☐ Jul ☐ Aug<br>☐ Sep ☐ Oct ☑ Nov ☐ Dec<br>☑ Survey month outside the specified months? |
| ***Calyptorhynchus lathami lathami***<br>South-eastern Glossy Black-Cockatoo | No (surveyed) | ☐ Jan ☐ Feb ☐ Mar ☑ Apr<br>☐ May ☐ Jun ☐ Jul ☐ Aug<br>☑ Sep ☐ Oct ☐ Nov ☐ Dec<br>☐ Survey month outside the specified months? |
| ***Carterornis leucotis***<br>White-eared Monarch | No (surveyed) | ☐ Jan ☐ Feb ☐ Mar ☑ Apr<br>☐ May ☐ Jun ☐ Jul ☐ Aug<br>☑ Sep ☐ Oct ☑ Nov ☐ Dec<br>☐ Survey month outside the specified months? |

| | | |
|---|---|---|
| ***Cercartetus nanus***<br>Eastern Pygmy-possum | No (surveyed) | ☐ Jan ☑ Feb ☑ Mar ☐ Apr<br>☐ May ☐ Jun ☐ Jul ☐ Aug<br>☐ Sep ☐ Oct ☑ Nov ☐ Dec<br>☐ Survey month outside the specified months? |
| ***Coeranoscincus reticulatus***<br>Three-toed Snake-tooth Skink | No (surveyed) | ☐ Jan ☐ Feb ☐ Mar ☐ Apr<br>☐ May ☐ Jun ☐ Jul ☐ Aug<br>☐ Sep ☐ Oct ☑ Nov ☐ Dec<br>☐ Survey month outside the specified months? |
| ***Crinia tinnula***<br>Wallum Froglet | Yes (surveyed) | ☐ Jan ☐ Feb ☑ Mar ☐ Apr<br>☐ May ☐ Jun ☐ Jul ☐ Aug<br>☐ Sep ☐ Oct ☑ Nov ☐ Dec<br>☐ Survey month outside the specified months? |
| ***Cryptostylis hunteriana***<br>Leafless Tongue Orchid | Yes (assumed present) | ☐ Jan ☐ Feb ☐ Mar ☐ Apr<br>☐ May ☐ Jun ☐ Jul ☐ Aug<br>☐ Sep ☐ Oct ☐ Nov ☐ Dec<br>☐ Survey month outside the specified months? |
| ***Cynanchum elegans***<br>White-flowered Wax Plant | No (surveyed) | ☐ Jan ☐ Feb ☐ Mar ☑ Apr<br>☐ May ☐ Jun ☐ Jul ☐ Aug<br>☑ Sep ☐ Oct ☑ Nov ☐ Dec<br>☐ Survey month outside the specified months? |
| ***Dendrobium melaleucaphilum***<br>Spider orchid | Yes (assumed present) | ☐ Jan ☐ Feb ☐ Mar ☐ Apr<br>☐ May ☐ Jun ☐ Jul ☐ Aug<br>☐ Sep ☐ Oct ☐ Nov ☐ Dec<br>☐ Survey month outside the specified months? |

| | | |
|---|---|---|
| ***Haliaeetus leucogaster***<br>White-bellied Sea-Eagle | No (surveyed) | ☐ Jan ☐ Feb ☐ Mar ☐ Apr<br>☐ May ☐ Jun ☐ Jul ☐ Aug<br>☐ Sep ☑ Oct ☑ Nov ☐ Dec<br>☐ Survey month outside the specified months? |
| ***Hibbertia hexandra***<br>Tree Guinea Flower | No (surveyed) | ☐ Jan ☐ Feb ☐ Mar ☑ Apr<br>☐ May ☐ Jun ☐ Jul ☐ Aug<br>☑ Sep ☐ Oct ☑ Nov ☐ Dec<br>☐ Survey month outside the specified months? |
| ***Hieraaetus morphnoides***<br>Little Eagle | No (surveyed) | ☐ Jan ☐ Feb ☐ Mar ☐ Apr<br>☐ May ☐ Jun ☐ Jul ☐ Aug<br>☑ Sep ☐ Oct ☐ Nov ☐ Dec<br>☐ Survey month outside the specified months? |
| ***Hoplocephalus bitorquatus***<br>Pale-headed Snake | No (surveyed) | ☐ Jan ☑ Feb ☐ Mar ☐ Apr<br>☐ May ☐ Jun ☐ Jul ☐ Aug<br>☐ Sep ☐ Oct ☑ Nov ☐ Dec<br>☐ Survey month outside the specified months? |
| ***Hoplocephalus stephensii***<br>Stephens' Banded Snake | No (surveyed) | ☐ Jan ☑ Feb ☐ Mar ☐ Apr<br>☐ May ☐ Jun ☐ Jul ☐ Aug<br>☐ Sep ☐ Oct ☐ Nov ☐ Dec<br>☐ Survey month outside the specified months? |
| ***Lathamus discolor***<br>Swift Parrot | Yes (assumed present) | ☐ Jan ☐ Feb ☐ Mar ☐ Apr<br>☐ May ☐ Jun ☐ Jul ☐ Aug<br>☐ Sep ☐ Oct ☐ Nov ☐ Dec<br>☐ Survey month outside the specified months? |

| | | |
|---|---|---|
| ***Lindernia alsinoides***<br>Noah's False Chickweed | No (surveyed)<br>*Survey months are outside of the months specified in Bionet. | ☐ Jan ☐ Feb ☐ Mar ☑ Apr<br>☐ May ☐ Jun ☐ Jul ☐ Aug<br>☐ Sep ☐ Oct ☑ Nov ☐ Dec<br>☑ Survey month outside the specified months? |
| ***Litoria aurea***<br>Green and Golden Bell Frog | No (surveyed) | ☐ Jan ☐ Feb ☑ Mar ☐ Apr<br>☐ May ☐ Jun ☐ Jul ☐ Aug<br>☐ Sep ☐ Oct ☑ Nov ☐ Dec<br>☐ Survey month outside the specified months? |
| ***Litoria brevipalmata***<br>Green-thighed Frog | Yes (assumed present) | ☐ Jan ☐ Feb ☐ Mar ☐ Apr<br>☐ May ☐ Jun ☐ Jul ☐ Aug<br>☐ Sep ☐ Oct ☐ Nov ☐ Dec<br>☐ Survey month outside the specified months? |
| ***Lophoictinia isura***<br>Square-tailed Kite | No (surveyed) | ☐ Jan ☐ Feb ☐ Mar ☐ Apr<br>☐ May ☐ Jun ☐ Jul ☐ Aug<br>☑ Sep ☐ Oct ☑ Nov ☐ Dec<br>☐ Survey month outside the specified months? |
| ***Marsdenia longiloba***<br>Slender Marsdenia | Yes (surveyed)<br>*Survey months are outside of the months specified in Bionet. | ☐ Jan ☐ Feb ☐ Mar ☑ Apr<br>☐ May ☐ Jun ☐ Jul ☐ Aug<br>☑ Sep ☐ Oct ☑ Nov ☐ Dec<br>☑ Survey month outside the specified months? |
| ***Maundia triglochinoides***<br>Maundia triglochinoides | No (surveyed) | ☐ Jan ☐ Feb ☑ Mar ☐ Apr<br>☐ May ☐ Jun ☐ Jul ☐ Aug<br>☐ Sep ☐ Oct ☑ Nov ☐ Dec<br>☐ Survey month outside the specified months? |

| | | |
|---|---|---|
| ***Melaleuca biconvexa***<br>Biconvex Paperbark | No (surveyed) | ☐ Jan ☐ Feb ☐ Mar ☑ Apr<br>☐ May ☐ Jun ☐ Jul ☐ Aug<br>☑ Sep ☐ Oct ☑ Nov ☐ Dec<br>☐ Survey month outside the specified months? |
| ***Melaleuca groveana***<br>Grove's Paperbark | No (surveyed) | ☐ Jan ☐ Feb ☐ Mar ☑ Apr<br>☐ May ☐ Jun ☐ Jul ☐ Aug<br>☑ Sep ☐ Oct ☑ Nov ☐ Dec<br>☐ Survey month outside the specified months? |
| ***Mixophyes balbus***<br>Stuttering Frog | No (surveyed) | ☐ Jan ☐ Feb ☐ Mar ☐ Apr<br>☐ May ☐ Jun ☐ Jul ☐ Aug<br>☐ Sep ☐ Oct ☑ Nov ☐ Dec<br>☐ Survey month outside the specified months? |
| ***Mixophyes iteratus***<br>Giant Barred Frog | No (surveyed) | ☐ Jan ☐ Feb ☐ Mar ☐ Apr<br>☐ May ☐ Jun ☐ Jul ☐ Aug<br>☐ Sep ☐ Oct ☑ Nov ☐ Dec<br>☐ Survey month outside the specified months? |
| ***Myotis macropus***<br>Southern Myotis | Yes (surveyed) | ☐ Jan ☐ Feb ☐ Mar ☐ Apr<br>☐ May ☐ Jun ☐ Jul ☐ Aug<br>☐ Sep ☐ Oct ☑ Nov ☐ Dec<br>☐ Survey month outside the specified months? |
| ***Niemeyera whitei***<br>Rusty Plum, Plum Boxwood | No (surveyed) | ☐ Jan ☐ Feb ☐ Mar ☑ Apr<br>☐ May ☐ Jun ☐ Jul ☐ Aug<br>☑ Sep ☐ Oct ☑ Nov ☐ Dec<br>☐ Survey month outside the specified months? |

| | | |
|---|---|---|
| ***Notamacropus parma***<br>Parma Wallaby | No (surveyed) | ☐ Jan ☑ Feb ☑ Mar ☐ Apr<br>☐ May ☐ Jun ☐ Jul ☐ Aug<br>☐ Sep ☐ Oct ☐ Nov ☐ Dec<br>☐ Survey month outside the specified months? |
| ***Oberonia titania***<br>Red-flowered King of the Fairies | No (surveyed) | ☐ Jan ☐ Feb ☐ Mar ☑ Apr<br>☐ May ☐ Jun ☐ Jul ☐ Aug<br>☑ Sep ☐ Oct ☑ Nov ☐ Dec<br>☐ Survey month outside the specified months? |
| ***Ocybadistes knightorum***<br>Black Grass-dart Butterfly | No (surveyed)<br>*Survey months are outside of the months specified in Bionet. | ☐ Jan ☐ Feb ☐ Mar ☑ Apr<br>☐ May ☐ Jun ☐ Jul ☐ Aug<br>☑ Sep ☐ Oct ☑ Nov ☐ Dec<br>☑ Survey month outside the specified months? |
| ***Parsonsia dorrigoensis***<br>Milky Silkpod | No (surveyed) | ☐ Jan ☐ Feb ☐ Mar ☑ Apr<br>☐ May ☐ Jun ☐ Jul ☐ Aug<br>☑ Sep ☐ Oct ☑ Nov ☐ Dec<br>☐ Survey month outside the specified months? |
| ***Petalura gigantea***<br>Giant Dragonfly | Yes (surveyed) | ☑ Jan ☐ Feb ☐ Mar ☐ Apr<br>☐ May ☐ Jun ☐ Jul ☐ Aug<br>☐ Sep ☐ Oct ☐ Nov ☐ Dec<br>☐ Survey month outside the specified months? |
| ***Petauroides volans***<br>Southern Greater Glider | No (surveyed) | ☐ Jan ☑ Feb ☑ Mar ☐ Apr<br>☐ May ☐ Jun ☐ Jul ☐ Aug<br>☐ Sep ☐ Oct ☑ Nov ☐ Dec<br>☐ Survey month outside the specified months? |

| | | |
|---|---|---|
| ***Petaurus norfolcensis***<br>Squirrel Glider | Yes (surveyed) | ☐ Jan ☐ Feb ☐ Mar ☐ Apr<br>☐ May ☐ Jun ☐ Jul ☐ Aug<br>☐ Sep ☐ Oct ☑ Nov ☐ Dec<br>☐ Survey month outside the specified months? |
| ***Phaius australis***<br>Southern Swamp Orchid | No (surveyed) | ☐ Jan ☐ Feb ☐ Mar ☐ Apr<br>☐ May ☐ Jun ☐ Jul ☐ Aug<br>☑ Sep ☐ Oct ☐ Nov ☐ Dec<br>☐ Survey month outside the specified months? |
| ***Phascogale tapoatafa***<br>Brush-tailed Phascogale | No (surveyed) | ☐ Jan ☑ Feb ☑ Mar ☐ Apr<br>☐ May ☐ Jun ☐ Jul ☐ Aug<br>☐ Sep ☐ Oct ☐ Nov ☐ Dec<br>☐ Survey month outside the specified months? |
| ***Phascolarctos cinereus***<br>Koala | Yes (assumed present) | ☐ Jan ☐ Feb ☐ Mar ☐ Apr<br>☐ May ☐ Jun ☐ Jul ☐ Aug<br>☐ Sep ☐ Oct ☐ Nov ☐ Dec<br>☐ Survey month outside the specified months? |
| ***Planigale maculata***<br>Common Planigale | No (surveyed) | ☐ Jan ☐ Feb ☐ Mar ☐ Apr<br>☐ May ☐ Jun ☐ Jul ☐ Aug<br>☐ Sep ☐ Oct ☑ Nov ☐ Dec<br>☐ Survey month outside the specified months? |
| ***Pomaderris queenslandica***<br>Scant Pomaderris | No (surveyed) | ☐ Jan ☐ Feb ☐ Mar ☑ Apr<br>☐ May ☐ Jun ☐ Jul ☐ Aug<br>☑ Sep ☐ Oct ☑ Nov ☐ Dec<br>☐ Survey month outside the specified months? |

| | | |
|---|---|---|
| ***Potorous tridactylus***<br>Long-nosed Potoroo | No (surveyed) | ☐ Jan ☑ Feb ☑ Mar ☐ Apr<br>☐ May ☐ Jun ☐ Jul ☐ Aug<br>☐ Sep ☐ Oct ☐ Nov ☐ Dec<br>☐ Survey month outside the specified months? |
| ***Rhodamnia rubescens***<br>Scrub Turpentine | No (surveyed) | ☐ Jan ☐ Feb ☑ Mar ☐ Apr<br>☐ May ☐ Jun ☐ Jul ☐ Aug<br>☑ Sep ☐ Oct ☑ Nov ☐ Dec<br>☐ Survey month outside the specified months? |
| ***Rhodomyrtus psidioides***<br>Native Guava | No (surveyed) | ☐ Jan ☐ Feb ☐ Mar ☑ Apr<br>☐ May ☐ Jun ☐ Jul ☐ Aug<br>☑ Sep ☐ Oct ☑ Nov ☐ Dec<br>☐ Survey month outside the specified months? |
| ***Senna acclinis***<br>Rainforest Cassia | No (surveyed) | ☐ Jan ☐ Feb ☐ Mar ☑ Apr<br>☐ May ☐ Jun ☐ Jul ☐ Aug<br>☑ Sep ☐ Oct ☑ Nov ☐ Dec<br>☐ Survey month outside the specified months? |
| ***Solanum sulphureum***<br>Manning Yellow Solanum | No (surveyed) | ☐ Jan ☐ Feb ☐ Mar ☑ Apr<br>☐ May ☐ Jun ☐ Jul ☐ Aug<br>☑ Sep ☐ Oct ☑ Nov ☐ Dec<br>☐ Survey month outside the specified months? |
| ***Syzygium paniculatum***<br>Magenta Lilly Pilly | No (surveyed)<br>*Survey months are outside of the months specified in Bionet. | ☐ Jan ☐ Feb ☐ Mar ☑ Apr<br>☐ May ☐ Jun ☐ Jul ☐ Aug<br>☑ Sep ☐ Oct ☑ Nov ☐ Dec<br>☑ Survey month outside the specified months? |

| | | |
|---|---|---|
| ***Thesium australe***<br>Austral Toadflax | No (surveyed)<br>*Survey months are outside of the months specified in Bionet. | ☐ Jan ☐ Feb ☐ Mar ☑ Apr<br>☐ May ☐ Jun ☐ Jul ☐ Aug<br>☐ Sep ☐ Oct ☑ Nov ☐ Dec<br>☑ Survey month outside the specified months? |
| ***Turnix maculosus***<br>Red-backed Button-quail | No (surveyed) | ☐ Jan ☑ Feb ☐ Mar ☐ Apr<br>☐ May ☐ Jun ☐ Jul ☐ Aug<br>☐ Sep ☐ Oct ☐ Nov ☐ Dec<br>☐ Survey month outside the specified months? |
| ***Tylophora woollsii***<br>Cryptic Forest Twiner | No (surveyed) | ☐ Jan ☐ Feb ☐ Mar ☑ Apr<br>☐ May ☐ Jun ☐ Jul ☐ Aug<br>☐ Sep ☐ Oct ☐ Nov ☐ Dec<br>☐ Survey month outside the specified months? |
| ***Vespadelus troughtoni***<br>Eastern Cave Bat | Yes (surveyed) | ☐ Jan ☐ Feb ☐ Mar ☐ Apr<br>☐ May ☐ Jun ☐ Jul ☐ Aug<br>☐ Sep ☐ Oct ☑ Nov ☐ Dec<br>☐ Survey month outside the specified months? |

## Threatened species Manually Added

None added

## Threatened species assessed as not on site

Refer to BAR for detailed justification

| Common name | Scientific name | Justification in the BAM-C |
|---|---|---|
| Banksia conferta | Banksia conferta | Refer to BAR |
| Barking Owl | Ninox connivens | Habitat constraints |
| Bar-tailed Godwit (baueri) | Limosa lapponica baueri | Habitat constraints |
| Beach Stone-curlew | Esacus magnirostris | Refer to BAR |

| | | |
|---|---|---|
| Big Nellie Hakea | Hakea archaeoides | Refer to BAR |
| Black-tailed Godwit | Limosa limosa | Habitat constraints |
| Brush-tailed Rock-wallaby | Petrogale penicillata | Habitat constraints |
| Curlew Sandpiper | Calidris ferruginea | Habitat constraints |
| Eastern Curlew | Numenius madagascariensis | Habitat constraints |
| Eastern Osprey | Pandion cristatus | Habitat constraints |
| Eucalyptus seeana population in the Greater Taree local government area | Eucalyptus seeana - endangered population | Refer to BAR |
| Great Knot | Calidris tenuirostris | Habitat constraints<br>Geographic limitations |
| Greater Sand-plover | Charadrius leschenaultii | Habitat constraints<br>Geographic limitations |
| Grey-headed Flying-fox | Pteropus poliocephalus | Habitat constraints |
| Large Bent-winged Bat | Miniopterus orianae oceanensis | Habitat constraints |
| Lesser Sand-plover | Charadrius mongolus | Habitat constraints<br>Geographic limitations |
| Little Bent-winged Bat | Miniopterus australis | Habitat constraints |
| Masked Owl | Tyto novaehollandiae | Habitat constraints |
| North Brother Wattle | Acacia courtii | Refer to BAR |
| Pied Oystercatcher | Haematopus longirostris | Habitat constraints<br>Geographic limitations |
| Powerful Owl | Ninox strenua | Habitat constraints |
| Red Helmet Orchid | Corybas dowlingii | Geographic limitations |
| Red Knot | Calidris canutus | Habitat constraints |
| Regent Honeyeater | Anthochaera phrygia | Habitat constraints |
| Rufous Scrub-bird | Atrichornis rufescens | Refer to BAR |
| Sanderling | Calidris alba | Habitat constraints |
| Sooty Owl | Tyto tenebricosa | Habitat constraints |
| Sphagnum Frog | Philoria sphagnicolus | Refer to BAR |
| Terek Sandpiper | Xenus cinereus | Habitat constraints |

# BAM Predicted Species Report

## Proposal Details

| | | |
|---|---|---|
| Assessment Id | Proposal Name | BAM data last updated * |
| 00047273/BAAS17094/24/00047274 | State Significant_WF_RS_240607 | 14/03/2024 |
| Assessor Name | Report Created | BAM Data version * |
| | 24/07/2024 | 67 |
| Assessor Number | Assessment Type | BAM Case Status |
| BAAS24011 | Major Projects | Finalised |
| Assessment Revision | | Date Finalised |
| 6 | | 24/07/2024 |

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

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

| Common Name | Scientific Name | Vegetation Types(s) |
|---|---|---|
| Australasian Bittern | Botaurus poiciloptilus | 3967-Northern Lower Floodplain Eleocharis Wetland |
| | | 4006-Northern Paperbark-Swamp Mahogany Saw-sedge Forest |
| Australian Painted Snipe | Rostratula australis | 3967-Northern Lower Floodplain Eleocharis Wetland |
| | | 4006-Northern Paperbark-Swamp Mahogany Saw-sedge Forest |
| Barred Cuckoo-shrike | Coracina lineata | 3167-Northern Hinterland Blackbutt-Forest Oak Wet Forest |
| | | 3250-Northern Foothills Blackbutt Grassy Forest |
| | | 4006-Northern Paperbark-Swamp Mahogany Saw-sedge Forest |
| Bar-tailed Godwit (baueri) | Limosa lapponica baueri | 3967-Northern Lower Floodplain Eleocharis Wetland |
| | | 4006-Northern Paperbark-Swamp Mahogany Saw-sedge Forest |
| Beach Stone-curlew | Esacus magnirostris | 3250-Northern Foothills Blackbutt Grassy Forest |
| | | 3544-Coastal Sands Apple-Blackbutt Forest |
| Black Bittern | Ixobrychus flavicollis | 3167-Northern Hinterland Blackbutt-Forest Oak Wet Forest |
| | | 3250-Northern Foothills Blackbutt Grassy Forest |
| | | 3967-Northern Lower Floodplain Eleocharis Wetland |
| | | 4006-Northern Paperbark-Swamp Mahogany Saw-sedge Forest |

| | | |
|---|---|---|
| Black-necked Stork | Ephippiorhynchus asiaticus | 3167-Northern Hinterland Blackbutt-Forest Oak Wet Forest |
| | | 3250-Northern Foothills Blackbutt Grassy Forest |
| | | 3544-Coastal Sands Apple-Blackbutt Forest |
| | | 3967-Northern Lower Floodplain Eleocharis Wetland |
| | | 4006-Northern Paperbark-Swamp Mahogany Saw-sedge Forest |
| Black-tailed Godwit | Limosa limosa | 3967-Northern Lower Floodplain Eleocharis Wetland |
| Blue-billed Duck | Oxyura australis | 3967-Northern Lower Floodplain Eleocharis Wetland |
| Brolga | Grus rubicunda | 3967-Northern Lower Floodplain Eleocharis Wetland |
| Brown Treecreeper (eastern subspecies) | Climacteris picumnus victoriae | 3167-Northern Hinterland Blackbutt-Forest Oak Wet Forest |
| | | 3250-Northern Foothills Blackbutt Grassy Forest |
| | | 3544-Coastal Sands Apple-Blackbutt Forest |
| | | 4006-Northern Paperbark-Swamp Mahogany Saw-sedge Forest |
| Comb-crested Jacana | Irediparra gallinacea | 3967-Northern Lower Floodplain Eleocharis Wetland |
| Common Blossom-bat | Syconycteris australis | 3167-Northern Hinterland Blackbutt-Forest Oak Wet Forest |
| | | 3250-Northern Foothills Blackbutt Grassy Forest |
| | | 3544-Coastal Sands Apple-Blackbutt Forest |
| | | 4006-Northern Paperbark-Swamp Mahogany Saw-sedge Forest |
| Curlew Sandpiper | Calidris ferruginea | 3967-Northern Lower Floodplain Eleocharis Wetland |
| | | 4006-Northern Paperbark-Swamp Mahogany Saw-sedge Forest |
| Dusky Woodswallow | Artamus cyanopterus cyanopterus | 3167-Northern Hinterland Blackbutt-Forest Oak Wet Forest |
| | | 3250-Northern Foothills Blackbutt Grassy Forest |
| | | 3544-Coastal Sands Apple-Blackbutt Forest |
| | | 3967-Northern Lower Floodplain Eleocharis Wetland |
| | | 4006-Northern Paperbark-Swamp Mahogany Saw-sedge Forest |
| Eastern Chestnut Mouse | Pseudomys gracilicaudatus | 3967-Northern Lower Floodplain Eleocharis Wetland |
| | | 4006-Northern Paperbark-Swamp Mahogany Saw-sedge Forest |
| Eastern Coastal Free-tailed Bat | Micronomus norfolkensis | 3250-Northern Foothills Blackbutt Grassy Forest |
| | | 3544-Coastal Sands Apple-Blackbutt Forest |
| | | 3967-Northern Lower Floodplain Eleocharis Wetland |

| | | |
|---|---|---|
| Eastern Coastal Free-tailed Bat | Micronomus norfolkensis | 4006-Northern Paperbark-Swamp Mahogany Saw-sedge Forest |
| Eastern Curlew | Numenius madagascariensis | 3967-Northern Lower Floodplain Eleocharis Wetland |
| | | 4006-Northern Paperbark-Swamp Mahogany Saw-sedge Forest |
| Eastern False Pipistrelle | Falsistrellus tasmaniensis | 3167-Northern Hinterland Blackbutt-Forest Oak Wet Forest |
| | | 3250-Northern Foothills Blackbutt Grassy Forest |
| | | 3544-Coastal Sands Apple-Blackbutt Forest |
| | | 3967-Northern Lower Floodplain Eleocharis Wetland |
| | | 4006-Northern Paperbark-Swamp Mahogany Saw-sedge Forest |
| Eastern Grass Owl | Tyto longimembris | 3250-Northern Foothills Blackbutt Grassy Forest |
| | | 3967-Northern Lower Floodplain Eleocharis Wetland |
| Eastern Osprey | Pandion cristatus | 3167-Northern Hinterland Blackbutt-Forest Oak Wet Forest |
| | | 3250-Northern Foothills Blackbutt Grassy Forest |
| | | 3544-Coastal Sands Apple-Blackbutt Forest |
| | | 3967-Northern Lower Floodplain Eleocharis Wetland |
| | | 4006-Northern Paperbark-Swamp Mahogany Saw-sedge Forest |
| Flame Robin | Petroica phoenicea | 3167-Northern Hinterland Blackbutt-Forest Oak Wet Forest |
| | | 3250-Northern Foothills Blackbutt Grassy Forest |
| Freckled Duck | Stictonetta naevosa | 3967-Northern Lower Floodplain Eleocharis Wetland |
| Golden-tipped Bat | Phoniscus papuensis | 3167-Northern Hinterland Blackbutt-Forest Oak Wet Forest |
| | | 3250-Northern Foothills Blackbutt Grassy Forest |
| | | 3544-Coastal Sands Apple-Blackbutt Forest |
| | | 4006-Northern Paperbark-Swamp Mahogany Saw-sedge Forest |
| Great Knot | Calidris tenuirostris | 3967-Northern Lower Floodplain Eleocharis Wetland |
| | | 4006-Northern Paperbark-Swamp Mahogany Saw-sedge Forest |
| Greater Broad-nosed Bat | Scoteanax rueppellii | 3167-Northern Hinterland Blackbutt-Forest Oak Wet Forest |
| | | 3250-Northern Foothills Blackbutt Grassy Forest |
| | | 3544-Coastal Sands Apple-Blackbutt Forest |
| | | 4006-Northern Paperbark-Swamp Mahogany Saw-sedge Forest |
| Greater Sand-plover | Charadrius leschenaultii | 3967-Northern Lower Floodplain Eleocharis Wetland |

| | | |
|---|---|---|
| Greater Sand-plover | Charadrius leschenaultii | 4006-Northern Paperbark-Swamp Mahogany Saw-sedge Forest |
| Grey-headed Flying-fox | Pteropus poliocephalus | 3167-Northern Hinterland Blackbutt-Forest Oak Wet Forest |
| | | 3250-Northern Foothills Blackbutt Grassy Forest |
| | | 3544-Coastal Sands Apple-Blackbutt Forest |
| | | 3967-Northern Lower Floodplain Eleocharis Wetland |
| | | 4006-Northern Paperbark-Swamp Mahogany Saw-sedge Forest |
| Hoary Wattled Bat | Chalinolobus nigrogriseus | 3167-Northern Hinterland Blackbutt-Forest Oak Wet Forest |
| | | 3250-Northern Foothills Blackbutt Grassy Forest |
| Large Bent-winged Bat | Miniopterus orianae oceanensis | 3167-Northern Hinterland Blackbutt-Forest Oak Wet Forest |
| | | 3250-Northern Foothills Blackbutt Grassy Forest |
| | | 3544-Coastal Sands Apple-Blackbutt Forest |
| | | 3967-Northern Lower Floodplain Eleocharis Wetland |
| | | 4006-Northern Paperbark-Swamp Mahogany Saw-sedge Forest |
| Lesser Sand-plover | Charadrius mongolus | 3967-Northern Lower Floodplain Eleocharis Wetland |
| | | 4006-Northern Paperbark-Swamp Mahogany Saw-sedge Forest |
| Little Bent-winged Bat | Miniopterus australis | 3167-Northern Hinterland Blackbutt-Forest Oak Wet Forest |
| | | 3250-Northern Foothills Blackbutt Grassy Forest |
| | | 3544-Coastal Sands Apple-Blackbutt Forest |
| | | 3967-Northern Lower Floodplain Eleocharis Wetland |
| | | 4006-Northern Paperbark-Swamp Mahogany Saw-sedge Forest |
| Little Eagle | Hieraaetus morphnoides | 3250-Northern Foothills Blackbutt Grassy Forest |
| | | 3544-Coastal Sands Apple-Blackbutt Forest |
| | | 3967-Northern Lower Floodplain Eleocharis Wetland |
| | | 4006-Northern Paperbark-Swamp Mahogany Saw-sedge Forest |
| Little Lorikeet | Glossopsitta pusilla | 3167-Northern Hinterland Blackbutt-Forest Oak Wet Forest |
| | | 3250-Northern Foothills Blackbutt Grassy Forest |
| | | 3544-Coastal Sands Apple-Blackbutt Forest |
| | | 4006-Northern Paperbark-Swamp Mahogany Saw-sedge Forest |
| Magpie Goose | Anseranas semipalmata | 3967-Northern Lower Floodplain Eleocharis Wetland |

| | | |
|---|---|---|
| New Holland Mouse | Pseudomys novaehollandiae | 3167-Northern Hinterland Blackbutt-Forest Oak Wet Forest |
| | | 3250-Northern Foothills Blackbutt Grassy Forest |
| | | 3544-Coastal Sands Apple-Blackbutt Forest |
| | | 4006-Northern Paperbark-Swamp Mahogany Saw-sedge Forest |
| Olive Whistler | Pachycephala olivacea | 3167-Northern Hinterland Blackbutt-Forest Oak Wet Forest |
| | | 3250-Northern Foothills Blackbutt Grassy Forest |
| Red Knot | Calidris canutus | 3967-Northern Lower Floodplain Eleocharis Wetland |
| | | 4006-Northern Paperbark-Swamp Mahogany Saw-sedge Forest |
| Red-legged Pademelon | Thylogale stigmatica | 3167-Northern Hinterland Blackbutt-Forest Oak Wet Forest |
| | | 3250-Northern Foothills Blackbutt Grassy Forest |
| Regent Honeyeater | Anthochaera phrygia | 3544-Coastal Sands Apple-Blackbutt Forest |
| | | 4006-Northern Paperbark-Swamp Mahogany Saw-sedge Forest |
| Rose-crowned Fruit-Dove | Ptilinopus regina | 3167-Northern Hinterland Blackbutt-Forest Oak Wet Forest |
| | | 3250-Northern Foothills Blackbutt Grassy Forest |
| | | 4006-Northern Paperbark-Swamp Mahogany Saw-sedge Forest |
| Sanderling | Calidris alba | 3967-Northern Lower Floodplain Eleocharis Wetland |
| | | 4006-Northern Paperbark-Swamp Mahogany Saw-sedge Forest |
| Scarlet Robin | Petroica boodang | 3250-Northern Foothills Blackbutt Grassy Forest |
| | | 3544-Coastal Sands Apple-Blackbutt Forest |
| South-eastern Glossy Black-Cockatoo | Calyptorhynchus lathami lathami | 3167-Northern Hinterland Blackbutt-Forest Oak Wet Forest |
| | | 3250-Northern Foothills Blackbutt Grassy Forest |
| | | 3544-Coastal Sands Apple-Blackbutt Forest |
| | | 4006-Northern Paperbark-Swamp Mahogany Saw-sedge Forest |
| South-eastern Hooded Robin | Melanodryas cucullata cucullata | 3250-Northern Foothills Blackbutt Grassy Forest |
| | | 4006-Northern Paperbark-Swamp Mahogany Saw-sedge Forest |
| Speckled Warbler | Chthonicola sagittata | 3250-Northern Foothills Blackbutt Grassy Forest |
| | | 3544-Coastal Sands Apple-Blackbutt Forest |
| Spotted Harrier | Circus assimilis | 3544-Coastal Sands Apple-Blackbutt Forest |
| | | 3967-Northern Lower Floodplain Eleocharis Wetland |

| | | |
|---|---|---|
| Spotted Harrier | Circus assimilis | 4006-Northern Paperbark-Swamp Mahogany Saw-sedge Forest |
| Spotted-tailed Quoll | Dasyurus maculatus | 3167-Northern Hinterland Blackbutt-Forest Oak Wet Forest |
| | | 3250-Northern Foothills Blackbutt Grassy Forest |
| | | 3544-Coastal Sands Apple-Blackbutt Forest |
| | | 3967-Northern Lower Floodplain Eleocharis Wetland |
| | | 4006-Northern Paperbark-Swamp Mahogany Saw-sedge Forest |
| Square-tailed Kite | Lophoictinia isura | 3167-Northern Hinterland Blackbutt-Forest Oak Wet Forest |
| | | 3250-Northern Foothills Blackbutt Grassy Forest |
| | | 3544-Coastal Sands Apple-Blackbutt Forest |
| | | 3967-Northern Lower Floodplain Eleocharis Wetland |
| | | 4006-Northern Paperbark-Swamp Mahogany Saw-sedge Forest |
| Superb Fruit-Dove | Ptilinopus superbus | 3167-Northern Hinterland Blackbutt-Forest Oak Wet Forest |
| | | 3250-Northern Foothills Blackbutt Grassy Forest |
| | | 3544-Coastal Sands Apple-Blackbutt Forest |
| Swift Parrot | Lathamus discolor | 3167-Northern Hinterland Blackbutt-Forest Oak Wet Forest |
| | | 3250-Northern Foothills Blackbutt Grassy Forest |
| | | 3544-Coastal Sands Apple-Blackbutt Forest |
| | | 4006-Northern Paperbark-Swamp Mahogany Saw-sedge Forest |
| Terek Sandpiper | Xenus cinereus | 3967-Northern Lower Floodplain Eleocharis Wetland |
| | | 4006-Northern Paperbark-Swamp Mahogany Saw-sedge Forest |
| Varied Sittella | Daphoenositta chrysoptera | 3167-Northern Hinterland Blackbutt-Forest Oak Wet Forest |
| | | 3250-Northern Foothills Blackbutt Grassy Forest |
| | | 3544-Coastal Sands Apple-Blackbutt Forest |
| | | 3967-Northern Lower Floodplain Eleocharis Wetland |
| | | 4006-Northern Paperbark-Swamp Mahogany Saw-sedge Forest |
| White-bellied Sea-Eagle | Haliaeetus leucogaster | 3167-Northern Hinterland Blackbutt-Forest Oak Wet Forest |
| | | 3250-Northern Foothills Blackbutt Grassy Forest |
| | | 3544-Coastal Sands Apple-Blackbutt Forest |
| | | 3967-Northern Lower Floodplain Eleocharis Wetland |
| | | 4006-Northern Paperbark-Swamp Mahogany Saw-sedge Forest |

| | | |
|---|---|---|
| White-fronted Chat | Epthianura albifrons | 3967-Northern Lower Floodplain Eleocharis Wetland |
| White-throated Needletail | Hirundapus caudacutus | 3167-Northern Hinterland Blackbutt-Forest Oak Wet Forest |
| | | 3250-Northern Foothills Blackbutt Grassy Forest |
| | | 3544-Coastal Sands Apple-Blackbutt Forest |
| | | 3967-Northern Lower Floodplain Eleocharis Wetland |
| | | 4006-Northern Paperbark-Swamp Mahogany Saw-sedge Forest |
| Wompoo Fruit-Dove | Ptilinopus magnificus | 3167-Northern Hinterland Blackbutt-Forest Oak Wet Forest |
| | | 3250-Northern Foothills Blackbutt Grassy Forest |
| | | 4006-Northern Paperbark-Swamp Mahogany Saw-sedge Forest |
| Yellow-bellied Glider | Petaurus australis | 3167-Northern Hinterland Blackbutt-Forest Oak Wet Forest |
| | | 3250-Northern Foothills Blackbutt Grassy Forest |
| | | 3544-Coastal Sands Apple-Blackbutt Forest |
| Yellow-bellied Sheathtail-bat | Saccolaimus flaviventris | 3250-Northern Foothills Blackbutt Grassy Forest |
| | | 3544-Coastal Sands Apple-Blackbutt Forest |
| | | 4006-Northern Paperbark-Swamp Mahogany Saw-sedge Forest |

## Threatened species Manually Added

None added

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

| Common Name | Scientific Name | Plant Community Type(s) |
|---|---|---|
| Diamond Firetail | Stagonopleura guttata | 3250-Northern Foothills Blackbutt Grassy Forest |
| | | 3544-Coastal Sands Apple-Blackbutt Forest |
| Pale-vented Bush-hen | Amaurornis moluccana | 3167-Northern Hinterland Blackbutt-Forest Oak Wet Forest |
| | | 3250-Northern Foothills Blackbutt Grassy Forest |
| | | 3967-Northern Lower Floodplain Eleocharis Wetland |
| | | 4006-Northern Paperbark-Swamp Mahogany Saw-sedge Forest |

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

Refer to BAR for detailed justification

| Common Name | Scientific Name | Justification in the BAM-C |
|---|---|---|
| Diamond Firetail | Stagonopleura guttata | Refer to BAR |
| Pale-vented Bush-hen | Amaurornis moluccana | Refer to BAR |

# APPENDIX 4 SIGNIFICANT IMPACT CRITERIA ASSESSMENTS

## Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland

### *Community background*

Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland is listed as endangered under the EPBC Act. Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland is described in the Conservation Advice as often having a layered canopy, dominated by melaleucas and/or *Eucalyptus robusta* species and occurring between the Great Dividing Range and Coastline from near Gladstone in Queensland, through to the south coast of New South Wales.

The community typically occurs in low-lying coastal alluvial areas with minimal relief such as swamps, floodplain pockets, depressions, behind fore-dunes and other similar locations. The frequency and duration of water inundation, salinity and nutrient content of the soil, and latitude influences the vegetation composition of the Coastal Swamp Sclerophyll Forest.

Typically, the community is found on hydric soils that are either waterlogged or intermittently or episodically inundated for typically between one to three months per year. The soils are typically unconsolidated sediments such as alluvial deposits, marine or aeolian sand or inter-barrier creek deposits that have been stained black or dark grey with humus. The structure of the community varies from open woodland to closed forest with a crown cover of at least 10% and typically no more than 70%.

### *Occurrence in the study area*

Based on a review of the EPBC Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland Conservation Advice (DAWE 2021), the Subject Land shows 0.04 hectares of PCT 4006 in moderate condition, which will be impacted by trenching to install the SRMs & RWMs. This association with the EEC is due to the presence of dominant canopy species such as *Melaleuca quinquenervia*, suitable mid and ground cover, suitable landscape position and soil characteristics (further described in Section 3.0). Hence, based on floristic attributes (less than 20% perennial exotic ground cover) and patch size (>5 hectares), mapped areas of this community meet the minimum condition thresholds for this EEC (High Condition Class A) (DAWE 2021).

Coastal Swamp Sclerophyll Forest also occurs within Kooloonbung Creek to the east and north of the effluent outlet, where it is mapped as PCT4004. This area will also be considered as part of the assessment. A detailed discussion of the potential impacts of effluent released into Kooloonbung Creek is in Section 8.4

### *Significant impact assessment*

Based on an understanding of the extent and condition of this EEC in the study area, it is concluded that project impacts are unlikely to lead to a significant impact on the Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland, endangered ecological community. It is critical that specific mitigation measures are adhered to and the construction footprint is reduced to the minimum extent possible to avoid impacts to this EEC. An assessment and justification are provided in Table A.1.

Table A. 1 Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland, EPBC EEC assessment against Significant Impact Criteria (CoA 2013).

| Significant impact criteria (Critically Endangered / Endangered Community) | Likelihood of significant impact | Justification |
|---|---|---|
| *Reduce the extent of an ecological community.* | Unlikely | Across Australia, Coastal Swamp Sclerophyll Forest has undergone a reduction in extent of between 53% and 76% since 1750.<br>This project will impact a small area of Coastal Swamp Sclerophyll Forest (0.04 ha) on the edge of a larger area of similar floristic composition. The project has sought to avoid impacts to native vegetation and TECs throughout its development (see Section 7.0). Primary infrastructure is situated on exotic grassland, avoiding the majority of Coastal Swamp Sclerophyll Forest in the surrounding landscape. There will be revegetation with shallow rooting species following works to install the SRMs & RWMs, which may support a partial restoration of the EEC. |

| Significant impact criteria (Critically Endangered / Endangered Community) | Likelihood of significant impact | Justification |
|---|---|---|
| | | While the removal of any area of TEC is not ideal, considering the project's overall impact on the TEC extent is relatively small, it is unlikely to significantly reduce the EEC's extent in NSW or Australia.<br><br>Regarding the effluent discharge, there are proposed changes in effluent discharge that will occur progressively over time. As the current level of discharge does not appear to have reduced the extent of TEC within Kooloonbung Creek, it is unlikely that the proposed discharge will have a significant impact. |
| *Fragment or increase fragmentation of an ecological community.* | Unlikely | The natural setting of this EEC is as large to small patches within a mosaic of coastal and floodplain communities. This community has suffered major ongoing threat from fragmentation of remnants and habitats across its range with vegetation clearing and altered hydrology reducing many large remnants to smaller, isolated, and disconnected patches within a heavily modified landscape (DAWE 2021).<br><br>There are significant areas of Coastal Swamp Sclerophyll Forest in the immediate landscape, of which the impact area of the SRMs & RWMs will be on the edge of this vegetation. There is existing fragmentation within the impact area due to a powerline corridor. The project will partially increase this fragmentation, but only as a small area.<br><br>The proposal will regenerate the vegetation with shallow rooting species from PCT 4006 in the area, following the placement of the SRMs & RWMs. This will decrease the quality of the vegetation, but the long-term outcome will not be complete removal of the EEC. The project will increase, in a small way (0.04 ha), the fragmentation that is already present.<br><br>Regarding the effluent discharge, there is not expected to be any construction work required within Kooloonbong Creek such that fragmentation would increase. Were there to be changes in community composition from the release of effluent, these would be concentrated in the south west corner, near current breaks due to roads. As the effluent is not expected to make a significant impact on the vegetation, the release of additional effluent is not anticipated to alter the local community in such a way as to increase fragmentation of this area. |
| *Adversely affect habitat critical to the survival of an ecological community.* | Unlikely | No Critical Habitat as defined under section 207A of the EPBC Act has been identified or included in the Register of Critical Habitat.<br><br>According to the conservation advice from DAWE (2021), hydrology is a determining factor in the occurrence of this community and therefore prioritized for the integrity of this community. The Subject Land contains High Condition Class A Coastal Swamp Sclerophyll Forest and therefore is representative of vegetation that provides the highest chance for the long-term survival of the EEC. The Subject Land was also partially flooded during the site visit.<br><br>It is unlikely the project proposal will impact on the overall hydrology regime of this community, which could lead to wetland feature loss, as it doesn't involve drawing water from land within the EEC. However, mitigation measures are implemented on the impacted vegetation, by regenerating and reseeding particularly with short-rooting species from PCT4006 on completion on installing the SRMs & RWMs, hence ensuring the long- term preservation of the EEC remnant. |

| Significant impact criteria (Critically Endangered / Endangered Community) | Likelihood of significant impact | Justification |
|---|---|---|
| | | It is not anticipated that the installation of the SRMs & RWMs will adversely affect habitat critical to the survival of the ecological community, provided appropriate mitigation measures are employed.<br><br>The treated effluent is planned to be discharged into Koolongbung Creek, which may create small changes in the existing environments chemistry. As the current vegetation is already receiving treated effluent with minimal impact, the Coastal Swamp Forest TEC in this area is not anticipated to undergo significant impacts from this increase. |
| *Modify or destroy abiotic factors necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns.* | Unlikely | The conservation advice (DAWE 2021) states that hydrology is a determining factor in the occurrence of this community and should therefore be considered as important for the integrity of this community.<br><br>The installation of the SRMs & RWMs will have a temporary impact on surface water drainage in the Subject Land (0.04 ha of PCT 4006) due to the removal of the topsoil for installing the SRMs & RWMs. This action will be temporary and mitigation measures are implemented to restore it to its original on completion of installing the SRMs & RWMs. Nonetheless, the project is not anticipated to affect groundwater levels in the EEC.<br><br>It is not anticipated that the installation of the SRMs & RWMs will modify or destroy abiotic factors necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns.<br><br>The release of effluent into Kooloonbung Creek will change abiotic conditions in a minor way but is unlikely have a significant impact on the survival of the TEC. It is possible that the minor increase in nutrients will lead to an increase in exotic species which will be managed under the VMP. |
| *Cause a substantial change in the species composition of an occurrence of an ecological community, including a decline or loss of functionally important species, for example through regular burning or flora and fauna harvesting.* | Unlikely | The Coastal Swamp Sclerophyll Forest Ecological community includes a wide array of flora and fauna that constitutes as a part of the species composition including threatened species such as Koalas and Swift parrots. However, the impact of 0.04 hectares of the moderate condition of PCT 4006 is unlikely to significantly affect the overall species composition as it is a small area of impact in an area that is already disturbed by a powerline easement. This is because the area is small, and flora and fauna can still disperse throughout the landscape. Additionally, the surrounding area has a substantial high-quality native vegetation that supports the ecological needs of these species. Therefore, it's not expected that there will be a significant change in the species composition of the community. After the project is completed, the site will be replanted with shallow rooting species from the local community consistent with PCT 4006.<br>As the impact to the community from this proposal is comparatively small (0.04 hectares) and temporary, it is not expected that there will be a significant decline or loss of functionally important species. The restoration of the impacted areas following the project completion will also reduce the risk of a substantial change occurring to the EEC.<br><br>As effluent is already being discharged into Kooloonbung Creek, it is unlikely that the project will lead to a species compositional shift or loss of functionally important species. It is possible that the minor increase in |

| Significant impact criteria (Critically Endangered / Endangered Community) | Likelihood of significant impact | Justification |
|---|---|---|
| | | nutrients will lead to an increase in exotic species which will be managed under the VMP. |
| *Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including but not limited to:*<br>*- Assisting invasive species establishment-*<br>*Causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community.* | Unlikely | The project will create a shallow trench to install the SRMs & RWMs, temporarily affecting 0.04 hectares of EEC.<br><br>Mitigation measures have been implemented to prevent the establishment of invasive species, see Section 8.8.<br><br>The use of herbicides and pollutants is discussed in the mitigation measures within Section 8.8. The use of Fertilisers will be clarified within the VMP.<br><br>It is not anticipated that the proposal will cause a substantial reduction in the quality or integrity of an occurrence of this EEC, as, where practicable the impacts have been micro -located to avoid ecological values and the construction will implement mitigation measures to limit risk.<br><br>It is possible that soil disturbance from the project will lead to an increase in exotic species. In Kooloonbung Creek it is possible that there will be a small increase in eutrophication which may support some exotic species to establish. To ensure that the quality of the environment is maintained, the site will be managed and monitored under a VMP.<br><br>The project will release nitrate and ammonia into the Kooloonbung Creek which can be harmful to amphibians and aquatic plants. Modelling by Intrawater (2024) indicated a 95% level of species protection would require a mixing zone of 800 m downstream and 200 m upstream. However, at the 90% level of species protection, dilution would be sufficient, and no mixing zone would be required. It is therefore possible that species that are sensitive to these pollutants would be impacted by the proposal such that they would not be able to remain within the locality of the discharge point.<br><br>It is unlikely that this would be sufficient to impact flora though it is possible that local amphibian species would be impacted by the works. Impacts would be particularly strong if the pH of the effluent were to be between 8.0 and 8.5 when ammonia is most toxic; the pH of effluent discharge will be between 6.5 and 8.5.<br><br>In considering if the risk of increase in exotic species or the potential impacts to common amphibian species, it is unlikely that the project will contribute to any changes in the key diagnostics of the community as listed in Section 2.1 of the Conservation Advice (DAWE, 2021). The community does include the plants, animals and other organisms typically associated with forested palustrine wetlands, or swamp forests, Australia's east cost and is strongly associated with water-dependant animals. As the release of nitrate and ammonia is only likely to impact a section of the creek under a 95% level of species protection and not under a 90% level of species protection, it not likely to impact in a way that will cause a substantial reduction in quality or integrity of the community. Acknowledging that there is some degree of uncertainty, assessment of the amphibian community and exotic species is included in the VMP for further monitoring . |

| Significant impact criteria (Critically Endangered / Endangered Community) | Likelihood of significant impact | Justification |
|---|---|---|
| *Interfere with the recovery of an ecological community.* | Unlikely | There is no direct adopted or made Recovery Plan for this ecological community and therefore recovery priorities (actions and locations) have not been formerly articulated by the Australian Government. However, there are a number of associated plans for common threats of the community that have been already developed including plans for feral cats, prevention of invasive plant disease and weed spread as well as the recovery plan for the Regent Honeyeater.<br><br>In addition to these plans, the NSW Saving our Species Strategy for the NSW listed Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and Southeast Corner Bioregions aligns in part with the EPBC-listed TEC. The Saving our Species Strategy addresses a number of threats. Those actions that are particularly relevant to the proposal include:<br>• Maintain, improve or reinstate optimal hydrological regimes.<br>• Control weeds using a 'staged approach' as per the bitou bush monitoring manual (https://www.environment.nsw.gov.au//topics/animals-and-plants/pest-animals-and-weeds/weeds/widespread-weeds/staged-approach-to-weed-control) and best practice techniques that minimise off-target damage.<br>• Implement appropriate water sensitive design to reduce impacts of runoff on the TEC and implement best practice stormwater and soil conservation principles (e.g. identify problem stormwater input locations, install stormwater basins and maintain sediment traps etc).<br>• Prioritise protection of sites where the TEC can migrate into adjacent areas of suitable elevation and land use and investigate actions to facilitate the migration of the TEC, where suitable.<br>• Provide land managers and industry with information about the value of the TEC and the threats impacting it. Encourage best practice management, for example, to maintain native vegetation buffers around the TEC, prevent clearing, and/or encourage appropriate use of potential pollutants within and adjacent to the TEC. Promote use of the NSW Coastal Management Manual (State of New South Wales and Office of Environment and Heritage 2018).<br><br>This BDAR recommends the development and implementation of a VMP to assess and manage impact to this EEC. If mitigation measures are followed, including weed management and restoration, it is anticipated that the EEC will make a strong recovery following the project completion and implementation of a VMP. It is not anticipated that the proposal will lead to a degradation of the condition of this EEC.<br><br>It is unlikely to have a significant impact on the implementation of the Saving our Species Strategy outside of the study area. |

*Conclusion*

The Subject Land will be temporarily impacted through the construction of trenching in 0.04 ha in moderate condition of PCT 4006. This area meets the minimum condition thresholds for the EPBC-listed EEC as Class A1. Following the impact, measures will be implemented to regenerate the vegetation with short rooting species from PCT 4006 in the area, following the placement of the SRMs & RWMs. This will decrease the quality of the vegetation, but the long-term outcome will not be complete removal of the EEC.

The release of effluent into Kooloonbung Creek currently is not causing an observed impact on the community, though there will be a slight increase in nutrient conditions including nitrate and ammonia, it is unlikely that further discharge will have a significant impact on the EEC.

Across Australia, Coastal Swamp Sclerophyll Forest has undergone a reduction in extent of between 53% and 76% since 1750. However, considering the project's overall impact on the TEC extent is relatively small, it is unlikely to significantly reduce the EEC's extent in NSW or Australia. Therefore, it is considered unlikely that the proposal will result in a significant impact on the Coastal Swamp Sclerophyll Forest of New South Wales and Southeast Queensland TEC and a referral is therefore not required.

Koala *(Phascolarctos cinereus)*

*Species background*

The Koala combined populations of Queensland (QLD), New South Wales (NSW) and the Australian Capital Territory (ACT) are listed as endangered under the EPBC Act. The species is a tree-dwelling, medium-sized marsupial with a stocky body, large, rounded ears, sharp claws and variable but predominantly grey-coloured fur. It is one of Australia's most distinctive and iconic wildlife species. The combined populations of QLD, NSW and the ACT have a distribution from Cairns in Queensland through to the New South Wales / Victoria border, the distribution is not continuous with some areas isolated due to clearing or unsuitable habitat. Koalas inhabit a range of temperate, sub-tropical and tropical forest, woodland and semi-arid areas dominated by the genus *Eucalyptus*. The distribution is limited by altitude (limited to <800m ASL), temperature and leaf moisture (DAWE, 2022; DSEWPC, 2012).

The endangered status of Koalas population is attributed by multifaceted threats such as climate change exacerbated by habitat degradation and fragmentation. In addition, disease such as Chlamydia and koala retrovirus contributes substantially to population declines in some areas, Furthermore Koala face heightened vulnerability to predation by dogs and mortality resulting from vehicle movement (DCCEEW, Youngentob, K.N, et al 2021).

*Occurrence in the study area*

The NSW BioNet Atlas provided records of koalas within and around the Subject Land as recent as 2023. Overall, there have been records of 4667 koalas sighted around the locality in the last 30 years to present. This comprehensive data, coupled with the NSW framework for prioritizing koala conservation areas (DPIE 2020), identifies Port Macquarie as an Area of Regional Koala Significance with moderate resilience and security. Port Macquarie is also considered a Koala stronghold by experts due to its large population of Koalas, intensive intervention and investment are focused on mitigating threats to these animals (DPIE 2018).

While no targeted survey specifically focused on koalas was conducted on the subject land, a koala was observed during other biodiversity surveys conducted by deWitt's ecology within the site. Given the high population in the locality, recent records, and encounter of the animal, it is reasonable to infer the presence of koalas on the site.

*Significant impact assessment*

Based on a reasonable understanding of the habitat requirements for *Phascolarctos cinereus*, it is concluded that project impacts are unlikely to lead to a significant impact. An assessment and justification are provided in Table A.2

Table A. 2 Koala (*Phascolarctos cinereus)*, EPBC endangered species assessment against Significant Impact Criteria (CoA 2013)

| Significant impact criteria (endangered species) | Likelihood of significant impact | Justification |
|---|---|---|
| *Lead to a long-term decrease in the size of a population* | Unlikely | The Koala populations of QLD, NSW and ACT are considered and assessed by the Threatened Species Scientific Committee as one population (DAWE 2022). This population is formed by multiple sub-populations separated by cleared land or unsuitable habitat. The latest conservation advice refers to several different methods of identifying subpopulations including state government systems, genetic analysis, and climate sensitivity.<br>NSW framework for spatial prioritisation of koala conservation areas (SOS 2020) gives a robust detail on the Koala status across NSW, and this identifies Port Macquarie as being an Area of Regional Koala Significance with moderate resilience and security. |

| Significant impact criteria (endangered species) | Likelihood of significant impact | Justification |
|---|---|---|
| | | The Subject Land is within the Port Macquarie Area of Regional Koala Significance, the proposed project will impact a total of 1.87 ha potential koala habitat.<br>However, it is not anticipated that the proposed works would lead to a long-term decrease in the size a population, due to the current relatively stable status of the population in the locality (DPIE 2020).<br>In addition, the extensive conservation areas around the WWTP provides suitable habitat, forest corridors and foraging areas for the koalas.<br>Mitigation measures listed in Section 8.8 will be implemented to avoid and minimise tree removal across the project. Therefore, the area of impact will be mostly limited to groundcover vegetation and avoiding native trees, when possible, thereby unlikely to result in a long-term decrease in population size of Koala. |
| *Reduce the area of occupancy of the species* | Unlikely | Recent records within the assessment area confirms the presences of Koala, and therefore it is assumed that animals are likely to forage within the locality.<br>The proposal has been modified to avoid preferred Koala habitat and feed trees. This has been addressed through,<br>a) designing the infrastructure of the main WWPT primarily on the exotic vegetation in the Subject Land.<br>b) Rerouting the WWTP within existing easements and cleared lands as possible, to avoid areas of high ecological values and sensitive native vegetation and communities in the locality. Where possible, the topsoil will be restored over the trenches and seeded with native seeds as needed for revegetation.<br>The large forest adjacent to the proposed WWTP site provides a good habitat and foraging area for the koalas and, it is unlikely that the proposal will significantly reduce the area of occupancy of the species. |
| *Fragment an existing population into two or more populations* | Unlikely | The removal of native vegetation spans 1.87 hectares and will impact koala habitat in low to moderate-good condition.<br>Mitigation measures have been incorporated into the project design to minimise fragmentation of Koala habitat and population due to these impacts (Section 8.8).<br>The project has sought to avoid areas where possible, through measures such as HDD. Where vegetation is to be impacted, the project has placed the impact in already disturbed areas where possible, including in areas of exotic vegetation, along existing roads and existing walking paths. This has been done in an effort to reduce fragmentation.<br>Due to the presences of large areas of native vegetation and existing fauna corridors adjacent to the WWTP proposed site, the construction of such infrastructure is unlikely to fragment the Koala population as it ensures the safe movements of Koala and habitat connectivity. |
| *Adversely affect habitat critical to the survival of the species* | Unlikely | Critical habitat has not been defined for Koala. The species is known to inhabit various habitats dominated by Eucalyptus species. In addition, assessing koala habitat quality can vary due to regional and seasonal variations and based on local preferences.<br>The project sites will impact on the 1.87 hectares of native vegetation, that are potential habitat for Koala. However, mitigations have been incorporated into the project design to minimise the impact on native vegetation such as utilizing the exotic vegetation area in the Subject Land for constructing the main infrastructure (WWTP). This is also accompanied by HDD, micro locating areas for development footprints, reinstating topsoil on the trenches and revegetating with native plants as a mitigation measure for soil erosion and sedimentation.<br>The presence of substantial contiguous forest dominated by Eucalyptus species in the vicinity in the WWTP, reduces the impacts on the long- |

| Significant impact criteria (endangered species) | Likelihood of significant impact | Justification |
|---|---|---|
| | | term survival of Koala. Therefore, the project proposal is unlikely to affect habitat critical to the survival of the species. |
| *Disrupt the breeding cycle of a population* | Unlikely | The proposal has been micro-located to avoid and minimise the impact on native trees. In addition, remnant native vegetation in the locality and adjoining the Subject Land provides foraging habitat for the species. Therefore, the proposed works are unlikely to result in a disruption of the breeding cycle of the Koala.<br>Though targeted surveys were not performed for this project, the spotlighting and remote camera deployment performed did not detect any Koala's within the Subject Land.<br>Additional measures listed in Section 8.8 will be undertaken to mitigate the disruption of dispersal given the Koala preference of movement between trees at night and ground traversal for further dispersal. This will involve optimising infrastructure construction to minimise interference with koala movement across the landscape (DPIE 2022, DES 2022). |
| *Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline* | Unlikely | The Subject Land contains potential Koala habitat, the removal of native vegetation will impact on approximately 1.87 hectares of low through to moderate-good condition koala habitat. However, it is unlikely that the impacts will decrease the habitat to the extent such that it might cause the decline of the species due to the avoidance measures (Section 7.0) and mitigation measures implemented (Section 8.8).<br>The measures include efforts to reduce potential habitat loss, modification of landscape by avoiding removal of trees, when possible, diverting direct impacts to existing easements and cleared lands and, where possible, revegetating the disturbed areas along the SRMs & RWMs.<br>The proposal would result in a decrease of 1.87 hectares of potential habitat for the species. However, the quality of adjoining forest habitat surrounding the proposed WWTP and the existing population of Koala in the locality will unlikely be modified, destroyed, removed, or isolated to the extent that the 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* | Unlikely | The Subject Land is already impacted by existing weed invasion such as Whisky Grass (*Andropogon virginicus*), Cobbler's Pegs (*Bidens Pilosa*), Coolatai Grass (*Hyparrhenia hirta*) Broadleaf Paspalum (*Paspalum mandiocanum*), Fireweed (*Senecio madagascariensis*), and Blackberry (*Rubus fruticosus sp. Agg*). The proposal does involve greater transport to site by trucks that could spread propagules and seeds of invasive species, but these will be managed through hygiene measures (Section 8.8).<br>Construction activities will be managed through standard practices to avoid further spread of weeds and pests such as ensuring equipment and clothing are free of soil and vegetative matter prior to being brought to site, establishing vehicle cleaning stations with high pressure water hoses and brushes to remove soils, weeds and seeds; conducting regular vehicle inspections and restricting vehicle access zones and designated entry; ensure erosion controls are in place to minimize the spread of weed from run off (NSW Transport 2019).<br>Therefore, the proposed works are unlikely to result in an increase of invasive species provided the appropriate mitigation measures are implemented. |
| *Introduce disease that may cause the species to decline* | Unlikely | The Koala suffers from two major diseases, particular strains of *Chlamydia*, and Koala Retrovirus (TSSC 2012). Both diseases are common within the Koala population with up to 100% of Koala's in NSW and Queensland carrying Koala Retrovirus. |

| Significant impact criteria (endangered species) | Likelihood of significant impact | Justification |
|---|---|---|
| | | As both of these viruses are predominantly spread through contact with infected individuals or through the germ line, it is unlikely that any of the activities in the proposal will introduce disease that may lead to decline of the species. |
| *Interfere with the recovery of a species* | Unlikely | The conservation advice (DAWE 2022a) identifies six strategies for conservation which include:<br>• Build and share knowledge.<br>• Strong community engagement and partnerships<br>• Increase habitat protection.<br>• Koala conservation is integrated into policy, and statutory and land-use plans.<br>• Strategic habitat restoration<br>• Active metapopulation management<br>The national recovery plan for Koala was announced in 2022. This contains the following goal:<br>*To stop the trend of decline in population size of the listed Koala, by having resilient, connected, and genetically healthy metapopulations across its range, and to increase the extent, quality and connectivity of habitat occupied.*<br>The objectives to this are:<br>1AThe area of occupancy and estimated size of populations that are declining, suspected to be declining, or predicted to decline are instead stabilised then increased<br>1B The area of occupancy and estimated size of populations that are suspected and predicted to be stable are maintained or increased<br>2 Metapopulation processes are maintained or improved<br>3 Partners, communities and individuals have a greater role and capability in listed Koala monitoring, conservation and management<br>Though the project will reduce a small amount of koala habitat (1.87 ha). Mitigation measures have been put in place to ensure that no koalas are impacted by the proposal, such as pre-clearing surveys, and stop work procedures if Koala's are encountered (Section 8.8).<br>The NSW Saving our Species Iconic Koala Project (OEH 2017) aims to secure the koala in the wild in NSW for 100 years by:<br>• Reducing critical threats to the species.<br>• Ensuring adequate protection, management, and restoration of koala habitat<br>• Maintaining healthy breeding populations of koalas throughout their current range<br>Of the issues raised in the projects Action Toolbox, the most related issues are:<br>• Loss, modification, and fragmentation of habitat<br>• Vehicle strike<br>Whilst the proposal is impacting on the overall Koala habitat of 1.87 hectares, the Subject Land has already been minimised and reassessed to avoid areas of native vegetation, including koala feeding trees and habitat. Hence, it is not anticipated that the proposed works would lead to a long-term decrease in the size of the population on the area proposed for the WWTP, due to the current relatively stable population |

| Significant impact criteria (endangered species) | Likelihood of significant impact | Justification |
|---|---|---|
| | | in the locality and the large contiguous forest nearby and existing fauna corridors in the locality.<br>The proposed development will result in increased vehicle movements within the Subject Land during the construction process. This will also result in ongoing vehicle movements beyond the construction works for the purposes of SRMs & RWMs maintenance and routine checks. However, it is anticipated that vehicle speed would be limited to avoid vehicle strike on Koala crossing (Section 8.8).<br>Overall, it is unlikely that the project will lead to loss, modification, or fragmentation of habitat significant enough to interfere with the recovery of the species. |

*Conclusion*

The project proposed will impact on approximately 1.87 hectares of Koala habitat, including low through to moderate-good condition native vegetation. Efforts have been undertaken to avoid this impact by reducing the project's footprint to minimize its impact on local vegetation and avoiding areas known to harbour preferred feeding sites for Koalas. Through strategic planning to utilize the existing exotic vegetation for construction the infrastructure for the WWTP, rerouting of the SRMs & RWMs within pre-existing cleared lands and along already fragmented edges areas of high ecological values and sensitive native vegetation and communities in the locality were avoided. To mitigate the impact of SRMs & RWMs construction on cleared land, restoration efforts include reseeding native plants and restoring topsoil to the trenches to prevent further soil erosion and reestablishment of vegetation on site for native biodiversity. Notably, the contiguous forest adjacent to the project site serves as a substantial habitat for Koalas, thus ensuring that Koala habitat is retained in the locality. Additionally, mitigation strategies, including minimizing habitat loss and to prevent impacts to individual Koalas, have been incorporated into the project design to further mitigate potential impacts. Constructions measures and weed controls are also incorporated in this design Considering these measures alongside the intact forest habitat in proximity, it is considered unlikely that the proposed action will significantly impact *Phascolarctos cinereus*, and a referral is therefore not required.

Swift Parrot (*Lathamus discolor*)

*Species background*

Swift Parrot is listed as Critically Endangered, under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). This species breeds in Tasmania and migrates to the Australian south-east mainland between February and October. The species' status was reassessed in 2016 due to evidence of predation of females and nestlings by the introduced Sugar Glider (Petaurus breviceps) in their breeding grounds on Tasmania, with 50.9% of nesting females in Tasmania falling victim (Heinsohn et al., 2015). Fluctuations in food availability and unpredictable breeding site selection further endanger the population (Webb et al., 2014). Consequently, they are a focal point of an Australian National Recovery Plan, with population viability analysis considered crucial (DCCEEW, 2019).

During the winter migration period, the majority of the population frequents eucalypt woodlands and forests in Victoria and New South Wales (Saunders D.L. and Tzaros C. L., 2011). The Swift Parrot relies on eucalyptus forests for forging habitat feeding extensively on nectar and lerp and other items from eucalypt foliage (Saunders D.L. and Tzaros C. L., 2011). In NSW, it mostly occurs on the coast and south west slopes and have been found to forage regularly in Spotted Gum and Swamp Mahogany forests (LLS, NSW 2018).

Favoured feed trees include winter flowering species such as *Eucalyptus robusta* (Swamp Mahogany), *Corymbia maculata* (Spotted Gum), *C. gummifera* (Red Bloodwood), *E. tereticornis* (Forest Red Gum), *E. sideroxylon* (Mugga Ironbark) and *E. albens* (White Box). Commonly used lerp infested trees include Inland *E. microcarpa* (Grey Box), *E. moluccana* (Grey Box), *E. pilularis* (Blackbutt) and *E. melliodora* (Yellow Box). Swift Parrot return to some foraging sites on a cyclic basis depending on food availability. Following winter, they return to Tasmania where they breed from September to January, nesting in old trees with hollows and feeding in forests dominated by *Eucalyptus globulus* (Tasmanian Blue Gum).

Estimations regarding population size have shown a decline over recent years. In 2010, the Action Plan for Australian Birds approximated around 2,000 mature individuals in the wild, which decreased to an estimated 750 (with a range of 300-1,000) mature individuals by 2020 (Webb et al., 2021; DAWE, 2021).

*Occurrence in the study area*

Swift Parrot was assumed present within the area mapped under the Swift Parrot Important Area Map of the Subject Land. Within the Subject Land, there will be removal of 1.07 hectares of foraging habitat mapped, including 0.71 ha of exotic vegetation, 0.03 ha in low condition and 0.33 ha in moderate-good condition.

The most recent sighting of a Swift Parrot within the studied locality was noted in August 2021 (Birdlife, 2021). Detailed vegetation mapping within the Subject Land identified the area of mapped important habitat for the species covers the study area. No Swift Parrot have been observed within the Subject Land.

*Significant impact assessment*

Based on a reasonable understanding of the habitat requirements for Swift Parrot, it is concluded that project impacts are unlikely to lead to a significant impact. An assessment and justification are provided in Table A.3.

Table A. 3 Swift Parrot, EPBC critically endangered species assessment against Significant Impact Criteria (CoA 2013)

| Significant impact criteria (endangered or critically endangered species) | Likelihood of significant impact | Justification |
|---|---|---|
| Lead to a long-term decrease in the size of a population | Unlikely | Although the subject land falls within the Swift Parrot Important Area Map, no Swift Parrots were detected during field surveys. The most recent sighting of a Swift Parrot in the studied area was in August 2021 (Birdlife, 2021).<br>The proposal will impact 1.07 hectares of the overall Swift Parrot Important Area Map, recognized as significant for the species. |

| Significant impact criteria (endangered or critically endangered species) | Likelihood of significant impact | Justification |
|---|---|---|
| | | However, this is unlikely to reduce the population size as no individuals are anticipated to be impacted by the project.<br>Mitigation measures, such as pre-clearance surveys for Swift Parrots before construction, will be implemented within the Subject Land (Section 8.8). Overall, the proposed project has been redesigned to avoid a large, intact area of potential Swift Parrot foraging habitat which is mapped as an important area for the species. This area is expected to withstand indirect impacts from the proposal, which will be managed through mitigation measures (Section 8.8). |
| *Reduce the area of occupancy of the species* | Unlikely | The proposal is unlikely to impact the species' area of occupancy, considering the habitat's attributes and quality. The majority of the area to be impacted was mapped as being exotic vegetation (0.71 ha). The remaining habitat does not have direct evidence of use as there are no records within these areas, though it is possible that they could be used by Swift Parrot in the future.<br>The project will avoid impacts to a significant, intact area of mapped important Swift Parrot foraging habitat in the locality. Moreover, given the species' nomadic tendencies, and the lack of threatened ecological communities containing Swift Parrot favoured feed trees, it's unlikely that the proposal would reduce the area of occupancy of the species. |
| *Fragment an existing population into two or more populations* | Unlikely | Swift Parrots occur as a single, migratory population that can move long distances in response to changing food availability and landscape scale (TSSC, 2016). Minor reductions or habitat fragmentation is unlikely to impede their ability to access suitable foraging habitat. However, fragmentation and reduction of forest habitat is known to increase competition for resources with other species such as large aggressive honeyeaters as well as introduced birds and bees (TSSC,2016).<br>The proposed development will impact 1.07 hectares of the overall Swift Parrot Important Area Map, recognized as significant for the species. Given the ample suitable habitat available across the locality, including Port Macquarie, and considering the careful micro-locating of the impact area to avoid areas of high biodiversity value, it's unlikely that the proposed action would fragment an existing population of Swift Parrots into two or more populations. The species' nomadic behaviour further reduces the likelihood of fragmentation.<br>The project incorporated mitigation measures by designing the infrastructure of WWTP in an area with exotic vegetation, avoiding impact on the overall native plants. To minimize the impact on cleared land, restoration efforts will involve reseeding native plants and restoring topsoil to prevent erosion. Additionally, promoting native biodiversity will be a priority, especially along the SRMs & RWMs route. |
| *Adversely affect habitat critical to the survival of a species* | Unlikely | Critical habitat hasn't been designated for the Swift Parrot and Port Macquarie is not recognised as a priority site for the population. However, it is unlikely that critical habitat for the species' survival would be affected, though there are areas of important area mapping for the species in the area, there are few records. Additionally, mitigation measures have been taken to avoid impacting areas of high biodiversity value. It is unlikely that the Subject Land would support key foraging habitat for Swift Parrots, and there are large areas of potential foraging habitat for the species remaining across Port Macquarie. |
| *Disrupt the breeding cycle of a population* | Unlikely | The proposal is unlikely to disrupt the breeding cycle of a population given that the species breeding habitat is restricted to Tasmania. |

| Significant impact criteria (endangered or critically endangered species) | Likelihood of significant impact | Justification |
|---|---|---|
| | | Swift Parrot comes to NSW for foraging as a part of their life cycle. It is unlikely that the alteration of 1.07 ha will disrupt individual life cycles of the species. |
| *Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline* | Unlikely | The project will alter 1.07 ha of foraging habitat mapped as important area. The majority of this impact will be located within exotic dominated vegetation (0.71 ha), which is unlikely to support Swift Parrot. The project has sought to micro-locate structures and impacts within existing disturbed lands and along existing paths and roads to reduce the impact on fragmentation. Suitable habitat for this species is available throughout the local area, which extends throughout the Port Macquarie region. Based on the availability of suitable habitat, the size of the impact area, and the impact area being microsited to avoid areas of high biodiversity value, it is considered that the proposed action is unlikely 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 critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat* | Unlikely | The Subject Land is already impacted by existing weed invasion such as Whisky Grass (*Andropogon virginicus*), Cobbler's Pegs (*Bidens Pilosa),* Coolatai Grass (*Hyparrhenia hirta*), Broadleaf Paspalum (*Paspalum mandiocanum*), Fireweed (*Senecio madagascariensis*), and Blackberry (Rubus fruticosus sp. agg). These species are unlikely to directly impact on Swift Parrot, but may reduce the recovery of flowering Eucalypt species that they feed upon. Weed control will be part of the VMP to support the project (Section 8.8, Section 8.9). The proposal does involve greater transport to and from site by trucks and heavy machinery that could spread propagules and seeds of invasive species, but these will be managed through hygiene measures (Section 8.8).<br>Construction activities will be managed through standard practices to avoid further spread of weeds and pests such as ensuring equipment and clothing are free of soil and vegetative matter prior to being brought to site, establishing vehicle cleaning stations with high pressure water hoses and brushes to remove soils, weeds and seeds; conducting regular vehicle inspections and restricting vehicle access zones and designated entry; ensure erosion controls are in place to minimize the spread of weed from run off (NSW Transport 2019).<br>Therefore, the proposed works are unlikely to result in an increase of invasive species provided the appropriate mitigation measures are implemented. |
| *Introduce disease that may cause the species to decline* | Unlikely | Psittacine Beak and Feather Disease is a common and potentially deadly disease of parrots caused by a circovirus. This disease is listed as a threat to Swift Parrot, but the threated abatement advice only lists Swift Parrot as being at Moderate Risk Level, due to evidence that the threat level observed in collected blood and feather samples is not as great.<br>If the stress levels of Swift Parrots were to increase, then it possible that the risk from Beak and Feather Disease could increase. However, it is acknowledged that it is almost impossible to separate Swift Parrot from other Parrots such as lorikeets.<br>As Beak and Feather Disease originated in Australia and is common among parrot species including Swift Parrot, the project is unlikely to increase decline observed due to this disease. The project is unlikely to lead to introduction of any other diseases that may cause the species to decline. |

| Significant impact criteria (endangered or critically endangered species) | Likelihood of significant impact | Justification |
|---|---|---|
| *Interfere with the recovery of the species* | Unlikely | The National Recovery Plan for the Swift Parrot (Saunders and Tzaros 2011) identifies the relevant actions for the recovery of the species:<br>• Action 1 - Identify the extent and quality of habitat.<br>• Action 2 - Manage and protect Swift Parrot habitat at the landscape scale.<br>• Action 3 - Monitor and manage the impact of collisions, competition, and disease.<br>• Action 4 - Monitor population and habitat.<br>• Action 5- Increase community involvement in, and awareness of the recovery program.<br>• Action 6- Co-ordinate, review, and report on recovery process.<br><br>Considering the above factors, and the fact that there are no previous records of the species within the Subject Land and based on the availability of suitable habitat in the surrounding landscape, it is not anticipated that the project will interfere substantially with the recovery of the Swift Parrot. Nonetheless, efforts have been made to avoid and mitigate risks to the species including reducing the size of the impact area and the impact area being microsited to avoid areas of high biodiversity values. |

*Conclusion*

The proposed works will affect 1.07 hectares, including 0.36 ha of native vegetation in low through to moderate-good condition, along with 0.71 hectares of exotic vegetation. Despite the wide distribution of habitat for the Swift Parrot across Port Macquarie, the project design aims to minimize its footprint's impact, avoiding areas known to harbour Swift Parrot habitat and utilizing existing areas of managed exotic vegetation for construction.

To mitigate the impact on cleared land from SRMs & RWMs construction, restoration efforts will include reseeding shallow rooting native plants and restoring topsoil to prevent soil erosion and promote native biodiversity. The project's nature and location are not expected to significantly reduce habitat availability in the broader area. As Swift Parrot breed in Tasmania, the project is unlikely to have an impact on breeding habitat. Given the lack of small area impacted, it is unlikely that the project will result in the loss of foraging habitat.

Furthermore, the project has been redesigned to avoid a large, intact area of potential Swift Parrot foraging habitat, which will be further protected through mitigation measures. No Swift Parrots have been recorded in the study area. Considering these measures and the forest habitat across the region, the proposed action is not expected to significantly impact the Swift Parrot, thus a referral is unnecessary.

*Cryptostylis hunteriana* (Leafless Tongue-orchid)

*Species background*

Leafless Tongue-orchid is listed as vulnerable under the EPBC Act. This orchid can be described as an upright perennial leafless terrestrial herb. It grows up to 75cm tall and produces an upright flower-stem, bearing five to ten flowers between November and February. The most prominent feature of the plant is the labellum, presenting hairy maroon colour, growing up to 33 mm long.

The leafless tongue-orchid grows singly or in small colonies in a range of habitats including wet heath and sedgeland, on grasstree plains and in woodland. The species is found in nearby ranges south from Tenterfield in New South Wales to East Gippsland between Marlo and Genoa in Victoria. In it has been recorded from the coast at Tin Can Bay to the Glass House Mountains.

In NSW, it is recorded mainly on coastal and near coastal ranges. The most inland findings of this species and the closest records to the project area, are two populations located inland, north-west of Nowendoc. These records are west of Port Macquarie, approximately 115 km from the Subject Land. Other populations of this species include Bulahdelah, being the largest site for this species, north of Newcastle around Nelson Bay and Karuah, south of Newcastle around Lake Macquarie and two isolated occurrences inland north-west of Grafton.

*Occurrence in the study area*

This species was not identified within the project area during targeted surveys undertaken in November 2023. 19.33ha of suitable habitat for the Leafless Tongue-orchid is contained within the Subject Land. Since November 2023, there has been a change in the project footprint, resulting in approximately 2.33 hectares of potential habitat remaining within the Subject Land. Therefore, 17 hectares of the total suitable habitat for this species within the site was surveyed for adequately. The NSW BioNet Atlas does not identify any records of Leafless Tongue-orchid within or near the project area. The closest record of this species to the project area is >100km west of the site.

*Significant impact assessment*

Based on a reasonable understanding of the habitat requirements, it is concluded that project impacts are unlikely to lead to a significant impact. An assessment and justification are provided in Table A.4.

Table A. 4 *Cryptostylis hunteriana*, EPBC vulnerable species - assessment against Significant Impact Criteria (CoA 2013)

| Significant impact criteria (vulnerable species) | Likelihood of significant impact | Justification |
|---|---|---|
| *Lead to a long-term decrease in the size of an important population of a species* | Unlikely | An 'important population' is defined as a population that is necessary for the long-term survival and recovery of the species (CoA 2013). The approved conservation advice for *Cryptostylis hunteriana* does not describe or define an important population for this species.<br><br>No records of the Leafless Tongue-orchid are located within or near the project area. A targeted survey spanning 17 hectares was performed within the site, confirming no presence of this species.<br><br>There remains 2.33 hectares of potential suitable habitat to support this species in the Subject Land. The Subject Land has been refined to areas of least impact, avoiding areas |

| Significant impact criteria (vulnerable species) | Likelihood of significant impact | Justification |
|---|---|---|
| | | of high biodiversity value where practicable, including avoiding impacts to other threatened species.<br>Given that many areas within the remaining suitable habitat are small, highly modified or disturbed, it is not anticipated that the project works will lead to a long-term decrease in the size a population.<br><br>The project will impact on potential habitat for this species, but it is unlikely to impact on an important population of this species. |
| *Reduce the area of occupancy of an important population* | Unlikely | Given there are no records of the Leafless Tongue-orchid within or near the project area, the project is unlikely to adversely impact an important population provided appropriate mitigation measures are implemented. |
| *Fragment an existing important population into two or more populations* | Unlikely | Given there are no records of the Leafless Tongue-orchid within or near the project area, the project is unlikely to fragment an existing important population provided appropriate mitigation measures are implemented. |
| *Adversely affect habitat critical to the survival of the species* | Unlikely | Critical habitat has not been defined in the conservation advice for this Leafless Tongue-orchid.<br><br>This species mostly occurs in coastal heathlands, margins of coastal swamps and sedgelands, coastal forest, dry woodlands and lowland forest. It prefers open areas in the understorey of forested communities, typically on moist sands, moist to dry clay loam and occasionally in accumulated eucalypt leaves.<br><br>Though 2.33 ha of potential habitat for this species is located within the project area, there are no records of the species within 100 km of the project area. Given there are no records of the Leafless Tongue-orchid within or near the project area this potential habitat is unlikely that the habitats present in the project area would be considered as critical to the survival of this species.<br><br>The subject land has been refined to areas of least impact, avoiding areas of high biodiversity value where practicable. |
| *Disrupt the breeding cycle of an important population* | Unlikely | The poor root system of the Leafless Tongue-orchid makes it unlikely that it will spread vegetatively. Pollination is likely dependant on the ichneumonid wasp *Lissopimpla excelsa* (Bell, 2001). |

| Significant impact criteria (vulnerable species) | Likelihood of significant impact | Justification |
|---|---|---|
| | | The project is targeted to refined areas to reduce impacts on areas of high biodiversity value, and in most areas is not a broad enough impact to reduce the connectivity of wasps. The project is unlikely to disrupt the breeding cycle of an important population given there are no records of the Leafless Tongue-orchid within or near the project area |
| *Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline* | Unlikely | Targeted surveys have already confirmed the species absence from 17ha ha of potential habitat. 2.33 ha of potential habitat for this species is located within the project area. Within this area, project works are to occur within low condition (0.32 ha), moderate condition (1.75 ha), moderate-good condition (0.60 ha) native vegetation and exotic vegetation (1.40 ha). The impact area has been refined to avoid high biodiversity value areas where practicable, including avoidance of other threatened species.<br><br>Though the ecosystems within the Subject Land are likely suitable for the Leafless Tongue-orchid, the nearest record of the Leafless Tongue-orchid is >100km away from the project area. It is not anticipated that the project works will impact upon 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* | Unlikely | The WWTP and associated roads will be a permeant impact from the proposal. The remaining areas will be subject to revegetation and a VMP following the construction phase of the project to ensure invasive species do not threaten vegetation within and surrounding the project at its completion.<br><br>The proposed works are unlikely to result in an increase of invasive species as long as construction activities are managed through weed control standard practices and recommendations. |
| *Introduce disease that may cause the species to decline* | Unlikely | It is unclear if Leafless Tongue-orchid or other *Cryptostylis* species are susceptible to diseases.<br><br>The project is unlikely to result in the introduction of a disease that is harmful to the Leafless Tongue-orchid. |
| *Interfere substantially with the recovery of a species* | Unlikely | There is no current NSW Saving Our Species site-managed program for the Leafless Tongue-orchid, though three are proposed at Bulahdelah, Tomaree Head and Meroo National Park. None of these locations are near the project area. |

| Significant impact criteria (vulnerable species) | Likelihood of significant impact | Justification |
|---|---|---|
| | | The conservation advice (DCCEEW, 2008) identifies five regional priority actions to support the recovery of the Leafless Tongue-orchid which include:<br><br>Habitat Loss, Disturbance and Modification<br>1. Monitor known populations to identify key threats.<br>2. Monitor the progress of recovery, including the effectiveness of management actions and the need to adapt them if necessary.<br>3. Identify populations of high conservation priority.<br>4. Ensure chemicals or other mechanisms used to eradicate weeds do not have a significant adverse impact on Leafless Tongue-orchid.<br>5. Ensure road widening and maintenance activities and other infrastructure or development activities involving substrate and vegetation disturbance in areas where the species occurs do not adversely impact on known populations.<br>6. Manage any changes to hydrology that may result in changes to the water table levels, increased run-off, sedimentation or pollution.<br>7. Investigate further formal conservation arrangements such as the use of covenants, conservation agreements or inclusion in reserve tenure.<br><br>Invasive Weeds<br>8. Develop and implement a management plan, such as that proposed for the Bulahdelah bypass site (Parsons Brinckerhoff, 2006), for the control of numerous potential weed species in the local regions.<br><br>Fire<br>9. Develop and implement a suitable fire management strategy for Leafless Tongue-orchid.<br>10. Identify appropriate intensity and interval of fire to promote flowering, seed germination and vegetation regeneration.<br>11. Provide maps of known occurrences of Leafless Tongue-orchid to local and state Rural Fire Services and seek |

| Significant impact criteria (vulnerable species) | Likelihood of significant impact | Justification |
|---|---|---|
| | | inclusion of mitigative measures in bush fire risk management plans, risk register and/or operation maps.<br><br>Conservation Information<br>12. Raise awareness of Leafless Tongue-orchid within the local community.<br><br>Enable Recovery of Additional Sites and/or Populations<br>13. Undertake appropriate seed and mycorrhizal fungi collection and storage.<br>14. Investigate options for linking, enhancing or establishing additional populations.<br>15. Implement national translocation protocols (Vallee et al., 2004) if establishing additional populations is considered necessary and feasible.<br><br>Whilst the proposal is impacting on 2.33 ha of potential habitat for the Leafless Tongue-orchid, it is unlikely that the project will impact on or reduce the effectiveness of the above conservation measures. The Subject Land has been refined to avoid areas of high biodiversity value.<br><br>Appropriate weed management and minimising vegetation removal have also been adopted as part of the project or recommended as part of this report to limit potential impacts to any threatened species.<br><br>Considering the above factors, and the lack of records of the species near the Subject Land, the project is unlikely to interfere substantially with the recovery of the Leafless Tongue-orchid. |

*Conclusion*

2.33ha of potential habitat for this species is located within the Subject Land. Within this area, project works are to occur within low condition (0.32 ha), moderate condition (1.75 ha), moderate-good condition (0.60 ha) native vegetation and exotic vegetation (1.40 ha). The impact area has been refined to avoid high biodiversity value areas where practicable, including avoidance of other threatened species. The project is unlikely to cause habitat fragmentation, impact on critical habitat, interfere with life cycle completion, introduce disease, introduce competitive exotic species, reduce the area of occupancy, lead to a long term reduction in the species population or interfere with conservation measures of the species. In consideration of the lack of records of the species within the local area, the vegetation removal to occur as

part of the project is unlikely to place any populations at risk of extinction or be important to the long-term survival of the Leafless Tongue-orchid.

The outcome of this assessment is that project impacts are unlikely to lead to a significant impact on the Leafless Tongue-orchid, and therefore referral to the Commonwealth is not anticipated to be required.

Bell, S. A. J, 2001 Notes on population size and habitat of the vulnerable *Cryptostylis hunteriana* (Orchidaceae) from the Central Coast of New South Wales

*Marsdenia longiloba* (Slender Marsdenia)

*Species background*

*Marsdenia longiloba* (Slender Marsdenia) is listed as vulnerable under the EPBC Act. This vine can be described as a slender climber with clear, watery latex. Leaves are opposite with a fine leaf tip, 3–10 cm long, 1–5 cm wide. Fruit form long narrow capsules containing many seeds with tufts of long silky hair. The species has had a reclassified scientific name adopted by the Commonwealth, *Leichhardtia longiloba*, following Forster (2021), but this name has yet to be adopted by the NSW Herbarium, which is the standard used for this BDAR.

*Marsdenia longiloba* occurs sporadically across the NSW north coast from Taree northwards to Mount Nebo in Queensland. It is conserved within the Lamington National Park, Main Range National Park, Mt Barney National Park, and Toonumbar National Park. The conservation of species populations within these National Parks important to its survival and genetic diversity.

*Marsdenia longiloba* grows in open eucalypt forest, or margins of subtropical and warm temperate rainforest, and in areas of rocky outcrops. This species occurs within the Hunter–Central Rivers, Northern Rivers (NSW) and South East Queensland Natural Resource Management Regions. The distribution of this species overlaps with the "White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland" EPBC Act-listed threatened ecological community. This species is commonly associated with *Eucalyptus crebra* (Narrow-leaved Ironbark), *E. microcorys* (Tallowood), *E. acmenoides* (White Mahogany), *E. saligna* (Sydney Blue Gum), *E. propinqua* (Grey Gum), *Corymbia intermedia* (Pink Bloodwood) and *Lophostemon confertus* (Brush Box).

*Occurrence in the study area*

This species was not identified within the project area during targeted surveys undertaken in September and November 2023, which covered 0.41 ha of suitable habitat. There remains 1.11 hectares of potential habitat occurring within the Subject Land that has not been adequately surveyed for this species. The NSW BioNet Atlas does not identify any records of *Marsdenia longiloba* within the project area. The closest record of this species to the project area is 7.8km south-west, located to the west of the Lake Innes Nature Reserve. Another record occurs nearby, located over the Pacific Highway within the Cowarra State Forest followed by multiple other records to the south.

*Significant impact assessment*

Based on a reasonable understanding of the habitat requirements, it is concluded that project impacts are unlikely to lead to a significant impact. An assessment and justification are provided in Table A.4.

Table A. *Marsdenia longiloba*, EPBC vulnerable species - assessment against Significant Impact Criteria (CoA 2013)

| Significant impact criteria (vulnerable species) | Likelihood of significant impact | Justification |
|---|---|---|
| *Lead to a long-term decrease in the size of an important population of a species* | Unlikely | An 'important population' is defined as a population that is necessary for the long-term survival and recovery of the species (CoA 2013). The approved conservation advice for *Marsdenia longiloba* does not describe or define an important population for this species.<br>No records of *Marsdenia longiloba* are located within the Subject Land or its surrounding area. A targeted survey spanning 0.41 hectares was performed within the site, confirming no presence of this species. |

| Significant impact criteria (vulnerable species) | Likelihood of significant impact | Justification |
|---|---|---|
| | | There remains 1.11 hectares of potential suitable habitat to support this species in the Subject Land. The Subject Land has been refined to areas of least impact, avoiding areas of high biodiversity value where practicable, including avoiding impacts to other threatened species.<br>Given that many areas within the remaining suitable habitat are small, highly modified or disturbed, it is not anticipated that the project works will lead to a long-term decrease in the size of a population.<br>The project will impact on potential habitat for this species, but it is unlikely to impact on an important population of this species. |
| *Reduce the area of occupancy of an important population* | Unlikely | Given that surveys performed did not identify any *Marsdenia longiloba,* and, there are no records of the *Marsdenia longiloba* within the Subject Land or its surrounding area, the project is unlikely to adversely impact an important population provided appropriate mitigation measures are implemented. |
| *Fragment an existing important population into two or more populations* | Unlikely | Given that surveys performed did not identify any Marsdenia longiloba, and, there are no records of the *Marsdenia longiloba* within the Subject Land or its surrounding area, the project is unlikely to fragment an existing important population provided appropriate mitigation measures are implemented. |
| *Adversely affect habitat critical to the survival of the species* | Unlikely | Critical habitat has not been defined in the conservation advice for this *Marsdenia longiloba.*<br><br>This species mostly occurs in open eucalypt forest, or margins of subtropical and warm temperate rainforest or in areas of rocky outcrops. Its preferred species include *Eucalyptus crebra* (Narrow-leaved Ironbark), *E. microcorys* (Tallowood), *E. acmenoides* (White Mahogany), *E. saligna (*Sydney Blue Gum), *E. propinqua (*Grey Gum), *Corymbia intermedia* (Pink Bloodwood) *and Lophostemon confertus (*Brush Box).<br><br>Though 1.52 ha of potential habitat for this species is located within the project area, 0.41 ha has been surveyed and the nearest record of the species is >7.8 km of the project area. Given there are no records of the *Marsdenia longiloba* within the Subject Land or its surrounding area, it is unlikely that the habitats present in the project area would be considered as critical to the survival of this species. |

| Significant impact criteria (vulnerable species) | Likelihood of significant impact | Justification |
|---|---|---|
| | | The Subject Land has been refined to areas of least impact, avoiding areas of high biodiversity value where practicable. |
| *Disrupt the breeding cycle of an important population* | Unlikely | *Marsdenia longiloba* has been long assumed to only clonally reproduce, but has been found to undergo sexual reproduction with larger sites having greater genetic variation (Shapcott et al., 2017).<br>The project is targeted to refined areas to reduce impacts on areas of high biodiversity value. The project is unlikely to disrupt the breeding cycle of an important population as no individuals have been found within the Subject Land there are no nearby records of the species. Appropriate mitigation measures are recommended by the BDAR including limiting soil disturbance where practicable. Given there are no records of *Marsdenia longiloba* within the Subject Land or its surrounding area it is not anticipated for the breeding cycle of an important population to be impacted. |
| *Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline* | Unlikely | Targeted surveys have already confirmed the species absence from 0.41 ha of potential habitat. Within the total 1.52 ha of potential habitat for this species located within the project area, project works are to occur within low condition (0.30 ha), moderate condition (0.60 ha) and moderate-good condition (0.60 ha) native vegetation. Though the project will impact on potential habitat for *Marsdenia longiloba*, the lack of observed individuals makes it unlikely that habitat currently relevant to the species will be reduced in quantity or quality.<br>The impact area has been refined to avoid high biodiversity value areas where practicable, including avoidance of other threatened species. Though the ecosystems within the Subject Land are likely suitable for *Marsdenia longiloba*, the nearest record of the species is >7.8km away from the project area. It is not anticipated that the project works will impact upon 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* | Unlikely | The WWTP and associated roads will be a permeant impact from the proposal. The remaining areas will be subject to revegetation and a VMP following the construction phase of the project to ensure invasive species do not threaten vegetation within and surrounding the project at its completion.<br>The proposed works are unlikely to result in an increase of invasive species as long as construction activities are managed through |

| Significant impact criteria (vulnerable species) | Likelihood of significant impact | Justification |
|---|---|---|
| | | weed control standard practices and recommendations. |
| *Introduce disease that may cause the species to decline* | Unlikely | *Phytophthora cinnamomi* is a disease which impacts *Marsdenia longiloba,* capable of damaging individuals and populations (often referred to as *Phytophthora* dieback). This disease is a root-rot fungus listed as a key threatening process under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*. Reproduction and infection of this disease occur entirely within soil or plants and there is no airborne transmission of the pathogen.<br><br>This soil borne plant pathogen can spread easily via movement of soil, water or plant material. It is therefore important to ensure that footwear, tools and vehicles are always clean on arrival and departure.<br><br>It is unclear if *Marsdenia longiloba* or other *Marsdenia* species are susceptible to other diseases.<br><br>The project is unlikely to result in the introduction of a disease that is harmful to *Marsdenia longiloba* provided appropriate mitigation measures are implemented.<br>. |
| *Interfere substantially with the recovery of a species* | Unlikely | A NSW Saving Our Species site-managed program is under development for *Marsdenia longiloba.*<br><br>The conservation advice (DCCEEW, 2008) identifies five regional priority actions to support the recovery of *Marsdenia longiloba* (or Clear Milkvine) which include:<br>Habitat Loss, Disturbance and Modification<br>1. Monitor known populations to identify key threats.<br>2. Monitor the progress of recovery, including the effectiveness of management actions and the need to adapt them if necessary.<br>3. Identify populations of high conservation priority.<br>4. Mark all populations on roadsides, and ensure road widening and maintenance activities (or other infrastructure or development activities) involving substrate or vegetation disturbance in areas where Clear Milkvine occurs do |

| Significant impact criteria (vulnerable species) | Likelihood of significant impact | Justification |
|---|---|---|
| | | not adversely impact on known populations (DECC, 2005b).<br>5. Control access routes to suitably constrain public access to known sites on public land.<br>6. Suitably control and manage access on private land.<br>7. Minimise adverse impacts from land use at known sites.<br>8. Investigate formal conservation arrangements, management agreements and covenants on private land, and for crown and private land investigate inclusion in reserve tenure if possible.<br><br>Invasive Weeds<br>9. Implement the threat abatement strategies for the control of Lantana in the region (DECC, 2005c).<br>10. Identify, remove, and prevent introduction of weeds in the local area, which could become a threat to the Clear Milkvine, using appropriate methods (DECC, 2005a).<br>11. Ensure chemicals or other mechanisms used to eradicate weeds do not have a significant adverse impact on the Clear Milkvine (DECC, 2005a).<br><br>Fire<br>12. Develop and implement a suitable fire management strategy for Clear Milkvine.<br>13. Provide maps of known occurrences to local and state Rural Fire Services and seek inclusion of mitigative measures in bush fire risk management plan(s), risk register and/or operation maps.<br><br>Trampling, Browsing or Grazing<br>14. Ensure that livestock grazing, if it occurs in the area, uses an appropriate management regime and density that does not detrimentally affect this species.<br>15. Where appropriate manage total grazing pressure at important/significant sites through exclusion fencing or other barriers<br><br>Conservation Information |

| Significant impact criteria (vulnerable species) | Likelihood of significant impact | Justification |
|---|---|---|
| | | 16. Raise awareness of Clear Milkvine within the local community by distributing a species profile to relevant land managers, consent authorities, and conservation groups (DECC, 2005b).<br>17. Liaise with private landholders to convey the significance of Clear Milkvine populations occurring on or adjacent to their property and encourage works for species protection (DECC, 2005b).<br><br>Enable Recovery of Additional Sites and/or Populations<br>18. Undertake appropriate seed collection and storage for NSW Seedbank, and develop collection program of one provenance of Clear Milkvine in collaboration with Botanic Gardens Trust (DECC, 2005b).<br>19. Implement national translocation protocols (Vallee et al., 2004) if establishing additional populations is considered necessary and feasible.<br>Whilst the proposal is impacting on 1.52 ha of potential habitat for the *Marsdenia longiloba*, it is unlikely that the project will impact on or reduce the effectiveness of the above conservation measures, particularly as individuals of the species have yet to be observed in the Subject Land or locality. The Subject Land has been refined to avoid areas of high biodiversity value.<br><br>Appropriate weed management and minimising vegetation removal have also been adopted as part of the project or recommended as part of this report to limit potential impacts to any threatened species.<br><br>Considering the above factors, and the lack of records of the species near the Subject Land, the project is unlikely to interfere substantially with the recovery of the *Marsdenia longiloba*. |

*Conclusion*

1.52 ha of potential habitat for this species is located within the Subject Land. Within this area, project works are to occur within low condition (0.30 ha), moderate condition (0.60 ha) and moderate-good condition (0.60 ha) native vegetation. Surveys performed across 0.41 ha of the Subject Land did not observe *Marsdenia longiloba*, leaving 1.11 ha of unsurveyed potential habitat for the species. The impact area has been refined to avoid high biodiversity value areas where practicable, including avoidance of other threatened species. The project is unlikely to cause habitat fragmentation, impact on critical habitat, interfere with life cycle completion, introduce disease, introduce competitive exotic species, reduce the area of occupancy, lead to a long term reduction in the species population or interfere with conservation measures of the species. In

consideration of the lack of records of the species within the Subject Land or its surrounding area, the vegetation removal to occur as part of the project is unlikely to place any populations at risk of extinction or be important to the long-term survival of the *Marsdenia longiloba*.

The outcome of this assessment is that project impacts are unlikely to lead to a significant impact on the *Marsdenia longiloba*, and therefore referral to the Commonwealth is not anticipated to be required.

Foster, P. I., 2021. *Gymnema* R.Br. and *Leichhardtia* R.Br. (Apocynaceae), reinstated genera for taxa previously included in *Marsdenia* R.Br.: a conspectus for Australia, New Guinea and the Solomon Islands. Austrobaileya 11: 1–18 Queensland Department of Environment, Science and Innovation

Shapcott, Alison & Lamont, Robert & O'Connor, Katie & James, Heather & Benwell, Andrew. (2016). How is genetic variability in the threatened rainforest vine *Marsdenia longiloba* distributed at different geographical scales?. Botanical Journal of the Linnean Society.

# APPENDIX 5 – SERIOUS AND IRREVERSIBLE IMPACT (SAII) ASSESSMENTS

Swift Parrot

Future development on the subject land would result in an impact on a potential SAII entity through the proposed removal of 1.07 hectares of potential Swift Parrot (*Lathamus discolor*) mapped important habitat (Figure 71 & Figure 72). The vegetation includes 0.36 ha of native vegetation in low through to moderate-good condition, along with 0.71 hectares of exotic vegetation

This section presents information to help the decision maker in two forms. The first section addresses the questions from Appendix B of the document 'Guidance to assist the decision maker to determine a serious and irreversible impact' (DPIE, 2019). The second section directly addresses the content as required by Section 9.1 of the BAM (DPIE, 2020).

*a. the action and measures taken to avoid the direct and indirect impact on the potential entity for an SAII*

The proposed SRMs & RWMs have projections of 1.07 hectares of impact. The development has made adjustments to minimise impacts on Flora and Fauna and reduce impact areas by following roadsides and utility corridors. Nonetheless, effort has been made through the proposal planning and design process to avoid features of higher ecological value.

The Threatened Biodiversity Data Collection (TBDC) specifies that the Swift Parrot Important Areas mapping should be used to determine species presence or absence within the Subject Land. Part of the Subject Land is currently shown on the Swift Parrot Important Areas mapping (Figure 71 & Figure 72). The species was not recorded during field surveys within the study area and has never been recorded within it.

To avoid direct and indirect impacts on this species, and because it is not known if the species could occur within the Subject Land, mitigation measures will be implemented prior to construction within the Subject Land. These measures include conducting pre-clearance surveys for Swift Parrot prior to proposed works (Section 8.8). Conducting targeted surveys for Swift Parrot in conjunction with advice and records from DPIE and Birdlife Australia (who have prepared the mapping based on monitoring data since 2000) is not considered to be required based on the absence of preferred feed trees within the Subject Land.

The proposed development has, where practicable, avoid higher condition, intact areas of potential Swift Parrot foraging habitat which is likely to be resilient to indirect impacts arising from the proposal. As shown on Figure 71 & Figure 72, impact would be limited to 1.07 hectares of Swift Parrot Important habitat.

*b. the size of the local population directly and indirectly impacted by the development, clearing or biodiversity certification*

Development on the Subject Land would result in an impact on a potential SAII entity through the proposed removal of 0.36 hectares of Native vegetation and 0.71 hectares of Exotic vegetation mapped as a Swift Parrot Important Area (Figure 71 & Figure 72).

The Swift Parrot occurs as a single, migratory population (Saunders D.L. and Tzaros C. L., 2011). The total Swift Parrot population was estimated to be no more than 1000 pairs (Saunders D.L. and Tzaros C. L., 2011) and recently confirmed to be approximately 500 individuals (Olah, Waples & Stojanovic, 2024) and is at best stable but most likely continuing to decline, given the continued mortality of birds and the ongoing loss of habitat (Saunders D.L. and Tzaros C. L., 2011). The most recent Swift Parrot record within the locality occurred in August 2021 (Birdlife 2021).

During the winter migration period, the majority of the population frequents eucalypt woodlands and forests in Victoria and New South Wales (Saunders D.L. and Tzaros C. L., 2011). The Swift Parrot relies on eucalyptus forests for forging habitat feeding extensively on nectar and lerp and other items from eucalypt foliage (Saunders D.L. and Tzaros C. L., 2011). Key foraging habitats during this time are species such as Swamp Mahogany (*Eucalyptus robusta*), Forest Red Gum (*Eucalyptus tereticornis*), Blackbutt (*Eucalyptus pilularis*) and Spotted Gum (*Corymbia maculata*) (Saunders D.L. and Tzaros C. L., 2011). Blackbutt and Swamp Mahogany are both extremely common in the locality and both Forest Red Gum and Spotted Gum are common.

The proposal will directly impact a total of 1.07 hectares of native vegetation, composed of:

- PCT3167 Northern Hinterland Blackbutt-Forest Oak Wet Forest in Low condition (0.03 ha)

- PCT3167 Northern Hinterland Blackbutt-Forest Oak Wet Forest in Moderate condition (0.31 ha)
- PCT4006 Northern Paperbark-Swamp Mahogany Saw-sedge Forest in Moderate condition (0.02 ha)
- Exotic vegetation (0.71 ha)

Due to their nomadic behaviour in response to flowering feed trees, it is difficult to estimate the direct and indirect impacts on a local population of Swift Parrot. However, given the lack of records within the Subject Land, that the direct impact on foraging habitat within the Subject Land is restricted to 1.07 hectares of exotic, low and moderate condition vegetation along roadsides and developed areas, it is unlikely that the size of the Swift Parrot local population would be directly or indirectly impacted by the development.

*c. the extent to which the impact exceeds any threshold for the potential entity that is specified in the Guidance to assist a decision-maker to determine a serious and irreversible impact*

Thresholds for SAII entities are designed to assist in determining whether an impact will be a potential SAII. As the Swift Parrot is identified as being at risk from multiple principles, all impacts need to be considered for the Swift Parrot. As such, a conservative approach to the threshold for this species has been taken, and the threshold has been assumed to be zero hectares.

The development proposed within the subject land would result in the removal of 1.07 hectares of vegetation mapped as important habitat for the Swift Parrot (i.e. of 1.07 hectares above the threshold of zero). It is though noted that 0.71 ha occurs within exotic vegetation that likely couldn't support Swift Parrot. Therefore the more appropriate number is 0.36 ha above the threshold of zero.

*d. the likely impact (including direct and indirect impacts) that the development, clearing or biodiversity certification will have on the habitat of the local population, including but not limited to:*

*(i) an estimate of the change in habitat available to the local population as a result of the proposed development*

NSW government threatened species profile has an indicative distribution with known and predicted areas highlighted. distribution, habitat and ecology are discussed which are used by researchers to better understand winter foraging distribution north of Tasmania and breeding habitats in Tasmania.

The NSW government has opened a conservation project for the Swift Parrot species, identifying priority management areas with mapping of predicted and known occurrence as well as site locations. Currently, the Central Coast, Newcastle and Lake Macquarie as well as Cootamundra-Gundagai Regional, Greater Hume Shire and Wagga Wagga are priority locations, with Port Macquarie not included. Due to the migratory behaviour of the Swift Parrot, coastal fringes as well as areas with previous sightings are protected from potential habitat removal.

Port Macquarie is within the winter-feeding distribution range (Birds Australia, 2011). Port Macquarie has recorded sightings up until 2021 where 18 individuals were sighted (Birdlife, 2021). The proposed development impacts on important area mapping along roadsides in suburban developed areas. Out of 14,047 hectares of mapped important areas in the Macleay Hastings IBRA subregion, only 1.07 hectares are within the study area alignment. This would be an estimated reduction of 0.0076% of Mapped Important Areas.

Given the temporally and spatially variable long-distance movements of Swift Parrots, and their specialised breeding and foraging requirements, calculating area of occupancy (AOO) for the species is challenging (TSSC, 2016). In New South Wales, habitat mapping has been limited by the availability of suitable vegetation types. Due to the highly fragmented nature of some Swift Parrot sites in New South Wales, some important habitats, such as those within coastal urban environments, are not evident from vegetation mapping alone (Saunders D.L. and Tzaros C. L., 2011). Therefore, Swift Parrot records need to be combined with vegetation mapping to get a clearer indication of habitat use in New South Wales. The Port Macquarie region is not recognised as a priority site for the population.

*(ii) the proposed loss, modification, destruction or isolation of the available habitat used by the local population, and*

The proposal will impact on 1.07 hectares of vegetation mapped as a Swift Parrot Important Area, with 0.36 ha containing native vegetation that may be able to support the species. This impact will happen in the context of a large buffer around a previous Swift Parrot sighting record. There are significant areas of important habitat map remaining within the landscape. Swift Parrots are capable of moving long distances in response to changing food availability and landscape scale (TSSC, 2016) so minor reduction or habitat fragmentation does not impede their ability to access suitable foraging habitat. However, fragmentation and reduction of forest habitat is known to increase competition for resources with other species such as large aggressive honeyeaters as well as introduced birds and bees (TSSC, 2016).

*(iii) modification of habitat required for the maintenance of processes important to the species' life cycle (such as in the case of a plant –pollination, seed set, seed dispersal, germination), genetic diversity and long-term evolutionary development.*

Swift Parrots are a migratory species who rely on the availability of suitable foraging habitat in NSW and Victoria during the winter months as part of their life cycle. Whilst on the mainland the Swift Parrot disperses widely to forage on flowers and psyllid lerps in *Eucalyptus* species. There is strong evidence to support a continuing decline in the area of occupancy of Swift Parrots. The reduction in population has been attributed to a reduction in available habitat caused by a variety of factors, including residential, agricultural, and industrial development, and dieback and suppression of regeneration in agricultural and urban areas (TSSC, 2016).

The proposal will impact 1.07 hectares of native vegetation mapped as a Swift Parrot Important Area. The proposal is not anticipated to have any noticeable impact on the life-cycle of the Swift Parrot.

*e. the likely impact on the ecology of the local population. At a minimum, address the following:*

*(i) for fauna: – breeding – foraging – roosting, and – dispersal or movement pathways*

The migratory Swift Parrot are dependent on a combination of suitable wintering, migration, and breeding habitats. Identification and protection of these habitats is essential for their conservation (Saunders D.L. and Tzaros C. L., 2011). Swift Parrots breed in Tasmania and migrate to mainland Australia in autumn. During winter the parrots disperse across a broad landscape, foraging on nectar and lerps in eucalypts mainly in Victoria and New South Wales (Saunders D.L. and Tzaros C. L., 2011). In New South Wales, Swift Parrots forage in forests and woodlands throughout the coastal and western slopes regions each year (Saunders D.L. and Tzaros C. L., 2011). The proposal will not remove breeding habitat and impacts will be limited to 1.07 hectares of foraging habitat mapped as important area and also mapped as low-moderate value by Birds Australia.

*f. a description of the extent to which the local population will become fragmented or isolated as a result of the proposed development*

There is an estimated 8715 hectares of available potential Swift Parrot foraging habitat in the Macleay Hastings IBRA region. Despite impacting on 1.07 hectares of foraging habitat mapped as important area, the proposal will further fragment the mapped Swift Parrot Important Areas by an area reduction of 0.0076% within the Macleay-Hastings IBRA region.

The Swift Parrot occurs as a single, migratory population (Saunders D.L. and Tzaros C. L., 2011). This population is capable of moving long distances, and can occupy new locations in response to changing food availability and landscape scale (TSSC, 2016).

*g. the relationship of the local population to other population/populations of the species. This must include consideration of the interaction and importance of the local population to other population/populations for factors such as breeding, dispersal and genetic viability/diversity, and whether the local population is at the limit of the species' range*

As outlined above, the Swift Parrot occurs as one population. Swift Parrots breed in Tasmania and migrate to mainland Australia in autumn (Saunders D.L. and Tzaros C. L., 2011). During winter the whole population disperses across a broad landscape, foraging on nectar and lerps in eucalypts mainly in Victoria and New South Wales. Small numbers of Swift Parrots individuals are also recorded in the Australian Capital Territory, southeastern South Australia and southern Queensland (Saunders D.L. and Tzaros C. L., 2011).

Movement pathways used by Swift Parrots throughout their range are not well understood. The species appear to prefer particular regions, with foraging sites used repetitively (Saunders D.L. and Tzaros C. L., 2011).

The Subject Land is not located at the limit of the species' range and its local population only occurs on the locality on a seasonal basis. No individuals have been identified within the Subject land.

*h. The extent to which the proposed development will lead to an increase in threats and indirect impacts, including impacts from invasive flora and fauna, that may in turn lead to a decrease in the viability of the local population*

The National Recovery Plan for the Swift Parrot outlines the threats for the Swift Parrot. Urban development on the central and north coasts of NSW are listed as posing an ongoing threat of habitat loss, with an increasingly large proportion of the human population (about 86%) residing in coastal areas of Australia (Saunders D.L. and Tzaros C. L., 2011). Despite the minimal presence of preferred feed trees within the Subject Land, the proposal will remove 1.07 hectares of an area mapped as potential foraging habitat for the species.

Indirect impacts that may be associated with the proposal include reduced tree regeneration from weed infestation, fire and competition. The proposal may also reduce the health of foraging trees for Swift Parrot, such as due to impacts to root zones. Where natural regeneration is inhibited, the health of existing mature trees and the seed source are also reduced, posing a potential risk to long term foraging habitat (Saunders D.L. and Tzaros C. L., 2011).

An increase in the incidence of accidental and deliberate fires has the potential to occur as a result of the proposal. Increases in fire frequency poses a significant threat to avian communities. Where fire intervals are too regular, flowering events and maturation of nectar rich plant species may be reduced, resulting in a reduction of foraging resources for nectivorous birds (Saunders D.L. and Tzaros C. L., 2011). Collisions with wire netting or mesh fences, windows and cars may cause mortality to Swift Parrots in urban areas throughout the species' range (Saunders D.L. and Tzaros C. L., 2011).

Continued encroachment into foraging habitat exacerbates the problem. Fragmentation of forest habitat is known to increase competition for resources with other species such as large aggressive honeyeaters as well as introduced birds and bees (TSSC, 2016). The proposed development within the Subject Land will avoid most of the foraging habitat for the species within the locality as well as implement additional mitigation measures listed in Section 8.8.

*i. an estimate of the area, or number of populations and size of populations that is in the reserve system in NSW, the IBRA region and the IBRA subregion*

As outlined above, the Swift Parrot exists as one migratory population. The Swift Parrots which inhabit NSW, including the NSW North Coast IBRA, Sydney Basin IBRA bioregion and the Macleay-Hastings IBRA subregion are all part of the same population.

Data downloaded from the Important Area Map indicates that the area of Swift Parrot Important Areas within the Hastings-Macleay IBRA subregion is approximately 14,047 hectares. The project will remove 1.07 hectares of native vegetation mapped as important Swift Parrot foraging habitat. This represents a reduction of approximately 0.0076% in available foraging habitat within the Macleay-Hastings IBRA subregion.

The National Recovery Plan for the Swift Parrot outlines the recovery actions and performance criteria for Swift Parrot (Saunders D.L. and Tzaros C. L., 2011). The Swift Parrot population is distributed across 30 Natural Resource Management regions, making management throughout the range of the species challenging (Saunders D.L. and Tzaros C. L., 2011). The Macleay-Hastings IBRA region is not recognised as a priority management site.

SAII Assessment as per Section 9.1.2 of BAM 2020 – Swift Parrot (*Lathamus discolor*)

| BAM s9.1.2 Sub Clause | BAM s9.1.2 Provision | Assessment- Swift Parrot *(Lathamus discolor)* |
|---|---|---|
| *2a* | Evidence of rapid decline (*Principle 1, clause 6.7(2)(a) BC Regulation*) presented by an estimate of the:<br><br>i. decline in population of the species in NSW in the past 10 years or three generations (whichever is longer), or<br><br>ii. 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. | Estimations regarding population size have shown a decline over recent years. In 2010, the Action Plan for Australian Birds approximated around 2,000 mature individuals in the wild, which decreased to an estimated 750 (with a range of 300-1,000) mature individuals by 2020 (Webb et al., 2021; DAWE, 2021). A recently genetic study indicated the likely population to be approximately 500 individuals (Olah, Waples & Stojanovic, 2024) The most recent sighting of a Swift Parrot within the studied locality was noted in August 2021 (Birdlife, 2021).<br><br>They are listed as Critically Endangered, under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). This listing status underwent reassessment in 2016 due to the evidence revealing predation of females and nestlings by the introduced Sugar Glider (*Petaurus breviceps*) in their breeding grounds on Tasmania, with 50.9% of nesting females in Tasmania falling victim (Heinsohn et al., 2015). Additionally, fluctuations in availability of food resource and unpredictable annual movements for the selection of breeding sites also challenge the population (Webb et al., 2014).<br><br>This species falls within the focus of an Australian National Recovery Plan, with population viability analysis deemed a crucial component (DCCEEW, 2019).<br><br>Species meets the Criteria for Principle 1. |
| *2b* | Evidence of small population size (*Principle 2, clause 6.7(2)(b) BC Regulation*) presented by:<br><br>i. an estimate of the species' current population size in NSW, | Swift Parrots form a single genetically homogenous breeding population which migrate between Tasmania and mainland Australia (DAWE 2021). The occurrence of these disjunct local populations in New South Wales (NSW) makes it |

| BAM s9.1.2 Sub Clause | BAM s9.1.2 Provision | Assessment- Swift Parrot *(Lathamus discolor)* |
|---|---|---|
| | and<br><br>ii. an estimate of the decline in the species' population size in NSW in three years or one generation (whichever is longer), and<br><br>iii. 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. | challenging to assess relationships within the overall population.<br><br>Population estimates for the Swift Parrot have shown a decline in recent years between breeding habitat in Tasmania and foraging habitat on mainland Australia. In 2010, the Action Plan for Australian Birds estimated around 2,000 mature individuals in the wild, which decreased to approximately 750 by 2020 (Webb et al., 2021; DAWE, 2021). A recently genetic study indicated the likely population to be approximately 500 individuals (Olah, Waples & Stojanovic, 2024)<br><br>A generation time of 5.4 years has been estimated for the species (EPBC TSSC, 2016). This would indicate a decline of approximately 1500 individuals between 2010 and 2024, or approximately 2.6 generations<br><br>**Species likely meets the Criteria for Principle 2.** |
| *2c* | Evidence of limited geographic range for the threatened species (*Principle 3, clause 6.7(2)(c) BC Regulation*) presented by:<br><br>i. extent of occurrence<br><br>ii. area of occupancy<br><br>iii. number of threat-defined locations (geographically or ecologically distinct areas in which a single threatening event may rapidly affect all species occurrences), and<br><br>iv. whether the species' population is likely to undergo extreme fluctuations | It is evident that the species utilises a significant geographic range across NSW, with Port Macquarie (Hastings Macleay region) falling within the 18 Key Biodiversity Areas (KBAs), as identified by Birdlife Australia. However, it is not listed as a priority management area in Port Macquarie (Hastings Macleay region IBRA) by NSW government (DPE 2000).<br><br>It is unclear at this stage how the reduction in population is altering the extent of occurrence or area of occupancy. Since 1/012022, Bionet has recorded 136 sightings of Swift Parrot across NSW. This includes 2022 sightings as far north as Woombah and Kings Plains as well as west to Dandry and Weddin Mountains National Park.<br>It is not clear how the species population is fluctuating. |

| BAM s9.1.2 Sub Clause | BAM s9.1.2 Provision | Assessment- Swift Parrot *(Lathamus discolor)* |
|---|---|---|
| | | Species does not meet the Criteria for Principle 3. |
| *2d* | Evidence that the species is unlikely to respond to management (*Principle 4, clause 6.7(2)(d) BC Regulation*) because:<br><br>i. 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.<br><br>ii. the species is reliant on abiotic habitats which cannot be restored or replaced (e.g., karst systems) on a biodiversity stewardship site, or<br><br>iii. 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). | Due to the nomadic and seasonal behaviour of birds, managing the population presents significant challenges (Saunders D.L. and Tzaros C. L., 2011). Hence, even though the Macleay-Hastings IBRA region has available potential Swift Parrot foraging habitat, it is not recognised as a priority management site by the NSW government (DPE 2000).<br><br>While significant management programs are in place for the species, there has still been major reductions in the population, potentially indicating that current management is not successfully restoring the species.<br><br>Species could meet the Criteria for Principle 4 |
| *3* | Where the TBDC indicates data is 'unknown' or 'data deficient' for a species for a criterion listed in Subsection 9.1.2(2.), the assessor must record this in the BDAR or BCAR. | It remains difficult to reliably estimate the Swift Parrot population and it's migratory behaviour. |
| *4a* | The impact on the species' population (Principles 1 and 2) presented by:<br><br>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<br><br>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 | As stated above, population estimates in NSW are difficult to determine, though the most recent estimate was of 500 individuals remaining (Olah, Waples & Stojanovic, 2024).<br><br>Despite the avoidance and minimisation processes (discussed in Section 7.0), the proposal will remove 1.07 hectares of an area mapped as potential foraging habitat for the species which will further reduce, and fragment mapped Swift Parrot Important Areas. Of the 1.07 ha of mapped habitat, only 0.36 ha are vegetated with native vegetation. |

| BAM s9.1.2 Sub Clause | BAM s9.1.2 Provision | Assessment- Swift Parrot *(Lathamus discolor)* |
|---|---|---|
| | 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. | Given the nomadic behaviour of Swift Parrots and its capability of moving long distances in response to changing food availability and landscape scale (TSSC, 2016), minor reduction, or habitat fragmentation is unlikely to impede Swift Parrots ability to access suitable foraging habitat.<br><br>No individuals have been observed within the Subject Land |
| *4b* | Impact on geographic range (Principles 1 and 3) presented by:<br><br>i. the area of the species' geographic range to be impacted by the proposal in hectares, and a percentage of the total AOO, or EOO within NSW.<br><br>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.<br><br>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.<br><br>iv. to determine changes in threats affecting remaining subpopulations and habitat if the proposed impact proceeds, | Considering the bird's nomadic behaviour and its response to changing food availability, as well as its wide distribution across New South Wales and southeastern Australia, it is considered unlikely that the proposed impact on 1.07 ha of mapped Important Swift Parrot Habitat will have an impact on the habitat resulting in fragmentation or affecting the species range.<br><br>The species has a highly variable area of occupancy between years, with estimates prior to 2010 ranging from 4000 km2 to 500 km2 depending on year and season (EPBC TSSC, 2011). Assuming a conservative approach of 500 km2, a reduction of 1.07 ha would equate to a reduction of AOO of 0.002%.<br><br>No individuals have been observed in the Subject Land . Due to the mitigation measures put in place (Section 8.0),It is not anticipated that any individuals will be impacted.<br><br>The purpose of this project is to improve sewage for the Port Macquarie-Hastings Local Government Area. The relevant infrastructure within the Important Mapped Area is the SRMs & RWMs, which will carry recycled water and effluent as any necessary electrical or fibre optic cables. The SRMs & RWMs will be buried in a trench, leaving little surface |

| BAM s9.1.2 Sub Clause | BAM s9.1.2 Provision | Assessment- Swift Parrot *(Lathamus discolor)* |
|---|---|---|
| | 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. | impacts. There may be a slight change in fire, hydrology, or pollutant risk from the project during the construction phase but this is likely to be temporary. |
| *5* | The assessor may also provide new information that can be used to demonstrate that the principle identifying the species as at risk of an SAII, is inaccurate. | No additional new information that has not been discussed above is required<br><br>The project will alter a small area (0.36 ha) of native vegetation. The project has implemented multiple location and design features to avoid and minimise impacts to Swift Parrot (Section 7.0) and has implemented mitigation measures to reduce impacts (Section 8.8). An adaptive management strategy has been set out for the project (Section 8.9). |

## Giant Dragonfly

The Giant Dragonfly is found along the east coast of NSW from the Victorian border to northern NSW. The species has not been found west of the Great Dividing Range.

There are known occurrences in the Blue Mountains and Southern Highlands, in the Clarence River catchment, and on a few coastal swamps from north of Coffs Harbour to Nadgee in the south. Breeding habitat for the species is defined as peat swamps and mires (Baird & Burgin, 2013), where a moist substrate is present (Baird, 2012). Foraging habitat is not explicitly explained within the literature, however the Threatened Biodiversity Data Collection (2024) states that appropriate surveys for the species is within 500 m of swamp habitats, whilst Baird (2012) observed individuals in 'non-breeding' habitat, such as woodland and forest, up to 500 m away from swamp habitats.

The Giant Dragonfly is listed under the *Biodiversity Conservation Act 2016* (BC Act) as being Endangered (Schedule 1, Part 2 Endangered species, Division 1 Animals). The species is also included in a list made by the department of species likely to be at risk of serious and irreversible impact (SAII) based on Principle 4: "*the impacted species … is unlikely to respond to measures to improve its habitat and vegetation integrity, and therefore its members are not replaceable*".

Future development on the Subject Land is proposed to occur where an individual Giant Dragonfly has been observed foraging. The proposal will remove approximately 14.32 hectares of potential Giant Dragonfly (*Petalura gigantea)* foraging habitat composed of 4.22 ha native vegetation and 10.1 ha of exotic vegetation.

This review initially provides a thorough description to give background to the specific details of the SAII assessment by addressing the questions in *Guidance to assist a decisionmaker to determine a serious and irreversible impact - Appendix B Additional information in the Biodiversity Assessment Report to support decision-makers*. Below that is a table section addressing the impact assessment provisions for threatened fauna species that may be considered an SAII entity, as required by Section 9.1.2 of the BAM (DPIE, 2020) to facilitate consideration of the risk of SAII by the consent authority

### Guidance to assist a decisionmaker to determine a serious and irreversible impact - Appendix B Additional information in the Biodiversity Assessment Report to support decision-makers.

*a. the action and measures taken to avoid the direct and indirect impact on the potential entity for an SAII*

The proposed development affects 14.32 hectares of potential Giant Dragonfly foraging habitat, most of which consists of exotic vegetation (10.1 ha) with small areas of native vegetation (4.22 ha). Following the discovery of the Giant Dragonfly, subsequent reconsideration of the use of the same plain was undertaken, this ultimately confirmed that the same plain was still the optimal location. Within the sand plain, the location of the WWTP was micro located to avoid and minimise impacts where possible. This process is described in full in Section 7.0. Effort has been made throughout the proposal planning and design process to avoid features of higher conservation value, specifically the edge of the adjacent wetland area where suitable breeding characteristics occur.

The impact footprint of the development site has been microsited to avoid areas of adjacent wetland, including edge areas that are recognised as having suitable breeding conditions for the species. The impact footprint is situated within an elevated area of grassland with a predominately sandy substrate. No groundwater seepage or moist substrate consistent with breeding habitat within the impact footprint has been noted during ecological surveys. However, an adult individual has been recorded within the impact footprint prior to targeted surveys, likely using the area as foraging habitat.

Surveys were conducted during appropriate time periods (January 2024) for this species. Surveys were conducted within the Subject Land and the wetland area adjacent to the Subject Land.

To avoid direct and indirect impacts on this species, mitigation measures (Section 8.8) will be implemented prior to construction within the Subject Land.

Surveys did not identify any threatened species breeding habitat, it is therefore likely that the project will avoid all suitable breeding habitat for the species. Overall there will be 14.32 ha (10.1 ha of exotic vegetation and 4.22 ha of native vegetation) of likely foraging habitat will be impacted as part of the proposal.

*b. the size of the local population directly and indirectly impacted by the development, clearing or biodiversity certification*

Development on the subject land would result in an impact on a potential SAII entity through the proposed removal of 14.32 hectares of native (4.22 ha) and exotic (10.1 ha) vegetation identified as foraging habitat for the species.

The extent of specific vegetation communities are listed below:

- PCT3250 Northern Foothills Blackbutt Grassy Forest in Low condition (0.12 ha)
- PCT3250 Northern Foothills Blackbutt Grassy Forest in Moderate-Good condition (0.61 ha)
- PCT 3544 Coastal Sands Apple-Blackbutt Forest in Low condition (1.61 ha)
- PCT 3544 Coastal Sands Apple-Blackbutt Forest in Moderate condition (0.21 ha)
- PCT3967 Northern Lower Floodplain Eleocharis Wetland in Good Condition (1.67 ha)
- Exotic dominated vegetation (10.1 ha)

The Giant Dragonfly is found along the east coast of NSW from the Victorian border to northern NSW. The species has not been found west of the Great Dividing Range. There are known occurrences in the Blue Mountains and Southern Highlands, in the Clarence River catchment, and on a few coastal swamps from north of Coffs Harbour to Nadgee in the south.

There are gaps in our knowledge about this species, particularly relating to emergence patterns. Therefore, the size of a local population is hard to be determined for the species, as the larvae can remain in permanent burrows for up to 30 years (DPIE, 2021)).

Within the Port Macquarie locality there are 6 records, all within the last 30 years. Due to the limited knowledge on the species it is difficult to estimate the direct and indirect impacts on the local population of the Giant Dragonfly. Breeding habitat for the species is defined as peat swamps and mires (Baird & Burgin, 2013), where a moist substrate is present (Baird, 2012). The majority of potential habitat for Giant Dragonfly that is identified above is likely only suitable as foraging habitat.

*c. the extent to which the impact exceeds any threshold for the potential entity that is specified in the Guidance to assist a decision-maker to determine a serious and irreversible impact*

Thresholds for SAII entities are designed to assist in determining whether an impact will be a potential SAII. Any impact from development could potentially be considered serious and irreversible for the Giant Dragonfly. As such, a conservative approach to the threshold for this species has been taken, and the threshold has been assumed to be zero hectares.

The development proposed within the subject land would result in the removal of 14.32 hectares of vegetation identified as foraging habitat for the species (14.32 ha above the threshold). Foraging habitat is not explicitly explained within the literature, however the Threatened Biodiversity Data Collection (2024) states that appropriate surveys for the species is within 500 m of swamp habitats, whilst Baird (2012) observed individuals in 'non-breeding' habitat, such as woodland and forest, up to 500 m away from swamp habitats.

BioNet records highlight individuals that have been recorded within urban environments that are not suitable for breeding. An assumption has been made that Giant Dragonfly foraging habitat is variable, as long as it is in relatively close proximity to a suitable swamp environment. Whilst still important to the species, foraging habitat is less important than breeding habitat, as the conditions required for breeding to be successful are likely more restricted.

*d. the likely impact (including direct and indirect impacts) that the development, clearing or biodiversity certification will have on the habitat of the local population, including but not limited to:*

> *(i) an estimate of the change in habitat available to the local population as a result of the proposed development*

The Giant Dragonfly's area of occupancy within the North Coast IBRA region is unknown. The known range of the species extends along the east coast of NSW from the Victorian border to northern NSW, and does not extend west beyond the Great Dividing Range.

The impact footprint will cause a decrease in foraging habitat for the species by 14.32 hectares of native (4.22 ha) and exotic (10.1 ha), it is unlikely to impact to breeding habitat. Whilst the Giant Dragonfly is known to forage within urban environments, as seen in BioNet records, it is unknown whether continual development of vegetated foraging habitat is sustainable for the species. As such, a precautionary approach has been adopted, and the estimated change of habitat available for the species is a reduction of 14.32 hectares of potential foraging habitat.

> *(ii) the proposed loss, modification, destruction or isolation of the available habitat used by the local population, and*

The proposal will impact on 14.32 hectares of native (4.22 ha) and exotic (10.1 ha) vegetation identified as possible foraging habitat, with no impact on breeding habitat. Clearing of 14.32 hectares may reduce the total amount of foraging habitat for the local population, as they are recognised as being relatively poor flyers that do not readily disperse (DPIE, 2021). Whilst the Giant Dragonfly is known to forage within urban environments, as seen in BioNet records, it is unknown whether continual development of vegetated foraging habitat is sustainable for the species. As such, a precautionary approach has been adopted with the project undergoing a redesign to avoid and minimise impacts to Giant Dragonfly (see further details in Section 7.0).

> *(iii) modification of habitat required for the maintenance of processes important to the species' life cycle (such as in the case of a plant –pollination, seed set, seed dispersal, germination), genetic diversity and long-term evolutionary development.*

Giant Dragonflys are a species that is poorly understood. Gaps in our knowledge, especially regarding emergence patterns, exist. This species relies on a groundwater regime that provides sufficient surface wetness, to minimise risk at the egg and early larval stage (Baird, 2012).

Surface seepage is vital for species breeding processes (Baird, 2012), which was not identified within the development proposal during times of survey. The main factor associated with the species decline include hydrological disturbance through longwall mining by subsidence, damage to the substrate and subsequent loss of water from the swamp (TBDC, 2024)). The development has been microsited to avoid impacts on potential breeding habitat, where surface seepage is evident. The proposed development footprint would be limited to areas that has been identified as foraging habitat. Surveys did not identify any evidence of potential breeding habitat.

The proposal entails the removal of 14.32 hectares of both native and exotic vegetation, identified as potential foraging habitat. However, it's important to note that habitat neighbouring the development proposal, recognized for its suitable breeding characteristics for the species, will remain unaffected.

*e. the likely impact on the ecology of the local population. At a minimum, address the following:*

> *(i) for fauna: – breeding – foraging – roosting, and – dispersal or movement pathways*

Giant Dragonfly is dependent on a groundwater regime that provides sufficient surface seepage for breeding. Protection of these habitats is integral for the species. Adults emerge during October and will be active until late January (DPIE, 2021). Adults will forage around the swamp edge and within adjacent low shrubby vegetation, in which they will roost during the night (Baird, 2012). Surveys have indicated that the project will not remove habitat suitable for breeding and impacts will be limited to 14.32 hectares of foraging habitat. As an adult, the Giant Dragonfly is considered to be a poor flyer but is still relatively mobile and will be able to access the surrounding conservation lands. This indicates that connectivity of habitat is unlikely to be an issue for the Giant Dragonfly.

*f. a description of the extent to which the local population will become fragmented or isolated as a result of the proposed development*

The Giant Dragonfly's area of occupancy within the North Coast IBRA region is unknown. Its known range extends along the east coast of NSW from the Victorian border to northern NSW, and does not extend west beyond the Great Dividing Range. The proposal will impact upon 14.32 hectares of likely foraging habitat, however, due to the extent of native vegetation within the locality, and the mobility of the species, is unlikely to fragment or isolate a local population.

Whilst there is limited knowledge of the species regarding its area of occupancy, it is known to inhabit peat swamps or mires and surrounding vegetation. Breeding habitat is confined to the Coastal Heath Swamps or Montane Bogs and Fens vegetation classes (Baird & Burgin, 2013), and suitable foraging habitat being largely variable, as outlined above. Appropriate survey methods (BioNet, 2024 (TBDC, 2024)) indicate that swamps and any areas within 500m of swamps are utilised by the species.

Urban development is a threat to the species (SoS, 2024). The proposal is not anticipated to restrict movement across the locality. Due the to the mobile nature of the species, it is not anticipated that the proposed development will impede movement in such a way that it significantly fragments or isolates the population.

*g. the relationship of the local population to other population/populations of the species. This must include consideration of the interaction and importance of the local population to other population/populations for factors such as breeding, dispersal and genetic viability/diversity, and whether the local population is at the limit of the species' range*

Distinct populations for the species exist, largely within the Sydney Basin bioregion. As outlined above, limited knowledge exists surrounding the dispersal of the species, however, large emergence events are theorised to significantly contribute to interpatch movements between populations (Baird, 2012). The proposal is not anticipated to impact breeding habitat, which minimises impact to potential large emergence events (Baird, 2012). Therefore, as breeding habitat will not be impacted, the proposal is unlikely to restrict the interaction of the local population to other populations of the species.

Further, suitable breeding habitat such as the adjacent wetland area, and surrounding foraging habitat, will be retained within the locality. Whilst urban development is a threat to the species (SoS, 2024), due to this species mobile nature it is not anticipated that the proposed development will impede movement in such a way that it significantly restricts dispersal and subsequently genetic variability.

As outlined above, the species range extends along the east coast of NSW from the Victorian border, south of Eden, to northern NSW, near Byron Bay and Tenterfield. The species has not been found west of the Great Dividing Range. The proposal is not located at the limit of the species' range, with the local population likely remaining within the area, unless a large emergence event takes place.

*h. The extent to which the proposed development will lead to an increase in threats and indirect impacts, including impacts from invasive flora and fauna, that may in turn lead to a decrease in the viability of the local population*

The NSW 'Saving our Species' programs' conservation strategy outlines the threats for the Giant Dragonfly. Urban development and longwall mining impacts pose the greatest threat to the species suitable habitat. Despite the proposal being microsited to avoid areas with suitable breeding characteristics, the development will still remove 14.32 hectares of likely foraging habitat.

The proposal will involve the construction of a emergency discharge that will release partially treated effluent during periods of peak flow, likely due to heavy rain and flooding. This event is likely to occur when the landscape is already full with water, diluting the contents of the discharge.

Mitigation measures will be implemented to ensure that impacts to the surrounding water bodies will be minimised, such as erosion and sediment control procedures (see Section 8.8)

Indirect impacts that may be associated with the proposal potentially include weed invasion and a decrease of 14.32 hectares of foraging habitat. The development may inadvertently reduce the health of adjacent vegetation, which could further disrupt likely breeding and foraging habitat for the species.

Continued encroachment into foraging habitat exacerbates the problem. Development and associated construction work have the potential to assist in the transport of invasive weeds into the site and adjacent environment. It is unknown whether invasive flora has an impact on the species breeding habitat, however, provided mitigation measures as outline in Section 8.8 are followed, this impact will be avoided.

The proposed development within the Subject Land has been micro-located to avoid suitable breeding habitat, impacting upon 14.32 hectares of likely foraging habitat. The Giant Dragonfly will also use low shrubby vegetation as roosting and shelter, especially during the night (Baird, 2012) However, there are large area within the surrounding vegetation not impacted as part of the proposal that contain similar vegetation structure in which the species can forage.

> *(i) an estimate of the area, or number of populations and size of populations that is in the reserve system in NSW, the IBRA region and the IBRA subregion*

As outline above, there are several populations existing within NSW for the species. Whilst there is a limited knowledge of the dispersal patterns of the species, Baird (2012) theorises that whilst local populations remain relatively separate, large emergence events are likely to contribute significantly to interpatch movements.

Whilst there are several known populations of the species, as evidenced by BioNet records (2385 recorded individuals), there are no estimated areas of occupancy for the species within NSW, IBRA region or IBRA subregions. The Wollemi IBRA subregion, which forms part of the Sydney Basin bioregion, has the highest number of records for the species. The species is known to breed within peat swamps and mires, foraging within them and the surrounding vegetation.

The species known range extends along the east coast of NSW from the Victorian border to northern NSW, and does not extend west beyond the Great Dividing Range. As such, it is assumed that the total area of occupancy, whilst not able to be determined as an exact area amount, will potentially include all peat swamps and mires within its distribution range, as well as adjacent vegetation up to 500m surrounding them.

The conservation strategy for the Giant Dragonfly has been outlined by the 'Saving our Species' program. This strategy outlines key threats to the species and actions that can be undertaken to minimise impact. This strategy does not outline regions of importance for the species, such that the actions described are not specific and can be implemented across all regions within the distribution range of the species.

As shown in Figure 70, 14.32 hectares of foraging area for Giant Dragonfly within the study will be impacted by the proposal. Suitable breeding and foraging habitat exist within the assessment area adjacent to the proposal.

SAII Assessment as per Section 9.1.2 of BAM 2020 – Giant Dragonfly (*Petalura gigantea*)

| BAM s9.1.2 Sub Clause | BAM s9.1.2 Provision | Assessment- Giant Dragonfly *Petalura gigantea* |
|---|---|---|
| *2a* | Evidence of rapid decline (*Principle 1, clause 6.7(2)(a) BC Regulation*) presented by an estimate of the:<br>i. decline in population of the species in NSW in the past 10 years or three generations (whichever is longer), or<br>ii. 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. | The Giant Dragonfly inhabits the east coast of NSW from the Victorian border to northern NSW but has not been seen west of the Great Dividing Range. Occurrences have been documented in various locations, including the Blue Mountains, Southern Highlands, Clarence River catchment, and coastal swamps from north of Coffs Harbour to Nadgee.<br>Due to increasing urban development, habitat loss, and degradation of wetlands in which it occurs, the species is listed as Endangered under the Biodiversity Conservation Act 2016 (BC Act) (Schedule 1, Part 2 Endangered species, Division 1 Animals). The species is also included in a list made by the department of species likely to be at risk of serious and irreversible impact (SAII) based on Principle 4.<br>Limited knowledge about the species makes estimating local populations difficult, particularly concerning emergence patterns, as larvae can remain in burrows for up to 30 years (DPIE, 2021).<br>**Insufficient knowledge to clearly determine if species meets the Criteria for Principle 1.** |
| *2b* | Evidence of small population size (*Principle 2, clause 6.7(2)(b) BC Regulation*) presented by:<br>i. an estimate of the species' current population size in NSW, and<br>ii. an estimate of the decline in the species' population size in NSW in three years or one generation (whichever is longer), and<br>iii. 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. | There are known occurrences in the Blue Mountains and Southern Highlands, in the Clarence River catchment, and on a few coastal swamps from north of Coffs Harbour to Nadgee in the south (DPE, 2024).<br>BioNet records listed 2385 recorded individuals, the highest density of these are within the Wollemi IBRA subregion, which forms part of the Sydney Basin bioregion. Whilst, in the Port Macquarie area (North Coast IBRA region), there have been six records within the last 30 years.<br>**Unable to determine if species meets the Criteria for Principle 2 in NSW due to uncertainty of the population.** |

| BAM s9.1.2 Sub Clause | BAM s9.1.2 Provision | Assessment- Giant Dragonfly *Petalura gigantea* |
|---|---|---|
| *2c* | Evidence of limited geographic range for the threatened species (*Principle 3, clause 6.7(2)(c) BC Regulation*) presented by:<br>i. extent of occurrence<br>ii. area of occupancy<br>iii. number of threat-defined locations (geographically or ecologically distinct areas in which a single threatening event may rapidly affect all species occurrences), and<br>iv. whether the species' population is likely to undergo extreme fluctuations | The Giant Dragonfly's area of occupancy within the North Coast IBRA region is unknown. Its known range extends along the east coast of NSW from the Victorian border to northern NSW and does not extend west beyond the Great Dividing Range.<br>Whilst there is limited knowledge of the species about its area of occupancy, it is known to inhabit peat swamps or mires and surrounding vegetation. Breeding habitat is confined to the Coastal Heath Swamps or Montane Bogs and Fens vegetation classes (Baird & Burgin, 2013), and suitable foraging habitat being largely variable, as outlined above. Research has indicated that swamps and any areas within 500m of swamps are utilised by the species.<br>The species can remain as larva for six year, and potentially 30 years. There is significant uncertainty around the species emergence patterns, with emergences being unpredictable in space and time. It is likely that the species would experience fluctuations in the adult population between years.<br>Urban development is a threat to the species (SoS, 2024) and would likely struggle to adequately identify the species during surveys due to the unpredictable emergence events of the species.<br>Species may meet the Criteria for Principle 3. |

| BAM s9.1.2 Sub Clause | BAM s9.1.2 Provision | Assessment- Giant Dragonfly *Petalura gigantea* |
|---|---|---|
| *2d* | Evidence that the species is unlikely to respond to management (*Principle 4, clause 6.7(2)(d) BC Regulation*) because:<br><br>i. 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.<br><br>ii. the species is reliant on abiotic habitats which cannot be restored or replaced (e.g., karst systems) on a biodiversity stewardship site, or<br><br>iii. 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). | There are very few known reproductive characteristics for this species, which severely limits the ability of conservation efforts to increase the existing population or habitat expansion for the species. This is considered a species with complex ecology and gaps in understanding. Despite the species having a larval stage that can last 10-30 years, their emergence as adults remains unpredictable, hence it is impossible to determine the species response to management (DPIE 2021).<br><br>The species relies on abiotic habitats linked to underground water for breeding (Baird, 2012). Therefore, the irreversible decline of peat swamps and bogs, caused by habitat loss and degradation due to urban development and longwall mining, will lower water tables, leading to substrate damage and eventual water loss from the swamp, thereby necessitating species to response to management (DPIE 2021).<br><br>There is a lack of knowledge in the species' life history and ecology. While foraging habitats are not explicitly detailed in literature, surveys suggest proximity to swamp habitats is required, with estimations extending up to 500m from such areas (Bairds, 2012).<br><br>BioNet records also show instances of individuals in urban environments unsuitable for breeding. It is assumed that foraging habitats for the Giant Dragonfly are diverse, as long as they're relatively close to suitable swamp environments. While foraging habitat is important, breeding habitat holds greater significance due to its variability.<br><br>Species does meet the Criteria for Principle 4 |
| *3* | Where the TBDC indicates data is 'unknown' or 'data deficient' for a species for a criterion listed in Subsection 9.1.2(2.), the assessor must record this in the BDAR or BCAR. | It remains difficult to reliably estimate the Giant dragonfly population and its security. |

| BAM s9.1.2 Sub Clause | BAM s9.1.2 Provision | Assessment- Giant Dragonfly *Petalura gigantea* |
|---|---|---|
| *4a* | The impact on the species' population (Principles 1 and 2) presented by:<br>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<br>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<br>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. | In the past 30 years, there have been only six recorded sightings of Giant Dragonflies in the Port Macquarie area. The species population and the area of occurrence within the North Coast IBRA region remains uncertain. Hence, estimating the population of this species in New South Wales (NSW) is challenging due to its lack of occurrence in distinct, well characterised, local populations.<br>Due to the uncertainty of the population, estimating the number of individuals impacted by the proposal in the Subject Land is challenging. One individual was identified within the Subject Land. Surveys for the species did not identify any burrows, breeding habitat, or any further evidence of the species.<br>The proposal will impact on 14.32 hectares of native (4.22 ha) and exotic (10.1 ha) vegetation identified as possible foraging habitat. Mitigations in the proposal aim to avoid impacting breeding habitat (Section 8.8).<br>The proposed project is not expected to have an impact on the species population, as it has been redesigned to generally avoid the wetland areas of the Subject Land, which have potential to serve as an important breeding habitat for the species (though no individuals or breeding habitat were found). |

| BAM s9.1.2 Sub Clause | BAM s9.1.2 Provision | Assessment- Giant Dragonfly *Petalura gigantea* |
|---|---|---|
| *4b* | Impact on geographic range (Principles 1 and 3) presented by:<br>i. the area of the species' geographic range to be impacted by the proposal in hectares, and a percentage of the total AOO, or EOO within NSW.<br>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.<br>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.<br>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. | Due to the gaps of understanding the species geographic range, it is not possible to reliably determine the area of species occurrence in NSW. One individual was observed foraging within the Subject Land but further surveys did not identify any burrows, breeding habitat or further individuals in or immediately surrounding the Subject Land.<br>The project would be limited to 14.32 hectares of vegetation, of which 4.22 ha is native vegetation and 10.1 ha is exotic vegetation. Potential breeding habitat within the existing wetlands and swamplands is not anticipated to be impacted by the project. Additionally, the presence of suitable native and exotic vegetation throughout the locality offers alternative foraging habitat for the species. |
| *5* | The assessor may also provide new information that can be used to demonstrate that the principle identifying the species as at risk of an SAII, is inaccurate. | No additional new information that has not been discussed above is required. The project has taken major steps to redesign the project in such as way as to avoid impacts to Giant Dragonfly while balancing potential impacts on other species. |

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# APPENDIX 6 – BAT CALL ANALYSIS RESULTS

# CORYMBIA ECOLOGY

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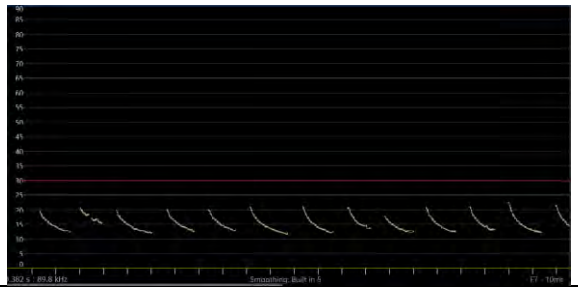
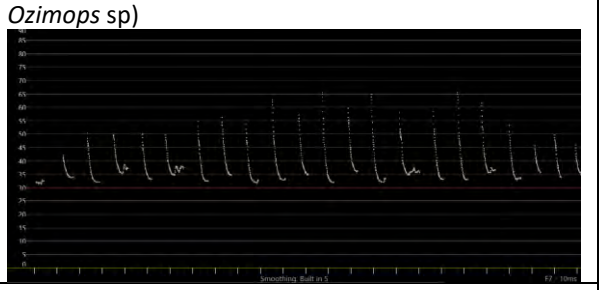
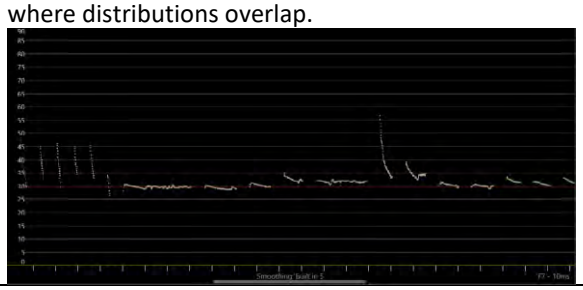
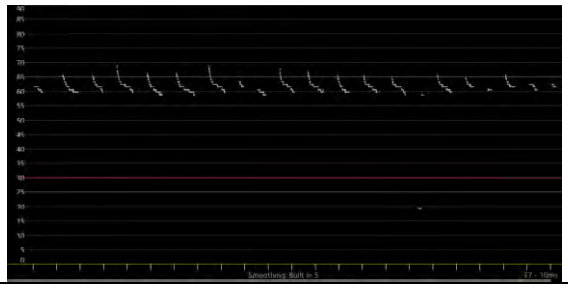
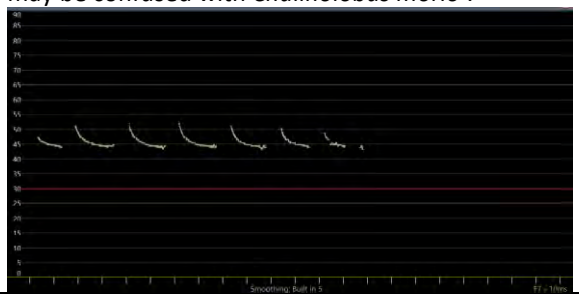
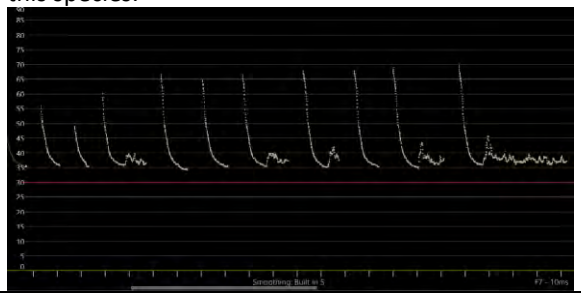
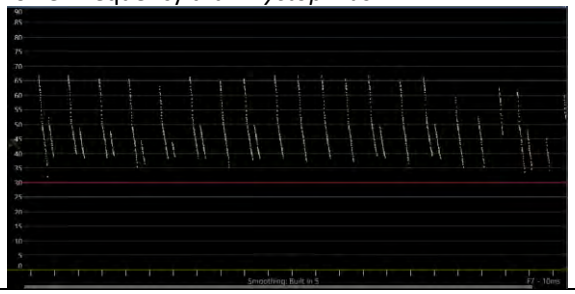
## BAT CALL ANALYSIS RESULTS

## DeWitt – EC217, Thrumster 9-23/11/2023

| Species | Bat 1 13-23/11/23 | Bat 2 9-16/11/23 | Bat 3 9-16/11/23 | Bat 4 14-23/11/23 | Comments |
|---|---|---|---|---|---|
| *Austronomus australis* | D | | D | D | Flat to curved pulse characteristic frequency at 10-15khz  |
| *Chalinolobus gouldii* | D | D | D | D | Usually curved, upright pulses with a prominent foot with no tail. May sometimes downsweep and be flatter at the lower frequencies in more open areas. Alternation is present in many passes which distinguish the species from others calling at the same frequency (i.e. *Scotorepens balstoni* and *Ozimops* sp)  |
| *Chalinolobus morio* | Pr | Pr | D | | Curved upright call with a downsweeping tail. Characteristic frequency at 46.5-53khz. |

| Species | Bat 1 13-23/11/23 | Bat 2 9-16/11/23 | Bat 3 9-16/11/23 | Bat 4 14-23/11/23 | Comments |
|---|---|---|---|---|---|
| | | | | | |
| *Ozimops ridei* | Po | Po | Po | Po | Characteristic frequency 28.5 to 31khz. Usually flat pulses, but also curved in attack phase. During attack phase this species can produce pulses that may be confused with other species calling in the same frequency range. Where distribution overlap this species may be confused with *Ozimops petersi* and *Ozimops planiceps* and *Micronomus norfolkensis.* |
| *Micronomus norfolkensis* | D | Po | D | D | Characteristic frequency 31-35khz. The Characteristic pulses of this species are easily identifiable with alternating flat calls, often with a very short initial section and a down sweeping tail. However, this species displays a wide variety of pulse shapes and sequences, with some segments resembling other species that call in the 35khz range. Non-alternating, distinctive passes could be confused with *Ozimops ridei* or *Ozimops petersi* where distributions overlap.  |
| *Miniopterus australis* | D | D (very high activity) | D | D (very high activity) | Curved upright call with a downsweeping tail. Characteristic frequency at 54 - 64khz.  |
| *Miniopterus orianae oceanensis* | Pr | | Po | Po | Characteristic frequency 43-48khz. The passes at the mid to lower frequencies often have a relatively short initial section, with a fairly long characteristic section with no tail or down sweeping tail. |

| Species | Bat 1 13-23/11/23 | Bat 2 9-16/11/23 | Bat 3 9-16/11/23 | Bat 4 14-23/11/23 | Comments |
|---|---|---|---|---|---|
| | | | | | Consecutive pulses in a sequence are often irregular with varying shape and frequency. There is considerable overlap with *Vespadelus sp* and some passes may not be confidently distinguishable. A more prominent down sweep tail helps to identify from *Vespadelus sp*. The higher frequency pulses, particularly in clutter or roost entrances are steeper with a longer initial section, shorter characteristic section, often down sweeping tail. These sequences may be confused with *Chalinolobus morio* .  |
| *Scotorepens orion* (probable) */ Scoteanax rueppellii* (possible) | E (Pr- *S. orion*) | | E (Pr- *S. orion*) | E (Po *S. orion*) | *Scotorepens orion* - Characteristic frequency 34.5-37.5khz. Curved pulse shape with absent or downsweeping tail. *Scoteanax rueppellii*- curved pulse, characteristic frequency 32-36.5. Often long pre-characteristic section. Frequency of knee usually higher than 37. Call characteristics for these species overlap considerably, usually difficult to give a definite ID for this species.  |
| *Scotorepens sp* | Pr | | Pr | Pr | Characteristic frequency 35-40kh. Curved pulse shape, usually with upsweeping tail. Indistinguishable from *Scotorepens greyii* where distribution overlaps. May also have down sweeping or absent tail and when this occurs it is difficult to separate from *Scotorepens orion*. |

| Species | Bat 1 13-23/11/23 | Bat 2 9-16/11/23 | Bat 3 9-16/11/23 | Bat 4 14-23/11/23 | Comments |
|---|---|---|---|---|---|
| | | | | | |
| *Nyctophilus geoffroyi / Nyctophilus gouldi / Myotis macropus* | E – 13 passes | | | E – 6 passes | Near vertical pulse shape. *Nyctophilus* species currently indistinguishable on call characteristics . *Myotis macropus* calls are very similar to *Nyctophilus* species and often cannot be distinguished. Good Myotis passes are often longer and stronger than *Nyctophilus* with a varying slope between consecutive pulses and often occur at a slightly lower frequency than *Nyctophilus*.  |
| *Vespadelus darlingtoni* | Po | | Po | Po | Characteristic frequency for this species varies geographically from 38-46khz, with higher calls in the north and lower in the south. In the southeast corner of NSW are lower with characteristic frequency of 38-40kz. Passes will overlap with *Vespadelus regulus* above 40khz. |
| *Vespadelus vulturnus* (probable) / *V. troughtoni* (possible) / *V. pumilus* (possible) | E | E | E (very high activity) | E (very high activity) | Characteristic frequency for *V. vulturnus* 42.5-53khz, where this frequency varies geographically. Characteristic frequency for *V. troughtoni* 49-53.5khz. The characteristic frequency of *V. pumilus* is 50-58khz, with a prominent upsweeping tail and lower frequency passes may be confused with *V. troughtoni* and *V. vulturnus.* For *V. vulturnus*, the characteristic frequency of consecutive pulses often varies within a sequence. The passes recorded were more likely *V. vulturnus,* however with the significant overlap in call characteristics, *V. troughtoni* cannot be excluded. If suitable cave habitat occurs in the vicinity for *V. troughtoni* trapping surveys are recommended to confirm presence or apparent absence of the species. |

| Species | Bat 1<br>13-<br>23/11/23 | Bat 2<br>9-<br>16/11/23 | Bat 3<br>9-<br>16/11/23 | Bat 4<br>14-<br>23/11/23 | Comments |
|---|---|---|---|---|---|
| | | | | | |

**Note: only calls identified a definite should be entered in Bionet**

- D – definite; Pr – probable; Po – possible; E – one or more
- Calls were analysed using Anabat Insight.
- Example calls presented below are displayed in this report at F7.
- Analysis was completed on the 1 April 2024.
- Activity levels are in relation to overall activity at the site.
- The following resources were consulted during analysis:
    - Pennay M., Law B., and Reinhold L. (2004) Bat Calls of NSW. DEC of NSW.
    - Corben C. (2009) Anabat Techniques Workshop, Titley Scientific.
    - Personal experience analysing calls and collection of reference calls in NSW
    - Anabat Insight Workshop (2019), Titley Scientific and Balance Environmental.

# APPENDIX 7 – BIODIVERSITY DEVELOPMENT ASSESSMENT REPORT MINIMUM INFORMATION REQUIREMENTS COMPLIANCE

Table Minimum Information Compliance Requirements. The below table indicates where the information required to presented in a BDAR is located within this BDAR. It represents the requirements as per BAM (2020) Appendix K - Table 24 (Stage 1: Biodiversity Assessment) and Table 25 (Stage 2: Impact Assessment (Biodiversity Values)).

| Typical Report Section | Information type | Minimum information | Location in this report |
|---|---|---|---|
| Introduction | Information | Brief description of the proposal | Section 1.0, Section 1.1.3 |
| | | Identification of Subject Site boundary including:<br>• Operation footprint<br>• Construction footprint indicating clearing associated with temporary/ancillary construction facilities and infrastructure | Section 1.1.3, Figure 1 - Figure 5, Figure 8 - Figure 13 |
| | | General description of the Subject Site | Section 1.1.2, Section 1.1.3, Section 3.0, Figure 1 - Figure 5, Figure 8 - Figure 13 |
| | | Sources of information used in the assessment, including reports and spatial data | Section 1.6, Section 2.2.1, Section 2.3.1, Section 2.4.1 |
| | Maps and Tables | Map of the Subject Site boundary showing the final proposal footprint, including the construction footprint for any clearing associated with temporary/ancillary construction facilities and infrastructure | Figure 8 - Figure 13 |
| | Data | NA | NA |
| Landscape context | Information | general description of Subject Site topographic and hydrological setting, geology and soils | Section 1.1.2, Section 3.2.1 Section 3.2.3, Section 3.2.9 |
| | | percent native vegetation cover in the assessment area (as described in BAM Section 3.2) | Section 3.3 Table 6 |
| | | IBRA bioregions and subregions (as described in BAM Subsection 3.1.3(2.)) | Section 3.2.2 |
| | | rivers and streams classified according to stream order (as described in BAM Subsection 3.1.3(3.) and Appendix E) | Section 3.2.3 |
| | | wetlands within, adjacent to and downstream of the site (as described in BAM Subsection 3.1.3(3.)) | Section 3.2.3 |
| | | connectivity of different areas of habitat (as described in BAM Subsection 3.1.3(5–6.)) | Section 3.2.4 |
| | | karst, caves, crevices, cliffs, rocks and other geological features of significance and for vegetation clearing proposals, soil hazard features (as described in BAM Subsections 3.1.3(7.) and 3.1.3(12.) | Section 3.2.5 |
| | | areas of outstanding biodiversity value occurring on the Subject Site and assessment area (as described in BAM Subsection 3.1.3(8–9.)) | Section 3.2.6 |
| | | any additional landscape features identified in any SEARs for the proposal | N/A |
| | | NSW (Mitchell) landscape on which the Subject Site occurs | Section 3.2.7 |
| | Maps and Tables | Site Map<br>• Boundary of Subject Site<br>• Cadastre of Subject Site | Figure 1 - Figure 5. Note: As the nearest IBRA Sub-region |

| Typical Report Section | Information type | Minimum information | Location in this report |
|---|---|---|---|
| | | • Landscape features identified in BAM Subsection 3.1.3 | boundary is approximately 20 km from the Subject Land, this has not been indicated on either the Site Map or Location Map. |
| | | Location Map<br>• Digital aerial photography at 1:1,000 scale or finer<br>• Boundary of Subject Site<br>• Assessment area, (i.e. the Subject Site and either 1500 m buffer area or 500 m buffer for linear development<br>• Landscape features identified in BAM Subsection 3.1.3<br>• Additional detail (e.g. local government area boundaries) relevant at this scale | Figure 6. Note: As the nearest IBRA Sub-region boundary is approximately 20 km from the Subject Land, this has not been indicated on either the Site Map or Location Map. |
| | | IBRA bioregions and subregions | As the nearest IBRA Sub-region boundary is approximately 20 km from the Subject Land, this has not been indicated on either the Site Map or Location Map. |
| | | rivers, streams and estuaries | Figure 1 - Figure 5. |
| | | wetlands and important wetlands | Figure 6 |
| | | connectivity of different areas of habitat | Figure 1 - Figure 5. |
| | | karst, caves, crevices, cliffs, rocks and other geological features of significance and if required, soil hazard features | N/A |
| | | areas of outstanding biodiversity value occurring on the Subject Site and assessment area | N/A |
| | | any additional landscape features identified in any SEARs for the proposal | N/A |
| | | NSW (Mitchell) landscape on which the Subject Site occurs | Figure 1 - Figure 5. |
| | Data | All report maps as separate jpeg files | Supplied with submission |
| | | Individual digital shape files of:<br>• Subject Site boundary | Supplied with submission |

| Typical Report Section | Information type | Minimum information | Location in this report |
|---|---|---|---|
| | | • assessment area (i.e. Subject Site and 1500 m buffer area) boundary<br>• cadastral boundary of Subject Site<br>• areas of native vegetation cover<br>• landscape features | |
| Native vegetation | Information | Identify native vegetation extent within the Subject Site, including cleared areas and evidence to support differences between mapped vegetation extent and aerial imagery (as described in BAM Section 4.1(1–3.) and Subsection 4.1.1) | Section 2.1.2, Section 4.0 opening, Section 4.1.1 |
| | | Provide justification for all parts of the Subject Site that do not contain native vegetation (as described in BAM Subsection 4.1.2) | Section 4.1, see also Section 4.2.7, Section 4.2.4.2.1 and Section 4.3.6 |
| | | Review of existing information on native vegetation including references to previous vegetation maps of the Subject Site and assessment area (described in BAM Section 4.1(3.) and Subsection 4.1.1) | Section 2.2.1, Section 3.2.10. Also many PCT descriptions in Section 4.2 provide further detail. |
| | | Describe the systematic field-based floristic vegetation survey undertaken in accordance with BAM Section 4.2 | Section 2.2.2, Section 2.2.3 |
| | | Where relevant, describe the use of more appropriate local data, provide reasons that support the use of more appropriate local data and include the written confirmation from the decision-maker that they support the use of more appropriate local data (as described in BAM Subsection 1.4.2 and Appendix A) | Not used for this BDAR, stated in Section 5.5 |
| | | For each PCT within the Subject Site, describe:<br>• vegetation class<br>• extent (ha) within Subject Site<br>• evidence used to identify a PCT including any analyses undertaken, references/sources, existing vegetation maps (BAM Section 4.2(1–3.))<br>• plant species relied upon for identification of the PCT and relative abundance of each species<br>• if relevant, TEC status including evidence used to determine vegetation is the TEC (BAM Subsection 4.2.2(1–2.))<br>• estimate of percent cleared value of PCT (BAM Subsection 4.2.1(5.)) | Section 4.2, Section 4.3, Section 4.4, Table 7 - Table 17 |
| | | Describe the vegetation integrity assessment of the Subject Site, including:<br>• identification and mapping of vegetation zones (as described in BAM Subsection 4.3.1)<br>• assessment of patch size (as described in BAM Subsection 4.3.2)<br>• survey effort (i.e. number of vegetation integrity survey plots) as described in BAM Subsection 4.3.4(1–2.) | Section 4.2, Section 4.5, Section 4.6, Table 19, Table 20 |

| Typical Report Section | Information type | Minimum information | Location in this report |
|---|---|---|---|
| | | • use of relevant benchmark data from BioNet Vegetation Classification (as described in BAM Subsection 4.3.3(5.)) | |
| | | Where use of more appropriate local benchmark data is proposed (as described in BAM Subsection 1.4.2, BAM Subsection 4.3.3(5.) and BAM Appendix A):<br>• identify the PCT or vegetation class for which local benchmark data will be applied<br>• identify published sources of local benchmark data (if benchmarks obtained from published sources)<br>• describe methods of local benchmark data collection (if reference plots used to determine local benchmark data)<br>• provide justification for use of local data rather than BioNet Vegetation Classification benchmark values<br>• provide written confirmation from the decision-maker that they support the use of local benchmark data | N/A |
| | Maps and Tables | Map of native vegetation extent within the Subject Site 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 Site that do not contain native vegetation (BAM Subsection 4.1.2) | Figure 33 - Figure 37 |
| | | Map of PCTs within the Subject Site (as described in BAM Section 4.2(1.)) | Figure 38 - Figure 43 |
| | | Map of vegetation zones within the Subject Site (as described in BAM Subsection 4.3.1) | Figure 38 - Figure 43 |
| | | Map the location of floristic vegetation survey plots and vegetation integrity survey plots relative to PCTs boundaries | Figure 16 - Figure 20 |
| | | Map of TEC distribution on the Subject Site and table of TEC listing, status and area (ha) | Figure 44 - Figure 45 |
| | | Map of patch size locations for each native vegetation zone and table of patch size areas (as described in BAM Subsection 4.3.2) | Figure 6 indicates native vegetation in the assessment area, Figure 38 - Figure 43 indicate specific PCT locations, Table 19 identified patch size classes. |
| | | Table of current vegetation integrity scores for each vegetation zone within the site and including:<br>• composition condition score<br>• structure condition score<br>• function condition score<br>• presence of hollow bearing trees | Table 20 |
| | Data | All report maps as separate jpeg files | Supplied with submission |
| | | Plot field data (MS Excel format) | Supplied with submission |
| | | Plot field data sheets | Supplied in excel format with submission |

| Typical Report Section | Information type | Minimum information | Location in this report |
|---|---|---|---|
| | | Digital shape files of:<br>• PCT boundaries within Subject Site<br>• TEC boundaries within Subject Site<br>• vegetation zone boundaries within Subject Site<br>• floristic vegetation survey and vegetation integrity plot locations | Supplied with submission |
| Threatened species | Information | Identify ecosystem credit species likely to occur on the Subject Site, including:<br>• list of ecosystem credit species derived from the BAM-C (as described in BAM Subsection 5.1.1 and Section 5.2(1.))<br>• 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)<br>• justification for addition of any ecosystem credit species to the list | Section 5.1.1, Table 21 |
| | | Identify species credit species likely to occur on the Subject Site, including:<br>• list of species credit species derived from the BAM-C (as described in BAM Subsection 5.1.1)<br>• 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)<br>• 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)<br>• justification for addition of any species credit species to the list | Section 5.1.2, Table 22, Table 23 |
| | | From the list of candidate species credit species, identify:<br>• species assumed present within the Subject Site (if relevant) (as described in BAM Subsection 5.2.4(2.a.))<br>• species present within the Subject Site on the basis of being identified on an important habitat map for a species (as described in BAM Subsection 5.2.4(2.d.))<br>• species for which targeted surveys are to be completed to determine species presence (Subsection 5.2.4(2.b.))<br>• species for which an expert report is to be used to determine species presence (Subsection 5.2.4(2.c.)) | Section 5.2, Table 24 |
| | | Present the outcomes of species credit species assessments from:<br>• threatened species survey (as described in BAM Section 5.2.4)<br>• expert reports (if relevant) including justification for presence of the species and information used to make this | Section 5.3, Table 25 |
| | | Where survey has been undertaken include detailed information on:<br>• survey method and effort, (as described in BAM Section 5.3)<br>• 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<br>• 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<br>• survey personnel and relevant experience | Section 2.3, Section 2.4, Section 5.3, Table 25, see also uploaded GIS data of suitable VZs for survey. |

| Typical Report Section | Information type | Minimum information | Location in this report |
|---|---|---|---|
| | | • describe any limitations to surveys and how these were addressed/overcome | See also Details and Experience of Authors and Contributors<br>2.6 - Limitations |
| | | Where an expert report has been used in place of survey (as described in BAM Section 5.3, Box 3), include:<br>• justification of the use of an expert report<br>• identify the expert, provide evidence of their expert credentials and Departmental approval of expert status<br>• all requirements of Box 3 have been addressed in the expert report | No expert report was sought for this BDAR, stated in Section 5.4 |
| | | Where use of local data is proposed (BAM Subsection 1.4.2):<br>• identify relevant species<br>• identify data to be amended<br>• identify source of information for local data, e.g. published literature, additional survey data, etc.<br>• justify use of local data in preference to VIS Classification or TBDC data<br>• provide written confirmation from the decision-maker that they support the use of local data | No local data was used for this BDAR, stated in Section 5.5 |
| | | Species polygon completed for species credit species present within the Subject Site (assumed present or determined on the basis of survey, expert report or important habitat map) ensuring that:<br>• the unit of measure for each species is documented<br>• for species assessed by area:<br>o the polygon includes the extent of suitable habitat for the target species within the Subject Site (as described in BAM Subsection 5.2.5)<br>o a description of, and evidence-based justification for, the habitat constraints, features or microhabitats used to map the species polygon including reference to information in the TBDC for that species and any buffers applied<br>• for species assessed by counts of individuals:<br>o the number of individual plants present on the Subject Site (as described in BAM Subsection 5.2.5(3.))<br>o the method used to derive this number (i.e. threatened species survey or expert report) and evidence-based justification for the approach taken<br>o the polygon includes all individuals located on the Subject Site with a buffer of 30 m around the individuals or groups of individuals on the Subject Site | Section 5.6, Table 26 |
| | | Identify the biodiversity risk weighting for each species credit species identified as present within the Subject Site (as described in BAM Section 5.4) | Section 5.6, Table 26, Section 10.1, Table 37 |
| | Maps and Tables | Table showing ecosystem credit species in accordance with BAM Section 5.1.1, and identifying:<br>• the ecosystem credit species removed from the list | Table 21 |

| Typical Report Section | Information type | Minimum information | Location in this report |
|---|---|---|---|
| | | • the sensitivity to gain class of each species | |
| | | Table detailing species credit species in accordance with BAM section 5.2 and identifying:<br>• 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<br>• the candidate species credit species not recorded on the Subject Site as determined by targeted survey, expert report or important habitat map | Table 22, Table 23 |
| | | Table detailing species credit species recorded or assumed as present within the Subject Site, 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) | Table 24, Table 25, Table 26. Further details are provided in text of Section 5.3 |
| | | Map indicating the GPS coordinates of all individuals of each species recorded within the Subject Site and the species polygon for each species (as described in BAM Subsection 5.2.5) | Figure 46 - Figure 56, Figure 57 - Figure 59 |
| | Data | Digital shape files of suitable habitat identified for survey for each candidate species credit species | Supplied with submission |
| | | Survey locations including GPS coordinates of any plots, transects, grids | Supplied with submission |
| | | Digital shape files of each species polygon including GPS coordinates of located individuals | Supplied with submission |
| | | Species polygon map in jpeg format | Supplied with submission |
| | | Expert reports and any supporting data used to support conclusions of the expert report | NA |
| | | Field data sheets detailing survey information including prevailing conditions, date, time, equipment used, etc. | NA |
| Prescribed impacts | Information | Identify potential prescribed biodiversity impacts on threatened entities, including:<br>• karst, caves, crevices, cliffs, rocks and other geological features of significance (as described in BAM Subsection 6.1.1)<br>• occurrences of human-made structures and non-native vegetation (as described in BAM Subsection 6.1.2)<br>• corridors or other areas of connectivity linking habitat for threatened entities (as described in BAM Subsection 6.1.3)<br>• water bodies or any hydrological processes that sustain threatened entities (as described in BAM Subsection 6.1.4)<br>• 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)<br>• where the proposed development may result in vehicle strike on threatened fauna or on animals that are part of a threatened ecological community (as described in BAM Subsection 6.1.6) | Section 6.0, Table 27 |

| Typical Report Section | Information type | Minimum information | Location in this report |
|---|---|---|---|
| | | Identify a list of threatened entities that may be dependent upon or may use habitat features associated with any of the prescribed impacts | Described within Table 27 |
| | | 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) | Section 6.0, Table 27 |
| | | Where the proposed development is for a wind farm:<br>• identify a candidate list of protected animals that may use the development site as a flyway or migration route, including: resident threatened aerial species, resident raptor species and nomadic and migratory species that are likely to fly over the proposal area (as described in BAM Subsection 6.1.5)<br>• provide details of targeted survey for candidate species of wind farm developments undertaken in accordance with BAM Subsection 6.1.5(2–3.)<br>• predict the habitual flight paths for nomadic and migratory species likely to fly over the Subject Site and map the likely habitat for resident threatened aerial and raptor species (BAM Subsection 6.1.5(4.)) | NA |
| | Maps and Tables | Map showing location of any prescribed impact features (i.e. karst, caves, crevices, cliffs, rocks, human-made structures, etc.) | Figure 1 - Figure 6. Note: only features present within the assessment area |
| | | 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) | NA |
| | Data | Digital shape files of prescribed impact feature locations | Supplied with submission |
| | | Prescribed impact features map in jpeg format | Supplied with submission |
| Avoid and minimise impacts | Information | Demonstration of efforts to avoid and minimise impacts on biodiversity values (including prescribed impacts) associated with the proposal location in accordance with Chapter 7, including an analysis of alternative:<br>• modes or technologies that would avoid or minimise impacts on biodiversity values and justification for selecting the proposed mode or technology<br>• routes that would avoid or minimise impacts on biodiversity values and justification for selecting the proposed route<br>• alternative locations that would avoid or minimise impacts on biodiversity values and justification for selecting the proposed location<br>• alternative sites within a property on which the proposal is located that would avoid or minimise impacts on biodiversity values and justification for selecting the proposed site | Section 7.0, Section 7.1.2, Section 7.1.3, Section 7.2 |
| | | Describe efforts to avoid and minimise impacts (including prescribed impacts) to biodiversity values through proposal design (as described in BAM Sections 7.1 and 7.2) | Section 7.1.2, Section 7.1.3, Section 7.2 |

| Typical Report Section | Information type | Minimum information | Location in this report |
|---|---|---|---|
| | | 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.)) | Section 7.3 |
| | Maps and Tables | Table of measures to be implemented to avoid and minimise the impacts of the proposal, including action, outcome, timing and responsibility | Table 32, Table 33 |
| | | Map of alternative footprints considered to avoid or minimise impacts on biodiversity values; and of the final proposal footprint, including construction and operation | Plate 21, Plate 22, Plate 24, Plate 25, Plate 26, Plate 28, Plate 29 |
| | | Maps demonstrating indirect impact zones where applicable | Prescribed Impacts are shown in Figure 60 |
| | Data | Digital shape files of:<br>• alternative and final proposal footprint<br>• direct and indirect impact zones | Supplied with submission<br><br>Formal areas of indirect impact have not been mapped as they are generally diffuse across the assessment area. An area of prescribed impact has been included. |
| | | Maps in jpeg format | Supplied with submission |
| Assessment of impacts | Information | Determine the impacts on native vegetation and threatened species habitat, including a description of direct impacts of clearing of native vegetation, threatened ecological communities and threatened species habitat (as described in BAM Section 8.1) | Section 8.5, Table 28 Table 29 |
| | | Assessment of indirect impacts on vegetation and threatened species and their habitat including (as described in BAM Section 8.2):<br>• description of the nature, extent, frequency, duration and timing of indirect impacts of the proposal<br>• documenting the consequences to vegetation and threatened species and their habitat including evidence-based justifications<br>• reporting any limitations or assumptions, etc. made during the assessment<br>• identification of the threatened entities and their habitat likely to be affected | Section 8.6, Table 30 |
| | | Assessment of prescribed biodiversity impacts (as described in BAM Section 8.3) including:<br>• assessment of the nature, extent and duration of impacts on the habitat of threatened species or ecological communities associated with: | Section 8.7 Table 31 |

| Typical Report Section | Information type | Minimum information | Location in this report |
|---|---|---|---|
| | | o karst, caves, crevices, cliffs, rocks and other features of geological significance<br>o human-made structures<br>o non-native vegetation<br>o connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range<br>o movement of threatened species that maintains their life cycle<br>o water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities<br>• assessment of the impacts of wind turbine strikes on protected animals<br>• assessment of the impacts of vehicle strikes on threatened species of animals or on animals that are part of a TEC | |
| | Maps and Tables | Table showing change in vegetation integrity score for each vegetation zone as a result of identified impacts | Table 29 |
| | Data | NA | NA |
| Mitigation and Management of Impacts | Information | Identification of measures to mitigate or manage impacts in accordance with the recommendations in BAM Sections 8.4 and 8.5 including:<br>• techniques, timing, frequency and responsibility<br>• identify measures for which there is risk of failure<br>• evaluate the risk and consequence of any residual impacts<br>• document any adaptive management strategy proposed | Section 8.8 , Section 8.9, Table 32, Table 33 |
| | | Identification of measures for mitigating impacts related to:<br>• displacement of resident fauna (as described in BAM Subsection 8.4.1(2.))<br>• indirect impacts on native vegetation and habitat (as described in BAM Subsection 8.4.1(3.))<br>• mitigating prescribed biodiversity impacts (as described in BAM Subsection 8.4.2) | Section 8.8, Table 32 |
| | | Details of the adaptive management strategy proposed to monitor and respond to impacts on biodiversity values that are uncertain (BAM Section 8.5) | Section 8.9, Table 33 |
| | Maps and Tables | Table of measures to be implemented to mitigate and manage impacts of the proposal, including action, outcome, timing and responsibility | Table 32, Table 33 |
| | Data | NA | NA |
| Impact Summary (BAM ref. Ch 9) | Information | Identification and assessment of impacts on TECs and threatened species that are at risk of a serious and irreversible impacts (SAII, in accordance with BAM Section 9.1) including:<br>• addressing all criteria in Subsection 9.1.1 for each TEC listed as at risk of an SAII present on the Subject Site<br>• addressing all criteria in Subsection 9.1.2 for each threatened species at risk of an SAII present on the Subject Site<br>• documenting assumptions made and/or limitations to information | Section 9.0, Appendix 5 |

| Typical Report Section | Information type | Minimum information | Location in this report |
|---|---|---|---|
| | | • documenting all sources of data, information, references used or consulted<br>• clearly justifying why any criteria could not be addressed | |
| | | Identification of impacts requiring offset in accordance with BAM Section 9.2 | Section 10.1, Table 35, Table 37 |
| | | Identification of impacts not requiring offset in accordance with BAM Subsection 9.2.1(3.) | Section 10.1, Table 35 |
| | | Identification of areas not requiring assessment in accordance with BAM Section 9.3 | Section 10.2 |
| | Maps and Tables | Map showing the extent of TECs at risk of an SAII within the Subject Site | N/A, see Section 4.4 and Section 9.0 for further details. |
| | | Map showing location of threatened species at risk of an SAII within the Subject Site | Figure 70 - Figure 72 |
| | | Map showing location of:<br>• impacts requiring offset<br>• impacts not requiring offset<br>• areas not requiring assessment | Figure 65 - Figure 69 |
| | Data | Digital shape files of:<br>• extent of TECs at risk of an SAII within the Subject Site<br>• location of threatened species at risk of an SAII within the Subject Site<br>• boundary of impacts requiring offset<br>• boundary of impacts not requiring offset<br>• boundary of areas not requiring assessment | Supplied with submission |
| | | Maps in jpeg format | Supplied with submission |
| Impact Summary (BAM ref. Ch 10) | Information | Ecosystem credits and species credits that measure the impact of the development on biodiversity values, including:<br>• future vegetation integrity score for each vegetation zone within the Subject Site (Equation 25 and Equation 26 in BAM Appendix H)<br>• change in vegetation integrity score (BAM Subsection 8.1.1)<br>• number of required ecosystem credits for the direct impacts of the proposal on each vegetation zone within the Subject Site (BAM Subsection 9)<br>• number of required species credits for each candidate threatened species that is directly impacted on by the proposal (BAM Subsection 10.1.3) | Section 10.1, Table 35, Table 36, Table 37. See also Section 11.1, Section 11.2, Table 38, Table 39 |
| | Maps and Tables | Table of PCTs requiring offset and the number of ecosystem credits required | Table 36 |
| | | Table of threatened species requiring offset and the number of species credits required | Table 37 |
| | Data | Submitted proposal in the BAM Calculator | Supplied with submission |

| Typical Report Section | Information type | Minimum information | Location in this report |
|---|---|---|---|
| Biodiversity credit report | Information | Description of credit classes for ecosystem credits and species credits at the development or clearing site or land to be biodiversity certified (BAM Section 10.2) | Section 11.0, Table 38, Table 39, Appendix 3 |
| | Maps and Tables | Table of credit class and matching credit profile | Table 38, Table 39 |
| | Data | BAM credit report in pdf format | Supplied with submission |