120 NORTH CREEK RD, BALLINA

Biodiversity Development Assessment Report

For:

Palm Lake Works

June 2019

Final

PO Box 2474
Carlingford Court 2118

Report No. 18187RP1

The preparation of this report has been in accordance with the brief provided by the Client and has relied upon the data and results collected at or under the times and conditions specified in the report. All findings, conclusions or recommendations contained within the report are based only on the aforementioned circumstances. The report has been prepared for use by the Client and no responsibility for its use by other parties is accepted by Cumberland Ecology.

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Approved by: Dr David Robertson

Position: Director

Signed: David Robertson

Date: *11 June, 2019*

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Glossary of Terms

AOBV	Area of Outstanding Biodiversity Value
Assessment area	Area of land within a 1500 m buffer around the outer boundary of the subject land
BAAS	Biodiversity Assessor Accreditation System
BAM	Biodiversity Assessment Method
BAMC	Biodiversity Assessment Method Calculator
BAR	Biodiversity Assessment Report
BC Act	*Biodiversity Conservation Act 2016*
BCT	Biodiversity Conservation Trust
BDAR	Biodiversity Development Assessment Report
BOAMS	Biodiversity Offsets and Agreement Management System
BOPC	Biodiversity Offsets Payment Calculator
BOS	Biodiversity Offset Scheme
BOSET	Biodiversity Offsets Entry Tool
CM Act	NSW *Coastal Management Act 2016*
Council	Ballina Shire Council
DA	Development Application
Development site	The land directly impacted by the proposed development, including the development footprint, APZ and ancillary works (see **Figure 1.2**)
EEC	Endangered Ecological Community
EPA	NSW Environment Protection Authority
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
EP&A Act	NSW *Environmental Planning and Assessment Act 1979*
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
Fisheries	NSW Department of Primary Industries Fisheries
FM Act	NSW *Fisheries Management Act 1994*
GIS	Geographic Information System
GPS	Global Positioning System
ha	Hectares
IBRA	Interim Biogeographic Regionalisation for Australia

Glossary of Terms

LGA	Local Government Area
NSW	New South Wales
MNES	Matters of National Environmental Significance
OEH	NSW Office of Environment and Heritage
PCT	Plant Community Type
the Project	Palm Lake Resort Ballina North Development
SAII	Serious and Irreversible Impacts
SEPP	State Environmental Planning Policy
Study area	The larger Palm Lake Resort Ballina site, including the subject land and the Retirement Village to the South, and adjoining lots to the north, south and east (**Figure 1.1**)
Subject land	The area subject to the proposed action (**Figure 1.1)**
TBDC	Threatened Biodiversity Data Collection
TEC	Threatened Ecological Community
TS	Threatened Species

Chapter 1

Introduction

Cumberland Ecology was commissioned by Palm Lake Works to prepare a Biodiversity Development Assessment Report (BDAR) for the development of a retirement village located at 120 North Creek Road, Ballina (Lot 11 DP 1245510) (the 'Project'). The Project involves construction of a new seniors living development that adjoins the existing Palm Lake Resort Ballina, located to the north, and includes a Development Application (DA) for the staged erection of a seniors housing development under the State Environmental Planning Policy (Housing for Seniors or People with a Disability 2004) – comprising 108 self-care dwellings, associated car parking, infrastructure works and site filling. This BDAR will form part of the required documentation to support an amended DA under Part 4 of the New South Wales (NSW) *Environmental Planning and Assessment Act 1979* (EP&A Act).

A development application for the Project was submitted for approval by Ballina Shire Council ('Council') on 29 March 2018. Council issued a Request for Information (RFI) in relation to the DA, and a package of documentation responding to the RFI was lodged by Palm Lake Works on 3 August 2018. Due to ongoing unresolved issues with the DA, Palm Lake Works Class 1 appeal is before the NSW Land and Environment Court (LEC) (Case No. 2018/00326045).

A Statement of Facts and Contentions (SoFC) was filed with the LEC by Ballina Council on 17 December 2018. In order to respond to the issues outlined in the SoFC, an amended DA submission has been prepared, and includes an updated BDAR, which incorporates the ecological data from James Warren and Associates (JWA) (2018) and recent supplementary surveys conducted by Cumberland Ecology (2018).

In response to the amended DA, Amended SoFC were filed with the LEC by Council on 24 May 2019, which included several new contentions relating to inconsistencies of the development proposal with the Site Compatibility Certificate (SCC), and ecological issues that were not addressed in the BDAR, including assessment of the proposed upgrade to North Creek Road. This has resulted in the preparation of amended development plans, including a reduction in the development footprint to fall within the approved SCC boundary (as shown in **Figure 1.3**), and also road upgrade plans for North Creek Road on behalf of Council (located outside of the subject land).

1.1 Requirement for BDAR

The Biodiversity Offsets Scheme applies to local developments assessed under Part 4 of the EP&A Act that triggers the Biodiversity Offsets Scheme (BOS) threshold or is likely to

significantly affect threatened species based on the Test of Significance in Section 7.3 of the *Biodiversity Conservation Act 2016* (BC Act).

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

- whether the amount of native vegetation being cleared exceeds a threshold area; OR
- 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 BOS applies to the proposed development including biodiversity impacts prescribed by Clause 6.1 of the Biodiversity Regulation 2017.

For projects for which the BOS applies, a Biodiversity Development Assessment Report (BDAR) must be undertaken in accordance with the Biodiversity Assessment Method (BAM).

The subject land is mapped on the Biodiversity Values Map, and therefore the BOS applies to the Palm lake Resort Ballina North project. This report is a BDAR, and has been prepared to comply with the BAM.

1.2 Purpose

The purpose of this BDAR is to document the findings of an assessment undertaken for the Project in accordance with Stage 1 (Biodiversity Assessment) and Stage 2 (Impact Assessment) of the BAM. Specifically, the objectives of this BDAR are to:

- Identify the landscape features and site context (native vegetation cover) within the subject land and assessment area;
- Assess native vegetation extent, plant community types (PCTs), threatened ecological communities (TECs) and vegetation integrity (site condition) within the subject land;
- Assess habitat suitability for threatened species that can be predicted by habitat surrogates (ecosystem credits) and for threatened species that cannot be predicted by habitat surrogates (species credit species);
- Identify potential prescribed biodiversity impacts on threatened species;
- Describe measures to avoid and minimise impacts on biodiversity values and prescribed biodiversity impacts during project planning;
- Describe impacts to biodiversity values and prescribed biodiversity impacts and the measures to mitigate and manage such impacts;

- Identify the thresholds for the assessment and offsetting of impacts, including:
    - Impact assessment of potential entities of serious and irreversible impacts (SAII);
    - Impacts for which an offset is required;
    - Impacts for which no further assessment is required;
- Describe the application of the no net loss standard, including the calculation of the offset requirement.

1.3 Project Description

1.3.1 Location

The Locality is defined as the area within a 10km radius of the subject land for the purposes of this assessment. The Locality therefore extends from Empire Vale in the south-west to Broken Head in the north and from Alstonville in the west to the Pacific Ocean in the east (**Figure 1.1**).

Prominent features in the locality include Ballina, Prospect Lake, Chickiba Lake, Ballina Nature Reserve, Ballina Byron Gateway Airport and the Richmond River.

The Project is located on a vacant rural property described as 120 North Creek Road, Ballina, located within Lot 11 DP 1245510, located on the corner of Corks Lane and North Creek Road. The subject land has a total area of approximately 9.13 ha and adjoins vacant rural land and the Ballina Airport to the west and north, residential properties to the south and rural residential properties to the east. It is located within the Ballina Shire Local Government Area (LGA).

A location map and site map have been prepared in accordance with the BAM and are presented as **Figure 1.1** and **Figure 1.2**, respectively.

1.3.2 Project Overview

The Development Application is for the staged erection of a seniors housing development under the State Environmental Planning Policy (Housing for Seniors or People with a Disability 2004) – comprising 108 self-care dwellings, associated car parking, infrastructure works and site filling.

1.3.3 Identification of the Development Site

The amended layout of the Project is shown in **Figure 1.3**. The development site comprises the area of land directly impacted by the Project including the dwellings and access roads, as well as Asset Protection Zones (APZs) of 30m to the west and 50m to the north, south and east surrounding the proposed development. The development site and APZ has been designed to contain all construction activities and there is not expected to be any further

encroachment into the adjacent land, which includes riparian zones and Coastal Wetlands to be protected and restored.

The development site has been substantially reduced as part of the amendments to the DA from the Concept Plan submitted with DA 2018/321 documentation in March 2018, and response to RFI submitted in August 2018, and in response to each issue of the Statement of Facts and Contentions. The reduction in footprint has allowed for the greater retention of intact native vegetation, and provides the required set-backs from Coastal Wetlands and riparian corridors, as per the guidelines produced by Department of Primary Industries (DP&I) and the Office of Water.

In response to the May 2019 issue of the Statement of Facts and Contentions, amendments to the Project design have included upgrade works to North Creek Road, to facilitate its use for access to the proposed development. The road upgrade works are very minor in nature, and provide for the minimum width and increased sight-lines required to safely access the proposed driveway. The minor upgrade works have been proposed with regard to the sensitive Coastal Wetlands that directly adjoin the existing North Creek Road, to the south.

1.3.4 General Description of the Development Site

i. Historical and Present Land Use

Historically, the subject land has been predominantly cleared of native vegetation and was used for agricultural purposes, most likely for cattle grazing, and has been vacant for more than 15 years. Management by the current owners has involved continued slashing in parts of the site to maintain the Asset Protection Zone (APZ) to the existing development to the west.

It is acknowledged that native vegetation has regrown in a number of areas that are required to be managed for bushfire protection purposes (slashed) under the CVMP, in order to comply with the approval for the existing Palm Lake Resort (DA 2004/328). It is therefore recommended that remedial works (under DA 2004/328) are carried out as a priority to ensure the safety of existing residents.

We have received legal advice that remedial work in order to comply with the bushfire protection requirements of DA 2004/328, is not required by reason of the new seniors housing development proposed by the pending DA. The remedial work is therefore not required to be authorised by any development consent granted in relation to the proposed Palm Lake Resort Ballina North extension.

The proponent, Palm Lake Works, intends to either carry out rectification works under DA 2004/328 or, if necessary, make a modification application for that consent to carry out the works. It is recommended that a Site Specific Fuel Management Plan is prepared that addresses the ongoing fuel management of the subject land as required under the existing and proposed DA's.

ii. Topography and Soils

The topography and soils of the subject land are characterised as the Clarence - Richmond Alluvial Plains (Mitchell 2002), as shown in **Figure 1.2**. This landform is characterised as floodplain that is flat with silt soils.

iii. Hydrology

The subject land is characterised as a floodplain and is surrounded by coastal wetlands to the north, south and east. The coastal wetlands present are part of the North Creek floodplain, a coastal tributary of the Richmond River, and is brackish to saline. The wetlands contain swamp forest types, mangroves and saltmarsh, and are identified as Key Fish Habitats under the *Fisheries Management Act 2004*. The wetlands are tidal, with open water present in the channel approximately 500m to the east of the subject land.

A minor watercourse is present on the western boundary of the development site, and runs from north to south through the centre of the subject land. The watercourse is tributary of North Creek, located to the south. Following classification under the Strahler System of ordering watercourses, using current 1:25 000 topographic maps, the watercourse present on the subject land is a 2nd order stream.

The subject land is located on the floodplain, and hence is periodically inundated during severe storm events. Past water management measures have been implemented to drain the subject land, including drainage channels

iv. Vegetation

The vegetation of the locality and the surrounding rural landscapes have been heavily modified since the first European settlement in NSW. Most of the pre-existing vegetation was historically cleared. The majority of cleared areas have been planted with pasture grasses to support agricultural grazing, and few areas have been allowed to regenerate due to ongoing land use activities. Native grasses do still occur throughout the locality, and may intergrade with the exotic pasture grasses where unrestricted by agricultural practices.

Extensive areas of swamp vegetation types have regenerated in riparian areas and floodplains. The predominant vegetation community mapped in the locality is swamp Forest types (NSW National Parks & Wildlife Service 1999).

1.4 Information Sources

1.4.1 Databases

A number of databases were utilised during the preparation of this BDAR, including:

- OEH BioNet Atlas;
- OEH Threatened Biodiversity Data Collection;

- OEH BioNet Vegetation Classification database;
- Commonwealth Department of the Environment and Energy (DoEE) Species Profile and Threat Database;
- DoEE Protected Matters Search Tool (PMST); and
- DoEE Directory of Important Wetlands in Australia.

1.4.2 Literature

This BDAR has utilised the results and/or spatial data from the following documents:

- JWA (2018a) Biodiversity Development Assessment Report;
- JWA (2018b) Flora and Fauna Impact Assessment;
- GDE Mapping (Bureau of Meteorology 2018); and
- DoEE (Department of the Environment and Energy 2018) Flying- fox Map Viewer

1.4.3 Aerial Photography

The aerial imagery utilised in this BDAR is sourced from Nearmap and is dated 11 March 2019.

1.5 Authorship and Personnel

This document has been authorised by Dr David Robertson (BAM Accredited Assessor No: BAAS17027). This document, and associated filed surveys and Geographic Information Systems (GIS) mapping, was prepared with the assistance of additional personnel as outlined in **Table 1.1**. Notwithstanding the assistance of the additional personnel, the assessment presented within this document is Dr Robertson's.

Table 1.1 Personnel

Name	Tasks	Relevant Qualifications / Training	BAM Accredited Assessor No.
Dr David Robertson	Document review	Doctor of Philosophy. Ecology, University of Melbourne, 1986 Bachelor of Science (Honours) in Ecology, University of Melbourne, 1980 BAM Accredited Assessor Training. Muddy Boots, 2017	BAAS17027
Dr Gitanjali Katrak	Document review	Doctor of Philosophy, Intertidal Wetland Ecology.	BAAS17064

Table 1.1 Personnel

Name	Tasks	Relevant Qualifications / Training	BAM Accredited Assessor No.
		Flinders University, 2011 Bachelor of Science (Honours) in Biological Sciences. La Trobe University, 2002 BAM Accredited Assessor Training. Muddy Boots, 2017	
Dr Trevor Meers	Field surveys, Document review	Doctor of Philosophy (Restoration Ecology), School of Forest and Ecosystem Science. University of Melbourne, 2007 Bachelor of Applied Science (Honours) in Natural Resource Management BAM Accredited Assessor Training. Muddy Boots, 2017	BAAS18119
Ms Vanessa Orsborn	Field surveys, document preparation, credit calculations	Bachelor of Environmental Science. Australian Catholic University, 2005 BAM Accredited Assessor Training. Muddy Boots, 2017	BAAS18166
Mr Michael Davis	GIS mapping, credit calculations	Bachelor of Biodiversity and Conservation. Macquarie University, 2016 BAM Accredited Assessor Training. Muddy Boots, 2017	-
Mr Jesse Luscombe	GIS mapping, credit calculations	Bachelor of Marine Science. Macquarie University, 2013 Certificate III in Conservation and Land Management. TAFE NSW, 2016	-

1.6 Other Relevant Legislative Requirements

1.6.1 Commonwealth

The Project will be referred to the Minister for the Environment for consideration of the need to seek approval under the *Environment Protection and Biodiversity Conservation Act 1999* (EBPC Act. Matters of National Environmental Significance (MNES) listed by the EPBC Act potentially impacted by the Project that include Swamp Oak Floodplain Forest endangered ecological community. However, due to the small area of clearing and impacts to MNES, it is not considered likely that the Project will be deemed a Controlled Action.

1.6.2 State

i. NSW Fisheries Management Act 1994

Threatened species legislation in NSW currently consists of the *Fisheries Management Act 1994* (FM Act), and the BC Act. The FM Act protects threatened fish species and marine vegetation and identifies associated threatening processes and is administered by the DPI Fisheries.

The FM Act has the objective to conserve, develop and share the fishery resources of NSW for the benefit of present and future generations. In particular, this Act includes measures to conserve fish stocks and key fish habitats, to conserve threatened species, populations and ecological communities of fish and marine vegetation, and to promote ecologically sustainable development, including the conservation of biological diversity.

Under the FM Act, "fish" means marine, estuarine or freshwater fish or other aquatic animal life at any stage of their life history and includes molluscs, crustaceans, echinoderms, beach worms and other polychaetes.

a. Fish Habitat – mangrove and saltmarsh vegetation

Marine vegetation is considered to be 'key fish habitat' and is protected under the FM Act. The FM Act sets out provisions to protect marine vegetation (which includes mangroves, saltmarshes, seagrass and seaweeds) from 'harm'. Harm under the FM Act means 'gather, cut, pull up, destroy, poison, dig up, remove, injure, prevent light from reaching or otherwise harm the marine vegetation, or any part of it.

DPI Fisheries is responsible for the management of mangroves and saltmarsh vegetation on the subject land. The proposed development will require a Section 205 permit issued by DPI Fisheries to enable works affecting saltmarsh and mangrove vegetation to proceed.

Potential impacts on matters listed under the FM Act are further discussed in Chapter 7.

ii. State Environmental Planning Policy (Coastal Management) 2018

State Environmental Planning Policy (Coastal Management) 2018 (Coastal Management SEPP) came into force on 3 April 2018, replacing State Environmental Planning Policy No 14—Coastal Wetlands, State Environmental Planning Policy No 26—Littoral Rainforests and State Environmental Planning Policy No 71—Coastal Protection.

The following zones of the Coastal Management SEPP occur within the subject land:

- Coastal Wetlands;
- Proximity Area for Coastal Wetlands;
- Coastal Environment Area; and
- Coastal Use Area.

The objectives of each zone are outlined below, whilst potential impacts on matters mapped under the Coastal Management SEPP are further discussed in Chapter 7.

a. Coastal Wetland Zone

Under the Coastal Management SEPP, development can be carried out in areas mapped as Coastal Wetlands (as Designated Development) if the consent authority is satisfied that sufficient measures have been, or will be, taken to protect, and where possible enhance, the biophysical, hydrological and ecological integrity of the coastal wetland.

The areas within the subject land mapped as Coastal Wetland correspond to the wetland vegetation associated with North Creek, located on the northern, eastern and southern boundaries of the subject land.

b. Proximity to Coastal Wetland Zone

Under the Coastal Management SEPP, development can be carried out in areas mapped "proximity area for coastal wetlands" if the consent authority is satisfied that the proposed development will not significantly impact on the biophysical, hydrological and ecological integrity of the coastal wetland or the quantity and quality of surface and ground water flows to and from the adjacent coastal wetland.

The areas mapped as 'Proximity to Coastal Wetland' surrounds the development site, and corresponds in some areas with the APZ, and contains some stormwater infrastructure, within the subject land.

c. Coastal Environment Area

Under the Coastal Management SEPP, development can be carried out in areas mapped within the coastal environment area if the consent authority is satisfied that the proposed development will not significantly impact on the following:

- the integrity and resilience of the biophysical, hydrological (surface and groundwater) and ecological environment,
- coastal environmental values and natural coastal processes,
- the water quality of the marine estate (within the meaning of the Marine Estate Management Act 2014), in particular, the cumulative impacts of the proposed development on any of the sensitive coastal lakes identified in Schedule 1,
- marine vegetation, native vegetation and fauna and their habitats, undeveloped headlands and rock platforms,
- existing public open space and safe access to and along the foreshore, beach, headland or rock platform for members of the public, including persons with a disability,
- Aboriginal cultural heritage, practices and places,

- the use of the surf zone.

An area either side of North Creek has been mapped as Coastal Environment Area. This includes areas within the subject land, but located outside of the development site.

1.6.3 SEPP 62 – Sustainable Aquaculture

State Environmental Planning Policy (SEPP) 62 – Sustainable Aquaculture was repealed on 27 February 2019 and was replaced by the Primary Production and Rural Development SEPP. As the DA was submitted prior to commencement of the new SEPP, SEPP 62 applies under the relevant savings provisions. SEPP 62 refers to the guidelines produced by Department of Primary Industries in regard to the management of Oyster Aquaculture Areas. The guidelines are of relevance to the development site, as Priority Oyster Aquaculture Areas have been mapped within 100m of the development site, to the east and the south, in North Creek.

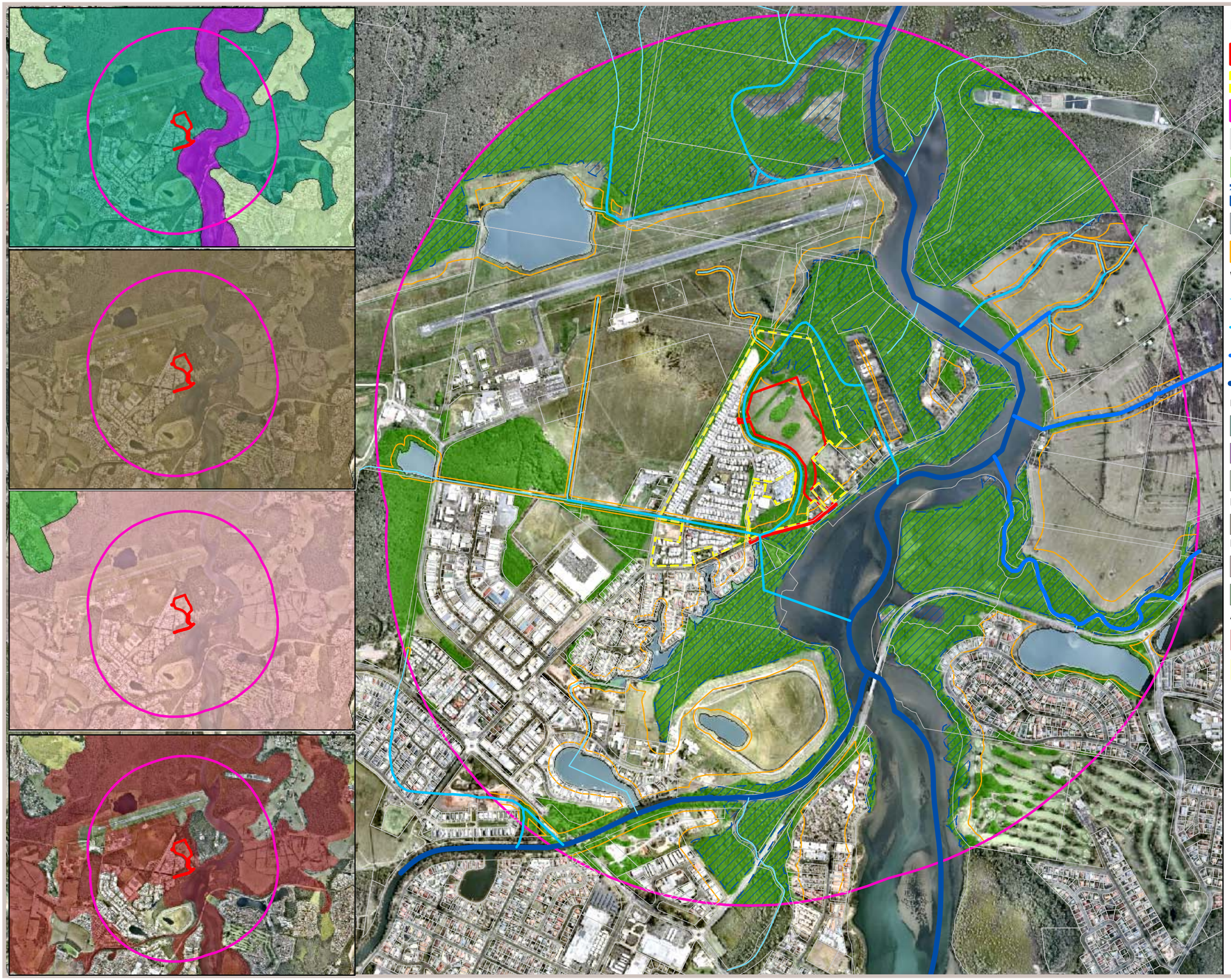

Figure 1.1. Location Map

Figure 1.2. Site Map

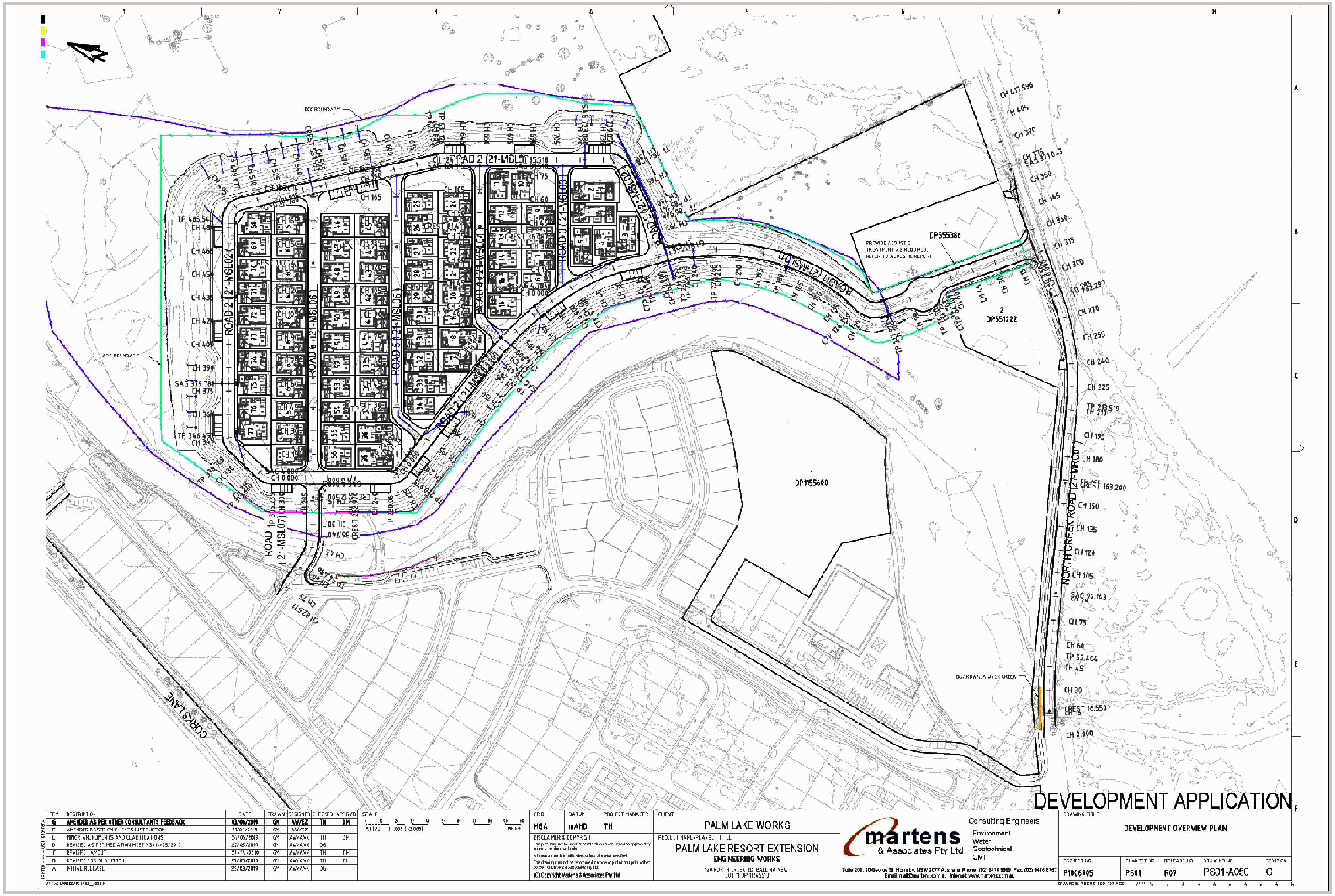

Figure 1.3. Layout of the Project

Image Source: Palm Lake Works (2019)

I:\...\18187\Figures\RP1\20190611\Figure 1.3. Layout_Project

Chapter 2

Landscape Features

2.1 Site Context

2.1.1 Assessment Area

As the Project is being assessed as a non-linear project, the assessment area comprises the area of land within a 1500 m buffer around the outer boundary of the subject land. The location of the assessment area is shown in **Figure 1.2**.

2.1.2 Native Vegetation Cover

The native vegetation cover was determined through the use of GIS. To map native vegetation cover within the subject land and assessment area, this assessment utilised the detailed vegetation mapping prepared by Cumberland Ecology in conjunction with broad scale mapping published by the OEH (NSW National Parks & Wildlife Service 1999).

2.2 Landscape Features

Landscape features identified within the subject land and assessment area are outlined below. The extent of these features within the subject land is shown in **Figure 1.1** and the extent within the assessment area is shown in **Figure 1.2**.

2.2.1 IBRA Bioregions and IBRA Subregions

The subject land and assessment area occurs within the South East Queensland Biogeographic Regionalisation for Australia (IBRA) Bioregion and within the Clarence Lowlands IBRA Subregion.

2.2.2 Rivers, Streams and Estuaries

The subject land and assessment area occurs within the Richmond River catchment. Notable surface drainage systems include the North Creek. A 2nd Order stream is located within the subject land, being a tributary of North Creek, with 3rd Order stream (North Creek) within the assessment area.

A buffer of 20m and 30m either side of the waterways applies to 2nd Order and 3rd Order streams, respectively, in accordance with Appendix 3 of the BAM.

2.2.3 Important and Local Wetlands

According to the BAM Operational Manual Stage 1 (OEH 2017a), important wetlands are defined as those listed in the Directory of Important Wetlands in Australia (DIWA) and coastal wetlands protected under State Environment Planning Policy (Coastal Management) 2018 (the Coastal Management SEPP). Local wetlands as defined in the BAM refer to all other wetlands, including but not restricted to, those listed or mapped in regional planning or conservation strategies.

The subject land is characterised as a floodplain and is surrounded by coastal wetlands to the north, south and east. The coastal wetlands present are part of the North Creek floodplain, a coastal tributary of the Richmond River, and are brackish to saline. The wetlands contain swamp forest types, mangroves and saltmarsh, and are identified as Key Fish Habitats under the FM Act. The wetlands are tidal, with open water present in the channel approximately 500 m to the east of the subject land.

Large areas of wetlands occur within the assessment area in close proximity to the subject land in association with North Creek that have been mapped as Coastal Wetlands under the Coastal Management SEPP (see **Figure 2.1**). These occur in patches on both sides of North Creek, with the most significant area occurring in the Ballina Nature Reserve, approximately 1 km north of the subject land along North Creek. This is a 721 ha area that is comprised predominantly of wetland and has been mapped as wetland under the Coastal Management SEPP. It is in this area that North Creek has its headwaters and it contains mangroves, swamp sclerophyll forest and saltmarsh (NSW National Parks and Wildlife Service 2003).

A small area of Coastal Wetlands has been mapped within the northern portion of the subject land with further small areas occurring adjacent to the southern boundary of the subject land. Both these areas have some connectivity, including connective vegetation outside of the subject land, to a large patch of wetlands to the north-east of the subject land mapped under the Coastal Management SEPP. It is fragmented from the larger area of wetland in the Ballina Nature Reserve by the runway of the Ballina Byron Gateway Airport.

Other, smaller patches of wetland in the locality include areas directly to the south of the subject land along North Creek, north of the Ballina Racetrack. Wetland areas also occur on the eastern side of North Creek, opposite the subject land. Another area of wetlands is located further to the west of the subject land, directly north of the Ballina Byron Gateway Airport.

The subject land also includes areas mapped as the following under the Coastal Management SEPP (see **Figure 2.1**):

- Coastal Wetlands;
- Proximity Area for Coastal Wetlands;
- Coastal Environment Area; and

- Coastal Use Area

No nationally important wetlands identified by the DIWA are present in the subject land. The nearest Nationally Important Wetland is Tuckean Swamp, which is located approximately 25 km to the southwest.

i. Priority Oyster Aquaculture Areas

Priority Oyster Aquaculture Areas, as identified by the Department of Primary Industries are located in association with North Creek and the mapped Coastal Wetlands, with two areas mapped to the south, and one area mapped to the east of the development site (Figure 2.1).

These areas are separated from the development site by existing infrastructure such as North Creek Road and/or the Coastal Wetlands. However these have the potential to be impacted by any changes in water quality as a result of the works.

2.2.4 Habitat Connectivity

The subject land is located in an agricultural and residential environment, and is surrounded on two sides by grazing properties, by Ballina Byron Gateway Airport, an existing aged care facility, and North Creek Road. The floodplain provides extensive wetland habitats and connectivity from north to south by North Creek. This wetland vegetation provides significant connective habitat to the Richmond River in the south and Ballina Nature Reserve in the north.

2.2.5 Karsts, Caves, Crevices, Cliffs and Areas of Geological Significance

No karsts, caves, crevices, cliffs or areas of geological significance have been identified within the assessment area.

2.2.6 Areas of Outstanding Biodiversity Value

No Areas of Outstanding Biodiversity Value (AOBV) have been mapped within the assessment area.

2.2.7 Mitchell Landscapes

The Mitchell Landscape that occurs in the subject land and surrounds is defined as Clarence – Richmond Alluvial Plains, and is adjoined by Estuary Landscape (DECC 2002).

2.2.8 Soil Hazard Features

Soil hazard features have not been accurately identified as part of this study, and no testing has occurred. Although not mapped, there is a potential that wetland areas of the subject land are underlain by Potential Acid Sulphate soils (PASS), which pose a potential risk to water quality and aquatic ecology in the subject land. PASS are naturally occurring sediments that are deposited under estuarine conditions. They contain iron sulphides, most commonly as pyrite, and/or the products of iron sulphide oxidation. When exposed to oxygen through drainage or disturbance, these materials produce sulfuric acid, reducing the

pH of the soil and often releasing toxic quantities of iron, aluminium and other metals (OEH 2016a). Prior to disturbance they are known as PASS, and when they are disturbed and become acidic, they are then known as Acid Sulphate Soils (ASS), as the sediments have actually become acidic.

Figure 2.1. Relevant State Planning Policy Areas

Chapter 3

Methodology

3.1 Review of Existing Data

Existing information on biodiversity values within the assessment area were reviewed, which includes:

- Survey data that is held in the Flora Survey (BioNet) including:
  - OEH Threatened Biodiversity Data Collection.
- Existing vegetation mapping, being:
  - Regional Upper North East CRAFTI Floristic Vegetation Mapping dataset by OEH (NSW National Parks & Wildlife Service 1999);

Extensive surveys of the subject land have previously been undertaken, as part of the current DA, and previous DA's in relation to the Palm Lake Resort and BUPA Healthcare facility. Where previous survey data has been utilised in the preparation of this BDAR, a description of the survey methods are provided. The data utilised includes:

- Vegetation mapping of the subject land prepared by JWA (2018); and
- Floristic plot data collected by JWA during the preparation of the DA.

This existing information was considered and included, where appropriate, into survey design, vegetation mapping and reporting.

3.2 Previous Surveys (JWA, 2017, 2018)

JWA conducted field surveys as part of the preparation of the Flora and Fauna Impact Assessment (JWA 2018b), and subsequent BDAR (JWA 2018a) for the proposed development on the subject land. Data has been utilised in the preparation of the current BDAR, where appropriate. Methods used as summarised below:

3.2.1 Vegetation surveys

JWA conducted vegetation surveys for the preparation of a BDAR (JWA 2018a), and included a detailed assessment of composition, structure and function of site vegetation

completed on the 1st June 2018 utilising the Biodiversity Assessment Method. A total of five (5) BAM plots were conducted as part of the surveys by JWA, the locations of which are shown in **Figure 3.1**.

3.2.2 Targeted surveys for threatened species

Numerous surveys of the subject land conducted by JWA have included targeted searches for threatened flora and fauna species as part of general surveys for the Flora and Fauna Impact Assessment (JWA 2018b) and BDAR (JWA 2018a). Surveys targeted a range of Species Credit Species with potential to occur were conducted on the 16th May 2017, 20th November 2017, 19th February 2018 and 1st June 2018. Methods utilised included detailed habitat assessments, random meander searches in suitable habitat, and incidental recordings of species. Methods are further described in the JWA (2018a, 2018b) reports.

3.3 Current Surveys (Cumberland Ecology, 2018)

In order to respond to Council contentions in relation to the DA, and update the data collected by JWA, additional field surveys were conducted by Cumberland Ecology on 12 and 13 December 2018. The combined dataset has been used in the preparation of this BDAR. Methods used by Cumberland Ecology are described below.

3.3.1 Vegetation Mapping

Vegetation mapping of the subject land was undertaken by random meander searches throughout each patch of vegetation, noting key characteristics of areas in similar broad condition states such as similar tree cover, shrub cover, ground cover, weediness or combination of these.

3.3.2 Vegetation Integrity Assessment

Vegetation integrity assessments were undertaken following the BAM. Surveys included establishment of a 20 x 50 m plot within which the following data was collected:

- Composition for each growth form group by counting the number of native plant species recorded for each growth form group within a 20 m x 20 m plot;
- Structure of each growth form group as the sum of all the individual projected foliage cover estimates of all native plant species recorded within each growth form group within a 20 m x 20m plot;
- Cover of 'High Threat Exotic' weed species within the 20 m x 20m plot ;
- Assessment of function attributes within a 20 m x 50 m plot, including:
    - Count of number of large trees;
    - Tree stem size classes, measured as 'diameter at breast height over bark' (DBH);

- Regeneration based on the presence of living trees with steams <5 cm DBH;
- The total length in metres of fallen logs over 10 cm in diameter;

- Assessment of litter cover within five 1 m x 1 m plots evenly spread within the 20 m x 50 m plot; and
- Number of trees with hollows that are visible from the ground within the 20 m x 50 m plot.

A total of seven plots were undertaken within the subject land, and their location is shown in **Figure 3.1**. The seven plots were undertaken within the native vegetation within the subject land and utilised further within this assessment, while additional random meanders were completed in areas of non-native vegetation and small patches of vegetation located outside of the development site. The approximate locations of random meanders are shown in **Figure 3.1. Table 3.1** summarises the plot requirements based on vegetation zones. The minimum number of plots has been completed for both vegetation zones.

Table 3.1 Plot survey requirements

Vegetation Zone	PCT	Condition*	Area (ha)	Minimum Number of Plots Required	Number of Plots Completed
1	1235	High	1.55	1	4
2	1235	Low	0.99	1	2
3	1064	Moderate	0.06	1	1

3.3.3 Threatened Flora Species Survey

Targeted threatened flora surveys were undertaken for species credit species that have the potential to occur within the subject land as determined by the BAM Calculator. All targeted surveys were conducted in accordance with the NSW Guide to Surveying Threatened Plants (OEH 2016b). Targeted threatened flora surveys were undertaken by Trevor Meers and Vanessa Orsborn between the 12th and 13th of December 2018, for the following species:

- *Allocasuarina defungens* (Dwarf Heath Casuarina);
- *Archidendron hendersonii* (White lace flower);
- *Arthraxon hispidus* (Hairy Jointgrass);
- *Callistemon linearifolius* (Netted Bottle Brush);
- *Centranthera cochinchinensis* (Swamp Foxglove);
- *Cyperus aquatilis* (Water Nutgrass);

- *Davidsonia jerseyana* (Davidson's Plum);
- *Desmodium acanthocladum* (Thorny Pea);
- *Diploglottis campbellii* (Small-leaved Tamarind);
- *Drynaria rigidula* (Basket Fern);
- *Endiandra muelleri* subsp. *bracteata* (Green-leaved Rose Walnut);
- *Geodorum densiflorum* (Pink Nodding Orchid);
- *Gossia fragrantissima* (Sweet Myrtle);
- *Lindernia alsinoides* (Noah's False Chickweed);
- *Macadamia tetraphylla* (Rough-shelled Bush Nut);
- *Maundia triglochinoides* (Maundia triglochinoides);
- *Melaleuca irbyana* (Weeping Paperbark);
- *Myrsine richmondensis* (Ripple-leaf Muttonwood);
- *Ochrosia moorei* (Southern Ochrosia);
- *Olax angulata* (Square-stemmed Olax);
- *Oldenlandia galioides* (Oldenlandia galioides);
- *Persicaria elatior* (Tall Knotweed);
- *Petalura litorea* (Coastal Petaltail);
- *Phyllanthus microcladus* (Brush Sauropus);
- *Polygala linariifolia* (Native Milkwort);
- *Rotala tripartita* (Rotala tripartita); and
- *Syzygium hodgkinsoniae* (Red Lilly Pilly);

Additionally, surveys by JWA (2018) included appropriate survey period for:

- *Acronychia littoralis* (Scented Acronychia); and
- *Oberonia titania* (Red-flowered King of the Fairies);

3.3.4 Flora Survey Effort

Table 3.2 below shows the flora survey effort, including dates, staff members and weather conditions.

Table 3.2 Survey Effort (Cumberland Ecology, 2018)

Survey Detail	Dates	Personnel	Survey effort	Weather conditions
Vegetation Mapping	12 and 13 December 2018	Trevor Meers and Vanessa Orsborn	8 person hours	Clear skies, no rain, light to moderate breeze, temperature range: 17-29°C
BAM Plots	12 and 13 December 2018	Trevor Meers and Vanessa Orsborn	20 person hours	Clear skies, no rain, light to moderate breeze, temperature range: 17-29°C
Threatened Flora Searches	12 and 13 December 2018	Trevor Meers and Vanessa Orsborn	28 person hours	Clear skies, no rain, light to moderate breeze, temperature range: 17-29°C

3.4 Fauna Survey

3.4.1 Threatened Fauna Species Survey

Targeted threatened fauna surveys were not completed, beyond detailed habitat assessments, conducted during multiple surveys in spring, autumn and summer seasons, by JWA and subsequently by Cumberland Ecology, concurrently with flora surveys, as summarised in **Table 3.2**.

Under Section 6.4.1.13 of the BAM, species credit species can be excluded from further assessment, and thereby targeted surveys, if it is determined that none of the species-specific habitat constraints are present within the subject land (see ***Section 5.3***). Candidate species were only removed from consideration in the BAM following a detailed review of the habitat requirements of each fauna species, and consideration of the available habitats within and adjoining the subject land.

Of the candidate species predicted in the BAM calculator, the Regent Honeyeater, Swift Parrot, Little Eagle, Square-tailed Kite, Powerful Owl, Eastern Osprey, White-bellied Sea-Eagle, Squirrel Glider, Brush-tailed Phascogale, Koala, Little Bentwing-bat, Eastern Bentwing-bat, Large-eared Pied Bat, Green and Golden Bell Frog, Mitchell's Rainforest Snail and White-crowned Snake were excluded from requiring further assessment based on either the lack of/degradation of habitat constraints within the subject land, or the subject land not occurring within the mapped area for the species as advised by OEH. A detailed

assessment of the removal of consideration for candidate species is provided in **Section 5.3.2**.

3.4.2 Fauna Survey Methods

i. Habitat Assessment

Habitat assessments were carried out throughout the entirety of the subject land by Cumberland Ecology between 12 and 13 December 2018. This survey identified any potential habitat features such as significant rocky outcrops, bush rock, fallen logs, culverts, water bodies, decorticating bark, nests and hollow-bearing trees. Observations made during the habitat assessment by Cumberland Ecology in December 2018 were further supported by the findings of JWA in May and November 2017 and February and June 2018.

Legend

- Development Site
- Subject Land

Plant Community Type

- 1235: Swamp Oak swamp forest of the coastal lowlands of the NSW North Coast Bioregion
- 1125: Saltmarsh complex of the NSW North Coast Bioregion
- 1064: Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion
- 916: Mangrove - Grey Mangrove low closed forest of the NSW Coastal Bioregion
- N/A

Flora Survey Locations

- BAM Plot (CE 2018)
- BAM Plot (JWA 2018)
- BAM Plot Midline (CE 2018)
- BAM Plot Midline (JWA 2018)
- Random Meander Survey (CE 2018)

Image Source:
Image © Nearmap 2019
Dated: 11/3/2019

Data Source:
JWA PTY LTD 2018
Ecological Consultants

Coordinate System: MGA Zone 56 (GDA 94)

cumberland ecology

0 50 100 150 200 m

I:\...\18187\Figures\RP1\20190611\Figure 3.1. Flora survey locations

Figure 3.1. Flora survey locations

Legend

- Development Site
- Subject Land
- Random Meander Survey (CE 2018)

Habitat Assessment Points

- CE 2018
- JWA 2018

Image Source:
Image © Nearmap 2019
Dated: 11/3/2019

Data Source:
JWA PTY LTD 2018
Ecological Consultants

Coordinate System: MGA Zone 56 (GDA 94)

cumberland ecology

0 50 100 150 200 m

I:\...\18187\Figures\RP1\20190611\Figure 3.2. Fauna survey locations

Figure 3.2. Fauna survey locations

Chapter 4

Native Vegetation

4.1 Native Vegetation Extent

The subject land has been subject to detailed surveys by Cumberland Ecology for the purpose of this BDAR. The native vegetation extent within the subject land was determined through aerial photograph interpretation and field surveys. The native vegetation extent within the subject land is shown in **Figure 4.1**.

4.2 Plant Community Types

4.2.1 Introduction

Identification of the PCTs occurring within the subject land was guided by the results of the Cumberland Ecology surveys. The data collected during surveys of the subject land was analysed in conjunction with a review of the PCTs held within the BioNet Vegetation Classification Database. Consideration was given to the following:

- Occurrence within the Clarence Lowlands IBRA subregion;
- Vegetation formation;
- Alignment with TECs;
- Landscape position; and
- Upper, mid and ground strata species.

The analysis determined that the native vegetation within the subject land aligned with the following PCT's:

- 1235 - Swamp Oak swamp forest of the coastal lowlands of the NSW North Coast Bioregion;
- 1064 - Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion;
- 1125 - Coastal Saltmarsh in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions; and

- 916 - Mangrove - Grey Mangrove low closed forest of the NSW Coastal Bioregion

The distribution of this PCT within the subject land is shown in **Figure 4.2**. Detailed descriptions of this PCT and the justification for PCT selection is provided in the sections below.

4.2.2 Swamp Oak Swamp Forest of the Coastal Lowlands of the NSW North Coast Bioregion

PCT: 1235

Vegetation Formation: Forested Wetlands

Vegetation Class: Coastal Floodplain Wetlands

Area: 12.81 ha

Percent Cleared Value: 75%

TEC Status: BC Act - Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions Endangered Ecological Community (EEC)

EPBC Act - EEC

i. General Description

Swamp Oak swamp forest of the coastal lowlands of the NSW North Coast Bioregion (PCT 1235) is found on the coastal floodplains of NSW. It has a dense to sparse tree layer in which *Casuarina glauca* (Swamp Oak) is the dominant species. The community is associated with grey-black clay-loams and sandy loams, where the groundwater is saline or sub-saline, on waterlogged or periodically inundated flats, drainage lines, lake margins and estuarine fringes associated with coastal floodplains. It generally occurs below 20m in elevation. The structure of the community may vary from open forests to low woodlands, scrubs or reedlands with scattered trees. Swamp Oak swamp forest of the coastal lowlands of the NSW North Coast Bioregion (PCT 1235) is listed as an Endangered Ecological Community (EEC) under the BC Act and is also listed as Endangered under the EPBC Act.

This plant community type is the dominant native plant community type on the subject land, as shown in **Photograph 4.1**. It surrounds the periphery of the development site and low-lying areas around the subject land. The total area that this plant community occupies is 12.81 ha. This is split into: 1.41 ha of tall closed forest to 16m dominated by *Acacia melanoxylon* (Blackwood) with *Casuarina glauca* (Swamp Oak) occurring; 2.02 ha of tall closed forest dominated by *Casuarina glauca* (Swamp Oak) with sub-dominant *Avicennia marina* (Grey Mangrove); 8.07 ha of tall closed forest to 18m dominated by *Casuarina glauca* (Swamp Oak); 0.92 ha of highly degraded Swamp Oak forest, and; 0.38 ha of Tall Closed Grassland to 2.5m (*Phragmites australis*). The latter two variant represent highly degraded forms of the community, as described in Section 4.2.2 iii below.

The dominant canopy species within this community is *Casuarina glauca* (Swamp Oak). Other tree species include *Melaleuca quinquenervia* (Broad-leaved Paperbark) *Cupaniopsis anacardioides* (Tuckeroo) and *Acacia melanoxylon* (Blackwood). The shrub layer is sparse and includes natives; *Duboisia myoporoides* (Corkwood) and *Wikstroemia indica*. The groundcover is characterised grasses including native species; *Imperata cylindrica* (Blady Grass), *Leersia hexandra* (Swamp Ricegrass) and *Microlaena stipoides* (Weeping Grass), and exotic species; *Paspalum mandiocanum* (Broadleaf Paspalum) and *Paspalum dilatatum* (Paspalum), and forbs including natives; *Dianella caerulea* (Blue Flax-Lilly) and *Lobelia stenophylla* and exotics; *Ageratum houstonianum, Solanum mauritianum* (Wild Tobacco) and *Crotalaria* spp. In some locations *Phragmites australis* (Common Reed) dominates the ground layer. Saltmarsh species such as *Juncus kraussii* (Sea Rush) and *Sporobolus virginicus* (Saltwater Couch) may dominate the ground layer in waterlogged areas on estuarine fringes. Some exotic sedges are also present in wet areas, including *Cyperus eragrostis* (Umbrella Sedge) and *Cyperus brevifolius*.

ii. Justification of PCT Selection

PCTs were initially filtered using BioNet Vegetation Classification System for IBRA Region and for the key canopy species *Casuarina glauca* (Swamp Oak). The resulting list was narrowed down based on landform and geology. PCT 1235 was determined to be the best fit based on the PCT Classification Confidence Level and the number of key indicator species present based on the BAM plot surveys undertaken.

Photograph 4.1 Swamp Oak Swamp Forest on the subject land

Other variants on the subject land include the following low condition examples of Swamp Oak Swamp Forest, as described below:

iii. Phragmites Wetland

Phragmites Wetland corresponds to the mapped area of Tall Closed Grassland to 2.5m (*Phragmites australis*) (**Figure 3.1**) and is a component of Swamp Oak swamp forest of the coastal lowlands of the NSW North Coast Bioregion (PCT 1235). It is characterised by dense swards of *Phragmites australis* (Common Reed). It is located in environments inundated by saline and brackish water where the canopy of *Casuarina glauca* has been removed or partially removed. These include low-lying swamps on riverbanks, river flat depressions, and banks on coastal lagoons that are open to tidal influence. This community is commonly encountered on the landward side of swamp forest and coastal saltmarsh flats. Phragmites Wetland is associated with Swamp Oak swamp forest of the coastal lowlands of the NSW North Coast Bioregion (PCT 1235) which is listed as an Endangered Ecological Community (EEC) under the BC Act and is also listed as Endangered under the EPBC Act.

This plant community type is located in patches along the drainage line close to the western boundary of the development site, as shown in **Photograph 4.2**. The total area that this plant community occupies is 0.38 ha. The dominant species are the native sedge; *Phragmites australis* (Common Reed) and the exotic grass; *Setaria sphacelata* (South African Pigeon Grass). Twelve of the 24 species present are exotic. The canopy species present are found as shrubs and include *Casuarina glauca* (Swamp Oak), *Avicennia marina* (Grey Mangrove) and *Melaleuca quinquenervia* (Broad-leaved Paperbark). Sparse shrubs are present, and include the native species; *Hibiscus diversifolius* (Swamp Hibiscus) and the exotic species; *Gomphocarpus physocarpus* (Balloon Cottonbush). Forb species present include natives; *Persicaria decipiens* (Slender Knotweed) and *Ranunculus inundatus* (River Buttercup), and exotics; *Solanum mauritianum* (Wild Tobacco Bush). Other native species present include *Sporobolus virginicus* and *Cyperus polystachyos*.

Photograph 4.2 Phragmites Wetland on the subject land

iv. Swamp Oak swamp forest of the coastal lowlands of the NSW North Coast Bioregion - Highly degraded

Swamp Oak swamp forest of the coastal lowlands of the NSW North Coast Bioregion (PCT 1235) is found on the coastal floodplains of NSW. It has a dense to sparse tree layer in which *Casuarina glauca* (Swamp Oak) is the dominant species. The community is associated with grey-black clay-loams and sandy loams, where the groundwater is saline or sub-saline, on waterlogged or periodically inundated flats, drainage lines, lake margins and estuarine fringes associated with coastal floodplains. It generally occurs below 20m in elevation. The structure of the community may vary from open forests to low woodlands, scrubs or reedlands with scattered trees. This community on the subject land varies in condition.

This plant community type is located in two patches within the exotic grassland and is central to the development site, as shown in **Figure 3.1** and **Photograph 4.3** below. The total area that this plant community occupies is 0.92 ha. Fifteen of the 31 species present are exotic. The dominant canopy species within this community is *Casuarina glauca* (Swamp Oak). Other tree species include *Glochidion ferdinandi* (Cheese Tree), *Cupaniopsis anacardioides* (Tuckeroo) and *Acacia melanoxylon* (Blackwood). The ground cover is dominated by exotic grass species such as *Setaria sphacelata* (South African Pigeon Grass) and *Paspalum mandiocanum* (Broadleaf Paspalum). The native grasses present include *Ottochloa gracillima* and *Leersia hexandra* (Swamp Ricegrass). The other native species present include the vines *Parsonsia straminea* (Common Silkpod), *Stephania japonica* (Snake Vine) and *Marsdenia rostrata* (Milk Vine), and other species such as *Cordyline stricta* (Narrow-

leaved Palm Lily), *Centella asiatica* (Indian Pennywort) and *Hypolepis muelleri* (Harsh Ground Fern). Exotic woody vines are also present, and include; *Ipomoea cairica* (Coastal Morning Glory), *Passiflora subpeltata* (White Passionflower) and *Passiflora suberosa* (Cork Passionfruit).

Photograph 4.3 Swamp Oak Swamp Forest – highly degraded, located in the centre of the development site

4.2.3 Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion

PCT: 1064

Vegetation Formation: Forested Wetlands

Vegetation Class: Coastal Swamp Forests

Area: 0.06 ha

Percent Cleared Value: 75%

TEC Status: BC Act - Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions Endangered Ecological Community (EEC)

EPBC Act – Not listed

i. General Description

This swamp community has an open to dense tree layer of paperbarks (*Melaleuca* species) although some remnants only have scattered trees. The community is associated with humic clay loams and sandy loams, on waterlogged or periodically inundated alluvial flats and drainage lines associated with coastal floodplains. It generally occurs below 20 m (though sometimes up to 50 m) elevation. The composition of the community is primarily determined by the frequency and duration of waterlogging and the texture, salinity nutrient and moisture content of the soil. Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion (PCT 1064) is equivalent to Swamp Sclerophyll Forest on Coastal Floodplains EEC, and the narrow strip of this community present on the subject land represents a small and degraded representative of this EEC, as shown in **Photograph 4.4**.

This community is located in a small area mostly surrounded by exotic grassland on the eastern side of the development site. The total area that this plant community occupies is 0.06 ha. Ten of the 21 species present are exotic. A canopy is absent and the sub-dominant canopy species is *Melaleuca quinquenervia* (Broad-leaved Paperbark). Other canopy species present in the sub-canopy layer include *Casuarina glauca* (Swamp Oak) and *Acacia melanoxylon* (Blackwood). The ground cover is mostly exotic species such as *Ageratum houstonianum*, *Setaria sphacelata* (South African Pigeon Grass) *Cyperus eragrostis* (Umbrella Sedge), *Cuphea carthagenensis* (Colombian Waxweed) and *Cyperus brevifolius*. The native forbs present include *Centella asiatica* (Indian Pennywort), *Pratia purpurascens* (Whiteroot), *Ludwigia octovalvis* (Willow Primrose) and *Persicaria decipiens* (Slender Knotweed). Other native species present include *Cyperus polystachyos*, *Fimbristylis dichotoma* (Common Fringe-sedge) and *Eleocharis equisetina*.

ii. Justification of PCT Selection

PCTs were initially filtered using BioNet Vegetation Classification System for IBRA Region and for the key canopy species *Melaleuca quinquenervia* (Broad-leaved Paperbark). This community often grades into Swamp Oak Swamp Forest, but the change in dominant canopy species was main reason for splitting these. The resulting list was narrowed down based on landform and geology. PCT 1064 was determined to be the best fit based on the PCT Classification Confidence Level and the number of key indicator species present based on the BAM plot surveys undertaken.

Photograph 4.4 Paperbark Swamp Forest present on the subject land

4.2.4 Coastal Saltmarsh in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions

PCT: 1125

Vegetation Formation: Saline Wetlands

Vegetation Class: Saltmarshes

Area: 0.24 ha

Percent Cleared Value: 75%

TEC Status: BC Act - Coastal Saltmarsh in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions EEC

EPBC Act – Coastal Saltmarsh in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions Vulnerable Ecological Community

i. General Description

Coastal Saltmarsh occurs in the intertidal zone on the shores of estuaries and lagoons that are permanently or intermittently open to the sea. It is frequently found as a zone on the landward side of mangrove stands. Coastal Saltmarsh in the New South Wales North Coast,

Sydney Basin and South East Corner Bioregions (PCT 1125) is listed as an Endangered Ecological Community (EEC) under the BC Act and is also listed as Vulnerable under the EPBC Act.

This plant community type is located southwest of the drainage line that runs along the centre of the subject land, but located outside of the south western boundary of the development site, as shown in **Photograph 4.5**. The total area that this plant community occupies is 0.24 ha. Two of the 19 species present are exotic. It is closely associated with the tall closed forest of *Casuarina glauca* (Swamp Oak) and *Avicennia marina* (Grey Mangrove). The dominant species in this community are *Juncus kraussii* subsp. *australiensis* (Sea Rush) and *Sporobolus virginicus*. Typical coastal saltmarsh species present include *Suaeda australis* (Seablite), *Triglochin striata* (Streaked Arrowgrass) and *Sarcocornia quinqueflora* (Samphire). The canopy species present are only represented by seedlings and saplings colonising from adjacent communities such as *Casuarina glauca* (Swamp Oak), *Acacia melanoxylon* (Blackwood) and *Avicennia marina* (Grey Mangrove). Other species present include *Phragmites australis* (Common Reed), *Aegiceras corniculatum* (River Mangrove) and *Apium prostratum* (Sea Celery).

Photograph 4.5 Saltmarsh present on the subject land, located to the west of the development site

4.2.5 Mangrove - Grey Mangrove low closed forest of the NSW Coastal Bioregion

PCT: 916

Vegetation Formation: Saline Wetlands

Vegetation Class: Mangrove Swamps

Area: 0.18 ha

Percent Cleared Value: 75%

TEC Status: BC Act – Not listed

EPBC Act – Not listed

Fisheries Management Act: Listed Key Fish Habitat

i. General Description

Stands of mangroves form a low closed to open forest on mudflats along the foreshore of saltwater estuaries. Stands of *Avicennia marina* (Grey Mangrove) are often encountered in pure stands and contain very few species other than the canopy, with the understorey mostly an open mudflat sometimes with scattered saltmarsh herbs. This community protects foreshores from erosive forces of the ocean and provides a valuable ecological role in providing breeding habitat for many threatened birds, fish and crustaceans. Mangrove - Grey Mangrove low closed forest of the NSW Coastal Bioregion (PCT 916) is neither listed under the BC Act nor the EPBC Act.

This community is located in the south east of the subject land, outside of the development site, at the head waters of the drainage line that runs along the south west of the subject land. The total area that this plant community occupies is 0.18 ha and is shown in **Photograph 4.6**. The dominant canopy species within this community is *Avicennia marina* (Grey Mangrove) and to a lesser extent *Aegiceras corniculatum* (River Mangrove). *Aegiceras corniculatum* (River Mangrove) is a small tree /shrub and occurs where freshwater influences from runoff or rivers cause lower salinity levels. The understorey is this community is open mudflats or water (depending in the tide) and is occupied by seedlings of the canopy species together with root pneumatophores with sparse occurrences of *Suaeda australis* (Seablite) and *Triglochin striata* (Streaked Arrowgrass).

Photograph 4.6 Mangroves on the subject land, located to the south west of the development site

4.2.6 Non-native Vegetation Communities

i. Exotic Grassland

PCT: Not applicable

Area: 7.43 ha

TEC Status: BC Act – Not listed

EPBC Act – Not listed

Exotic grassland is not a native plant community and therefore is not assigned plant community type identification. By nature these areas are highly disturbed from past clearing, grazing and colonisation by exotic species that have established and now dominate.

The exotic grassland on site occupies the majority of the development site, as shown in **Photograph 4.7**. The total area that this plant community occupies is 7.43 ha. The dominant species in this community are exotic grasses such as *Setaria sphacelata* (South African Pigeon Grass), *Paspalum dilatatum* (Paspalum), *Axonopus fissifolius* (Narrow-leaved Carpet Grass) and *Stenotaphrum secundatum* (Buffalo Grass). Other exotic species include *Cuphea carthagenensis* (Colombian Waxweed), *Cyperus eragrostis* (Umbrella Sedge) and the vine

Ipomoea cairica. Native species present include *Cynodon dactylon* (Common Couch), *Juncus usitatus*, and *Persicaria decipiens* (Slender Knotweed).

Photograph 4.7 Exotic grassland on the subject land, located in the centre of the development site

ii. Exotic Herbfield

PCT: Not applicable

Area: 0.02 ha

TEC Status: BC Act – Not listed

EPBC Act – Not listed

Exotic herbfield is not a native plant community and therefore is not assigned plant community type identification. By nature these areas are disturbed from past clearing and subsequent colonisation by exotic species that have established and now dominate.

The exotic herbfield on the subject land occupies a small pocket of vegetation surrounded by tall closed forest in the south east of the lot boundary, located outside of the development site, as shown in **Photograph 4.8**. The total area that this plant community occupies is 0.02 ha. The dominant species in this community is the exotic herb *Sphagneticola trilobata* (Singapore Daisy). Exotic grass species present include *Setaria sphacelata* (South African Pigeon Grass), *Paspalum dilatatum* (Paspalum), *Axonopus fissifolius* (Narrow-leaved Carpet

Grass) and *Stenotaphrum secundatum* (Buffalo Grass). Exotic shrub species present include *Lantana camara* (Lantana) and *Gomphocarpus physocarpus* (Balloon Cotton Bush). Other exotic species include *Cuphea carthagenensis* (Colombian Waxweed), *Cyperus eragrostis* (Umbrella Sedge) and the vine *Ipomoea cairica*. Native species present include the non-endemic *Cynodon dactylon* (Common Couch) and *Juncus usitatus*.

Photograph 4.8 Exotic herbfield on the subject land, located to the south of the development site

4.3 Threatened Ecological Communities

As described in the native vegetation descriptions in **Section 4.2**, three TECs have been identified on the subject land, as follows:

- Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions Endangered Ecological Community (EEC);
- Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions Endangered Ecological Community (EEC); and
- Coastal Saltmarsh in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions.

The distribution of this TEC within the subject land is shown in **Figure 4.3**. A discussion of the extent of each TEC on the subject land is provided below:

4.3.1 Swamp Oak Floodplain Forest

All forms of PCT 1235 conform to the TEC Swamp Oak Floodplain Forest, although the low condition variants are considered to be highly degraded forms of the community. This PCT conforms to the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) listing for Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community. However, only the high quality variant of 1235, meets the minimum condition class for the EPBC Act listing, being a large patch (>5ha) with a mostly native understorey and is therefore classified as 'Good Quality', while the low condition variants do not. The low condition variants of PCT 1235 are small patches (between 0.5 ha and 2 ha) that are contiguous to larger patches of native vegetation, however, they do not contain a predominantly native understorey, as required to meet the minimum of 'moderate condition' under the EPBC Act listing.

Tall Closed Grassland (Phragmites australis) is a degraded wetland community, and conforms most closely to PCT 1235. It has affinities with two TEC's; Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner Bioregions and Swamp Oak Floodplain Forest on Coastal Floodplains.

Coastal Saltmarsh is frequently found as a zone landward of mangrove stands. Occasional scattered mature Avicennia marina trees occur through saltmarsh at some sites, and Avicennia (and less frequently Aegiceras corniculatum) seedlings may occur throughout saltmarsh. In brackish areas dense stands of tall reeds (Phragmites australis, Bulboschoenus spp., Schoenoplectus spp., Typha spp.) may occur as part of the community.

However the small patch of Tall Closed Grassland (Phragmites australis) is more likely to be part of Swamp Oak Forest for which the final determination states:

> *On the fringes of coastal estuaries, where soils are more saline, the ground layer may include the threatened grass species, Alexfloydia repens, as well as Baumea juncea, Juncus kraussii, Phragmites australis, Selliera radicans and other saltmarsh species.*

4.3.2 Swamp Sclerophyll Forest

The small strip of PCT 1064 present on the subject land conforms to the TEC Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions. The example present on the subject land is degraded and present in a simplified form, due to a complete lack of canopy species, and dominated by a low diversity of native midstorey and understorey species, including the characteristic shrub species; *Melaleuca quinquenervia* (Broad-leaved Paperbark). There is no minimum condition for listing under the BC Act, and the PCT does not conform to any community listed under the EPBC Act.

4.3.3 *Coastal Saltmarsh*

Small patches form a mosaic of Coastal Saltmarsh - PCT 1125, on the subject land, which conforms to the TEC Coastal Saltmarsh in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions. The patches grade into Swamp Oak Floodplain Forest. The collective area of the mosaic of Coastal Saltmarsh is 0.23 ha within the subject land.

The entire area of Coastal Saltmarsh conforms to the EPBC Act listing for Subtropical and Temperate Coastal Saltmarsh TEC, as it meets the minimum collective area of patches within the mosaic of ≥ 0.1 ha, with a distance between individual patches ≤ 30 m.

4.4 Vegetation Integrity Assessment

The native vegetation identified within the subject land was assigned to a vegetation zone based on PCTs and broad condition state. Patch sizes were subsequently assigned for each vegetation zone. The extent of vegetation zones and patch size classes within the subject land are shown in **Figure 4.4**.

Each vegetation zone was assessed using survey plots/transects (see ***Section 3.2***) to determine the vegetation integrity score. Plot/transects utilised within the BAM Calculator to determine the vegetation integrity score is provided in **Appendix A**. A flora species list for the subject land is provided in **Appendix B**. Field data sheets and electronic copies of raw data are provided separately to this document.

Vegetation zones, patch sizes and vegetation integrity scores for the development site are summarised in **Table 4.1**.

Table 4.1 Vegetation Zones

Zone	Type	Area (ha)	Direct Impact Area (ha)	Patch Size (ha)
1: PCT 1235 High Condition	Swamp Oak Swamp Forest	1.55	1.16	101.00
2: PCT 1235 Low Condition	Swamp Oak Swamp Forest	0.99	1.00	101.00
3: PCT 1064 Moderate Condition	Paperbark Swamp Forest	0.06	0.05	101.00

4.5 Groundwater Dependent Ecosystems

Due to the presence of riparian land, and coastal wetlands in close association with the subject land the Project requires an assessment of potential impacts to groundwater dependent ecosystems (GDEs). The potential presence of GDEs has been determined based on review of the GDE Atlas (Bureau of Meteorology 2018) mapping, which identifies the location of potential aquatic, terrestrial and subterranean GDEs in Australia.

According to the GDE Atlas, the Richmond River is identified as an aquatic GDE, however North Creek is not characterised as such. As described in **Section 2.2.2** and shown in **Figure 2.1,** North Creek flows close to the southern boundary of the subject land and joins the Richmond River approximately 3 km to the south, and shortly afterwards discharges into the Pacific Ocean. The entire length of the Richmond River is considered to comprise an aquatic GDE.

No terrestrial GDEs have been identified as occurring in the subject land, however the majority of the wetlands that occur in the location are considered to be terrestrial GDEs, including some in close proximity to the subject land to the north and south (see **Figure 2.1)**. These include an area of wetlands to the north of the Ballina Racetrack to the immediate south of the subject land. To the north-east of the subject land is a large area of wetlands mapped under the Coastal Management SEPP; the majority of these have been mapped as terrestrial GDEs according to the GDE Atlas. Wetland areas on the eastern side of North Creek, opposite the subject land are also mapped as terrestrial GDEs. Another area of terrestrial GDEs is mapped further to the west of the subject land, directly north of the Ballina Byron Gateway Airport.

In common with all of NSW, the subject land has been identified according to the GDE Atlas as occurring within a Subterranean GDE area.

Figure 4.1. Native vegetation extent

Legend

Development Site

Subject Land

Plant Community Type

1235: Swamp Oak swamp forest of the coastal lowlands of the NSW North Coast Bioregion

1125: Saltmarsh complex of the NSW North Coast Bioregion

1064: Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion

916: Mangrove - Grey Mangrove low closed forest of the NSW Coastal Bioregion

N/A

Image Source:
Image © Nearmap 2019
Dated: 11/3/2019

Coordinate System: MGA Zone 56 (GDA 94)

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0 50 100 150 200 m

I:\...\18187\Figures\RP1\20190611\Figure 4.2. Plant community types

Figure 4.2. Plant community types

Figure 4.3. Threatened ecological communities

Figure 4.4. Vegetation zones

Chapter 5

Threatened Species

5.1 Threatened Species for Assessment

The BAM Calculator generates a list of threatened species requiring assessment utilising a number of variables. The following criteria have been utilised to predict the threatened species requiring further assessment. Note that only the PCTs present in the development site have been used in the tool:

- IBRA subregion: Clarence Lowlands;
- Habitat constraints and Geographic constraints:
  - Second Order tributary of the North Creek within the subject land;
  - Waterbodies;
  - Within 100 m of estuarine areas and the ocean;
  - Semi-permanent/ephemeral wet areas;
  - Within 1 km of wet areas/ swamps;
  - Within 1 km of swamp/ waterbodies;
  - Within 1 km of waterbody;
  - Swamps;
  - Swamp margins or creek edges;
  - Within 200 m of riparian zone;
  - Deep permanent fresh waters on floodplains with floating and submergent vegetation;
  - Margins of salt marshes and lakes, both coastal and inland;
  - Land containing freshwater bodies.
- Associated PCTs:

- 1235; and
- 1064

- Percent native vegetation cover in the assessment area: 33%;
- Patch size:
  - PCT 1235: >100ha; and
  - PCT 1064: >100ha
- Credit type: Ecosystem and/or species.

Based on the above variables, the BAM Calculator generated a list of 26 ecosystem credit species, 52 species credit species and 13 joint ecosystem/species credit species.

5.2 Ecosystem Credit Species

Table 5.1 lists the predicted ecosystem credit species for the vegetation zones within the subject land. Based on a lack of suitable habitat features on the subject land or the development site, Yellow-bellied Glider and Koala have been removed from consideration. The reason for removal of these species is outlined in **Table 5.1**.

Table 5.1 Predicted ecosystem credit species

Scientific Name	Common Name	PCT 1064	PCT 1235	Habitat Constraint	Removed from Consideration	Reason for Inclusion or Removal
Amaurornis moluccana	Pale-vented Bush-hen	x	x	Waterbodies. Dense vegetation, within 300m of, or in shallows of streams or other natural or artificial wetlands.	No	Potential suitable habitat present
Anthochaera phrygia	Regent Honeyeater	x			No	Potential suitable habitat present
Botaurus poiciloptilus	Australasian Bittern	x	x	waterbodies, brackish	No	Potential suitable habitat present
Calyptorhynchus lathami	Glossy Black-Cockatoo	x	x	Feed trees present	No	lack of Allocasuarina species suitable for foraging
Chalinolobus nigrogriseus	Hoary Wattled Bat	x	x		No	Potential suitable habitat present
Climacteris picumnus victoriae	Brown Treecreeper	x			No	Potential suitable habitat present
Coracina lineata	Barred Cuckoo-shrike	x	x		No	Potential suitable habitat present
Daphoenositta chrysoptera	Varied Sittella	x	x		No	Potential suitable habitat present
Dasyurus maculatus	Spotted-tailed Quoll	x	x		No	Potential suitable habitat present
Ephippiorhynchus asiaticus	Black-necked Stork	x	x	swamps, open water	No	Potential suitable habitat present
Falsistrellus tasmaniensis	Eastern False Pipistrelle	x	x			
Glossopsitta pusilla	Little Lorikeet	x			No	Potential suitable habitat present
Haliaeetus leucogaster	White-bellied Sea-Eagle	x	x		No	Potential suitable habitat present

Table 5.1 Predicted ecosystem credit species

Scientific Name	Common Name	PCT 1064	PCT 1235	Habitat Constraint	Removed from Consideration	Reason for Inclusion or Removal
Hieraaetus morphnoides	Little Eagle	x	x		No	Potential suitable habitat present
Ixobrychus flavicollis	Black Bittern	x	x	waterbodies, freshwater and estuarine wetlands	No	Potential suitable habitat present
Kerivoula papuensis	Golden-tipped Bat	x	x		No	Potential suitable habitat present
Lathamus discolor	Swift Parrot	x			No	Potential suitable habitat present
Lophoictinia isura	Square-tailed Kite		x		No	Potential suitable habitat present
Miniopterus australis	Little Bentwing-bat	x	x		No	Potential suitable habitat present
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	x	x		No	Potential suitable habitat present
Mormopterus lumsdenae	Northern Free-tailed Bat	x	x		No	Potential suitable habitat present
Mormopterus norfolkensis	Eastern Freetail-bat	x	x		No	Potential suitable habitat present
Ninox connivens	Barking Owl	x	x		No	Potential suitable habitat present
Ninox strenua	Powerful Owl	x	x		No	Potential suitable habitat present
Nyctophilus bifax	Eastern Long-eared Bat	x	x		No	Potential suitable habitat present
Oxyura australis	Blue-billed Duck	x			No	Potential suitable habitat present
Pandion cristatus	Eastern Osprey	x	x		No	Potential suitable habitat present
Petaurus australis	Yellow-bellied Glider			Hollows	Yes	No hollows present in assessment area
Phascolarctos cinereus	Koala	x		Feed trees present	Yes	Complete lack of feed tree

Table 5.1 Predicted ecosystem credit species

Scientific Name	Common Name	PCT 1064	PCT 1235	Habitat Constraint	Removed from Consideration	Reason for Inclusion or Removal
						species in the assessment area.
Pomatostomus temporalis	Grey-crowned Babbler (eastern subspecies)	x			No	Potential suitable habitat present
Potorous tridactylus	Long-nosed Potoroo	x	x	Dense shrub layer or alternatively high canopy cover exceeding 70% (i.e. to capture populations inhabiting wet sclerophyll and rainforest))	No	Potential suitable habitat present
Pseudomys gracilicaudatus	Eastern Chestnut Mouse	x	x		No	Potential suitable habitat present
Pteropus poliocephalus	Grey-headed Flying-fox	x	x		No	Potential suitable habitat present
Ptilinopus superbus	Superb Fruit-Dove	x			No	Potential suitable habitat present
Rostratula australis	Australian Painted Snipe		X		No	Potential suitable habitat present
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	x	x		No	Potential suitable habitat present
Scoteanax rueppellii	Greater Broad-nosed Bat	X	x		No	Potential suitable habitat present
Stictonetta naevosa	Freckled Duck	x	x		No	Potential suitable habitat present
Syconycteris australis	Common Blossom-bat	x	X		No	Potential suitable habitat present

5.3 Species Credit Species

5.3.1 Assessment of Habitat Constraints and Microhabitats

Table 5.2 lists the species credit species predicted by the BAM Calculator and details whether the species have been further assessed based on the presence or absence of habitat constraints within the subject land. Under Section 6.4.1.13 of the BAM, further species credit species can be excluded from further assessment if an assessment of habitat constraints and microhabitats determines that the habitat within the subject land is substantially degraded such that the species credit species is unlikely to occur.

Detailed habitat assessments of the site were undertaken as described in ***Section 3.3.3***. The habitat assessments focussed on habitat features relevant to species credit species predicted to occur. This included determining the presence/absence of the habitat constraints identified for the predicted threatened species and the condition of these habitat constraints and other microhabitats.

Three threatened flora species have been excluded from consideration, including *Ancistrachne maidenii*, *Peristeranthus hillii* (Brown Fairy-chain Orchid), *and Lindernia alsinoides.* This is due to a lack of important habitat features, including sandstone derived soils, suitable for *A. maidenii*, and a lack of rainforest habitat suitable for *P. hillii (DEC (NSW) 2005, OEH 2018a)*. *Lindernia alsinoides* is known to occur in the Shannon Creek area, near Grafton, and is not recorded within the locality of the subject land, and has therefore been excluded on the basis of no known local population of the species (NSW Scientific Committee 2004).

The Regent Honeyeater and Swift Parrot have been excluded from further assessment subsequent to confirmation from OEH that no important habitat occurs within the subject land for either species. Breeding habitat for both species is limited to specific areas that are not associated with, or in the vicinity of, the subject land, therefore since the species credit species component for both species is associated with breeding habitat only, both the Regent Honeyeater and Swift Parrot were excluded from further assessment.

The habitat assessment survey completed by Cumberland Ecology in December 2018 focussed on determining if habitat for any potential species credit species (or relevant breeding component for dual credit species) was substantially degraded such that the species is unlikely to utilise the subject land or specific vegetation zone in accordance with the requirements of Step 3 (a) of Section 6.4 of the BAM.

All cave roosting bat species were excluded from assessment, due to the lack of caves or artificial roost structures within the subject land or surrounds, this includes Eastern Bentwing-bat and Little Bentwing-bat, and Large-eared Pied Bat (OEH 2019a, c, b). Likewise, a lack of nesting habitat rested in the removal of the Powerful Owl (OEH 2018c), as no hollow-bearing trees are present on the subject land or are expected in adjoining habitats, due to the landscape position on a floodplain, dominated by Swamp Oak forest, which did not appear to form hollows.

Large birds of prey, including the Little Eagle, White-bellied Sea-Eagle, Eastern Osprey and Square-tailed Kite form large stick nests for breeding (OEH 2017b, 2018e, d), and the detailed habitat assessment conducted by JWA and Cumberland Ecology over spring, summer and autumn failed to detected any nests for these species. Habitat features to support nesting for these species are also absent, including very large mature trees. For this reason, these species have been removed from consideration for relevant breeding component for these dual credit species.

Red Goshawk was also removed from further assessment due to a lack of recent records, with none occurring in the locality since the 1980's. It is also considered that the subject land lacks important habitat features, including large mature trees for nesting. The Threatened Biodiversity Data Collection information on the species states that the 'population in NSW is naturally small (probably only one pair), and lies at extreme of the natural range of species in Australia. Large mature trees are used for nesting. Significant tracts of apparently suitable habitat are not occupied suggesting threats other than land clearing may be contributing to the species on-going decline (possibly egg collection)' (OEH, 2019). Detailed habitat assessments and recording of incidental species records on the subject land by JWA and Cumberland Ecology failed to record this species, or any birds of prey.

No rainforest habitat is present, and therefore Mitchell's Rainforest Snail has been removed from consideration (OEH 2018b).

Grey-headed Flying-fox maternity camps do not occur on the subject land, and the closest known camp is at Little Fisheries Creek, located approximately 2km to the south of the subject land. The National Monitoring Program has recorded between 500 – 2500 most years, including 2018 (Department of the Environment and Energy 2018). For this reason, Grey-headed Flying-fox has not been removed from consideration further in the BAM.

Table 5.2 Species credit species assessment

Species Credit Species	Common Name	Habitat Constraint	Removed from Consideration	Reason for Inclusion or Removal
Flora				
Acronychia littoralis	Scented Acronychia	None	No	Potential suitable habitat present
Allocasuarina defungens	Dwarf Heath Casuarina	None	No	Potential suitable habitat present
Ancistrachne maidenii		None	Yes	Assessment area does not have appropriate sandstone-derived soils
Archidendron hendersonii	White Lace Flower	None	No	Potential suitable habitat present
Arthraxon hispidus	Hairy Jointgrass	None	No	Potential suitable habitat present
Callistemon linearifolius	Netted Bottle Brush	None	No	Potential suitable habitat present
Centranthera cochinchinensis	Swamp Foxglove	None	No	Potential suitable habitat present
Cyperus aquatilis	Water Nutgrass	None	No	Potential suitable habitat present
Davidsonia jerseyana	Davidson's Plum		No	Potential suitable habitat present
Dendrobium melaleucaphilum	Spider orchid		No	Potential suitable habitat present
Desmodium acanthocladum	Thorny Pea		No	Potential suitable habitat present
Diploglottis campbellii	Small-leaved Tamarind		No	Potential suitable habitat present
Drynaria rigidula	Basket Fern		No	Potential suitable habitat present
Endiandra muelleri subsp. *bracteata*	Green-leaved Rose Walnut		No	Potential suitable habitat present
Geodorum densiflorum	Pink Nodding Orchid		No	Potential suitable habitat present
Gossia fragrantissima	Sweet Myrtle	None	No	Potential suitable habitat present
Lindernia alsinoides	Noah's False Chickweed	Restricted to Shannon Creek,	Yes	The subject land is not in the

Table 5.2 Species credit species assessment

Species Credit Species	Common Name	Habitat Constraint	Removed from Consideration	Reason for Inclusion or Removal
		Grafton area		distribution of the species
Macadamia tetraphylla	Rough-shelled Bush Nut		No	Potential suitable habitat present
Maundia triglochinoides			No	Potential suitable habitat present
Melaleuca irbyana	Weeping Paperbark		No	Potential suitable habitat present
Myrsine richmondensis	Ripple-leaf Muttonwood		No	Potential suitable habitat present
Oberonia titania	Red-flowered King of the Fairies		No	Potential suitable habitat present
Ochrosia moorei	Southern Ochrosia		No	Potential suitable habitat present
Olax angulata	Square-stemmed Olax		No	Potential suitable habitat present
Oldenlandia galioides			No	Potential suitable habitat present
Peristeranthus hillii	Brown Fairy-chain Orchid	Rainforest habitat and rocks	Yes	Subject land does not contain rainforest habitat
Persicaria elatior	Tall Knotweed		No	Potential suitable habitat present
Petalura litorea	Coastal Petaltail		No	Potential suitable habitat present
Phaius australis	Southern Swamp Orchid		No	Potential suitable habitat present
Phyllanthus microcladus	Brush Sauropus		No	Potential suitable habitat present
Polygala linariifolia	Native Milkwort		No	Potential suitable habitat present
Rotala tripartita			No	Potential suitable habitat present
Syzygium hodgkinsoniae	Red Lilly Pilly		No	Potential suitable habitat present

Table 5.2 Species credit species assessment

Species Credit Species	Common Name	Habitat Constraint	Removed from Consideration	Reason for Inclusion or Removal
Fauna				
Anthochaera phrygia (breeding)	Regent Honeyeater	Mapped area	Yes	Subject land not within mapped area for the species
Argynnis hyperbius	Laced Fritillary	Arrowhead Violet (Viola betonicifolia)) host plant present	Yes	Host plant, Arrowhead Violet, not present in assessment area
Cacophis harriettae	White-crowned Snake	Litter|Rocky areas Surface rocks|Fallen/standing dead timber including logs Or within 50m of fallen timber including logs	No	Subject land does not contain rocky habitat or dense litter. However, some logs are present. In the absence of survey, this species could not be discounted.
Calyptorhynchus lathami (breeding)	Glossy Black-Cockatoo	Large tree hollows	Yes	Subject land does not contain tree hollows
Cercartetus nanus	Eastern Pygmy-possum		No	Potential suitable habitat present
Chalinolobus dwyeri (breeding)	Large-eared Pied Bat	Cliff and cave habitat	Yes	Assessment area does not contain cliff or cave habitat
Crinia tinnula	Wallum Froglet		No	Potential suitable habitat present
Dromaius novaehollandiae - endangered population	Emu population in the New South Wales North Coast Bioregion and Port Stephens local government area		No	Potential suitable habitat present

Table 5.2 Species credit species assessment

Species Credit Species	Common Name	Habitat Constraint	Removed from Consideration	Reason for Inclusion or Removal
Haliaeetus leucogaster (breeding)	White-bellied Sea Eagle	Stick nests in tall large trees	Yes	No stick nest present on the subject land
Hieraaetus morphnoides	Little Eagle		No	Potential suitable habitat present
Hoplocephalus bitorquatus	Pale-headed Snake		No	Potential suitable habitat present
Lathamus discolor (breeding)	Swift Parrot	Mapped area	Yes	Subject land is not within mapped area
Litoria aurea	Green and Golden Bell Frog	Population within the locality	Yes	No records of a population within the locality since 1970's. Assumed to be locally extinct.
Litoria brevipalmata	Green-thighed Frog		No	Potential suitable habitat present
Litoria olongburensis	Olongburra Frog		No	Potential suitable habitat present
Lophoictinia isura (breeding)	Square-tailed Kite		Yes	No nests present on the subject land
Miniopterus australis	Little Bentwing-bat	Caves and artificial structures	Yes	No caves or artificial structures suitable for roosting and breeding present on the subject land.
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	Cave, tunnel, mine, culvert or other structure known or suspected to be used for breeding	Yes	No caves or artificial structures suitable for roosting and breeding present on the subject land.
Myotis macropus	Southern Myotis		No	Potential suitable habitat present

Table 5.2 Species credit species assessment

Species Credit Species	Common Name	Habitat Constraint	Removed from Consideration	Reason for Inclusion or Removal
Ninox strenua (breeding)	Powerful Owl	Large tree hollows	Yes	Subject land does not contain tree hollows
Pandion cristatus (breeding)	Eastern Osprey	Stick nests in tall large trees	Yes	Subject land does not contain stick nests in tall large trees
Petaurus norfolcensis	Squirrel Glider	Hollows	Yes	Habitat degraded and small for this species and lacking required feed trees such as Eucalypt and Acacia sp.
Phascogale tapoatafa (breeding)	Brush-tailed Phascogale	Hollows	Yes	Habitat degraded and small for this species and lacking required feed trees such as Eucalypt and Acacia sp. Subject land does not contain tree hollows
Phascolarctos cinereus (breeding)	Koala	Areas identified via survey as important habitat: Important' habitat is defined by the density of koalas and quality of habitat determined by on-site survey.	Yes	No feed trees present on the subject land. No areas of important habitat identified in the assessment area.
Planigale maculata	Common Planigale		No	Potential suitable habitat present
Pteropus poliocephalus (breeding)	Grey-headed Flying-fox	Maternity camps	Yes	No maternity camps are known to occur on the subject land, although a recorded camp is present in Little

Table 5.2 Species credit species assessment

Species Credit Species	Common Name	Habitat Constraint	Removed from Consideration	Reason for Inclusion or Removal
				Fisheries Creek, a tributary of North Creek, located to the south of the subject land. For this reason, Grey-headed Flying-fox is considered further on a precautionary basis.
Thersites mitchellae	Mitchell's Rainforest Snail	Rainforest habitat	Yes	Subject land does not contain rainforest habitat
Todiramphus chloris	Collared Kingfisher	Hollow bearing trees Hollows in large mangrove trees, or hollows or arboreal termitaria in Eucalyptus or Melaleuca adjacent to mangroves and estuarine foraging habitat	Yes	No suitable habitat present in the assessment area

5.3.2 Candidate Species for Further Assessment

Candidate species indented for further assessment are listed **Table 5.2**.

5.3.3 Presence of Candidate Species

i. Surveys

Targeted surveys for the candidate species credit species for further assessment undertaken within the subject land are described in ***Section 3.3***. Additional targeted surveys were undertaken for the species credit species that required no further assessment throughout the additional survey period due to the opportunity to do so within the additional December period as described in ***Section 3.3***.

Surveys were limited to detailed habitat assessments for fauna species, flora surveys during the flowering period of most species (summer and spring) and random meander surveys throughout the entire area of the subject land, as described in **Section 3.3**.

Where species were not surveyed, their presence was assumed.

ii. Species Occurrence

None of the candidate species credit species were detected within the subject land, nor was any suitable breeding habitat such as nests observed for these species. As these species were not recorded within the subject land, or considered likely to utilise the habitat within the subject land, no further assessment is required for species credit species.

5.4 Prescribed Impacts

Prescribed impacts are outlined within the NSW *Biodiversity Conservation Regulation 2017*. The project is considered to result in a number of prescribed impacts outlined in **Table 5.3**.

Table 5.3 Identification of Prescribed Impacts on the Development Site

Feature	Present (Yes/No)	Description of feature characteristics and location	Potential Impact	Threatened Species or community using or dependent on feature	Section of BDAR where impact is addressed
Karst, caves. Crevices, cliffs or other geologically significant feature	No	N/A	Feature not present within site	N/A	N/A
Rocks	No	N/A	Feature not present within site	N/A	N/A
Human-made structure	No	N/A	Feature not present within site	N/A	N/A
Non-native vegetation	Yes	Exotic vegetation is present in the form of exotic grassland and her bland.	Reduce extent of potential foraging habitat for species	*Litoria brevipalmata, Crinia tinnula*	Section 6.1.2 Chapter 6
Connectivity of different areas of habitat that facilitates movement across a species' range	Yes	Vegetated corridor along the western margin of the subject land	Reduce connectivity between habitats and accessibility to habitat for species	All fauna species	Section 6.1.2 Chapter 6
Movement of threatened species that maintains their lifecycle	Yes	Swamp Oak Floodplain Forest (high quality) in association with riparian areas.	Removal of foraging habitat	Threatened migratory birds	Section 6.1.2 Chapter 6
Water quality, water bodies and hydrological processes	Yes	Coastal Wetlands, North Creek tributary and riparian zone	Disturbance of tidal flow potential to affect the health of TEC's and wetland habitats	Swamp Oak Floodplain Forest, Swamp Sclerophyll Forest and Saltmarsh TECs, and threatened migratory birds	Section 6.1.2, Chapter 6
Wind turbine strikes	No	N/A	No wind farm proposed on site	N/A	N/A
Vehicle strikes	Yes	Increased truck movements	Vehicle strikes possible during	All fauna species	N/A

Table 5.3 Identification of Prescribed Impacts on the Development Site

Feature	Present (Yes/No)	Description of feature characteristics and location	Potential Impact	Threatened Species or community using or dependent on feature	Section of BDAR where impact is addressed
		during construction phase. Increase localised traffic during operation phase.	construction. Additional localised traffic during operational phase unlikely to be a risk to threatened species.		
Other	No	N/A	No additional prescribed impacts identified	N/A	N/A

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Chapter 6

Avoid and Minimise Impacts

6.1 Avoid and Minimise Impacts

This section includes demonstration of efforts to avoid and minimise impact on biodiversity values identified within the subject land, which includes assessment of direct and indirect impacts.

6.1.1 Avoid and Minimise Direct Impacts

i. Project Location

The Project has been situated within the subject land to allow the development site to provide for the operational requirements of the site, yet minimise impacts to areas of biodiversity values.

Therefore the proposed development will avoid and minimise direct impacts on clearing of native vegetation and habitat by:

- Locating the project predominantly in areas where there are low to no biodiversity values (such as in the exotic dominated pasture);
- Situating the development site to minimise clearing of native vegetation that is a TEC;
- Locating the project to reduce impacts to waterways; and
- Incorporating comprehensive water cycle management measures, including bioretention basins and grassed swales, and construction controls including gross pollutant traps (Martens and Associates 2019)

ii. Consideration of Alternative Locations

Alternative development layouts were considered throughout the planning stage, and the current layout has been developed to respond to ecological and hydrological concerns raised by Council and OEH in relation to the Project. The footprint has been significantly reduced, to both minimise impacts on TECs and adjoining Coastal Wetlands. The current layout is the fifteenth revision, and includes APZs within the total footprint, whereas the original DA did not. The most recent revision (as shown in **Figure 3.1**), provides the entire development site within the SCC boundary.

Alternative development layouts have included access from the proposed development through the existing palm Lake Resort, in order to avoid use of North Creek Road, which is narrow in width and is adjoined both sides by mangrove and swamp oak vegetation. However, due to traffic concerns, the access was relocated, in response to the Statement of Facts and Contentions.

Significant changes to the water cycle management systems have been incorporated into the amended layout, and this has minimised any potential indirect impacts.

iii. Consideration of Project Design

The project design has been developed to avoid and minimise clearing of native vegetation and habitats by minimising the clearing footprint to include only the operational footprint and the APZ, which contains the entire construction footprint. All ancillary works for water cycle management will be contained within the development site. By retaining all works within the one development site, and in areas of the least biodiversity values practical, the Project will avoid and minimise direct impacts to native vegetation and habitats through:

- Reducing the overall clearing footprint of the project;
- Locating facilities in areas where the native vegetation or threatened species habitat will be least impacted; and
- Ensure that indirect impacts to adjoining Coastal Wetlands are managed and contained.

The Project will include as a design component the retention of the remaining native vegetation and habitat within the subject land, where compliant with the approval for the existing Palm Lake Resort (which includes provisions for APZs to that development). The retained vegetation will be managed under a fully funded (for a five year duration) Vegetation Management Plan (VMP). The VMP will focus on restoring riparian habitats and buffering the Coastal Wetlands, while complying with the bushfire protection and mosquito management requirements of the existing development.

6.1.2 Avoid and Minimise Prescribed Impacts

Measures to avoid and minimise prescribed impacts identified in ***Section 5.4*** are outlined below.

i. Non-native Vegetation

The majority of the subject land contains non-native vegetation, in the form of exotic pasture and also a small patch of exotic herbfield. No overstorey vegetation was recorded in these areas, and due to the long history of agriculture and clearing, it is considered to be too degraded to regenerate to any form of woodland or forest. For this reason, the non-native vegetation offers very limited habitat for threatened species. However, during inundation, the grassland areas may be utilised for foraging and potentially for breeding by threatened frog

species, including Green-thighed Frog, Olongburra Frog and Wallum Froglet. However, the exotic grassland is unlikely to be favoured over the adjoining intact wetland habitats.

Avoidance of impacts to these species will include the correct installation of sediment and 'frog-proof' fencing around the construction site, to avoid entry by these species. Additionally, supplementary habitat will be created in the riparian areas under the VMP, and in water cycle management basins.

ii. Connectivity

The development has been designed to avoid impacts to native vegetation; hence the development will only remove a relatively small area of native vegetation/habitat within the subject land. The vegetation to be removed consists of low condition isolated fragments surrounded by exotic dominated pasture, which adjoins more intact areas of native vegetation and Coastal Wetland habitats. As the development site is located to the east of the main corridor of habitat, no fragmentation will occur, and it is not expected that connectivity will be reduced. Threatened birds and bats may occasionally utilise this area for movement throughout the landscape and between areas of habitat, however none are likely to rely on the highly fragmented, small areas of habitat available within the development site.

iii. Movement of Threatened Species

Small patches of native vegetation and the removal of small edge areas from a larger patch of forest will be removed that may act as part of threatened woodland bird movements; however it is considered unlikely that any birds would be solely reliant or regularly utilising the highly degraded and exposed habitat within the subject land.

iv. Water quality, water bodies and hydrological processes

Changes to drainage lines can affect the integrity, structure and composition of habitat and thus, have secondary impacts on the species that rely on them. This is particularly relevant to the subject land because the most important habitats are swamp forests, mangroves and saltmarsh that are reliant on specific hydrological regimes. The proposed development will result in the removal of only small edge areas of swamp forest, and no removal of mangroves or saltmarsh. The proposed development has been developed with particular regard to maintaining and improving the hydrological regime in the study area. With the implementation of the proposed hydrological regimes, it is expected that habitat quality in the areas of retained swamp oak floodplain forest, mangroves and saltmarsh, and the areas of created wetland and saltmarsh will be higher than at present.

v. Vehicle Strikes

The construction of the development site will result in additional trucks and vehicles that will be accessing the site will increase the risk of fauna vehicle strike. This has been minimised by restricting the additional vehicles and construction to an area primarily devoid of native vegetation that could act as habitat for threatened species. Accordingly, the chance of vehicle strike to species, particularly threatened bird species, is substantially reduced by avoidance of areas most likely to facilitate the movements and foraging of these species.

Chapter 7

Impact Assessment

7.1 Assessment of Impacts to Native Vegetation and Habitat

7.1.1 Direct Impacts

The primary and direct impact resulting from the proposed development is the loss of vegetation and associated habitat within the subject land.

i. Impacts on Vegetation Communities

The proposed development will result in the removal of Swamp Oak Floodplain Forest and Swamp Sclerophyll Forest TECs for the construction of the seniors housing development, APZ and ancillary works.

Table 7.1 identifies the areas of vegetation to be removed from within the development footprint. Further details on management of retained vegetation in the wider subject land is provided within the VMP prepared by Cumberland Ecology.

Table 7.1 Areas of Vegetation on the Subject Land and Removed from the Development Site

Name	PCT	Condition	TEC_BC_Act	Present on Subject Land (ha)	Removed from Development Site (ha)
Tall closed forest to 16m (Acacia melanoxylon +/- Casuarina glauca)	1235	High	Swamp oak floodplain forest of the NSW North Coast, Sydney Basin and South East Corner bioregions	1.41	0.67
Tall closed forest (Casuarina glauca +/- Avicennia marina)	1235	High	Swamp oak floodplain forest of the NSW North Coast, Sydney Basin and South East Corner bioregions	2.11	0.20
Coastal saltmarsh (Juncus kraussii/Sporobolus virginicus)	1125	High	Coastal saltmarsh in the NSW North Coast, Sydney Basin and South East Corner bioregions	0.24	0.00
Singapore daisy herbfield (Sphagneticola trilobata)	N/A	N/A	N/A	0.02	0.00
Tall closed forest to 18m (Casuarina glauca +/- Acacia melanoxylon)	1235	High	Swamp oak floodplain forest of the NSW North Coast, Sydney Basin and South East Corner bioregions	8.07	0.37
Mangrove closed forest (Avicennia marina/Aegiceras corniculatum)	916	High	N/A	0.18	0.00
Tall Shrubland to 6 m (Melaleuca quinquenervia)	1064	Moderate	Swamp sclerophyll forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions	0.06	0.05
Highly degraded Swamp Oak forest	1235	Low	Swamp oak floodplain forest of the NSW North Coast, Sydney Basin and South East Corner bioregions	0.92	0.92
Tall closed grassland to 2.5 m (Phragmites australis)	1235	Low	Swamp oak floodplain forest of the NSW North Coast, Sydney Basin and South East Corner bioregions	0.38	0.07
Tall Closed grassland to 2m (Setaria sp.)	N/A	N/A	N/A	7.44	5.33

ii. Loss of Specific Habitat Features

The majority of the habitat, albeit degraded habitat, for native fauna in the subject land is in the areas of native vegetation. Overall, more than half of the native vegetation on site and the majority of the habitat features will be retained under the proposed development, and will be managed under a VMP.

Nevertheless, the proposed development will result in the loss of some existing habitat in the form of swamp oak floodplain forest, small strips of swamp sclerophyll forest and non-native grassland and herbfield vegetation.

iii. Threatened and Migratory species

No threatened flora species have been recorded from the subject land and none are considered likely to be affected by the proposed development.

7.1.2 Change in Vegetation Integrity Score

The changes in vegetation integrity scores as a result of clearing are documented for each vegetation zone in **Table 7.2** below.

For the purposes of this BDAR, it has been assumed that the future integrity score of each vegetation zone will be zero (0) following development. Some native vegetation will be planted within the APZ, as specified in the Landscape Plan (Site Image, 2019), which will result in a future vegetation integrity score above zero. However, due to earthworks proposed for battering and construction of bioretention basins, and the difficultly in estimating the future vegetation integrity score within the APZ, it has been assumed based on complete and permanent removal, on a precautionary basis.

Table 7.2 Change in vegetation integrity score

Zone	Name	PCT	Condition	Area (ha)	Current Vegetation Integrity Score	Future Vegetation Integrity Score
1	1235_High	1235-Swamp Oak swamp forest of the coastal lowlands of the NSW North Coast Bioregion	High	1.25	22.8	0
2	1235_Low	1235-Swamp Oak swamp forest of the coastal lowlands of the NSW North Coast Bioregion	Low	1.00	39.5	0
3	1064_Moderate	1064-Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion	Moderate	0.05	33.9	0

7.1.3 Indirect Impacts

The following indirect impacts to native vegetation and habitat may occur as a result of the Project:

- Inadvertent impacts on adjacent habitat or vegetation;
- Reduced viability of adjacent habitat due to noise, dust or light spill;
- Increased sedimentation and erosion; and
- Inadvertent impacts to hydrological processes.

i. Inadvertent Impacts on Adjacent Habitat or Vegetation

a. Nature and Extent

The vegetation within the subject land that will be removed is centred on disturbed land, although riparian and coastal wetland habitats adjoin the development site. Removal of the small edge areas of native vegetation and construction activities associated with the new development are unlikely to inadvertently impact on the adjacent habitat beyond potential minor loss of connectivity that could act as "stepping stone" habitat.

There is some potential for the minor road upgrade works in association with North Creek Road to indirectly impact the wetland habitats that adjoin the road, and down-stream environment, including Priority Oyster Aquaculture Areas to the south.

b. Duration

Impacts on adjacent habitat or vegetation are likely to be long term. The road upgrade works have an elevated potential for impacts to adjoining wetlands during the construction phase.

c. Likely Affected Threatened Entities

There is a potential for the following threatened entities to be affected:

Swamp Oak floodplain forest of the NSW North Coast (EEC) and all threatened fauna species with potential to occur.

d. Consequences

The construction of the Project will result in removal or modification of approximately 2.29 ha of native vegetation that has some, albeit very minor, connectivity to adjacent vegetation and habitats that could be used by threatened species as they traverse throughout the landscape. However, this vegetation is predominantly in low condition and is scattered such that is unlikely to be solely relied upon by any threatened species, or contribute substantially to genetic flow between adjacent areas of habitat.

Although the edge 'ratios' within the subject land may increase, the increase is not due to fragmentation of existing vegetation but due to the proposed establishment of vegetation corridors through currently cleared land (as seen in **Figure 7.1**). Additionally, the vegetation will be managed and edge effects, such as weed encroachment and disturbance will be better controlled than current conditions. Hence, the consequences of the edge effects is expected to be nil or minimal.

The road upgrade works, and increased traffic using North Creek Road have the potential to increase sediment run-off and nutrients entering the waterway, to a minor extent. However, the increases are not likely to be greatly exacerbated beyond current conditions, as the road is inundated during high flows, and water quality in North Creek is fairly poor overall. It is expected that the water cycle management measures proposed as part of the development will improve water quality, and therefore the consequences of increased run-off are expected to be negligible.

ii. Reduced Viability of Adjacent Habitat Due to Noise, Dust or Light Spill

a. Nature and Extent

Noise, dust and light spill will be exacerbated by construction activities, resulting from truck movements, machinery and lighting (if night work is proposed).

b. Duration

Increases in noise, dust and light are expected to last in the short-term for the duration of the construction activities of the Project.

c. Likely Affected Threatened Entities

There is a potential for the Swamp Oak Floodplain Forest TEC to be affected.

d. Consequences

The potential increase in noise, dust and light from the proposed development is unlikely to significantly impact the Swamp Oak Floodplain Forest TEC and adjacent habitats. The area of vegetation is already subject to the moderate levels of noise, dust and light from the traffic of North Creek and Corks Road, the operation of the Ballina Airport, and the surrounding agricultural and industrial infrastructure. The minor increase in light, noise and dust from the Project is unlikely to be such that it would reduce the viability of the adjacent habitats surrounding the subject land.

iii. Inadvertent impacts to hydrological processes

a. Nature and Extent

The location and design of the development site have been modified so that it avoids the inclusion of wetlands in the subject land and the majority of the secondary watercourse present within the subject land.

Nevertheless, a proposed minor access road will cross the secondary watercourse to provide access to the existing road network within the existing Palm Lake Resort development. This is considered unlikely to inadvertently alter the hydrological regime in the secondary watercourse as the road crossing is suspended above the 1 in 100 year flood level.

Any alterations to hydrology have the potential to impact on saltmarsh and mangroves, which represent key fish habitats. Either a reduction or increase in flows have the potential to impact on these communities.

There is also minor potential for sedimentation to occur in the secondary watercourse and North Creek to occur as a result of the construction phase of the Project.

Sediment control and reduction measures in accordance with Managing Storm Water: Soils and Construction – Volume 1, 4th Edition "The Blue Book" (2004) will also be employed to minimise impacts on water quality in the secondary watercourse and North Creek. Additionally, the development site has been located outside the 20 m buffer applied to the North Creek tributary and will thereby avoid impacts to the most ecologically significant watercourse in the vicinity of the subject land.

b. Duration

Impacts to hydrological processes are expected to be short term in the secondary watercourse and are likely to be limited to the construction phase only. In the long term, the existing hydrological regime will persist due to the design of the creek crossing that permits water flow underneath it.

In the unlikely event that sedimentation occurs in North Creek as a result of the construction stage of the Project, this impact will be short term.

c. Likely Affected Threatened Entities

There is a potential for the Swamp Oak Floodplain TEC to be affected.

d. Consequences

The potential impacts to hydrological processes are unlikely to significantly impact the Swamp Oak Floodplain Forest TEC and adjacent habitats. The design of the crossings and water cycle management measures will limit any alterations to natural hydrological processes such that would affect this community and associated habitats.

7.1.4 Groundwater Dependent Ecosystems

a. Nature and Extent

No GDEs have been identified as occurring in the subject land, however the majority of the wetlands that occur in the locality along North Creek are mapped as terrestrial GDEs by the GDE Atlas, including some in close proximity to the subject land to the north and south (see **Figure 2.1**). There is also potential for riparian vegetation adjacent to the subject land

associated with North Creek and the secondary watercourse to have root access to alluvial groundwater. This vegetation is not considered likely to be completely dependent on groundwater, with the water balance for this vegetation likely comprising rainfall, surface water and water stored in the soil.

The Project does not include the extraction of groundwater and no areas comprising known GDE vegetation are unlikely to be significantly impacted by the Project.

b. Duration

Impacts to GDEs (if they occur) are expected to be long-term. No impact to GDE vegetation is considered likely to occur however.

c. Likely Affected Threatened Entities

There is a potential for the Swamp Oak Floodplain Forest TEC to be affected. Associated wetland species, including threatened frogs, and foraging habitat for Southern Myotis and Grey-headed Flying-fox have potential to be impacted.

d. Consequences

The potential indirect impacts to GDEs are unlikely to be significant. The vegetation within the subject land and adjacent areas may have some access to alluvial groundwater, however are unlikely to rely on it as a sole water source. The proposed development is not expected to exacerbate any impacts on GDEs as it does not include the extraction of groundwater.

7.2 Assessment of Prescribed Impacts

The following prescribed impacts are potentially relevant to the proposal:

- The impacts of development on the habitat of threatened species or ecological communities associated with human made structures;
- Impacts of development on the threatened species that utilise the non-native vegetation within the subject land;
- Impacts of development on the connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range;
- Impacts of the development on movement of threatened species that maintains their life cycle;
- Impacts of development on water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities; and

- Impacts of development on threatened species that may occur as a result of vehicle strike.

These are discussed in detail in subsequent sections.

7.2.1 Connectivity of Different Areas of Habitat that Facilitates Movement Across a Species Range

The development has been designed to avoid impacts to native vegetation to the highest extent possible; hence the development will only remove a relatively small area of native vegetation/habitat within the subject land. The vegetation to be removed consists of low condition isolated fragments surrounded by existing development, agricultural and an airport. The proposed removal of these relatively small isolated areas of vegetation and marginal habitat would very minimally add to fragmentation further than current conditions, as the development site is located at the western edge of a large patch of contiguous vegetation. While the minor connectivity on the subject land may provide for the occasional "stepping stone" for threatened species movement throughout the landscape for threatened birds and bats; it is unlikely these degraded and highly fragmented areas would be relied upon by any threatened species to facilitate movements between habitats throughout their range.

7.2.2 Movement of Threatened Species that Maintains their Lifecycle

The project design has aimed to reduce the development site where feasible and the current layout will allow for the retention of the majority of high condition native vegetation on the subject land, which includes the Coastal Wetlands. These retained areas will provide for any movement of threatened species required to maintain their lifecycle, and will contribute to the larger corridor of habitat located to the east.

7.2.3 Water quality, water bodies and hydrological processes

Changes to drainage lines can affect the integrity, structure and composition of habitat and thus, have secondary impacts on the species that rely on them. This is particularly relevant to the subject land because the most important habitats are swamp forests, mangroves and saltmarsh that are reliant on specific hydrological regimes. The proposed development will result in the removal of only small edge areas of swamp forest, and no removal of mangroves or saltmarsh. The proposed development has been developed with particular regard to maintaining and improving the hydrological regime in the study area. With the implementation of the proposed hydrological regimes, it is expected that habitat quality in the areas of retained swamp oak floodplain forest, mangroves and saltmarsh, and the areas of created wetland and saltmarsh will be higher than at present.

7.2.4 Vehicle Strike

The construction of the development site will result in any increase in trucks and vehicles that will be accessing the site, and will increase the risk of fauna vehicle strike. This has been minimised by restricting the speed and number of trucks accessing the site, and use of the existing roads, to be implemented through the future Construction Environmental Management Plan. Accordingly, the chance of vehicle strike to species, particularly

threatened bird species, is substantially reduced by avoidance of areas most likely to facilitate the movements and foraging of these species.

7.3 Impacts to Coastal Wetlands

7.3.1 Mapped Coastal Wetlands

Land mapped as Coastal Wetlands under the Coastal Management SEPP occurs in the subject land, as shown in **Figure 2.1**; however none occurs in the development site. Additional areas of Coastal Wetlands occur outside the subject land along North Creek to the north and south. The closest Coastal wetlands to the development site are located outside of the subject land to the south along North Creek and adjoining North Creek Road, and within the subject land to the north-east. This area of Coastal Wetlands is connected to a much larger patch of wetland to the north of the subject land along North Creek.

The SEPP Coastal Wetlands that adjoin North Creek Road are located very close to the proposed construction area for the proposed road widening, and there is the potential for indirect impacts in this location, and downstream aquatic habitats, including Priority Oyster Aquaculture Areas. However, the road upgrade works are very minor in nature, and it is expected that with the implementation of appropriate mitigation measures to protect water quality in this sensitive environment, no reduction in water quality will be experienced.

No area of SEPP Coastal Wetland will be removed by the project, and none is located within the development site. There is potential for some indirect impacts to occur to SEPP Coastal Wetlands outside the development site through erosion and sedimentation caused by construction works, however these potential impacts will be avoided through the implementation of appropriate erosion and sedimentation control measures. These are described in more detail in **Section 7.6** and include avoiding soil disturbance prior to rainfall, covering soil stockpiles when not in use, stabilising areas of disturbed ground and the installation of sediment fences on the perimeter of the works area. With the implementation of these measures, sedimentation is unlikely to impact on nearby areas of Coastal Wetlands.

7.3.2 Mapped Proximity Area

The development site includes land mapped as 'Proximity Area' to the Coastal Wetlands, which acts effectively as a buffer area. The proposed development is contained primarily outside of the Proximity Area, although parts of the APZ and ancillary works for water cycle management contained in the Proximity Area. The purpose of the Proximity Area is to protect the Coastal Wetlands from impacts from surrounding development. The proposed mitigation measures implemented for protection of the Coastal Wetlands are compatible with the function of the Proximity Area (wetland buffer). The results of the hydrological studies by Martens and Associates indicate that the proposed development will not increase frequent flows or negatively affect the hydrological regime at the sensitive receiving environments. Additionally, the provision of unlined biofiltration systems increases the opportunity for ground water recharge and maintain a neutral hydrological outcome (Martens and Associates, 2019). Therefore it is not expected to have a negative impact on the ecological function of the SEPP Coastal Wetlands, and GDEs present.

The proposed water cycle management system is consistent with the principles of Water Sensitive Urban Design (WSUD) as the proposed treatment strategy utilises 'at source' controls and a 'treatment train' rather than relying solely on large end of line structures (Martens and Associates, 2019).

Results of the studies indicate that Ballina Shire Council, SEPP (Coastal Management) 2018 and SEPP 62 water quality objectives will be met by the proposed stormwater treatment train. Further refinement of the model at detailed design stage may alter the sizes and locations of proposed treatment structures; however, performance outcomes of the final design are to achieve the water quality objectives adopted in this report (Martens and Associates, 2019).

The quality of water entering the wetlands is expected to be equal to improved beyond current conditions, due to the improved water cycle management measures proposed as part of the development (Martens and Associates, 2019). This will ensure that although some works are proposed in the Proximity Area, including APZ management and water management structures, indirect impacts on SEPP Coastal Wetlands will not be exacerbated.

7.4 Impacts to Key Fish Habitats

Marine vegetation including mangroves, saltmarshes, seagrass and seaweeds is considered to be 'key fish habitat' and is protected under the FM Act.

Several vegetation communities in the subject land are considered to contain elements of such vegetation and are therefore considered to comprise key fish habitat. These include the following:

- Tall closed forest (*Casuarina glauca* +/- *Avicennia marina*);
- Mangrove closed forest (*Avicennia marina*/*Aegiceras corniculatum*); and
- Coastal saltmarsh (*Juncus kraussii*/*Sporobolus virginicus*).

In the subject land these communities occur along the secondary watercourse that runs from north to south down the western boundary, and ultimately into North Creek. The majority of the occurrence of these communities is located outside the development site, however; a small area (approximately 0.18 ha) of Tall closed forest (*Casuarina glauca* +/- *Avicennia marina*) is present in the development site and will be removed. As this vegetation contains some Grey Mangrove vegetation (*Avicennia marina*), it is considered to comprise key fish habitat.

The significance of this community as fish habitat is considered to be low and it is located adjacent to degraded grassland. Within this community, *Avicennia marina* is only a component of the vegetation, and *Casuarina glauca* is co-dominant. That notwithstanding the area of Tall closed forest (*Casuarina glauca* +/- *Avicennia marina*) to be removed is very small, and is located on the periphery of larger areas of this community along the secondary

watercourse that will remain. The majority of this community and other associated communities along the secondary watercourse will remain and continue to provide similar levels of habitat for fish.

There is potential for some indirect impacts such as erosion and sedimentation caused by construction works to occur to mangrove vegetation along the secondary watercourse as well as areas of mangrove vegetation outside the subject land to the south along North Creek. These potential impacts will be avoided through the establishment of a riparian buffer (of 20m from each bank) and implementation of appropriate erosion and sedimentation control measures, as well as the complex water cycle management system, as described above. These are described in more detail in **Section 7.6** and include avoiding soil disturbance prior to rainfall, covering soil stockpiles when not in use, stabilising areas of disturbed ground and the installation of sediment fences on the perimeter of the works area. With the implementation of these measures, sedimentation is unlikely to impact on areas of fish habitat either within or outside of the subject land. Furthermore, with due consideration to the location of the developable SCC boundary, relative to Type 1 and Type 2 habitats, the maximum feasible buffers as required by the Policy and Guidelines for Key Fish Habitats, have been provided to further reduce indirect impacts on Type 1 (saltmarsh) and Type 2 (mangroves) habitats. The vegetation/habitats within these buffer areas will be managed/improved compared to current under a VMP thus improving the quality of key fish habitats in the long-term.

7.5 Impacts to Priority Oyster Aquaculture Areas

As described for the Coastal Wetlands, the primary impacts to Primary Oyster Aquaculture Areas result from the potential decrease in water quality entering North Creek. This impact is managed by the buffer to the Coastal Wetlands in the east, the restriction of works to the road corridor in the south, and implementation of a suite of mitigation measures, as described further in **Section 7.6**. No uncontrolled run-off will enter the Priority Oyster Aquaculture Areas in the south, and the implementation of the water cycle management system will ensure that water quality will be maintained or improved in North Creek.

7.6 Mitigation Measures for Impacts to Native Vegetation and Habitat

A range of mitigation measures have been developed for this project to mitigate the impacts that are unable to be avoided using the measures outlined previously. These include a range of measures to be undertaken before and during construction to limit the impact of construction, enhance the retained vegetation and weed control measures.

These measures are discussed in more detail below.

7.6.1 Construction Mitigation Measures

i. Timing of Construction Works

In order to minimise impacts to amphibians, bulk earthworks within the vicinity of the North Creek Tributary will either be:

- Undertaken during the winter months when movement of amphibian species is not occurring; or
- Undertaken during periods of no ephemeral pooling of water in the tributary; or
- Undertaken after a pre-clearance inspection by a qualified ecologist determines no amphibian presence at that time.

ii. Delineation of Clearing Areas

Areas that require clearance will be flagged and clearly delineated by temporary fencing to ensure that no areas intended for conservation will be inadvertently cleared during the construction process. No machinery will be parked on areas beyond the temporary fencing and no access will be allowed during construction. Ancillary facilities such as stockpile sites, site compounds and construction zones will not be located beyond the limits of clearing.

A frog-proof fence is to be installed around the wetland areas, to avoid frogs entering the construction site.

iii. Pre-clearance Surveys

In order to avoid impacts to fauna species during construction, pre-clearance surveys will be conducted in all areas that are required to be cleared. Pre-clearing surveys will be undertaken ahead of clearing, to limit fauna injury and mortality and to identify habitat features to be relocated. Pre-clearance surveys will be conducted by suitably qualified ecologists and all fauna found during these surveys will be encouraged to move on or relocated by the ecologists in areas of similar habitat nearby that will not be impacted.

Pre-clearing protocols will include:

- Checking trees for the presence of bird nests and arboreal mammals, such as possums, gliders and bats, prior to felling;
- Animals found to be occupying trees and habitat will be safely removed before the clearing of trees and relocated into nearby habitats;
- Checking wetland vegetation for frogs, immediately prior to clearing of any wetland vegetation; and
- Boulders and large logs will be placed in nearby areas of retained vegetation to allow their continued use as fauna habitat.

iv. Sedimentation Control Measures

One of the potential impacts of the project is increased sedimentation of waterways and wetlands as a result of soil disturbance during construction. In order to prevent this impact, the Statement of Environment Effects (SEE) for the Project includes details of erosion, sediment and stormwater and leachate control measures to be implemented. These measures will be undertaken in accordance with "The Blue Book" (Landcom 2004).

v. Acid Sulphate Soils Management

An Acid Sulphate Soils management plan is recommended to be prepared prior to construction, which will include details of how the riparian works should proceed in order to reduce the impacts of ASS.

vi. Weed Management

In order to minimise the spread of weeds throughout the subject land, and spread of weeds present in the subject land to surrounding areas, appropriate weed control activities will be undertaken in accordance with all state, regional and local weed management plans.

The subject land lies within the North Coast Local Land Services Area and is subject to the North Coast Regional Strategic Weed Management Plan 2017 – 2022 (LLS: North Coast 2017) and management of Weeds of National Significance (WoNS).

The *Biosecurity Act 2015* and regulations provide specific legal requirements for state level priority weeds and high risk activities, as provided in the Appendices of the North Coast Regional Strategic Weed Management Plan.

The objectives of the management plan are:

- Prevention: preventing the entry of new risks into NSW;
- Eradication: quickly finding, identifying and eradicating threats where possible;
- Containment: quickly finding, identifying and containing threats; and
- Minimisation: effectively minimising the impacts of those pests, diseases and weeds that cannot be eradicated.

In order to comply with the objectives of the North Coast Regional Strategic Weed Management Plan, it is recommended the following measures be implemented as part of a management plan for the subject land.

a. Prevention

Appropriate site hygiene measures will be implemented to prevent entry of new weeds to the area.

b. Eradication

Initial weed management will be carried out over the development site according to best-practice methods under the direction of a suitably qualified bush regenerator. The targeted species will be those listed under Appendices 1 and 2 of the North Coast Regional Strategic Weed Management Plan (LLS: North Coast 2017). Initial weed treatment will include eliminating woody species and targeting large dominant infestations of exotic herbs. This may be achieved via a combination of manual weed removal and herbicide use.

Best-practice bush regeneration should undertake measures to avoid adverse impacts to retained vegetation within the development site, including not over clearing (remove only targeted species), employment of minimal disturbance techniques to avoid soil and surrounding vegetation disturbance, and replacement of disturbed mulch/leaf-litter.

It is noted that due to the agricultural history of the subject land and surrounds, removal of all exotic grasses will not be feasible and weed management will focus on non-grass species.

c. Containment

Follow-up monitoring and maintenance should be undertaken in areas of the development site that have received past primary weeding treatments in the following months, to contain any re-emergence of weed species.

d. Minimisation

Minimisation of weed species that cannot be effectively controlled on the site, such as exotic grasses, will be prevented from further spread through construction and operational phase site hygiene procedures.

7.7 Mitigation Measures for Prescribed Impacts

7.7.1 Connectivity of Different Areas of Habitat that Facilitates Movement Across a Species' Range

As previously stated in ***Section 7.2.3***, the vegetation to be removed already consists of fragments of vegetation surrounded by agricultural, urban development and Ballina Airport, and is located at the western edge of more intact habitats including coastal wetlands. The proposed removal of these small edge areas of vegetation would very minimally add to fragmentation further than current conditions, as there is currently limited connectivity due to numerous existing hostile gaps throughout the subject land.

The design of the Project provides for retention and enhancement of riparian vegetation on the subject land, with acts as a narrow local corridor, and protection of intact coastal wetland habitats to the east.

7.7.2 Movement of Threatened Species that Maintains their Lifecycle

As previously mentioned in ***Section 7.3.1***, a number of construction measures are proposed to mitigate any potential impacts to threatened species that may occasionally utilise the development site for foraging. These measures are focused around the timing of the construction works and pre-clearance surveys.

To minimise the impacts upon native and threatened birds utilising tree limbs for nesting, vegetation pre-clearance is required for all vegetation to be removed and clearing should not occur during the breeding period for any species found to be utilising the habitats within the development site. Clearing supervision should be conducted for all wetland vegetation, to minimise the impacts on frogs and other semi-aquatic species.

7.7.3 Vehicle Strike

As discussed in ***Section 7.2.5***, the design of the access road has been situated so as to avoid areas of the treed vegetation that are most likely to be inhabited by fauna species susceptible to vehicle strike.

Accordingly, the chance of vehicle strike to species, particularly threatened woodland bird species, is substantially reduced by avoidance of areas most likely to facilitate the movements and foraging of these species.

A quantitative traffic impact assessment has been prepared for the project in accordance with relevant Council, Ausroads and Roads and Maritime Services guidelines and is included in the EIS material.

7.8 Adaptive Management of Uncertain Impacts

Vehicle strike is the only uncertain impact likely to be relevant to the Project. Management of vehicle strike will be through implementation of:

- Signage: appropriate signage notifying vehicles of potential fauna presence should be installed along the access road;
- Speed limits: Speed limits will be introduced to restrict the speed of vehicles travelling along the access road; and
- Lighting: Low wattage lighting, and minimal / well-spaced street lights should be considered. The use of lights with flat glass aeroscreen rather than reflector glass covers may be an option to reduce glare, thus reducing impact on nocturnal fauna. The location of street lights is subject to the final road design plans.

7.9 Assessment Thresholds

Unavoidable impacts of the project have been considered and a determination made of the assessment thresholds. The following sections outline the assessment thresholds and their relevance to the project.

7.9.1 Impacts to Potential Serious and Irreversible Impact Entities

i. Identification of the Serious and Irreversible Impact Entity

No SAII entities have been identified for the proposed development by the BAM.

7.9.2 Impacts that Require an Offset

i. Native Vegetation

In accordance with the BAM, an offset is required for all impacts of development on PCTs that are associated with:

- A vegetation zone that has a vegetation integrity score ≥15 where the PCT is representative of an EEC or CEEC, or;
- A vegetation zone that has a vegetation integrity score of ≥17 where the PCT is associated with threatened species habitat (as represented by ecosystem credits), or is representative of a vulnerable ecological community; or
- A vegetation zone that has vegetation integrity score of ≥20 where the PCT is not representative of a TEC or associated with threatened species habitat.

The PCTs and vegetation zones requiring offsets, and the number of ecosystem credits required, are documented in **Table 7.3**, whilst these areas are mapped in **Figure 7.2**.

ii. Threatened Species

Species credit species have been assessed as impacted within the development site and therefore offsets are required for the species listed in **Table 7.4**. Species credits are based on the Species Polygon areas mapped in **Figure 4.5**.

Table 7.3 Ecosystem credit liability

Zone	Vegetation zone name	Vegetation integrity loss / gain	Area (ha)	Constant	Species sensitivity to gain class (for BRW)	Biodiversity risk weighting	Candidate SAII	Ecosystem credits
Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion								
3	1064_Moderate	33.9	0.1	0.25	High Sensitivity to Potential Gain	2		1
							Subtotal	1
Swamp Oak swamp forest of the coastal lowlands of the NSW North Coast Bioregion								
1	1235_High	22.8	1.3	0.25	High Sensitivity to Potential Gain	2		14
2	1235_Low	39.5	1	0.25	High Sensitivity to Potential Gain	2		20
							Subtotal	46
							Total	**47**

Table 7.4 Species Credit Liability

Vegetation zone name	Habitat condition (HC)	Area (ha) / individual (HL)	Constant	Biodiversity risk weighting	Candidate SAII	Species credits
Cacophis harriettae / White-crowned Snake (Fauna)						
1064_Moderate	33.9	0.06	0.25	2	False	1
1235_High	22.8	1.25	0.25	2	False	14
1235_Low	39.5	1	0.25	2	False	20
					Subtotal	35
Cercartetus nanus / Eastern Pygmy-possum (Fauna)						
1064_Moderate	33.9	0.06	0.25	2	False	1
1235_High	22.8	1.25	0.25	2	False	14
1235_Low	39.5	1	0.25	2	False	20
					Subtotal	35
Crinia tinnula / Wallum Froglet (Fauna)						
1064_Moderate	33.9	0.06	0.25	1.5	False	1
1235_High	22.8	1.25	0.25	1.5	False	11
1235_Low	39.5	1	0.25	1.5	False	15
					Subtotal	27
Dendrobium melaleucaphilum / Spider orchid (Flora)						
1064_Moderate	33.9	0.06	0.25	2	False	1
1235_High	22.8	1.25	0.25	2	False	14

Table 7.4 Species Credit Liability

Vegetation zone name	Habitat condition (HC)	Area (ha) / individual (HL)	Constant	Biodiversity risk weighting	Candidate SAII	Species credits
1235_Low	39.5	1	0.25	2	False	20
					Subtotal	35
Hoplocephalus bitorquatus / Pale-headed Snake (Fauna)						
1064_Moderate	33.9	0.06	0.25	2	False	1
1235_High	22.7	1.25	0.25	2	False	14
1235_Low	39.5	1	0.25	2	False	20
					Subtotal	35
Litoria brevipalmata / Green-thighed Frog (Fauna)						
1064_Moderate	33.9	0.06	0.25	1.5	False	1
1235_High	22.8	1.25	0.25	1.5	False	11
1235_Low	39.5	0.99	0.25	1.5	False	15
					Subtotal	27
Litoria olongburensis / Olongburra Frog (Fauna)						
1064_Moderate	33.9	0.06	0.25	1.5	False	1
1235_High	22.8	1.25	0.25	1.5	False	11
1235_Low	39.5	1	0.25	1.5	False	15
					Subtotal	27

Table 7.4 Species Credit Liability

Vegetation zone name	Habitat condition (HC)	Area (ha) / individual (HL)	Constant	Biodiversity risk weighting	Candidate SAII	Species credits
Myotis macropus / Southern Myotis (Fauna)						
1064_Moderate	33.9	0.06	0.25	2	False	1
1235_High	22.8	1.25	0.25	2	False	14
1235_Low	39.5	1	0.25	2	False	20
					Subtotal	35
Phaius australis / Southern Swamp Orchid (Flora)						
1064_Moderate	33.9	0.06	0.25	2	False	1
1235_High	22.8	1.25	0.25	2	False	14
1235_Low	39.5	1	0.25	2	False	20
					Subtotal	35
Planigale maculata / Common Planigale (Fauna)						
1064_Moderate	33.9	0.06	0.25	2	False	1
1235_High	22.8	1.25	0.25	2	False	14
1235_Low	39.5	1	0.25	2	False	20
					Subtotal	35

7.9.3 Impacts that do not Require an Offset

All areas identified in **Figure 7.3** as 'Cleared' or 'Exotic grassland' and 'exotic herbfield' occur within the development site however do not require an offset. Areas within the subject land that do not require assessment are shown in **Figure 7.4**.

7.10 Summary of Offset Credits Required

The credit requirements for the project is summarised in **Table 7.4** and **Table 7.5**. A credit report (like for like) and credit report 'variations' from the BAM calculator have been included in **Appendix C**.

Figure 7.1. Location of impacts that require an offset

Figure 7.2. Location of impacts that do not require an offset

Chapter 8

Conclusion

This BDAR has been prepared to assess the impacts of the proposed development on biodiversity values utilising the BAM. It also addresses the Statement of Facts and Contentions in relation to the LEC Proceedings and additional requirements received from various governmental agencies during the consultation period of the DA for the project.

Native vegetation occurring within the subject land includes Swamp Oak Floodplain Forest TEC, Swamp Sclerophyll Forest TEC, Coastal Saltmarsh TEC, and mangroves. Saltmarsh is also listed as Type 1 key fish habitat under the FM Act. Mangrove vegetation is not listed as a threatened ecological community under the BC Act, but is however protected as Type 2 key fish habitat under the FM Act. An area of planted native and landscaped vegetation is also present within the subject land, however the ecological value associated with this vegetation is considered to be low. Mapped Coastal Wetlands occur in the eastern, north eastern, and southern portions of the subject land.

The proposed development will include earthworks and extensive fill of the subject land, and the construction of drainage structures, and will predominantly avoid TEC vegetation, and will not remove any areas of Coastal Wetlands.

As the project includes the removal of some areas of native vegetation, offsets are required in the form of ecosystem credits. This assessment indicated that the removal of the native vegetation within the subject land requires a total of 35 ecosystem credits, comprising all PCT 1235 and PCT 1064.

No threatened flora was recorded within the subject land and none are considered likely to occur. Similarly, no candidate fauna species credit species were identified during habitat assessments, however, in the absence of fauna surveys conducted using appropriate methods, the predicted species credit species have been assumed present. Therefore, potential impacts to the habitat of the threatened species identified in this assessment (**Table 5.2**) will need to be offset with species credits. This assessment indicates that the potential impacts on 10 species requires a total of 326 species credits.

Notwithstanding, the proposed development will also include the retention and restoration of riparian habitats in association with North Creek tributary under a VMP, which will enhance habitat for these species on site. Improved water quality in the adjoining areas of Coastal Wetlands will further benefit these species.

Further impacts of the project may entail indirect impacts and prescribed impacts, including impacts on hydrological processes in relation to the wetlands. Nevertheless, mitigation

measures are proposed to minimise the impacts to biodiversity values and maintain the hydrology required for the health and survival of the wetlands in the subject land.

With the implementation of the proposed mitigation measures and the offsetting described previously, it is considered that the impacts of this project on biodiversity, in particular on TECs, Mangroves and the threatened wetland fauna habitat will be minimal and can be appropriately managed. It is expected that with improved water quality, the wetland habitats will be improved over time.

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OEH. 2019b. Large-eared Pied Bat - Profile. NSW Office of the Environment and Heritage, Hurstville.

OEH. 2019c. Little Bentwing-bat - Profile. NSW Office of the Environment and Heritage, Hurtsville.

Appendix A

Plot Data

Table A.1 BAM Plot Data

Family	Exotic	Scientific Name	Common Name	NSW Status	Comm. Status	Native	Exotic	High Threat Weed	Plot Number	CE1	CE1	CE2	CE2	CE3	CE3	CE4	CE4	CE5	CE5	CE6	CE6	CE7	CE7	RMS
									BAM Growth Form Group	Cover	Abundance	Cover	Abundance	Cover	Abundance	Cover	Abundance	Cover	Abundance	Cover	Abundance	Cover	Abundance	Cover
Myrtaceae		Melaleuca quinquenervia	Broad-leaved Paperbark			YES		#N/A	Tree (TG)	50.0	100			2.0	7	1.0	3			0.3	1	0.2	1	
Fabaceae (Mimosoideae)		Acacia melanoxylon	Blackwood			YES		#N/A	Tree (TG)	6.0	2	0.5	2	50.0	15	2.0	6	0.5	1			0.1	2	
Poaceae	*	Setaria sphacelata	South African Pigeon Grass				YES	#N/A	#N/A	90.0	10,000	50.0	10,000	90.0	10,000	2.0	500			20.0	2,000	0.5	100	X
Apocynaceae		Parsonsia straminea	Common Silkpod			YES		#N/A	Other (OG)	0.5	3	5.0	20			0.2	3					2.0	50	
Polygonaceae		Persicaria decipiens	Slender Knotweed			YES		#N/A	Forb (FG)	0.2	50									0.2	10			X
Onagraceae		Ludwigia octovalvis	Willow Primrose			YES		#N/A	Forb (FG)	0.2	20													
Cyperaceae		Eleocharis equisetina				YES		#N/A	Grass & grasslike (GG)	0.1	5													
Lythraceae	*	Cuphea carthagenensis					YES	#N/A	#N/A	0.5	100	0.1	5							0.2	100			X
Asteraceae	*	Ageratum houstonianum					YES	#N/A	#N/A	1.0	500	2.0	500	0.1	2	0.1	5			0.3	500			
Convolvulaceae	*	Ipomoea cairica					YES	YES	#N/A	1.0	50	5.0	50	1.0	200	0.3	20	0.5	5	3.0	50	0.1	10	X
Solanaceae	*	Solanum mauritianum	Wild Tobacco Bush				YES	#N/A	#N/A	0.1	2									0.2	2			
Casuarinaceae		Casuarina glauca	Swamp Oak	YES				#N/A	Tree (TG)	1.0	3	1.0	3	50.0	5	50.0	200	4.0	20	5.0	10	70.0	200	X
Cyperaceae	*	Cyperus eragrostis	Umbrella Sedge				YES	YES	#N/A	1.0	500													X
Cyperaceae		Fimbristylis dichotoma	Common Fringe-sedge	YES				#N/A	Grass & grasslike (GG)	0.2	20					0.1	20	0.5	50					X
Poaceae	*	Paspalum mandiocanum	Broadleaf Paspalum				YES	#N/A	#N/A	0.2	10	1.0	50	0.1	5							0.2	10	X
Cyperaceae	*	Cyperus brevifolius					YES	#N/A	#N/A	0.5	100													X
Polygalaceae	*	Polygala paniculata					YES	#N/A	#N/A	0.1	20	0.1	5	0.1	5					0.2	50			X
Cyperaceae		Cyperus polystachyos		YES				#N/A	Grass & grasslike (GG)	0.2	50							0.3	50	0.5	200			
Plantaginaceae		Limnophila aromatica		YES				#N/A	#N/A	0.2	10													
Lobeliaceae		Pratia purpurascens	Whiteroot	YES				#N/A	Forb (FG)	0.1	5													

Table A.1 BAM Plot Data

Family	Exotic	Scientific Name	Common Name	NSW Status	Comm. Status	Native	Exotic	High Threat Weed	Plot Number	CE1	CE1	CE2	CE2	CE3	CE3	CE4	CE4	CE5	CE5	CE6	CE6	CE7	CE7	RMS
									BAM Growth Form Group	Cover	Abundance	Cover	Abundance	Cover	Abundance	Cover	Abundance	Cover	Abundance	Cover	Abundance	Cover	Abundance	Cover
Apiaceae		Centella asiatica	Indian Pennywort			YES		#N/A	Forb (FG)	0.1	10	0.5	200											X
Malvaceae		Commersonia hermanniifolia				YES		#N/A	#N/A			15.0	4											
Phyllanthaceae		Glochidion ferdinandi	Cheese Tree			YES		#N/A	Tree (TG)			2.0	1											
Asteliaceae		Cordyline stricta	Narrow-leaved Palm Lily	P		YES		#N/A	Other (OG)			0.2	2											
Luzuriagaceae		Eustrephus latifolius	Wombat Berry			YES		#N/A	Other (OG)			0.1	5											
Menispermaceae		Stephania japonica	Snake vine			YES		#N/A	Other (OG)			0.5	10			0.2	10							
Poaceae		Leersia hexandra	Swamp Ricegrass			YES		#N/A	Grass & grasslike (GG)			15.0	1,000					0.2	50			2.0	1,000	X
Poaceae		Ottochloa gracillima				YES		#N/A	Grass & grasslike (GG)			25.0	1,000									0.2	2,000	
Apocynaceae	*	Gomphocarpus physocarpus	Balloon Cotton Bush				YES	#N/A	#N/A			0.2	5							0.2	2			X
Asteraceae	*	Bidens pilosa	Cobbler's Pegs				YES	YES	#N/A			0.5	500											
Verbenaceae	*	Lantana camara	Lantana				YES	YES	#N/A			1.0	5	0.5	2							0.2	2	X
Sapindaceae		Cupaniopsis anacardioides	Tuckeroo		YES			#N/A	Tree (TG)			0.5	2									0.5	5	
Passifloraceae	*	Passiflora subpeltata	White Passionflower				YES	#N/A	#N/A			0.1	5	0.2	10									
Asteraceae	*	Baccharis halimifolia	Groundsel Bush				YES	YES	#N/A			0.2	2			0.1	1			0.2	1			
Asteraceae	*	Conyza sumatrensis	Tall fleabane				YES	#N/A	#N/A			0.1	5											
Malvaceae		Sterculia quadrifida	Red-fruited Kurrajong		YES			#N/A	Tree (TG)			0.2	2											
Apocynaceae		Marsdenia rostrata	Milk Vine		YES			#N/A	Other (OG)			0.5	3									2.0	20	
Juncaceae		Juncus usitatus			YES			#N/A	Grass & grasslike (GG)			0.1	1					0.1	5	0.1	2			X
Dennstaedtiaceae		Hypolepis muelleri	Harsh Ground Fern		YES			#N/A	Fern (EG)			0.2	5	0.5	20					0.1	1			
Apiaceae		Hydrocotyle verticillata	Shield Pennywort		YES			#N/A	Forb (FG)			0.1	10											

Table A.1 BAM Plot Data

Family	Exotic	Scientific Name	Common Name	NSW Status	Comm. Status	Native	Exotic	High Threat Weed	Plot Number	CE1	CE1	CE2	CE2	CE3	CE3	CE4	CE4	CE5	CE5	CE6	CE6	CE7	CE7	RMS
									BAM Growth Form Group	Cover	Abundance	Cover	Abundance	Cover	Abundance	Cover	Abundance	Cover	Abundance	Cover	Abundance	Cover	Abundance	Cover
Commelinaceae		Commelina cyanea	Native Wandering Jew			YES		#N/A	Forb (FG)			0.1	10	0.1	2			0.2	10					
Poaceae	*	Paspalum dilatatum	Paspalum				YES	YES	#N/A			0.2	10	0.1	2									X
Passifloraceae	*	Passiflora suberosa	Cork Passionfruit				YES	YES	#N/A					0.2	2							0.2	10	
Acanthaceae		Avicennia marina subsp. australasica	Grey Mangrove			YES		#N/A	Tree (TG)							5.0	20	4.0	20	0.4	5			X
Juncaceae		Juncus laeviusculus				YES		#N/A	Grass & grasslike (GG)							2.0	30							
Poaceae		Sporobolus virginicus				YES		#N/A	Grass & grasslike (GG)							20.0	1,000	20.0	5,000	0.5	100			X
Chenopodiaceae		Sarcocornia quinqueflora subsp. quinqueflora				YES		#N/A	Shrub (SG)							3.0	500	2.0	500					
Lobeliaceae		Lobelia stenophylla				YES		#N/A	Forb (FG)							0.2	100					0.1	5	
Juncaginaceae		Triglochin striata	Streaked Arrowgrass			YES		#N/A	Forb (FG)							2.0	1,000	0.1	50					
Pteridaceae		Acrostichum speciosum	Mangrove Fern			YES		#N/A	Fern (EG)							0.1	1							
Chenopodiaceae		Suaeda australis				YES		#N/A	Shrub (SG)							0.2	50	0.1	2					
Chenopodiaceae		Atriplex australasica				YES		#N/A	Forb (FG)							0.1	2							
Poaceae		Phragmites australis	Common Reed			YES		#N/A	Grass & grasslike (GG)							0.2	10	5.0	200	60.0	5,000			
Myrsinaceae		Aegiceras corniculatum	River Mangrove			YES		#N/A	Shrub (SG)							0.5	10	0.5	10					X
Juncaceae		Juncus kraussii subsp. australiensis	Sea Rush			YES		#N/A	Grass & grasslike (GG)									60.0	2,000	0.2	20			X
Fabaceae (Faboideae)	*	Crotalaria spp.					YES	#N/A	#N/A									0.5	10					
Apiaceae		Apium prostratum	Sea Celery			YES		#N/A	Forb (FG)									0.1	1					
Cyperaceae		Bolboschoenus spp.				YES		#N/A	Grass & grasslike									0.2	10					

Table A.1 BAM Plot Data

Family	Exotic	Scientific Name	Common Name	NSW Status	Comm. Status	Native	Exotic	High Threat Weed	Plot Number	CE1	CE1	CE2	CE2	CE3	CE3	CE4	CE4	CE5	CE5	CE6	CE6	CE7	CE7	RMS
									BAM Growth Form Group	Cover	Abundance	Cover	Abundance	Cover	Abundance	Cover	Abundance	Cover	Abundance	Cover	Abundance	Cover	Abundance	Cover
									(GG)															
Verbenaceae	*	Verbena bonariensis	Purpletop				YES	#N/A	#N/A											0.3	10			
Poaceae	*	Paspalum conjugatum	Johnston River Grass				YES	#N/A	#N/A											1.0	100			X
Malvaceae	*	Sida acuta	Spinyhead Sida				YES	#N/A	#N/A											0.2	10			
Lamiaceae		Vitex trifolia				YES		#N/A	Shrub (SG)											0.2	4			
Malvaceae		Hibiscus diversifolius	Swamp Hibiscus			YES		#N/A	Shrub (SG)											0.3	10			
Ranunculaceae		Ranunculus inundatus	River Buttercup			YES		#N/A	Forb (FG)											0.1	1			
Asparagaceae	*	Asparagus aethiopicus	Asparagus Fern				YES	YES	#N/A													0.2	20	
Solanaceae		Duboisia myoporoides	Corkwood			YES		#N/A	Shrub (SG)													0.2	2	
Polypodiaceae		Platycerium superbum	Staghorn	P		YES		#N/A	Fern (EG)													0.1	1	
Polypodiaceae		Platycerium bifurcatum	Elkhorn Fern	P		YES		#N/A	Fern (EG)													0.1	1	
Phormiaceae		Dianella caerulea	Blue Flax-lily			YES		#N/A	Forb (FG)													0.1	2	
Poaceae		Microlaena stipoides	Weeping Grass			YES		#N/A	Grass & grasslike (GG)													1.0	1,000	
Poaceae	*	Andropogon virginicus	Whisky Grass				YES	YES	#N/A													0.2	10	
Poaceae		Imperata cylindrica	Blady Grass			YES		#N/A	Grass & grasslike (GG)													0.2	50	
Thymelaeaceae		Wikstroemia indica				YES		#N/A	Shrub (SG)													0.1	1	
Asteraceae	*	Sphagneticola trilobata					YES	#N/A	#N/A															X
Asteraceae	*	Ageratum conyzoides subsp. conyzoides	Goatweed				YES	#N/A	#N/A															X
Poaceae	*	Axonopus fissifolius	Narrow-leafed Carpet Grass				YES	YES	#N/A															X
Poaceae		Cynodon dactylon	Common Couch			YES		#N/A	Grass &															X

Table A.1 BAM Plot Data

Family	Exotic	Scientific Name	Common Name	NSW Status	Comm. Status	Native	Exotic	High Threat Weed	Plot Number	CE1	CE1	CE2	CE2	CE3	CE3	CE4	CE4	CE5	CE5	CE6	CE6	CE7	CE7	RMS
									BAM Growth Form Group	Cover	Abundance	Cover	Abundance	Cover	Abundance	Cover	Abundance	Cover	Abundance	Cover	Abundance	Cover	Abundance	Cover
									grasslike (GG)															
Fabaceae (Faboideae)	*	Lotononis bainesii					YES	#N/A	#N/A															X
Fabaceae (Faboideae)	*	Medicago lupulina	Black Medic				YES	#N/A	#N/A															X
Poaceae	*	Stenotaphrum secundatum	Buffalo Grass				YES	YES	#N/A															X
Fabaceae (Faboideae)	*	Trifolium repens	White Clover				YES	#N/A	#N/A															X
Fabaceae (Faboideae)	*	Lespedeza striata	Japanese Clover				YES	#N/A	#N/A															X
Asteraceae	*	Erechtites valerianifolia	Brazilian Fireweed				YES	#N/A	#N/A															X

Appendix B

Flora Species List

Table B.1 Flora Species List

Family	Exotic	Scientific Name	Common Name	NSW Status
Myrtaceae		*Melaleuca quinquenervia*	Broad-leaved Paperbark	
Fabaceae (Mimosoideae)		*Acacia melanoxylon*	Blackwood	
Poaceae	*	*Setaria sphacelata*	South African Pigeon Grass	
Apocynaceae		*Parsonsia straminea*	Common Silkpod	
Polygonaceae		*Persicaria decipiens*	Slender Knotweed	
Onagraceae		*Ludwigia octovalvis*	Willow Primrose	
Cyperaceae		*Eleocharis equisetina*		
Lythraceae	*	*Cuphea carthagenensis*		
Asteraceae	*	*Ageratum houstonianum*		
Convolvulaceae	*	*Ipomoea cairica*		
Solanaceae	*	*Solanum mauritianum*	Wild Tobacco Bush	
Casuarinaceae		*Casuarina glauca*	Swamp Oak	
Cyperaceae	*	*Cyperus eragrostis*	Umbrella Sedge	
Cyperaceae		*Fimbristylis dichotoma*	Common Fringe-sedge	
Poaceae	*	*Paspalum mandiocanum*	Broadleaf Paspalum	
Cyperaceae	*	*Cyperus brevifolius*		
Polygalaceae	*	*Polygala paniculata*		
Cyperaceae		*Cyperus polystachyos*		
Plantaginaceae		*Limnophila aromatica*		

Table B.1 Flora Species List

Family	Exotic	Scientific Name	Common Name	NSW Status
Lobeliaceae		*Pratia purpurascens*	Whiteroot	
Apiaceae		*Centella asiatica*	Indian Pennywort	
Phyllanthaceae		*Glochidion ferdinandi*	Cheese Tree	
Asteliaceae		*Cordyline stricta*	Narrow-leaved Palm Lily	P
Luzuriagaceae		*Eustrephus latifolius*	Wombat Berry	
Menispermaceae		*Stephania japonica*	Snake vine	
Poaceae		*Leersia hexandra*	Swamp Ricegrass	
Poaceae		*Ottochloa gracillima*		
Apocynaceae	*	*Gomphocarpus physocarpus*	Balloon Cotton Bush	
Asteraceae	*	*Bidens pilosa*	Cobbler's Pegs	
Verbenaceae	*	*Lantana camara*	Lantana	
Sapindaceae		*Cupaniopsis anacardioides*	Tuckeroo	
Passifloraceae	*	*Passiflora subpeltata*	White Passionflower	
Asteraceae	*	*Baccharis halimifolia*	Groundsel Bush	
Asteraceae	*	*Conyza sumatrensis*	Tall fleabane	
Apocynaceae		*Marsdenia rostrata*	Milk Vine	
Juncaceae		*Juncus usitatus*		
Dennstaedtiaceae		*Hypolepis muelleri*	Harsh Ground Fern	
Apiaceae		*Hydrocotyle verticillata*	Shield Pennywort	

Table B.1 Flora Species List

Family	Exotic	Scientific Name	Common Name	NSW Status
Commelinaceae		*Commelina cyanea*	Native Wandering Jew	
Poaceae	*	*Paspalum dilatatum*	Paspalum	
Passifloraceae	*	*Passiflora suberosa*	Cork Passionfruit	
Acanthaceae		*Avicennia marina subsp. australasica*	Grey Mangrove	
Juncaceae		*Juncus laeviusculus*		
Poaceae		*Sporobolus virginicus*		
Chenopodiaceae		*Sarcocornia quinqueflora subsp. quinqueflora*		
Lobeliaceae		*Lobelia stenophylla*		
Juncaginaceae		*Triglochin striata*	Streaked Arrowgrass	
Pteridaceae		*Acrostichum speciosum*	Mangrove Fern	
Chenopodiaceae		*Suaeda australis*		
Chenopodiaceae		*Atriplex australasica*		
Poaceae		*Phragmites australis*	Common Reed	
Myrsinaceae		*Aegiceras corniculatum*	River Mangrove	
Juncaceae		*Juncus kraussii subsp. australiensis*	Sea Rush	
Fabaceae (Faboideae)	*	*Crotalaria spp.*		
Apiaceae		*Apium prostratum*	Sea Celery	
Cyperaceae		*Bolboschoenus spp.*		
Verbenaceae	*	*Verbena bonariensis*	Purpletop	

Table B.1 Flora Species List

Family	Exotic	Scientific Name	Common Name	NSW Status
Poaceae	*	*Paspalum conjugatum*	Johnston River Grass	
Malvaceae	*	*Sida acuta*	Spinyhead Sida	
Malvaceae		*Hibiscus diversifolius*	Swamp Hibiscus	
Ranunculaceae		*Ranunculus inundatus*	River Buttercup	
Asparagaceae	*	*Asparagus aethiopicus*	Asparagus Fern	
Solanaceae		*Duboisia myoporoides*	Corkwood	
Polypodiaceae		*Platycerium superbum*	Staghorn	P
Polypodiaceae		*Platycerium bifurcatum*	Elkhorn Fern	P
Phormiaceae		*Dianella caerulea*	Blue Flax-lily	
Poaceae		*Microlaena stipoides*	Weeping Grass	
Poaceae	*	*Andropogon virginicus*	Whisky Grass	
Poaceae		*Imperata cylindrica*	Blady Grass	
Thymelaeaceae		*Wikstroemia indica*		
Asteraceae	*	*Sphagneticola trilobata*		
Asteraceae	*	*Ageratum conyzoides subsp. conyzoides*	Goatweed	
Poaceae	*	*Axonopus fissifolius*	Narrow-leafed Carpet Grass	
Poaceae		*Cynodon dactylon*	Common Couch	
Fabaceae (Faboideae)	*	*Lotononis bainesii*		
Fabaceae (Faboideae)	*	*Medicago lupulina*	Black Medic	

Table B.1 Flora Species List

Family	Exotic	Scientific Name	Common Name	NSW Status
Poaceae	*	*Stenotaphrum secundatum*	Buffalo Grass	
Fabaceae (Faboideae)	*	*Trifolium repens*	White Clover	
Fabaceae (Faboideae)	*	*Lespedeza striata*	Japanese Clover	
Asteraceae	*	*Erechtites valerianifolia*	Brazilian Fireweed	

Appendix C

BAM Credit Report

BAM Credit Summary Report

Proposal Details

Assessment Id

00014336/BAAS17027/19/00014337

Proposal Name

18187 - Palm Lake Resort
Ballina

BAM data last updated *

03/06/2019

Assessor Name

David Robertson

Report Created

11/06/2019

BAM Data version *

9

Assessor Number

BAAS17027

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

Revision No

1

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

Zone	Vegetation zone name	Vegetation integrity loss / gain	Area (ha)	Constant	Species sensitivity to gain class (for BRW)	Biodiversity risk weighting	Potential SAII	Ecosystem credits
Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion								
3	1064_Moderate	33.9	0.1	0.25	High Sensitivity to Potential Gain	2.00		1
							Subtotal	**1**

Swamp Oak swamp forest of the coastal lowlands of the NSW North Coast Bioregion								
1	1235_High	22.8	1.3	0.25	High Sensitivity to Potential Gain	2.00		14
2	1235_Low	39.5	1.0	0.25	High Sensitivity to Potential Gain	2.00		20
							Subtotal	**34**
							Total	**35**

Species credits for threatened species

Vegetation zone name	Habitat condition (HC)	Area (ha) / individual (HL)	Constant	Biodiversity risk weighting	Potential SAII	Species credits
Cacophis harriettae / White-crowned Snake (Fauna)						
1064_Moderate	33.9	0.05	0.25	2	False	1
1235_High	22.8	1.25	0.25	2	False	14
1235_Low	39.5	1	0.25	2	False	20
					Subtotal	**35**
Cercartetus nanus / Eastern Pygmy-possum (Fauna)						
1064_Moderate	33.9	0.05	0.25	2	False	1
1235_High	22.8	1.25	0.25	2	False	14
1235_Low	39.5	1	0.25	2	False	20
					Subtotal	**35**

Crinia tinnula / Wallum Froglet (Fauna)						
1064_Moderate	33.9	0.05	0.25	1.5	False	1
1235_High	22.8	1.25	0.25	1.5	False	11
1235_Low	39.5	1	0.25	1.5	False	15
					Subtotal	**27**
Dendrobium melaleucaphilum / Spider orchid (Flora)						
1064_Moderate	33.9	0.05	0.25	2	False	1
1235_High	22.8	1.25	0.25	2	False	14
1235_Low	39.5	1	0.25	2	False	20
					Subtotal	**35**
Hoplocephalus bitorquatus / Pale-headed Snake (Fauna)						
1064_Moderate	33.9	0.05	0.25	2	False	1
1235_High	22.8	1.25	0.25	2	False	14
1235_Low	39.5	1	0.25	2	False	20
					Subtotal	**35**
Litoria brevipalmata / Green-thighed Frog (Fauna)						
1064_Moderate	33.9	0.05	0.25	1.5	False	1
1235_High	22.8	1.25	0.25	1.5	False	11

1235_Low	39.5	1	0.25	1.5	False	15
					Subtotal	**27**
Litoria olongburensis / Olongburra Frog (Fauna)						
1064_Moderate	33.9	0.05	0.25	1.5	False	1
1235_High	22.8	1.25	0.25	1.5	False	11
1235_Low	39.5	1	0.25	1.5	False	15
					Subtotal	**27**
Myotis macropus / Southern Myotis (Fauna)						
1064_Moderate	33.9	0.05	0.25	2	False	1
1235_High	22.8	1.25	0.25	2	False	14
1235_Low	39.5	1	0.25	2	False	20
					Subtotal	**35**
Phaius australis / Southern Swamp Orchid (Flora)						
1064_Moderate	33.9	0.05	0.25	2	False	1
1235_High	22.8	1.25	0.25	2	False	14
1235_Low	39.5	1	0.25	2	False	20
					Subtotal	**35**

Planigale maculata / Common Planigale (Fauna)						
1064_Moderate	33.9	0.05	0.25	2	False	1
1235_High	22.8	1.25	0.25	2	False	14
1235_Low	39.5	1	0.25	2	False	20
					Subtotal	**35**