



Biodiversity Development Assessment Report

Sandhills Stormwater Management Systems Project

Prepared for Byron Shire Council

By Planit Consulting Pty Ltd

(v1.0) - December 2023

Job No: J6810

Company Details

Name	Planit Consulting Pty Ltd
ABN	20 099 261 711
Address	Level 1, 2247 Gold Coast Hwy, Nobby Beach QLD 4218
Mailing Address	PO Box 206, Nobby Beach QLD 4218
Telephone	(07) 5526 1500
Email	administration@planitconsulting.com.au
Website	www.planitconsulting.com.au

Document Control

Document	PRJ-TEM-016 Report Template_Tomy BDAR_AB Edits.docx
Project Name	Sandhills Stormwater Management Systems Project
Client	Byron Shire Council
Planit Reference	J6810
Revision Number	(v1.0)

Revision History

Revision	Date	Prepared By	Reviewed By	Approved By
(A)	16/08/2022	TR/GD	RH/M	TR
(B)	30/05/2023	TR/GD	RH/MP	TR
(C)	11/12/2023	TR/GD	RVI	TR

Approval Details

Approved By	Tomy Rados
Email	tomy@planitconsulting.com.au
Signature	

Certification Details

This Biodiversity Development Assessment Report has been prepared to address requirements of the NSW *Biodiversity Conservation Act 2016*, the Commonwealth *Environment Protection & Biodiversity Conservation Act 1999*, and the *Byron Local Environmental Plan 2014*. To the best of my knowledge, it presents true and relevant facts without omission, and draws conclusions from logical and reasonable interpretation of the facts. It is current at the date of issue, being 11th December 2023.



Tomislav Rados

BAM Accredited Assessor BAAS18025

Disclaimer

The information within this document is and shall remain the property of Planit Consulting Pty Ltd ("Planit"), including drawings, plans and figures.

This document must be read as a whole and cannot be read or reproduced except in its entirety. The document supersedes all previous draft or interim documents, whether written or presented orally, before the date of this report. Any subsequent reports must be read in conjunction with this document.

This document has been prepared for the sole use of our client, Byron Shire Council, for the particular brief and on the terms and conditions agreed. It may not be used or relied on (in whole or part) by anyone else, or for any other purpose or context without prior written agreement from Planit.

No unauthorised third party is entitled to use or rely on this document whatsoever. Planit accept no liability if any of the advice is used or relied on by the Client for any unauthorised purpose or by any unauthorised third party.

Executive Summary

Planit Consulting has been commissioned by Byron Shire Council to prepare a Biodiversity Development Assessment Report (BDAR) relating to the Sandhills Stormwater Management System Project at Byron Bay.

This Biodiversity Development Assessment Report (BDAR) has been prepared in accordance with the Secretary's Environmental Assessment Requirements (SEARs) issued for the proposal on 1 September 2023 by the Planning Secretary of the NSW Department of Planning and Environment (DPE).

This project will be assessed and determined under Part 5 of the *Environmental Planning and Assessment Act 1979*. The proponent has chosen to 'opt in' to the Biodiversity Offset Scheme to offset the unavoidable impacts as a result of the project.

This BDAR outlines the results of flora and fauna investigations and describes Plant Community Types (PCTs), recorded flora and fauna species, habitat associations and ecological values of the proposed development footprint and surrounding areas.

The development footprint supports three Plant Community Type (PCT):

- PCT 751: Brush Box - Tuckeroo littoral rainforest on coastal headlands of the NSW North Coast Bioregion (Zone 1)
- PCT 1235: Swamp Oak swamp forest of the coastal lowlands of the NSW North Coast Bioregion (Zone 2)
- PCT 1064: Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion (Zones 3 and 4)

Drainage lines and another largely modified/cleared vegetation community occurs within the project area.

The following PCTs recorded within the development footprint are considered to be reflective of an endangered ecological community listed under the NSW Biodiversity Conservation Act 2016 (BC Act):

- PCT 751 - Littoral Rainforest in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions
- PCT 1064 – Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions
- PCT 1235 – Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner Bioregion

Two patches of PCT 1064 are considered to be reflective of the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1992* (EPBC Act) endangered ecological community known as Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland. Additionally, PCT 751 is considered to be reflective of the critically endangered Littoral Rainforest and Coastal Vine Thickets of Eastern Australia.

Targeted surveys within the development footprint and immediate surrounds were conducted for a number of species between June – July 2021, November 2021 – February 2022, October 2022, April 2023 and August 2023.

Six threatened fauna species listed as vulnerable under the *Biodiversity Conservation Act 2016* were recorded during targeted fauna surveys, being the Sooty Owl (*Tyto tenebricosa*), Wallum Froglet (*Crinia tinnula*), Grey-headed Flying Fox (*Pteropus poliocephalus*), Little Bent-winged Bat (*Miniopterus australis*), Large Bent-winged Bat (*Miniopterus orianae oceanensis*) and Southern Myotis (*Myotis macropus*). The Grey-headed Flying Fox is also listed as vulnerable under the EPBC Act.

Two threatened flora species listed as vulnerable under the *Biodiversity Conservation Act 2016* were recorded during targeted flora surveys. Forty-three (43) Stinking Cryptocarya (*Cryptocarya foetida*) individuals and six (6) Fine-leaved Tuckeroo (*Lepiderema pulchella*) individuals were recorded within the study area. Eleven (11) Stinking Cryptocarya occur within the development footprint and will be required to be removed, while all the recorded Fine-leaved Tuckeroo will be retained.

The proposal would result in direct impacts on ~2.0777 ha of native vegetation comprising 'PCT 751: Brush Box - Tuckeroo littoral rainforest on coastal headlands of the NSW North Coast Bioregion (Zone 1)', 'PCT 1235: Swamp Oak swamp forest of the coastal lowlands of the NSW North Coast Bioregion (Zone 2)' and 'PCT 1064: Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion (Zones 3 and 4)'.

Approximately 0.5824 ha of 'Highly Disturbed Areas Cleared of Native Vegetation and/or Dominated by Exotic Grasses with Native Flora Scarce' and 0.06689 ha of 'Drainage Channels +/- Areas of Native Vegetation (Where not part of a PCT)' will be directly impacted upon as a result of the proposal.

Fine-leaved Tuckeroo (*Lepiderema pulchella*) is listed as a serious and irreversible impacts (SAll) entity. The development will retain all individuals of Fine-leaved Tuckeroo and is well removed from the development footprint, therefore not being impacted upon. The Little Bent-winged Bat (*Miniopterus australis*) and Large Bent-winged Bat (*Miniopterus orianae oceanensis*) are SAll entities. No breeding habitat of either of these microbats occur within the site. No other SAll candidates were recorded on site.

This BDAR outlines the measures taken to avoid, minimise and mitigate impacts to the vegetation and habitats present within the development footprint during the design, construction and operation of the development. The residual unavoidable impacts of the proposed development were calculated in accordance with the BAM by utilising the Biodiversity Assessment Method Credit Calculator (BAM-C).

The BAMC calculated that a total of forty-five (45) ecosystem credits are required to offset the unavoidable impacts to the vegetation and habitats present within the development site.

Additionally, twenty-two (22) species credits are required to be retired for the unavoidable impacts to Stinking Cryptocarya. Furthermore, forty-six (46) species credits are required to be retired for impacts upon Southern Myotis habitat and Common Planigale habitat, while six (6) credits are required to be retired for impacts upon Wallum Froglet habitat.

Contents

Document Control	2
Contents	6
1 Introduction	9
1.1 Overview	9
1.2 Site Description & Location.....	11
1.3 Project Description.....	13
1.4 Biodiversity Offset Scheme Entry.....	15
1.5 Aim and Approach.....	16
1.6 Resources, Documents and Policies	16
1.7 Contributors	17
1.8 Relevant Licenses	17
2 Landscape	18
2.1 Identify Landscape Features.....	18
2.1.1 <i>IBRA Regions and Subregions</i>	18
2.1.2 <i>NSW Landscape</i>	18
2.1.3 <i>Geology</i>	21
2.1.4 <i>Hydrology – Rivers, Streams and Wetlands</i>	22
2.1.5 <i>Connectivity Features</i>	24
2.1.6 <i>Areas of Geological Significance</i>	26
2.1.7 <i>Areas of Outstanding Biodiversity Value (AOBV)</i>	26
2.2 Determining the Site Context.....	26
2.2.1 <i>Identification of Method Applied</i>	26
2.2.2 <i>Assessing Native Vegetation Cover</i>	26
2.2.3 <i>Assessing Patch Size</i>	28
3 Native Vegetation	29
3.1 Desktop Mapped Vegetation Communities.....	29
3.1.1 <i>Byron Shire Council Vegetation Map</i>	29
3.1.2 <i>NSW State Vegetation Map</i>	29
3.2 Onsite Vegetation Assessment.....	30
3.2.1 <i>Vegetation Description</i>	33
3.2.2 <i>Plant Community Type (PCT) Justification</i>	39
3.3 Threatened Ecological Communities	43
3.3.1 <i>Vegetation Integrity Assessment</i>	46
4 Threatened Species	47
4.1 Identification of Threatened Species	47
4.1.1 <i>Predicted Ecosystem Credit Species</i>	47
4.1.2 <i>Predicted Species Credit Species</i>	54
4.1.3 <i>Identifying Candidate Species Credit Species for Further Assessment</i>	70
4.1.4 <i>Candidate Species for Further Assessment</i>	92
4.2 Threatened Species Survey.....	97
4.2.1 <i>Habitat Assessment</i>	97
4.3 Targeted Threatened Flora Techniques and Survey Results	98
4.4 Fauna Survey Techniques.....	98
4.4.1 <i>Weather Conditions during Survey</i>	115
4.4.2 <i>Survey Limitations</i>	118
4.5 Site Survey Results.....	118
4.6 Discussion of Survey Results.....	125
4.6.1 <i>Birds</i>	125
4.6.2 <i>Mammals</i>	126
4.6.3 <i>Reptiles</i>	127
4.6.4 <i>Amphibians</i>	128

4.7	Threatened Species Polygons.....	128
5	Prescribed Impacts	134
5.1	Prescribed Biodiversity Values	134
6	Avoid and Minimise Impacts.....	137
6.1	Avoiding and Minimising Impacts of Biodiversity Values.....	137
6.1.1	<i>Locating a Project to Avoid and Minimise Impacts on Biodiversity Values</i>	<i>137</i>
6.1.2	<i>Designing a Project to Avoid and Minimise Impacts on Native Vegetation and Habitat</i> <i>138</i>	
6.1.3	<i>Avoidance of Prescribed Impacts.....</i>	<i>141</i>
7	Assessment of Impacts on Native Vegetation and Habitat.....	142
7.1.1	<i>Direct Impacts.....</i>	<i>142</i>
7.1.2	<i>Indirect Impacts</i>	<i>145</i>
7.1.3	<i>Assessing Prescribed Biodiversity Impacts</i>	<i>145</i>
7.1.4	<i>Serious and Irreversible Impacts</i>	<i>145</i>
7.1.5	<i>Environment Protection and Biodiversity Conservation Act 1999.....</i>	<i>145</i>
7.1.6	<i>Adaptable Management of Uncertain Impacts</i>	<i>146</i>
8	Mitigating and Managing Impacts on Biodiversity Values.....	147
8.1.1	<i>Risk Assessment.....</i>	<i>152</i>
8.2	Unexpected Finds Protocol	153
9	Thresholds for Assessing and Offsetting Impacts	154
9.1.1	<i>Impacts Which Require an Offset.....</i>	<i>154</i>
10	Final Credit Calculations	155
10.1.1	<i>Calculation of the Offset Requirement for Ecosystem Credits.....</i>	<i>155</i>
10.1.2	<i>Calculation of the Offset Requirement for Species Credits.....</i>	<i>155</i>
11	References	156

Appendices

Appendix 1 – Proposal Plan	158
Appendix 2 – Flora List	159
Appendix 3 – BAM Vegetation Integrity Plot Survey Data Sheets.....	160
Appendix 4 – BAM Calculator Report	161
Appendix 5 – MNES Likelihood of Occurrence Assessment	162
Appendix 6 – MNES TEC Field Sheets.....	163
Appendix 7 – MNES Significant Impact Assessment.....	164
Appendix 8 – Planting Plan	165

List of Tables

Table 1-1 Report Contributors.....	17
Table 2-1: NSW Landscape Description.....	18
Table 2-2 Native Vegetation Cover.....	26
Table 3-1 Vegetation Condition Definitions.....	31
Table 3-2 Vegetation Zones and Number of Plots Required	32
Table 3-3 Vegetation Integrity Assessment Scores.....	46
Table 4-1 Predicted Ecosystem Credits.....	48
Table 4-2 Candidate Species Credit Species Identified by the BAM Calculator.....	55
Table 4-3 Assessment of Species Credit Species Habitat.....	71
Table 4-4 Species Credit Species Nominated Survey Periods	92
Table 4-5 Site Habitat Features	97
Table 4-6 Flora and Fauna Survey Efforts.....	105
Table 4-7 Weather Conditions During Survey Period.....	115
Table 5-1: Prescribed Impacts.....	134
Table 7-1 Clearing Rates as a Result of the Proposal.....	143
Table 8-1 Minimisation of Potential Indirect Impacts.....	148
Table 8-2: Risk Matrix.....	152
Table 8-3: Risk Matrix Criteria	152
Table 9-1 Impacts to Native Vegetation That Require Offsets.....	154
Table 9-2 Impacts to Credit Species That Require Offsets.....	154
Table 10-1 Ecosystem Credits Required.....	155
Table 10-2 Species Credits Required	155

List of Figures

Figure 1-1 Site Plan.....	10
Figure 2-1 IBRA Regions And NSW Mitchell Landscapes.....	20
Figure 2-2 eSpade Geology Mapping.....	22
Figure 2-3 Wetlands, Watercourse and Waterbodies.....	23
Figure 2-4 Wildlife Corridors	25
Figure 2-5 Native Vegetation Cover and Patches Within 1500m Buffer Area	27
Figure 3-1 Byron Council Online Mapping	29
Figure 3-2 NSW State Vegetation Map	30
Figure 3-3: Vegetation Map	42
Figure 3-4: BC Act 2016 Endangered Ecological Communities.....	45
Figure 4-1 Fauna and Flora Survey Summary Map 1.....	112
Figure 4-2 Fauna and Flora Survey Summary Map 2.....	113
Figure 4-3 Fauna and Flora Survey Summary August 2023.....	114
Figure 4-4 Species Polygon Plan - Wallum Froglet.....	129
Figure 4-5 Species Polygon Plan – Southern Myotis	130
Figure 4-6 Species Polygon Plan - Common Planigale.....	131
Figure 4-7 Species Polygon Plan – Stinking Cryptocarya	132
Figure 4-8 Species Polygon Plan – Fine-leaved Tuckeroo.....	133
Figure 6-1 Previous Concept Design.....	139
Figure 6-2 Current Concept Design.....	140
Figure 7-1 Clearing Plan.....	144

1 Introduction

1.1 Overview

Planit Consulting has been commissioned by Byron Shire Council to prepare Biodiversity Development Assessment Report (BDAR) relating to the Sandhills Stormwater Management System Project at Byron Bay (refer to **Figure 1-1**).

This Biodiversity Development Assessment Report (BDAR) has been prepared in accordance with the Secretary's Environmental Assessment Requirements (SEARs) issued for the proposal on 1 September 2023 by the Planning Secretary of the NSW Department of Planning and Environment (DPE).

This report outlines the results of flora and fauna investigations and describes Plant Community Types (PCTs), recorded flora and fauna species, habitat associations and ecological values of the proposed development footprint and surrounding areas.

The Biodiversity Development Assessment Report (BDAR) has been prepared by Tomislav Rados, who is an Accredited Assessor (BAAS18025) under the NSW Biodiversity Conservation Act 2016.



Figure 1-1 | Site Plan

1.2 Site Description & Location

The site map subject to this document is provided within **Figure 1-1**. The Development Footprint shall hereafter be referred to as 'the site'.

The Sandhills Crown Reserve is the largest parcel of undeveloped land within the township of Byron Bay. This land was subject to intensive sand mining activities during the early 1960s, though since restoration has been left largely untouched, allowing regrowth of native vegetation communities.

It falls under the ownership of the Crown and is a reserve within the meaning of Part 5 of the Crown Lands Act 1989. Council is currently negotiating tenure with the Crown. The site is centrally located within the town of Byron Bay, generally bound by Lawson Street to the north, Massinger Street to the east, Middleton Street to the west and the Byron recreation grounds to the south. The Crown Reserve has frontages to Gilmore Crescent, Tennyson Street and Cowper Street, and is traversed by a shared path in the Cowper Street road reserve.

The site is located directly across the road (Lawson Street) from Byron Bay's main beach. Land to the north and east is residential in nature with a mix of single dwellings, medium density development and tourist accommodation. To the south, part of the site also joins residential and aged care accommodation, but much of the southern boundary joins the Byron Bay recreation grounds, which contain several sporting fields and associated facilities. To the west, the site adjoins commercial uses and the Byron Bay Town Centre.

As previously stated, the site has historically been subject to sand mining activities which ceased in the late 1960s, allowing natural regeneration to occur. Underground services and stormwater infrastructure (i.e. drainage lines) have also historically been constructed. Presently, the site is vacant land although it is regularly utilised by the public. This is evident through numerous walking tracks and anthropogenic debris (i.e. tents, empty bottles etc.). A shared path (Cowper Street) dissects the central area of the Sandhills Precinct.

A review of 1968 aerial photograph (refer to **Figure 1-2**) indicates that the majority of the area was previously cleared and utilised for sandmining purposes. This was evident as no large (>80cm diameter at breast height) or hollow-bearing trees were noted within the site. Once sandmining activities ceased (around the late 1960s), agencies have carried out maintenance in some areas and some natural regeneration has occurred.



Figure 1-2 | 1968 Aerial (Source: Byron Historical Society)

The majority of the Crown Reserve is zoned as DM Deferred Matter under the Byron LEP 2014 with small portions also zoned as B4 Mixed Use and RE1 Public Recreation (refer to **Figure 1-3**).



Figure 1-3 | Land Use Zoning (BSC, 2014)

1.3 Project Description

The scope of works for the proposal includes the establishment of (refer to Figure 1-4):

- A series of three artificial wetlands, including two permanent open water zones, for stormwater management and water quality improvement.
- Formal entry and circulation paths.
- Landscape works post construction.
- Secondary informal gravel access paths.
- A boardwalk through areas of flood storage overflow.



Figure 1-4 | Proposal Plan

1.4 Biodiversity Offset Scheme Entry

The *Biodiversity Conservation Act 2016*, together with the Biodiversity Conservation Regulation 2017, outlines the framework for addressing impacts on biodiversity from development and clearing. It establishes a framework to avoid, minimise and offset impacts on biodiversity from development through the Biodiversity Offsets Scheme (BOS).

The Biodiversity Offsets Scheme creates a transparent, consistent and scientifically based approach to biodiversity assessment and offsetting for all types of development that are likely to have a significant impact on biodiversity. It also establishes biodiversity stewardship agreements, which are voluntary in-perpetuity agreements entered into by landholders, to secure offset sites.

The Scheme applies to:

- Local development (assessed under Part 4 of the *Environmental Planning and Assessment Act 1979*) that is likely to significantly affect threatened species or triggers the Biodiversity Offsets Scheme threshold;
- State significant development and state significant infrastructure projects, unless the Secretary of the Department of Planning and Environment and the Chief Executive of OEH determine that the project is not likely to have a significant impact;
- Biodiversity certification proposals;
- Clearing of native vegetation in urban areas and areas zoned for environmental conservation that exceeds the Biodiversity Offsets Scheme threshold and does not require development consent;
- Clearing of native vegetation that requires approval by the Native Vegetation Panel under the *Local Land Services Act 2016*; and
- Activities assessed and determined under Part 5 of the *Environmental Planning and Assessment Act 1979* (generally, proposals by government entities), if proponents choose to 'opt in' to the Scheme.

The Biodiversity Offsets Scheme Threshold is a test used to determine when is necessary to engage an accredited assessor to apply the Biodiversity Assessment Method (the BAM) to assess the impacts of a proposal.

It is used for local developments (development applications submitted to councils) and clearing that does not require development consent in urban areas and areas zoned for environmental conservation (under the *State Environmental Planning Policy (Vegetation in Non-Rural Areas) 2017*).

The Biodiversity Conservation Regulation 2017 sets out threshold levels for when the Biodiversity Offsets Scheme will be triggered. The threshold has two elements:

- whether the amount of native vegetation being cleared exceeds a threshold area set out below; and
- whether the impacts occur on an area mapped on the Biodiversity Values map published by the Minister for the Environment.

If clearing and other impacts exceeds either trigger, the Biodiversity Offset Scheme applies to the proposed development including biodiversity impacts prescribed by clause 6.1 of the Biodiversity Regulation 2017.

This project will be assessed and determined under Part 5 of the *Environmental Planning and Assessment Act 1979*. The proponent has chosen to 'opt in' to the Biodiversity Offset Scheme to offset unavoidable impacts as a result of the project.

The proposal will therefore require a Biodiversity Development Assessment Report (BDAR) to accompany the application.

1.5 Aim and Approach

This report has been prepared in accordance with the Biodiversity Assessment Method (DPIE 2020) 'Appendix K: Biodiversity Development Assessment Report and Biodiversity Certification Assessment Report' and aims to:

- describe the biodiversity values present within the Subject Land and surrounding area, including the extent of native vegetation, vegetation integrity and the presence of threatened ecological communities (TECs);
- determine the habitat suitability within the Subject Land for candidate threatened species;
- prepare an impact assessment regarding potential impacts of the proposed development on biodiversity values, including potential prescribed impacts and serious and irreversible impacts (SAIIs) within the Subject Land;
- identify and discuss efforts to avoid and minimise impacts on biodiversity values; and
- calculate the biodiversity credits (i.e. ecosystem credits and species credits) that measure potential impacts of the development on biodiversity values.

This calculation will inform the decision maker of the number and class of offset credits required to be purchased and retired as a result of the proposed development.

1.6 Resources, Documents and Policies

The following resources, documents and policies were utilised during the preparation of this BDAR for the proposal:

- Biodiversity Assessment Method (2020)
- Biodiversity Assessment Calculator
- Proposed layout provided by proponent
- Survey Guidelines for Australia's Threatened Mammals (DEWHA, 2011)
- Survey Guidelines for Australia's Threatened Birds (DEWHA, 2010)
- Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities Working Draft (DEC, 2004)
- NSW Survey Guide for Threatened Frogs – A guide for the survey of threatened frogs and their habitats for the Biodiversity Assessment Method (DPIE, 2020a)
- NSW Guide to Surveying Threatened Plants (DPIE, 2020b)
- Species credit' threatened bats and their habitats – NSW survey guide for the Biodiversity Assessment Method (OEH, 2018)
- Koala (*Phascolarctos cinereus*) Biodiversity Assessment Method Survey Guide (DPE, 2022a)
- Threatened Reptiles Biodiversity Assessment Method Survey Guide (DPE, 2022b)
- *Biodiversity Conservation Act 2016*
- Biodiversity Conservation Regulation 2017
- *Environment Protection and Biodiversity Conservation Act 1999*
- BioNet Atlas of NSW Wildlife database and mapping tool, accessed April 2022
- Threatened Biodiversity Data Collection (TBDC)
- Vegetation Information System (VIS) Classification Data, accessed April 2022
- Google Earth, Nearmap and Six maps (Aerial Photos)
- Sharing and Enabling Environmental Data (SEED)
- Byron Local Environmental Plan 2014
- Byron Shire Council Online Mapping Tools, accessed April 2022.

1.7 Contributors

The roles of all Planit staff responsible for the preparation of this BDAR are listed within Table 1-1 below:

Table 1-1 | Report Contributors

Name	Assessor ID	Role	Experience
Tomy Rados <i>Ecologist / Environmental Planner</i>	BAAS18025	BDAR Preparation Field Surveys GIS Mapping and Analysis Technical Direction BAM Calculator Application	10+ years conducting flora and fauna surveys in northern NSW
Graham Dart <i>Senior Ecologist / Environmental Planner</i>	BAAS19041	Field Surveys GIS Mapping and Analysis Technical Assistance	20+ years conducting flora and fauna surveys in northern NSW

1.8 Relevant Licenses

The following issued licenses are held by the surveyors at the time of survey:

Table 1-2 | Relevant Licences

Authority	Licence/Permit	Title	Expiration	Permit No.
NSW DPI Animal Care & Ethics Committee	Animal Research Approval	Fauna Surveying, Trapping & Release	30 June 2024	TRIM 14/1971
NSW DPI Animal Care & Ethics Committee	Animal Research Authority	Fauna Surveying, Trapping & Release	30 June 2028	TRIM 14/1971
NSW DPIE	Scientific Licence	Ecological Survey	31 May 2024	SL100142

2 Landscape

2.1 Identify Landscape Features

In accordance with the BAM, a number of features are assessed within and surrounding the subject site. Provided below are details related to IBRA region and subregion and NSW landscape regions (Mitchell Landscapes). Other features, such as rivers, streams, estuaries, wetlands, habitat connectivity, areas of geological significance, or areas of outstanding biodiversity value are considered where appropriate.

2.1.1 IBRA Regions and Subregions

The subject site occurs within the following Interim Biogeographic Regionalisation of Australia (IBRA) regional and subregion (as shown within **Figure 2-1**):

Table 2-1 | IBRA Region and Subregion

IBRA Region	South Eastern Queensland
IBRA Subregion	Burringbar – Conondale Ranges

2.1.2 NSW Landscape

The subject site occurs in two NSW Landscape (Mitchell Landscape), being the Byron – Tweed Alluvial Plains as well as the Summervale Range (refer to **Figure 2-1**). A description of this Landscape is provided below (DECC, 2002):

A description of these Landscapes are provided below (DECC, 2002):

Table 2-1: NSW Landscape Description

NSW Landscape	Description
Byron – Tweed Alluvial Plains	<p>Channels, floodplain, terraces and estuary of the Tweed River and other coastal streams on Quaternary alluvium, general elevation 0 to 50m, local relief 15m.</p> <p>Uniform brown earths and structured brown clays on floodplains. Brown texture-contrast soil with high organic content on terrace remnants.</p> <p>Most of the valley is cleared but contained subtropical closed forest with; white booyong (<i>Argyrodendron trifoliolatum</i>), red cedar (<i>Toona australis</i>), and retains many rare species such as; heart-leaved bosistoa (<i>Bosistoa selwynii</i>), velvet laurel (<i>Endiandra hayesii</i>), red-fruited ebony (<i>Diospyros mabacea</i>) and southern fontainea (<i>Fontainea australis</i>).</p> <p>Dry coastal hardwood forest on the terraces and slopes including; cabbage gum (<i>Eucalyptus amplifolia</i>), forest red gum (<i>Eucalyptus tereticornis</i>), broad-leaved apple (<i>Angophora subvelutina</i>), river oak (<i>Casuarina cunninghamiana</i>), silky oak (<i>Grevillea robusta</i>), rough-barked apple (<i>Angophora floribunda</i>), native teak (<i>Flindersia australis</i>), coastal grey box (<i>Eucalyptus bosistoana</i>), pink bloodwood (<i>Corymbia intermedia</i>), spotted gum (<i>Corymbia maculata</i>), grey ironbark (<i>Eucalyptus paniculata</i>), broad-leaved paperbark (<i>Melaleuca quinquenervia</i>), blackwood (<i>Acacia melanoxylon</i>) and black she-oak (<i>Casuarina litoralis</i>).</p>

NSW Landscape	Description
<p>Summervale Range</p>	<p>Higher inland coastal range adjacent to Ballina Coastal Ramp on prominent line of middle Jurassic quartz sandstone and conglomerate, with prominent water gaps where streams have cut across the structure.</p> <p>Strong structural control with north-south folds.</p> <p>General elevation 50 to 325m, local relief 150m. Shallow stony red-brown structured loams, and red, yellow or brown texture-contrast soils in different slope positions, the colour differing with drainage conditions.</p> <p>Dry hardwood forest of; spotted gum (<i>Corymbia maculata</i>), blackbutt (<i>Eucalyptus pilularis</i>), large-fruited blackbutt (<i>Eucalyptus pyrocarpa</i>), with grasses and burrawang (<i>Macrozamia</i> sp.).</p>

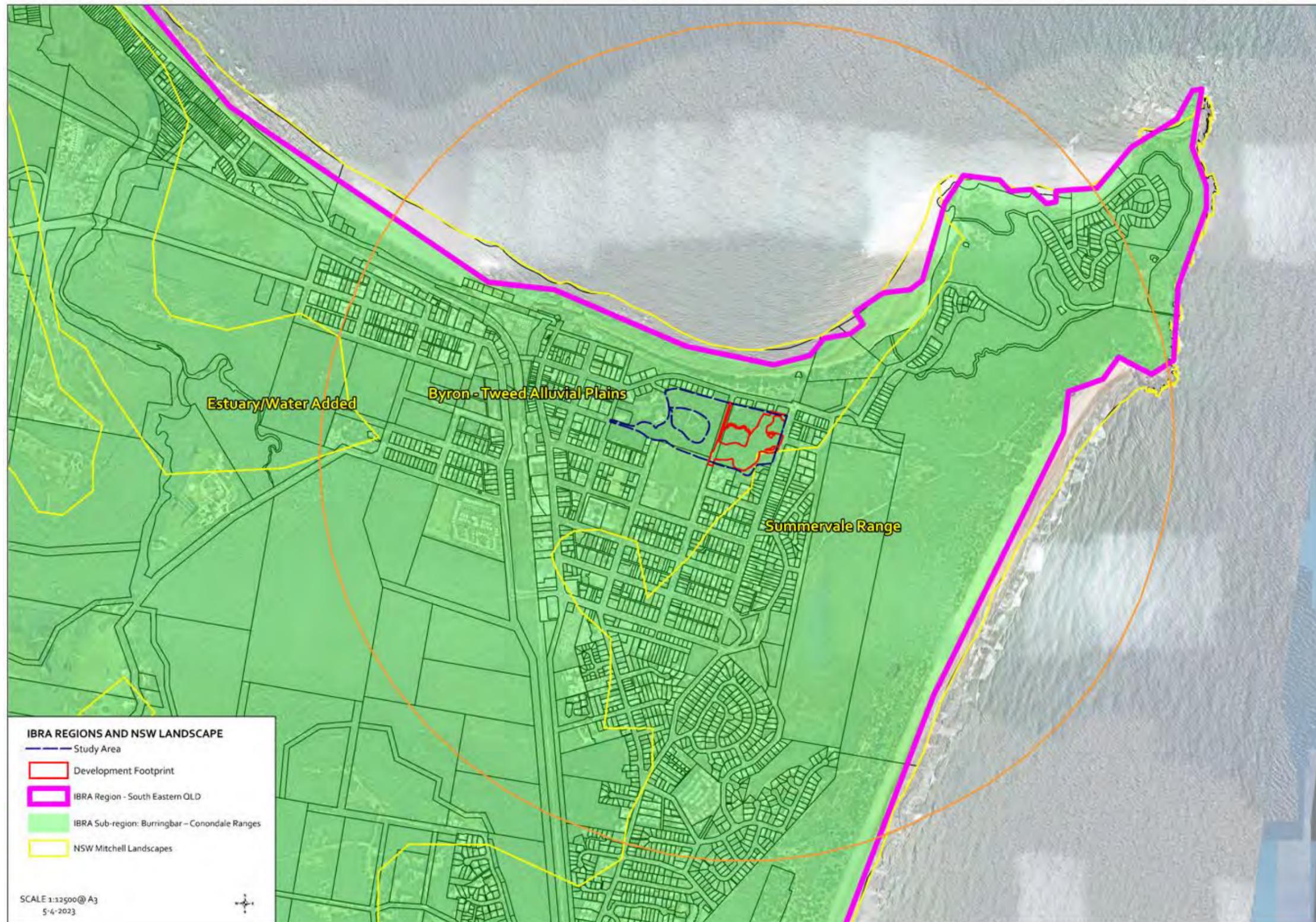


Figure 2-1 | IBRA Regions And NSW Mitchell Landscapes

2.1.3 Geology

The site has been mapped by eSPADE (refer to **Figure 2-2**) as containing the following soil types:

- Tyagarah (9540ty); and
- Bilinudgel variant a (9540bia)

These areas are described in more detail within 'Soil Landscapes of the Murwillumbah Tweed Heads' (Morland, 1996):

Tyagarah (9540ty): Mapped over the majority of the site.

Location: Sediment basins of mixed estuarine and aeolian origin within the inland margins of the Tweed-Byron Coast.

Geology: Quaternary estuarine alluvium overlain by and/or mixed with Quaternary (Pleistocene) sands. The sands are generally Aeolian, originating from the adjacent beach ridge systems.

Topography: Level to gently undulating plains. Watertables are generally within 100-200cm of the surface but can be higher in poorly drained areas. These are essentially the back barrier environment (Thom, 1984), a flat-lying sediment basin located inland of the inner barrier system. Within the back barrier zone sediments have accumulated from a number of processes, as listed below (summarised from Thom, 1984):

- Deposition by suspension from rivers
- Washover sand deposition as extensive sheets which have been transported by storm surges across the shore zone and frontal dune ridges
- Aeolian reworking of exposed sand surfaces to produce back dune flats
- Channel-fill deposition of flood-tidal delta origin

Bilinudgel variant a (9540bia): Small area mapped within the eastern corner.

Location: Low hills on the metasediments of the Neranleigh-Fernvale Group. Occurs on the edges of the Burringbar Hills and on the flanks of the Alstonville Plateau. Also occurs as headlands at Cape Byron and Broken Head. Type location is the area of low hills surrounding Billinudgel and Ocean Shores.

Landscape: low rolling hills on metamorphics of the Neranleigh-Fernvale Group. Relief is 50–100 m, slopes 10–20% and locally >33%. Slopes are generally moderately long (100–300 m). Ridges and crests are narrow (100–150 m). Partly cleared open eucalypt forest. Littoral closed-forest at Brunswick and Broken Heads.

Geology: Neranleigh-Fernvale Group. Thinly bedded fissile shales, siltstones and sandstones with occasional more massive units such as greywacke, volcanic tuffs, agglomerates, sandstones and massive cobble conglomerates (Chesnut 1980). These were previously known as the Fitzroy Beds. Also quartzite, slate and phyllite.

Topography: Low rolling hills that abut the higher and steeper Burringbar (bu) soil landscape. Relief is 50–100 m and slopes range from 10–20%, with some localised steeper (>33%) areas. Elevation is 60–100 m. Slope length is generally moderate (200–300 m) and slope shape is simple and occasionally waning. Ridges and crests are narrow (100–150 m). Sideslopes, rather than distinct hills, are common on the southern part of the sheet near Uralba. Where this soil landscape meets the coast, seacliffs are common such as at Cape Byron and Broken Head. Streams are erosional, tributary and integrated.



Figure 2-2 | eSpade Geology Mapping (Source: eSpade Mapping, 2022)

2.1.4 Hydrology – Rivers, Streams and Wetlands

The site itself does not contain any naturally occurring rivers or streams. A mapped watercourse traverses through the central section of the development footprint. This constructed drainage line is an unnamed Strahler 1st order stream. This drain was historically constructed for stormwater purposes.

A large portion of the site is prone to flooding. Paperbark Swamp Forest and Swamp Oak Forests are present within these lower-laying areas.

The western edge of the study area is located within an area mapped 'proximity area for coastal wetland' (**Figure 2-3**) as defined under the *State Environmental Planning Policy (Resilience and Hazards) 2021*. The development footprint is well removed from this area (>250m).

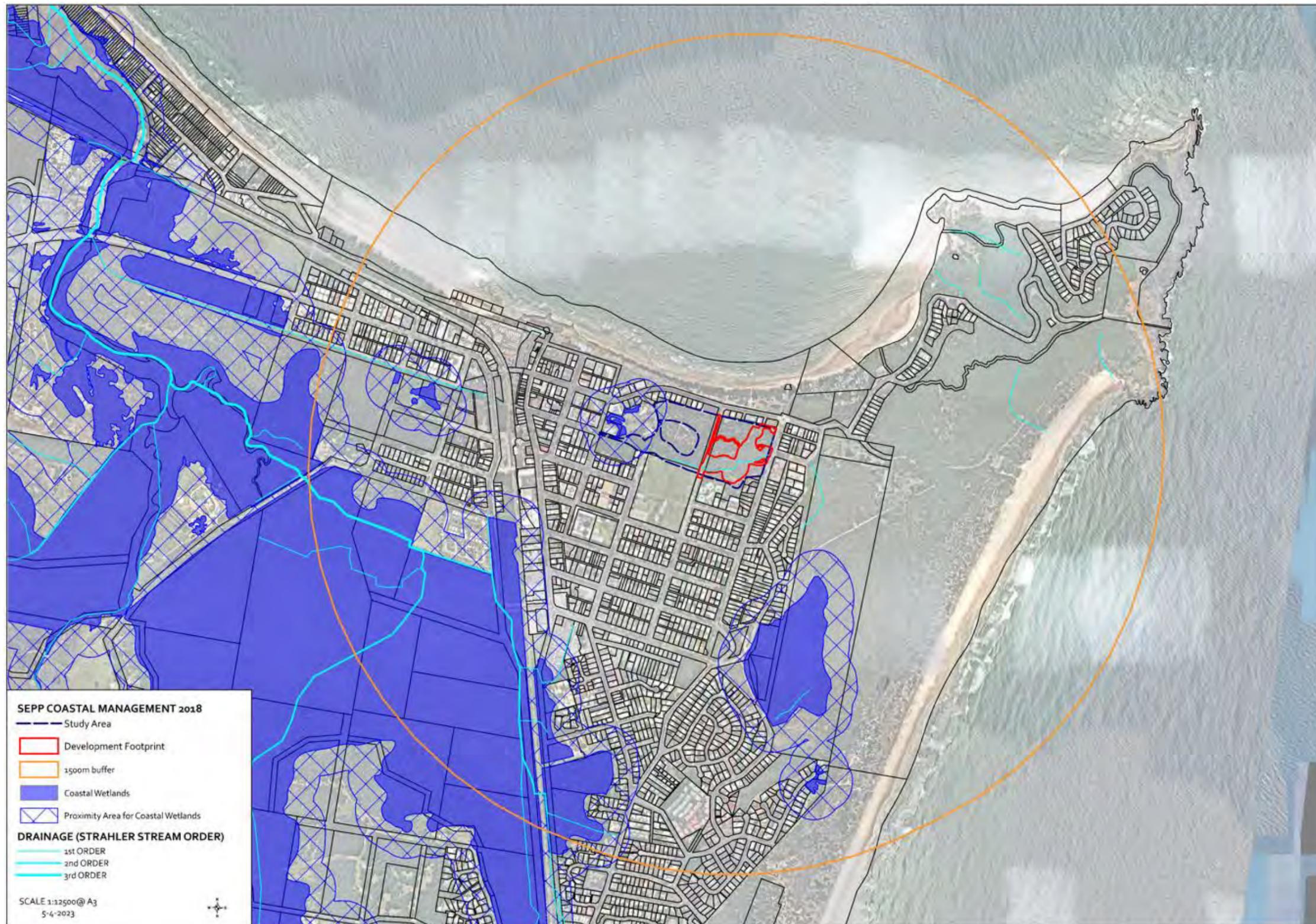


Figure 2-3 | Wetlands, Watercourse and Waterbodies

2.1.5 Connectivity Features

Wildlife corridors can be defined as 'retained and/or restored systems of (linear) habitat which, at a minimum enhance connectivity of wildlife populations and may help them overcome the main consequences of habitat fragmentation' (Wilson & Lindenmayer, 1995).

Corridors can assist ecological functioning at a variety of spatial and temporal scales from daily foraging movements of individuals, to broad-scale genetic gradients across biogeographical regions (Parsons Brinkerhoff, 2005).

The connectivity values of the site are considered to be low-moderate given the highly fragmented nature of the surrounding locality.

The site does not occur within any regional or sub-regional corridors (refer to **Figure 2-4**). The site itself is largely fragmented from expansive forested areas by the surrounding residential areas, fencing, roadways and the ocean.

While it is noted that any development over the site will likely intensify barrier effects for terrestrial fauna species, it is considered unlikely that the proposal (i.e. establishment of wetlands and footpaths) would have a significant impact upon the existing fauna corridor/dispersal values of the site such that its existing dispersal function is significantly diminished. The retained vegetated areas in addition to the proposed wetland creation and future landscape works will ensure fauna movement is ultimately retained throughout the broader landscape.

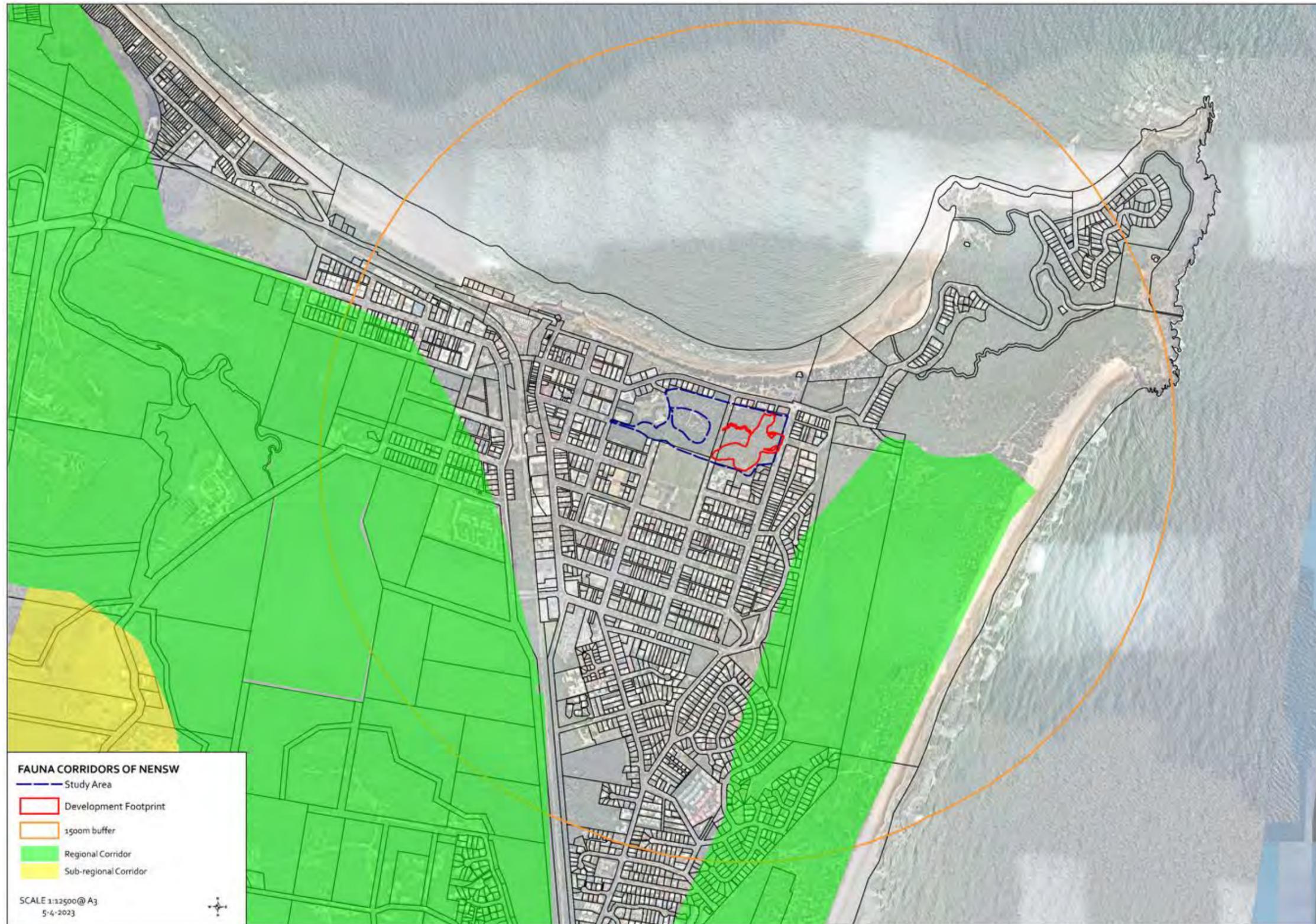


Figure 2-4 | Wildlife Corridors

2.1.6 Areas of Geological Significance

The site is not considered to contain any areas of geological significance. No karst, caves, crevices, cliffs or any other areas of geological significance occurs within the subject site, or areas immediately surrounding the subject site.

2.1.7 Areas of Outstanding Biodiversity Value (AOBV)

Areas of Outstanding Biodiversity Value (AOBV) listed under the *Biodiversity Conservation Act 2016* include:

- Wollemia nobilis (The Wollemi Pine)
- Little Penguin population in Sydney's North Harbour
- Gould's Petrel (*Pterodroma leucoptera leucoptera*)
- Mitchell's Rainforest Snail (*Thersites mitchellae*) in Stotts Island Nature Reserve

The site is well removed from the listed AOBVs.

2.2 Determining the Site Context

The following site context was determined:

2.2.1 Identification of Method Applied

A site-based method was applied for the proposed development and this BDAR.

2.2.2 Assessing Native Vegetation Cover

Native vegetation cover and patch size have been assessed in accordance with Section 3.2 and Section 4.3.2 of the *Biodiversity Assessment Methodology (2020)*.

Native vegetation mapping within the buffer circle utilised the Byron Shire Council's Vegetation Mapping (BSC, 2021) and aerials sourced from Nearmap. The mapping also considered the knowledge of the locality, including previous site inspections, history of disturbance, Google street view and reviewing ecological studies previously conducted in the locality.

Native vegetation cover is assigned to a class, being 0-10%, >10-30%, >30-70% and >70% for the proposal.

Within the 1500m buffer surrounding the subject site, native vegetation comprises ~260ha of the ~822ha area within the assessment circle. This equates to approximately 32% of the assessment circle covered by native vegetation, which corresponds with the >30-70% vegetation cover class.

The native percentage cover is shown within **Table 2-2** and illustrated within **Figure 2-5** below.

Table 2-2 | Native Vegetation Cover

Total Area within the 1500m buffer area (ha)	Native vegetation cover within the 1500m buffer area (ha)	Vegetation Cover Class %
822	260	>30-70%



Figure 2-5 | Native Vegetation Cover and Patches Within 1500m Buffer Area

2.2.3 Assessing Patch Size

A Patch Size is defined as the following within the BAM:

“An area of native vegetation that:

- a) occurs on the development site or biodiversity stewardship site, and
- b) includes native vegetation that has a gap of less than 100 m from the next area of native vegetation (or ≤ 30 m for non-woody ecosystems).

Patch size may extend onto adjoining land that is not part of the development site or biodiversity stewardship site.”

Patch size is required to be assessed as one of four classes per vegetation zone mapped, being <5 ha, 5-24 ha, 25-100 ha or >100 ha.

In assessing the patch size, native vegetation within 100 m (or ≤ 30 m for non-woody ecosystems) but which are separated by hard barriers (i.e. permanent artificial structures such as buildings and wide roadways) are being treated as separate patches. These highly modified breaks in vegetation connectivity would significantly alter ecological function of these areas of native vegetation such that these areas warrant recognition as separate patches.

The subject site's vegetation adjoins (<100m gap) similar forested sclerophyll type vegetation to the northwest which ultimately connects to Cape Byron Conservation Area and Arakwal National Park. This patch size is well in excess of 100ha.

The patch size in which the subject vegetation occurs has been estimated to be in the >100ha class.

3 Native Vegetation

3.1 Desktop Mapped Vegetation Communities

3.1.1 Byron Shire Council Vegetation Map

The Byron Council Online Mapping (refer to **Figure 3-1**) maps the following vegetation communities as occurring within the site:

- Coastal Dune Dry Sclerophyll Forest;
- Coastal Swamp Forest; and
- Coastal Heath Swamps.



Figure 3-1 | Byron Council Online Mapping

3.1.2 NSW State Vegetation Map

A review of the NSW State Vegetation Type Map notes that the following Plant Community Types (PCTs) occur within the Study Area:

- PCT 3988: Far North Mesophyll Paperbark Swamp Forest;
- PCT 3989: Far North Paperbark Fern Swamp Forest;
- PCT 3900: Northern Sandplain Saw-sedge-Fern Swamp Heath;
- PCT 3553: Northern Sands Bloodwood-Swamp Turpentine; and
- PCT 3132: Northern Sands Tuckeroo-Banksia Forest.



A total of seven (7) vegetation integrity survey plots were conducted. The location of these plots is provided within **Figure 3-3**.

Samples of flora species which were unable to be identified during the site assessment were analysed in the office with the aid of recognised field guides and botanical keys.

Vegetation conditions of each PCT is required as per the BAM. Vegetation conditions are defined as either being good, moderate or low as presented within **Table 3-1** below.

Table 3-1 | Vegetation Condition Definitions

Vegetation Condition	Definition
Good	Pristine or nearly so, no obvious signs of disturbance or damage caused by human activities since European settlement.
Moderate	Vegetation retaining a native canopy and has a native understorey of greater than 50% cover. This condition class can include derived native grasslands and can have minor weed incursions with some patches being subject to grazing.
Poor	Vegetation within which the understorey is generally dominated by exotic species being greater than 50% exotic cover. The shrub layer is generally sparse and/or dominated by weeds. Severely impacted by grazing and human disturbances.

Table 3-2 | Vegetation Zones and Number of Plots Required

Vegetation Zone	Plant Community Type (PCT)	Condition	Area within Development Footprint (ha)	Plots Required	Plots Completed
1	PCT 751: Brush Box - Tuckeroo littoral rainforest on coastal headlands of the NSW North Coast Bioregion	Poor - Moderate	0.5646	1	2
2	PCT 1235: Swamp Oak swamp forest of the coastal lowlands of the NSW North Coast Bioregion	Poor - Moderate	0.05263	1	1
3	PCT 1064: Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion	Poor	0.2615	1	1
4	PCT 1064: Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion	Poor - Moderate	1.199	1	2
5	PCT 1302: White Booyong – Fig subtropical rainforest of the NSW North Coast Bioregion	Poor - Moderate	0	0	0
6	PCT 1275: Tuckeroo – Riberry – Yellow Tulipwood Littoral Rainforest of the NSW North Coast Bioregion (Poor Moderate Condition)	Poor - Moderate	0	0	0
-	Slash Pine (<i>Pinus elliotii</i>) Forest	N/A	0	0	0
-	Closed Camphor Laurel (<i>Cinnamomum camphora</i>) Forest	N/A	0	0	0
-	Post-mining Coastal Heath Shrubland-Forest (<i>Leptospermum laevigatum</i>)	N/A	0	0	1
-	Drainage Channels (where not part of a PCT)	N/A	0.06886	0	0
-	Highly Disturbed Areas Cleared of Native Vegetation and/or Dominated by Exotic Grasses with Native Flora Scarce (<15% cover)	N/A	0.58241	0	0
Total			2.729	4	7

3.2.1 Vegetation Description

A description of the identified vegetation zones within the Study Area are provided below:

Zone 1 - PCT 751: Brush Box - Tuckeroo littoral rainforest on coastal headlands of the NSW North Coast Bioregion (Poor - Moderate Condition)



This community occupies the central and northern areas of the Study Area. The area was subject to sand-mining activities which ceased in the late 1960s, allowing for regeneration to occur. As a result of this, no mature (i.e. hollow-bearing trees) occur within the site. The structure of the community varies between open forest to woodland within the 12-18m height range.

Although the canopy layer is dominated by Coastal Banksia (*Banksia integrifolia*), early regrowth rainforest occurs within the mid-lower strata. Whilst not going into great detail, a variety of trees were noted within the sub-canopy and small tree layers which included Tuckeroo (*Cupaniopsis anacardioides*), Beach Acronychia (*Acronychia imperforata*), Blackbean (*Castanospermum australe*), Stinking Cryptocarya (*Cryptocarya foetida*), Pepperberry (*C. obovata*), Three-veined Laurel (*C. triplinervis*), Ribbonwood (*Euroschinus falcatus*), Wild Quince (*Guioa semiglauca*), Green Bolly Gum (*Neolitsea australis*), Macaranga (*Macaranga tanarius*), Midgenberry (*Austromyrtus dulcis*), Sweet Pittosporum (*Pittosporum undulatum*), Ribbery (*Syzygium luehmannii*), Fine-leaved Tuckeroo (*Lepiderema pulchella*), Foambark (*Jagera pseudorhus*) and Weeping Lillipillii (*Waterhousia floribunda*).

The lowest strata is mixed and varies from exposed sand or a deep leaf litter layer/fallen timber, to areas dominated by exotic grasses and herbaceous weeds. Juvenile specimens of plant species recorded in the higher strata are noted, with native grasses and ferns sporadically present.

Those species most commonly encountered include Creeping Beard Grass (*Oplismenus aemulus*), Bracken (*Pteridium esculentum*), Tall Saw Sedge (*Gahnia clarkei*), Soft Bracken (*Calochlaena dubia*) and Pennywort (*Centella asiatica*).

Vines are common and well established in numerous areas including Monkey Rope (*Parsonia straminea*), Snake Vine (*Hibbertia scandens*), Burny Vine (*Trophis scandens*), Water Vines (*Cissus Antarctica*, *C. sterculiifolia*), Barbed-wire Vine (*Smilax australis*), Tape Vine (*Stephania japonica*) and Scrambling Lily (*Geitenoplesium cymosum*).

A variety of epiphytes were also encountered including Birds Nest Fern (*Asplenium australasicum*), Staghorn (*Platycterium superbum*) and Elkhorn (*Platycterium bifurcatum*). Weeds are also common on the fringes of the community, particularly adjacent existing residences, within canopy gaps and along tracks.

Weed species are dominant or codominant within the understory of this community. The shared fringes with adjacent residences, tracks and canopy gaps also exhibit infestations of woody and herbaceous pasture/environmental weeds dominating the lower strata and becoming impenetrable in several thickets. Species recorded include Umbrella Tree (*Scefflera actinophylla*), Camphor Laurel (*Cinnamomum camphora*), Vasey Grass (*Paspalum* spp.), Pigeon Grass (*Setaria sphacelata*), Wild

Tobacco (*Solanum mauritianum*), Brazil Cherry (*Eugenia uniflora*), Devil's Fig (*Solanum hispidum*), Lantana (*Lantana camara*), Slash Pine (*Pinus elliottii*), Mickey Mouse Plant (*Ochna serrulata*), Paddy's Lucerne (*Sida rhombifolia*), Easter Cassia (*Senna pendula*), Asparagus Fern (*Asparagus aethiopicus*, *A. plumosus*), Blue Billygoat Weed (*Ageratum houstonianum*), Crofton weed (*Ageratina adenophora*), Fishbone Fern (*Nephrolepis cordifolia*), Mistweed (*Ageratina riparia*), Silverleaf (*Desmodium uncinatum*), Singapore Daisy (*Sphagneticola trilobata*), Privet (*Ligustrum lucidum*), Pepper Tree (*Schinus terebinthifolius*), Thickhead (*Crassocephalum crepidioides*), Climbing Nightshade (*Solanum seaforthianum*), Cocos Palm (*Syagrus romanzoffiana*), Mile-a-minute (*Ipomoea cairica*), White Passionflower (*Passiflora subpeltata*) etc.

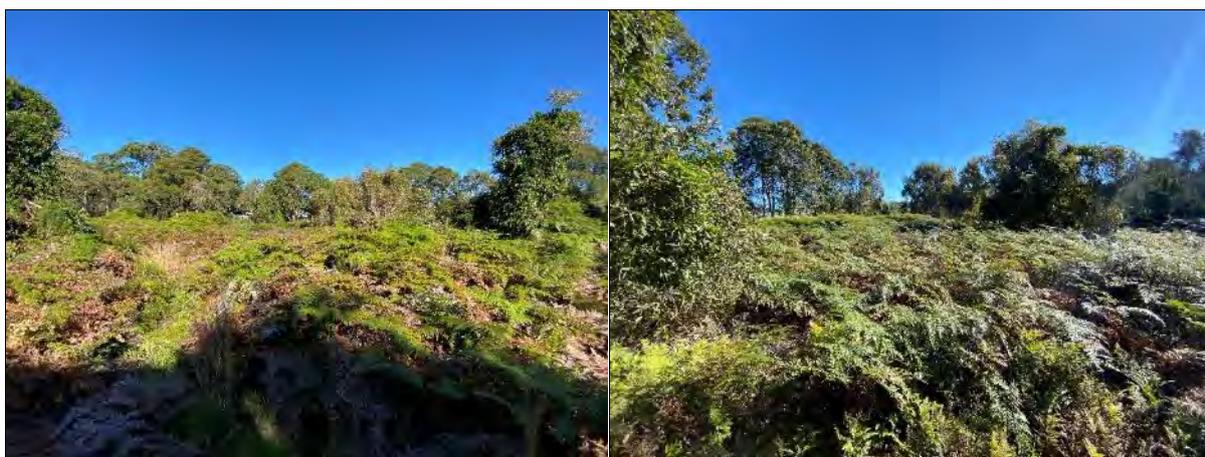
Zone 2 -PCT 1235: Swamp Oak swamp forest of the coastal lowlands of the NSW North Coast Bioregion (Poor – Moderate Condition)



This community occurs as sporadic patches of Swamp Oak (*Casuarina glauca*) throughout the Study Area, in particularly within the western areas which extends offsite.

The condition of this community varies depending upon the maintenance regime. Areas subject to regular slashing/mowing occurs as maintained grassed areas, while unmaintained areas are dominated by weeds and exotic grasses, although the occasional native sedge and forb were also noted.

Zone 3 - PCT 1064: Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion (Poor Condition)



This community occurs as a relatively large patch within the southeastern portion of the Study Area where the tree layer has been largely removed. This area is slightly higher in elevation in comparison to the neighbouring Swamp Sclerophyll Forest community and isn't subject to frequent waterlogging.

The community is very dense and dominated by Ferns within the 1-2m height range, principally comprising of Bracken (*Pteridium esculentum*) and Coral Fern (*Gleichenia dicarpa*). Additional native ferns, sedges, rushes and forbs were also recorded, amongst other herbaceous weeds and exotic grasses. Whilst scarce, the occasional shrub/tree (i.e. paperbark, wattle, bottlebrush) were noted.

Zone 4 - PCT 1064: Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion (Poor – Moderate Condition)



This community occupies the majority of the southern and eastern portions of the Study Area which is low-laying and subject to regular ponding. Several constructed drainage lines traverses through these areas.

The canopy layer of the community is comprised primarily of Broad-leaved Paperbark (*Melaleuca quinquenervia*) typically in the 8-15m height range. The canopy is mostly intact although several areas of fragmentation occur due to historical clearing and maintenance regimes.

Whilst Paperbark is the dominant species within this community, several additional canopy and sub-canopy species noted included Pink Doughwood (*Melicope elleryana*), Swamp Box (*Lophostemon suaveolens*), Swamp Oak (*Casuarina glauca*), Blueberry Ash (*Elaeocarpus reticulatus*), Corkwood (*Duboisia myoporoides*), Willow Bottlebrush (*Callistemon salignus*), Tuckeroo (*Cupaniopsis anacardioides*), Sandpaper Fig (*Ficus coronata*), Wattles (*Acacia sophorae*, *A. melanoxylon*, *A. fimbriata*), Brown Kurrajong (*Commersonia bartamia*), Bangalow Palm (*Archontophoenix cunninghamiana*), Alexander Palm (*A. alexandrae*), Cheese Tree (*Glochidion ferdinandi*), Umbrella Cheese Tree (*Glochidion sumatranum*), Brown Bolly Gum (*Litsea australis*) and Beach Acronychia (*Acronychia imperforata*).

The ground layer varies from being grassy and/or weedy to being comprised of ferns and semi-aquatic species in the lowest areas. A deep leaf litter layer is also prominent throughout this community. Species recorded within the lower strata included Bracken (*Pteridium esculentum*), Matrush (*Lomandra longifolia*), Wandering Jew (*Commelina cyanea*), Climbing Maidenhair (*Lygodium microphyllum*), Blue Flax Lily (*Dianella caerulea*), Pennywort (*Centella asiatica*), Sedges (*Cyperus difformis*, *C. polystachyos*), Tall Saw-sedge (*Gahnia clarkei*), Pouched Coral Fern (*Gleichenia dicarpa*), Common Rush (*Juncus usitatus*), Common Reed (*Phragmites australis*), Slender Rice Flower (*Pimelea linifolia*), Pastel Flower (*Pseuderanthemum variabile*), Bog Rush (*Schoenus brevifolius*), Swamp Water Fern (*Blechnum indicum*), Binung (*Cyclosorus dentatus*), Rainbow Fern (*Calochlaena dubia*), Water Primrose (*Ludwigia octovalvis*) and Cumbungi (*Typha orientalis*).

Scramblers, vines and epiphytic species included Strangler Fig (*Ficus watkinsiana*), Bird's Nest Fern (*Asplenium australasicum*), Guinea Vine (*Hibbertia scandens*), Coastal Morning Glory (*Ipomoea cairica*), Climbing Fern (*Lygodium microphyllum*), Monkey Rope (*Parsonsia straminea*), Barbed Wire Vine (*Smilax australis*), and Tape Vine (*Stephania japonica*).

Exotic species were common throughout this community, in particularly Singapore Daisy (*Sphagneticola trilobata*) and exotic grasses (i.e. *Setaria sphacelata*, *Paspalum* spp., *Axonopus* spp., *Melinis minutiflora*) which dominated the ground-layer in several locations. Additional weeds noted included Crofton Weed (*Ageratina adenophora*), Blue Billygoat Weed (*Ageratum houstonianum*),

Umbrella Tree (*Schefflera actinophylla*), Broad-leaved Pepper Tree (*Schinus terebinthifolius*), Easter Cassia (*Senna pendula* var. *Glabrata*), Paddy's Lucerne (*Sida rhombifolia*), Camphor Laurel (*Cinnamomum camphora*), Wild Tobacco (*Solanum mauritianum*) and Cocos Palm (*Syagrus romanzoffianum*).

Zone 5 - PCT 1302: White Booyong – Fig subtropical rainforest of the NSW North Coast Bioregion (Poor – Moderate Condition)



This community occurs as a patch of Bangalow Palms (*Archontophoenix cunninghamiana*) within the very western section of the Study Area, south of the Court House. A well-known Flying-fox roost site occurs within this patch of vegetation. The canopy is 12-18m in height and comprised almost entirely of Bangalow Palms.

Although scarce, additional trees noted within the canopy and mid-strata layer included Broad-leaved Paperbark (*Melaleuca quinquenervia*), Camphor Laurel (*Cinnamomum camphora*), Umbrella Tree (*Schefflera actinophylla*), Swamp Oak (*Casuarina glauca*) and Cheese Tree (*Glochidion ferdinandi*).

The ground-layer varies considerably, depending upon flooding regimes. Areas subject to frequent ponding occurs as bare mud with fallen debris (i.e. palm fronds), whereas areas subject to infrequent ponding events comprised primarily of weeds, in particularly Singapore Daisy and exotic grasses.

Zone 6 - PCT 1275: Tuckeroo – Riberry – Yellow Tulipwood Littoral Rainforest of the NSW North Coast Bioregion (Poor – Moderate Condition)



This vegetation community occurs along the eastern boundary of the Study Area, extending into the Massinger Street road reserve which were generally limited to small clusters of Tuckeroo (*Cupaniopsis anacardioides*) within the 6-12m height range.

The lower strata is heavily disturbed and dominated by exotic grasses and herbaceous weeds.

Slash Pine (*Pinus elliottii*) Forest



This community occurs as a small patch within the southwestern portion of the Study Area, north of sporting fields. The community is dominated by Slash Pines (*Pinus elliottii*) within the 12-16m height, although native species were occasionally present such as Broad-leaved Paperbark (*Melaleuca quinquenervia*), Swamp Box (*Lophostemon suaveolens*), Wattles (*A. sophorae*) and Swamp Oak (*Casuarina glauca*).

The shrub layer is non-existent with the ground layer occupied by either a deep layer of pine needles and/or exotic grasses.

Closed Camphor Laurel (*Cinnamomum camphora*) Forest



This community occurs as two patches within the southwestern portion of the Study Area, north of Tennyson Street. The community is dominated by Camphor Laurel (*Cinnamomum camphora*) within the 8-15m height range.

Although dominated by Camphor Laurel, several native species were also noted, in particularly rainforest type trees/shrubs such as Bangalow Palm (*Archontophoenix cunninghamiana*), Stinking Cryptocarya (*Cryptocarya foetida*), Cheese Tree (*Glochidion ferdinandi*) and Scentless Rosewood (*Synoum glandulosum*). Typical to Camphor Laurel forests, the groundlayer comprises of a deep leaf litter layer.

Post-mining Coastal Heath Shrubland-Forest (*Leptospermum laevigatum*)



This community occurs within the central portion of the Study Area which has historically been subject to sand mining. The area is predominately monospecific of Coast Tea Tree (*Leptospermum laevigatum*) which reaches its natural northern limit around Nambucca Heads. This species is commonly planted post sand-mining activities. Additional species is scarce although Wattles, Pines and Banksia were also noted.

The lower strata are predominantly denuded of vegetation and limited to leaf litter and sand with the occasional patch of exotic grass and/or weeds. Walking tracks and anthropogenic debris are common within this area.

Drainage Channels (where not part of a PCT)



This community occurs within the southeastern and southwestern areas of the site in association with a series of constructed drainage lines which were historically created for stormwater purposes.

Similar to the rest of the site, the condition of this association was for the most part in poor condition. The banks of the drains were highly infested with weeds, in particularly Singapore Daisy and exotic grasses.

Aquatic and semi-aquatic species were scarce, although several species were occasionally observed such as Common Reed (*Phragmites australis*), Cumbungi (*Typha orientalis*), Bog Rush (*Schoenus brevifolius*), Water Lily (*Nymphaea caerulea*), Frogsmouth (*Philydrum lanuginosum*), Knotweed (*Persicaria strigosa*), Pennywort (*Hydrocotyle bonariensis*), Club Rush (*Isolepis inundata*), Willow Primrose (*Ludwigia octovalvis*), Spike Rush (*Elaeocharis sphacelata*), Rushes (*Juncus spp.*) and Sedges (*Cyperus spp.*).

Highly Disturbed Areas Cleared of Native Vegetation and/or Dominated by Exotic Grasses with Native Flora Scarce (<15% cover)



This community occurs in pockets throughout the site where historical clearing/disturbances has resulted in weed species to persist. The majority of this community occurs along the edges of the site, along walking tracks, and along the banks of the drainage lines. This community is dominated by weeds, in particularly exotic grasses and Singapore Daisy with native species very scarce (<10% coverage).

3.2.2 Plant Community Type (PCT) Justification

It should be noted that the BAM requires vegetation communities to be classified into specific PCTs based on the 'best fit' principle, which does not necessarily align with BC Act or EPBC Act TEC determinations.

Justification for the Plant Community Type (PCT) identification is provided below:

Zone 1 - PCT 751: Brush Box - Tuckeroo littoral rainforest on coastal headlands of the NSW North Coast Bioregion (Poor - Moderate Condition)

- The vegetation is a native vegetation community occurring within the Burringbar – Conondale Ranges IBRA Sub-region;
- The canopy is dominated with Coastal Banksia (*Banksia integrifolia*) with Tuckeroo (*Cupaniopsis anacardioides*) also common which are the indicator species within the canopy layer;
- Guioa (*Guioa semiglauca*) and Beach Acronychia (*Acronychia imperforata*) were also commonly noted within the middle stratum;
- The three most common species per growth form (where possible) and IBRA Region was entered within the BioNet Vegetation Classification program. PCT 751 produced the highest 'number of matches' in comparison to other potential PCTs.

Advice was sort from the BAM Support Team regarding assigning PCTs, and whether the land formation needs to be accurate.

The BAM Support Team provided a response to this enquiry (email dated 15 March 2022):

'If the best fit PCT is occurring in a land formation other than the title or other ecological information refers to, it is fine to use that PCT based on adequate justification and evidence that the PCT is the best fit according to the diagnostic species and community composition.'

After review, whilst it is acknowledged that the site does not occur on a coastal headland, it is believed that PCT 751 floristically best suits this community on site. As such, PCT 751 was chosen.

Zone 2 - PCT 1235: Swamp Oak swamp forest of the coastal lowlands of the NSW North Coast Bioregion (Poor – Moderate Condition)

- The vegetation is a native vegetation community occurring within the Burringbar – Conondale Ranges IBRA Sub-region;
- The PCT is known to occur within the locality and has been recorded within ecological surveys conducted within the surrounding areas;
- The canopy is dominated with Swamp Oak (*Casuarina glauca*) which is an indicator species within the canopy layer;
- The three most common species per growth form (where possible) and IBRA Region was entered within the BioNet Vegetation Classification program. PCT 1235 produced the highest 'number of matches' in comparison to other potential PCTs.

Zone 3 - PCT 1064: Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion (Poor Condition)

- The vegetation is a native vegetation community occurring within the Burringbar – Conondale Ranges IBRA Sub-region;
- The canopy is largely absent and has historically been removed although scattered Broad-leaved Paperbark (*Melaleuca quinquenervia*) occurs which is an indicator species within the canopy layer;
- The ground layer is co-dominated by Bracken (*Pteridium esculentatum*) and Coral Fern (*Gleichenia dicarpa*) with Tall Sawsedge (*Gahnia clarkei*) also scarcely present;
- It is considered that this Zone is reflective of the neighbouring Zone 4 with the exception of the tree layer and small tree layer being largely absent and the area being slightly elevated and less prone to flooding. As such, this community was assigned PCT 1064.

Zone 4 - PCT 1064: Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion (Poor – Moderate Condition)

- The vegetation is a native vegetation community occurring within the Burringbar – Conondale Ranges IBRA Sub-region;
- The canopy is dominated with Broad-leaved Paperbark (*Melaleuca quinquenervia*) which is an indicator species within the canopy layer;
- Although dominated by exotic species in most areas, Swamp Box (*Lophostemon suaveolens*), Willow Bottlebrush (*Callistemon salignus*), Monkey Rope (*Parsonia straminea*), Saw-sedges (*Gahnia* spp.) and Swamp Water Fern (*Blechnum indicum*) were also often noted within the mid-ground layer;
- The three most common species per growth form (where possible) and IBRA Region was entered within the BioNet Vegetation Classification program. PCT 1064 produced the highest 'number of matches' in comparison to other potential PCTs.

Zone 5 - PCT 1302: White Booyong – Fig subtropical rainforest of the NSW North Coast Bioregion (Poor – Moderate Condition)

- The vegetation is a native vegetation community occurring within the Burringbar – Conondale Ranges IBRA Sub-region;
- Bangalow Palm (*Archontophoenix cunninghamiana*) is the dominant canopy species which is an indicator species for this PCT;
- The abovementioned native species and IBRA Region was entered within the BioNet Vegetation Classification program. PCT 1302 produced the highest 'number of matches' in comparison to other potential PCTs.

Zone 6 - PCT 1275: Tuckeroo – Riberry – Yellow Tulipwood Littoral Rainforest of the NSW North Coast Bioregion (Poor – Moderate Condition)

- The vegetation is a native vegetation community occurring within the Burringbar – Conondale Ranges IBRA Sub-region;
- The canopy is dominated with Tuckeroo (*Cupaniopsis anacardioides*) which is an indicator species within the canopy layer;

-
- The abovementioned native species and IBRA Region was entered within the BioNet Vegetation Classification program. PCT 1275 produced the highest 'number of matches' in comparison to other potential PCTs.

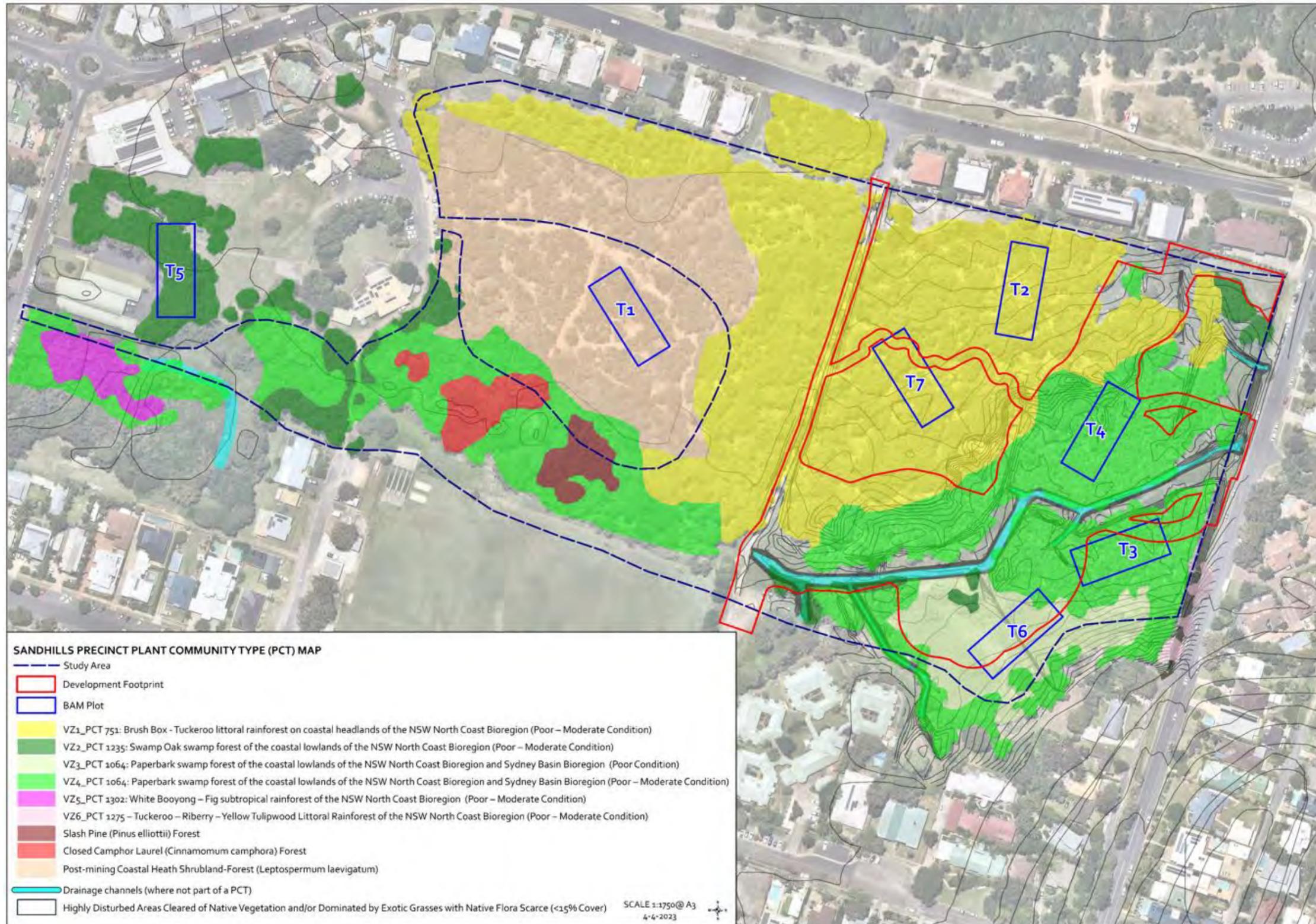


Figure 3-3 | Vegetation Map

3.3 Threatened Ecological Communities

Endangered Ecological Communities (EECs) are listed under Schedule 2, Part 2 of the *Biodiversity Conservation Act 2016*, while Threatened Ecological Communities (TECs) are listed under the *Environment Protection and Biodiversity Conservation Act 1999* as Critically Endangered, Endangered and Vulnerable.

An assessment of the below mentioned potentially occurring TECs (under both the BC Act and EPBC Act) has been undertaken to determine whether any PCTs is consistent with the description for these TECs.

Biodiversity Conservation Act 2016

The following EEC listed under the BC Act was identified as potentially occurring within the site:

- Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions (Endangered);
- Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner Bioregion (Endangered);
- Lowland Rainforest on Floodplain in the NSW North Coast Bioregion (Endangered); and
- Littoral Rainforest in the NSW North Coast, Sydney Basin and South East Corner Bioregions (Endangered).

Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion (PCT 1064) is potentially reflective of Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions.

The occurrence of Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion (PCT 1064) is approximately 1.4605 ha across the development site (Vegetation Zones 3 and 4).

It is considered that Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion (PCT 1064) is partially reflective of the above listed EEC as described by the Scientific Committee. The community has dominance of Paperbark within the canopy, is situated in low lying areas (<5m AHD), but occurs on sandy substrates.

Review of *Gales Holdings Pty Ltd vs Tweed Shire Council* (NSWLEC 209, 2008) notes that:

As with the Scientific Committee's description of Freshwater Wetlands, the description of Swamp Sclerophyll Forest has three components: an edaphic component ("humic clay loams and sandy loams"), a topographical component ("waterlogged or periodically inundated alluvial flats and drainage lines") and a locational component ("associated with coastal floodplains"). [106]

The court in this instance held that the soils described in the applicable soil landscapes of Kingscliff Aeolian sand sheets establish that the soils are not humic clay loams or sandy loams, nor are they associated with such soils. For this reason, the court held that the edaphic component of the EEC determination was not met and thus not an EEC.

It is further noted that the following was quoted in regard to the swamp sclerophyll forest within the overall subject site. Page 33 within the Byron Shire Flying-fox Camp Management Plan prepared by Byron Shire Council (2017) notes that the swamp sclerophyll community within the Sandhills site was not considered to be an EEC due to the vegetation occurring on coastal sand:

'The vegetation does not comprise an EEC listed under the BC Act as it is located on a coastal sandplain. Vegetation surveys undertaken by BSC in 2016 specifically map the soil landscape as 'aeolian/estuarine, coastal sandplains, unconsolidated sediment (aeolian)'. Council's vegetation mapping has been reviewed using a combination of aerial photographic interpretation, existing survey data and on-ground inspections'.

Although the above arguments could be made for this site, as a precautionary, it is considered that the floodplain communities of the site are EECs scheduled under the BCA 2016.

Swamp Oak swamp forest of the coastal lowlands of the NSW North Coast Bioregion (PCT 1235) is potentially reflective of Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner Bioregion.

The occurrence of Swamp Oak swamp forest of the coastal lowlands of the NSW North Coast Bioregion (PCT 1235) is restricted to approximately 0.05263 ha within the development site (Vegetation Zone 2).

It is considered that Swamp Oak swamp forest of the coastal lowlands of the NSW North Coast Bioregion (PCT 1235) is partially reflective of the above listed EEC as described by the Scientific Committee. The community has dominance of Swamp Oak within the canopy, is situated in low lying areas (<5m AHD), but occurs on sandy substrates. Additionally, this community is highly disturbed within the understory for the most part. Please refer to the Swamp Sclerophyll EEC above for discussion regarding edaphic features of floodplain forests.

White Booyong – Fig subtropical rainforest of the NSW North Coast Bioregion (PCT 1302) is potentially reflective of the EEC known as Lowland Rainforest on Floodplain in the NSW North Coast Bioregion.

Whilst not occurring within the development site itself, White Booyong – Fig subtropical rainforest of the NSW North Coast Bioregion (PCT 1302) occurs within the Study Area approximately 250m west of the project area (Vegetation Zone 5).

It is considered that the mapped patch of White Booyong – Fig subtropical rainforest of the NSW North Coast Bioregion (PCT 1302) is potentially reflective of the above listed EEC as described by the Scientific Committee. Limiting factors include that the community occurs on sand sheets (not associated with floodplains) and has low rainforest type diversity (Palms only). This patch is well removed from the works area and will not be impacted by the project.

Tuckeroo – Riberry – Yellow Tulipwood Littoral Rainforest of the NSW North Coast Bioregion (PCT 1275) is potentially reflective of Littoral Rainforest in the NSW North Coast, Sydney Basin and South East Corner Bioregions (Vegetation Zone 6).

In regard to the above it is considered that Tuckeroo – Riberry – Yellow Tulipwood Littoral Rainforest of the NSW North Coast Bioregion (PCT 1275) may be described as 'rainforest' per DECNSW (2004) due to the height and species composition of the canopy trees.

With regard to edaphic and locational features of the EEC the following is noted:

- Described Vegetation Community (PCT 1275) is located within 2km of the sea as noted within the Scientific Committee determination of the EEC
- Described Vegetation Community (PCT 1275) is located on sandy substrates as noted within the Scientific Committee determination of the EEC

It is noted that these areas are highly disturbed with weeds dominating the understory. Nevertheless, the mapped PCT 1275 is external to the works footprint and will not be impacted by this project.

Reviewing the above, it is also considered that Brushbox – Tuckeroo littoral rainforest on coastal headlands of the NSW North Coast Bioregion (PCT 751) also meets the edaphic and locational feature of the EEC (Vegetation Zone 1). This community is dominated by Coastal Banksia (*Banksia integrifolia*) within the canopy layer. Other rainforest species were commonly recorded within this community which included Tuckeroo (*Cupaniopsis anacardioides*), Cheese Tree (*Glochidion ferdinandi*), Beach Acronychia (*Acronychia imperforata*), Scentless Rosewood (*Synoum glandulosum*) and Sweet Pittosporum (*Pittosporum undulatum*). It is considered likely that mapped areas of PCT 751 is reflective of this EEC.

No other vegetation communities within the site are considered to be reflective of an EEC listed under the Biodiversity Conservation Act 2016.

Mapped EECs recorded within the site have been provided within **Figure 3-4**.



Figure 3-4 | BC Act 2016 Endangered Ecological Communities

Environment Protection and Biodiversity Conservation Act

The following TEC listed under the EPBC Act was identified as potentially occurring within the development site:

- Coastal Swamp Oak (*Casuarina glauca*) forest of South-east Queensland and New South Wales (Endangered);
- Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland (Endangered);
- Lowland Rainforest of Subtropical Australia (Critically Endangered); and
- Littoral Rainforest and Coastal Vine Thickets of Eastern Australia (Critically Endangered).

Coastal Swamp Oak (Casuarina glauca) forest of South-east Queensland and New South Wales

Whilst Swamp Oak forests are present, these areas did not meet the condition threshold for it to be considered to be the federally listed TEC. These areas were small in size and dominated by weeds, therefore not meeting the minimum condition threshold for it to be considered this TEC.

Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland

Approximately 0.12 ha of a small contiguous patch of high quality swamp sclerophyll forest (Class B2) occurs within the development footprint.

Lowland Rainforest of Subtropical Australia

No vegetation communities within the site meets the key diagnostic characteristics and/or condition thresholds of this listed ecological community. As such, this TEC does not occur within the site.

Littoral Rainforest and Coastal Vine Thickets of Eastern Australia

Approximately 0.5646 ha of vegetation considered to be reflective of Littoral Rainforest and Coastal Vine Thickets of Eastern Australia occurs within the development site.

More detailed discussions and mapping regarding the abovementioned EPBC Act listed threatened ecological communities are provided within **Section 7.1.5** and **Appendices 5, 6 & 7**.

3.3.1 Vegetation Integrity Assessment

From the abovementioned vegetation zones recorded within the Study Area, only Zones 1-4 were recorded within the development footprint.

A vegetation integrity assessment using the BAM Credit Calculator was undertaken with the result provided in **Table 3-3** below.

Table 3-3 | Vegetation Integrity Assessment Scores

Veg Zone	PCT	Condition	Area (ha)	Composition Condition Score	Structure Condition Score	Function Condition Score	Current Vegetation Integrity Score
1	751	Poor-Mod	0.56	48	45.7	74.7	54.7
2	1235	Poor-Mod	0.05	30	20.8	82.9	37.3
3	1064	Poor	0.26	9.3	0.8	43.8	6.9
4	1064	Poor-Mod	1.2	58.3	31.1	63.8	48.7

4 Threatened Species

4.1 Identification of Threatened Species

Section 5 of the BAM details the process for determining the habitat suitability for threatened species. The BAM calculator generates a list of threatened species which are likely to utilise the site based on the IBRA region, patch sizes, plant community types and habitat resources.

Under the BAM, threatened species are separated into two classes, 'ecosystem' and 'species' credit species. Those threatened species where the likelihood of occurrence of a species or elements of the species' habitat can be predicted by vegetation surrogates and landscape feature, or for which a targeted survey has a low probability of detection, are identified as 'ecosystem' credit species. Targeted surveys are not required for ecosystem species and potential impacts to these species are assessed in conjunction with impacts to PCTs.

Threatened species where the likelihood of occurrence of a species or elements of suitable habitat for the species cannot be confidently predicted by vegetation surrogates and landscape features and can be reliably detected by survey are identifiable as species credit species. A targeted survey or an expert report is required to confirm the presence or absence of these species on the subject land.

For some threatened species, they are identified as both ecosystem and species credit species, with different aspects of the habitat and life cycle representing different credit types. Commonly, threatened fauna species may have foraging habitat as an ecosystem credit, while their breeding habitat represents a species credit.

The following sections outline the process for determining the habitat suitability for threatened species within the subject lands, and the results of targeted surveys for candidate threatened species.

4.1.1 Predicted Ecosystem Credit Species

The list of predicted threatened fauna species (ecosystem species) generated by the BAM calculator is provided within **Table 4-1**. Habitat constraints and geographic limitations has been displayed to relevant species. No ecosystem credit species were excluded.

Targeted surveys are not required for ecosystem credit species.

The following species were also added to the BAM calculator due to BioNet records occurring within the locality:

- Comb-crested Jacana (*Irediparra gallinacea*);
- Marbled Frogmouth (*Podargus ocellatus*);
- Eastern Grass Owl (*Tyto longimembris*);
- Masked Owl [foraging] (*Tyto novaehollandiae*); and
- Sooty Owl [foraging] (*Tyto tenebricosa*).

A total of forty-four (44) ecosystem credit species have been predicted by the BAM calculator to occur within the site:

Table 4-1 | Predicted Ecosystem Credits

Common Name	Species Name	BCA 2016 Status	EPBCA 1999 Status	Sensitivity to Gain Class	Habitat Constraints	Geographic Limitations
Pale-vented Bush-hen	<i>Amaurornis moluccana</i>	Vulnerable	-	High	Waterbodies Dense vegetation within 300m of, or in shallows of streams or other natural or artificial wetlands	-
Regent Honeyeater (foraging)	<i>Anthochaera phrygia</i>	Critically Endangered	Critically Endangered	High	-	-
Dusky Woodswallow	<i>Artamus cyanopterus cyanopterus</i>	Vulnerable	-	Moderate	-	-
Australasian Bittern	<i>Botaurus poiciloptilus</i>	Endangered	Endangered	Moderate	Waterbodies Brackish or freshwater wetlands	-
Glossy Black-cockatoo (foraging)	<i>Calyptorhynchus lathami</i>	Vulnerable	-	High	Presence of Allocasuarina and casuarina species	-
Hoary Wattled Bat	<i>Chalinolobus nigrogriseus</i>	Vulnerable	-	High	-	-
Barred Cuckoo-shrike	<i>Coracina lineata</i>	Vulnerable	-	Moderate	-	-

Common Name	Species Name	BCA 2016 Status	EPBCA 1999 Status	Sensitivity to Gain Class	Habitat Constraints	Geographic Limitations
Varied Sittella	<i>Daphoenositta chrysoptera</i>	Vulnerable	-	Moderate	-	-
Spotted-tailed Quoll	<i>Dasyurus maculatus</i>	Vulnerable	Endangered	High	-	-
Black-necked Stork	<i>Ephippiorhynchus asiaticus</i>	Endangered	-	Moderate	Swamps Shallow, open freshwater or saline wetlands or shallow edges of deeper wetlands within 300m of these Shallow lakes, lake margins and estuaries within 300m of these waterbodies	-
Eastern False Pipistrelle	<i>Falsistrellus tasmaniensis</i>	Vulnerable	-	High	-	-
Little Lorikeet	<i>Glossopsitta pusilla</i>	Vulnerable	-	High	-	-
White-bellied Sea-eagle (foraging)	<i>Haliaeetus leucogaster</i>	Vulnerable	-	High	Waterbodies Within 1km of a rivers, lakes, large dams or creek, wetlands and coastlines	-
Little Eagle (foraging)	<i>Hieraetus morphnoides</i>	Vulnerable	-	Moderate	-	-

Common Name	Species Name	BCA 2016 Status	EPBCA 1999 Status	Sensitivity to Gain Class	Habitat Constraints	Geographic Limitations
White-throated Needletail	<i>Hirundapus caudacutus</i>	-	Vulnerable	High	-	-
Comb-crested Jacana	<i>Irediparra gallinacea</i>	Vulnerable	-	Moderate	-	-
Black Bittern	<i>Ixobrychus flavicollis</i>	Vulnerable	-	Moderate	Waterbodies Land within 40m of freshwater and estuarine wetlands, in areas of permanent water and dense vegetation	-
Swift Parrot (foraging)	<i>Lathamus discolor</i>	Endangered	Critically Endangered	Moderate	-	-
Square-tailed Kite (foraging)	<i>Lophoictinia isura</i>	Vulnerable	-	Moderate	-	-
Eastern Coastal Free-tailed Bat	<i>Micronomus norfolkensis</i>	Vulnerable	-	High	-	-
Little Bent-winged Bat (foraging)	<i>Miniopterus australis</i>	Vulnerable	-	High	-	-
Large Bentwing-bat (foraging)	<i>Miniopterus oriana oceanensis</i>	Vulnerable	-	High	-	-

Common Name	Species Name	BCA 2016 Status	EPBCA 1999 Status	Sensitivity to Gain Class	Habitat Constraints	Geographic Limitations
Barking Owl (foraging)	<i>Ninox connivens</i>	Vulnerable	-	High	-	-
Powerful Owl (foraging)	<i>Ninox strenua</i>	Vulnerable	-	High	-	-
Eastern Tube-nosed Bat	<i>Nyctimene robinsoni</i>	Vulnerable	-	High	-	-
Eastern Long-eared Bat	<i>Nyctophilus bifax</i>	Vulnerable	-	High	-	-
Northern Free-tailed Bat	<i>Ozimops lumsdenae</i>	Vulnerable	-	High	-	-
Eastern Osprey (foraging)	<i>Pandion cristatus</i>	Vulnerable	-	Moderate	-	-
Yellow-bellied Glider	<i>Petaurus australis</i>	Vulnerable	Vulnerable	High	-	-
Eastern Chestnut Mouse	<i>Pseudomys gracilicaudatus</i>	Vulnerable	-	High	-	-
New Holland Mouse	<i>Pseudomys novaehollandiae</i>	-	Vulnerable	High	-	-
Grey-headed Flying-fox (foraging)	<i>Pteropus poliocephalus</i>	Vulnerable	Vulnerable	High	-	-

Common Name	Species Name	BCA 2016 Status	EPBCA 1999 Status	Sensitivity to Gain Class	Habitat Constraints	Geographic Limitations
Wompoo Fruit-dove	<i>Ptilinopus magnificus</i>	Vulnerable	-	Moderate	-	-
Rose-crowned Fruit-dove	<i>Ptilinopus regina</i>	Vulnerable	-	Moderate	-	-
Superb Fruit-dove	<i>Ptilinopus superbus</i>	Vulnerable	-	Moderate	-	-
Australian Painted Snipe	<i>Rostratula australis</i>	Endangered	Endangered	Moderate	-	-
Yellow-bellied Sheath-tail-bat	<i>Saccolaimus flaviventris</i>	Vulnerable	-	High	-	-
Greater Broad-nosed Bat	<i>Scoteanax rueppellii</i>	Vulnerable	-	High	-	-
Freckled Duck	<i>Stictonetta naevosa</i>	Vulnerable	-	Moderate	-	-
Common Blossom Bat	<i>Syconycteris australis</i>	Vulnerable	-	High	-	-
Red-legged Pademelon	<i>Thylogale stigmatica</i>	Vulnerable	-	High	-	-
Eastern Grass Owl	<i>Tyto longimembris</i>	Vulnerable	-	Moderate	-	-

Common Name	Species Name	BCA 2016 Status	EPBCA 1999 Status	Sensitivity to Gain Class	Habitat Constraints	Geographic Limitations
Masked Owl (foraging)	<i>Tyto novaehollandiae</i>	Vulnerable	-	High	-	-
Sooty Owl (foraging)	<i>Tyto tenebricosa</i>	Vulnerable	-	High	-	-

4.1.2 Predicted Species Credit Species

As previously stated, species credit species are predicted by the BAM Calculator based on the PCT that occurs within the site, the distributional range of the species, the condition of the vegetation, and patch size.

A list of the species credit species identified by the BAM calculator as potentially occurring on the subject site is provided within **Table 4-2** below.

The following species were also added to the BAM calculator due to BioNet records occurring within the locality (<10km from the centre of the site):

- Knicker Nut (*Caesalpinia bonduc*);
- Crystal Creek Walnut (*Endiandra floydii*);
- Rusty Rose Walnut (*Endiandra hayesii*);
- Beach Stone-curlew [breeding] (*Esacus magnirostris*);
- Southern Pink Underwing Moth (*Phyllodes imperialis* southern subspecies);
- Flat Fork Fern (*Psilotum complanatum*);
- Dark Greenhood (*Pterostylis nigricans*);
- Scrub Turpentine (*Rhodamnia rubescens*);
- Native Guava (*Rhodomyrtus psidioides*); and
- Masked Owl [breeding] (*Tyto novaehollandiae*).

Table 4-2 | Candidate Species Credit Species Identified by the BAM Calculator

Common Name	Species Name	BCA Status	EPBCA Status	Sensitivity to Gain Class	Habitat Constraints	Geographic Limitations
Marblewood	<i>Acacia bakeri</i>	Vulnerable	-	High	-	-
Acalypha	<i>Acalypha eremorum</i>	Endangered	-	High	-	-
Scented Acronychia	<i>Acronychia littoralis</i>	Endangered	Endangered	High	-	Within 5km of coast
Dwarf Heath Casuarina	<i>Allocasuarina defungens</i>	Endangered	Endangered	High	-	-
Regent Honeyeater (breeding)	<i>Anthochaera phrygia</i>	Critically Endangered	Critically Endangered	High	As per Important Habitat Map	-
White Lace Flower	<i>Archidendron hendersonii</i>	Vulnerable	-	High	-	-
Laced Fritillary	<i>Argynnis hyperbius</i>	Endangered	Critically Endangered	High	Arrowhead Violet (<i>Viola betonicifolia</i>)	Within 15km of coast
Hairy Joint Grass	<i>Arthraxon hispidus</i>	Vulnerable	Vulnerable	High	-	-
Giant Ironwood	<i>Backhousia subargentea</i>	Endangered	-	High	-	-
Yellow Satinheart	<i>Bosistoa transversa</i>	Vulnerable	Vulnerable	High	-	-

Common Name	Species Name	BCA Status	EPBCA Status	Sensitivity to Gain Class	Habitat Constraints	Geographic Limitations
Bush Stone Curlew	<i>Burhinus grallarius</i>	Endangered	-	High	Fallen/standing dead timber including logs	-
White-crowned Snake	<i>Cacophis harriettae</i>	Vulnerable	-	High	Litter rocky areas	-
					Surface rocks fallen/standing dead timber including logs	
					Or within 50m of fallen timber including logs	
Knicker Nut	<i>Caesalpinia bonduc</i>	Endangered	-	High	-	Within 20km of coast
Glossy Black-cockatoo (breeding)	<i>Calyptorhynchus lathami</i>	Vulnerable	Vulnerable	High	Hollow bearing trees	-
					Living or dead tree with hollows greater than 15cm diameter and greater than 8m above ground	
White-eared Monarch	<i>Carterornis leucotis</i>	Vulnerable	-	High	-	-
Cassia marksiana	<i>Cassia marksiana</i>	Endangered	-	High	-	-
Swamp Foxglove	<i>Centranthera cochinchinensis</i>	Endangered	-	High	Semi-permanent / ephemeral wet areas	-

Common Name	Species Name	BCA Status	EPBCA Status	Sensitivity to Gain Class	Habitat Constraints	Geographic Limitations
					Or within a 50m buffer swamps	
					Or within a 50m buffer waterbodies	
					Including wetlands, or within a 50m buffer	
Eastern Pygmy-possum	<i>Cercartetus nanus</i>	Vulnerable	-	High	-	-
Large-eared Pied Bat	<i>Chalinolobus dwyeri</i>	Vulnerable	Vulnerable	Very High	Cliffs	-
					Within two kilometres of rocky areas containing caves, overhangs, overhangs, escarpments, outcrops, or crevices, or within two kilometres of old mines or tunnels.	
Corokia	<i>Corokia whiteana</i>	Vulnerable	Vulnerable	High	-	-
Wallum Froglet	<i>Crinia tinnula</i>	Vulnerable	-	Moderate	-	Within 10km of coast
Stinking Cryptocarya	<i>Cryptocarya foetida</i>	Vulnerable	Vulnerable	High	-	-

Common Name	Species Name	BCA Status	EPBCA Status	Sensitivity to Gain Class	Habitat Constraints	Geographic Limitations
Smooth Tuckeroo	<i>Cupaniopsis serrata</i>	Endangered	-	High	-	-
Coxen's Fig-parrot	<i>Cyclopsitta diophthalma coxeni</i>	Critically Endangered	Endangered	High	-	-
White-flowered Wax Plant	<i>Cynanchum elegans</i>	Endangered	Endangered	High	-	-
Water Nutgrass	<i>Cyperus aquatilis</i>	Endangered	-			
Davidson's Plum	<i>Davidsonia jerseyana</i>	Endangered	Endangered	High	-	-
Smooth Davidson's Plum	<i>Davidsonia johnsonii</i>	Endangered	Endangered	Very high	-	-
Spider Orchid	<i>Dendrobium melaleucaphilum</i>	Endangered	-	High	-	-
Gympie Stinger	<i>Dendrocnide moroides</i>	Endangered	-	High	-	-
Thorny Pea	<i>Desmodium acanthocladum</i>	Vulnerable	Vulnerable	High	-	-
Red-fruited Ebony	<i>Diospyros mabacea</i>	Endangered	Endangered	High	-	-
Shiny-leaved Ebony	<i>Diospyros yandina</i>	Endangered	-	High	-	-

Common Name	Species Name	BCA Status	EPBCA Status	Sensitivity to Gain Class	Habitat Constraints	Geographic Limitations
Small-leaved Tamarind	<i>Diploglottis campbellii</i>	Endangered	Endangered	High	-	-
Byron Bay Diuris	<i>Diuris byronensis</i>	Endangered	-	High	-	Arakwal National Park or within a buffer of 2km from the Park
Basket Fern	<i>Drynaria rigidula</i>	Endangered	-	High	-	-
Hairy Quandong	<i>Elaeocarpus walliamsianus</i>	Endangered	Endangered	Very High	-	-
Crystal Creek Walnut	<i>Endiandra floydii</i>	Endangered	Endangered	High	-	-
Rusty Rose Walnut	<i>Endiandra hayesii</i>	Vulnerable	Vulnerable	High	-	-
Green-leaved Rose Walnut	<i>Endiandra muelleri subsp. bracteata</i>	Endangered	-	High	-	-
Beach Stone-curlew	<i>Esacus magnirostris</i>	Critically Endangered	-	High	-	Within 2km of coast
Ball Nut	<i>Floydia praealta</i>	Vulnerable	Vulnerable	High	-	-
Pink Nodding Orchid	<i>Geodorum densiflorum</i>	Endangered	-	High	-	-

Common Name	Species Name	BCA Status	EPBCA Status	Sensitivity to Gain Class	Habitat Constraints	Geographic Limitations
Sweet Myrtle	<i>Gossia fragrantissima</i>	Endangered	Endangered	High	-	-
White Yiel Yiel	<i>Grevillia hilliana</i>	Endangered	-	High	-	-
White-bellied Sea-eagle (breeding)	<i>Haliaeetus leucogaster</i>	Vulnerable	-	High	Living or dead mature trees within suitable vegetation within 1m of rivers, lakes, large dams or creeks, wetlands and coastlines	-
Native Justicia	<i>Harnieria hygrophiloides</i>	Endangered	-	High	-	-
Little Eagle (breeding)	<i>Hieraaetus morphnoides</i>	Vulnerable	-	Moderate	Nest trees – live (occasionally dead) large old trees within vegetation)	-
Pale-headed Snake	<i>Hoplocephalus bitorquatus</i>	Vulnerable	-	High	-	-
Stephen's Banded Snake	<i>Hoplocephalus stephensii</i>	Vulnerable	-	High	Hollow bearing trees	-
					Or within 500m of this habitat other	
					Within 500m of aboreal vine tangles fallen / standing dead timber including logs	

Common Name	Species Name	BCA Status	EPBCA Status	Sensitivity to Gain Class	Habitat Constraints	Geographic Limitations
					Or within 500m of this habitat	
Isoglossa	<i>Isoglossa eranthemoides</i>	Endangered	Endangered	High	-	-
Swift Parrot (breeding)	<i>Lathamus discolor</i>	Endangered	Critically Endangered	Moderate	As per Important Habitat Map	-
Fine-leaved Tuckeroo	<i>Lepiderema pulchella</i>	Vulnerable	-	High	-	-
Mangrove Honeyeater	<i>Lichenostomus fasciolaris</i>	Vulnerable	-	High	-	· Within 10km of coast
Fraser's Screw Fern	<i>Lindsaea fraseri</i>	Endangered	-	High	-	· Within 30km of coast
Green-thighed Frog	<i>Litoria brevipalmata</i>	Vulnerable	-	Moderate	Semi-permanent / ephemeral wet areas swamps waterbodies	-
Olongburra Frog	<i>Litoria olongburensis</i>	Vulnerable	Vulnerable	Moderate	-	· Within 10km of coast
Square-tailed Kite (breeding)	<i>Lophoictina isura</i>	Vulnerable	-	Moderate	Nest trees	-
Rough-shelled Bush Nut	<i>Macadamia tetraphylla</i>	Vulnerable	Vulnerable	High	-	-

Common Name	Species Name	BCA Status	EPBCA Status	Sensitivity to Gain Class	Habitat Constraints	Geographic Limitations
Slender Marsdenia	<i>Marsdenia longiloba</i>	Endangered	Vulnerable	High	-	-
Coast Euodia	<i>Melicope vitiflora</i>	Endangered	-	High	-	-
Little Bentwing-bat (breeding)	<i>Miniopterus australis</i>	Vulnerable	-	Very high	Caves	-
					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 scientific literature	
Large Bentwing-bat (breeding)	<i>Miniopterus orianae ocaeanensis</i>	Vulnerable	-	Very High	Caves	-
					Cave, tunnel, mine, culvert or other structure known or suspected to be used for breeding including species records in BioNet	

Common Name	Species Name	BCA Status	EPBCA Status	Sensitivity to Gain Class	Habitat Constraints	Geographic Limitations
					with microhabitat code 'IC – in cave'	
					Observation type code 'E nest-roost'	
					With numbers of individuals >500	
Southern Myotis	<i>Myotis macropus</i>	Vulnerable	-	High	Waterbodies	-
					Waterbodies with permanent pools/stretches 3m or wider, including rivers, large creeks, billabongs, lagoons, estuaries, dams and other, on or within 200m of the site.	
Smooth-leaved Plum	<i>Niemeyera chartacea</i>	Endangered	-	High	-	-
Rusty Plum	<i>Niemeyera whitei</i>	Vulnerable	-	High	-	-
Barking Owl (breeding)	<i>Ninox connivens</i>	Vulnerable	-	High	Hollow bearing trees	-
					Living or dead trees with hollow greater than 20cm diameter and greater	

Common Name	Species Name	BCA Status	EPBCA Status	Sensitivity to Gain Class	Habitat Constraints	Geographic Limitations
					than 4m above the ground	
Powerful Owl (breeding)	<i>Ninox strenua</i>	Vulnerable	-	High	Hollow bearing trees	-
					Living or dead trees with hollow greater than 20cm diameter	
Yellow-flowered King of the Fairies	<i>Oberonia complanata</i>	Endangered	-	High	-	-
Red-flowered King of the Fairies	<i>Oberonia titania</i>	Vulnerable	-	High	-	-
Southern Ochrosia	<i>Ochrosia moorei</i>	Endangered	Endangered	High	-	-
Sweet False Galium	<i>Oldenlandia galioides</i>	Endangered	-	High	-	Hastings Point to Tweed Heads and within 3km of coast
Eastern Osprey (breeding)	<i>Pandion cristatus</i>	Vulnerable	-	Moderate	Presence of stick-nests in living and dead trees (>15m) or artificial structures within 100m of a floodplain for nesting)	-

Common Name	Species Name	BCA Status	EPBCA Status	Sensitivity to Gain Class	Habitat Constraints	Geographic Limitations
Brown Fairy-chain Orchid	<i>Peristeranthus hillii</i>	Vulnerable	-	High	-	Within 5km of coast
Coastal Petaltail	<i>Petalura litorea</i>	Endangered	-	Very high	Swamps	-
					Vegetation within 500m of swamps	
Southern Greater Glider	<i>Petauroides volans</i>	Endangered	Endangered	High	Hollow bearing trees	-
Squirrel Glider	<i>Petaurus norfolcensis</i>	Vulnerable	-	High	-	-
Southern Swamp Orchid	<i>Phaius australis</i>	Endangered	Endangered	High	-	-
Bush-tailed Phascogale	<i>Phascogale tapoatafa</i>	Vulnerable	-	High	-	-
Koala (breeding)	<i>Phascolarctos cinereus</i>	Vulnerable	Vulnerable	High	Presence of koala use trees – refer to Survey Comments field in TBDC	-
Brush Sauropus	<i>Phyllanthus microcladus</i>	Endangered	-	Moderate	-	-
Southern Pink Underwing Moth	<i>Phyllodes imperialis southern subspecies</i>	Endangered	Endangered	Moderate	-	-
Common Planigale	<i>Planigale maculata</i>	Vulnerable	-	High	-	-

Common Name	Species Name	BCA Status	EPBCA Status	Sensitivity to Gain Class	Habitat Constraints	Geographic Limitations
Long-nosed Potoroo	<i>Potorous tridactylus</i>	Vulnerable	Vulnerable	High	Dense shrub layer or alternately high canopy cover exceeding 70% (i.e. to capture populations inhabiting wet sclerophyll and rainforest))	-
Potorous tridactylus - endangered population		Endangered Population	-	Moderate	-	Between Tweed Heads West to the east, NSW-Qld border to the north, Piggabeen to the west and the north shore of Cobaki Broadwater to the south
Long-nosed Potoroo, Cobaki Lakes and Tweed Heads West population						
Flat Fork Fern	<i>Psilotum complanatum</i>	Endangered	-	High	Epiphytes	-
Grey-headed Flying-fox (breeding)	<i>Pteropus poliocephalus</i>	Vulnerable	Vulnerable	High	-	-
Dark Greenhood	<i>Pterostylis nigricans</i>	Vulnerable	-	Moderate	-	Within 10km of coast
Spiny Gardenia	<i>Randia moorei</i>	Endangered	Endangered	High	-	-

Common Name	Species Name	BCA Status	EPBCA Status	Sensitivity to Gain Class	Habitat Constraints	Geographic Limitations
Scrub Turpentine	<i>Rhodamnia rubescens</i>	Critically Endangered	Critically Endangered	Very high	-	-
Native Guava	<i>Rhodomyrtus psidioides</i>	Critically Endangered	Critically Endangered	Very high	-	-
Rotala tripartita	<i>Rotala tripartita</i>	Endangered	-	High	Shallow swampy or poorly drained areas including gilgai semi-permanent / ephemeral wet areas	-
					Sites may dry out for several months but rarely	
					Sites may dry out for several months but rarely longer swamps waterbodies	
					Farm dams and freshwater wetlands or within 50m	
Rainforest Senna	<i>Senna acclinis</i>	Endangered	-	High	-	-
Brush Sophora	<i>Sophora fraseri</i>	Vulnerable	-	High	-	-
Red Lilly Pilly	<i>Syzygium hodgkinsoniae</i>	Vulnerable	Vulnerable	High	-	-

Common Name	Species Name	BCA Status	EPBCA Status	Sensitivity to Gain Class	Habitat Constraints	Geographic Limitations
Durobby	<i>Syzygium moorei</i>	Vulnerable	Vulnerable	High	-	-
Mitchell's Rainforest Snail	<i>Thersites mitchellae</i>	Endangered	Critically Endangered	High	-	-
Arrow-head Vine	<i>Tinospora tinosporoides</i>	Vulnerable	-	High	-	-
Collared Kingfisher	<i>Todiramphus chloris</i>	Vulnerable	-	High	Hollow bearing trees	Within 5km of coast and tidal influenced water bodies
					Hollows in large mangrove trees, or hollows or aboreal termitaria in Eucalyptus or Melaleuca adjacent to mangroves and estuarine foraging habitat	
Masked Owl (breeding)	<i>Tyto novaehollandiae</i>	Vulnerable	-	High	Hollow bearing tree	-
					Living or dead trees with hollows greater than 20cm diameter	
False Water Rat	<i>Xeromys myoides</i>	-	Vulnerable	High	Intertidal zones	<50m asl
					Mangroves, sedge / saltmarsh and freshwater wetlands or within 100m	

Common Name	Species Name	BCA Status	EPBCA Status	Sensitivity to Gain Class	Habitat Constraints	Geographic Limitations
					Littoral zone wetlands or within 100m	
Queensland Xylosma	<i>Xylosma terrae-reginae</i>	Endangered	-	High	-	Within 5km of coast

4.1.3 Identifying Candidate Species Credit Species for Further Assessment

In accordance with Section 5.2.1.4 of the BAM, a predicted candidate species can be considered unlikely to occur within the subject land (or specific vegetation zones) where habitat is substantially degraded such that the species is unlikely to use the area, or where an expert report identifies that the species is unlikely to be present within the subject land (or a vegetation zone within the subject land).

A predicted candidate species credit species that is not considered to have suitable habitat on the subject land (or specific vegetation zones) in accordance with Section 5.2.1.4 of the BAM does not require further assessment on the subject land (or specific vegetation zones).

The reasons for determining that a predicted species credit species is unlikely to have suitable habitat on the subject land (or specific vegetation zones) is provided **Table 4-3**, this table includes a description of their habitat requirements and justification for their removal based on those habitat requirements.

A habitat assessment (refer to **Section 4.2.1**) was undertaken on the 18th May 2021, which focused upon habitat features which are relevant to species credit species. This included determining presence/absence of known habitat constraints and other microhabitats which may be utilised.

The potential for each species credit species was considered following the review of the subject site, date and locations of records of threatened species, available habitat on site and the condition of the habitat. **Table 4-3** outlines whether the subject it is suitable or not for each predicted candidate species and provides justification on why they have been included or excluded for further assessments.

Table 4-3 | Assessment of Species Credit Species Habitat

Species	Biodiversity Risk Weighting	Habitat Requirements	Further Assessment	Justification for Exclusion / Inclusion
Fauna				
<i>Anthochaera Phrygia</i> Regent Honeyeater Breeding)	Very High – 3	<p>The species mostly inhabits inland slopes of the Great Dividing Range, in areas of low to moderate relief with moist, fertile soils. It is most commonly associated with box-ironbark eucalypt woodland and dry sclerophyll forest, but also inhabits riparian vegetation such as sheoak (<i>Casuarina</i> spp) where it feeds on needle-leaved mistletoe and sometimes breeds (Franklin et al., 1989; Higgins et al., 2001; Oliver et al., 1998; Webster and Menkhorst, 1992). It sometimes utilises lowland coastal forest, which may act as a refuge when its usual habitat is affected by drought (Menkhorst et al., 1999). It also uses a range of other habitats including remnant patches in farmland and urban areas, roadside reserves and travelling stock routes (Franklin et al., 1989; Higgins et al., 2001; Oliver and Lollback, 2010).</p> <p>The timing of breeding varies between regions and appears to correspond with the flowering of key eucalypt and mistletoe species (Franklin et al., 1989; Geering and French, 1998). Regent honeyeater nests are usually placed in the canopy of mature trees with rough bark. Breeding mostly occurs during spring and summer, from August to January (Franklin et al., 1989).</p>	Excluded	The site is not mapped as occurring within an Important Area for the Regent Honeyeater (habitat constraint).
<i>Argynnis hyperbiu</i> Laced Fritillary	Very High – 3	<p>The Australian fritillary has been recorded in scattered locations across south-eastern Queensland and north-eastern New South Wales (Braby 2000; Sands & New 2002). The subspecies appears to have had a core distribution between Gympie in Queensland and Port Macquarie in NSW, although there are historical records which extend beyond this range. The subspecies has been recorded as far north as Mt Bellenden Ker in Queensland, and as far south as the Hunter Valley in NSW (Sands & New 2002).</p> <p>The Australian fritillary usually occurs around river estuaries or open, swampy coastal regions (McCubbin 1971; Sands & New 2002). The Australian fritillary is restricted to areas where its larval food plant, <i>Viola betonicifolia</i> (the arrowhead violet), occurs (NSW Scientific Committee 2002).</p>	Excluded	The site does not contain <i>Viola betonicifolia</i> (habitat constraint).
<i>Burhinus grallarius</i> Bush Stone-curlew	High - 2	<p>In NSW, Bush Stone-curlews occur in lowland grassy woodland and open forest. Habitat is described by broad ground and understorey structural features and is not necessarily associated with any particular vegetation communities. In general, habitat occurs in open woodlands with few, if any, shrubs, and short, sparse grasses of less than 15cm in height, with scattered fallen timber, leaf litter and bare ground present. In coastal areas, structurally similar elements of tidal and estuarine communities provide suitable habitat, for example Bush Stone curlews are recorded within <i>Casuarina</i> woodlands, saltmarsh and mangroves (Price 2004). The important structural elements of Bush Stone-curlew habitat appear to be:</p> <ul style="list-style-type: none"> • a low sparse ground cover • some fallen timber and leaf litter • a general lack of a shrubby understorey • open woodlands (DECC, 2006: 8) <p>Foraging however, has been noted to occur over a broader spectrum of habitats including paddocks, grasslands, domestic areas (gardens, sports fields, [golf courses, residential areas pers. Obs] etc), estuarine areas (mudflats, saltmarsh, mangrove forest, swamp oak, melaleuca forest) (NPWS, 1999; 2006).</p> <p>The Bush Stone-curlew nests on the ground, near dead timber, usually under trees within open woodlands that have an understorey of short grass or among brushwood (Wilson 1989 in NPWS, 1999). The nest site is typically in or near the edge of open grassy woodland or within a cleared paddock where there is good visibility across the surrounding lands (Johnson and Baker-Gabb 1994 in DECC, 2006). In modified environments the species is also noted to nest within various areas where they are protected from dogs and cats (i.e. golf courses, garden beds, shade houses etc pers. Obs).</p>	Included	As the species utilises a wide range of habitats (including modified residential areas) it is considered that the majority of the site represents potential habitat for the curlew (although areas containing dense understorey is unpreferred).

Species	Biodiversity Risk Weighting	Habitat Requirements	Further Assessment	Justification for Exclusion / Inclusion
<i>Cacophis harriettae</i> White-crowned Snake	High - 2	Favours low to mid-elevation dry eucalypt forest and woodland, particularly areas with a varied and well-developed litter layer, where their prey of small lizards may be more abundant. Also occasionally found in moist eucalypt forest and coastal heathland (OEH, 2018).	Included	Although preferred eucalypt forests/woodlands are absent from the site, fallen/standing dead timber including logs are present.
<i>Calyptorhynchus lathami</i> Glossy Black-Cockatoo (Breeding)	High - 2	Glossy Black Cockatoos are uncommon parrots found in scattered localities in the forests and woodlands of eastern Australia and Kangaroo Island (Forshaw, 1981). The eastern subspecies of Glossy Black Cockatoos seems thinly distributed through its range with the highest densities occurring in south-eastern Queensland and north-eastern New South Wales (Forshaw, 1989). The main habitat of the eastern subspecies is <i>Eucalyptus</i> woodlands and forest with moderate-high densities of <i>Allocasuarina</i> which are required for feeding (Clout, 1989; Park & Borsboom, 1996; Forshaw & Cooper, 1989; Crome & Shields, 1992; Cleland & Sims, 1968; Garnett, 1992b; Blakers <i>et al</i> , 1984). Suitable senescent trees (large hollow within a live or dead Eucalypt: 10-20m, Depth: 40-120cm, Entry: ~21cm: Inside Dia: ~23cm (Forshaw, 1981; Gibbons & Lindenmayer, 2002)) are also required for nesting.	Excluded	No hollow bearing trees occurs within the site (habitat constraint).
<i>Carterornis leucotis</i> White-eared Monarch	High - 2	This species generally occurs within Coastal/Subtropical/Littoral Rainforests and occasionally Eucalypt/Riparian Forest, Mangroves and Swamp Sclerophyll with mesomorphic understorey along the eastern coast of Australia from Cape York to the Tweed River (Readers Digest, 2002; DEC, 2005).	Included	Potential habitat occurs in the form of PCT 751, PCT 1235 and PCT 1064.
<i>Cercartetus nanus</i> Eastern Pygmy-possum	High - 2	The Eastern Pygmy-possum is found in south-eastern Australia, from southern Queensland to eastern South Australia and in Tasmania. In NSW it extends from the coast inland as far as the Pilliga, Dubbo, Parkes and Wagga Wagga on the western slopes (OEH, 2018c). Found in a broad range of habitats from rainforest through sclerophyll (including Box-Ironbark) forest and woodland to heath, but in most areas woodlands and heath appear to be preferred, except in northeastern NSW where they are most frequently encountered in rainforest (OEH, 2018c). Feeds largely on nectar and pollen collected from banksias, eucalypts and bottlebrushes; an important pollinator of heathland plants such as banksias; soft fruits are eaten when flowers are unavailable. Also feeds on insects throughout the year; this feed source may be more important in habitats where flowers are less abundant such as wet forests (OEH, 2018c). It shelters in tree hollows, rotten stumps, holes in the ground, abandoned bird-nests, Ringtail Possum (<i>Pseudocheirus peregrinus</i>) dreys or thickets of vegetation, (e.g. grass-tree skirts); nest-building appears to be restricted to breeding females; tree hollows are favoured but spherical nests have been found under the bark of eucalypts and in shredded bark in tree forks (OEH, 2018c).	Included	Marginal potential habitat for this species occurs in association with PCT 751 which contains an abundance of Banksias.

Species	Biodiversity Risk Weighting	Habitat Requirements	Further Assessment	Justification for Exclusion / Inclusion
<p><i>Chalinolobus dwyeri</i> Large-eared Pied Bat</p>	Very High - 3	<p>The Large-eared Pied Bat occurs within drier habitats, including dry sclerophyll forests and woodlands (Hoye and Schulz in Van Dyck and Strahan, 2008) although it has been recorded within a range of habitats, including wet and dry sclerophyll forest, Cyprus pine dominated forest, tall open eucalypt forest with a rainforest sub-canopy, sub-alpine woodland, but typically in association with sandstone relief.</p> <p>Much of the known distribution is within NSW. Available records suggest that the largest concentrations of populations appear to be in the sandstone escarpments of the Sydney basin and the north-west slopes (Coolah Tops, Mt Kaputar, Warrumbungle National Park (NP) and Pilliga Nature Reserve (NR). Although the species is widely distributed, it is uncommon and patchy within this area. Sightings of note include Tottenham, west of Narromine (NSW), which is the furthest west record (Shelly 2001); Swansea Open Cut Mine area of the Wallarah Peninsula, north coast NSW (Conacher Travers 2006); a disused gold mine near Barraba (NSW) that included lactating females and dependent young (Spark 2011 pers. comm. cited in Qld DERM 2011); and Moreton NP (NSW) at the southern end of the species' range (Hoye 2005).</p> <p>'Little is known about the habitat and roosting requirements of the Large-eared Pied Bat, but natural roosts may depend heavily on sandstone outcrops. It has been found roosting in disused mine shafts, caves, overhangs and disused Fairy Martin (<i>Hirundo ariel</i>) nests for shelter and to raise young (Hoye & Dwyer 1995; Schulz 1998).</p>	Included	<p>The site occurs within 2km of rocky escarpments associated with Cape Byron.</p> <p>There is no suitable cavernous rock potential breeding habitat in the site itself, only foraging habitat (native tree canopy and open areas).</p>
<p><i>Crinia tinnula</i> Wallum Froglet</p>	Moderate – 1.5	<p>This species of wallum frog is found along drainage lines in sub-coastal wet heath, in acid paperbark (<i>Melaleuca</i>) swamps, and sedge swamps associated with sandy coastal plains (but rarely from around coastal lakes) and low slopes below 40m altitude and above areas of tidal influence (Ehmann, 1997; Meyer et al, 2006). The habitats in which the wallum froglet species breed are typically oligotrophic (i.e. nutrient poor), tannin-stained and acidic ((pH 4.3-5.2) [QPWS 2001; Meyer et al. 2006; McDonald et al, 2009; Hines et al, 2004]. These attributes may render wallum frog breeding habitat unsuitable for related species (i.e. the common sedgefrog <i>Litoria fallax</i>, striped rocketfrog <i>L. nasuta</i>, clicking froglet <i>C. signifera</i> and beeping froglet <i>C. parinsignifera</i>). This could explain why wallum frog species and related species seldom occur together" (Ingram and Corben, 1975; Straughan, 1966 in Myer et al, 2006: 16).</p> <p>The coastal distribution occurs as far north as Litabella National Park on the southeast coast of Queensland south to Kurnell in mid-eastern New South and also upon a number of offshore islands including Fraser Island, Bribie Island, Moreton Island and North Stradbroke Island (BCC, 2010). Breeding usually occurs in autumn or early winter, but has been recorded in all seasons following rain with males vocalising from the base of sedges near water or atop matted sedges (McDonald et al, 2009; Meyer et al, 2006).</p>	Included	<p>Potential habitat for the species occurs in association with the drainage lines and Paperbark Swamps (PCT 1064) during ponding periods.</p> <p>This species has been previously recorded within the Study Area.</p>

Species	Biodiversity Risk Weighting	Habitat Requirements	Further Assessment	Justification for Exclusion / Inclusion
<p><i>Cyclopsitta diophthalma coxeni</i> Coxen's Fig-Parrot</p>	Very High – 3	<p>The small, predominantly green Coxen's Fig Parrot is found wherever fig trees are present in lowland and upland forest types, riparian corridors, farmland and urban environments (Coxen's Fig-Parrot Recovery Team 2001). Seeds of native figs are the major food source of this endangered bird species (Forshaw 1981, Romer and Spittall 1994, Pizzey and Knight 1997). The Moreton Bay Fig (<i>Ficus macrophylla</i>) and Green-leaved Strangler Fig (<i>F. watkinsiana</i>) are preferred species. Other fig species also selected as food source are Rusty Fig (<i>F. rubiginosa</i>), White Fig (<i>F. virens</i>), Small-leaved Fig (<i>F. oblique</i>), Cluster Fig (<i>F. racemosa</i>), Sandpaper Figs (<i>F. coronata</i>), and <i>F. fraseri</i> and deciduous fig <i>F. superba</i> (Holmes 1990, Gynther et al. 1998). Other likely food sources include fruits of Lilly-Pillies (<i>Syzygium</i> spp., <i>Acmena</i> spp.), Blue Quandong (<i>Elaeocarpus grandis</i>), bolly gum (<i>Litsea australis</i>), Red Ash (<i>Alphitonia excelsa</i>) and nectar of Silky Oaks (<i>Grevillea robusta</i>) (Holmes 1990, Irby 1930).</p> <p>The Coxen's Fig Parrot may obtain a source of zinc through consumption of lichens (Romer and Spittall 1994). Fruiting trees in gardens and cultivated farmlands may also be suitable as food source, including Edible Fig (<i>F. carica</i>), Cotoneaster (<i>Cotoneaster lacteus</i>), Queen Palm (<i>Syagrus romanzoffiana</i>) and Loquat (<i>Eriobotrya japonica</i>) (Holmes 1990, Gynther et al. 1998, Forshaw 1969).</p> <p>Most records of Coxen's Fig-Parrot have been taken within small remnant stands, forest edges (Holmes 1994) or thin strips of gallery forest (Norris 1964). Subtropical rainforest, dry rainforest, sclerophyll forest and subtropical rainforest are preferred nesting sites (Coxen's Fig-Parrot Recovery Team 2001). High trees within or near the edge of rainforest are suitable for nesting. The nest chamber is found to be within the excavated underside of a dead or decaying limb or trunk in a living or dead tree. Habitat clearing and fragmentation are the major threats of this species (Holmes 1995, Pizzey and Knight 1997).</p> <p>Coxen's Fig-Parrot is estimated to occur in four subpopulations: greater Bundaberg region, Maleny/Imbil/Kin Kin Creek area, the Qld/NSW border area (Lamington National Park, Whian Whian State Forest, Alstonville plateau), and the upper Hastings River catchment. This estimate is considered to be of low reliability (i.e. there is uncertainty about the number of subpopulations and the extent of genetic separation between subpopulations) (Garnett & Crowley 2000 in DSEWPC, 2013). Most recent records of the species are recorded from the Lamington Plateau (Qld) with only seven unconfirmed sightings recorded from NSW since 1981. It is estimated that the remaining wild population of the species may be less than 100 individuals (DSEWPC, 2013).</p>	Included	Marginal potential habitat for the Fig-parrot occurs in association with PCT 751 containing rainforest species, although preferred Fig trees are very scarce.
<p><i>Esacus magnirostris</i> Beach Stone-curlew (Breeding)</p>	Very High – 3	Beach Stone-curlews are found exclusively along the coast, on a wide range of beaches, islands, reefs and in estuaries, and may often be seen at the edges of or near mangroves. They forage in the intertidal zone of beaches and estuaries, on islands, flats, banks and spits of sand, mud, gravel or rock, and among mangroves. Beach Stone-curlews breed above the littoral zone, at the backs of beaches, or on sandbanks and islands, among low vegetation of grass, scattered shrubs or low trees; also among open mangroves (OEH, 2021).	Excluded	The site does not contain suitable breeding habitat for the Beach Stone-curlew. While the site is close to the beach, it does not contain suitable habitat (sand or gravel, above the tidal zone at the backs of beaches, or on sandbanks and islands or among open mangroves) for breeding. The site is also fragmented from suitable breeding habitat by roadways, dwellings and other anthropogenic structures.
<p><i>Haliaeetus leucogaster</i> White-bellied Sea-Eagle (Breeding)</p>	High – 2	The White-bellied Sea-Eagle is found in coastal habitats (especially those close to the sea-shore) and around terrestrial wetlands in tropical and temperate regions of mainland Australia and its offshore islands. The habitats occupied by the sea-eagle are characterised by the presence of large areas of open water (larger rivers, swamps, lakes, the sea). Birds have been recorded in (or flying over) a variety of terrestrial habitats (Marchant & Higgins 1993). The White-bellied Sea-Eagle feeds opportunistically on a variety of fish, birds, reptiles, mammals and crustaceans, and on carrion and offal (del Hoyo et al. 1994; Ferguson-Lees & Christie 2001; Marchant & Higgins 1993; Rose 2001a)	Excluded	There are no suitable nesting trees within the site (habitat constraint). The majority of the trees on site are relatively young (i.e. <50 years old) which regenerated post mining activities on site. No large raptor nests were recorded within the site.
<p><i>Hieraetus morphnoides</i> Little Eagle</p>	Moderate – 1.5	The Little Eagle occupies habitats rich in prey within open eucalypt forest, woodland or open woodland. Sheoak or acacia woodlands and riparian woodlands of interior NSW are also used (Marchant and Higgins 1993; Aumann 2001a).	Excluded	There are no suitable nesting trees within the site (habitat constraint). The majority of the trees on site are relatively young (i.e. <50 years

Species	Biodiversity Risk Weighting	Habitat Requirements	Further Assessment	Justification for Exclusion / Inclusion
(Breeding)		<p>For nest sites it requires a tall living tree within a remnant patch, where pairs build a large stick nest in winter and lay in early spring. Young fledge in early summer. It eats birds, reptiles and mammals, occasionally adding large insects and carrion (Marchant and Higgins 1993; Aumann 2001b; Debus <i>et al.</i> 2007). It was formerly heavily dependent on rabbits, but following the spread of rabbit calicivirus disease, and consequent decline in rabbit numbers by 65-85% in the arid and semi-arid zones (Sharp <i>et al.</i> 2002), the eagle is increasingly dependent on native prey. Most of its former native mammalian prey species in inland NSW are extinct (terrestrial mammals of rabbit size or smaller, e.g. large rodents, bandicoots, bettongs, juvenile hare-wallabies and nailtail wallabies: Van Dyck and Strahan 2008).</p> <p>The Little Eagle is distributed throughout the Australian mainland excepting the most densely forested parts of the Dividing Range escarpment (Marchant and Higgins 1993). It occurs as a single population throughout NSW. The population in New Guinea is now classified as a separate species, the Papuan Booted Eagle <i>Hieraetus weiskei</i> (Lerner and Mindell 2005).</p>		old) which regenerated post mining activities on site. No large raptor nests were recorded within the site.
<i>Hoplocephalus bitorquatus</i> Pale-headed Snake	High – 2	<p>A patchy distribution from north-east Queensland to the north-eastern quarter of NSW. In NSW it has historically been recorded from as far west as Mungindi and Quambone on the Darling Riverine Plains, across the north west slopes, and from the north coast from Queensland to Sydney. A small number of historical records are known for the New England Tablelands from Glenn Innes and Tenterfield; however, the majority of records appear to be from sites of relatively lower elevation (OEH, 2019b).</p> <p>The snake is found mainly in dry eucalypt forests and woodlands, cypress forest and occasionally in rainforest or moist eucalypt forest. In drier environments, it appears to favour habitats close to riparian areas (OEH, 2018c). It shelters during the day between loose bark and tree-trunks, or in hollow trunks and limbs of dead trees (OEH, 2018c).</p> <p>The main prey is tree frogs although lizards and small mammals are also taken (OEH, 2019b).</p>	Included	Marginal potential habitat for the Pale-headed Snake occurs in association with PCT 751.
<i>Hoplocephalus stephensii</i> Stephens' Banded Snake	High – 2	<p>Stephens' Banded Snake is nocturnal, and shelters between loose bark and tree trunks, amongst vines, or in hollow trunks limbs, rock crevices or under slabs during the day (OEH, 2019b).</p> <p>Stephen's Banded Snake occurs in Rainforest and eucalypt forests and rocky areas up to 950 m in altitude where it hunts frogs, lizards, birds and small mammals at night (OEH, 2019b).</p>	Included	Marginal potential habitat for the Pale-headed Snake occurs in association with PCT 751, although no hollow-bearing trees occur within the site. The site occurs within 500m of aboreal vine tangles]fallen/standing dead timber including logs.
<i>Lathamus discolor</i> Swift Parrot (Breeding)	Very High - 3	<p>The swift parrot breeds in Tasmania during the summer and the entire population migrates north to mainland Australia for the winter. Whilst on the mainland the swift parrot disperses widely to forage on flowers and psyllid lerps in Eucalyptus species, with the majority being found in Victoria and New South Wales (DAWE, 2021).</p>	Excluded	<p>The site is not mapped as occurring within an Important Area for the Swift Parrot (habitat constraint).</p> <p>The Swift Parrot breeds in Tasmania.</p>
<i>Lichenostomus fasciogularis</i> Mangrove Honeyeater	High – 2	<p>In NSW this species primary habitat is mangrove forest where a few colonies exist at scattered localities, including the Tweed, Richmond and Clarence River estuaries and Stuarts Point south of Macksville (DEC, 2005). The honeyeater has also been recorded from other coastal forest types including casuarinas and paperbark forest (DEC, 2005).</p>	Included	Although preferred mangrove forests are absent from the site, the species is also known to occur within casuarina and paperbark forests (PCTs 1235 and 1064). The site occurs within 10km of the coast.

Species	Biodiversity Risk Weighting	Habitat Requirements	Further Assessment	Justification for Exclusion / Inclusion
<p><i>Litoria brevipalmata</i> Green-thighed Frog</p>	<p>Moderate – 1.5</p>	<p>The Green-thighed Frog is a poorly understood and relatively recently discovered species which occurs within forests and swamps of the coast and adjacent ranges from central NSW to SEQLD (Cogger, 2000; Barker et al, 1995, Hines et al, 1999). Robinson (1993), Griffiths (1997) and Cogger (2000) list the breeding season as summer whereas Barker et al. (1995) record it as October and January. Calling has been documented to last for only a few days at a time (Natrass and Ingram 1993; Barker et al. 1995) and has been noted to occur in association with "heavy rains" (Barker et al.1995; Ehmann 1997). Males are noted to call around flooded semi-permanent or ephemeral pools, usually in grassy areas (Robinson 1993; Barker et al. 1995; Cogger 2000). This species may have varying habitat requirements across its range. Cogger (2000), Robinson (1993) and Barker et al. (1995) all record this species to be associated with moist forests (swamp forests, wet sclerophyll forest and rainforest). However, records from the northern parts of its range appear to predominantly come from dry sclerophyll forest (McDonald 1974; Czechura 1978; Natrass and Ingram 1993; Aridis, 1996) [in Lemckert et al, 2006: 1].</p>	<p>Included</p>	<p>Potential habitat for the species occurs in association with the drainage lines and Paperbark Swamps (PCT 1064) during ponding periods.</p>
<p><i>Litoria olongburensis</i> Olongburra Frog</p>	<p>Moderate - 1.5</p>	<p>This species is known from a variety of coastal sandy vegetation communities associated with wallam (banksia) including heathland, sedgeland, melaleuca forest/woodland and ephemeral wetlands with a preference for acidic (low pH) seasonally inundated sedge swamps for breeding. The known distribution includes such lowland coastal zones from Fraser Island (southeast QLD) to Yuraygir National Park (north-east NSW) including several offshore islands such as Fraser Island, Bribie Island, Moreton Island and North Stradbroke Island (DSEWPC, 2011; Meyer et al, 2006; BSC, 2010). A review of the distribution of <i>Litoria olongburensis</i> (DSEWPC, 2011) notes that the species is neither mapped as 'known/likely to occur' nor 'may occur' on the mainland between approximately Tugun and Beerwah.</p> <p>At swamp sites, the Wallum Sedge Frog can be found sheltering amongst sedges, reeds and ferns all year round (Anstis 2002; Ehmann 1997; Ingram & Corben, 1975; James, 1996; Lewis & Goldingay, 2005; Liem & Ingram, 1977; Neilson, 2000 in DSEWPC, 2012). During wet periods the frog can be found on emergent vegetation (rushes, sedges, ferns) whilst during drier periods it may be found at the base of such vegetation (BSC, 2010). Breeding occurs after rain in spring, summer and autumn within acidic, permanent to ephemeral freshwater wetlands with emergent vegetation, most notably sedges, reeds or ferns in still water 0.5-1.5m deep (Hines et al, 2004). These wetlands (wallum swamps, bogs, lakes or creeks), which are considered habitats critical to the survival of the species, typically overlie deep, low-nutrient, sandy soils where groundwater levels are characteristically high (Wallum Sedge Frog Workshop 2010 in DSEWPC, 2012; Meyer et al, 2006). Consequently, numerous survey guidelines indicate that searches for the species are best undertaken during the warmer months as activity may be increased. It is noted, however, that studies undertaken over a four year period in northeastern NSW (Lewis and Goldingay, 2005) resulted in counts of individuals of <i>Litoria olongburensis</i> being higher in winter than in summer. Additional activity information obtained noted that counts of adults were negatively influenced by rain during the previous day, but positively influenced by rain the previous week. Counts of juveniles were influenced by rain during the previous three months (Lewis and Goldingay, 2005).</p> <p>A significant population of the species is noted to occur within restricted wallum habitats on Gold Coast airport lands investigated in association with the Tugun Bypass SIS (PB, 2004; Hero et al, 2001; BAAM, 2005). Breeding habitat is characterised by low pH and relatively deep pools with some capacity to retain water for longer periods with six ponds of breeding importance located proximate to the Gold Coast Airport (Hero et al, 2001). It is noted that purpose built frog ponds established adjacent the airport site have been re-colonised by the wallum sedgefrog post construction of the Tugun Bypass (QDTMR, 2007). "The context of the Tugun population with respect to other populations of the frog is as follows:</p> <p>It is an isolated population that is 30-40km to the north of the nearest known population in the Pottsville Area, New South Wales and 45 km to the nearest known population in the north, North Stradbroke Island, Queensland.</p> <p>It also most likely occurs on South Stradbroke Island, which is about 16km north of Tugun.</p>	<p>Included</p>	<p>Marginal potential habitat occurs in association with the site's drainage lines, although these areas are generally unfavourable due to the poor development of emergent vegetation suitable for this species (i.e. tall grey sedges). The site occurs within 10km of the coast.</p>

Species	Biodiversity Risk Weighting	Habitat Requirements	Further Assessment	Justification for Exclusion / Inclusion
		The nearest known mainland population in Queensland is at Beerwah about 100km to the north. However, it is known from in between on the major Moreton Bay Islands of Bribie, Moreton and North Stradbroke. The Stradbroke Islands were apparently connected to each other and the mainland at Southport during European memory.		
Lophoictinia isura Square-tailed Kite (Breeding)	Moderate - 1.5	<p>This species typically prefers the coastal forested and wooded lands of tropical and temperate Australia where it appears to occupy large hunting ranges of more than 100km² (Marchant & Higgins 1993; NPWS, 1999; DEC, 2005). 'It particularly favours productive forests on the coastal plain, box-ironbark-gum woodlands on the inland slopes, and Coolibah/River Red Gum on the inland plains (Marchant & Higgins 1993). It also forages over coastal heathlands, and often near openings and edges of forest. The Square-tailed Kite will forage around suburban trees and shrubs, and nest in urban bushland. On the Mid-north Coast of NSW, landscapes within a 2 km radius of the nest sites of 11 pairs of Square-tailed Kites had a high proportion of young and older-aged regrowth Blackbutt forest, when compared with random sites (Kavanagh <i>et al.</i> 2001)' (NSW Scientific Committee, 2009:1) A common feature of the kite's habitat is the presence of profuse eucalypt blossom and attendant nectivorous/passerine birds which are the favoured prey of the kite (Readers Digest, 2002, NPWS, 1999). In eastern NSW, neighbouring nests of the Square-tailed Kite are about 13 km apart, with a density of one pair per 170 km², and home range of roughly 50 km² (Lutter <i>et al.</i> 2004).</p> <p>The Square-tailed Kite is highly mobile and dispersive, with southern populations migrating to winter in the tropics (Marchant & Higgins 1993; EPA, 2002). It is inferred not to be susceptible to population fragmentation (NSW Scientific Committee, 2009).</p>	Excluded	There are no suitable nesting trees within the site (habitat constraint). The majority of the trees on site are relatively young (i.e. <50 years old) which regenerated post mining activities on site. No large raptor nests were recorded within the site.
Miniopterus australis Little Bent-winged Bat (Breeding)	Very High - 3	<p>This species utilises well-timbered habitats including rainforest, <i>Melaleuca</i> swamps and dry sclerophyll forests where it feeds on insects within the canopy and requires caves, mines, stormwater drains and/or tree hollows to roost (Strahan eds, 2002). DECC (2005) note the following additional particulars with regard to the little bentwing bat:</p> <p>Maternity colonies form in spring. Males and juveniles disperse in summer.</p> <p>Only five nursery sites /maternity colonies are known in Australia.</p> <p>Moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, <i>Melaleuca</i> swamps, dense coastal forests and banksia scrub. Generally found in well-timbered areas.</p> <p>Little Bentwing-bats roost in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats.</p> <p>They often share roosting sites with the Common Bentwing-bat and, in winter, the two species may form mixed clusters.</p> <p>In NSW the largest maternity colony is in close association with a large maternity colony of Common Bentwing-bats (<i>M. schreibersii</i>) and appears to depend on the large colony to provide the high temperatures needed to rear its young.</p>	Excluded	No caves, tunnels, mines, culverts or other structures known or suspected to be used for breeding occur within the site (habitat constraint).
Miniopterus orianae oceanensis Large Bent-winged Bat (Breeding)	Very High - 3	<p>This species usually forages on insects within intact, well timbered forest complexes and have been found to roost within caves, tunnels, stormwater culverts or disused mining areas (Strahan eds, 2002; DEH, 2005). They utilise a broad range of habits including wet and dry sclerophyll forest, open woodland, paperbark forests, rainforests and open grasslands (North & Pasic, 2006). Twelve known maternity roost sites occur within its distribution ranging from tens of thousands to >100000 individuals. The known large roost sites are located in limestone and sandstone caves, abandoned gold mines, concrete bunkers and lava tubes. Outside the breeding season the eastern bentwing often selects cool areas within caves, mines, tunnels, drains and bridges (Hoye & Hall in Van Dyck & Strahan, 2008).</p>	Excluded	No caves, tunnels, mines, culverts or other structures known or suspected to be used for breeding occur within the site (habitat constraint).

Species	Biodiversity Risk Weighting	Habitat Requirements	Further Assessment	Justification for Exclusion / Inclusion
Myotis Macropus Southern Myotis	High – 2	The Myotis roosts within caves, tunnels, hollow-bearing trees, bridges, buildings and dense tree foliage always in close proximity to permanent water (NPWS, 2002; Richards, 2002). It forages over waterbodies where it scoops insects and small fish from the water surface or catches insects aerially (DEH, 2005; Menkhorst, 1996; Richards, 2002). It has been recorded foraging over small creeks, coastal rivers, estuaries, lakes and inland rivers (Law & Anderson, 1999) and other smaller waterbodies including farm dams (Law et al, 1998).	Included	Although no hollow bearing trees or other suitable nesting structures occurs within site, the site contains drainage lines (>3m or wider) suitable for this species.
Ninox connivens Barking Owl (Breeding)	High – 2	The Barking Owl lives in forests and woodlands of tropical, temperate and semi-arid zones. Its habitat is typically dominated by eucalypts, often red gum species and, in the tropics, paperbarks <i>Melaleuca</i> species. It usually roosts in or under dense foliage in large trees including rainforest species of streamside gallery forests, River She-oak <i>Casuarina cunninghamiana</i> , other <i>Casuarina</i> and <i>Allocasuarina</i> species, eucalypts, <i>Angophora</i> or <i>Acacia</i> species. Roost sites are often near watercourses or wetlands. It typically breeds in hollows of large eucalypts or paperbarks, usually near watercourses or wetlands. Barking Owls have been recorded in remnants of forest and woodland and in clumps of trees at farms, towns and golf courses. DECC (2005) notes that large home ranges of 30-200 hectares are occupied by the owl.	Excluded	No hollow bearing trees occur within the subject site (habitat constraint).
Ninox strenua Powerful Owl (Breeding)	High – 2	This species of Owl occupies a very large (800-1000ha) permanent range within mostly wet sclerophyll forests and woodlands in southeastern Australia (NPWS, 2002; NPWS, 2005). Within this range its favoured prey include large arboreal mammals (greater glider, brushtail possum) although additional smaller prey (flying fox, sugar glider, ringtail possum, rabbit, birds) are also taken (NPWS, 1997; 2005). Kavanagh & Stanton (2002) note that small (<200 ha) fragments do not provide a significant reservoir for populations of large forest owl (Sooty, Powerful, Masked) species. Roosting occurs within 'groves of dense mid-canopy trees or tall shrubs in sheltered gullies, typically on wide creek flats and at the heads of minor drainage lines, but also adjacent to cliff faces and below dry waterfalls. Roosting sites are commonly among small groves of up to 2 ha of similar-sized trees with dense foliage in the height range 3-15 m. (Data from Kavanagh 1997, Kavanagh 2002b in DEC, 2005; 8). Nesting has been recorded in over-mature eucalypts within 100m of streams/drainage lines in large hollows (>45cm dia; 100cm deep) surrounded by canopy trees and subcanopy or understorey trees or tall shrubs. The owl is faithful to traditional nesting hollows, but also sometimes uses alternative hollows in the nesting gully (Data from Schodde and Mason 1980, McNabb 1996, Kavanagh 1997, Kavanagh 2002b, Higgins 1999 in DEC, 2005: 8).	Excluded	No hollow bearing trees occur within the subject site (habitat constraint).
Pandion cristatus Eastern Osprey (Breeding)	Moderate - 1.5	This species is associated with waterbased habitats including estuaries, coastal wetlands, rivers and streams. The Osprey is predominately a coastal raptor frequenting estuaries, bays, inlets, islands and rocky cliffs within all Australian states except for Tasmania and sporadically within Victoria (DEC, 2005; NPWS, 2002). It is noted however, that the species sometimes inhabits inland islands (Pizzey and Knight, 1997; Readers Digest, 2002). Within suitable environment it usually constructs a nest in an overhanging large tree or upon elevated man-made structures such as platforms or telegraph poles. The species preys almost exclusively on fish by usually hunting alone and traversing the water's surface for prey which it secures by swooping over the waters surface or plunging below (Readers Digest, 2002; Clancy, 2005). Studies of prey middens on Lizard Island within the Great Barrier Reef also noted that occasional Terns and crustaceans are sourced for food (Smith, 1985).	Excluded	The site does not contain suitable breeding habitat (i.e. presence of stick-nests in living and dead trees [>15m] or artificial structures within 100m of a floodplain for nesting).
Petalura litorea Coastal Petaltail	Very High - 3	The Coastal Petaltail occupies a variety of permanent to semi-permanent coastal freshwater wetlands (OEH, 2018).	Included	The site occurs within 500m of swamps. Potential habitat for this species occurs in association with PCT 1235 and PCT 1064.

Species	Biodiversity Risk Weighting	Habitat Requirements	Further Assessment	Justification for Exclusion / Inclusion
<i>Petauroides Volans</i> Southern Greater Glider	High – 2	<p>The greater glider is an arboreal nocturnal marsupial, largely restricted to eucalypt forests and woodlands. It is primarily folivorous, with a diet mostly comprising eucalypt leaves, and occasionally flowers (Kehl & Borsboom 1984; Kavanagh & Lambert 1990; van der Ree et al., 2004). It is typically found in highest abundance in taller, montane, moist eucalypt forests with relatively old trees and abundant hollows (Andrews et al., 1994; Smith et al., 1994, 1995; Kavanagh 2000; Eyre 2004; van der Ree et al., 2004; Vanderduys et al., 2012).</p> <p>During the day it shelters in tree hollows, with a particular selection for large hollows in large, old trees (Henry 1984; Kehl & Borsboom 1984; Lindenmayer et al., 1991; Smith et al., 2007; Goldingay 2012).</p>	Excluded	No hollow bearing trees occur within the subject site (habitat constraint).
<i>Petaurus norfolcensis</i> Squirrel Glider	High – 2	<p>This species of Glider is associated with dry sclerophyll forest and woodlands although in northern NSW and Qld it has been recorded from wet sclerophyll environments (Suckling in Strahan eds, 2002; Lindenmayer 2002). It is considered to be most abundant in associations containing winter flowering Eucalypts and/or environments with a high abundance of Acacia, Banksia species in the lower layers (Smith & Murray, 2003; Menkhorst et al, 1998; Quinn, 1995).</p> <p>Within the canopy of the preferred habitat numerous trees bearing hollows are critical habitat values required to support populations of the species (Quinn, 1995; Smith & Murray, 2003; Lindenmayer, 2002). Gliders are known to regularly swap den trees and utilise a number of such dens (between 6 and 19 den trees per Glider) within their home range (van der Ree, 2000). These results are supported by survey work undertaken by Southern Cross University (June/July 2002) which indicated that 12 radio tracked gliders utilised 37 den trees incorporating live hollow bearing trees and stags (Cited in Warren, 2004).</p>	Included	Marginal potential habitat for the squirrel glider occurs in association with PCT 751 and PCT 1064 containing foraging resources. The absence of hollow bearing trees and fragmented nature of the site is likely to restrict the occurrence of this species on site.
<i>Phascogale tapoatafa</i> Brush-tailed Phascogale	High – 2	<p>The Brush-tailed Phascogale has a patchy distribution around the coast of Australia. In NSW it is mainly found east of the Great Dividing Range although there are occasional records west of the divide (OEH, 2019b).</p> <p>The species prefers dry sclerophyll open forest with sparse groundcover of herbs, grasses, shrubs or leaf litter, although also inhabits heath, swamps, rainforest and wet sclerophyll forest. (OEH, 2019b).</p> <p>The phascogale nest and shelter in tree hollows with entrances 2.5 - 4 cm wide and use many different hollows over a short time span (OEH, 2019b).</p>	Included	Marginal potential habitat for the phascogale occurs in association with PCT 751 and PCT 1064. The absence of hollow bearing trees and fragmented nature of the site is likely to restrict the occurrence of this species on site
<i>Phascolarctos cinereus</i> Koala (Breeding)	High – 2	<p>This species primarily occurs within Eucalypt Forest and Woodlands containing a suitable density of favoured food trees within coastal eastern and southeastern Australia. Preferred habitat generally contains a high percentage of primary food trees although underlying geology and soil type can be an important factor. Eucalypt Forests associated with drainage lines and floodplains of richer soil types (i.e. moisture and nutrients) can also be favoured due to feed trees containing higher levels of nutrients and less potential for toxicity (Hindell & Lee, 1990; Moore & Foley, 2000).</p> <p>Within SEQLD six primary foraging trees were identified by Pahl (1993); Tallowwood (<i>Eucalyptus microcorys</i>), Blue Gum (<i>E. tereticornis</i>), Scribbly Gum (<i>E. racemosa</i>), Grey Gum (<i>E. propinqua</i>), Red Mahogany (<i>E. resinifera</i>) and White Stringybark (<i>E. tindaliae</i>). Further research undertaken by Phillips & Callaghan (1996) in Tweed Shire indicates that Swamp Mahogany (<i>E. robusta</i>) and Blue Gum (<i>E. tereticornis</i>) [including</p>	Included	<p>Preferred habitat (i.e. eucalypt forests) for the koala is absent from the site. Preferred koala food trees within the site were limited to an individual Forest Red Gum (<i>Eucalyptus tereticornis</i>).</p> <p>Marginal potential habitat occurs in association with PCT 1064.</p>

Species	Biodiversity Risk Weighting	Habitat Requirements	Further Assessment	Justification for Exclusion / Inclusion
		<p>hybrids of the two] on alluvial deposits and Quaternary and Neranleigh-Fernvale Group geomorphologies were considered to be primary habitats. Areas with sub-dominance of these species on Neranleigh-Fernvale alliances supporting Blue Gum (<i>E. tereticornis</i>), Tallowwood (<i>E. microcorys</i>) and/or Grey Gum (<i>E. propinqua</i>) comprise secondary habitat or primary habitat depending on the density of the latter two species. Phillips & Callaghan (1998) also noted Tallowwood to be a primary browse species and two types of Grey Gum (<i>E. propinqua</i>, <i>E. biturbinata</i>) to be secondary browse species in Currumbin.</p> <p>Recent studies (Biolink, 2007) indicate that <i>Eucalyptus tereticornis</i>, <i>E. microcorys</i> and <i>E. propinqua</i>/<i>E. biturbinata</i> are the most preferred koala food trees throughout the Gold Coast LGA. Within the Tweed Coast Swamp Mahogany <i>Eucalyptus robusta</i> and Forest Red Gum <i>E. tereticornis</i> are the most preferred tree species with Tallowwood <i>E. microcorys</i> and Grey Gum <i>E. propinqua</i> being the next most preferred (Biolink, 2011).</p> <p>Within utilised Eucalypt Forest habitat the koala spends most of its time in distinct home-ranges which may overlap if available habitat area is reduced. Males are territorial but a dominance-hierarchy exists and they may attack during the summer breeding season. Home ranges of the species are considered to be large and can vary dependent upon habitat quality and extent. Studies have shown various home range sizes exist with the males usually larger than the female (Male 135ha, Female: 110ha [Ellis et al, 2002], Male: 34.4ha, Female: 15ha [White, 1999]).</p>		
<p><i>Phyllodes imperialis</i> southern subspecies Southern Pink Underwing Moth</p>	High – 2	<p>The Pink Underwing Moth is distributed from Nambour, south-east Queensland, to Dorrigo in northern NSW (Clarke & Spier-Ashcroft 2003). It is currently known from five locations, of which Mary Cairncross Scenic Reserve, near Maleny (Queensland), contains the only confirmed breeding habitat (NSW SC 2003j). This subspecies occurs within the Burnett Mary and South East (Queensland) and Northern Rivers (NSW) Natural Resource Management Regions (TSSC 2008xy).</p> <p>The Pink Underwing Moth is found below the altitude of 600 m in undisturbed, subtropical rainforest. It occurs in association with the vine <i>Carronia multise palea</i>, a collapsed shrub that provides the food and habitat the moth requires in order to breed (Clarke & Spier-Ashcroft 2003; NSW DECC 2005ag). Where <i>C. multise palea</i> attains an upright form, the association with the moth does not occur (TSSC 2002n).</p> <p>The larvae of the Pink Underwing Moth feed on the vine <i>Carronia multise palea</i> which appears to be relatively rare (NSW SC 2003j).</p>	Excluded	Preferred habitat for the pink underwing moth is considered to be absent from the site as suitable undisturbed rainforest and <i>Carronia multise palea</i> are absent.

Species	Biodiversity Risk Weighting	Habitat Requirements	Further Assessment	Justification for Exclusion / Inclusion
<p><i>Planigale maculate</i> Common Planigale</p>	High – 2	<p>This species is known to 'inhabit a broad range of habitats incorporating a dense ground cover layer including rainforest, eucalypt forest, heathland, marshland, grassland and rocky areas (Redhead in Strahan, 2002; Lewis, 2005). In northern NSW, it has been suggested that their distribution often corresponds with the low lying flat and undulating areas of the coastal plains often near intensively settled areas (Gilmore and Parnaby 1994 in Lewis, 2005).</p> <p><i>Planigale maculata</i> is an unspecialised predator foraging mainly on insects, other invertebrates, small vertebrates, and occasionally nectar (Callaghan <i>et al.</i> 2005 and references therein). <i>Planigale maculata</i> is generally most active from slightly before dusk to before sunrise, interspersed with rest periods and periods of high activity, and is capable of eating the equivalent of its own body weight in food daily (Van Dyck 1979). In contrast, Van Dyck (1979) also notes that <i>P. maculata</i> has the ability to enter torpor in response to cold weather or food deprivation. Introduced predators of <i>P. maculata</i> include cats (Redhead 1995) and dogs (Fleay 1981) with foxes also considered likely predators (Callaghan <i>et al.</i> 2005). There is currently little movement data available for <i>P. maculata</i> although other members of this genus are widely recognised as having a shifting home range in response to local climatic conditions and food resources (Denny 1982; Read, 1982; 1988; and Miller 1998; in Lewis 2004)' (and in Hannah, 2007: 5)</p> <p>A small population of the species has been recently recorded on the northern banks of the Cobaki Broadwater in association with Swamp Mahogany/Brushbox Forest (Ecopro, 2004; Lewis Ecological Surveys, 2004). A population of Planigales is also known further south of the site within the Koala Beach development where the species has been recorded within Brushbox Forest, Tall Eucalypt dominated Wet Sclerophyll Forest, Swamp Forest, Regrowth Eucalypt Forest and utilising artificial habitats within recorded habitats (AKF, 2005; TSC, 2007). Habitat features that appear most important to the local Planigale population include:</p> <ul style="list-style-type: none"> i) Dense or scattered tree canopy-cover; ii) Dense ground-cover vegetation; and iii) Areas within or adjacent to low-lying sites subject to seasonally wet conditions, with occasional inundation for short periods (AKF, 2005: 7) 	Included	All forested areas of the site containing a dense ground cover layer is considered to represent potential habitat for the common planigale.
<p><i>Potorous tridactylus</i> Long-nosed Potoroo</p>	High – 2	<p>Long-nosed Potoroos are generally restricted to areas with an annual rainfall greater than 760 mm where they inhabit dry and wet sclerophyll forests and woodland with a heathy understorey (Johnson in Strahan, 2002; DEC, 2005). The preferred habitat in north eastern NSW is dry and wet open shrubland (Mason 1997, DEC, 2005, Johnston in Strahan, 2002). In all habitats the species requires relatively thick groundcover growing on friable soils (Bennett, 1993). Within these areas the Potoroo digs for its food the main component of which is hypogeal fungi with other important items including hard-bodied arthropods, vascular plant tissues, seeds and fleshy fruits (Bennett & Baxter, 1989; Claridge <i>et al.</i>, 1993).</p> <p>It is also noted that a small, disjunct population of Potoroos exists in a small area of Crown land between the northern shore of Cobaki Broadwater and the NSW-Queensland border (Bali <i>et al.</i>, 2003; Ecopro, 2004; Warren & Associates, 1992; Hero, 2001). The extensive 2003 survey undertaken by Bali <i>et al.</i> notes that "within the Cobaki area, potoroos were most frequently trapped in Scribbly Gum Mallee Heathland followed by, Tree Broom Heathland, Scribbly Gum/Swamp Mahogany Forest, Black She-oak Heathland, Swamp Mahogany Forest and Scribbly Gum Forest. Our results suggest that potoroos prefer Scribbly Gum Mallee Heathland with an understorey of sedges and grasses such as <i>Restio</i> spp., <i>Lomandra</i> spp. and <i>Gahnia</i> spp., which is found along both sides of the Cobaki Lakes" (Bali <i>et al.</i>, 2003: 16).</p>	Included	While marginal potential habitat occurs in the form the forested areas of the site, known suitable dense understorey vegetation providing shelter is lacking within the site. The fragmented nature of the site is also likely to hinder the occurrence of this species. Nevertheless, the species was included for further assessment.

Species	Biodiversity Risk Weighting	Habitat Requirements	Further Assessment	Justification for Exclusion / Inclusion
<i>Potorous tridactylus</i> - endangered population Long-nosed Potoroo, Cobaki Lakes and Tweed Heads West population	High – 2	As above.	Excluded	This potoroo population occurs between Tweed Heads West to the east, NSW-Qld border to the north, Piggabeen to the west and the north shore of Cobaki Broadwater to the south. The site is well removed from this location (geographic limitation).
<i>Pteropus poliocephalus</i> Grey-headed Flying-fox (Breeding)	High – 2	<p>The Grey-headed Flying-fox inhabits subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps (Eby, 1995). Urban gardens and cultivated fruit crops also provide habitat for this species (NSW NPWS 1999c). Grey-headed Flying-foxes forage on the nectar and pollen of native trees, in particular Eucalyptus, Melaleuca, Banksia (Eby, 2000) and fruits of rainforest trees and vines (NSW NPWS 1999c). During periods when native food is limited, Grey-headed Flying-foxes disperse from colonial roosts, often foraging in cultivated gardens and fruit crops (NSW NPWS 1999c). This species roosts in large aggregations or camps in close proximity (20 km or less) to a regular food source, often in stands of riparian rainforest, Paperbark or Casuarina forest (Eby, 1995). This species is a canopy-feeding frugivore, blossom-eater and nectarivore of rainforests, open forests, woodlands, Melaleuca swamps and Banksia woodlands. As such, it plays an important ecosystem function by providing a means of seed dispersal and pollination for many indigenous tree species (Eby 1996; Pallin 2000).</p> <p>Grey-headed Flying-foxes roost in large aggregations in the exposed branches of canopy trees (Ratcliffe 1931, Nelson 1965a, Parry-Jones and Augee 1992). The locations of camps are generally stable through time, and several sites have documented histories that exceed 100 years (Lunney and Moon 1997). Camps provide resting habitat, sites of social interactions and refuge for animals during significant phases of their annual cycle, such as birth, lactation and conception (Parry-Jones and Augee 1992, 2001).</p> <p>On the basis of current knowledge, roosting habitat that meets at least one of the following criteria can be explicitly identified as habitat critical to survival, or essential habitat, for Grey-headed Flying-foxes. Roosting habitat that:</p> <ol style="list-style-type: none"> 1. is used as a camp either continuously or seasonally in > 50% of years 2. has been used as a camp at least once in 10 years (beginning in 1995) and is known to have contained > 10 000 individuals, unless such habitat has been used only as a temporary refuge, and the use has been of limited duration (i.e. in the order of days rather than weeks or months) 3. has been used as a camp at least once in 10 years (beginning in 1995) and is known to have contained > 2 500 individuals, including reproductive females during the final stages of pregnancy, during lactation, or during the period of conception (i.e. September to May) (in DECCW, 2009). 	Included	A well-known camp site is present within the western corner of the Study Area, proximate to the Court House.
<i>Thersites mitchellae</i> Mitchell's Rainforest Snail	Very High – 3	This species was formally widely distributed on coastal alluvia between the Richmond and Tweed Rivers (Stanisic, 1998, 2000; NSWNPWS, 2001). NPWS previously funded surveying within northern NSW to determine the extant distribution of the species in relation to its historical distribution. Surveys conducted (1998-2000) have provided limited success with only one robust population being recorded within the region at Stotts Island and evidence of marginal populations present at four additional sites (Stanisic 1998, 2000). An additional population was more recently discovered within Swamp Sclerophyll Forest in Kingscliff (Planit 2002, Stanisic 2003). Within its range the species is restricted to lowland subtropical rainforest and swamp sclerophyll forest with a rainforest understorey, typically on alluvial soils with a basaltic influence (NPWS, 2001, Stanisic 2002).	Included	<p>It is considered that site falls within the known range of the snail and potential habitat occur in association with PCT 1302 within the western area of the overall site, south of the Court House. The weedy understorey may deter the species from occurring within the development footprint.</p> <p>The species is known to occur within the locality (i.e. Byron bypass, Cumbebin Swamp Reserve, Byron STP).</p>

Species	Biodiversity Risk Weighting	Habitat Requirements	Further Assessment	Justification for Exclusion / Inclusion
<i>Todiramphus chloris</i> Collared Kingfisher	High – 2	<p>This species is recorded in coastal Australia from Shark Bay to the Clarence River where it is almost exclusively associated with mangrove and estuarine areas (NPWS, 2005; Readers Digest, 2002). DEH (2012) notes:</p> <p>Collared Kingfishers are virtually restricted to mangrove associations of estuaries, inlets, sheltered bays and islands, and the tidal flats and littoral zone bordering mangroves.</p> <p>They sometimes occur in terrestrial forests or woodlands bordering mangroves, where they will nest in holes in trees or in arboreal termitaria. They are sometimes seen in streets or gardens in built-up areas bordering mangrove vegetation.</p> <p>Nests are usually in holes in trunks of large, live or dead mangrove trees, though they sometimes nest in hollows or in arboreal termite nests in large eucalypts or paperbarks adjacent to mangroves or estuarine foraging habitats.</p> <p>They are often seen perched on rock walls, jetties, piles or on the ground on tidal flats. They also sometimes occur in parks and gardens along foreshores.</p> <p>Mostly take food from the ground, from the surface of mud and sand, mainly along seaward fringe of mangroves. Sometimes take food from shallow water or from air.</p> <p>The diet consists mostly of crustaceans, especially crabs, but they also take insects, small fish, and lizards. They have also been reported to occasionally take young birds.</p> <p>Breeding is usually in spring and summer, with clutches observed in NSW in September to December, and young birds from October to January. Birds usually lay three eggs, but clutches of two to four recorded. Young leave the nest about 1 month after hatching.</p>	Excluded	No hollow bearing trees or arboreal termitaria in Eucalyptus or Melaleuca adjacent mangroves and estuarine foraging habitat occurs within the site (habitat constraint).
<i>Tyto novaehollandiae</i>	High – 2	<p>The Masked Owl lives in eucalypt forests and woodlands from the coast, where it is most abundant, to the western plains (Kavanagh 2002b in NPWS, 2005). Within suitable habitat that species occupies a range of 5-10km² where it forages mostly upon rodents and marsupials, although this may be supplemented by bandicoots, arboreal mammals (Sugar Glider, Common Ringtail Possum) and some birds with introduced rodents and rabbits becoming important in disturbed environments (Debus, 1993, Kavanagh, 1996; NPWS, 2005). Habitats containing stands of large, hollow bearing eucalypts are also critical to roosting and nesting (NPWS, 2005; Kavanagh and Murray, 1996).</p>	Excluded	No hollow bearing trees occur within the subject site (habitat constraint).
<i>Xeromys myoides</i> False Water-rat	High – 2	<p>Although the water mouse had been documented in three distinct locations (Northern Territory, central south Queensland, south-east Queensland) they require similiar habitat including mangroves and the associated saltmarsh, sedgelands, clay pans, heathlands and freshwater wetlands.</p> <p>The water mouse creates nests which are important for breeding and refuge from high tide and predators. The Water Mouse constructs five types of nests: free-standing, termitarium-like mound nests or mounds at the base of mangrove trees (e.g. <i>Avicennia marina</i>), mound nests on small elevated 'islands' within the tidal zone, mound nests or holes in supralittoral banks; nests inside hollow tree trunks, and nests in spoil heaps created as a result of human activity (Van Dyck & Gynther 2003; Van Dyck et al. 2003)</p>	Excluded	<p>The site does not occur within intertidal zones. Additionally, the site does not contain mangroves, sedge/saltmarsh and freshwater wetlands (or within 100m) suitable for this species. Furthermore, the site does not contain littoral zone wetlands or occur within 100m of these.</p> <p>No False Water-rat nests were noted throughout the subject site during other survey efforts.</p>
Flora				
<i>Acacia bakeri</i> Marblewood	Very High – 3	<p><i>Acacia bakeri</i> has a restricted distribution in north-east New South Wales and south-east Queensland and is found in or near lowland subtropical rainforest, in adjacent eucalypt forest and in regrowth of both (DEH, 2012 online @http://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10004)</p>	Included	Potential habitat for this species occurs in association with PCT 751 which contains rainforest elements.
<i>Acalypha eremorum</i> Acalypha	High – 2	<p>Grows in subtropical and dry rainforest; north from Lismore district. In subtropical and dry rainforest.</p>	Included	Potential habitat for this species occurs in association with PCT 751 which contains rainforest elements.

Species	Biodiversity Risk Weighting	Habitat Requirements	Further Assessment	Justification for Exclusion / Inclusion
<i>Acronychia littoralis</i> Scented Acronychia	Very High – 3	<p>Scented Acronychia occurs from Fraser Island in Queensland to Port Macquarie in NSW. In 1996, the species occurred at 42 sites (Benwell, 1996). Most populations occur in NSW, between Ballina and Tweed Heads. The two Queensland populations include two trees at the Gold Coast and a few individuals in Great Sandy National Park (NP) (EPA, 2007). In NSW, populations are conserved in Bongil Bongil NP, Bundjalung NP, Broken Head Nature Reserve (NR), Cape Byron NR, Brunswick Heads NR, Cudgen Lake NR and Cooloola NP. Scented Acronychia is found on sand in humid, high rainfall zones (greater than 1600 mm), within 2 km of the ocean.</p> <p>The species occurs in transition zones between littoral rainforest and swamp sclerophyll forest; between littoral and coastal cypress pine communities; and margins of littoral forest and cleared land (Harden, 2002). Associated species include <i>Lophostemon confertus</i>, <i>Banksia integrifolia</i>, <i>Callitris columellaris</i>, <i>Araucaria cunninghamii</i>, <i>Eucalyptus intermedia</i> and <i>Melaleuca quinquenervia</i> (Benwell, 1996). Former habitat has been reduced as a result of coastal development, sand mining, waterlogging and land clearing for agriculture (Hunter et al., 1992; Benwell, 1996) [in DSEWPC, 2008:1-2]</p>	Included	Potential habitat for this species occurs in association with PCT 751 and PCT 1064 which occurs on sandy soils. The site occurs within 5km of the coast.
<i>Allocasuarina defungens</i> Dwarf Heath Casuarina	High – 2	The Dwarf Heath Casuarina is found in coastal areas of wet to dry, dense, low, closed heath land growing on Pleistocene marine tilize derived soils (Wilson & Johnson 1989). A few populations occur in coastal clay heath on bedrock soils, and on hinterland sandstone (Benwell & Steed 1997). These soils are humus podzols. The drier heath is on podzols with a sub-soil hard pan. Both soil types are subject to a high watertables during the rainy season (Benwell 1993).	Included	Marginal potential habitat for this species occurs on site and is commonly recorded within the locality. The site also occurs within 15km of the coast.
<i>Archidendron hendersonii</i> White Lace Flower	Very High – 3	This tree has been recorded from riverine and lowland subtropical rainforest and littoral rainforest from north Queensland south to the Richmond River in north-east NSW. It is found on a variety of soils including coastal sands and those derived from basalt and metasediments (DECC, 2005).	Included	Potential habitat for this species occurs in association with PCT 751 which contains rainforest elements.
<i>Arthraxon hispidus</i> Hairy Jointgrass	High – 2	“In NSW and Queensland, Hairy-joint Grass is found in or on the edges of rainforest and in wet eucalypt forest, often near creeks or swamps (Queensland CRA/RFA Steering Committee, 1997, 1998; DECC NSW, 2005), as well as woodland (Queensland Herbarium, 2008). In south-east Queensland, Hairy-joint Grass has also been recorded growing around freshwater springs on coastal foreshore dunes, in shaded small gullies, on creek banks, and on sandy alluvium in creek beds in open forests (Queensland CRA/RFA Steering Committee, 1997, 1998), and also with bog mosses in mound springs (Queensland Herbarium, 2008)” [Department of the Environment, Water, Heritage and the Arts 2008:1-2].	Included	The majority of the site contains potential habitat for the hairy joint grass.
<i>Backhousia subargentea</i> Giant Ironwood	Very High – 3	Giant Ironwood is found in dry rainforest regrowth consisting of thickets growing in steeply sloping paddocks on basalt-derived soil as well as in sub-tropical and warm temperate rainforest (OEH, 2018).	Included	Marginal potential habitat for this species occurs in association with PCT 751 which contains rainforest elements.
<i>Bosistoa transversa</i> Yellow Satinheart	High – 2	<p>‘Three-leaved Bosistoa’ is known from the Richmond River, NSW, to Mt Larcom near Gladstone, Queensland. This species is conserved within Mt Warning National Park, Numbinbah Nature Reserve, Limpinwood Nature Reserve and Whian Whian State Forest (Floyd, 1989). Population information is unavailable; however, it has been asserted that this species is common in its range (Hartley, 2004, pers. comm.). This species occurs within the Northern Rivers (NSW), Fitzroy, Burnett Mary and South East Queensland Natural Resource Management Regions.</p> <p>Three-leaved Bosistoa grows in wet sclerophyll forest, dry sclerophyll forest and rainforest up to 300 m in altitude (BRI, n.d.) [in TSSC, 2008:1].’</p>	Included	Potential habitat for this species occurs in association with PCT 751 which contains rainforest elements.

Species	Biodiversity Risk Weighting	Habitat Requirements	Further Assessment	Justification for Exclusion / Inclusion
<i>Caesalpinia bonduc</i> Knicker Nut	Very High – 3	<i>Caesalpinia bonduc</i> is distributed widely in the tropics and subtropics. Within NSW it has only been found on Lord Howe Island and the far north coast of mainland NSW. There are no known records from north-eastern NSW since the 1890's, when it was collected from Tintenbar and Murwillumbah <i>Caesalpinia bonduc</i> is currently found on Lord Howe Island at 2 locations in the north of the island, on sandy soil close to the shoreline. Plants of <i>Caesalpinia bonduc</i> that were previously recorded at a third location in the same vicinity could not be relocated in a recent survey. In 2001, one of the locations had 18 mature plants over an area of 0.24ha with a lone individual a further c.200m along the shore. The second location included only one individual (Hutton 2001).	Included	Marginal potential habitat for this species occurs in association with PCT 751 which contains rainforest elements.
<i>Cassia marksiana</i> <i>Cassia marksiana</i>	Very High – 3	This species is known from Brunswick Heads, around Murwillumbah, and north into south-east Queensland as far as Beenleigh where it occurs within Littoral and riverine rainforest, and in regrowth vegetation on farmland and along roadsides (DECC., 2005).	Included	Although preferred rainforest type habitat is absent from the site, marginal potential habitat occurs in association with PCT 693.
<i>Centranthera cochinchinensis</i> Swamp Foxglove	High – 2	In NSW, it is known from only 6 locations from near Woolli to north of Grafton in swampy areas and other moist sites. Two locations occur within conservation reserves, Yuraygir National Park and Fortis Creek National Park.	Included	Potential habitat for the swamp foxglove occurs in association with PCT 1235 and PCT 1064.
<i>Corokia whiteana</i> Corokia	Very High – 3	<i>Corokia whiteana</i> has a restricted distribution in north-east NSW (DECC NSW, 2005). Three distinct occurrences of the species are known: Nightcap Range, Tweed Valley, and near Brunswick Heads (DECC NSW, 2005) within the Mt Jerusalem National Park (NP), Nightcap NP, and Whian Whian State Forest (Sheringham & Westerway, 1995). Population counts range from 10 to 23, generally with scattered individuals (Quinn et al., 1995; Sheringham & Westerway, 1995; Karahed, 2002). <i>Corokia whiteana</i> occurs at altitudes of 10–800 m above sea level in ecotones between wet sclerophyll forest and Coachwood (<i>Ceratopetalum apetalum</i>) warm-temperate rainforests, or in Brush Box (<i>Lophostemon confertus</i>) open forest with littoral rainforest understorey (Quinn et al., 1995; DECC, 2005). Common vegetation associations include Black Wattle (<i>Callicoma serratifolia</i>) and Mountain Water Gum (<i>Tristaniopsis collina</i>) (Quinn et al., 1995). The species usually occurs on substrate derived from rhyolite and basalt, and also on quartzite sands (Quinn et al., 1995; J. Hunter, 2000, pers. comm.) (DSEWPC, 2008: 1).	Included	Marginal potential habitat for this species occurs in association with PCT 751 which contains rainforest elements.
<i>Cryptocarya foetida</i> Stinking Cryptocarya	High – 2	Stinking Cryptocarya is known from Iluka, NSW, to Fraser Island and east of Gympie, southern Queensland where it occurs within littoral rainforest, usually on sandy soils, but mature trees are also known on basalt soils. (DECC, 2005; DSEWPC, 2008).	Included	This species has been recorded throughout the site.
<i>Cupaniopsis serrata</i> Smooth Tuckeroo	Very High – 3	Occurs in rocky hillsides and subtropical and dry rainforest (OEH. 2018).	Included	Although preferred rainforest type habitat is absent from the site, marginal potential habitat occurs in association with PCT 693.
<i>Cynanchum elegans</i> White-flowered Wax Plant	High – 2	White-flowered Wax Plant occurs on a variety of lithologies and soil types, usually on steep slopes with varying degrees of soil fertility (Quinn et al. 1995). White-flowered Wax Plant occurs mainly at the ecotone between dry subtropical rainforest and sclerophyll forest/woodland communities (NSW NPWS 2002a).	Included	Marginal potential habitat for this species occurs in association with PCT 751 which contains rainforest elements.
<i>Cyperus aquatilis</i> Water Nutgrass	High – 2	Grows in ephemerally wet sites, such as roadside ditches and seepage areas from small cliffs and rock outcrops in sandstone areas (OEH, 2020).	Included	Potential habitat for the water nutgrass occurs in association with the swamp communities of the site (PCT 1235 and PCT 1064).

Species	Biodiversity Risk Weighting	Habitat Requirements	Further Assessment	Justification for Exclusion / Inclusion
<i>Davidsonia jerseyana</i> Davidson's Plum	High – 2	<p>The Davidson's Plum is restricted to the Brunswick and Tweed River catchments of the north coast of NSW. The southern-most confirmed record of the species is located near Mullumbimby.</p> <p>Records extend only a short distance inland on the Brunswick River. The northern-most and westernmost confirmed record is at Chillingham. There is an unconfirmed record further north near the border gate at Tomewin (Watson 1987). There are no confirmed records for southern Queensland. The species has been documented as occurring at a total of 118 point locations, which can be roughly grouped into 24 naturally occurring sub-populations,</p> <p>The Davidson's Plum is found in coastal and lowland subtropical rainforest and wet sclerophyll forest, often with an overstorey including <i>Lophostemon confertus</i> (Brush Box), <i>Araucaria cunninghamii</i> (Hoop Pine) and/or eucalypt species. Species commonly occurring at Davidson's Plum sites include <i>Acacia bakeri</i> (Marblewood), <i>Cupaniopsis newmanii</i> (Longleaved Tuckeroo), <i>Endiandra tilize</i> (Black Walnut), <i>Eucalyptus microcorys</i> (Tallowwood), <i>Flindersia bennettiana</i> (Bennett's Ash), <i>Flindersia schottiana</i> (Cudgerie), <i>Pentaceras tilize</i> (Crow's Ash), <i>Synoum glandulosum</i> (Scentless Rosewood) and the introduced <i>Cinnamomum camphora</i> (Camphor Laurel) (McKinley & Stewart 1999). Several sub-populations of the Davidson's Plum are known from areas of regrowth rainforest with a high percentage of Camphor Laurel, <i>Lantana camara</i> (Lantana) and other exotic weeds. Some trees are isolated in paddocks or in road reserves (McKinley & Stewart 1999) [in NPWS, 2004].</p>	Included	Marginal potential habitat for this species occurs in association with PCT 751 which contains rainforest elements. This species has also been recorded within the region as an ornamental species planted within yards (pers. obs.)
<i>Davidsonia johnsonii</i> Smooth Davidson's Plum	Very High – 3	Current records suggest that the Smooth Davidsonia is found mainly in wet sclerophyll forests, with a smaller number of sites known from subtropical rainforest (complex notophyll vine forest) (McKinley & Stewart 1999). Records of individuals have also been made from land that has been cleared in the past. Plants still persist in these areas as isolated clumps in paddocks or in regrowth dominated by Lantana (<i>Lantana camara</i>) and other weed species (DECC, 2004: 5).	Included	Marginal potential habitat for this species occurs in association with PCT 751 which contains rainforest elements. This species has also been recorded within the region as an ornamental species planted within yards (pers. obs.)
<i>Dendrobium melaleucaphilum</i> Spider orchid	High – 2	Grows frequently on <i>Melaleuca styphelioides</i> , less commonly on rainforest trees or on rocks in coastal districts; north from the lower Blue Mountains (OEH, 2018).	Included	Although <i>Melaleuca styphelioides</i> is absent from the site, this species is also known to occasionally occur on rainforest trees. Marginal potential habitat for this species occurs in association with PCT 751 which contains rainforest trees.
<i>Dendrocnide moroides</i> Gympie Stinger	High – 2	Occurs in CYP, NEQ and southwards as far as north-eastern New South Wales. Altitudinal range from near sea level to 900 m. Usually grows in disturbed areas (particularly where the soil has been disturbed by tractors during logging) in lowland and upland rainforests.	Included	Marginal potential habitat for this species occurs in association with PCT 751 which contains rainforest elements.
<i>Desmodium acanthocladum</i> Thorny Pea	High – 2	The Thorny Pea occurs mainly in the Lismore area of north-eastern NSW, but there are also records of the species from near Grafton, Coraki, Casino and the Mount Warning area (DECC, 2005a). The species has been recorded in two reserves —the Mount Warning National Park (though this is a very old record from 1898) and Andrew Johnston Big Scrub Nature Reserve (NSW NPWS, 2007). This species occurs within the Northern Rivers (NSW) Natural Resource Management Region. The Thorny Pea occurs on basalt-derived soils at low elevations, mainly along rivers (Harden, 1991), in dry rainforest and on the fringes of riverine subtropical rainforest (DECC, 2005a). [in DSEWPC, 2008:1].	Included	Marginal potential habitat for this species occurs in association with PCT 751 which contains rainforest elements.
<i>Diospyros mabacea</i> Red-fruited Ebony	Very High – 3	This species 'occurs only in north-east NSW. It is found in a few stands on the Tweed and Oxley Rivers, upstream from Murwillumbah, on Stotts Island in the lower Tweed River and one other small population west of Mullumbimby on the Brunswick River. The largest population is in Limpinwood Nature Reserve. Usually grows as an understorey tree in lowland subtropical rainforest, often close to rivers. Soils are generally basalt-derived or alluvial (OEH, 2018).	Included	Marginal potential habitat for this species occurs in association with PCT 751 which contains rainforest elements.
<i>Diospyros yandina</i>	High – 2	In NSW this species is found only in Hogans Scrub at North Tumbulgum and on Mount Cougal, in the Tweed Valley. It also occurs in south-east Queensland.	Included	

Species	Biodiversity Risk Weighting	Habitat Requirements	Further Assessment	Justification for Exclusion / Inclusion
Shiny-leaved Ebony		It grows in the understorey of riverine or lowland subtropical rainforest.		Marginal potential habitat for this species occurs in association with PCT 751 which contains rainforest elements.
<i>Diploglottis campbellii</i> Small-leaved Tamarind	Very High – 3	“The forest types in which the species occurs varies from lowland subtropical rainforest to drier subtropical rainforest with a <i>Lophostemon confertus</i> (Brush Box) open overstorey. Hunter <i>et al.</i> (1992) showed that the species occurs on basalt-derived soils and also on poorer soils such as those derived from quartz monzonite” (NPWS, 2004: 6).	Included	Marginal potential habitat for this species occurs in association with PCT 751 which contains rainforest elements. This species has also been recorded within the region as an ornamental species planted within yards (pers. obs.)
<i>Diuris byronensis</i> Byron Bay Diuris	Very High – 3	This orchid is known from a single location only, at Byron Bay in north-east NSW. Only about 20 plants have been recorded (OEH, 2012). Occurs in low-growing grassy heath on clay soil (OEH, 2012).	Excluded	Although the site occurs within 2km of Arakwal National Park, known habitat for this species (low-growing grassy heath on clay soil) is absent from this site. This orchid is known from a single location only.
<i>Drynaria rigidula</i> Basket Fern	Very High – 3	<i>Drynaria rigidula</i> was presumed extinct in New South Wales and has been recently rediscovered. The species is currently known from only 3 locations in N.S.W., although it is common in Queensland. It is a fern that grows on rocks or as an epiphyte from rainforests north from the Clarence River in northern coastal N.S.W (NSW Science Committee, 2015).	Included	Marginal potential habitat for this species occurs in association with PCT 751 which contains rainforest elements.
<i>Elaeocarpus williamsianus</i> Hairy Quandong	Very High – 3	Elaeocarpus williamsianus is currently known from nine populations in north-eastern NSW extending from the Tweed Valley, south to the Byron Bay area. The known range for the species covers an area of approximately 50 km north-south by 30 km east-west (NPWS 2004). Elaeocarpus williamsianus occurs along the coastal range within Notophyll vine rainforests and wet sclerophyll ecotones on metasediment -derived soils (Hunter <i>et al.</i> 1991). The species is typically found on steep and eroding slopes at low altitude in gullies, toe slopes, steep drops adjacent to creeks and the headwater areas of creeks. Common dominant canopy species include Camphor Laurel (<i>Cinnamomum camphora</i>), Brush Box (<i>Lophostemon confertus</i>) and Flooded Gum (<i>Eucalyptus grandis</i>). Other dominant species include Lantana (<i>Lantana cammara</i> and Black Apple (<i>Planchonella australis</i>) (Kooyman 2003).	Included	Marginal potential habitat for this species occurs in association with PCT 751 which contains rainforest elements.
<i>Endiandra floydii</i> Crystal Creek Walnut	High – 2	The Crystal Creek Walnut occurs in subtropical (including littoral) rainforest or wet sclerophyll forest, often with <i>Lophostemon confertus</i> (Brush Box) in the canopy and occasionally with <i>Araucaria cunninghamii</i> (Hoop Pine) emergents. Disturbed and regrowth sites may include <i>Cinnamomum camphora</i> (Camphor Laurel) and <i>Lantana camara</i> (Lantana) as weed components. Most locations are on soils derived from paleozoic metamorphics, sometimes with basalt nearby. A small number of sites are on alluvium or sand. Sheltered locations are apparently preferred, and landforms including ridgelines, slopes, gullies and creek flats have been documented. The altitude varies between close to sea level up to 430 m above sea level (Floyd 1989)' (in DEC, 2004: 3)	Included	Marginal potential habitat for this species occurs in association with PCT 751 which contains rainforest elements.
<i>Endiandra hayesii</i> Rusty Rose Walnut	High - 2	The species occurs on poorer soils derived from sedimentary, metamorphic, or acid volcanic rocks. Vegetation includes subtropical and warm temperate rainforests, and Brush Box (<i>Lophostemon confertus</i>) forests, including regrowth and highly modified forms of these habitats. The altitude varies from near sea level to 800 m. Rusty Rose Walnut occurs within the Northern Rivers (NSW) and South East Queensland Natural Resource Management Regions.	Included	Marginal potential habitat for this species occurs in association with PCT 751 which contains rainforest elements.

Species	Biodiversity Risk Weighting	Habitat Requirements	Further Assessment	Justification for Exclusion / Inclusion
<i>Endiandra muelleri</i> subsp. <i>Bracteata</i> Green-leaved Rose Walnut	Very High – 3	<p>'According to the literature the Green-leaved Rose Walnut is known from north-eastern NSW, north from the Clarence River (where a specimen from Maclean was employed in Hyland's 1989 description) to southern and central Queensland (Hyland 1989). The taxon is not considered threatened in Queensland, and is apparently moderately common. In NSW, records nominally of this taxon are concentrated on the Tweed and Byron coasts, but also extend inland to the hinterland ranges, and south to Tuckean, Bungawalbin and Maclean.</p> <p>Records for the combined taxa (<i>E. hayesii</i> and <i>E. muelleri</i> subsp. <i>bracteata</i>) are usually from the poorer soils derived from sedimentary, metamorphic or acid volcanic rocks. Vegetation includes subtropical and warm temperate rainforests and Brush Box forests, including regrowth and highly modified forms of these habitats' (NPWS, 2004: 5).</p>	Included	Marginal potential habitat for this species occurs in association with PCT 751 which contains rainforest elements.
<i>Floydia praealta</i> Ball Nut	Very High – 3	The Ball Nut occurs in small, scattered populations from Gympie, Queensland, southwards to the Clarence River in north-east NSW, where it inhabits riverine and subtropical rainforest, usually on soils derived from basalt (DECC, 2005) or in coastal scrub (Foreman, 1995).	Included	Marginal potential habitat for this species occurs in association with PCT 751 which contains rainforest elements.
<i>Geodorum densiflorum</i> Pink Nodding Orchid	High – 2	This orchid is found in dry sclerophyll forest, often on coastal sand, at lower altitudes, north from the Macleay River on the north coast of NSW (NPWS, 2004 online at http://www.nationalparks.nsw.gov.au/npws.nsf/Content/Geodorum+densiflorum+a+terrestrial+orchid+-+endangered+species+listing)	Included	The majority of the forested areas on site contains potential habitat for the pink nodding orchid, which has been regularly recorded within the locality (per bionet records).
<i>Gossia fragrantissima</i> Sweet Myrtle	High – 2	This species is known from dry subtropical and riverine rainforest mostly on basaltic soils (NPWS, 2002).	Included	Marginal potential habitat for this species occurs in association with PCT 751 which contains rainforest elements.
<i>Grevillea hilliana</i> White Yiel Yiel	Very High – 3	This species is known from small remnant patches of subtropical rainforest on basaltic soils in Brunswick and Tweed Heads (NPWS, 2002).	Included	Marginal potential habitat for this species occurs in association with PCT 751 which contains rainforest elements.
<i>Harnieria hygrophiloides</i> Native Justicia	High – 2	<p>Though relatively widespread in eastern Queensland, this plant is rarely seen in NSW. It has been recorded only at Hortons Creek and two other places south of Nymboida, and at Brunswick Heads (OEH, 2018).</p> <p>Its habitat is the understorey of littoral rainforest, dry rainforest and wet eucalypt forest, usually in well-drained areas (OEH, 2018).</p>	Excluded	The site occurs >5km from the Brunswick Heads township (geographic limitation).
<i>Isoglossa eranthemoides</i> Isoglossa	High – 2	<p>Isoglossa has a very restricted distribution in north east NSW from Tweed River to the Lismore area, with a single uncertain historical report from south east Queensland (NSW DECC 2005). Populations are centred around the upper reaches of the Tweed River (the eastern section of Mount Warning National Park (NP)), and in the vicinity of Inner Pocket Nature Reserve (NR), and to the south east in the Booyong-Nashua-Bexhill-Federal area (Quinn et al. 1995; Sheringham & Westaway 1995).</p> <p>Isoglossa occurs as an understorey component of highly diverse White Booyong (<i>Argyrodendron trifoliolatum</i>) subtropical rainforest sub-alliance. This vegetation community occurs in moist, protected situations in coastal lowlands, valleys, riparian zones, floodplains, and at the foothills of coastal ranges. These vegetation communities occur on fertile basic igneous geology (basalt or gabbro), metasediments, or alluvium. Climate of these areas is temperate to warm with reliable non-seasonal rainfall (more than 1300 mm). Subtropical rainforest may extend up escarpment gullies to an altitude of 900 m above sea level but are more common below 600 m. Isoglossa grows in lowland areas and a large percentage of rainforest where Isoglossa occurs (lowland with basic geology) has been cleared for agriculture.</p>	Included	Marginal potential habitat for this species occurs in association with PCT 751 which contains rainforest elements.
<i>Lepiderema pulchella</i> Fine-leaved Tuckeroo	Very High – 3	This species occurs within Lowland subtropical rainforest and is largely confined to infertile metasediments in the Tweed Valley (NPWS, 2002).	Included	This species has been recorded within the overall site.

Species	Biodiversity Risk Weighting	Habitat Requirements	Further Assessment	Justification for Exclusion / Inclusion
<i>Lindsaea fraseri</i> Fraser's Screw Fern	Very High – 3	Poorly drained, infertile soils in swamp forest or open eucalypt forest, usually as part of a ferny understorey (OEH, 2018).	Included	Potential habitat for the species occurs in association with the swamp communities of the site (PCT 1235 and PCT 1064). The site occurs within 30km of the coast.
<i>Macadamia tetraphylla</i> Rough-shelled Bush Nut	High – 2	This species of nut tree is confined chiefly to the Richmond and Tweed Rivers in north-east NSW, extending just across the border into Queensland where it occurs within subtropical rainforest, particularly on basaltic soils. (Williams, Harden and McDonald, UNE, 1984; DECC, 2005). The species is also commonly noted as a paddock tree on soils of basaltic influence and as an ornamental or orchard tree associated with residential and/or rural activities (pers.obs.).	Included	Marginal potential habitat for this species occurs in association with PCT 751 which contains rainforest elements. This species has also been recorded within the region as an ornamental species planted within yards (pers. obs.)
<i>Marsdenia longiloba</i> Slender Marsdenia	High – 2	Clear Milkvine is known from scattered sites on the NSW north coast from Hastings River northwards to Mount Nebo in Queensland (Forster, 1996). Clear Milkvine grows in open eucalypt forest, or margins of subtropical and warm temperate rainforest, and in areas of rocky outcrops (Forster, 1996; DECC, 2005a).	Included	Marginal potential habitat for this species occurs in association with PCT 751 which contains rainforest elements.
<i>Melicope vitiflora</i> Coast Euodia	Very High – 3	The species occurs in Queensland and reaches its southern limit in NSW, where it is restricted to the far north east corner of the State, in coastal areas around the Brunswick Heads and Broken Head. <i>Melicope vitiflora</i> grows in subtropical and littoral rainforest (NPWS 2003).	Included	Potential habitat for this species occurs in association with PCT 751 which contains rainforest elements.
<i>Myrsine richmondensis</i> Ripple-leaf Muttonwood	Very High – 3	The purple-leaf muttonwood is a small, evergreen tree or shrub that grows to 5 metres high. It occurs in the vegetation communities of tall open sclerophyll forest with a rainforest subcanopy, swamp sclerophyll open forest and on the margins of subtropical rainforest (DEC, 2004). The purple-leaf muttonwood occurs in north-eastern New South Wales (NSW) and is currently only known from three populations within the Richmond River and Clarence River catchments. It is estimated that 407 plants exist distributed across these three populations. The three populations occur on private property near Tathan, in Boatharbour Nature Reserve Lismore and in Mallangee National Park, west of Casino (DoEE, 2018).	Included	Marginal potential habitat for this species occurs in association with PCT 751 which contains rainforest elements.
<i>Niemeyera chartacea</i> Smooth-leaved Plum	Very High – 3	The species occurs in Queensland and reaches its southern limit in New South Wales. In New South Wales, it is found in subtropical rainforest and is known from only one location at Brunswick Heads.	Included	Marginal potential habitat for this species occurs in association with PCT 751 which contains rainforest elements.
<i>Niemeyera whitei</i> Rusty Plum, Plum Boxwood	High – 2	Rusty Plum occurs in the coast and adjacent ranges of northern NSW from the Macleay River into southern Queensland where it occurs within rainforest and the adjacent understorey of moist eucalypt forest. Its distributional stronghold is on the mid north coast around Coffs Harbour. (online @ http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/profile.aspx?id=10044).	Included	Marginal potential habitat for this species occurs in association with PCT 751 which contains rainforest elements.
<i>Oberonia complanate</i> Yellow-flowered King of the Fairies	Very High - 3	Within New South Wales, there are several historical collections (all pre 1917) of <i>Oberonia complanata</i> from Byron Bay and Lismore, and a collection from Coffs Harbour from 1961. Preferred habitat appears to be rainforest, but it can also occur in sclerophyll forest, coastal scrub and mangroves.	Included	Marginal potential habitat for this species occurs in association with PCT 751 which contains rainforest elements.
<i>Oberonia titania</i> Red-flowered King of the Fairies	High – 2	Red-flowered King of the Fairies occurs in littoral and subtropical rainforest and paperbark swamps, but it can also occur in eucalypt-forested gorges and in mangroves (OEH, 2019).	Included	Potential habitat for this species occurs in association with PCT 751 and PCT 1064

Species	Biodiversity Risk Weighting	Habitat Requirements	Further Assessment	Justification for Exclusion / Inclusion
<i>Ochrosia moorei</i> Southern Ochrosia	Very High - 3	The Southern Ochrosia has a sparse distribution from north-east NSW to south-east Queensland. The range of this species extends from the Richmond River in NSW through to the McPherson Ranges, Queensland (Barry & Thomas 1994; Floyd 1989; Forster 1996b; NSW OEH 2013f). Southern Ochrosia grows in riverine and lowland warm subtropical rainforest (Floyd, 1989) and complex notophyll vine forest in soils of volcanic origin (Forster 1993, 1996). This species is often found on hillsides near drainage lines, at elevations of 100–1000 m above sea level. Soils are deep, alluvial or basalt derived, well-drained, and reddish-brown to dark brown.	Included	Marginal potential habitat for this species occurs in association with PCT 751 which contains rainforest elements.
<i>Oldenlandia galioides</i> False Sweet Galium	High – 2	Margins of seasonally inundated wetlands in paperbark swamps and Forest Red Gum (<i>Eucalyptus tereticornis</i>) woodlands (OEH, 2018).	Excluded	The site does not occur between Hastings Point and Tweed Heads (geographic limitation).
<i>Peristeranthus hillii</i> Brown Fairy-chain Orchid	Very High – 3	<i>Peristeranthus hillii</i> is found in north eastern NSW, north from the Hastings River (Port Macquarie), and extends to north eastern Queensland, as far as the Bloomfield River. In subtropical regions, including NSW, the species is restricted to coastal and near-coastal environments, particularly remnants of littoral rainforest growing on aeolian sands and lowland subtropical rainforest on floodplains.	Included	Marginal potential habitat for this species occurs in association with PCT 751 which contains rainforest elements. The site occurs within 5km of the coast.
<i>Phaius australis</i> Southern Swamp Orchid	High – 2	This species is known from swampy grassland or swampy forest including rainforest, eucalypt or paperbark forest, mostly in coastal areas (NPWS, 2002).	Included	Potential habitat for the swamp orchid occurs in association with the swamp communities of the site (PCT 1235 and PCT 1064).
<i>Phyllanthus microcladus</i> Brush Sauropus	High – 2	In NSW confined to a few locations in the Tweed, Brunswick, Richmond and Wilson River Valleys with an outlying population near Grafton. Also occurs in south-east Queensland (OEH, 2018). Usually found on banks of creeks and rivers, in streamside rainforest or dry rainforest (OEH, 2018).	Included	Marginal potential habitat for this species occurs in association with PCT 751 which contains rainforest elements.
<i>Psilotum complanatum</i> Flat Fork Fern	Very High – 3	Epiphyte in rainforest, often found growing from bases of other large clumps of epiphytes; rare in N.S.W., north from Ballina, also recorded at Port Macquarie (PlantNET, 2020).	Included	Marginal potential habitat for this species occurs in association with PCT 751 which contains rainforest elements.
<i>Pterostylis nigricans</i> Dark Greenhood	Very High - 3	Coastal heathland with Heath Banksia (<i>Banksia ericifolia</i>), and lower-growing heath with lichen-encrusted and relatively undisturbed soil surfaces, on sandy soils (OEH, 2021).	Included	Although preferred heathland type habitat with <i>Banksia ericifolia</i> is absent from the site, the site occurs on preferred sandy soils and there are numerous BioNet records occurring within the locality.
<i>Randia moorei</i> Spiny Gardenia	Very High – 3	The known range of the Spiny Gardenia extends from Lismore on the north coast of NSW, northwards to the Logan River, southern Queensland (Quinn et al. 1995). The Spiny Gardenia occurs in subtropical, riverine, littoral and dry rainforest and sometimes along moist scrubby watercourses. In NSW the species is often found in Hoop Pine (<i>Araucaria cunninghamii</i>) - Brush Box (<i>Lophostemon confertus</i>) forest with other rainforest elements present in the understorey. Although plants are typically found within rainforest or in Hoop Pine - Brush Box forest, at Terranora in Tweed Shire and on the southern slopes of Mount Chincogan in Byron Shire, the Spiny Gardenia occurs as a scattered remnant shrub in open grazing land that was formerly rainforest (NPWS, 2004: 3-4).	Included	Marginal potential habitat for this species occurs in association with PCT 751 which contains rainforest elements.
<i>Rhodamnia rubescens</i> Scrub Turpentine	Very High – 3	Populations and individuals of <i>R. rubescens</i> are often found in wet sclerophyll associations in rainforest transition zones and creekside riparian vegetation (Benson and McDougall 1998). <i>Rhodamnia rubescens</i> commonly occurs in all rainforest subforms except cool temperate rainforest. The species occupies a range of volcanically derived and sedimentary soils and is also a common pioneer species in eucalypt forests (Floyd 1989).	Included	Marginal potential habitat for this species occurs in association with PCT 751 which contains rainforest elements.

Species	Biodiversity Risk Weighting	Habitat Requirements	Further Assessment	Justification for Exclusion / Inclusion
<i>Rhodomyrtus psidioides</i> Native Guava	Very High – 3	Populations and individuals of <i>R. rubescens</i> are often found in wet sclerophyll associations in rainforest transition zones and creekside riparian vegetation (Benson and McDougall 1998). <i>Rhodomyrtus rubescens</i> commonly occurs in all rainforest subforms except cool temperate rainforest. The species occupies a range of volcanically derived and sedimentary soils and is also a common pioneer species in eucalypt forests (Floyd 1989).	Included	Marginal potential habitat for this species occurs in association with PCT 751 which contains rainforest elements.
<i>Rotala tripartite</i> <i>Rotala tripartita</i>	Very High – 3	In New South Wales the species is currently known from only two locations, one in the Casino district and one in the South Grafton area, in the northern part of the North Coast bioregion (sensu Thackway and Creswell 1995). <i>Rotala tripartita</i> is a riparian species that grows in free-standing water with sedges.	Included	Potential habitat for the species occurs in association with the swamp communities of the site (PCT 1235 and PCT 1064) and the drainage lines.
<i>Senna acclinis</i> Rainforest Cassia	High – 2	This species grows in or on the edges of subtropical and dry rainforest within coastal districts and adjacent tablelands of NSW from the Illawarra in NSW to Queensland (DECC online @ http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/profile.aspx?id=10753).	Included	Marginal potential habitat for this species occurs in association with PCT 751 which contains rainforest elements.
<i>Sophora fraseri</i> Brush Sophora	High – 2	It grows in moist habitats, often in hilly terrain at altitudes from 60–660 m on shallow soils along rainforest margins in eucalypt forests or in large canopy gaps in closed forest communities (Queensland CRA/RFA Steering Committee, 1998).	Included	Marginal potential habitat for this species occurs in association with PCT 751 which contains rainforest elements.
<i>Syzygium hodgkinsoniae</i> Red Lilly Pilly	High – 2	Smooth-bark Rose Apple occurs in riverine rainforest on rich alluvial or basaltic soils, from the Richmond River in NSW to Gympie, Queensland, with a disjunct occurrence in north Queensland (Floyd, 1989; NSW NPWS, 2002). The species occurs mostly as scattered individuals along watercourses, where the habitat is frequently limited and degraded (Landmark Ecological Services, Ecograph & Terrafocus, 1999).	Included	Marginal potential habitat for this species occurs in association with PCT 751 which contains rainforest elements.
<i>Syzygium moorei</i> Durobby	Very High – 3	The Durobby occurs in warm, protected, fertile soils in riverine and gully rainforests at low altitudes, along sections of the Richmond, Brunswick and Tweed Rivers in NSW, as well as at three sites in Upper Mudgeeraba Creek and Upper Tallebudgera Creek in south-east Queensland (Floyd, 1989). Rose Apple is most commonly found in Subtropical Rainforest <i>Argyrodendron trifoliatum</i> Alliance, including sub-alliance 1 (<i>Argyrodendron trifoliatum</i>) on lowland krasnozems; suballiance 2 (<i>Toona-Flindersia</i> spp.) on lowland alluvium; and sub-alliance 6 (<i>Archontophoenix-Livistona</i>) on alluvium with excess moisture (Floyd, 1990). Stands of the <i>A. trifoliatum</i> Alliance originally occurred on the best potential agricultural land, so consequently was mostly cleared, with the exception of small patches occurring in floodprone, stony or poorly drained soils (DSEWPC, 2008:1-2).	Included	Marginal potential habitat for this species occurs in association with PCT 751 which contains rainforest elements. This species has also been recorded within the region as an ornamental species planted within yards or paddocks (pers. obs.)
<i>Tinospora tinosporoides</i> Arrow-head Vine	High – 2	Arrow-head Vine occurs near the coast at Richmond River in northern NSW to Burleigh Heads National Park (NP) in Queensland where it is locally common rainforest on basalt and also occurs in complex notophyll vine forest (DSEWPC, 2008:1).	Included	Marginal potential habitat for this species occurs in association with PCT 751 which contains rainforest elements.
<i>Xylosma terrae-reginae</i> Queensland Xylosma	Very High – 3	This species is known from six populations in NE NSW north of Lismore where it occurs in association with Littoral and Sub-tropical Rainforest (NPWS, 2004). Of the six populations only two populations in conservation reserves, at Broken Head and Brunswick Heads Nature Reserves. Individual populations are small and the best estimate of the total population in New South Wales is less than 250 mature individuals (NSW Scientific Committee, 2000 online @ http://www.environment.nsw.gov.au/determinations/XylosmaTerraeReginaeEndSpListing.htm).	Included	Marginal potential habitat for this species occurs in association with PCT 751 which contains rainforest elements.

4.1.4 Candidate Species for Further Assessment

The following species were identified as candidate species credit species which required further assessment. The species survey period specified for each species is also provided within **Table 4-4** below. It is noted that targeted surveys were conducted within suitable survey periods for all candidate species. Highlighted months are the months in which targeted surveys were undertaken for the relevant species.

Table 4-4 | Species Credit Species Nominated Survey Periods

Candidate Species	Survey Period (BAM Calculator)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Fauna												
Bush Stone-curlew	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
White-crowned Snake	Y	Y	Y	Y	N	N	N	N	Y	Y	Y	Y
White-eared Monarch	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Eastern Pygmy-possum	Y	Y	Y	N	N	N	N	N	N	Y	Y	Y
Large-eared Pied Bat	Y	N	N	N	N	N	N	N	N	N	Y	Y
Wallum Froglet	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Coxen's Fig-Parrot	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Pale-headed Snake	Y	Y	Y	N	N	N	N	N	N	N	Y	Y
Stephens' Banded Snake	Y	Y	Y	N	N	N	N	N	N	Y	Y	Y
Mangrove Honeyeater	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Green-thighed Frog	Y	Y	Y	Y	N	N	N	N	Y	Y	Y	Y
Olongburra Frog	Y	Y	Y	N	N	N	N	Y	Y	Y	Y	Y

Candidate Species	Survey Period (BAM Calculator)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Southern Myotis	Y	Y	Y	N	N	N	N	N	N	Y	Y	Y
Coastal Petaltail	Y	Y	N	N	N	N	N	N	N	N	Y	Y
Squirrel Glider	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Brush-tailed Phascogale	Y	Y	Y	Y	Y	Y	N	N	N	N	N	Y
Koala (Breeding)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Common Planigale	AP											
Long-nosed Potoroo	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Grey-headed Flying-fox (Breeding)	N	N	N	N	N	N	N	N	N	Y	Y	Y
Mitchell's Rainforest Snail	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Flora												
Marblewood	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Acalypha	Y	Y	N	N	N	N	N	N	Y	Y	Y	Y
Scented Acronychia	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Dwarf Heath Casuarina	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
White Lace Flower	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Hairy Jointgrass	Y	Y	Y	Y	N	N	N	N	N	N	Y	Y
Giant Ironwood	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Candidate Species	Survey Period (BAM Calculator)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Yellow Satinheart	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Knicker Nut	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Cassia marksiana	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Swamp Foxglove	Y	Y	Y	N	N	N	N	N	N	N	N	N
Corokia	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Stinking Cryptocarya	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Smooth Tuckeroo	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
White-flowered Wax Plant	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Water Nutgrass	Y	Y	Y	Y	N	N	N	N	N	N	N	N
Davidson's Plum	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Smooth Davidson's Plum	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Spider orchid	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Gympie Stinger	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Thorny Pea	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Red-fruited Ebony	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Shiny-leaved Ebony	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Small-leaved Tamarind	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Candidate Species	Survey Period (BAM Calculator)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Basket Fern	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Hairy Quandong	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Green-leaved Rose Walnut	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Ball Nut	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Pink Nodding Orchid	Y	Y	Y	N	N	N	N	N	N	N	N	N
Sweet Myrtle	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
White Yiel	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Isoglossa	N	N	N	N	N	N	N	N	Y	Y	Y	N
Fine-leaved Tuckeroo	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Fraser's Screw Fern	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Rough-shelled Bush Nut	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Slender Marsdenia	Y	Y	N	N	N	N	N	N	N	N	Y	Y
Coast Euodia	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Ripple-leaf Muttonwood	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Smooth-leaved Plum	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Rusty Plum, Plum Boxwood	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Yellow-flowered	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Candidate Species	Survey Period (BAM Calculator)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
King of the Fairies												
Red-flowered King of the Fairies	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Southern Ochrosia	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Brown Fairy-chain Orchid	N	N	N	N	N	N	N	N	Y	Y	N	N
Southern Swamp Orchid	N	N	N	N	N	N	N	N	Y	Y	N	N
Brush Sauropus	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Flat Fork Fern	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Dark Greenhood	N	N	N	Y	Y	N	N	N	N	N	N	N
Spiny Gardenia	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Rotala tripartita	Y	Y	Y	N	N	N	N	N	N	N	N	Y
Rainforest Cassia	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Brush Sophora	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Red Lilly Pilly	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Durobby	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Arrow-head Vine	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Queensland Xylosma	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

4.2 Threatened Species Survey

4.2.1 Habitat Assessment

Prior to the commencement of the targeted survey works on site a broad habitat assessment was conducted. The purpose of this overview was to determine potential occurrence of fauna based on available habitat components (discussed within Section 4.1) and to target areas for detailed surveying of threatened fauna species. The following habitat components were reviewed and occur as a result of previous land use, vegetation types, geomorphic variability, surrounding uses and hydraulic regime:

Table 4-5 | Site Habitat Features

Habitat Element/Feature	Comment
Presence of hollow bearing trees	Absent.
Presence of koala habitat and/or favoured koala trees	Very scarce. Limited to 1 x <i>Eucalyptus tereticornis</i> within the site (no signs of koala usage).
Presence of caves, culverts or disused buildings suitable for roosting of microchiropteran bat species	Absent.
Presence of scratches or feeding scars on tree trunks	Scratches noted on several smooth-barked trees reflective of possums.
Presence of megabat roosting sites	Well known roost site present south of the Byron Bay Courthouse.
Presence of creeklines, estuaries, mudflats, mangroves and/or riparian vegetation	Present in the form of Paperbark swamp forest. Drainage lines contains aquatic vegetation (i.e. sedges, lily pads) present.
Presence of dams, ponds, lakes and/or other natural or constructed permanent water sources	Constructed drainage lines present.
Presence of dense understorey and ground cover vegetation	Dense areas of grass, weeds, bracken and coral fern abundant.
Presence of deep leaf litter layer and/or debris (fallen logs etc)	Abundant in areas.
Presence of fruiting flora species	Present in the form of rainforest trees.
Presence of flowering species	Abundant including typically prolifically flowering Myrtaceaes such as melaleuca, banksia and leptospermum.
Presence of large stick nests indicative of raptor presence	Not recorded.
Presence of rocky outcrops and/or extensive exposed rocky areas favoring reptile populations	Absent.

4.3 Targeted Threatened Flora Techniques and Survey Results

Targeted flora searches were completed by conducting a combination of random meanders and parallel transects spaced approximately 5-10 m apart (depending on vegetation density and barriers) across parts of the site that support potential habitat, with reference to *Surveying threatened plants and their habitats* (DPIE, 2020). The targeted flora survey transects are provided within **Figures 4-1 & 4-2**.

Areas targeted for flora surveys included the proposed development footprint buffered by approximately 50m.

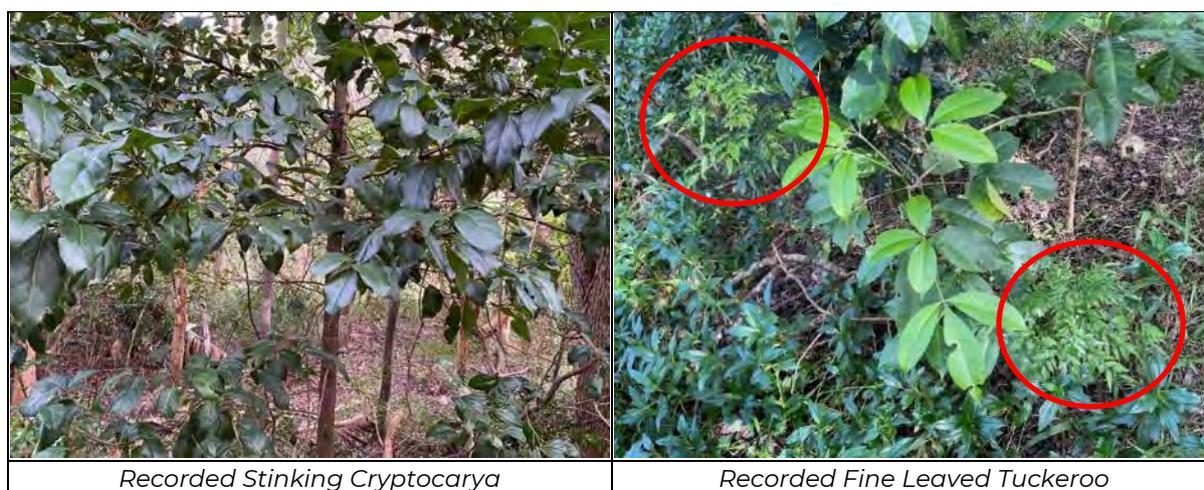
Opportunistic flora surveys were also conducted while conducting vegetation integrity plot surveys, habitat assessments, and other survey methods conducted within **Section 4.4** below.

Targeted threatened flora surveys were undertaken in both the summer and winter months, which is a suitable time of year to be surveying the candidate threatened flora species identified as potentially occurring within the development site (refer to **Table 4-3**).

For the most part, visibility across the survey area was good, with moderate midstorey vegetation present (with the exception of several areas containing dense weed thickets), which allowed for easy sighting of all species in the understorey and midstorey. The site was also easily traversed on foot, with minimal barriers to movement encountered during the field survey.

Targeted flora surveys resulted in the recording of six (6) Fine Leaved Tuckeroo (*Lepiderema pulchella*) individuals within the study area. It is noted that none of these individuals occur within the proposed works footprint and will be retained.

Targeted flora surveys also resulted in the recording of forty-three (43) Stinking Cryptocarya (*Cryptocarya foetida*) within the study area. Eleven (11) occur within the proposed works footprint.



Threatened flora species recorded during flora surveys are presented within **Figures 4-7 & 4-8**.

4.4 Fauna Survey Techniques

Diurnal Survey Methodology

- Binocular search and identification of all fauna heard or sighted; and
- Bird identification surveys were conducted in association with dawn and dusk activity and comprised walked transects (area search method) through the study area;

Duration: 10 x dawn/mid-morning (30 minutes) and 4 x dusk (4 x 45 minutes).

- Ground track/trace survey was performed including:
 - Scat/pellet examination
 - Scratch/trace examination of trees

- o Diggings, burrow, trace and track examination
- o Humus/crevice examination
- o Examination and assessment of tree hollows, hanging bark, termite mounds, flowering and nesting trees etc.

Duration: Opportunistic during other survey works

- Diurnal frog-call recognition and identification opportunistically performed during other survey works

Duration: Opportunistic during other survey works

- Ground strata searches and rock/timber/leaf litter rolls and examination for reptiles, frogs. Coastal petaltail and Mitchell's rainforest snail. All log and timber rolls were returned in their original state following inspection.

Duration: 6 x 30 minutes during the middle of the day or night (for Mitchell's Rainforest Snail), opportunistic during all other survey works.

- Spot Assessment Technique (SAT) for Koala faecal pellets per Phillips and Callaghan (2011) and *Koala (Phascolarctos cinereus) Biodiversity Assessment Method Survey Guide (2022)* performed at 3 locations to determine previous koala presence (if any). SAT sites commenced at a central tree (with dbh 10cm or larger) and included in decreasing order of preference:
 - o A tree with koala scats below
 - o A tree in which a koala is observed
 - o A tree with diagnostic koala scratches or slider marks
 - o A primary koala food tree (PKFT) as nominated within the Byron Coast KPOM
 - o Any other Eucalypt, Corymbia, Angophora or Lopostemon
 - o Area mapped as koala habitat under the Byron Coast KPOM.

The SAT then involved two-minute searches at the base (100cm basal search area) of the central tree and nearest 29 non-juvenile canopy trees.

Duration: 3 x SAT sites.

- Opportunistic microbat roost searches were undertaken by looking for bats or signs of bats (urine stains, droppings, remains) in suitable habitat. Depending on the species this may be trees, caves or overhangs, old buildings and sheds or bridges, mines and culverts (Churchill 2008). All roost searches utilised a torch to shine into any potential roosting areas (i.e. suitable holes/cracks/crevices). No suitable microbat roost site was recorded within the development site.
- 14 motion triggered trail cameras (ScoutGuard) were placed within the study area during the survey period to digitally capture fauna activity. Such passive camera traps were deployed in accordance with DSEWPC (2011) 'Survey guidelines for Australia's threatened mammals: Guidelines for detecting mammals listed as threatened under the *Environment Protection and Biodiversity Conservation Act 1999*. "Passive systems are single units that use heat and motion detectors to trigger the camera (Kelly & Holub 2008). Infrared sensors work better at cooler ambient temperatures and are less consistent in warm environments (Swann et al. 2004). Camera trapping has been found to be the most effective method of detecting species at low or moderate densities (Vine et al. 2009 in DSEWPC, 2011: 32)."
- Cameras were fixed to trees approximately 75-100cm from ground level and aimed at a bait station. Cameras were programmed to operate 24 hours and take 3-image bursts triggered by motion. A 60 second delay was programmed between bursts. Each bait station consisted of either fresh chicken pieces or tuna mixture (carnivore) or a mixture of oats, peanut butter and golden syrup (generalist). To reduce the ability for a single animal to move the bait away from the camera station the baits were placed within a steel or plastic burley cage and pegged to the ground.

- In addition, either tuna oil (carnivore) and golden syrup/aniseed mixture (generalist) was sprayed in an approximate 2m radius around each bait station to act as an attractant. All fauna images were identified to genus or species level by the authors.



Duration: 14 x cameras for 34 nights total.

- 12 hair funnels (Faunatech) were deployed in general accordance with DSEWPC (2011) 'Survey guidelines for Australia's threatened mammals: Guidelines for detecting mammals listed as threatened under the Environment Protection and Biodiversity Conservation Act 1999.' This included installing hair funnels (Faunatech large opening reducing to small) at least 20m apart.
- The bait utilised included a mixture of sardines and tuna oil with flour utilised as a binding agent or a generic mixture of oats, peanut butter and golden syrup. In addition, tuna oil or aniseed was sprayed in an approximate 2m radius around each funnel to act as an attractant. Each hair funnel was marked in the field with a piece of flagging tape on a proximate tree and the location recorded via hand-held GPS (to enable retrieval and mapping).



Deployed Hair Funnels

Duration: twelve hair funnels for twenty-two nights.

Nocturnal Survey Methodology

Nocturnal survey included the following survey techniques:

- Audible survey for calls, scratching and landings;
- Spotlighting: Meandering nocturnal searches with Fenix HP30 head lamps and Fenix TK75 hand held spotlights were performed in accordance with CoE (2011 Survey Guidelines for Australia's Threatened Mammals Section 3.3.3) searching for presence of and reflective eyeshine of fauna and to enable ground strata searches for activity. All torches/spotlights were equipped with dimmer switches to reduce light intensity whilst identifying an individual animal after initial discovery.

Duration: 1-2 researchers over 4 nights for 120 minutes each night.

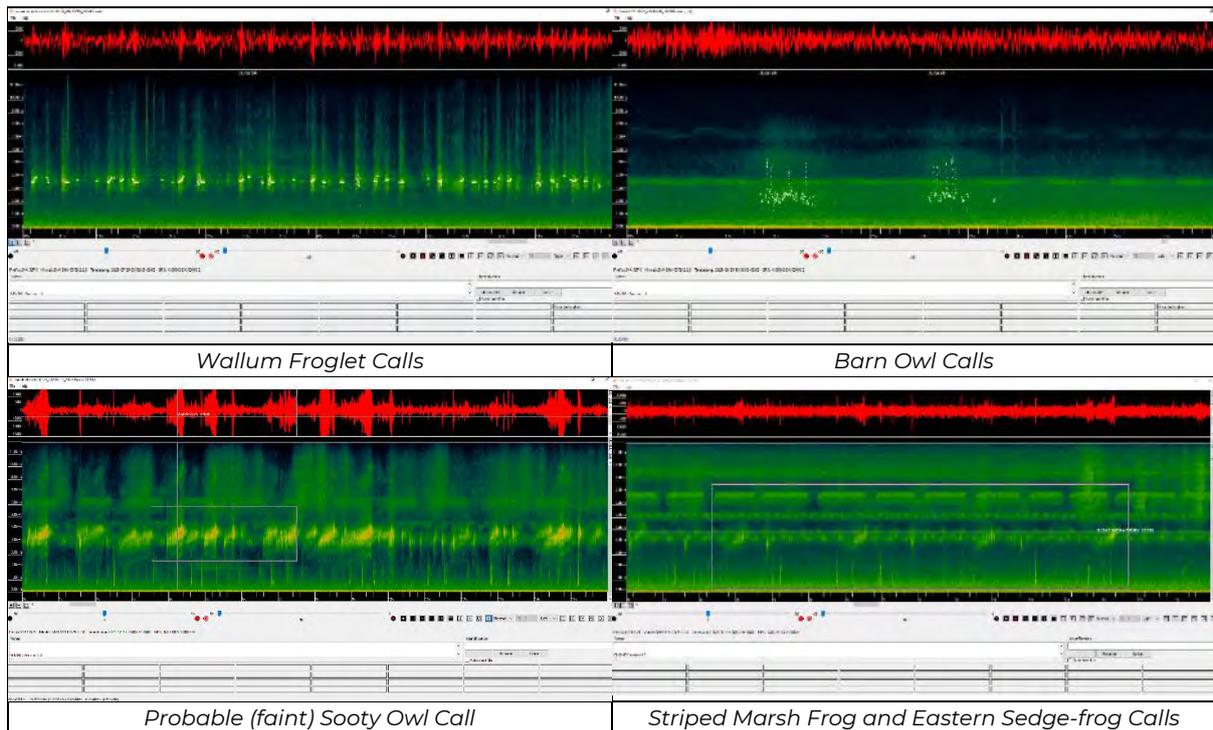
- Naked eye observation utilising dawn/dusk/moon light for bats and fauna returning to potential nest/shelter areas.

Duration: Four dusk/evenings.

- A songmeter SM4 was deployed between dusk and dawn for 34 nights at 4 different locations with the aim of recording unelicited nocturnal fauna vocalisations from dusk until dawn. Digital audio files were analyzed utilizing Songscope software developed by Wildlife Acoustics. Calls reviewed were compared existing call databases obtained from BOCA, NATURESOUND, Hoskin et al (2017) or Morcombe (2013).



Deployed Songmeter

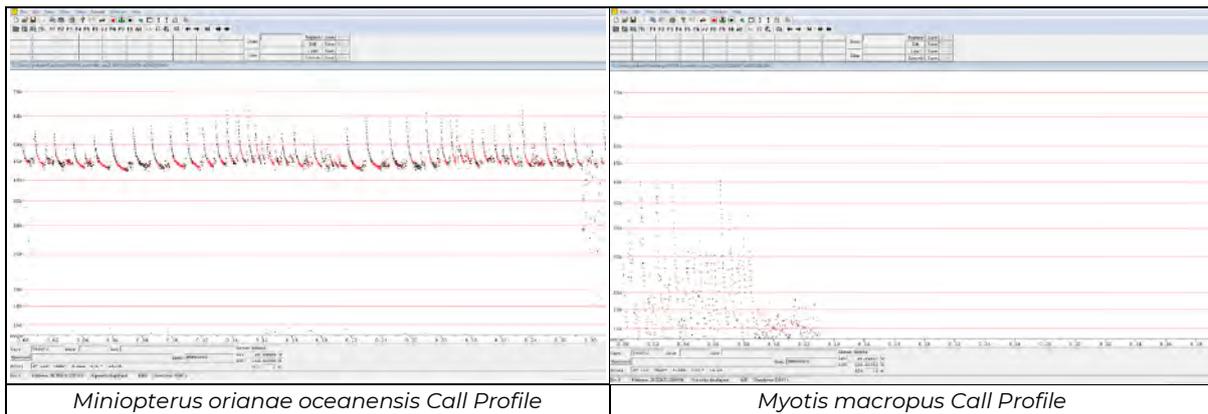


Duration: 34 nights at 4 locations.

- Anabat detection systems were utilized to record echolocation of microchiropteran bats from fixed stationary sites. Recordings were undertaken in areas most likely to attract bat species including standing water, woodland edges, areas of flowering vegetation and sites of high insect activity. Calls were extracted and analyzed utilizing Anabat Insight, Analoow, Kaleidoscope Pro and accepted reference keys.



Deployed Anabat



Duration: 1-2 devices for 34 nights at five locations.

- Amphibian nocturnal searches adjacent the drainage lines and swamp forests looking for exposed frogs, active frogs and reflective eyeshine was performed. Habitat features of these waterways and adjacent areas were searched, including under rocks and logs, under bark, leaf litter and emergent aquatic vegetation. Call playback was conducted randomly for targeted species either from the surveyor's mobile phone, or on a 25W Toa Megaphone.

Duration: Four nights proximate to the drainage lines and wetlands.

- 14 motion triggered trail cameras (ScoutGuard) were deployed as discussed in 'diurnal' above.



- Amplified call recording/playback for avifauna, amphibians and mammals. Playback of pre-recorded calls included the following threatened species:
 - Bush Stone-curlew (*Burhinus grallarius*);
 - White-eared Monarch (*Carterornis leucotis*);
 - Coxen's Fig-parrot (*Cyclopsitta diophthalma coxeni*);
 - Wallum Froglet (*Crinia tinnula*);
 - Mangrove Honeyeater (*Lichenostomus fasciogularis*);
 - Powerful Owl (*Ninox strenua*);
 - Masked Owl (*Tyto novaehollandiae*);
 - Sooty Owl (*Tyto tenebricosa*);
 - Eastern Grass Owl (*Tyto longimembris*);
 - Glossy Black Cockatoo (*Calyptorhynchus latham*);
 - Red Goshawk (*Erythrotriorchis radiatus*);
 - Marbled Frogmouth (*Podargus ocellatus*);
 - Green-thighed Frog (*Litoria brevipalmata*);
 - Olongburra Frog (*Litoria olongburensis*);
 - Squirrel Glider (*Petaurus norfolcensis*); and
 - Koala (*Phascolarctos cinereus*).

Each call playback session comprised of the following:

- A 2min listening period for unelicited fauna calls
- A 3min call playback for relevant species on a 25W Toa Megaphone
- A 5min search/spotlight for fauna at the playback site

Depending on the targeted species playback was undertaken at dusk and/or after dark. All call files were obtained from BOCA, NATURESOUND, Hoskin et al (2017) or Morcombe and Stewart (2020).

Duration: 10 dawn/early mornings and 4 dusks and nights.

The approximate locations of fauna survey plots (for defined methods such as camera trapping, call playback, spotlighting etc.) across the site are depicted in **Figures 4-4 – 4-8**.

The subject site is in the heart of the Byron Bay and is regularly used by the public. The site contains numerous walking tracks which are frequently used by the public to access the beach. Additionally, illegal campers were observed on several occasions during the survey period.

The use of drift fence lines for pitfall trapping would be easily spotted by the public and therefore may warrant an investigation. Should the pitfall trap contain trapped fauna, the uninformed person may feel obligated to free the animal, therefore putting both the person and animal at risk of harm.

As such, for both the safety of the captured animal, as well as the public, it was decided that pitfall and Elliot/cage trapping would not be utilised for the survey.

Additionally, the survey period occurred during a La Niña year with severe rainfall events frequently occurring. The subject site is flood prone and is often inundated during heavy rain events. This was an additional reason as to why trapping techniques were not utilised for targeted surveys of this site.

Due to these limitations, adequate targeted surveys for the Common Planigale (*Planigale maculata*) were not able to be achieved. As such, this species is 'assumed present' within the site.

Table 4-6 | Flora and Fauna Survey Efforts

Method	Target Species	Survey Effort	Number of site/units	Dates
Habitat Assessment	All fauna and flora	1 person x 4 hours	Entire site	18/05/2022
BAM Vegetation Integrity Plots	-	7 Plots	7 sites	29/11/2022 02/12/2022
Threatened Flora Surveys	All flora including targeted flora species: <i>Acacia bakeri</i> (Marblewood); <i>Acalypha eremorum</i> (Acalypha); <i>Acronychia littoralis</i> (Scented Acronychia); <i>Allocasuarina defungens</i> (Dwarf Heath Casuarina); <i>Archidendron hendersonii</i> (White Lace Flower); <i>Arthraxon hispidus</i> (Hairy Jointgrass); <i>Backhousia subargentea</i> (Giant Ironwood); <i>Bosistoa transversa</i> (Yellow Satinheart); <i>Caesalpinia bonduc</i> (Knicker Nut); <i>Cassia marksiana</i> (Cassia marksiana); <i>Centranthera cochinchinensis</i> (Swamp Foxglove); <i>Corokia whiteana</i> (Corokia); <i>Cryptocarya foetida</i> (Stinking Cryptocarya) <i>Cupaniopsis serrata</i> (Smooth Tuckeroo); <i>Cynanchum elegans</i> (White-flowered Wax Plant); <i>Cyperus aquatilis</i> (Water Nutgrass); <i>Davidsonia jerseyana</i> (Davidson's Plum);	1-2 x persons x 14 days (opportunistic during other surveys)	Development footprint + ~50m buffer	17/06/2021 18/06/2021 30/06/2021 09/07/2021 29/07/2021 29/11/2021 02/12/2021 07/12/2021 09/12/2021 10/02/2022 12/10/2022 24/04/2023 03/08/2023 10/08/2023 16/08/2023

Method	Target Species	Survey Effort	Number of site/units	Dates
	<i>Davidsonia johnsonii</i> (Smooth Davidson's Plum); <i>Dendrobium melaleucaphilum</i> (Spider orchid); <i>Dendrocnide moroides</i> (Gympie Stinger); <i>Desmodium acanthocladum</i> (Thorny Pea); <i>Diospyros mabacea</i> (Red-fruited Ebony); <i>Diospyros yandina</i> (Shiny-leaved Ebony); <i>Diploglottis campbellii</i> (Small-leaved Tamarind); <i>Drynaria rigidula</i> (Basket Fern); <i>Elaeocarpus williamsianus</i> (Hairy Quandong); <i>Endiandra floydii</i> (Crystal Creek Walnut); <i>Endiandra hayesii</i> (Rusty Rose Walnut); <i>Endiandra muelleri</i> subsp. <i>Bracteata</i> (Green-leaved Rose Walnut); <i>Floydia praealta</i> (Ball Nut); <i>Geodorum densiflorum</i> (Pink Nodding Orchid); <i>Gossia fragrantissima</i> (Sweet Myrtle); <i>Grevillea hilliana</i> (White Yiel Yiel); <i>Isoglossa eranthemoides</i> (Isoglossa); <i>Lepiderema pulchella</i> (Fine-leaved Tuckeroo); <i>Lindsaea fraseri</i> (Fraser's Screw Fern); <i>Macadamia tetraphylla</i> (Rough-shelled Bush Nut); <i>Marsdenia longiloba</i> (Slender Marsdenia); <i>Melicope vitiflora</i> (Coast Euodia); <i>Myrsine richmondensis</i> (Ripple-leaf Muttonwood);			

Method	Target Species	Survey Effort	Number of site/units	Dates
	<p><i>Niemeyera chartacea</i> (Smooth-leaved Plum); <i>Niemeyera whitei</i> (Rusty Plum, Plum Boxwood); <i>Oberonia complanata</i> (Yellow-flowered King of the Fairies); <i>Oberonia titania</i> (Red-flowered King of the Fairies); <i>Ochrosia moorei</i> (Southern Ochrosia); <i>Peristeranthus hillii</i> (Brown Fairy-chain Orchid); <i>Phaius australis</i> (Southern Swamp Orchid); <i>Phyllanthus microcladus</i> (Brush Sauropus); <i>Psilotum complanatum</i> (Flat Fork Fern); <i>Pterostylis nigricans</i> (Dark Greenhood); <i>Randia moorei</i> (Spiny Gardenia); <i>Rotala tripartite</i> (Rotala tripartite); <i>Senna acclinis</i> (Rainforest Cassia); <i>Sophora fraseri</i> (Brush Sophora) <i>Syzygium hodgkinsoniae</i> (Red Lilly Pilly); <i>Syzygium moorei</i> (Durobby); <i>Tinospora tinosporoides</i> (Arrow-head Vine); <i>Xylosma terrae-reginae</i> (Queensland Xylosma); and Other potentially occurring threatened flora species.</p>			
ANABAT Microbat Surveys	<p>Microbat species and the following threatened species: Large-eared Pied Bat (<i>Chalinolobus dwyeri</i>); Little Bentwing-bat (<i>Miniopterus australis</i>);</p>	<p>1-2 devices for 34 nights (1730- 0500)</p>	5 sites	<p>16/06/2021 - 26/06/2021 29/06/2021 – 09/07/2021 09/12/2021 – 20/12/2021 (2 x devices)</p>

Method	Target Species	Survey Effort	Number of site/units	Dates
	Large Bentwing-bat (<i>Miniopterus orianae oceanensis</i>); and Southern Myotis (<i>Myotis macropus</i>).			
Nocturnal Spotlighting	Nocturnal fauna species and the following threatened species: Bush Stone-curlew (<i>Burhinus grallarius</i>); Eastern Pygmy-possum (<i>Cercartetus nanus</i>); Wallum Froglet (<i>Crinia tinnula</i>); Pale-headed Snake (<i>Hoplocephalus bitorquatus</i>); Stephen's Banded Snake (<i>Hoplocephalus stephensii</i>); Green-thighed Frog (<i>Litoria brevipalmata</i>); Olongburra Frog (<i>Litoria olongburensis</i>); Squirrel Glider (<i>Petaurus norfolcensis</i>); Brush-tailed Phascogale (<i>Phascogale tapoatafa</i>); Koala (<i>Phascolarctos cinereus</i>); Long-nosed Potoroo (<i>Potorous tridactylus</i>); Grey-headed Flying-fox (<i>Pteropus poliocephalus</i>); and Mitchell's Rainforest Snail (<i>Thersites mitchellae</i>).	1-2 researchers for 4 nights (120 minutes per night)	Entire site	17/06/2021 29/07/2021 09/12/2021 10/02/2021
Motion Triggered Cameras	All fauna species including the following threatened species: Bush Stone-curlew (<i>Burhinus grallarius</i>); Eastern Pygmy-possum (<i>Cercartetus nanus</i>); Squirrel Glider (<i>Petaurus norfolcensis</i>); Brush-tailed Phascogale (<i>Phascogale tapoatafa</i>); Koala (<i>Phascolarctos cinereus</i>); Common Planigale (<i>Planigale maculata</i>); and	34 nights	14 sites	16/06/2021 - 26/06/2021 29/06/2021 – 09/07/2021 09/12/2021 - 21/12/2021

Method	Target Species	Survey Effort	Number of site/units	Dates
	Long-nosed Potoroo (<i>Potorous tridactylus</i>).			
Hair Funnel Survey	Small mammals including the following potentially occurring threatened species: Common Planigale (<i>Planigale maculata</i>); and Long-nosed Potoroo (<i>Potorous tridactylus</i>).	22 nights	12 sites	16/06/2021 - 26/06/2021 29/06/2021 – 09/07/2021
Koala SAT Survey	Determining the presence of Koalas (<i>Phascolartos cinereus</i>)	-	3 sites	10/05/2022
Dawn/Dusk Bird Survey	Avifauna species and the following threatened species: Bush Stone-curlew (<i>Burhinus grallarius</i>); White-eared Monarch (<i>Carterornis leucotis</i>); White-throated Needletail (<i>Hirundapus caudacutus</i>); Coxen's Fig-parrot (<i>Cyclopsitta diophthalma coxeni</i>); and Mangrove Honeyeater (<i>Lichenostomus fasciogularis</i>).	4 dusks and 6 dawns	Entire site	17/06/2021 18/06/2021 30/06/2021 09/07/2021 29/07/2021 29/11/2021 02/12/2021 09/12/2021 10/02/2022 12/10/2022 24/04/2023 03/08/2023 10/08/2023 16/08/2023

Method	Target Species	Survey Effort	Number of site/units	Dates
Call Playback	<p>Call playback was conducted at either dawn, dusk or evening for the following targeted and potentially occurring threatened species:</p> <p>Bush Stone-curlew (<i>Burhinus grallarius</i>); White-eared Monarch (<i>Carterornis leucotis</i>); Coxen's Fig-parrot (<i>Cyclopsitta diophthalma coxeni</i>); Wallum Froglet (<i>Crinia tinnula</i>); Mangrove Honeyeater (<i>Lichenostomus fasciogularis</i>); Powerful Owl (<i>Ninox strenua</i>); Masked Owl (<i>Tyto novaehollandiae</i>); Sooty Owl (<i>Tyto tenebricosa</i>); Eastern Grass Owl (<i>Tyto longimembris</i>); Glossy Black Cockatoo (<i>Calyptorhynchus latham</i>); Red Goshawk (<i>Erythrotriorchis radiatus</i>); Marbled Frogmouth (<i>Podargus ocellatus</i>); Green-thighed Frog (<i>Litoria brevipalmata</i>); Olongburra Frog (<i>Litoria olongburensis</i>); Squirrel Glider (<i>Petaurus norfolcensis</i>); and Koala (<i>Phascolarctos cinereus</i>).</p>	4 dusks/evenings and 10 dawns/mornings	Multiple sites	17/06/2021 18/06/2021 30/06/2021 09/07/2021 29/07/2021 29/11/2021 02/12/2021 09/12/2021 10/02/2022 12/10/2022 24/04/2023 03/08/2023 10/08/2023 16/08/2023
Acoustic Recorder (Songmeter SM4)	<p>Targeting the following threatened species:</p> <p>Bush Stone-curlew (<i>Burhinus grallarius</i>); White-eared Monarch (<i>Carterornis leucotis</i>); Coxen's Fig-parrot (<i>Cyclopsitta diophthalma coxeni</i>);</p>	34 nights	4 sites	16/06/2021 - 26/06/2021 29/06/2021 – 09/07/2021 09/12/2021 - 21/12/2021

Method	Target Species	Survey Effort	Number of site/units	Dates	
	Wallum Froglet (<i>Crinia tinnula</i>); Mangrove Honeyeater (<i>Lichenostomus fasciogularis</i>); Green-thighed Frog (<i>Litoria brevipalmata</i>); Olongburra Frog (<i>Litoria olongburensis</i>); Squirrel Glider (<i>Petaurus norfolcencis</i>); and Koala (<i>Phascolarctos cinereus</i>).				
Amphibian Assessment	Waterbody	Amphibians including the following threatened species: Wallum Froglet (<i>Crinia tinnula</i>); Green-thighed Frog (<i>Litoria brevipalmata</i>); and Olongburra Frog (<i>Litoria olongburensis</i>).	1-2 researchers for 4 nights	Areas proximate to waterbody	17/06/2021 29/07/2021 09/12/2021 10/02/2021
Ground Search Surveys	Targeting the following threatened species: White-crowned Snake (<i>Cacophis harriettae</i>); Pale-headed Snake (<i>Hoplocephalus bitorquatus</i>); Stephens' Banded Snake (<i>Hoplocephalus stephensii</i>); Coastal Petaltail (<i>Petalura litorea</i>); and Mitchell's Rainforest Snail (<i>Thersites mitchellae</i>).	1-2 researchers x 30 minutes	6 sites	17/06/2021 29/07/2021 02/12/2021 09/12/2021 10/02/2021 10/08/2023	

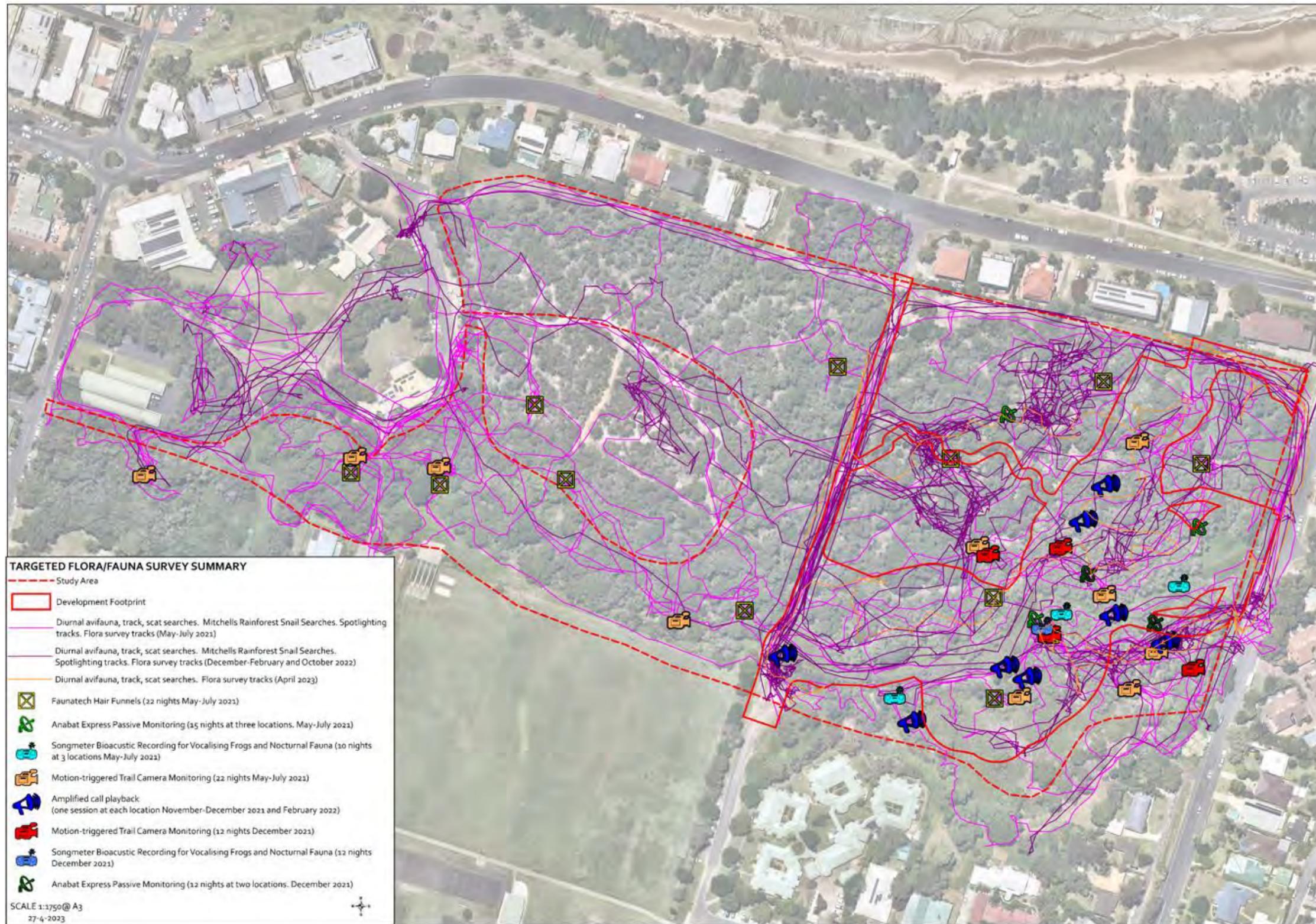


Figure 4-1 | Fauna and Flora Survey Summary Map 1

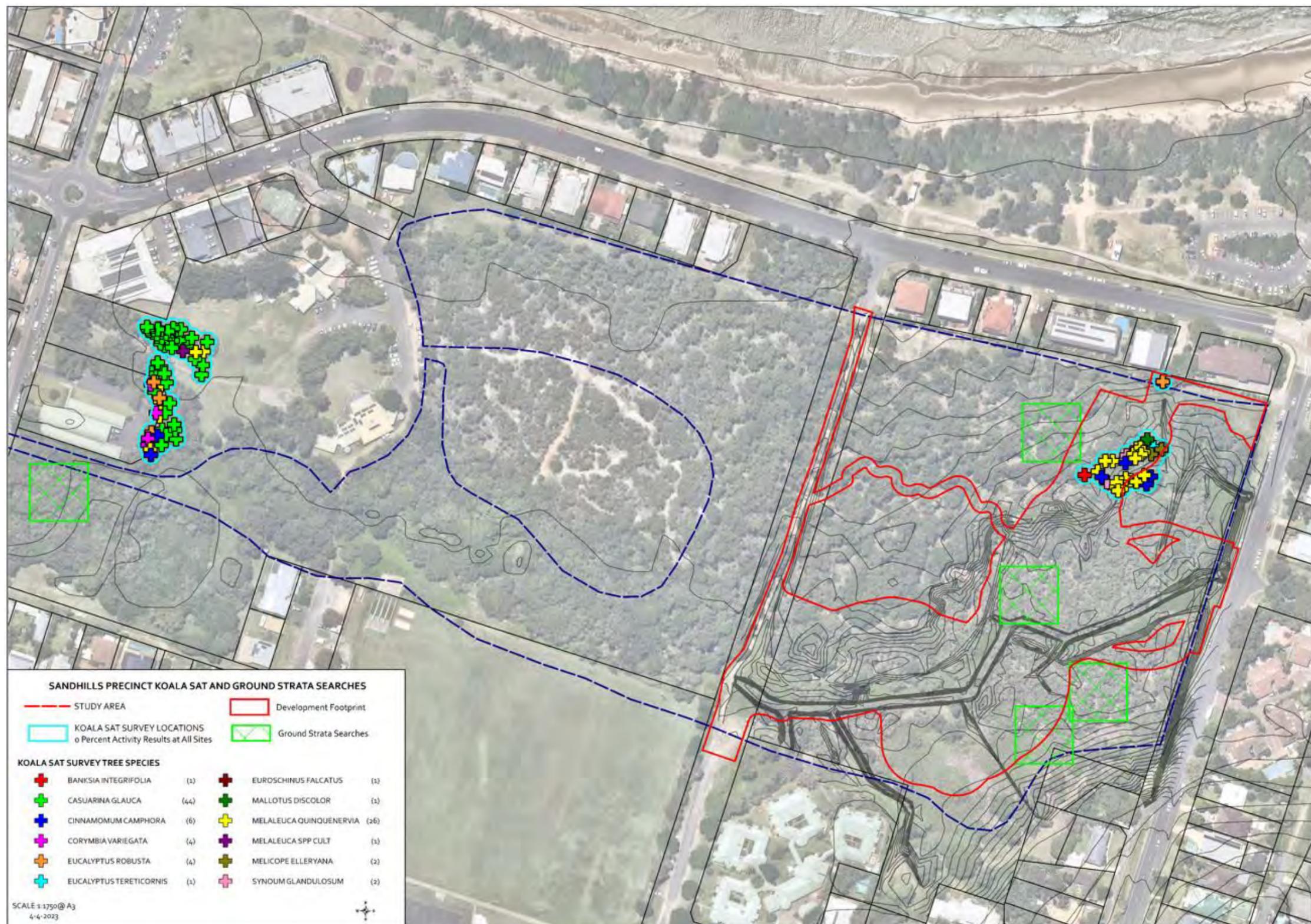


Figure 4-2 | Fauna and Flora Survey Summary Map 2



Figure 4-3 | Fauna and Flora Survey Summary August 2023

4.4.1 Weather Conditions during Survey

The following weather conditions (sourced from BOM) were recorded prior and during the survey period at Cape Byron AWS (station 058216) approximately 1km from the subject site.

Table 4-7 | Weather Conditions During Survey Period

Date	Daily Data			
	Min-Max Temp. (C°)	Rainfall (mm)	9am Wind (direction & speed)	9am Relative Humidity (%)
14 th June 2021	11.8 – 20.3	0	WSW 22 km/h	61
15 th June 2021	12.6 – 18.5	0	SW 17 km/h	78
16 th June 2021	14.8 – 21.3	0	Calm	78
17 th June 2021	15.7 – 22.9	0	NW 9 km/h	60
18 th June 2021	12.2 – 20.0	0	WSW 15 km/h	52
19 th June 2021	12.1 – 18.6	0	W 30 km/h	57
20 th June 2021	13.4 – 18.0	0	SW 41 km/h	64
21 st June 2021	13.0 – 18.5	0.2	SW 35 km/h	71
22 nd June 2021	12.1 – 18.4	1.6	SW 28 km/h	82
23 rd June 2021	13.0 – 20.0	7.2	WSW 15 km/h	93
24 th June 2021	14.6 – 19.6	1.8	NNW 17 km/h	91
25 th June 2021	17.4 – 20.8	0.2	NNW 22 km/h	80
26 th June 2021	14.0 – 16.8	0	WSW 24 km/h	80
27 th June 2021	11.7 – 17.9	0.4	SW 30 km/h	57
28 th June 2021	10.8 – 18.0	0	SW 28 km/h	74
29 th June 2021	12.7 – 18.7	11.4	SW 28 km/h	98
30 th June 2021	12.9 – 18.3	25.4	WSW 11 km/h	94
1 st July 2021	14.4 - 19.6	19.2	NNE 26 km/h	95
2 nd July 2021	16.0 – 18.3	34.0	NNW 6 km/h	96
3 rd July 2021	15.8 – 17.7	18.2	W 7 km/h	97
4 th July 2021	13.9 – 17.9	5.2	SW 24 km/h	92

Date	Daily Data			
	Min-Max Temp. (C°)	Rainfall (mm)	9am Wind (direction & speed)	9am Relative Humidity (%)
5 th July 2021	11.7 – 17.2	0	WSW 17 km/h	78
6 th July 2021	10.4 – 15.3	0	WSW 26 km/h	61
7 th July 2021	10.1 – 17.5	0	SW 26 km/h	69
8 th July 2021	11.7 – 19.5	0	SSW 15 km/h	75
9 th July 2021	14.0 – 18.4	21.4	N 11 km/h	97
27th November 2021	19.1 – 22.8	10.6	SSW 35 km/h	98
28th November 2021	17.9 – 22.5	0	SSW 35 km/h	84
29 th November 2021	18.0 – 22.6	2.2	SSW 24 km/h	97
30 th November 2021	19.5 – 21.6	4.6	SSW 28 km/h	98
1 st December 2021	19.3 – 22.1	48.8	SW 20 km/h	98
2 nd December 2021	19.4 – 23.8	8.8	SSW 26 km/h	90
5th December 2021	17.2 – 25.0	11.8	SSW 31 km/h	88
6th December 2021	17.7 – 24.8	9.4	SW 22 km/h	98
7 th December 2021	18.8 – 29.9	3.6	N 7 km/h	95
8 th December 2021	21.1 – 24.4	0.2	WSW 7 km/h	84
9 th December 2021	17.0 – 29.4	4.0	N 9 km/h	73
10 th December 2021	21.6 – 29.4	0	WSW 9 km/h	71
11 th December 2021	19.6 – 24.8	0	SSW 9 km/h	69
12 th December 2021	16.1 – 24.6	9.0	SW 26 km/h	83
13 th December 2021	17.6 – 23.8	0	SW 24 km/h	80
14 th December 2021	17.8 – 23.8	0.2	SSW 28 km/h	66

Date	Daily Data			
	Min-Max Temp. (C°)	Rainfall (mm)	9am Wind (direction & speed)	9am Relative Humidity (%)
15 th December 2021	17.5 – 25.6	0	SW 26 km/h	59
16 th December 2021	19.4 – 27.8	0	N 11 km/h	77
17 th December 2021	20.6 – 26.2	0	WSW 13 km/h	87
18 th December 2021	20.7 – 30.0	6.4	N 7 km/h	72
19 th December 2021	21.9 – 26.3	0	N 13 km/h	61
20 th December 2021	22.8 – 28.2	0	N 15 km/h	75
21 st December 2021	21.1 – 27.3	0	N 24 km/h	83
8th February 2022	17.1 – 24.6	0.8	SW 28 km/h	88
9th February 2022	18.0 – 28.9	0.8	SW 13 km/h	68
10 th February 2022	20.0 – 26.6	0	SW 11 km/h	75
10th October 2022	17.1 - 20.7	1.4	E 39 km/h	72
11th October 2022	17.4 - 20.8	0.2	ESE 35 km/h	59
12 th October 2022	14.4 - 21.1	0.8	SSE 30 km/h	61
22nd April 2023	15.7 - 22.2	18.2	SW 26 km/h	65
23rd April 2023	16.5 - 23.1	0	SE 31 km/h	72
24 th April 2023	19.1 - 23.4	0.8	E 57 km/h	66
1st August 2023	15.7 - 21.4	2.6	SW 11 km/h	87
2nd August 2023	14.8 - 20.0	0	SE 24 km/h	59
3 rd August 2023	15.3 - 19.7	0	ENE 24 km/h	65
8th August 2023	12.3 - 17.5	5.2	SW 20 km/h	92
9th August 2023	11.5 - 18.6	0	SSW 28 km/h	79
10 th August 2023	13.7 - 25.2	0	NNW 11 km/h	64
14th August 2023	15.4 - 22.8	0	NNW 9 km/h	76
15th August 2023	16.2 - 20.	0	Calm	80

Date	Daily Data			
	Min-Max Temp. (C°)	Rainfall (mm)	9am Wind (direction & speed)	9am Relative Humidity (%)
16th August 2023	12.8 – 19.8	1.4	SW 20 km/h	80

Note: Onsite survey dates are shown in bold

4.4.2 Survey Limitations

Whilst the duration of flora surveys and inspections of the property are considered appropriate in the context of the site, undetected threatened or other native flora species may be present on the property. It is noted that survey efforts have been previously conducted over the site by other consultants over the years (i.e. EcoPro, 2006). Seasonal surveys would also be necessary to detect flora species that are dormant or inconspicuous for part of the year (i.e. from the Asteraceae, Orchidaceae, Cyperaceae, Poaceae etc). Some of these species (dormant or non-flowering) may have been undetected or under-represented within the survey period. Further ungerminated seed of various species may have been present within the soil seed bank.

Whilst the duration and sampling methodology of the fauna survey is considered appropriate, it is acknowledged that the entire seasonal fauna assemblage is unlikely to be recorded. It is also accepted that although assessments of habitat and species ecology does provide an additional measure to anticipate the presence of species (as a surrogate for its actual observation), there is no absolute certainty to the absence of a species from marginal or potential habitat.

Additionally, there may be some species that may utilise the habitats within the site but have remained undetected due to their rarity, elusive nature or the sporadic utilisation of the habitats (i.e. the Long-nosed Potoroo, Common Planigale and Dunnart are elusive species that are difficult to trap or observe directly; the Black-necked Stork, Powerful Owl, Spotted-tail Quoll and Red Goshawk may only visit an area occasionally within a much larger home-range; the Swift Parrot and Regent Honeyeater may only visit an area during peak flowering periods etc.).

The conclusions of this report are therefore based upon data available at the time and the results of field works undertaken and are therefore indicative of the environmental condition of the site at the time of sampling, including the presence or otherwise of species. At should be acknowledged that site conditions, including the presence of threatened species, can change over time. Additionally, flora and fauna results from previous ecological studies of the locality were taken into account.

The above limitations have been taken into account and the likelihood of threatened such species occurring within the site assessed through habitat assessment, records of the species within the locality and aspects of species ecology. Targeted surveys were conducting during nominated survey periods for all species credit species.

4.5 Site Survey Results

The following section(s) list the fauna species recorded during detailed surveying and lists the methods by which each species was identified.

Family Name	Refers to the family name within the Bionet/Atlas of NSW Wildlife (B/ANW) database.
Scientific Name	The internationally recognised Latin name given to an organism, following the International Codes of Botanical and Zoological Nomenclature.
Exotic	Denoted by * for all non-native species.
Common Name	Refers to the common name of an organism within the B/ANW database.

NSW Status	This code identifies the Legal Status of the species within NSW under the Biodiversity Conservation Act 2016 No. 63 (BC Act 2016), the Fisheries Management Act 1994 No.38 (FM Act 1994) and the Sensitive Species Data Policy (SSDP).
-------------------	--

Code	Description	Definition under the BC Act 2016 No. 63, the FM Act 1994 No. 38, or the SSDP.
P	Protected	Refers to fauna listed in Schedule 5 of the BC Act 2016.
P13	Protected Native Plants	Refers to flora listed in Schedule 6 of the BC Act 2016.
V	Vulnerable	Refers to fauna and flora species that are likely to become endangered unless the circumstances & factors threatening its survival or evolutionary development cease to operate (Schedule 1, part 3, BC Act 2016).
E1	Endangered	Refers to fauna and flora species that are likely to become extinct in nature in NSW unless the circumstances and factors threatening its survival or evolutionary developments cease to operate; or, its numbers have been reduced to such a critical level, or its habitats have been so drastically reduced, that it is in immediate danger of extinction; or, it might already be extinct, but it is not presumed extinct (Schedule 1, part 2, BC Act 2016).

Survey Method Codes

A	Stranding/beached	OW	Observed and Heard call
AR	Acoustic recording	P	Scat
B	Burnt	Q	Camera
C	Cat kill	R	Road kill
D	Dog kill	S	Shot
E	Nest/roost	T	Trapped or netted
F	Tracks, scratchings	U	Ultrasonic recording
FB	Burrow	V	Fox kill
G	Crushed Cones	W	Heard call
H	Hair, feathers or skin	X	In scat
I	Subfossil/Fossil Remains	Y	Bone, teeth or shell
K	Dead	Z	In raptor/owl pellet
O	Observed		

*All birds were either directly observed through diurnal survey, spotlighting, camera trap or call identification

**Recorded in adjacent areas of the site or circling overhead

BIRDS

FAMILY	SCIENTIFIC NAME	EXOTIC	COMMON NAME	NSW STATUS
Acanthizidae	<i>Sericornis frontalis</i>		White-browed Scrubwren	P
Accipitridae	<i>Accipiter cirrocephalus</i>		Collared Sparrowhawk**	P
Accipitridae	<i>Aviceda subcristata</i>		Pacific Baza**	P

FAMILY	SCIENTIFIC NAME	EXOTIC	COMMON NAME	NSW STATUS
Accipitridae	<i>Haliastur indus</i>		Brahminy Kite**	P
Alcedinidae	<i>Dacelo novaeguineae</i>		Laughing Kookaburra	P
Anatidae	<i>Anas superciliosa</i>		Pacific Black Duck	P
Anatidae	<i>Aythya australis</i>		Hardhead	P
Anatidae	<i>Chenonetta jubata</i>		Australian Wood Duck	P
Anhingidae	<i>Anhinga novaehollandiae</i>		Australasian Darter	P
Ardeidae	<i>Bubulcus ibis</i>		Cattle Egret	P
Ardeidae	<i>Casmerodius modesta</i>		Eastern Great Egret	P
Ardeidae	<i>Egretta novaehollandiae</i>		White-faced Heron	P
Artamidae	<i>Artamus leucorhynchus</i>		White-breasted Woodswallow	P
Artamidae	<i>Cracticus nigrogularis</i>		Pied Butcherbird	P
Artamidae	<i>Gymnorhina tibicen</i>		Australian Magpie	P
Artamidae	<i>Nycticorax caledonicus</i>		Nankeen Night Heron	P
Artamidae	<i>Strepera graculina</i>		Pied Currawong	P
Cacatuidae	<i>Cacatua galerita</i>		Sulphur-crested Cockatoo	P
Cacatuidae	<i>Cacatua sanguinea</i>		Little Corella	P
Cacatuidae	<i>Eolophus roseicapilla</i>		Galah	P
Campephagidae	<i>Coracina novaehollandiae</i>		Black-faced Cuckoo-shrike	P
Charadriidae	<i>Vanellus miles</i>		Masked Lapwing	P
Cisticolidae	<i>Cisticola exilis</i>		Golden-headed Cisticola	P
Columbidae	<i>Columba leucomela</i>		White-headed Pigeon	P
Columbidae	<i>Columba livia</i>	*	Rock Dove	
Columbidae	<i>Geopelia humeralis</i>		Bar-shouldered Dove	P
Columbidae	<i>Geopelia striata</i>		Peaceful Dove	P
Columbidae	<i>Macropygia phasianella</i>		Brown Cuckoo-Dove	P
Columbidae	<i>Ocyphaps lophotes</i>		Crested Pigeon	P
Columbidae	<i>Phaps chalcoptera</i>		Common Bronzewing	P

FAMILY	SCIENTIFIC NAME	EXOTIC	COMMON NAME	NSW STATUS
Coraciidae	<i>Eurystomus orientalis</i>		Dollarbird	P
Corvidae	<i>Corvus orru</i>		Torresian Crow	P
Cuculidae	<i>Cacomantis variolosus</i>		Brush Cuckoo	P
Dicaeidae	<i>Dicaeum hirundinaceum</i>		Mistletoebird	P
Dicruridae	<i>Dicrurus bracteatus</i>		Spangled Drongo	P
Estrildidae	<i>Neochmia temporalis</i>		Red-browed Finch	P
Estrildidae	<i>Stizoptera bichenovii</i>		Double-barred Finch	P
Falconidae	<i>Falco cenchroides cenchroides</i>		Nankeen Kestrel	P
Hirundinidae	<i>Hirundo neoxena</i>		Welcome Swallow	P
Locustellidae	<i>Cincloramphus timoriensis</i>		Tawny Grassbird	P
Locustellidae	<i>Poodytes gramineus</i>		Little Grassbird	P
Maluridae	<i>Malurus lamberti</i>		Variegated Fairy-wren	P
Maluridae	<i>Malurus melanocephalus</i>		Red-backed Fairy-wren	P
Megapodiidae	<i>Alectura lathamii</i>		Australian Brush-turkey	P
Meliphagidae	<i>Acanthorhynchus tenuirostris</i>		Eastern Spinebill	P
Meliphagidae	<i>Anthochaera chrysoptera</i>		Little Wattlebird	P
Meliphagidae	<i>Caligavis chrysops</i>		Yellow-faced Honeyeater	P
Meliphagidae	<i>Entomyzon cyanotis</i>		Blue-faced Honeyeater	P
Meliphagidae	<i>Lichmera indistincta</i>		Brown Honeyeater	P
Meliphagidae	<i>Manorina melanocephala</i>		Noisy Miner	P
Meliphagidae	<i>Meliphaga lewinii</i>		Lewin's Honeyeater	P
Meliphagidae	<i>Myzomela sanguinolenta</i>		Scarlet Honeyeater	P
Meliphagidae	<i>Philemon citreogularis</i>		Little Friarbird	P
Meliphagidae	<i>Philemon corniculatus</i>		Noisy Friarbird	P
Meliphagidae	<i>Phylidonyris niger</i>		White-cheeked Honeyeater	P
Meliphagidae	<i>Plectorhyncha lanceolata</i>		Striped Honeyeater	P
Monarchidae	<i>Grallina cyanoleuca</i>		Magpie-lark	P
Monarchidae	<i>Myiagra rubecula</i>		Leaden Flycatcher	P

FAMILY	SCIENTIFIC NAME	EXOTIC	COMMON NAME	NSW STATUS
Motacillidae	<i>Anthus novaeseelandiae</i>		Australian Pipit	P
Oriolidae	<i>Oriolus sagittatus</i>		Olive-backed Oriole	P
Pachycephalidae	<i>Colluricincla harmonica</i>		Grey Shrike-thrush	P
Pachycephalidae	<i>Colluricincla megarhyncha</i>		Little Shrike-thrush	P
Pachycephalidae	<i>Pachycephala pectoralis</i>		Golden Whistler	P
Pardalotidae	<i>Pardalotus striatus</i>		Striated Pardalote	P
Passeridae	<i>Passer domesticus</i>	*	House Sparrow	
Phasianidae	<i>Synoicus ypsilophora</i>		Brown Quail	P
Podargidae	<i>Podargus strigoides</i>		Tawny Frogmouth	P
Psittacidae	<i>Alisterus scapularis</i>		Australian King-Parrot	P
Psittacidae	<i>Platycercus eximius</i>		Eastern Rosella	P
Psittacidae	<i>Trichoglossus chlorolepidotus</i>		Scaly-breasted Lorikeet	P
Psittacidae	<i>Trichoglossus haematodus</i>		Rainbow Lorikeet	P
Psophodidae	<i>Psophodes olivaceus</i>		Eastern Whipbird	P
Rallidae	<i>Gallinula tenebrosa</i>		Dusky Moorhen	P
Rallidae	<i>Hypotaenidia philippensis</i>		Buff-banded Rail	P
Rallidae	<i>Porphyrio porphyrio</i>		Purple Swamphe	P
Rallidae	<i>Porzana pusilla</i>		Baillon's Crake	P
Rhipiduridae	<i>Rhipidura albiscapa</i>		Grey Fantail	P
Rhipiduridae	<i>Rhipidura leucophrys</i>		Willie Wagtail	P
Sturnidae	<i>Acridotheres tristis</i>	*	Common Myna	
Threskiornithidae	<i>Platalea regia</i>		Royal Spoonbill	P
Threskiornithidae	<i>Threskiornis moluccus</i>		Australian White Ibis	P
Threskiornithidae	<i>Threskiornis spinicollis</i>		Straw-necked Ibis	P
Tyonidae	<i>Tyto alba</i>		Barn Owl	P
Tyonidae	<i>Tyto tenebriscoa</i>		Sooty Owl**	V
Zosteropidae	<i>Zosterops lateralis</i>		Silvereye	P

MAMMALS

FAMILY	SCIENTIFIC NAME	EXOTIC	COMMON NAME	NSW STATUS	METHOD
Canidae	<i>Canis familiaris</i>	*	Dog		O, Q, F
Canidae	<i>Vulpes vulpes</i>	*	Fox		Q
Felidae	<i>Felis catus</i>	*	Cat		O, H
Macropodidae	<i>Wallabia bicolor</i>		Swamp Wallaby	P	O, Q
Miniopteridae	<i>Miniopterus australis</i>		Little Bent-winged Bat	V,P	U
Miniopteridae	<i>Miniopterus orianae oceanensis</i>		Large Bent-winged Bat	V,P	U
Molossidae	<i>Austronomus australis</i>		White-striped Free-tailed Bat	P	U
Molossidae	<i>Mormopterus sp. 2</i>		A free-tailed bat	P	U
Muridae	<i>Muridae sp.</i>		unidentified murid rodent	P	Q
Muridae	<i>Mus musculus</i>	*	House Mouse		H
Muridae	<i>Rattus rattus</i>	*	Black Rat		H
Muridae	<i>Rattus sp.</i>		rat	P	Q
Peramelidae	<i>Isodon macrourus</i>		Northern Brown Bandicoot	P	Q, H
Phalangeridae	<i>Trichosurus caninus</i>		Short-eared Possum	P	Q
Phalangeridae	<i>Trichosurus vulpecula</i>		Common Brushtail Possum	P	Q, O, H
Pseudocheiridae	<i>Pseudocheirus peregrinus</i>		Common Ringtail Possum	P	O
Pteropodidae	<i>Pteropus alecto</i>		Black Flying-fox	P	O
Pteropodidae	<i>Pteropus poliocephalus</i>		Grey-headed Flying-fox	V,P	O
Tachyglossidae	<i>Tachyglossus aculeatus</i>		Short-beaked Echidna	P	Q
Vespertilionidae	<i>Chalinolobus gouldii</i>		Gould's Wattleed Bat	P	U

FAMILY	SCIENTIFIC NAME	EXOTIC	COMMON NAME	NSW STATUS	METHOD
Vespertilionidae	<i>Myotis macropus</i>		Southern Myotis	V,P	U
Vespertilionidae	<i>Nyctophilus spp.</i>		A Long-eared Bat	P	U
Vespertilionidae	<i>Vespadelus pumilus</i>		Eastern Forest Bat	P	U

REPTILES

FAMILY	SCIENTIFIC NAME	EXOTIC	COMMON NAME	NSW STATUS	METHOD
Agamidae	<i>Intellagama lesueurii</i>		Eastern Water Dragon	P	O
Colubridae	<i>Boiga irregularis</i>		Brown Tree Snake	P	O
Colubridae	<i>Dendrelaphis punctulatus</i>		Common Tree Snake	P	O
Elapidae	<i>Pseudechis porphyriacus</i>		Red-bellied Black Snake	P	O
Pythonidae	<i>Morelia spilota</i>		Carpet Python	P	O
Scincidae	<i>Cryptoblepharus virgatus</i>		Cream-striped Shinning-skink	P	O
Scincidae	<i>Ctenotus robustus</i>		Robust Ctenotus	P	O
Scincidae	<i>Lampropholis delicata</i>		Dark-flecked Garden Sunskink	P	O

AMPHIBIANS

FAMILY	SCIENTIFIC NAME	EXOTIC	COMMON NAME	NSW STATUS	METHOD
Bufonidae	<i>Rhinella marina</i>	*	Cane Toad		OW, AR
Hylidae	<i>Litoria fallax</i>		Eastern Dwarf Tree Frog	P	W, AR
Hylidae	<i>Litoria gracilentia</i>		Dainty Green Tree Frog	P	W, AR
Hylidae	<i>Litoria nasuta</i>		Rocket Frog	P	OW
Limnodynastidae	<i>Limnodynastes peronii</i>		Brown-striped Frog	P	OW, AR

FAMILY	SCIENTIFIC NAME	EXOTIC	COMMON NAME	NSW STATUS	METHOD
Myobatrachidae	<i>Crinia parinsignifera</i>		Eastern Sign-bearing Froglet	P	W
Myobatrachidae	<i>Crinia signifera</i>		Common Eastern Froglet	P	W, AR
Myobatrachidae	<i>Crinia tinnula</i>		Wallum Froglet	V,P	W, AR

4.6 Discussion of Survey Results

4.6.1 Birds

Eighty-five (85) species of bird were recorded during surveys of the subject site. One bird species scheduled as Vulnerable under the Biodiversity Conservation Act 2016 was recorded during fauna survey works.

The majority of bird species recorded are diurnal species including:

- Insectivores which forage for invertebrates in the leaves, branches and bark of trees, in the air spaces provided by canopy gaps, and amongst litter, woody debris and groundcovers (i.e. fairy wrens, whistlers, fantails, whipbird, cisticola etc.)
- Nectar feeders (i.e. lorikeets, honeyeaters, friarbirds, etc.)
- Large omnivores (i.e. butcherbirds, magpies, crows etc.)
- Waterbirds (ducks, swamp hen, heron, ibis etc.)
- Frugivores (pigeons)
- Coastal raptors (brahminy kite)
- Granivores (finches)

The most productive habitats for birds appear to be those providing a range of resources which can support a variety of different foraging groups (Bauer et al. 2000). This is most likely to occur where there is a diversity of vegetation strata available as foraging substrates (Gilmore 1985, Loyn 1985, Recher 1969, MacArthur and MacArthur 1961). In Australian temperate forests and woodlands different strata tend to reflect differences at the levels of plant life form (forb, shrub or tree) and plant genus. This provides different kinds of food (nectar, fruit, seeds) and foliage thereby increasing the diversity of foraging opportunities for bird species (Recher 1985).

Six habitat components have been consistently identified as important resource bases for birds (Recher et al. 1998, Woinarski et al. 1997, Traill 1993, Recher 1991, Gilmore 1985):

- Foliage; a source of exudates and invertebrates;
- Flowers; a source of nectar and invertebrates
- Bark; a source of exudates and invertebrates
- The ground layer, including ground vegetation, litter, logs and coarse woody debris; - a source of invertebrates and small vertebrates;
- Air spaces; within and between canopy strata - a source of invertebrates;
- Hollow bearing trees; for nesting and shelter" (McElhinny, 2000: 20).

Subsequent to the fauna survey, it is considered that the site exhibits habitat suitable for grassland/pasture birds, forest/woodland (particularly those associated with closed canopy environments) and common generalist species typically found within modified habitats (i.e. magpies, crows etc.). The presence of an array of interconnected and fragmented vegetation remnants on and adjacent to the site is likely the reason for the presence of a relatively diverse assemblage of avifauna. This corridor encompasses an altitudinal sequence of habitats rising from the drainage lines to rainforest over a short linear distance. Continuous habitat gradients such as this provide avifauna with

a range of resources throughout the year and are likely to have importance in connecting breeding populations across the landscape.

The nectarivorous guild was reasonably well represented and is generally well established within local paperbark and banksia forests favouring this avifauna group. Meliphagids were regularly encountered with the most noted species being the Scarlet Honeyeater, Lewin's Honeyeater, Friarbirds and Lorikeets (Scaly-breasted and Rainbow).

Suitable habitat for species associated with dense ground strata was abundant throughout the eastern areas of site which contains dense ground layer of rushes/sedges/grasses/weeds. A reasonable diversity of ground, low and shrub level foliage gleaners/pouncers and sallyers were recorded from these areas including Silvereyes, Scrub-wrens, Fantails and Fairy-wrens. These denser understorey components (including swards of rushes, grass trees and sedges) were also noted to be utilized by granivores such as finches (double-barred and red-browed).

The onsite presence and proximity of extensive coastal wetlands (palustrine) and drains has resulted in the recording of several waterfowl species with standing water/ponds favouring smaller, dense ground strata refuge species such as rails. Open water species such as ducks, herons and egrets were also recorded within the site's drainage lines.

Diurnal coastal raptors were also noted to be common in the locality and were recorded circling over the site (i.e. Brahminy Kite) although no nests were observed.

Two nocturnal species, the tawny frogmouth and barn owl, were recorded during nocturnal searches of the survey period. During the survey period, no trees within the survey area were considered to contain hollows suitable for large forest owl species. None were encountered during survey which was considered to coincide with the typical breeding period of the Masked Owl, Sooty Owl and Powerful Owl per DEC (2005). It is noted however, that a probable (very faint) Sooty Owl call was recorded on the acoustic recorded during survey efforts. As noted previously, given the absence of hollows, the site does not contain breeding habitat for this owl.

The presence of fruiting rainforest/riparian species has resulted in species list containing a high diversity of frugivores. Some fruiting eating species which also forage upon other resources (i.e. insects, seed and/or nectar) were also regularly recorded on site such as Doves, Pigeons and Cuckoo-shrikes.

In summary, the survey sites' physical features and resultant vegetation communities has produced a bird assemblage which is dominated by common sclerophyll forest/woodland species and species typical to low-lying swamps and rainforest which are abundant in the locality.

4.6.2 Mammals

A total of twenty-three (23) mammal species were recorded on the subject site. Four species listed as vulnerable under the Biodiversity Species Conservation Act 2016 were recorded on the site during fauna survey works. A long-eared bat (*Nyctophilus* spp.) was recorded during anabat surveys. Three long-eared bat species are known from the locality, which include the Gould's Long-eared Bat (*Nyctophilus gouldi*), the Lesser Long-eared Bat (*Nyctophilus geoffroyi*), and the vulnerable Eastern Long-eared Bat (*Nyctophilus bifax*). The anabat data was unable to accurately determine which of these long-eared bat species were recorded onsite during the survey works. Nevertheless, the vulnerable Eastern Long-eared Bat (*Nyctophilus bifax*) is not a species credit species, but rather an ecosystem credit species. Impacts towards this potentially occurring threatened microbat as a result of the proposal will be offset in accordance with the ecosystem credits.

4.6.2.1 Ground-dwelling Mammals

All terrestrial mammals require vegetated cover for shelter and to facilitate movement. Small terrestrial mammals prefer areas within a complex vegetation structure which is dense within the lower strata and subsequently provides shelter/nesting sites and refuge from predators. Larger terrestrial mammals (larger wallabies, kangaroos) also generally require dense cover for refuge but tend to favour more open areas for grazing/feeding.

Suitable structural forest variation and/or dense understorey components were present over the forested areas of the site. Non-native species such as the house mouse, black rat, fox, cats and dogs were also recorded.

Significant open and grassed areas suitable for a variety of macropods are absent from the site although the Swamp Wallaby was commonly noted sheltering on site during the day.

4.6.2.2 Arboreal Mammals

Within the site hollow bearing trees (HBT) are absent which resulted in the low abundance of hollow-dependent arboreal mammals.

Spotlighting, call playback/detection and trace analysis efforts over the site resulted in the recording of Possums (short-eared, brushtail and ringtail). No evidence of the Koala or gliders utilising the site was noted during the survey period.

4.6.2.3 Flying Mammals

Two species of flying fox (Grey-headed & Black-headed) were regularly recorded throughout the site, foraging on a variety of flowering and fruiting species (i.e. banksias, wattles, eucalypts etc.). A well-known roost camp occurs within the study area, immediately south of the Court House amongst Palm Forests and Swamp Oak. This roost is known as the 'Middleton Camp' (BSC, 2017).

Anabat Detection survey also recorded the following bat species on site:

- Southern Myotis;
- Little Bent-wing Bat;
- Large Bent-wing Bat;
- White-striped Free-tailed Bat
- A long-eared bat;
- A free-tailed bat;
- Gould's Wattled Bat; and
- Eastern Forest Bat.

It is considered that the site and surrounds contains a variety of suitable foraging spaces for microchiropteran bats (i.e. the turfed and cleared areas (i.e. sporting fields to the south), provide 'uncluttered open space'; the forest fringes provide 'edge' space, the lower canopy zone of the forest patches provides 'cluttered' space; constructed drains provide 'over water surfaces space' [per Schnitzerler and Kalko, 2001]). Numerous security, street lights and floodlights within the locality also provide additional micro-bat activity areas associated with increased insect activity per Adams et al (2005).

A review of the bats recorded within the site indicates that tree cavities and caves/crevices are necessary for roosting/breeding. In addition to providing shelter, maternity places and retreats for hibernation, roosts are also important places for social interactions among bats. The availability of suitable roosts is therefore critical for the survival of forest bats (Herr, 1998). Within the site it is considered that cave/mine potential breeding sites are absent with tree hollows and cavities also absent. Palm fronds which are suitable for species such as the Eastern Long-eared Bat are present in association with the Palm Forests within the site. Additionally, disused structures such as buildings which are potentially suitable for various species (i.e. Gould's Wattled Bat, Yellow-bellied Sheathtail Bat, Eastern Broad-nosed Bat) are also absent. Mangroves which may provide roosting habitat for the Eastern Freetail (McConville et al, 2013) are also absent from the site.

4.6.3 Reptiles

A total of eight (8) reptile species were recorded on the subject site. No species listed as endangered or vulnerable under the Biodiversity Conservation Act 2016 were recorded during fauna survey works.

The majority of individuals were encountered within the deep leaf litter layer and exposed layers adjacent to the drainage lines of the site which provide a high diversity of microhabitats within the lower layers.

The carpet python and brown tree snake were recorded during spotlighting efforts. A large red-bellied black snake was observed within dense singapore daisy cover proximate to a drainage line, while a common tree snake was observed crossing Cowper Street.

Whilst regular visual observations were made along the drainage lines surrounding the site no turtle species were noted.

4.6.4 Amphibians

Eight (8) species of native frog and one (1) introduced toad were recorded on the subject site. One frog scheduled as vulnerable under the Biodiversity Conservation Act 2016 was recorded during fauna survey works.

The cane toad was recorded on several occasions throughout the site. The balance of the frog species is considered common and/or generalist species with the shallowly ponded areas within swamp sclerophyll forests containing sedges/rushes and drainage lines, suitable for amphibians during ponding periods.

The vulnerable Wallum Froglet was heard vocalizing on numerous occasions within the southwestern drainage line.

4.7 Threatened Species Polygons

In accordance with Section 6.4.1.33 of the BAM, species polygons must be mapped for each species credit species identified with the subject site.

The following threatened species were recorded, or assumed present within the site during the targeted survey period:

- Wallum Froglet (*Crinia tinnula*);
- Southern Myotis (*Myotis macropus*);
- Common Planigale (*Planigale maculata*);
- Fine-leaved Tuckeroo (*Lepiderema pulchella*); and
- Stinking Cryptocarya (*Cryptocarya foetida*).

Species habitat polygons for the recorded species credit species are provided below.

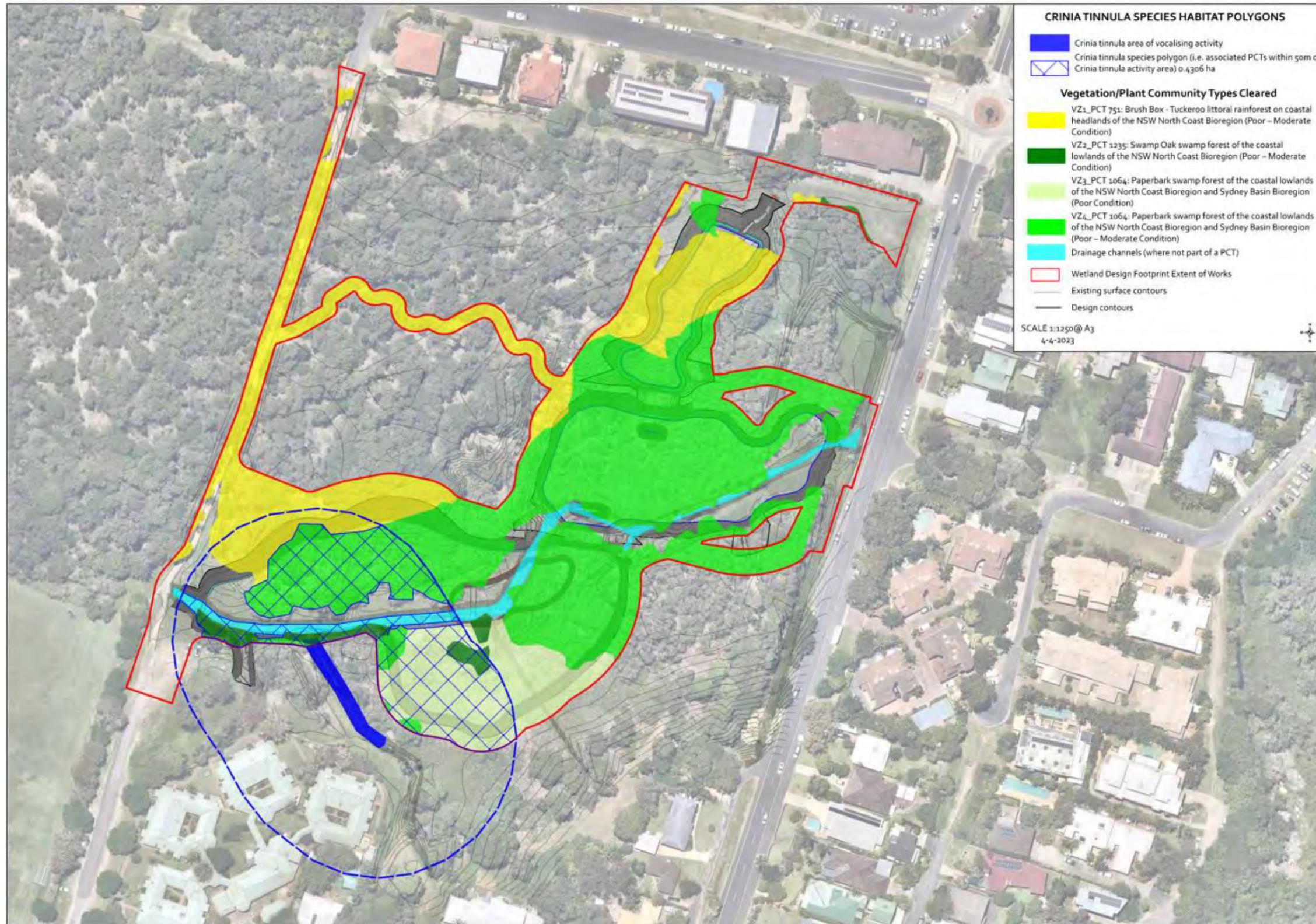


Figure 4-4 | Species Polygon Plan - Wallum Froglet

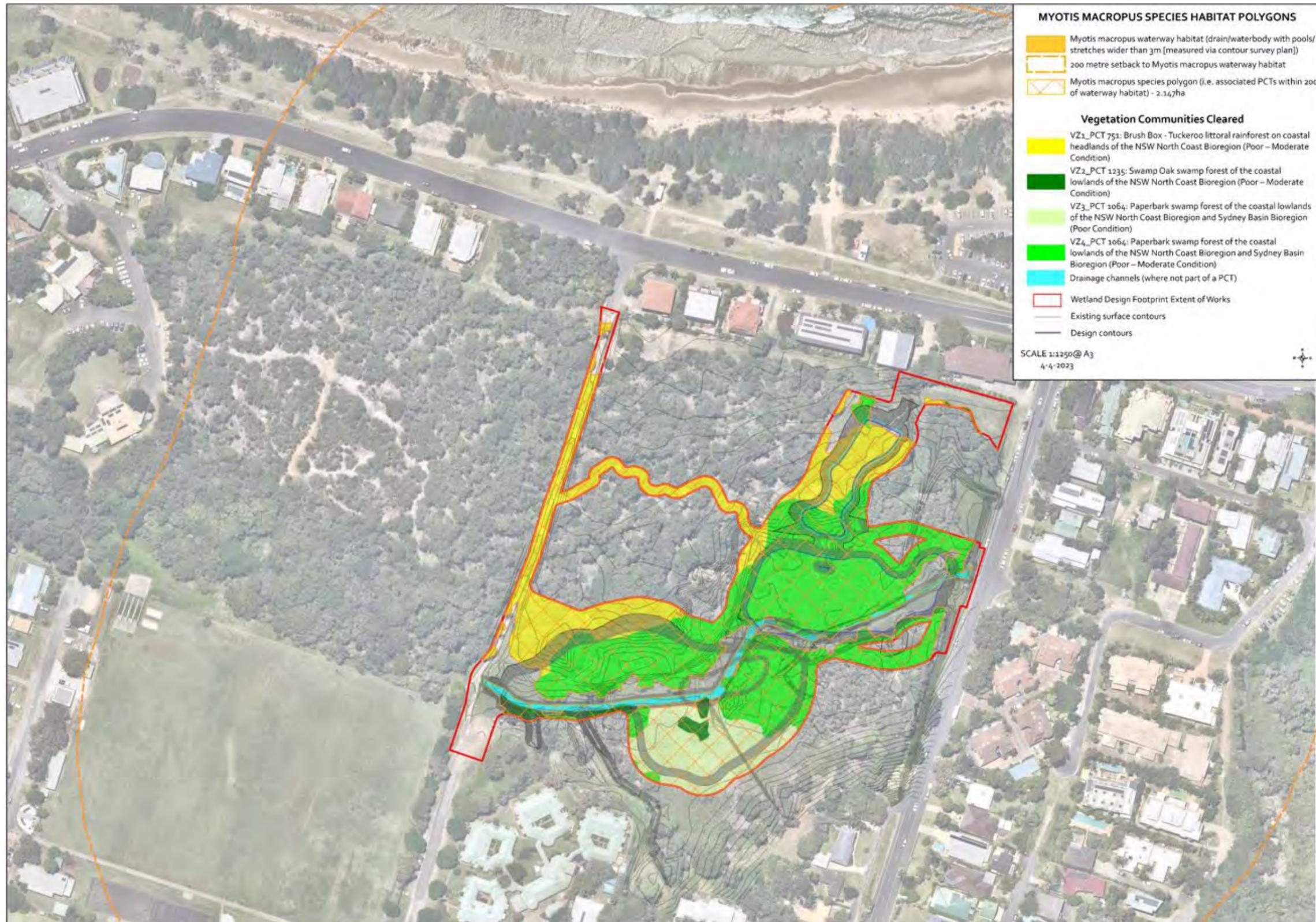


Figure 4-5 | Species Polygon Plan – Southern Myotis

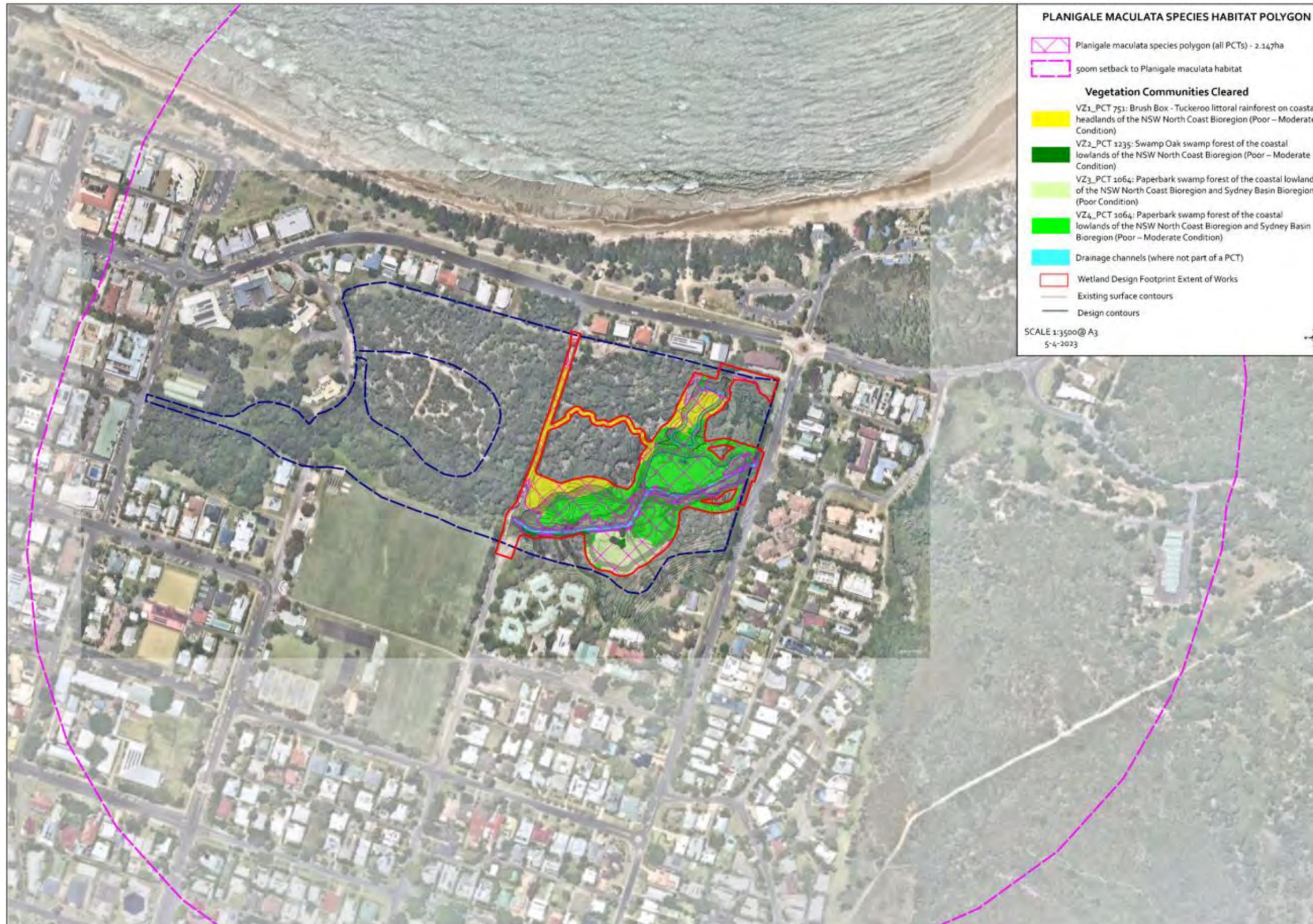


Figure 4-6 | Species Polygon Plan - Common Planigale

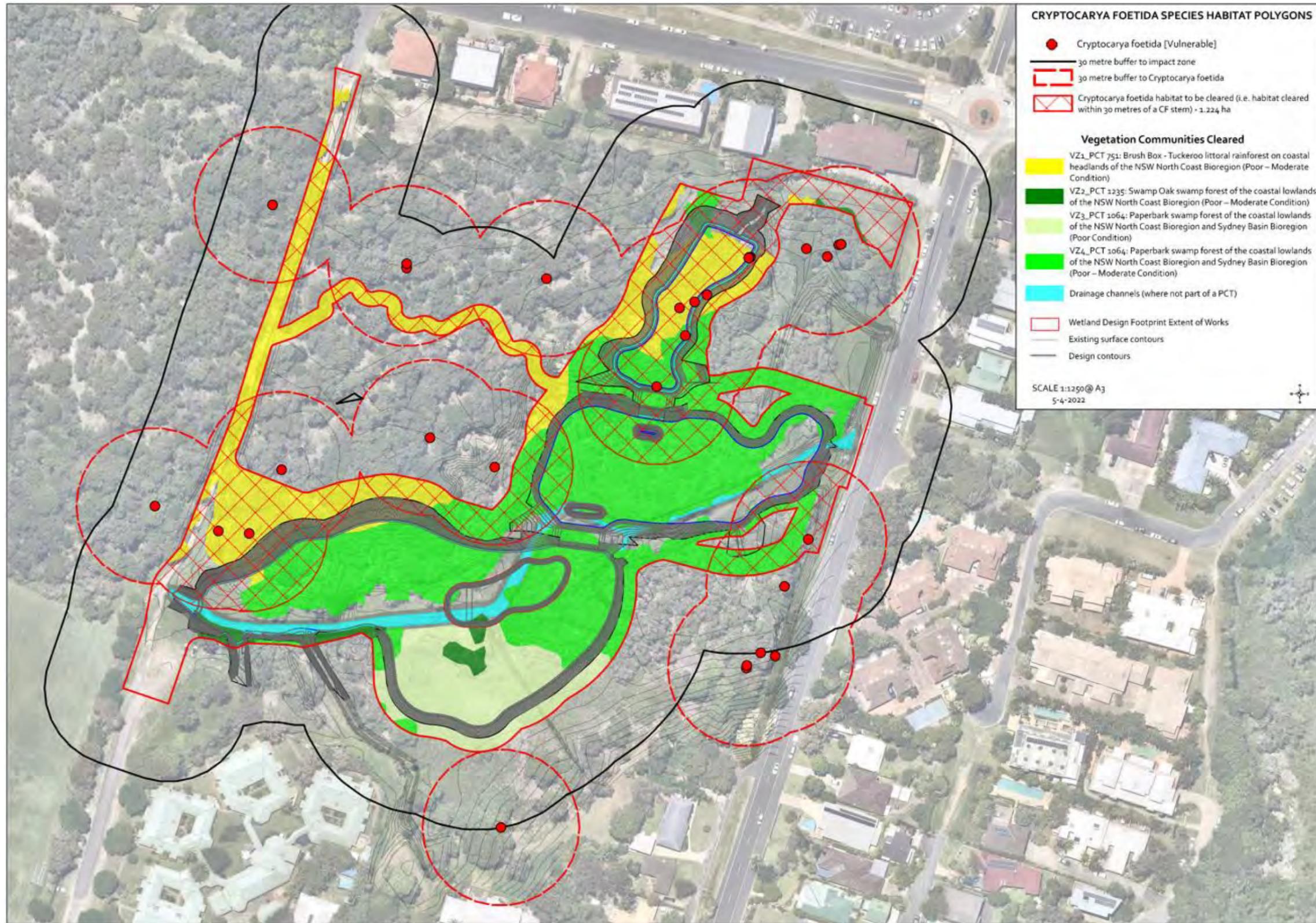


Figure 4-7 | Species Polygon Plan – Stinking *Cryptocarya*

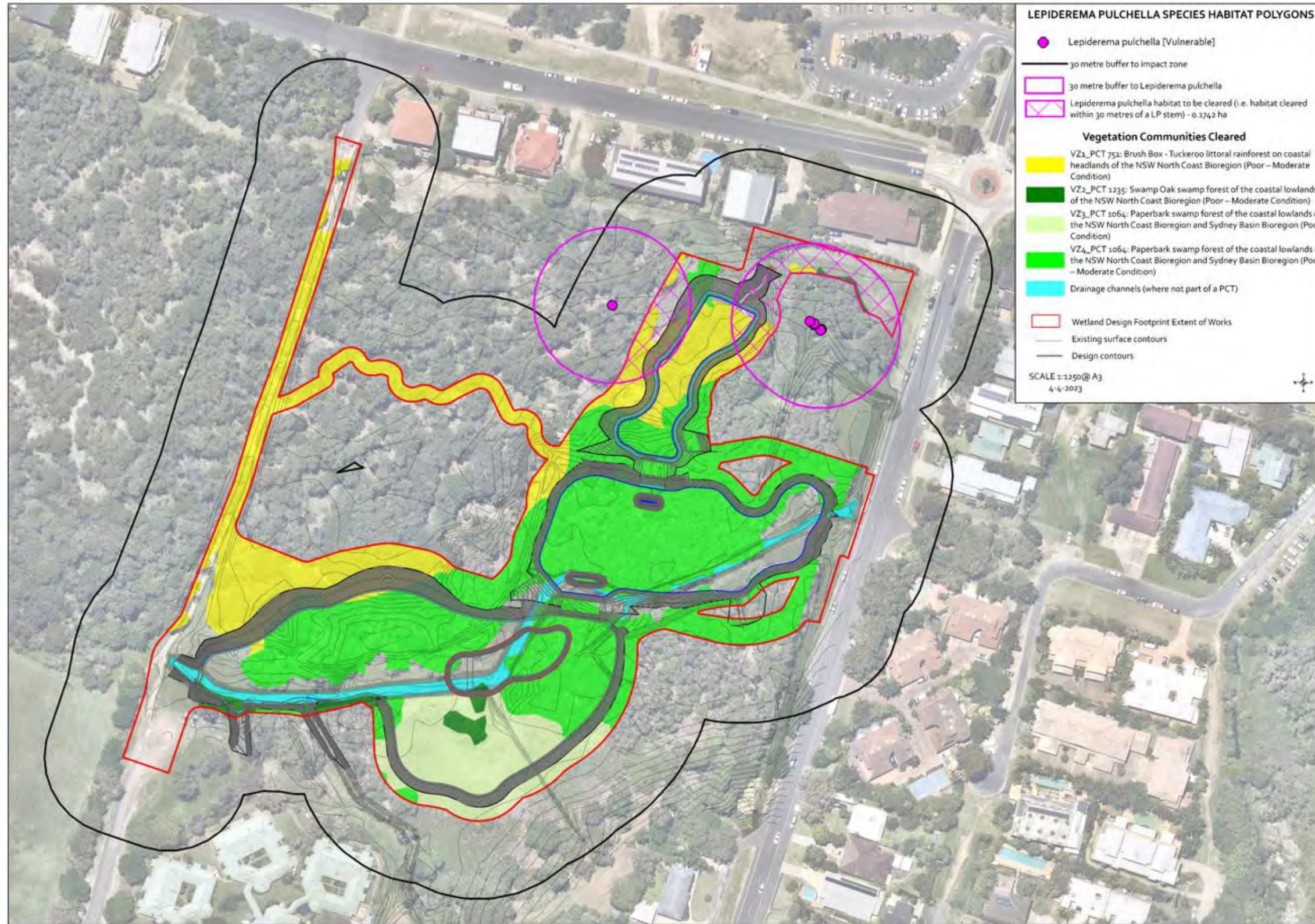


Figure 4-8 | Species Polygon Plan - Fine-leaved Tuckeroo

5 Prescribed Impacts

5.1 Prescribed Biodiversity Values

This list of impacts includes all of those impacts on biodiversity values not caused by direct vegetation clearing or development that have been prescribed by the *Biodiversity Conservation Regulation 2017*.

Prescribed additional biodiversity impacts (prescribed impacts) must be assessed as part of the BOS, as per clause 6.1 of the BC Regulation. Such prescribed impacts (including direct and indirect impacts) are impacts are detailed in **Table 5-1**.

Table 5-1: Prescribed Impacts

Prescribed Additional Biodiversity Value	Will there be an impact?	Details
Karst, caves, crevices, cliffs, rocks and other geological features of significance	No	The site is not considered to contain any karst, caves, crevices, cliffs, rocks or other geological features of significance.
Human-made structures and non-native vegetation	No	<p>There are no human-made structures within the site considered to provide habitat for threatened species. With the exception of anthropogenic debris/rubbish, walking tracks, underground services and constructed drainage lines (discussed further below), the site does not contain any human-made structures.</p> <p>Non-native vegetation is abundant throughout the site, in particularly within the ground layer which comprises primarily of exotic grasses and herbaceous weeds. These are not considered to provide habitat for threatened species or ecological communities.</p>
Habitat connectivity	Yes	<p>The site itself is largely fragmented from expansive forested areas by the surrounding residential areas, fencing, roadways and the ocean.</p> <p>While it is noted that any development over the site will likely intensify barrier effects for terrestrial fauna species, it is considered unlikely that the proposal (i.e. establishment of wetlands and walkways) would have a significant impact upon the existing fauna corridor/dispersal values of the site such that such that its existing dispersal function is significantly diminished. The retained vegetated areas, in addition to the proposed wetland creation will ensure fauna movement is ultimately retained throughout the broader landscape.</p> <p>Whilst the Project will see the removal of additional areas of vegetation, this will generally</p>

Prescribed Additional Biodiversity Value	Will there be an impact?	Details
		<p>be along edges of existing patches of vegetation and will not completely sever connectivity across the landscape.</p> <p>The majority of the project footprint will be landscaped with native wetland and swamp sclerophyll species which will restore habitat connectivity throughout the site.</p>
Water bodies, water quality and hydrological processes	Yes	<p>There are several constructed drainage lines traversing the site. No naturally occurring waterways occurs within the site.</p> <p>These constructed drainage lines provides habitat for the Southern Myotis (<i>Myotis macropus</i>) and the Wallum Froglet (<i>Crinia tinnula</i>).</p> <p>Numerous wetland type communities (i.e. Paperbark Swamp Forest and Swamp Oak Forest) occur throughout the site, in particularly within the eastern and southern areas of the Study Area which are lower laying. The condition of these wetlands varies significantly (moderate condition - highly disturbed).</p> <p>Currently there is an incised artificial drain that is likely to be actively lowering local groundwater levels. This is fed by a number of shallow drains running from the south of the site.</p> <p>The main hydrological control on the site is the existing RCP pipe at the intersection of the main drainage feature and the pathway along the Cowper Street alignment that runs to the east and Clarkes Beach. The outlet condition and tides therefore impact on the Sandhills site groundwater levels. The outlet is frequently covered in sand restricting flows out of the site.</p> <p>The wetland has been designed in consideration of local groundwater levels and the existing outlet pipe invert along the Cowper Street alignment that runs to the east will be retained. The invert (floors and outlets) of the wetland cells have been designed to ensure that there is no further lowering of local groundwater levels or interaction with underlying PASS materials. The wetland design is intended to slow and spread out surface flows this will then allow for some interaction between surface and groundwater on the site. Impacts to groundwater are likely to be localised and will be determined by climatic conditions and flows into the site. It is possible that there may be some local increase in groundwater levels in the immediate vicinity of</p>

Prescribed Additional Biodiversity Value	Will there be an impact?	Details
		<p>the wetland, but these effects are unlikely to extend beyond the wetland footprint.</p> <p>The status of the outlet on Clarkes Beach (covered by sand or not) will remain unchanged and thus the impact on local groundwater levels will largely be unchanged.</p> <p>Sediment and erosion controls measures in addition to other management plans are to be implemented during the construction phase of the development ensuring there are no impacts to the surrounding retained areas.</p> <p>The project will create new wetlands which will be landscaped post construction works.</p>
Wind farm developments	No	The proposal is not for a wind farm.
Vehicle strikes	No	It is considered unlikely that the proposal would significantly increase the impact of vehicle strikes given the nature of the proposal (i.e. the creation of new wetlands). No new roads are required for the proposal.

6 Avoid and Minimise Impacts

6.1 Avoiding and Minimising Impacts of Biodiversity Values

6.1.1 Locating a Project to Avoid and Minimise Impacts on Biodiversity Values

Planit was engaged early in the design process, which has allowed initial ecological survey works to inform the design and layout of the proposal.

To avoid impacts on native vegetation the current design will largely be located in areas which have historically been cleared and disturbed by the sand quarry previously associated with the site.

The location of the project footprint was restricted to its current location within the overall Sandhills Crown Reserve due to engineering constraints. While other areas of the Reserve may be more suitable to utilise from an environmental point of view (i.e. the previously mined *Leptospermum* forested areas), the project would not be able to adequately function in these locations. Stormwater and flood management would only be able to work in the current proposal area.

Impacts upon threatened species and threatened species habitat have been avoided where possible, although ~2.15 ha of poor to moderate condition vegetation will still be required to be removed to facilitate the proposal (refer to **Figure 6-2**). It is noted that the majority of these areas would be subject to landscape works post construction.

While the location of the development footprint has avoided a considerable amount of clearing, some clearing will still be required in order to facilitate the proposal. It is considered that the following design and locational factors are suitable to demonstrate that the impacts on biodiversity values have been appropriately minimised:

- The proposal footprint has been redesigned to retain as many individuals of threatened flora as possible and to minimise the number of threatened flora that will be cleared;
- The proposal footprint has been adjusted to retain areas of Wallum Froglet calling activity;
- The proposal footprint has been located where possible to retain areas of higher condition (in regard to weed presence) and utilise areas containing a higher weed abundance;
- The proposal footprint has been located along the edge of the subject site, minimising edge effects and impact to connectivity;
- The proposal footprint has been located to avoid direct impacts upon the Middleton Street flying fox roost camp;
- The proposal footprint has been location to avoid as best as possible areas considered to be reflective of EECs and/or TECs;
- The proposed footpath locations utilise existing walking tracks to minimise clearing;
- The proposed construction access sites utilise existing cleared areas and access points from Cowper Street and Massinger Street;
- The majority of bushland habitat within the Sandhills Precinct will be unaffected by this proposal;
- None of the trees proposed for removal are preferred koala food trees (per Byron KPoM) or Glossy Black-cockatoo food trees (i.e. *Allocasuarina* spp.);
- No large trees containing hollows will be removed for the proposal;
- Unavoidable impacts as a result of the development are proposed be offset in accordance with the Biodiversity Offset Scheme (BOS).

6.1.2 Designing a Project to Avoid and Minimise Impacts on Native Vegetation and Habitat

As previously stated, the proposal footprint will largely be located in areas which have historically been disturbed by the sand quarry previously associated with the site.

The design of the proposal has been modified to avoid areas of higher environmental significance. This includes:

- Retaining areas of Wallum Froglet calling activity;
- Retaining all recorded individuals of Fine-leaved Tuckerroo (*Lepiderema pulchella*);
- Redesigning the proposal to reduce the development footprint where possible;
- Reducing the impact footprint towards Littoral Rainforest EEC (PCT 751) through redesign;
- Reducing the impact footprint towards Littoral Rainforest TEC (PCT 751) and Swamp Sclerophyll Forest TEC (part PCT 1064) through redesign;
- Designing the project to ensure there is no significant impacts or changes to the hydrology regimes within retained areas;
- Future landscaping incorporating native wetland/swamp sclerophyll type species;
- Planting dense areas of *Lomandra* species along the pond edges to help reduce Cane Toad breeding opportunities;
- Implementing a suite of mitigation measures as part of the project (refer to Section 8), to minimise the impacts on biodiversity.

While eleven (11) Stinking Cryptocarya (*Cryptocarya foetida*) individuals are required to be removed, the proposal has avoided thirty-two (32) others occurring within the study area. The project will plant Stinking Cryptocarya as a part of the future landscape works which will ensure that there is no net loss of Stinking Cryptocarya within the site.

Areas/trees required to be cleared are proposed to be clearly delineated/tagged prior to works commencing, in accordance with Australian Standard 4970-2009 Protection of Trees. Areas of exclusion will remain adequately marked until the conclusion of construction/building activities. Site personnel, including contractors, are to be made aware of the extent of any authorised area in which they will be working where necessary.

No machinery, rubbish or spoil will be stored within retained vegetation during the construction/building phase of the development. Vehicle/equipment wash-down areas or access tracks will not be located in or immediately adjacent to retained vegetation.

Trees to be removed and works within the drainage lines will be inspected for fauna by a suitably qualified ecologist/wildlife spotter catcher immediately prior to the commencement of clearing works. Any fauna detected within proposed clearing/works areas will be dispersed/relocated to adjacent habitat outside of the works footprint. The ecologist/wildlife spotter catcher is to supervise all clearing works.

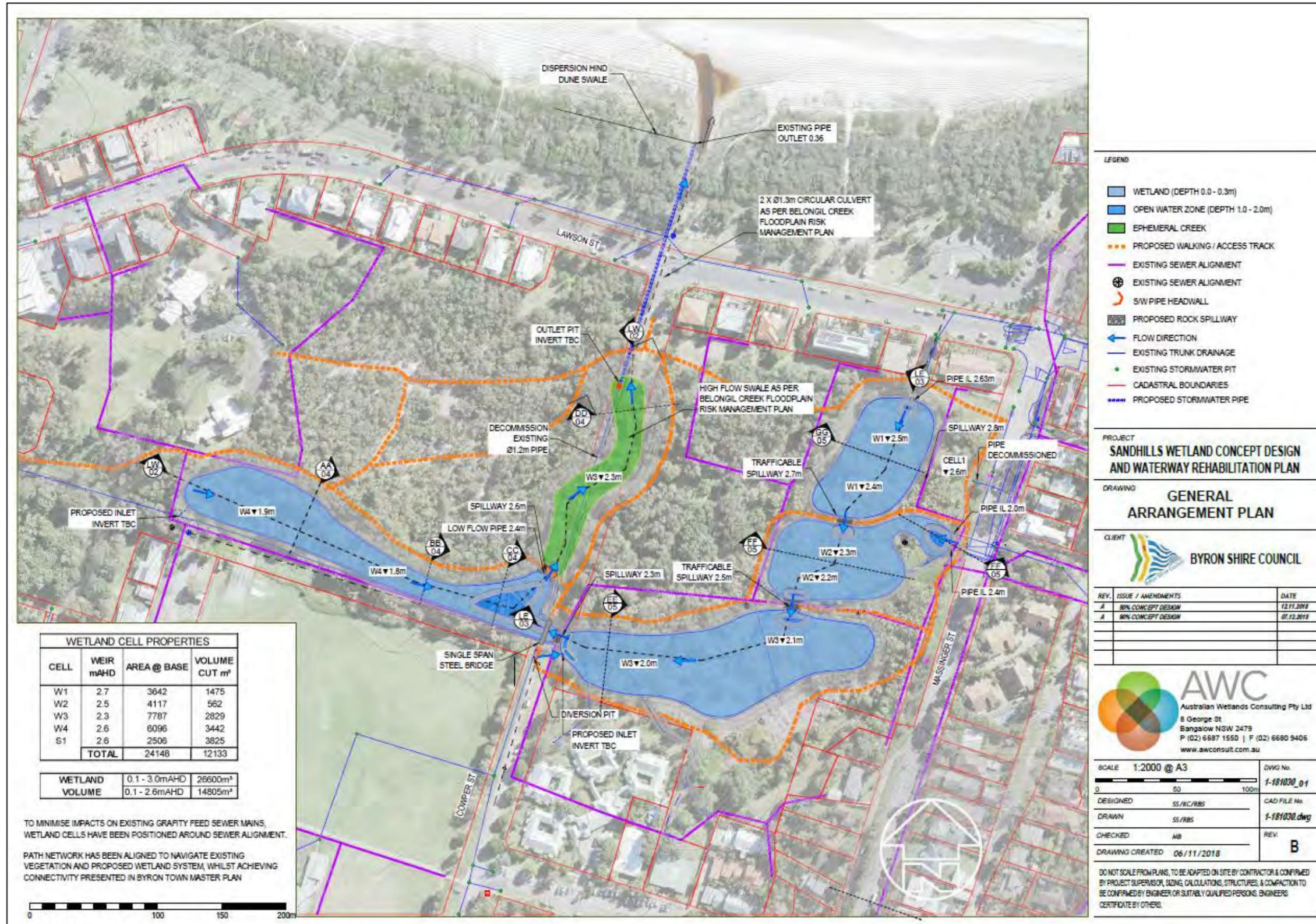


Figure 6-1 | Previous Concept Design



Figure 6-2 | Current Concept Design

6.1.3 Avoidance of Prescribed Impacts

Prescribed biodiversity impacts are defined under clause 6.1 of the Biodiversity Regulation 2017 and include impacts on biodiversity values in addition to, or instead of, impacts from clearing vegetation and/or loss of habitat. Prescribed biodiversity impacts are outlined within **Section 5.1** including their relevance to the proposal.

7 Assessment of Impacts on Native Vegetation and Habitat

7.1.1 Direct Impacts

Clearing of vegetation will be the major direct impact associated with the intended development although this clearing will be restricted to largely disturbed areas. Direct impact includes the loss of vegetation and fauna habitats as a result of clearing works in order to facilitate works required for the proposal.

The proposal would result in direct impacts on ~2.077 ha of native vegetation comprising 'PCT 751: Brush Box - Tuckeroo littoral rainforest on coastal headlands of the NSW North Coast Bioregion (Zone 1)', 'PCT 1235: Swamp Oak swamp forest of the coastal lowlands of the NSW North Coast Bioregion (Zone 2)' and 'PCT 1064: Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion (Zones 3 and 4)'.

The abovementioned clearing rates will result in a loss of marginal foraging habitat for several ecosystem credit species such as the Grey-headed Flying-fox and threatened cave roosting microbats.

Approximately 0.58241 ha of 'Highly Disturbed Areas Cleared of Native Vegetation and/or Dominated by Exotic Grasses with Native Flora Scarce (<15% Cover)' and 0.06886 ha of 'Drainage Channels (Where not part of a PCT)' will be directly impacted upon as a result of the proposal.

A summary of the proposed clearing rates for the development is tabulated below. A clearing plan for the proposal (**Figure 7-1**) has been prepared illustrating direct clearing impacts.

Table 7-1 | Clearing Rates as a Result of the Proposal

Veg Zone no.	Plant Community Type	BC Act 2016 EEC?	EPBC Act 1999 TEC?	Condition Class	PCT % Cleared	Biodiversity Risk Weighting	Clearing Area (ha)	
1	PCT 751: Brush Box - Tuckeroo littoral rainforest on coastal headlands of the NSW North Coast Bioregion	Yes	Yes	Poor - Moderate Condition	41	2	0.5646	
2	PCT 1235: Swamp Oak swamp forest of the coastal lowlands of the NSW North Coast Bioregion	No	No	Poor - Moderate Condition	75	2	0.05263	
3	PCT 1064: Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion	No	No	Poor	75	2	0.2615	
4	PCT 1064: Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion	No	Yes*	Poor - Moderate Condition	75	2	1.199	
N/A	Drainage Channels (Where not part of a PCT)	No	No	N/A	N/A	N/A	0.06886	
N/A	Highly Disturbed Areas Cleared of Native Vegetation and/or Dominated by Exotic Grasses with Native Flora Scarce (<15% Cover)	No	No	N/A	N/A	N/A	0.58241	
Total								2.729

* 0.13ha removed considered to be reflective of TEC (refer to **Section 3.3** for further information).

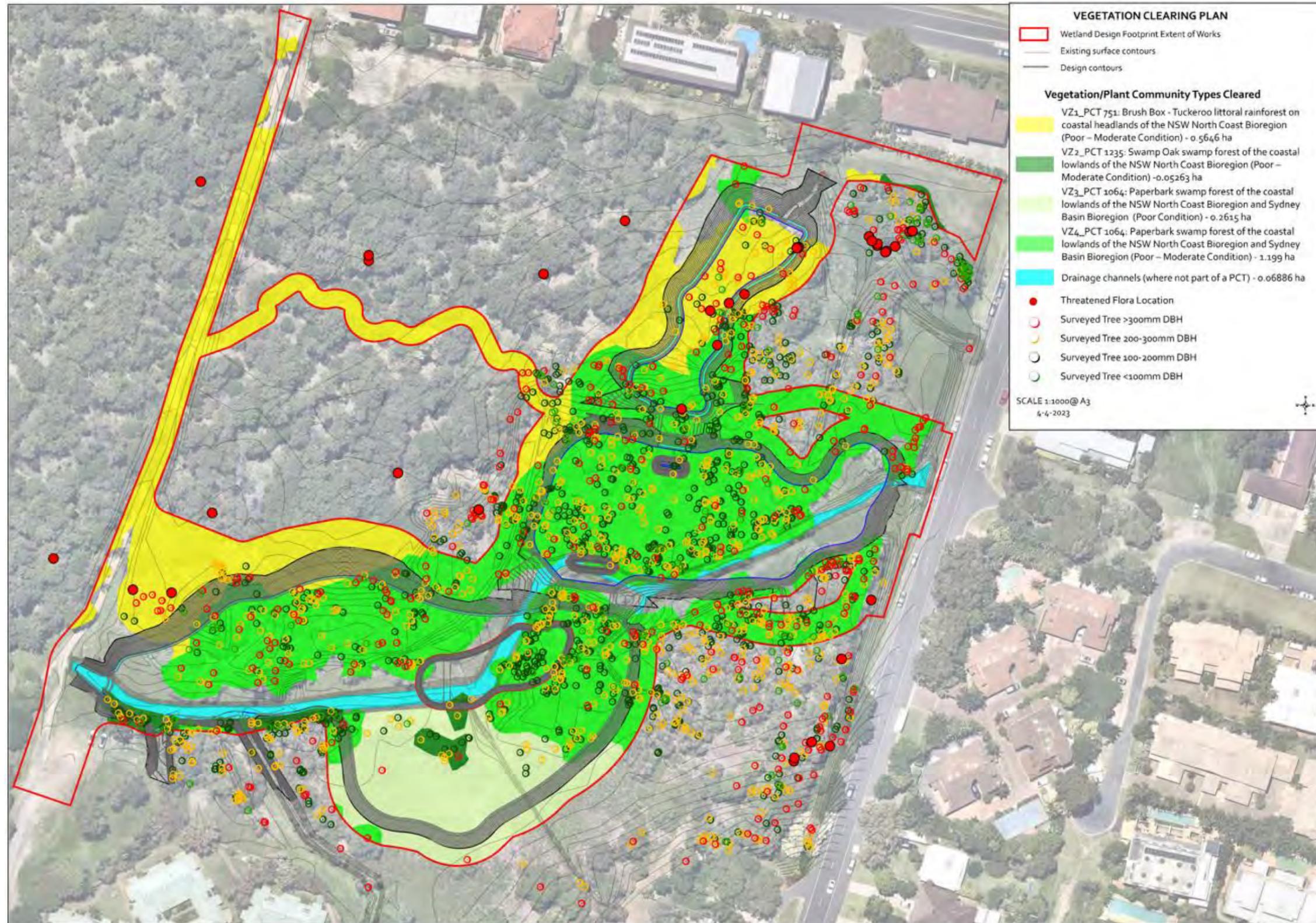


Figure 7-1 | Clearing Plan

7.1.2 Indirect Impacts

Indirect impacts which may occur on site if not adequately managed includes:

- Weeds and Pathogens;
- Rubbish dumping;
- Increase in predatory species populations;
- Increased risk of fire;
- Sedimentation run-off;
- Vehicle strikes;
- Noise & Vibration;
- Dust;
- Light Spill;
- Damage to Retained Native Vegetation; and
- Native Fauna Mortality/Injury.

Measures to mitigate and manage the abovementioned potentially occurring indirect impacts are discussed later within **Table 8-1**.

As a result of the indirect risk assessment, it was determined that residual risk following the implementation of mitigation measures was very low.

7.1.3 Assessing Prescribed Biodiversity Impacts

As described in **Section 5.1**, no prescribed impacts are anticipated from the proposed development.

7.1.4 Serious and Irreversible Impacts

Site assessments identified vegetation communities in the site does not correspond with any TEC identified as a SAIL entity.

While the Fine-leaved Tuckerroo (*Lepiderema pulchella*) is identified as an SAIL entity, the individuals recorded during targeted flora surveys were small (<1m height) and are well removed (>10m) from the development footprint and will not be impacted upon as a result of the proposal. Management plans (i.e. vegetation management plan) incorporated into the CEMP will ensure no indirect impacts will arise upon these individuals. As such, no SAIL assessment was conducted for the Fine-leaved Tuckerroo as it's considered unlikely that the proposal will reduce the population size of this species, and therefore result in a serious and irreversible impact.

The Little Bent-wing Bat (*Miniopterus australis*) and Large bent-winged Bat (*Miniopterus orianae oceanensis*) are also identified as an SAIL entity and were recorded via Anabat surveys of the site. The development will not be impacting any breeding habitat for these species, which are absent from the site.

No other SAIL candidates were recorded within the site.

7.1.5 Environment Protection and Biodiversity Conservation Act 1999

Threatened entities listed in the EPBC Act, such as threatened species or threatened ecological communities, require separate assessment to determine if a development will have a significant impact on relevant threatened entities. The Significant Impact Criteria, published by the Commonwealth Department of the Environment (2013), was applied to:

- Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland [Endangered];
- Littoral Rainforest and Coastal Vine Thickets of Eastern Australia [Critically Endangered];
- Stinking Cryptocarya (*Cryptocarya foetida*) [Vulnerable]; and
- Grey-headed Flying-fox (*Pteropus poliocephalus*) [Vulnerable].

Relevant significant impact assessments for the threatened entities listed above are provided in **Appendix 7**.

7.1.6 Adaptable Management of Uncertain Impacts

Uncertain impacts are those that are unable to be reliably predicted during the assessment process or are infrequent in nature. The proposed development is unlikely to result in any uncertain impacts that require adaptive management as stated within Section 8.5 of the BAM.

8 Mitigating and Managing Impacts on Biodiversity Values

The following measures is to be undertaken to mitigate impacts to native vegetation and habitat during the construction and operational phases of the development:

Table 8-1 | Minimisation of Potential Indirect Impacts

Aspect	Project Phase	Potential Impact and causes	Mitigation Measures	Timing	Responsibility	Risk Before Mitigation	Risk After Mitigation
Weeds and Pathogens	Construction	Introduction of weeds to the site and adjacent retained vegetation	Prepare a weed management protocol within the CEMP to ensure weeds are not transported or spread into retained areas. Ensure vehicle and machinery entering the site are weed free. Any weeds that are removed during the construction phase should be disposed of via an appropriate waste facility.	Duration of construction works	Project Manager/Contractor	Low	Very Low
	Operational		No exotic species are to be planted within site as a part of the future landscaping/gardens	During operations	All personnel	Low	Very Low
Rubbish dumping	Construction	Rubbish and waste retained onsite or dumped within retained areas	The contractor undertaking the works would detail waste management procedures in a Waste Management Plan to be incorporated into the CEMP.	Duration of construction works	Project Manager/Contractor	Low	Very Low
	Operational	Rubbish and waste dumped within retained areas.	Rubbish dumping (including garden waste) within retained vegetation areas is prohibited. All rubbish is to be appropriately disposed.	During operations	All personnel	Low	Very Low
Increase in predatory species populations	Construction	Predation by domestic animals	Domestic animals would not be permitted within the site during the construction phase of the development. This is to be documented within the CEMP prepared for the proposal.	Duration of construction works	Project Manager/Contractor	Low	Very Low
	Operational	Predation by domestic animals	Dogs and cats would not be permitted to free roam within the proposed open space areas which are to be an on-leash area only to minimize harassment of any fauna.	During operations	All personnel	Low	Very Low
Increased risk of fire	Construction	Changes to existing fire regimes and / or increased frequency of fire	Prohibition of lighting (with the exception of managed fire practices conducted by NPWS or RFS).	All times	All personnel	Low	Very Low
	Operational						

Aspect	Project Phase	Potential Impact and causes	Mitigation Measures	Timing	Responsibility	Risk Before Mitigation	Risk After Mitigation
Sedimentation run-off	Construction	<p>During construction/building, the disturbance of soils would create the potential for the mobilisation of sediment.</p> <p>The potential for accidental spill and leaks is a further issue.</p>	<p>Activities on the site will be managed in accordance with the approved CEMP which will incorporate mitigation measures such as:</p> <p>Appropriate sediment and erosion control measures will be incorporated during the clearing and construction phase of the proposal, ensuring no downstream impacts will arise, in particular during rainfall events.</p> <p>There is to be no release of dirty water into drainage lines and/or waterways</p> <p>Water quality control measures are to be used to prevent any materials (e.g. concrete, grout, sediment etc.) entering drain inlets or waterways.</p> <p>Stabilised construction access would be provided to all work areas.</p> <p>Works would be stopped if conditions are not suitable, such as during heavy rain or high winds.</p> <p>Construction works would be managed such that areas outside the scope of works would remain undisturbed.</p> <p>Potable or recycled water is to be used for wash down.</p> <p>Erosion and sediment controls would be inspected regularly by the site supervisor throughout construction and within 24 hours of a major rainfall event to ensure they are maintained in proper working order throughout the time they are in place.</p> <p>The condition of sediment control structures would be monitored and maintained in proper working order throughout the time they are in place. They would be kept clear of debris at all times and cleared of sediment if filled >50%.</p> <p>Procedures and measures for reporting, management and cleanup of spills of any fuels, chemicals or other potentially contaminating items are to be incorporated into the construction environmental management plan.</p> <p>If stored on site, chemicals and fuels would be stored within bunded areas. Spill kits are to be kept on-site.</p> <p>All spills are to be reported to the Site Manager and Environmental Officer.</p>	Duration of construction works	Project Manager/ Contractor Project Engineer Project Builder	Medium	Very Low
Vehicle strikes	Construction	Vehicle strikes on native fauna	<p>Signposting and enforcement of appropriate speed limits (to be detailed within the CEMP).</p> <p>Vehicle movement to occur during daylight hours only (with the exception of emergency works).</p>	Duration of construction works	Contractor	Low	Very Low
	Operational	Vehicle strikes on native fauna	<p>With the exception of maintenance vehicles, no vehicles are permitted within the development footprint. These are to be adequately blocked from public use (i.e. bollards, gates etc.). Council will be responsible for implementing these measures.</p>	During operations	Council	Low	Very Low
Noise & Vibration	Construction	<p>The proposed activity has the potential to cause an increase in noise levels at the site during the construction/building phase. Increases in noise would be</p>	<p>Activities on the site will be managed in accordance with the approved CEMP which will incorporate mitigation measures such as:</p> <p>Works are to be carried out during normal work hours (i.e. 7am to 6pm Monday to Friday; 8am to 1pm Saturdays). No works would likely be undertaken on Sundays or public holidays.</p>	Duration of construction works	Project Manager/Contractor	Low	Very Low

Aspect	Project Phase	Potential Impact and causes	Mitigation Measures	Timing	Responsibility	Risk Before Mitigation	Risk After Mitigation
		attributed to vehicles and machinery.	<p>The idling of machinery and equipment when not in use and for prolonged periods of time should be avoided at all times.</p> <p>Use of noisy plant simultaneously and/or close together, adjacent to sensitive receivers would be avoided where possible.</p> <p>Plant operators would be instructed to operate equipment in a manner that does not generate unnecessary noise such as avoiding excessive revving or avoiding dragging objects or dropping objects from a height</p> <p>Reversing of vehicles would be minimised where possible to alleviate the annoyance of beeping reverse alarms (or less tonal 'broadband' or 'quacker' type alarms would be utilised</p> <p>Complaint based monitoring would be performed throughout construction as required to confirm the effectiveness of noise management controls</p> <p>A noise complaint register would be developed if required and maintained throughout construction. The register would record all complaints including: Complainant contact details, Source/type of noise causing disturbance, time and duration of noise causing disturbance, times when the noise disruption would cause least disruption, measures taken to address the complaint.</p> <p>All machines will be in good working condition, with particular attention to exhaust silencers, engine covers and other noise reduction devices.</p>				
	Operational	Potential disruption of threatened species or reduced viability of adjacent habitat	Minimise unreasonable noise and vibration impacts on the surrounding environment.	During operations	All personnel	Low	Very Low
Dust	Construction	<p>The proposed activity has the potential to cause minor reductions in localised air quality through emissions from vehicles, machinery and equipment.</p> <p>Additionally, dust would also likely be generated during exposing earth/soil during the building phase.</p>	<p>Measures (including watering or covering exposed areas) are to be used to minimise or prevent air pollution and dust.</p> <p>Works (including the spraying of paint and other materials) are not to be carried out during strong winds or in weather conditions where high levels of dust or air borne particulates are likely.</p> <p>Vegetation or other materials are not to be burnt on site.</p> <p>Vehicles transporting waste or other materials that may produce odours or dust are to be covered during transportation.</p> <p>Stockpiles or areas that may generate dust are to be managed to suppress dust emissions.</p> <p>All stationary vehicles and equipment not in use will be switched off.</p> <p>Areas of disturbance would be managed at any one time.</p> <p>All disturbed surfaces would be reinstated and stabilised as soon as possible after completion.</p> <p>A Construction Environmental Management Plan (CEMP) is to be prepared for the proposal which will include abovementioned mitigation measures.</p>	Duration of construction works	Project Manager Contractor	Medium	Very Low

Aspect	Project Phase	Potential Impact and causes	Mitigation Measures	Timing	Responsibility	Risk Before Mitigation	Risk After Mitigation
Light Spill	Construction	Potential disruption of threatened species	Lights should be turned off when they are not required.	All times	All personnel	Low	Very Low
	Operational					Low	Very Low
Damage to Retained Native Vegetation	Construction	Removal of retained native vegetation and loss of habitat	<p>All works with regards to vegetation clearing and working within proximity to vegetation to be retained is to be undertaken in accordance with a Vegetation Management Plan (VMP) to be prepared as a part of the CEMP prior to the commencement of works.</p> <p>Vegetation to be retained onsite must be tagged/marked/delineated prior to commencement of tree clearing for easy identification (do not use permanent paints or similar) i.e. trees and copses of less mature vegetation/small trees will be retained within designated areas are to be clearly fenced in general accordance with the <i>Australian Standard 4970-2009 Protection of Trees on Development Sites</i> and similar.</p> <p>The following activities are not permitted within the drip zones of trees to be retained (i.e. trees not designated for removal):</p> <ul style="list-style-type: none"> • Storage and mixing of materials; • Vehicle parking or manoeuvring; <ul style="list-style-type: none"> • Liquids disposal; • Machinery repairs or refuelling; • Site office and/or shed erection; <ul style="list-style-type: none"> • Lighting of fires; • Rubble, soil or debris stockpiling; and <ul style="list-style-type: none"> • Excavation. 	Prior to construction commencing and during construction works	Site Manager Contractor Project Arborist/Ecologist	Medium	Very Low
	Operational					No trees within the site proposed for retention are to be removed without the consent from Council.	During operations
Native Fauna Mortality/Injury	Construction	Fauna mortality/injury during vegetation removal and construction/building works	<p>Within the designated development/construction zone identification of areas to be cleared are to be pre-assessed by an experienced ecologist/wildlife spotter/catcher. This pre-assessment shall allow for an inventory of fauna habitat components (i.e. birds nests, loose rocks providing reptile refuge, ground logs etc.) to be undertaken prior to felling and construction works. A wildlife spotter catcher would be utilised during all phases of clearing of the site to ensure safe dispersal and relocation of native fauna into neighbouring retained vegetation within the locality.</p> <p>A wildlife spotter catcher is to be utilised if any native fauna is trapped within the construction site.</p>	Prior and during vegetation clearing	Project Ecologist/Spotter Catcher	Medium	Very Low
	Operational					Injury to fauna during operational phase	Injured or orphaned fauna recorded should referred to an appropriate wildlife carer group (i.e. Wildcare, RSPCA) or veterinarian.

8.1.1 Risk Assessment

A risk assessment has been undertaken for any residual impacts likely to remain after the mitigation measures have been applied (refer to **Table 8-1** above).

The risk before and after mitigation measures have been implemented have also been displayed within the last two columns of **Table 8-1** above.

The likelihood criteria, consequence criteria and the risk matrix are provided within Table 8-2 and Table 8-3 below.

Table 8-2 | Risk Matrix

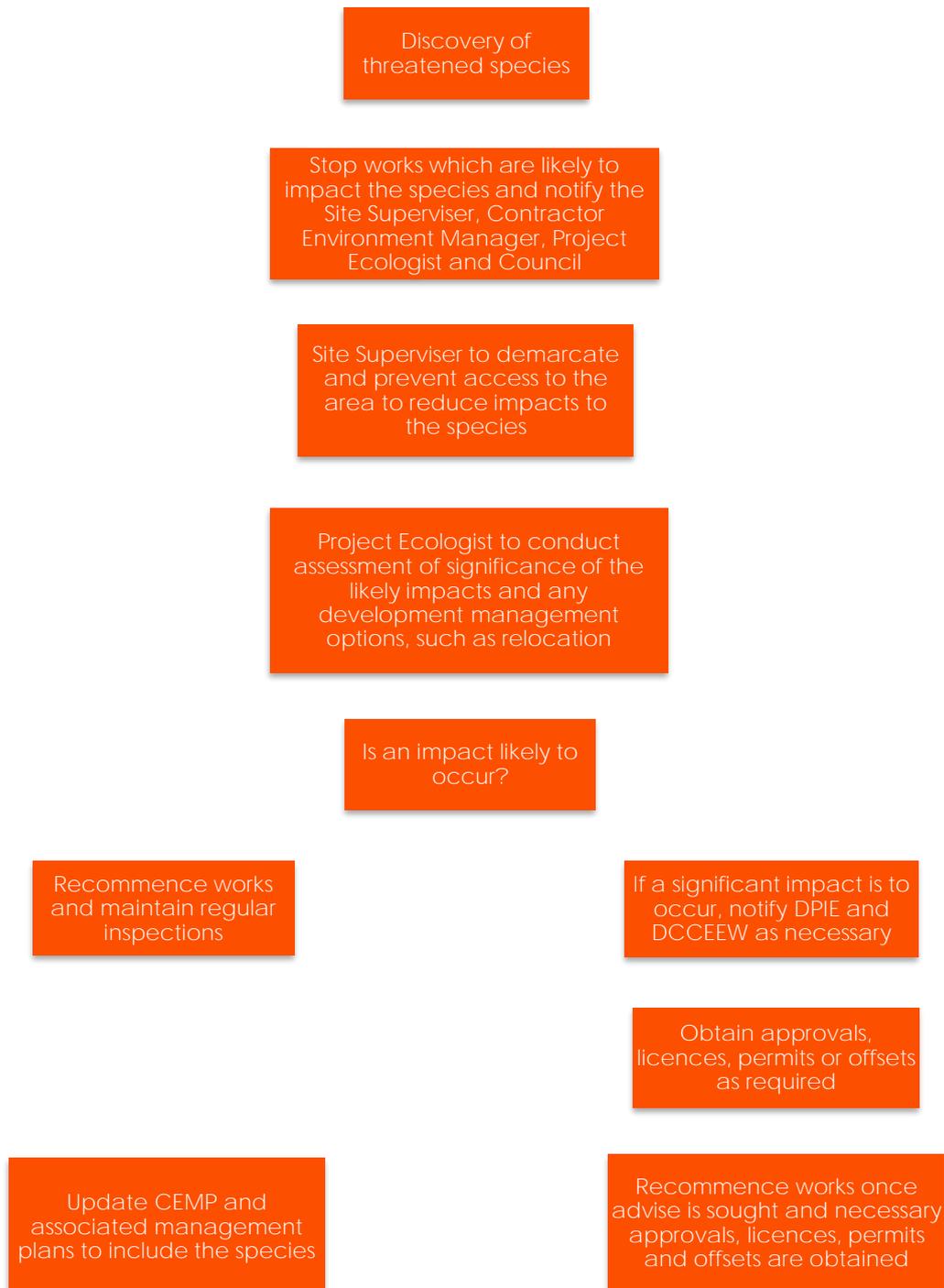
Consequence Severity	Likelihood				
	Almost Certain	Likely	Moderate	Unlikely	Remote
Critical	Very High	Very High	High	High	Medium
Major	Very High	High	High	Medium	Medium
Moderate	High	Medium	Medium	Medium	Low
Minor	Medium	Medium	Low	Low	Very Low
Negligible	Medium	Low	Low	Very Low	Very Low

Table 8-3 | Risk Matrix Criteria

Consequence Criteria	Description
Critical	Very serious, long-term and widespread environmental impact. Destruction of sensitive environmental features. Severe impact on ecosystem. Impacts are irreversible.
Major	Serious long-term moderate to widespread environmental impact.
Moderate	Moderate short-term impact at a localized-moderate scale. May be difficult to rehabilitate and may have negative implementations on the ecosystem.
Minor	Minor short-term impact at a localised scale. Impact on fauna, flora and/or habitat but no negative effects on ecosystem. Can be relatively easily rehabilitated.
Negligible	Negligible impact on fauna/flora, habitat, aquatic ecosystem or water resources. Impacts are local, temporary and reversible.
Likelihood Criteria	Description
Almost Certain	Event is expected to occur on most occasions (frequency - weekly)
Likely	Event is expected to occur on many occasions (frequency - monthly)
Moderate	Event is expected to occur on some occasions (frequency - yearly)
Unlikely	Event is expected to occur infrequently (frequency - 10 years)
Remote	Event is not expected to occur, but may occur under exceptional circumstances (frequency - 100 years)

8.2 Unexpected Finds Protocol

In the event an unexpected threatened species is encountered during site works, the following procedures must be followed:



9 Thresholds for Assessing and Offsetting Impacts

The BAM Calculator is the tool for quantifying the offset requirements for a project, the output being expressed as ecosystem credits and species credits. The results of the BAM credit calculations completed for the proposed development are provided below and a detailed in **Appendix 4**.

9.1.1 Impacts Which Require an Offset

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

Table 9-1 | Impacts to Native Vegetation That Require Offsets

Veg Zone Number	Plant Community Type (PCT)	BCA 2016 EEC?	Area (ha)
1	PCT 751: Brush Box - Tuckeroo littoral rainforest on coastal headlands of the NSW North Coast Bioregion	Yes	0.56
2	PCT 1235: Swamp Oak swamp forest of the coastal lowlands of the NSW North Coast Bioregion	No	0.05
4	PCT 1064: Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion	No	1.2

An offset is also required for the threatened species impacted by development that require species credits. These species are documented within **Table 9-2** below.

Table 9-2 | Impacts to Credit Species That Require Offsets

Species Credit Species	Biodiversity risk weighting	Area of habitat or count of individuals lost
Southern Myotis (<i>Myotis macropus</i>)	1.5	2.1 ha
Wallum Froglet (<i>Crinia tinnula</i>)	2	0.39 ha
Common Planigale (<i>Planigale maculata</i>)	2	2.1 ha
Stinking Cryptocarya (<i>Cryptocarya foetida</i>)	2	11 (count)

10 Final Credit Calculations

10.1.1 Calculation of the Offset Requirement for Ecosystem Credits

The number of ecosystem credits required for the development is outlined in **Table 10-1**.

Table 10-1 | Ecosystem Credits Required

Plant Community Type	Zone Name in BAM Calculator	Impact Area (ha)	Current Vegetation Integrity Score	Future Vegetation Integrity Score	BC Act Status	Ecosystem Credits Required
PCT 751: Brush Box - Tuckeroo littoral rainforest on coastal headlands of the NSW North Coast Bioregion	751_Poor_Moderate	0.56	54.7	0	None	15
PCT 1235: Swamp Oak swamp forest of the coastal lowlands of the NSW North Coast Bioregion	1235_Poor_Moderate	0.05	37.3	0	None	1
PCT 1064: Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion	1064_Poor_Moderate	1.5	48.7	0	None	29

10.1.2 Calculation of the Offset Requirement for Species Credits

The unavoidable impacts to the Southern Myotis (*Myotis macropus*), Common Planigale (*Planigale maculata*) and Wallum Froglet (*Crinia tinnula*) habitat, as well the the removal of Stinking Cryptocarya (*Cryptocarya foetida*) individuals will also be required to be offset. The number of species credits required to compensate the loss of these species and associated habitat are provided below (refer to **Table 10-2**).

Table 10-2 | Species Credits Required

Species	BCA Status	Zone	Individuals/Area	Biodiversity Risk Weighting	Species Credits Required
Southern Myotis (<i>Myotis macropus</i>)	V	1, 2, 3, 4	2.07 ha	2	46
Wallum Froglet (<i>Crinia tinnula</i>)	V	2, 3, 4	0.39 ha	1.5	5
Common Planigale (<i>Planigale maculata</i>)	V	1, 2, 3, 4	2.07 ha	2	46
Stinking Cryptocarya (<i>Cryptocarya foetida</i>)	V	N/A	11 (count)	2	22

It is noted that the consent authority has the power to increase or decrease the credit totals should they deem it necessary.

11 References

Byron Local Environmental Plan (2014).

Byron Shire Council (2015) *Byron Coast Comprehensive Koala Plan of Management*. Byron Shire Council, Mullumbimby, NSW.

Byron Shire Council. (2017). *Byron Shire Flying-fox Camp Management Plan*. Mullumbimby, NSW.

Byron Shire Council (2022). Byron Shire Council Environmental Mapping. Accessed at: <https://maps.byron.nsw.gov.au/Html5Viewer/index.html?viewer=ByronMaps>

BOM (2023) Climate Data Online. Retrieved from <http://www.bom.gov.au/climate/dwo/IDCJDW2022.latest.shtml>

DEC. (2004). *Threatened Biodiversity Survey and Assessment Guidelines Working Draft*. Sydney South NSW.

DECC. (2002). *Descriptions for NSW (Mitchell) Landscapes Version 2. Based on the descriptions by Dr. Peter Mitchell*.

DEWHA. (2010). *Threatened birds – Survey Guidelines for Australia's Threatened Birds.*: Commonwealth of Australia.

DEWHA. (2011). *Threatened mammals – Survey Guidelines for Australia's Threatened Mammals*. Commonwealth of Australia.

DEWHA. (2013). *Significant Impact Guidelines 1.1 - Matters of National Environmental Significance*. Canberra: Commonwealth of Australia.

DoE (2022). National Flying-fox monitoring viewing. Retrieved from <http://www.environment.gov.au/webgis-framework/apps/ffc-wide/ffc-wide.jsf>.

DAWE. (2022a). *EPBC Protected Matters Search Tool*. Commonwealth of Australia.

DAWE. (2022b). *Species Profile and Threats Database (SPRAT)*. Commonwealth of Australia.

Department of Sustainability, Environment, Water, Population and Communities (2011). *Approved Conservation Advice for the Lowland Rainforest of Subtropical Australia*. Canberra, ACT: Department of Sustainability, Environment, Water, Population and Communities

DPE (2022a). *Koala (Phascolarctos cinereus): Biodiversity Assessment Method Survey Guide*.

DPE (2022b). *Threatened Reptiles Biodiversity Assessment Method Survey Guide*.

DPIE (2019). *Guidance to assist a decision-maker to determine a serious and irreversible impact*.

DPIE (2020a). *NSW Survey Guide for Threatened Frogs – A guide for the survey of threatened frogs and their habitats for the Biodiversity Assessment Method*. State of New South Wales

DPIE (2020b). *Surveying threatened plants and their habitat – NSW survey guide for the Biodiversity Assessment Method*. State of New South Wales.

DPIE (2020c). *Biodiversity Assessment Method*. NSW Office of Environment and Heritage Retrieved from <https://www.environment.nsw.gov.au/topics/animals-and-plants/biodiversity-offsets-scheme/accredited-assessors/biodiversity-assessment-method-2020>.

DPIE (2022a). The NSW Biodiversity Values Map. Retrieved from <https://www.environment.nsw.gov.au/biodiversity/biodiversity-values-map.htm>.

DPIE (2022b). NSW Bionet Vegetation Information System. Retrieved from <http://www.environment.nsw.gov.au/NSWVCA20PRapp/LoginPR.aspx>.

DPIE (2022c). Threatened Species Profile Database. Retrieved from <https://www.environment.nsw.gov.au/threatenedSpeciesApp/>.

DPIE (2022d) eSPADE. NSW Soil and Land Information. Retrieved from <http://www.environment.nsw.gov.au/eSpade2WebApp#>

DPIE (2022e). Bionet Atlas of NSW. Retrieved from https://www.environment.nsw.gov.au/atlaspublicapp/UI_Modules/ATLAS_/AtlasSearch.aspx.

Gibbons, P., and Lindenmayer, D. (2002). 'Tree Hollows and Wildlife Conservation in Australia.' (CSIRO Publishing: Melbourne.).

Harden, G. (1993). *Flora of New South Wales Volumes 1–4*.

Keith, D. A. (2004). *Ocean shores to desert dunes: the native vegetation of NSW and the ACT (Selected Extracts)*: Department of Environment and Conservation (NSW).

Morand D.T., 1994, *Soil Landscapes of the Lismore-Ballina 1:100,000 Sheets* report, NSW Department of Land and Water Conservation, Sydney.

NSW Land and Property Information (LPI) (2022). SIX Maps public/NSW_Hydrography – Hydroline. Accessed at: https://maps.six.nsw.gov.au/arcgis/rest/services/public/NSW_Hydrography/MapServer/3

OEH (2018). '*Species credit*' *threatened bats and their habitats – NSW survey guide for the Biodiversity Assessment Method*. State of New South Wales.

Phillips, S., and Callaghan, J. (2011). The spot assessment technique: a tool for determining localised levels of habitat use by koalas *Phascolarctos cinereus*. *Australian Zoologist* 35, 774–780.

SMEC (2019). *Biodiversity Assessment Report for Byron Bay Bus Interchange* prepared for Sydney Trains. Sydney. NSW.

Stahler, A. N. (1952). Hypsometric (area-altitude) analysis of erosional topology. *Geological Society of America Bulletin*, 63(11), 1117-1142.

Threatened Species Scientific Committee (TSSC) (2011). *Commonwealth Listing Advice on Lowland Rainforest of Subtropical Australia*. Department of Sustainability, Environment, Water, Population and Communities. Canberra, ACT: Department of Sustainability, Environment, Water, Population and Communities.

Wilson, A-M. and Lindenmayer, D.B. (1995). *Wildlife Corridors and the Conservation of Biodiversity: A Review*. Centre for Resource and Environmental Studies, Australian National University, Canberra.