



Biodiversity Development Assessment Report

MERIMBULA AIRPORT RUNWAY EXTENSION



AUGUST 2022



Document Verification



Project Title:

Merimbula Airport Runway Extension

Project Number: 18-143

Project File Name: Merimbula Airport v4

Revision	Date	Prepared by (name)	Reviewed by (name)	Approved by (name)
v1	9/05/19	Gillian Young	Mitch Palmer Accredited BAM Assessor (BAAS17051)	Brooke Marshall
V2	1/10/19	Gillian Young	Brooke Marshall	Brooke Marshall
V3	23/07/20	Gillian Young	Brooke Marshall	Brooke Marshall
V3.1	23/03/21	Gillian Young	Beth Noel BAM Assessor (BAAS19015)	Beth Noel BAM Assessor (BAAS19015)
V4	04/11/21	Brooke Marshall and Gillian Young: Haul road removal	Brooke Marshall	Brooke Marshall
V4.1	08/08/22	Gillian Young	Daniel Perkovic (BAAS21013)	Gillian Young

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

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

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Development Case for ULTIMATE EIS (00012032/BAAS17086/18/00012970 – Revision 10), within the BAM Calculator (Version 54) is finalised and submitted to consent authority (9 Aug 22). Identical credit reports can be found in Appendix E of this BDAR v4-1. It is the sum of all clearing areas for the development (Project + Ultimate EIS).

Credit reports in Appendix F for PROJECT EIS clearing areas is not finalised or submitted in the BAM Calculator (00012032/BAAS17086/18/00012970 - Revision 9). It is used to generate ecosystem and species credits on the same date (9 Aug 22).

The two cases above allow separation of credit obligations for this staged development.

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ACRONYMS AND ABBREVIATIONS

ASL	Above sea level
ASS	Acid sulfate soils
AWS	Automatic weather station
BAM	<i>Biodiversity Assessment Method</i>
BC Act	<i>Biodiversity Conservation Act 2016 (NSW)</i>
BDAR	Biodiversity development assessment report
BOM	Australian Bureau of Meteorology
BOS	Biodiversity Offset Scheme (in accordance with the <i>Biodiversity Conservation Act</i>)
BVCS	Bionet Vegetation Classification System
BVSC	Bega Valley Shire Council
CASA	Civil Aviation Safety Authority
CEMP	Construction environmental management plan
Cwth	Commonwealth
DECCW	Refer to OEH
DP&I	(NSW) Department of Planning and Infrastructure
EEC	Endangered Ecological Community – as defined under relevant law applying to the proposal
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EPBC Act	<i>Environmental Protection and Biodiversity Conservation Act 1999 (Cwth)</i>
EP&A Act	<i>Environmental Planning and Assessment Act 1979 (NSW)</i>
ESD	Ecologically Sustainable Development
FM Act	<i>Fisheries Management Act 1994 (NSW)</i>
ha	hectares
Heritage Act	<i>Heritage Act 1977 (NSW)</i>
ISEPP	<i>State Environmental Planning Policy (Infrastructure) 2007 (NSW)</i>
KFH	Key Fish Habitat
km	kilometres
LEP	Local Environment Plan
m	Metres
NES	Matters of National Environmental Significance under the EPBC Act (c.f.)

NPW Act	<i>National Parks And Wildlife Act 1974 (NSW)</i>
NSW	New South Wales
OEH	(NSW) Office of Environment and Heritage, formerly Department of Environment, Climate Change and Water
OLS	Obstacle Limitation Surface
PCT	Plant Community Type
REF	Review of Environmental Factors
REP	Regional Environmental Plan
SAII	Serious and Irreversible Impact
SEARS	Secretary's Environmental Assessment Requirements
SEPP	State Environmental Planning Policy (NSW)
SEWPAC	(Cwth) Department of Sustainability, Environment, Water, Population and Communities
SIS	Species Impact Statement
sp/spp	Species/multiple species
TEC	Threatened Ecological Community (pertaining to either state or federal listings)
TSC Act	<i>Threatened Species Conservation Act 1995 (NSW)</i>
TBDC	Threatened Biodiversity Data Collection

EXECUTIVE SUMMARY

This Biodiversity Assessment Report (BDAR) has been prepared by NGH for the proponent Bega Valley Shire Council. An extension of the runway is proposed to the north and south at Merimbula Airport within Lot 100 DP1201186 along Arthur Kaine Drive, Merimbula. Merimbula Airport is located in the Bega Valley Local Government Area and is adjacent to Merimbula Lake in NSW. Two clearing options have been investigated as part of the BDAR assessment. These include:

1. 'Ultimate EIS Footprint' (clearing of 10.68 ha in total, with six vegetation zones inside the footprint)
2. 'Project EIS Footprint' (clearing of 8.61 ha in total with, four vegetation zones inside the footprint)

This BDAR assesses the larger option 'Area of Ultimate EIS', although credit calculations for the smaller 'Project EIS Footprint' have been undertaken as well, as it is expected the project will be developed in two stages being;

- Stage one – Project EIS
- Stage two – Ultimate EIS

The proposal is classified as designated development under Part 4 of the *Environmental Planning and Assessment Act 1979*. Designated development is triggered because the runway extension areas overlay Coastal Wetlands Mapping in accordance with the *Coastal Management Act*. The Secretary's Environmental Assessment Requirements (SEARs) have been prepared. The clearing of native vegetation will trigger the Biodiversity Offset Scheme (BOS) and a BDAR is required to address the impacts on biodiversity in accordance with the *Biodiversity Conservation Act 2016* through the application of the Biodiversity Assessment Methodology (BAM).

This BDAR is consistent with field work methodologies and assessment requirements by the BAM. It has been prepared and reviewed by persons accredited under the BAM.

Versions issued

The BDAR V2 was submitted and publicly exhibited with the Environmental Impact Statement (EIS) for this project.

BDAR V3, was updated to address agency and community submissions from the exhibition.

BDAR V3.1 was updated to correct an error regarding the generation of Beach Stone Curlew credits. A DA modification to reflect BDAR V3.1 (specifically the removal of the Beach Stone Curlew from the consent requirements) was lodged on 2 August 2021.

BDAR V4 updates the assessment to include the removal of a haul road south of the project. This is an environmental remediation action to improve hydrological function surrounding the southern extension by removing a barrier to flow.

BDAR V4.1 has been updated to address agency comments (DOC22/390518-5) including:

- Bega Valley Shire Council's preference was to maintain the assumption of 'presence' for species credit species as previously detailed in BDAR V4. This was based on evidence that Pied Oystercatchers have utilised habitat inside the development footprint. The addition of some new candidate species (added to Version 54 of the BAM calculator) could not be surveyed prior to finalising this report.

- Some minor changes to text about inclusion of the Haul Rd into Ultimate EIS clearing areas,

In revising updated BAM Calculations (as of 9 Aug 22, Version 54 of the calculator),

- there has been inclusion of Leafless Tongue Orchid requiring assessment under the BAM and
- Updated BAM calculations for both 'project' and 'ultimate' EIS clearing areas. Corresponding credits reports can be seen in Appendix E and F.

For the Ultimate EIS proposal, including the removal of the southern haul road, the clearing of 8.52 ha of (PCT 659) '*Bangalay - Old-man Banksia open forest on coastal sands, Sydney Basin Bioregion and South East Corner Bioregion*' generated 2 ecosystem credits. The clearing of 2.06 ha of (PCT 920) '*Mangrove Forests in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion*' generated 64 ecosystem Credits. The clearing of 0.05 ha of (PCT 1126) '*Saltmarsh in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion*' generated 2 ecosystem credits. The remaining area of the development footprint consisted of aquatic areas, south haulage road and asphalt both of which were not assessed under the BAM. The smaller bangalay scrub area of PCT 659 met the definition of the NSW TEC *Bangalay Sand Forest of the Sydney Basin and South East Corner bioregion*. No Commonwealth listed TECs will be impacted.

Targeted surveys were undertaken for candidate flora species where habitat elements were known to exist onsite. Of the flora species surveyed, none were found during targeted survey.

Most fauna candidate species identified in the calculator were excluded from further assessment due to inappropriate habitat. The Orange-bellied Parrot was surveyed onsite within appropriate habitat where no individuals were found and was also excluded from further assessment or species being vagrant (such as Beach Stone-curlew breeding habitat). All other species were assumed to exist onsite. One more credit species is now in the BAM calculator (resulting from the release of version 54 of BAM C) post submission of BDAR V4. This was Leafless Tongue Orchid. It was assumed to be present within one vegetation zone inside the 'Ultimate EIS' clearing area only. Targeted survey could not be conducted at the time that this version of BDAR was completed (July 22). As such, presence was assumed within the appropriate vegetation zone and it generated 1 species credit. As previously documented, the Pied and Sooty Oystercatcher generated 128 species credits (64 credits each) and the Southern Brown Bandicoot and Long-nosed Potoroo generated 4 species credits (2 credits each).

For Project EIS, the clearing of 7.64 ha of PCT 659 '*Bangalay - Old-man Banksia open forest on coastal sands, Sydney Basin Bioregion and South East Corner Bioregion*' did not generate ecosystem credits because the patch of bangalay scrub was excluded from the development footprint leaving only the highly degraded grassland for assessment. The clearing of 0.95 ha of (PCT 920) '*Mangrove Forests in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion*' generated 28 ecosystem Credits. The clearing of 0.02 ha of (PCT 1126) '*Saltmarsh in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion*' generated 1 ecosystem credit. The remaining 0.31 ha of the development footprint consisted of asphalt and was not assessed under the BAM.

Because the development footprint was reduced in area, the Pied and Sooty Oystercatcher each generated 29 credits each and the Southern Brown Bandicoot and Long-nosed Potoroo no longer generated species credits due to the small patch of bangalay scrub being excluded from the development footprint.

Consideration was given to avoiding and minimising impacts to biodiversity throughout each phase of the assessment to date, however re-siting the runway extension to avoid impacts was not possible due to this proposal being an extension of the existing runways at Merimbula Airport. The assessment has

considered key environmental, social and economic criteria which is reported more fully within the Environmental Impact Statement for this project. Mitigation and management measures are proposed to adequately address impacts associated with the proposal, both directly and indirectly.

The retirement of the credits generated will be carried out in accordance with the NSW Biodiversity Offsets Policy under the *Biodiversity Conservation Act 2016*. With the retirement of credits and effective implementation of the mitigation measures, the proposal is consistent with the requirements of the BAM.

1 INTRODUCTION

The Merimbula Airport Runway Extension proposal is classified as State Significant Development (SSD) under the State and Regional Development State Environmental Planning Policy (SEPP) and therefore a 'major project'. This Biodiversity Development Assessment Report (BDAR) assesses the impacts of the proposed Merimbula Airport Runway Extension (the proposal) according to the NSW Biodiversity Assessment Methodology (BAM) as required by the Secretary's Environmental Assessment Requirements (SEARs) for the proposal. NGH Environmental has prepared this report on behalf of the proponent, Bega Valley Shire Council.

The following terms are used in this document:

- **Development footprint** – The area of land that is directly impacted by the proposal. This includes all land affected by runway extension activities, including areas receiving imported fill and areas likely to be disturbed through construction activities and areas used for stock piling of fill. The total area of the northern runway development footprint (Ultimate EIS) is 7.3 ha and the southern runway development footprint is 3.54 ha. There is also a central stockpiling area (0.64 ha). A portion of the southern runway includes aquatic seagrass vegetation in the south west corner of the development footprint and existing asphalt. Aquatic and asphalt areas are not assessed under the BAM. This area will be subjected to a separate aquatic assessment to meet the requirements of the SEARs and the NSW Fisheries Management Act and necessary offsetting requirements.
- **Development site** – A broader area of land surrounding the development footprint where indirect impacts may result. The development site includes adjoining saltmarsh and shorebird habitat adjoining the north and south runway.
- **Subject land** – All land within the airport lot boundary being Lot 100 DP 1201186. It is land that may be subjected to future development associated with airport activities and includes all areas in accordance with Merimbula Airport's Masterplan (Kleinfelder, 2017).
- **Buffer area** – All land within 1500 metres (m) of the outside edge of the boundary of the subject land.

Versions issued:

The BDAR V2 was submitted and publicly exhibited with the Environmental Impact Statement (EIS) for this project.

BDAR V3, was updated to address agency and community submissions from the exhibition. The BDAR V3.0 was submitted to address agency and community submissions from the public exhibition stage.

BDAR V3.1 was submitted too late to be considered by the determining Joint Regional Panel but included one change that affected the credit profile. NGH's BAM accredited author contacted BCD on 20/04/21 noting the changes to the BDAR in V3.1, as follows:

- *In response to BCD comments on the draft BDAR, the species credit assessment for Beach Stone Curlew was revised in the Project EIS assessment for Merimbula Airport.*
- *It was confirmed after a brief discussion with Allison Treweek that species credits should only be generated if the BAM assessor is of the belief that the development footprint forms key breeding habitat for Beach Stone Curlew.*
- *From conducting the SAIL assessment for BSC, there is evidence that there are no breeding pairs of BSC south of the Manning River.*

- *As such BSC was removed from requiring survey and it is my opinion as the accredited officer that the species is vagrant in the subregion in relation to breeding habitat.*
- *As such, BSC is no longer generating species credits and does not require survey at Merimbula Airport.*
- *As this species is a dual credit species, the BSC is still accounted for in generating ecosystem credits for foraging habitat in relevant vegetation zones (PCT 920)*

A DA modification to reflect BDAR V3.1 (specifically the removal of the Beach Stone Curlew from the consent requirements) was lodged on 2 August 2021.

BDAR V4 was undertaken after the approval of Stage 1 works to assess the removal of a haul road south of the project. Removal of the haul road is environmental remediation aiming to improve hydrological function surrounding the southern extension by removing a barrier to flow.

BDAR V4.1 has been updated to address agency comments (DOC22/390518-5). There is no change to the assumption of 'presence' for species credit species as detailed in BDAR V4 and some minor changes to text about inclusion of the Haul Rd into Ultimate EIS clearing areas and some corrections to tables in chapter 4.2. In revising updated BAM Calculations (July 22), there has been inclusion of Leafless Tongue Orchid for assessment under the BAM.

BDAR V4-1 updates are now presented in the latest BAM calculations (Version 54 of the BAM calculator) for both 'project' and 'ultimate' EIS clearing areas and attached in Appendix E and F.

1.1 THE PROPOSAL

Bega Valley Shire Council own Merimbula Airport and are proposing to extend the length of the north and south runway. This BDAR supports an Environmental Impact Statement (EIS) and subsequent Submissions Report. The proposal includes clearing of land to extend the north and south runway. Ancillary works required as part of the proposal now include the installation of temporary stock pile sites and the expansion of an existing arrangement of culverts near to the southern runway, to mitigate as much as possible changes in tidal flow resulting from the extensions.

In accordance with Merimbula Airport's Masterplan there will be two stages of development (Stage 1 and Stage 2). This BDAR covers the assessment of clearing under stages 1 and 2 being the extension of the north and south runway (Ultimate EIS).

The north runway development footprint is 7.4 ha. Of this area, 7.20 ha comprises 'native vegetation' for the purposes of this BDAR assessment. The remaining 0.15 ha comprises non-native vegetation consisting of existing runway asphalt and will be assessed no further.

The south runway development footprint (Ultimate EIS) occupies 3.3 ha of land of which 2.59 ha comprises 'native vegetation' for the purpose of this BDAR assessment. The remaining areas comprise runway asphalt and aquatic habitat not assessed under the Biodiversity Conservation Act.

In addition, Stage 2 (assessed in BDAR V4) now also includes the removal of a haul road south of the project. Removal of the haul road is an environmental remediation action that aims to improve hydrological function surrounding the southern extension by removing a barrier to flow. It results in:

- A very minor increase in native vegetation clearing (0.085 ha) to dismantle the road
- Removal of a key threatening process under both the BC and FM Acts:
 - BC Act: Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands.

- FM Act: Installation and operation of instream structures and other mechanisms that alter natural flow regimes of rivers and streams.
- A 4.5 ha area of beneficial impact comprised of:
 - Saltmarsh: 3.57 ha
 - Bangalay and Swamp Oak Forest: 0.93 ha

The centre of the development footprint is a stockpile site (0.64 ha) located east of the existing runway which was assessed under the Biodiversity Conservation Act.

In consideration of the impact areas assessed in this BDAR:

- The development footprint has been defined with input from engineers and hydrologists to ensure the works method is feasible and the containment of soil and water impacts is rigorous. Further detail on this is provided in the Submissions Report (NGH 2020). The development of this works method allows certainty regarding the direct and indirect impact on adjacent terrestrial and aquatic habitat. No impacts adverse impacts are anticipated outside of the mapped development footprints (however, a commitment to monitoring is also included in the proposal to allay stakeholder concerns).
- The development site includes an area of increased inundation expected to be caused by the southern extension. The hydrological modelling concludes the extent and frequency of the events would not be sufficient to affect terrestrial or aquatic habitat composition and as such this area is not considered in the development footprint but will be monitored to confirm the assumptions of this assessment and allay stakeholder concerns.
- The development footprint in BDAR V4 includes a 10m corridor centred on the existing southern haul road. This has been determined as sufficient to remove the road, including with the installation of environmental controls to manage the removal process. The adverse impact of the removal of 0.091 ha of native vegetation has been assessed in this BDAR (v4). The beneficial impacts of reestablishment of native vegetation in the area now occupied by the barrier (0.24 ha) and increased inundation to the east, modelled as 4.5 ha, have not been included in any way by this assessment.
- The impacts of associated developments have now been articulated in the Submissions Report (NGH 2020). As such, issues such as increased flight numbers (and any resultant impact on collision risk) and vegetation clearing for Obstacle Limitation Surface (OLS) have been excluded from this assessment. They will be assessed if required, as part of separate development assessment processes.

1.2 THE DEVELOPMENT SITE

1.2.1 Site location

The proposal site is located within the town of Merimbula, NSW within Bega Valley Shire Council Local Government Area (LGA) which forms part of the NSW Far South Coast region. The airport is located approximately 1.5 km south east of Merimbula town centre and approximately 26 km from Bega (refer to Figure below).

1.2.2 Site description

The proposal forms part of the Merimbula Airport located on the north west side of Arthur Kaine Drive, at the town of Merimbula, NSW.

The site includes the runway, airport terminal, commercial business activities (car hire, storage, scenic flight operator locksmith, tyre business). There is also airport operation activities including airport maintenance, aircraft storage, aircraft maintenance, aviation fuel storage and supply and car parking areas.

The airport site is situated between the town of Merimbula to the north east and the town of Pambula to the south west. Merimbula Lake directly borders the site to the north west and Merimbula Main Beach and associated tree covered sand dunes lie to the south east.

The land within the immediate vicinity of the site includes uses such as Tourist and Visitor Accommodation, residential developments, oyster leases within Merimbula Lake, Commercial and Industrial developments, a Golf Course, and a National Park.

Notable features within the locality include:

- Merimbula Lake and oyster farming operations;
- The Pambula/Merimbula Golf Club, adjacent to the site on the south west side;
- Sewage Treatment Works directly south of the subject land;
- Merimbula Main Beach and other significant Sapphire Coast beaches and coastline; and
- National Parks including Ben Boyd National Park located south of the proposal site.



Figure 1-1 Site Map

1.3 STUDY AIMS

This BDAR has been prepared by NGH on behalf of Bega Valley Shire Council.

The aim of this BDAR is to address the requirements of the BAM, as required in the Secretary's Environmental Assessment Requirements (SEARs) and summarised below.

Secretary's Environmental Assessment Requirement	Where addressed
The EIS must address the following specific issues for Biodiversity: - for all project options, construction and operational phases and obstacle limitation surface (OLS) requirements; - assess impacts on flora and fauna and habitat, within and surrounding the proposed development footprint, including threatened species, ecological communities and critical habitat listed under the Biodiversity Conservation Act 2016; and - assess impacts on marine vegetation and aquatic species and key fish habitat listed under the Fisheries Management Act 1994 and aquaculture activities in the area.	Sections 3 to 9

No specific considerations for any threatened species, populations or communities were specified in the SEARs or by the NSW Office of Environment and Heritage (OEH).

This BDAR also addresses the assessment requirements of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

1.4 SOURCES OF INFORMATION USED IN THE ASSESSMENT

The following information sources were used in this BDAR:

- Proposal layers, construction methodology and concept designs provided by Bega Valley Shire Council.
- Australian Government's Species Profiles and Threats (SPRAT) database
<http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl>
- NSW OEH's Threatened Species Profiles
<http://www.environment.nsw.gov.au/threatenedspeciesapp/>
- DPI profiles of threatened species, population, and ecological communities
- Commonwealth Department of Environment and Energy Protected Matters Search Tool
Accessed online at <http://environment.gov.au/epbc/protected-matters-search-tool>
- Australia's IBRA Bioregions and sub-bioregions. Accessed
<http://environment.gov.au/land/nrs/science/ibra/australias-bioregions-maps>
- Department of Environment and Climate Change NSW (DECC) (2002). Descriptions for NSW (Mitchell) Landscapes, Version 2.
- NSW OEH's Biodiversity Assessment Method (BAM) calculator
<http://www.environment.nsw.gov.au/bbccapp/ui/mynews.aspx>.
- NSW OEH's Bioregion Overviews

<https://www.environment.nsw.gov.au/bioregions/SouthEastCornerBioregion.htm>

- NSW OEH's BioNet threatened biodiversity database
Accessed online via login at <http://www.bionet.nsw.gov.au/>.
- NSW OEH Threatened Species Profiles
<http://www.environment.nsw.gov.au/threatenedSpeciesApp/> and
www.environment.nsw.gov.au/AtlasApp/UI_Modules/
- OEH BioNet Vegetation Classification Database (OEH 2017b)
Accessed online via login at <http://www.environment.nsw.gov.au/NSWVCA20Prapp/default.aspx>
- OEH VIS Mapping
Accessed online at <http://www.environment.nsw.gov.au/research/VISmap.htm>
- Office of Environment and Heritage (OEH) (2017a). Biodiversity Assessment Method.
- NSW Government SEED Mapping
https://geo.seed.nsw.gov.au/Public_View/index.html?viewer=Public_View&locale=en-AU
- NSW Biodiversity Values Map
<https://www.lmbc.nsw.gov.au/Maps/index.html?viewer=BVMap>
- Previous environmental and planning studies undertaken for Merimbula Airport including Masterplans, Ecological Constraints Assessment and Wildlife Hazard Management Plans (Specific reports cited in chapter 12 references).

2 LANDSCAPE FEATURES

2.1 IBRA BIOREGIONS AND SUBREGIONS

Bioregions are large, geographically distinct areas of land with common characteristics such as geology, landform patterns, climate, ecological features, and flora and fauna communities. The development site is located within the South East Corner Bioregion, in the South East Coastal Ranges subregion. This was entered into the BAM Calculator for the proposal.

The bioregion is characterised by warm summers and no dry season (OEH 2016). Geology is characteristic of the Lachlan Ford Belt, Devonian sandstones and mudstones overlying the Ordovician rocks with intruding granite bodies. A great escarpment lines the region, creating a line of steep hills and gorges on the coastal side of the Great Dividing Range formed by eroded streams.

2.2 NSW LANDSCAPE REGIONS AND AREA

The development site is in the Bodalla – Nadgee Coastal Sands Mitchell Landscape. This landscape is distinguished by beach, dune and lagoon complexes of Quaternary quartz sand and organic silty sand in lagoons and estuaries (DoEE 2002). Bodalla – Nadgee Coastal Sands Mitchell Landscape was entered into the BAM Calculator for the proposal.

2.3 NATIVE VEGETATION

As determined by GIS mapping from aerial imagery, 1780 ha of land is within the 1500 m buffer. Of this area, 748 ha comprises native vegetation which includes vegetation inside the subject land. This equates to 42% native vegetation cover overall. The native vegetation within the 1500 m area is typically dominated by estuarine vegetation including Grey Mangrove (*Avicennia marina*) and Saltmarsh with some Bangalay Sand Forest with a fringe of Swamp Oak (*Casuarina glauca*) (OEH 2016).

2.4 CLEARED AREAS

Cleared areas inside the subject land are primarily managed grasslands for maintaining airport Obstacle Limitation Surfaces (OLS), the runway itself and the golf course land directly south of the subject land (See Table 3-1 plot 6 photo). These areas provide limited foraging habitat for native species, including parrots and raptors, and introduced species such as foxes and rabbits. Approximately 315 ha (18% of land within the 1500 m buffer) is cleared. The remaining 40% of the 1500 m radius consists of aquatic areas that includes Merimbula Lake and its inlet to the ocean.

2.5 RIVER AND STREAMS

There are no rivers or streams crossing the Merimbula airport land. The land adjoins Merimbula Lake which is saline and tidal in nature.

2.6 WETLANDS

No Ramsar listed wetlands occur in or adjacent to the development site. The nearest is Blue Lake in the Kosciuszko National Park, which is approximately 150 km north west of the development site.

The EPBC Act Protected matters Report listed Merimbula Lake – NSW061 (DEE 2010) as a Nationally Significant wetland, which is adjacent to and within the subject land.

There are a large quantities of Coastal Wetlands mapping (in accordance with the *Coastal Management Act 2016*) inside the development footprint for the south runway and a small quantity of mapping in the north west corner of the northern runway development footprint. As a result, the proposal is classified as ‘designated development’ and the requirement of an Environmental Impact Assessment undertaken to address impacts on the coastal wetlands. A separate aquatic assessment has been prepared for NSW Fisheries to devise an offset plan for the loss of aquatic sea grass habitat.

2.7 CONNECTIVITY FEATURES

The landscape within the development site is a combination of heavily mowed dry vegetation and wetter saline estuarine habitat. There is no notable connectivity features as there is no capacity for assisted natural regeneration at the development site due to the requirement to maintain OLS for airport safety reasons.

Connectivity occurs adjacent to the site throughout the Merimbula Lake watercourse. This watercourse supplies permanent water and has remnant mangrove, saltmarsh and bangalay sand forest. These would provide habitat connectivity for aquatic species and waterbirds as well as migratory species.

2.8 AREAS OF GEOLOGICAL SIGNIFICANCE

No karsts, caves, crevices or cliffs or other areas of geological significance occur inside or adjacent to the development site.

2.9 BIODIVERSITY VALUES MAPPING

There are no Areas of Outstanding Biodiversity Value within the subject land and inside the development footprint in accordance with Part 3 Div 3 of the *Biodiversity Conservation Regulation*. Both the north and south runway areas occur on the Biodiversity Values mapping due to presence of mangrove coastal wetlands under the *State Environmental Planning Policy (Coastal Management) 2018* (see Figure below). Due to the already existing airport runways, avoidance of these areas is not possible in proceeding with this development proposal.

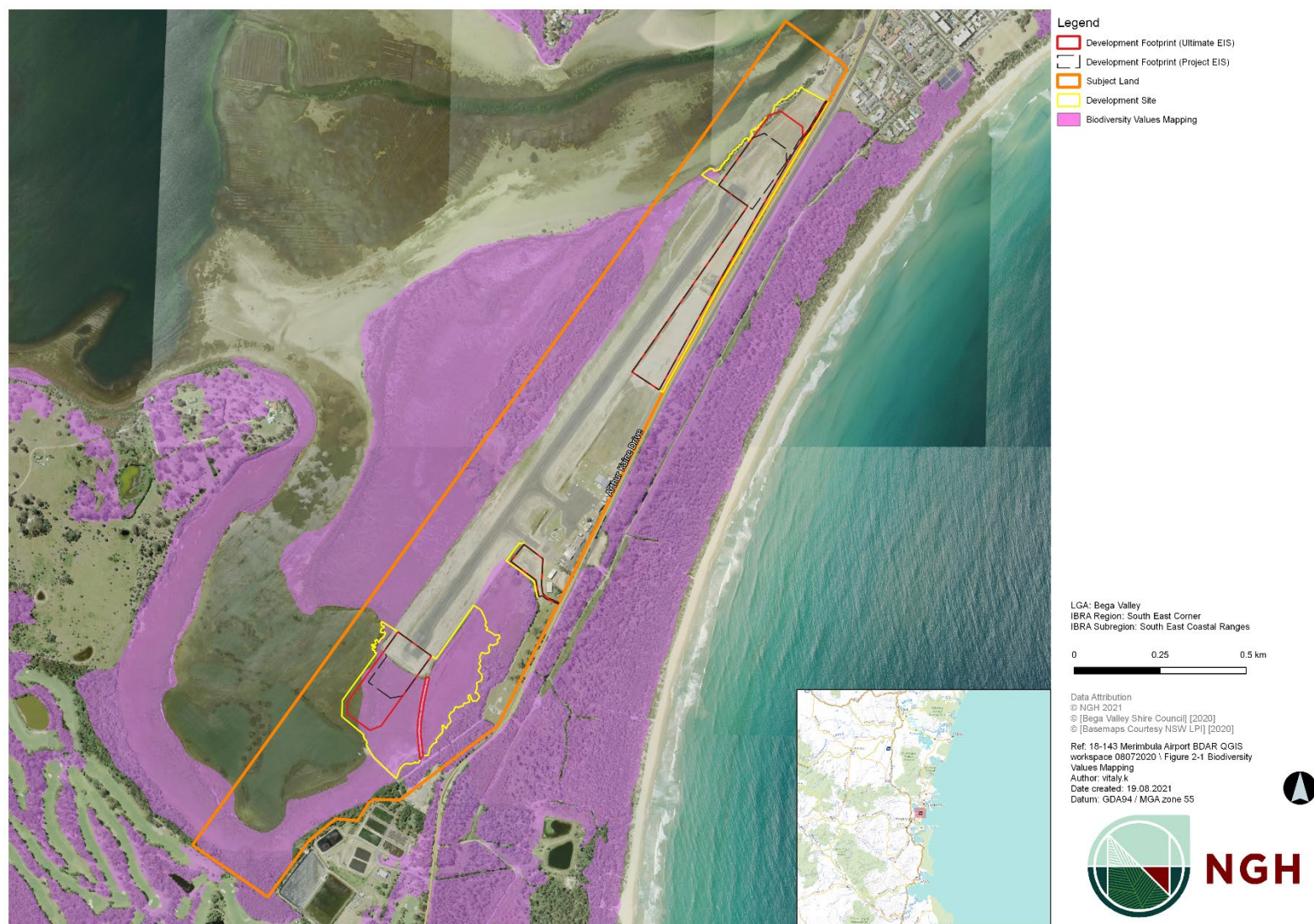


Figure 2-1 Biodiversity values mapping (highlighted purple) sourced from NSW Government

2.10 SITE CONTEXT COMPONENTS

Method applied

The proposal conforms to the definition of a *site-based development* under the Biodiversity Assessment Methodology. The site-based development assessment methodology has been used in this BAM assessment.

Percent Native Vegetation Cover

The Percent Native Vegetation Cover within the 1500 m buffer area surrounding the development site is calculated to be 42%. This was entered into the BAM calculator for the proposal.

Percent Native Vegetation cover was calculated largely through aerial photo interpretation (dated 31/03/16) excluding areas not containing native vegetation (such as hard stand areas and open water bodies). Vegetation mapping was also used to become familiar with the expected vegetation types in the local area. Fifteen PCTs occur inside the 1500 m buffer as illustrated within Table 2-1 below.

Table 2-1 Existing vegetation mapping surrounding Merimbula Airport (Sourced from South East Local Land Services (OEH 2014).

Biometric Vegetation Type	Keith Class ID	Plant Community Type (PCT)
SR512 – Bangalay – Old-man Banksia open forest on coastal sands, Sydney Basin and South East Corner	South Coast Sands Dry Sclerophyll Forests	659 <i>Eucalyptus botryoides</i> , <i>Banksia serrata</i> , <i>Banksia integrifolia</i> subsp. <i>integrifolia</i> , <i>Eucalyptus pilularis</i> / <i>Allocasuarina littoralis</i> , <i>Breynia oblongifolia</i> , <i>Glochidion ferdinandi</i> , <i>Macrozamia communis</i> / <i>Dianella caerulea</i> , <i>Hardenbergia violacea</i> , <i>Lomandra longifolia</i> , <i>Pomax umbellata</i>
SR531 – Coast Banksia – Coast Wattle dune scrub of the Sydney Basin Bioregion and South East Corner Bioregion	South Coast Sands Dry Sclerophyll Forests	771 <i>Banksia integrifolia</i> subsp. <i>integrifolia</i> , <i>Leptospermum laevigatum</i> , <i>Acmena smithii</i> , <i>Eucalyptus botryoides</i> / <i>Breynia oblongifolia</i> , <i>Monotoca elliptica</i> , <i>Notelaea longifolia</i> , <i>Acacia longifolia</i> / <i>Lomandra longifolia</i> , <i>Commelina cyanea</i> , <i>Hibbertia scandens</i> , <i>Pteridium esculentum</i>
SR536 – Coastal freshwater lagoons of the Sydney Basin Bioregion and South East Corner Bioregion	Coastal Freshwater Lagoons	781 <i>Melaleuca ericifolia</i> / <i>Casuarina glauca</i> , <i>Melaleuca ericifolia</i> , <i>Blechnum indicum</i> , <i>Hypolepis muelleri</i>
SR544 – Forest Red Gum – Rough-barked Apple – White Stringybark grassy woodlands on hills in dry valleys, southern South East Corner	Coastal Valley Grassy Woodlands	834 <i>Eucalyptus baueriana</i> , <i>Eucalyptus bosistoana</i> , <i>Angophora floribunda</i> , <i>Eucalyptus melliodora</i> / <i>Acacia mearnsii</i> , <i>Bursaria spinosa</i> subsp. <i>spinosa</i> , <i>Ozothamnus diosmifolius</i> / <i>Desmodium varians</i> , <i>Dichanthium sericeum</i> , <i>Dichelachne micrantha</i> , <i>Dichondra repens</i>
SR551 – Grey Myrtle – Lilly Pilly dry rainforest in dry gullies of the Sydney Basin Bioregion and South East Corner Bioregion	Dry Rainforests	875 <i>Backhousia myrtifolia</i> , <i>Syzygium smithii</i> / <i>Ficus 12hrygia</i> 12, <i>Pittosporum undulatum</i> , <i>Breynia oblongifolia</i> , <i>Cissus hypoglauca</i> / <i>Doodia aspera</i> , <i>Oplismenus imbecillis</i> , <i>Pseuderanthemum variabile</i>
SR559 – Ironbark – Woollybutt – White Stringybark open forest on coastal hills, South East Corner	South East Dry Sclerophyll Forests	891 <i>Eucalyptus tricarpa</i> , <i>Eucalyptus longifolia</i> , <i>Eucalyptus globoidea</i> , <i>Eucalyptus muelleriana</i> / <i>Acacia falciformis</i> , <i>Allocasuarina littoralis</i> , <i>Daviesia mimosoides</i> , <i>Hibbertia aspera</i> / <i>Dianella caerulea</i> , <i>Entolasia stricta</i> , <i>Hardenbergia violacea</i> , <i>Joycea pallida</i>
SR571 – Lilly Pilly littoral rainforest of the southern Sydney Basin Bioregion and South East Corner Bioregion	South East Dry Sclerophyll Forests	910 <i>Acmena smithii</i> , <i>Guioa semiglauca</i> , <i>Livistona australis</i> , <i>Diospyros australis</i> / <i>Eupomatia laurina</i> , <i>Ripogonum album</i> , <i>Diospyros australis</i> , <i>Myrsine variabilis</i> / <i>Oplismenus imbecillis</i> , <i>Viola hederacea</i> , <i>Pellaea falcata</i> , <i>Gahnia aspera</i>
SR575 – Mangrove forest in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion	Mangrove Swamps	920 <i>Avicennia marina</i> subsp. <i>australasica</i> , <i>Aegiceras corniculatum</i> / <i>Sarcocornia quinqueflora</i>
SR596 – Red Bloodwood – Silvertop Ash – White Stringybark heathy open forest on coastal foothills, southern South East Corner	South East Dry Sclerophyll Forests	1084 <i>Allocasuarina littoralis</i> , <i>Corymbia gummifera</i> , <i>Banksia serrata</i> , <i>Eucalyptus pilularis</i> / <i>Acacia suaveolens</i> , <i>Acacia terminalis</i> , <i>Aotus ericoides</i> , <i>Banksia spinulosa</i> / <i>Amperea xiphoclada</i> ,

Biometric Vegetation Type	Keith Class ID	Plant Community Type (PCT)
		<i>Anisopogon avenaceus</i> , <i>Dianella caerulea</i> , <i>Entolasia stricta</i>
SR608 – River Peppermint – Rough-barked Apple – River Oak herb/grass riparian forest of coastal lowlands, southern Sydney Basin Bioregion and South East Corner Bioregion	Eastern Riverine Forests	1108 <i>Angophora floribunda</i> , <i>Eucalyptus elata</i> / <i>Acacia mearnsii</i> , <i>Breynia oblongifolia</i> , <i>Rubus parvifolius</i> , <i>Hymenanthera dentata</i> / <i>Adiantum aethiopicum</i> , <i>Carex longibrachiata</i> , <i>Desmodium varians</i> , <i>Dichondra repens</i>
SR612 – Rough-barked Apple shrubby open forest on gully flats, southern South East Corner	South Coast Wet Sclerophyll Forests	1119 <i>Angophora floribunda</i> , <i>Eucalyptus cypellocarpa</i> , <i>Eucalyptus baxteri</i> , <i>Eucalyptus globoidea</i> / <i>Acacia longifolia</i> , <i>Allocasuarina littoralis</i> , <i>Billardiera scandens</i> , <i>Eustrephus latifolius</i> / <i>Dianella caerulea</i> , <i>Dichondra repens</i> , <i>Entolasia stricta</i> , <i>Gonocarpus teucroides</i>
SR614 – Saltmarsh in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion	Saltmarshes	1126 <i>Samolus repens</i> , <i>Suaeda australis</i> , <i>Juncus kraussii</i> , <i>Sarcocornia quinqueflora</i>
SR623 – Silvertop Ash – Rough-barked Apple shrubby open forest on the hinterland hills, far southern South Eastern Corner	South East Dry Sclerophyll Forests	1157 <i>Eucalyptus sieberi</i> , <i>Angophora floribunda</i> , <i>Allocasuarina littoralis</i> / <i>Acacia terminalis</i> , <i>Billardiera scandens</i> , <i>Epacris impressa</i> , <i>Leucopogon lanceolatus</i> / <i>Dianella caerulea</i> , <i>Gahnia radula</i> , <i>Gonocarpus teucroides</i> , <i>Lomandra longifolia</i>
SR649 – Swamp Oak – Prickly Tea-tree – Swamp Paperbark swamp forest on coastal floodplains, Sydney Basin Bioregion and South East Corner Bioregion	Coastal Floodplain Wetlands	1232 <i>Casuarina glauca</i> , <i>Melaleuca quinquenervia</i> / <i>Myoporum spp.</i> , <i>Melaleuca ericifolia</i> , <i>Melaleuca styphelioides</i> / <i>Juncus kraussii</i> , <i>Samolus repens</i> , <i>Sarcocornia quinqueflora</i> , <i>Suaeda australis</i>
SR672 – Yellow Stringybark – Mountain Grey Gum moist shrubby open forest on coastal ranges, southern South East Corner	South Coast Wet Sclerophyll Forests	1337 <i>Eucalyptus cypellocarpa</i> , <i>Eucalyptus obliqua</i> , <i>Eucalyptus elata</i> , <i>Eucalyptus sieberi</i> / <i>Acacia cognata</i> , <i>Elaeocarpus reticulatus</i> , <i>Eustrephus latifolius</i> / <i>Dianella caerulea</i> , <i>Gonocarpus teucroides</i> , <i>Goodenia ovata</i> , <i>Hierochloe rariflora</i>

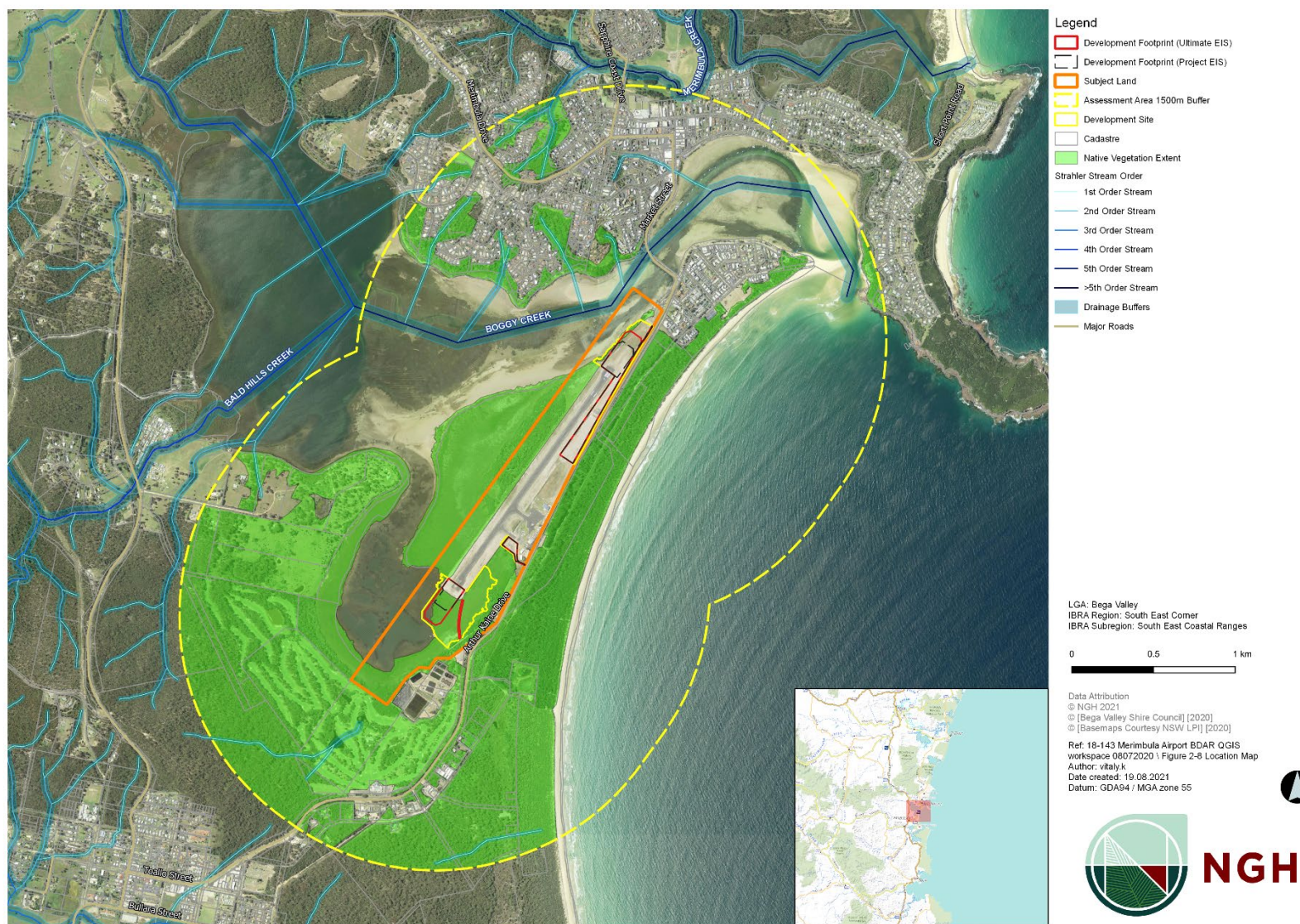


Figure 2-2 Location Map

3 NATIVE VEGETATION

3.1 NATIVE VEGETATION EXTENT

Approximately 45% of the Development Site comprises native vegetation. This includes mangrove wetlands, saltmarsh and disturbed bangalay forest scrub. In assessing native vegetation extent, the grassed areas surrounding the runway (north/south/east/west) were not identified as native vegetation because of strict management regimes that include mowing to maintain safe OLS for planes taking off and landing at Merimbula airport.



Figure 3-1 Native vegetation extent within and next to the development site (north runway)

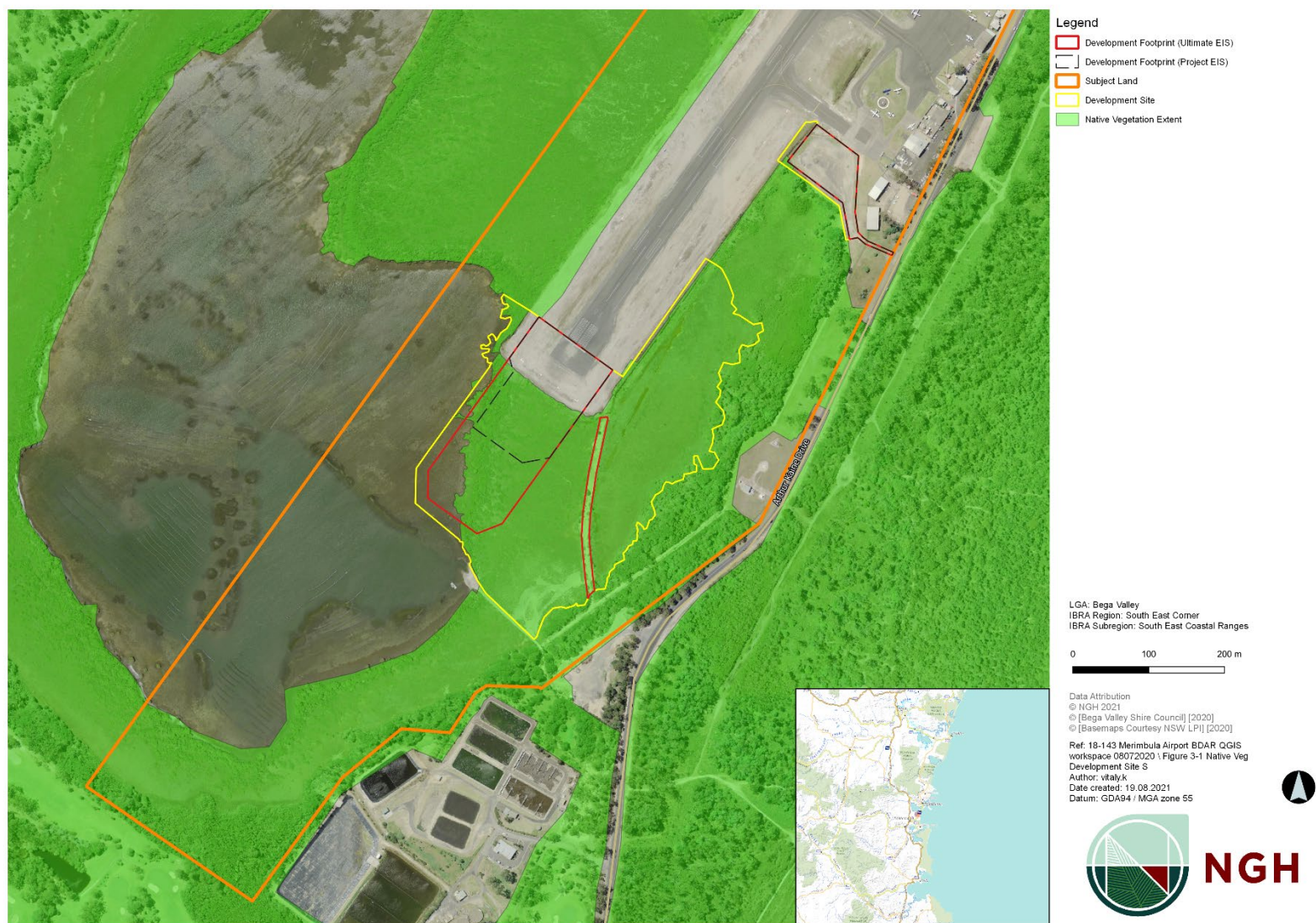


Figure 3-2 Native vegetation extent within and next to the development site (south runway)

3.2 PLANT COMMUNITY TYPES (PCTS)

3.2.1 Methods to assess PCTS

Review of existing information

A search was undertaken of the OEH BioNet Vegetation Classification System (BVCS) database when classifying Plant Community Types (PCTS). The South East Local Lands Service vegetation maps (SELLS 2015) were used to view existing mapping within and surrounding the development site. The compilation map for Biometric vegetation types and Threatened Ecological Communities of the Shoalhaven, Eurobodalla & Bega Valley local government areas was used to view descriptions of relevant Biometric vegetation (OEH 2013).

Most of the northern runway development footprint comprises Biometric vegetation type SR531 'Coast Banksia – Coast Wattle dune scrub of the Sydney Basin Bioregion and South East Corner'. This corresponds to PCT 772 'Coast Banksia – Coast Wattle dune scrub of the Sydney Basin Bioregion and South East Corner Bioregion'. From inspecting the subject land, none of this actual vegetation type/PCT exists. Instead, the site contains Biometric Vegetation type SR575 which is the equivalent of PCT 916 'Mangrove – Grey Mangrove low closed forest of the NSW Coastal Bioregion'. There are two other vegetation types inside the development footprint being SR512 'Bangalay – Old-man Banksia open forest on coastal sands, Sydney Basin Bioregion and South East Corner Bioregion' which is the equivalent of PCT 659 'Bangalay – Old-man Banksia open forest on coastal sands, Sydney Basin Bioregion and South East Corner Bioregion' and Biometric vegetation type SR614 'Saltmarsh in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion.' This converts into PCT 1126 'Saltmarsh in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion'.

All vegetation types are updated to PCTS and assessed as such and described in more detail within Chapter 3.2.2 below.

Floristic survey

An initial site inspection was undertaken by an experienced botanist on 20 July 2018 to stratify the vegetation zones inside the development footprint. The development site and adjacent vegetation was also inspected. Initially, random meander searches were conducted across larger sections within and adjacent to the development site and surrounds to gain more information about surrounding vegetation and dominant species. This was important for providing information about what dominant tree species were likely to occur within the development site which lacked tree cover. Vegetation adjoining the development site was inspected to assess the quality of adjoining habitat to inform habitat suitability and habitat survey assessment within the BAM calculator.

Vegetation integrity plot surveys were undertaken on 15 and 16 October 2018 and 5 November 2018 and 14 May 2020. Additional plots (plot 10, 11,12,13,15) were collected in the area of the southern haul road in May 2020, when this component was added to the Stage 2 works description. The aim of this survey was to determine the structure, function and composition of each vegetation zone inside the development footprint and site.

PCT identification was based on;

- Best matches of native species present inside 20 x 20 m plots to defined PCTS,

- Tree species observed in similar and adjoining landforms to the development footprint and,
- location in the IBRA subregion using the BioNet Vegetation Classification Database.

Once PCTs were identified, they were then stratified into different condition categories to identify vegetation zones for the purpose of undertaking survey.

Vegetation integrity quadrats consisting of 20 x 20 m floristic survey (composition, structure) and 20 x 50 m (function) were replicated across the development footprint as instructed by the BAM within each vegetation zone. Data was collected utilising the methodology presented in the BAM 2017 by persons trained in and/or accredited to apply the BAM. All work was conducted under the direction of persons accredited to apply the BAM.

3.2.2 PCTs identified on the development site

There are three PCTs identified within the development footprint. These include;

- PCT 659 Bangalay – Old-man Banksia open forest on coastal sands, Sydney Basin Bioregion and South East Corner Bioregion, &
- PCT 920 Mangrove – Grey Mangrove low closed forest of the NSW Coastal Bioregion &
- PCT 1126 Saltmarsh in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion

Table 3-1 PCTs identified within the development footprint (Ultimate EIS) & site

Bangalay – Old-man Banksia open forest on coastal sands, Sydney Basin Bioregion and South East Corner Bioregion		
Vegetation formation	Dry Sclerophyll Forest (Shrubby sub-formation)	
Vegetation class	South Coast Sands Dry Sclerophyll Forests	
Vegetation type	PCT ID	659
	Common Community Name	Bangalay – Old-man Banksia open forest on coastal sands, Sydney Basin Bioregion and South East Corner Bioregion
Extent within the development site	Totals 10.88ha, Zone 1 'Scrub' (0.19 ha) Zone 2 'Grassland' (10.69 ha)	
Extent within the development footprint	Totals 8.51 ha, Zone 1 'Scrub' (0.07 ha) Zone 2 'Grassland' (8.44)	
Species relied upon for PCT identification	Species name	Relative abundance
	<i>Eucalyptus botryoides</i>	17 individuals inside plot
	<i>Pteridium esculentum</i>	1000 individuals inside plot
	<i>Imperata cylindrica</i>	2000 individuals inside plot
	<i>Lomandra longifolia</i>	3 individuals inside plot

Bangalay – Old-man Banksia open forest on coastal sands, Sydney Basin Bioregion and South East Corner Bioregion

Justification of evidence used to identify the PCT

PCT 659 was the strongest match with the presence of *Eucalyptus botryoides* in the tree canopy in association with groundcover species found onsite. *Banksia serrata* and *Breynia oblongifolia* observed outside of the plot. Geology was beach sand.

- PCTs shortlisted include;
 - PCT 694 Blackbutt – Turpentine – Bangalay moist open forest on sheltered slopes and gullies, southern Sydney Basin Bioregion.
 - PCT 771 Coast Banksia – Coast Tea-tree low moist forest on coastal sands and headlands, Sydney Basin Bioregion and South East Corner Bioregion.
 - PCT 1079 Red Bloodwood – Blackbutt – Spotted Gum shrubby open forest on coastal foothills, southern Sydney Basin Bioregion.
 - PCT 1084 Red Bloodwood – Silvertop Ash – White Stringybark heathy open forest on coastal foothills, southern South East Corner Bioregion.

As well as matching plot data to PCTs, existing vegetation mapping was also reviewed to gain equivalent biometric vegetation types, to determine which PCT best fits the site condition and floristics. The Equivalent biometric vegetation type is SR512 'Bangalay – Old-man Banksia open forest on coastal sands, Sydney Basin Bioregion and South East Corner Bioregion' as described above.

TEC Status

PCT 659 is associated with one TEC under NSW Legislation. This is Bangalay Sand Forest of the Sydney Basin and South East Corner bioregion. Zone 1 'Scrub' is a degraded form of this TEC. Zone 2 'Derived grassland' is beyond any capabilities of regeneration with future management for OLS so this vegetation is not classified as TEC due to its degraded state and inability to regenerate with airport land management.

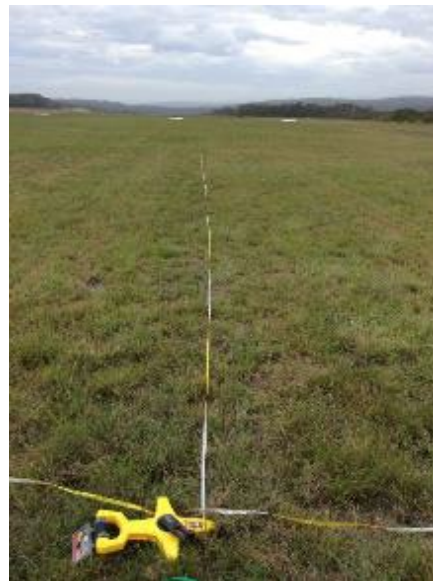
Estimate of percent cleared

50%

Examples



PCT 659 'Scrub' Plot 4



PCT 659 'Grassland' Plot 6

Mangrove Forests in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion		
Vegetation formation	Saline Wetlands	
Vegetation class	Mangrove Swamps	
Vegetation type	PCT ID	920
	Common Community Name	Mangrove Forests in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion
Extent within the development site	Totals 4.2 ha, Zone 3 Gmangrove Sand Nth (0.38 ha) Zone 4 Gmangrove Mud Sth (1.40 ha) Zone 5 RGMangrove Mud Sth (2.42 ha)	
Extent within the development footprint	Totals 2.06 ha Zone 3 Gmangrove Sand Nth (0.03 ha) Zone 4 Gmangrove Mud Sth (1.0ha) Zone 5 RGMangrove Mud Sth (1.03 ha)	
Species relied upon for PCT identification	Species name	Relative abundance (Ave 3 plots)
	<i>Avicennia marina subsp. australasica</i>	40 individuals inside plot
	<i>Aegiceras corniculatum</i>	129 individuals inside plot
	<i>Sarcocornia quinqueflora subsp. quinqueflora</i>	2000 individuals inside plot
Justification of evidence used to identify the PCT	PCT 920 was the strongest match with the presence of dominants Grey Mangrove (<i>Avicennia marina subsp. australasica</i>) and River Mangrove (<i>Aegiceras corniculatum</i>) in the upper stratum and Samphire (<i>Sarcocornia quinqueflora subsp. quinqueflora</i>) in the midstory. - PCTs shortlisted include; - PCT 916 Mangrove – Grey Mangrove low closed forest of the NSW Coastal Bioregion. - PCT 918 Mangrove – River Mangrove low closed forest of the NSW Coastal Bioregion. - As well as matching plot data to PCTs, existing vegetation mapping was also reviewed to gain equivalent biometric vegetation types, to determine which PCT best fits the site condition and floristics. The Equivalent biometric vegetation type is SR575 which is the equivalent of PCT 916 ‘Mangrove – Grey Mangrove low closed forest of the NSW Coastal Bioregion’. As PCT 920 had correct distribution and better floristic match, it was decided to name it this PCT.	
TEC Status	PCT 920 is associated with one endangered TEC listing under NSW Legislation. Coastal Saltmarsh in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions. On review of the scientific committee determination (SCD) for this TEC, it was decided not to classify it as this TEC primarily because;	

Mangrove Forests in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion

	○ This community was dominated by mangroves which occupied around 50% of the area. The presence of mangroves was not occasional as mentioned under paragraph 5 of the SCD. ○ The area lacked representative species such as <i>Juncus kraussii</i>, <i>Baumea juncea</i> and representative grasses.
Estimate of percent cleared	86%
Examples	  PCT 920 Plot 1 PCT 920 Plot 2

Saltmarsh in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion

Vegetation formation	Saline Wetlands
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Saltmarsh in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion		
Vegetation class	Saltmarshes	
Vegetation type	PCT ID	1126
	Common Community Name	Saltmarsh in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion
Approximate extent within the development site	Totals 5.58 ha, Zone 6 – Saltmarsh -mown (0.06 ha) Zone 7 – Saltmarsh – intact (5.13 ha) Zone 8 – Saltmarsh – channel/artificial (0.388)	
Extent within development footprint	Totals 0.12 ha Zone 6 – Saltmarsh – Mown (0.05 ha) Zone 7 – Saltmarsh – south haul road (0.07ha)	
Species relied upon for PCT identification	Species name	Relative abundance
	<i>Selliera radicans</i>	3000 individuals
	<i>Juncus kraussii</i>	1000 individuals
	<i>Sarcocornia quinqueflora</i>	500 individuals
Justification of evidence used to identify the PCT	PCT 1126 was the strongest match with the presence of <i>Selliera radicans</i>, <i>Juncus kraussii</i> subsp. <i>australiensis</i> & <i>Sarcocornia quinqueflora</i>. PCTs shortlisted (with reasonable matches) only included one PCT; PCT 1234 Swamp Oak swamp forest fringing estuaries, Sydney Basin Bioregion and South East Corner Bioregion. As well as matching plot data to PCTs, existing vegetation mapping was also reviewed to gain equivalent biometric vegetation types, to determine which PCT best fits the site condition and floristics. The equivalent biometric vegetation type is SR614 'Saltmarsh in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion.' This converts into PCT 1126 'Saltmarsh in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion'. It was difficult to classify Zone 8 'Saltmarsh – Channel/artificial' due to disturbances meaning this area was a combination of PCT 659 (in drier parts), PCT 920 (inside the channel with mangroves) and PCT 1126 (on eastern edge of channel). In order to assess this under BAM it was classified as PCT 1126 because of the extent of adjoining saltmarsh habitat.	
TEC Status	PCT 1126 is associated with one TEC under NSW Legislation. This is Coastal Saltmarsh in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions. While this small area would fit the definition of saltmarsh, the area itself is not subjected to tidal inundation and is found within a depression of the mown obstacle limitation surface area for planes landing and taking off. As such, taller species have been eliminated or kept permanently short and this is not likely to change with future use of the airport. Due to the highly degraded state of vegetation onsite this PCT is not defined as TEC under the NSW Biodiversity Conservation Act.	

Saltmarsh in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion

Estimate of percent cleared

50%

Examples



PCT 1126 Plot 5 (Mown Veg Zone 6)



PCT 1126 Plot 10 (Intact Veg Zone 7)



PCT 1126 Plot 15 (Artificial channel – Veg Zone 8)

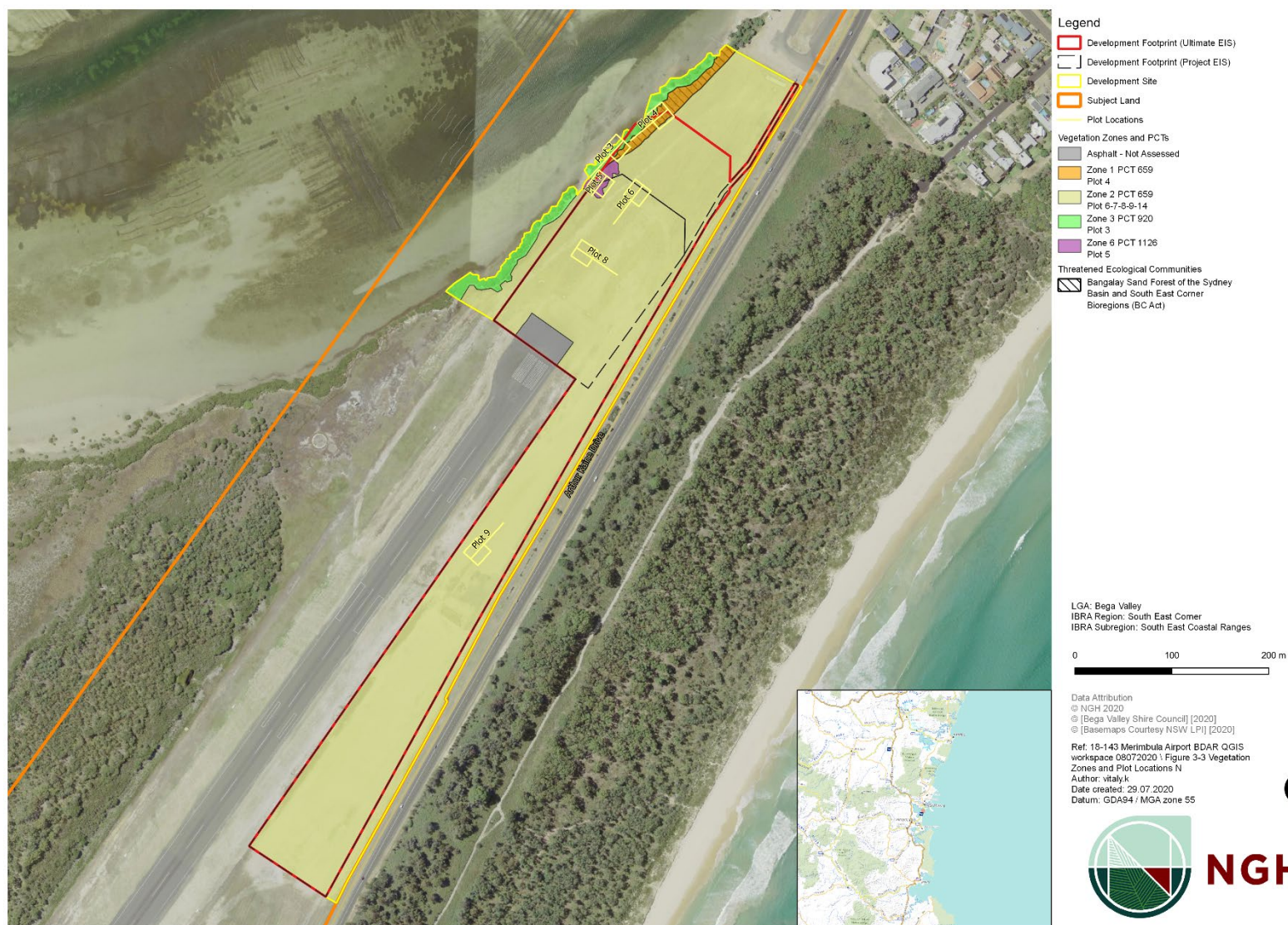


Figure 3-3 Vegetation zones, TECs and Plot locations (north runway)

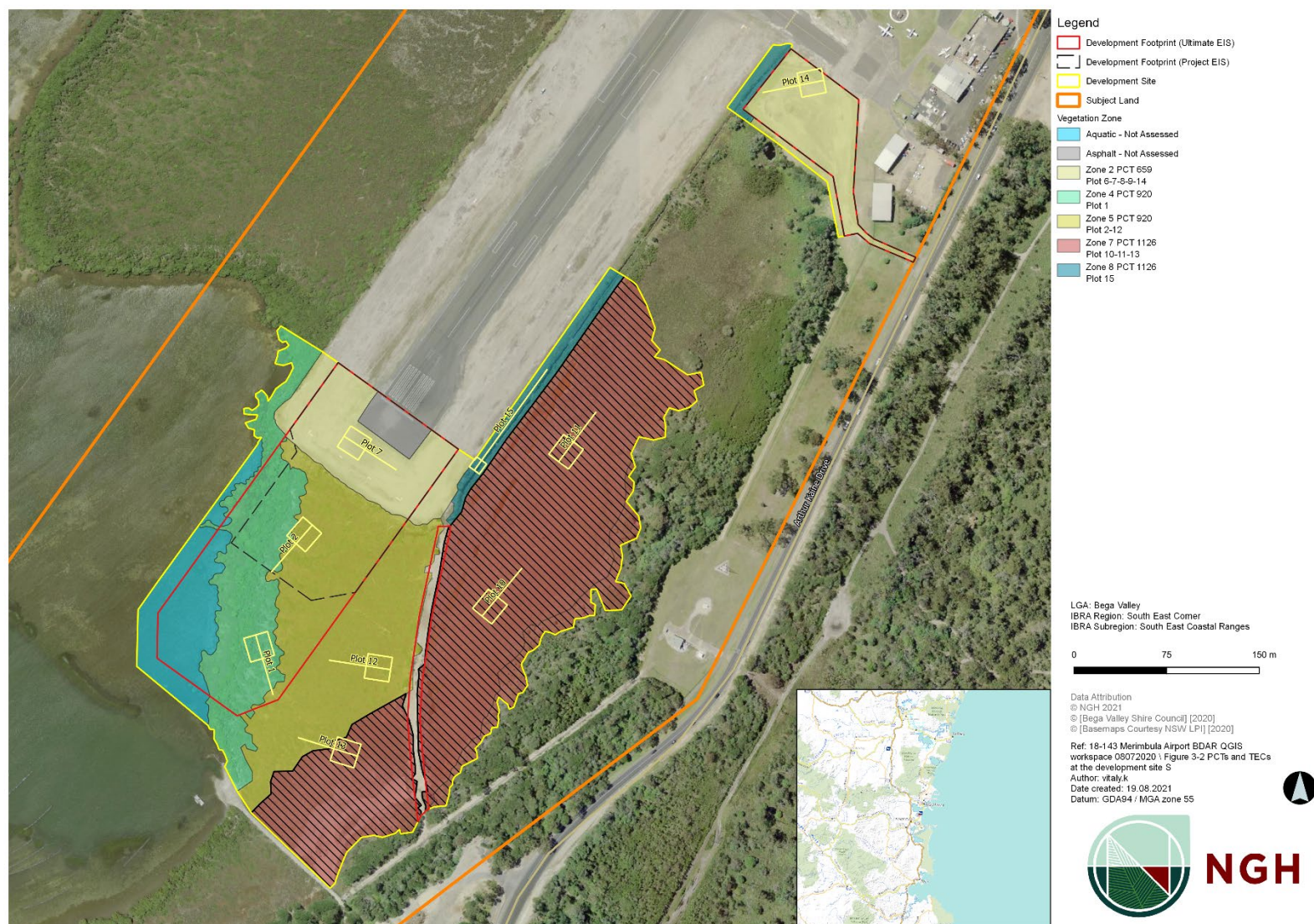


Figure 3-4 Vegetation zones and TECs (south runway)

3.3 VEGETATION INTEGRITY ASSESSMENT

3.3.1 Vegetation zones and survey effort

The random meander in combination with vegetation integrity plots have been used to stratify the vegetation into PCTs. Three PCTs were identified inside the development footprint these being PCT 659, 920 & 1126. These PCTs were further stratified into various condition categories to differentiate structural and floristic variations onsite. There were two condition categories for PCT 659 being 'Bangalay Scrub' with trees and 'Mown Grassland' with groundcovers only. There were three condition categories for PCT 920, being floristic variations with the dominance of Grey Mangrove, River Mangrove and the soil substrates being sand (north runway) and mud (south runway).

There are six vegetation zones inside the development footprint and eight vegetation zones inside the development site. Fifteen vegetation integrity plots completed to comply with the required number of plots in accordance with the BAM.

Table 3-2 Vegetation zones for the development site

Zone ID	PCT ID	Condition	Zone area (ha)	Survey effort (# plots)	Patch size (ha)
1	659	Bangalay Scrub (Nth Runway) This vegetation zone contained cut Bangalay trees and thick groundcover including recently cut bangalay branches resulting from the pruning for OLS airport safety height limitations.	0.19	1 plot (plot 4)	101
2	659	Mown Grassland (Nth/Sth Runway) This vegetation zone consisted of groundcovers only which were managed like a lawn. This area is within the most intensively managed OLS vegetation management zone.	10.69	5 plots (Plot 6, 7 & 8, 9, 14)	33
3	920	Grey Mangrove (Nth Runway) This vegetation zone was dominated by Grey Mangrove on the sandy shoreline of Merimbula Lake. No River Mangroves present.	0.38	1 plot (Plot 3)	101
4	920	Grey Mangrove (Sth Runway) This vegetation zone consisted of dominant Grey Mangrove established within anaerobic mud (not sand). Occasional River Mangrove present.	1.40	1 plot (Plot 1)	101
5	920	Grey & River Mangrove (Sth Runway) This vegetation zone consisted of equal distribution of Grey Mangrove and River Mangrove. Some saline herbs present as well. The vegetation zone includes the southern haul road.	2.42	2 plots (Plot 2, 12)	101

Zone ID	PCT ID	Condition	Zone area (ha)	Survey effort (# plots)	Patch size (ha)
6	1126	Mown Saltmarsh (Nth Runway) This vegetation zone consisted of mown and degraded saltmarsh. There were many weeds including Buckhorn Plantain and Chilean Needle Grass occupying the site.	0.06	1 plot (Plot 5)	33
7	1126	Intact Saltmarsh (Sth Runway) Largely intact and lacking species richness. The vegetation zone includes small areas of saltmarsh adjoining onto the southern haul road.	4.36	2 plots (Plot 10, 11,13) Plot 10 used in BAM C	101
8	1126	Artificial Channel Saltmarsh (Sth Runway) This vegetation zone consists of the artificial drain receiving overland flow from airport hardstand areas. It was ecotonal between PCTs 920, 1126 & 659. Not inside the development footprint.	0.39	1 plot (Plot 15)	101

3.3.2 Vegetation integrity assessment results

Four vegetation integrity plots were conducted within PCT 920 to reflect the variation in this community. Mangroves within the southern Runway section were growing in anerobic mud and there was a clear distinction between Grey Mangrove dominant vegetation (fringing Merimbula Lake) and an equal dominance between Grey and River Mangrove further inland as habitat transformed from Mangrove swamp to a saltmarsh community. As such, three zones were identified onsite. There was also Grey Mangrove fringing Merimbula Lake within the Northern Runway development footprint growing in a different soil substrate. These Mangroves were growing within Beach sand adjoining Merimbula Lake and habitat was different to the south runway. As such another zone was created for this site to reflect variation in composition and structure of vegetation onsite.

Six vegetation integrity plots were conducted within PCT 659 to reflect two distinct zones being 'Bangalay scrub' containing trees which were lopped for OLS and 'mown grasslands' (containing species representative of PCT 659) which did not contain any structural tree or shrub cover.

The remaining PCT 1126 was classified into three zones, with one zone inside the development footprint consisting of mown saltmarsh which was highly disturbed. The remaining two zones (Saltmarsh – good and Saltmarsh Channel/Artificial) are found outside the development footprint.

The results of the vegetation integrity assessment are provided in Table 3-3 below. The field data sheets for each vegetation zone are provided in Appendix A.

Table 3-3 Current vegetation integrity scores for each vegetation zone inside the 'ultimate' development footprint.

Zone ID	PCT ID	Composition score	Structure score	Function Score	Vegetation Integrity Score
1	PCT 659 Plot4_Nth_Bangalay	59.3	51.6	42.8	50.8
2	PCT 659 Plot6_Nth_Grassland	21.7	11.4	2.1	8.0
3	PCT 920 Plot3_Nth_Gmangrove	68.9	99.8	NA	82.9
4	PCT 920 Plot1_Sth_Gmangrove	48.9	100	NA	69.9
5	PCT 920 Plot2_SthRGMangrove	37.1	81.5	NA	55
6	PCT 1126 Plot5_Nth_Saltmarsh	63.2	89.9	NA	75.4
7	PCT 1126 Plot 10_Sth_Saltmarsh	6.9	20.6	NA	11.9

4 THREATENED SPECIES (NSW)

4.1 ECOSYSTEM CREDIT SPECIES

The following ecosystem credit species (Table 4-1) were returned by the calculator as being associated with the PCTs present on the development site:

Table 4-1 Ecosystem credit species generated by the BAM Calculator

Ecosystem Credit Species	Relevant vegetation zones	NSW listing status	National listing status
Regent Honeyeater <i>Anthochaera 30phrygia</i> (Foraging)	659_Plot 4_Nth_Scrub 659_Plot 6-7-8_NthSthGrass	Critically Endangered	Critically Endangered
Dusky Woodswallow <i>Artamus cyanopterus cyanopterus</i>	1126_Plot5_Nth_Saltmarsh 1126_Plot10_Sth_Saltmarsh 920_Plot1_Sth_Gmangrove 659_Plot 4_Nth_Scrub 659_Plot 6-7-8_NthSthGrass 920_Plot3_Nth_Gmangrove 920_Plot2_SthRGMangrove	Vulnerable	Not Listed
Australasian Bittern <i>Botaurus poiciloptilus</i>	1126_Plot5_Nth_Saltmarsh 1126_Plot10_Sth_Saltmarsh 920_Plot1_Sth_Gmangrove 920_Plot3_Nth_Gmangrove 920_Plot2_Sth_RGMangrove	Endangered	Endangered
Sanderling <i>Calidris alba</i> (Foraging)	1126_Plot5_Nth_Saltmarsh 1126_Plot10_Sth_Saltmarsh	Vulnerable	Not Listed
Curlew Sandpiper <i>Calidris ferruginea</i> (Foraging)	1126_Plot5_Nth_Saltmarsh 1126_Plot10_Sth_Saltmarsh 920_Plot1_Sth_Gmangrove 920_Plot3_Nth_Gmangrove 920_Plot2_Sth_RGMangrove	Endangered	Critically Endangered
Gang-gang Cockatoo	659_Plot4_Nth_Scrub 659_Plot6-7-8_NthSthGrass	Vulnerable	Not Listed

Ecosystem Credit Species	Relevant vegetation zones	NSW listing status	National listing status
<i>Calyptorhynchus lathamii</i> (Foraging)			
Glossy Black-Cockatoo <i>Calyptorhynchus lathamii</i> (Foraging)	659_Plot4_Nth_Scrub 659_Plot6-7-8_NthSthGrass	Vulnerable	Not Listed
Spotted Harrier <i>Circus assimilis</i>	1126_Plot5_Nth_Saltmarsh 1126_Plot10_Sth_Saltmarsh	Vulnerable	Not Listed
Varied Sittella <i>Daphoenositta chrysoptera</i>	659_Plot4_Nth_Scrub 659_Plot6-7-8_NthSthGrass	Vulnerable	Not Listed
Spotted-tailed Quoll <i>Dasyurus maculatus</i>	659_Plot4_Nth_Scrub 659_Plot6-7-8_NthSthGrass 920_Plot1_Sth_Gmangrove 920_Plot3_Nth_Gmangrove 920_Plot2_Sth_RGMangrove	Vulnerable	Endangered
White-fronted Chat <i>Epthianura albifrons</i>	1126_Plot5_Nth_Saltmarsh 1126_Plot10_Sth_Saltmarsh 920_Plot1_Sth_Gmangrove 920_Plot3_Nth_Gmangrove 920_Plot2_Sth_RGMangrove	Vulnerable	Not Listed
Beach Stone-curlew <i>Esacus magnirostris</i>	1126_Plot5_Nth_Saltmarsh 1126_Plot10_Sth_Saltmarsh 920_Plot1_Sth_Gmangrove 920_Plot3_Nth_Gmangrove 920_Plot2_Sth_RGMangrove	Critically Endangered	Not Listed
Little Lorikeet <i>Glossopsitta pusilla</i>	659_Plot4_Nth_Scrub 659_Plot6-7-8_NthSthGrass	Vulnerable	Not Listed
White-bellied Sea-Eagle <i>Haliaeetus leucogaster</i>	1126_Plot5_Nth_Saltmarsh 1126_Plot10_Sth_Saltmarsh 920_Plot1_Sth_Gmangrove 920_Plot3_Nth_Gmangrove 920_Plot2_Sth_RGMangrove	Vulnerable	Not Listed

Ecosystem Credit Species	Relevant vegetation zones	NSW listing status	National listing status
Little Eagle <i>Hieraaetus morphnoides</i>	659_Plot4_Nth_Scrub 659_Plot6-7-8_NthSthGrass 920_Plot1_Sth_Gmangrove 920_Plot3_Nth_Gmangrove 920_Plot2_Sth_RGMangrove 1126_Plot5_Nth_Saltmarsh 1126_Plot10_Sth_Saltmarsh	Vulnerable	Not Listed
Black Bittern <i>Ixobrychus flavicollis</i>	1126_Plot5_Nth_Saltmarsh 1126_Plot10_Sth_Saltmarsh 920_Plot1_Sth_Gmangrove 920_Plot3_Nth_Gmangrove 920_Plot2_Sth_RGMangrove	Vulnerable	Not Listed
Swift Parrot <i>Lathamus discolor</i> (Foraging)	659_Plot4_Nth_Scrub 659_Plot6-7-8_NthSthGrass	Endangered	Critically Endangered
Black-tailed Godwit <i>Limosa limosa</i> (Foraging)	1126_Plot5_Nth_Saltmarsh 1126_Plot10_Sth_Saltmarsh 920_Plot1_Sth_Gmangrove 920_Plot3_Nth_Gmangrove 920_Plot2_Sth_RGMangrove	Vulnerable	Not Listed
Square-tailed Kite <i>Lophoictinia isura</i>	659_Plot4_Nth_Scrub 659_Plot6-7-8_NthSthGrass	Vulnerable	Not Listed
Eastern Coastal Freetail Bat <i>Micronomus norfolkensis</i>	659_Plot4_Nth_Scrub 659_Plot6-7-8_NthSthGrass 920_Plot1_Sth_Gmangrove 920_Plot3_Nth_Gmangrove 920_Plot2_Sth_RGMangrove 1126_Plot5_Nth_Saltmarsh 1126_Plot10_Sth_Saltmarsh	Vulnerable	Not Listed
Large Bentwing Bat <i>Miniopterus orianae oceanensis</i> (Foraging)	659_Plot4_Nth_Scrub 659_Plot6-7-8_NthSthGrass 920_Plot1_Sth_Gmangrove 920_Plot3_Nth_Gmangrove	Vulnerable	Not Listed

Ecosystem Credit Species	Relevant vegetation zones	NSW listing status	National listing status
	920_Plot2_Sth_RGMangrove 1126_Plot5_Nth_Saltmarsh 1126_Plot10_Sth_Saltmarsh		
Barking Owl <i>Ninox connivens</i> (Foraging)	659_Plot4_Nth_Scrub 659_Plot6-7-8_NthSthGrass	Vulnerable	Not Listed
Eastern Osprey <i>Pandion cristatus</i> (Foraging)	920_Plot1_Sth_Gmangrove 920_Plot3_Nth_Gmangrove 920_Plot2_Sth_RGMangrove 1126_Plot5_Nth_Saltmarsh 1126_Plot10_Sth_Saltmarsh	Vulnerable	Not Listed
Yellow-bellied Glider <i>Petaurus australis</i>	659_Plot4_Nth_Scrub 659_Plot6-7-8_NthSthGrass	Vulnerable	Not Listed
Koala <i>Phascolarctos cinereus</i>	659_Plot4_Nth_Scrub 659_Plot6-7-8_NthSthGrass	Vulnerable	Vulnerable
Long-nosed Potoroo <i>Potorous tridactylus</i>	659_Plot4_Nth_Scrub 659_Plot6-7-8_NthSthGrass	Vulnerable	Vulnerable
Grey-headed Flying-fox <i>Pteropus poliocephalus</i>	659_Plot4_Nth_Scrub 659_Plot6-7-8_NthSthGrass 920_Plot1_Sth_Gmangrove 920_Plot3_Nth_Gmangrove 920_Plot2_Sth_RGMangrove 1126_Plot5_Nth_Saltmarsh 1126_Plot10_Sth_Saltmarsh	Vulnerable	Vulnerable
Yellow-bellied Sheath-tail Bat <i>Saccolaimus flaviventris</i>	659_Plot4_Nth_Scrub 659_Plot6-7-8_NthSthGrass 920_Plot1_Sth_Gmangrove 920_Plot3_Nth_Gmangrove 920_Plot2_Sth_RGMangrove	Vulnerable	Not Listed
Greater Broad-nosed Bat <i>Scoteanax rueppellii</i>	659_Plot4_Nth_Scrub 659_Plot6-7-8_NthSthGrass 920_Plot1_Sth_Gmangrove 920_Plot3_Nth_Gmangrove	Vulnerable	Not Listed

Ecosystem Credit Species	Relevant vegetation zones	NSW listing status	National listing status
	920_Plot2_Sth_RGMangrove 1126_Plot5_Nth_Saltmarsh 1126_Plot10_Sth_Saltmarsh		
Little Tern <i>Sternula albifrons</i> (Foraging)	920_Plot1_Sth_Gmangrove 920_Plot3_Nth_Gmangrove 920_Plot2_Sth_RGMangrove 1126_Plot5_Nth_Saltmarsh 1126_Plot10_Sth_Saltmarsh	Endangered	Not Listed
Masked Owl <i>Tyto novaehollandiae</i> (Foraging)	659_Plot4_Nth_Scrub 659_Plot6-7-8_NthSthGrass	Vulnerable	Not Listed

4.1.1 Species excluded from the assessment

The following species were excluded from further assessment based on a lack of specific habitat onsite (Table 4-2).

Table 4-2 Species excluded from the assessment based on lack of habitat

Ecosystem Credit Species	Vegetation zones excluded	Reason for exclusion
Regent Honeyeater <i>Anthochaera phrygia</i> (Foraging)	659_Plot 6-7-8_NthSthGrass	No foraging resources within grasslands without trees. (6.4.1.17 BAM) – TBDC Habitat and Ecology Tab.
Sanderling <i>Calidris alba</i> (Foraging)	1126_Plot5_Nth_Saltmarsh 1126_Plot10_Sth_Saltmarsh	Saltmarsh does not consist of mudflats or subjected to regular tides. Site subjected to regular mowing and frequent disturbance from planes landing and taking off. (6.4.17 BAM) – TBDC Habitat and Ecology Tab.
Curlew Sandpiper <i>Calidris ferruginea</i> (Foraging)	1126_Plot5_Nth_Saltmarsh	Saltmarsh does not consist of mudflats or subjected to regular tides. Saltmarsh subjected to regular mowing and disturbance from planes landing and taking off. (6.4.17 BAM) – TBDC Habitat and Ecology Tab.
Gang-gang Cockatoo <i>Calyptorhynchus lathami</i> (Foraging)	659_Plot6-7-8_NthSthGrass	Insufficient foraging habitat within mown grassland devoid of shrubs/trees near runway. (6.4.17 BAM) – TBDC Habitat and Ecology Tab.
Glossy Black-Cockatoo <i>Calyptorhynchus lathami</i> (Foraging)	659_Plot6-7-8_NthSthGrass	Insufficient foraging habitat within mown grassland near runway that is devoid of shrubs/trees near runway. (6.4.17 BAM) – Habitat and Ecology Tab.
Varied Sittella <i>Daphoenositta chrysoptera</i>	659_Plot6-7-8_NthSthGrass	Absence of timbered habitat within mown grassland near runway that is devoid of shrubs/trees. (6.4.17 BAM) – Habitat and Ecology Tab.

Ecosystem Credit Species	Vegetation zones excluded	Reason for exclusion
White-fronted Chat <i>Epthianura albifrons</i>	1126_Plot5_Nth_Saltmarsh	Saltmarsh subjected to regular mowing and disturbance from planes landing and taking off. Insufficient habitat for foraging. (6.4.17 BAM) – TBDC Habitat and Ecology Tab.
Beach Stone-curlew <i>Esacus magnirostris</i>	1126_Plot5_Nth_Saltmarsh	Saltmarsh subjected to regular mowing and disturbance from planes landing and taking off. Insufficient habitat for foraging. (6.4.17 BAM) – TBDC Habitat and Ecology Tab.
Little Lorikeet <i>Glossopsitta pusilla</i>	659_Plot6-7-8_NthSthGrass	Primarily forages in forests and woodlands. This zone does not contain any trees and is disturbed by planes landing and taking off. (6.4.17 BAM) – TBDC Habitat and Ecology Tab.
Swift Parrot <i>Lathamus discolor</i> (Foraging)	659_Plot6-7-8_NthSthGrass	Insufficient foraging habitat within mown grassland devoid of nectar bearing shrubs/trees near runway. (6.4.17 BAM) – TBDC Habitat and Ecology Tab.
Black-tailed Godwit <i>Limosa limosa</i> (Foraging)	1126_Plot5_Nth_Saltmarsh	Saltmarsh is well drained and generally dry ground subjected to regular mowing and disturbance from planes landing and taking off. Insufficient foraging habitat. (6.4.17 BAM) – TBDC Habitat and Ecology Tab.
Yellow-bellied Glider <i>Petaurus australis</i>	659_Plot4_Nth_Scrub 659_Plot6-7-8_NthSthGrass	Scrub zone devoid of trees >4 m in height (pruned for OLS). Pruned Bangalays inappropriate for feeding. (6.4.17 BAM) – TBDC Habitat Constraint Tab.
Grey-headed Flying-fox <i>Pteropus poliocephalus</i>	659_Plot6-7-8_NthSthGrass 1126_Plot5_Nth_Saltmarsh	Both zones devoid of food/roosting resources. Habitat is devoid of shrubs and trees and consists of mown grassland/groundcover near runway.

4.2 SPECIES CREDIT SPECIES

4.2.1 Candidate species to be assessed

The BAM Calculator predicted the following species credit species to occur at the development site (Table 4-3).

Table 4-3 Candidate species credit species requiring assessment

Species Credit Species	Habitat preferences and geographic distribution	Sensitivity to gain class	NSW listing status	National listing status
Regent Honeyeater <i>Anthochaera Phrygia</i> (Breeding)	Inhabits dry open forest woodland feeding on eucalypt nectar. Nests in tall eucalypts. Observation recorded in 1982 found 3 km south of development footprint.	High	Critically Endangered	Critically Endangered
Bush Stone-curlew <i>Burhinus grallarius</i>	Relies on open forests and woodlands with grassy ground layer and standing or fallen timber resources. No records within 10 km of the development footprint (Bionet).	High	Endangered	Not Listed
Thick Lip Spider Orchid <i>Caladenia tessellata</i>	Found in grassy sclerophyll woodland on clay loam or sandy soils. No records within 10 km of development footprint (Bionet).	Moderate	Endangered	Vulnerable
Sanderling <i>Calidris alba</i> (Breeding)	Found in coastal areas on low beaches of firm sand, along tidal mudflats and bare open coastal lagoons. Records are within 10 km of the development footprint (Bionet).	High	Vulnerable	Not Listed
Red Knot (<i>Calidris canutus</i>)	Found on intertidal mudflats, estuaries, bays, inlets, lagoons, sandflats and sandy beaches.	High	Not Listed	Endangered
Curlew Sandpiper <i>Calidris ferruginea</i> (Breeding)	Occupies littoral and estuarine habitats and found in intertidal mudflats of sheltered coasts.	High	Endangered	Critically Endangered

Species Credit Species	Habitat preferences and geographic distribution	Sensitivity to gain class	NSW listing status	National listing status
Gang-gang Cockatoo <i>Callocephalon fimbriatum</i> (Breeding)	Found in tall mountain forests and woodlands particularly heavily timbered habitat. Records are within 10 km of development footprint (Bionet).	High	Endangered	Not Listed
Glossy Black-Cockatoo <i>Calyptorhynchus lathami</i> (Breeding)	Inhabits open forest and woodlands where stands of Black Sheoak (<i>Allocasuarina littoralis</i>) and Forest Sheoak (<i>Allocasuarina torulosa</i>) are present for foraging. Records found within 10 km of development footprint (Bionet)	High	Vulnerable	Not Listed
Eastern Pygmy-possum <i>Cercartetus nanus</i>	Inhabits woodlands and heaths and rainforest vegetation. Feeds on nectar and pollen from banksias, eucalypts and bottlebrushes. Shelters in dreys, hollows, abandoned bird nests and in shredded bark. No records within 10 km of development footprint (Bionet).	High	Vulnerable	Not Listed
Large-eared Pied Bat <i>Chalinolobus dwyeri</i>	Roosts in caves, crevices in cliffs and old mine workings frequenting dry open forest and woodland close to roosting features. Usually found north of Batemans Bay. No records within 10 km of development footprint (Bionet)	Very High	Vulnerable	Vulnerable
Chef's Cap Correa <i>Correa baeuerlenii</i>	Geographically limited to north of Bega River, North of Tathra.	High	Vulnerable	Vulnerable
Leafless Tongue Orchid <i>Cryptostylis hunteriana</i>	Typically inhabits woodland dominated by Scribbly Gum, Silvertop Ash and Black Sheoak favouring open areas in the understory and often associated with Large Tongue Orchid and Tartan Tongue Orchid.	Moderate	Vulnerable	Vulnerable

Species Credit Species	Habitat preferences and geographic distribution	Sensitivity to gain class	NSW listing status	National listing status
Australian Saltgrass <i>Distichlis distichophylla</i>	Salt marsh, saline areas or margins of these areas. No records within 10 km of the development footprint (Bionet)	High	Endangered	Not Listed
Beach Stone-curlew <i>Esacus magnirostris</i> (Breeding)	Found along beaches and in estuaries and edges of mangroves. They forage in the intertidal zone of beaches and among mangroves. Beach Stone-curlews breed at the backs of beaches, or on sandbanks and islands, among low vegetation of grass, scattered shrubs or low trees; also among open mangroves.	High	Critically Endangered	Not Listed
Tangled Bedstraw <i>Galium australe</i>	Associated within sand dunes, sand spits, shrubland and woodland. No records within 10 km of the development footprint.	High	Endangered	Not Listed
Sooty Oystercatcher <i>Haematopus fuliginosus</i>	Land within 100 m of estuarine habitat including beaches and muddy estuaries. Breeds in spring and summer, almost exclusively on offshore islands, and occasionally on isolated promontories. The nest is a shallow scrape on the ground, or small mounds of pebbles, shells or seaweed when nesting among rocks. Records within 10 km of the development footprint (Bionet)	High	Vulnerable	Not Listed
Pied Oystercatcher <i>Haematopus longirostris</i>	Land within 100 m of estuarine habitat including beaches and muddy estuaries. Breeds in spring and summer, almost exclusively on offshore islands, and occasionally on isolated promontories. The nest is a shallow scrape on the ground, or small mounds of pebbles, shells or seaweed when nesting among rocks. Records within 10 km of the development footprint (Bionet)	High	Endangered	Not Listed

Species Credit Species	Habitat preferences and geographic distribution	Sensitivity to gain class	NSW listing status	National listing status
White-bellied Sea-Eagle <i>Haliaeetus leucogaster</i> (breeding only)	Habitat characterised by large areas of open water including rivers, swamps, lakes and the sea. Records within 10 km of the development footprint (Bionet). Nests in tall living or dead trees.	High	Vulnerable	Not Listed
Square Raspwort <i>Haloragis exalata</i> <i>subsp. exalata</i>	Associated with shaded and damp riparian habitat. Not recorded within 10 km of the development footprint (Bionet).	Moderate	Vulnerable	Vulnerable
Giant Burrowing Frog <i>Heleioporus australiacus</i>	Found in heath, woodland and open dry sclerophyll forest on a variety of soil types except clay soils. Can travel 300 m away from breeding sites which are first or second order streams. Records within 10 km of the development footprint (Bionet).	Moderate	Vulnerable	Vulnerable
Little Eagle <i>Hieraaetus morphnoides</i> (Breeding)	Occupies eucalypt forest, woodland or open woodland. Nests in tall living trees. Preys on birds, reptiles, carrion and large insects. Recorded within 10 km of the development footprint (Bionet).	Moderate	Vulnerable	Not Listed
Southern Brown Bandicoot (eastern) <i>Isoodon obesulus</i> <i>obesulus</i>	Only found in heath or open forest with a heathy understorey on sandy or friable soils. Nest in shallow depression in the ground covered by leaf litter, grass or other plant material under Grass trees Xanthorrhoea spp., blackberry bushes and other shrubs, or in rabbit burrows. One record within 10 km of the development footprint (Bionet)	High	Endangered	Endangered

Species Credit Species	Habitat preferences and geographic distribution	Sensitivity to gain class	NSW listing status	National listing status
Swift Parrot <i>Lathamus discolor</i> (Breeding)	Occur in areas where eucalypts flower profusely and abundant lerps. Species include Swamp Mahogany (<i>E. robusta</i>), Spotted Gum (<i>C. 4242hrygia42</i>), Red Bloodwood (<i>C. gummifera</i>). Breed in Tasmania in old trees with hollows. Recorded within 10 km of the development footprint (Bionet).	Moderate	Endangered	Critically Endangered
Bar-tailed Godwit (breeding)	Occurs in intertidal sandflats, banks mudflats, estuaries, inlets, harbours, coastal lagoons, bays. Needs these areas to rest and feed when migrating to nesting sites.	High	Not Listed	Vulnerable
Black-tailed Godwit <i>Limosa limosa</i> (Breeding)	Only considered as a candidate if important mapped areas are identified within the devt footprint. Usually found in sheltered bays, estuaries and lagoons with large intertidal mudflats and/or sandflats. Roosts and loafs on low banks of mud, sand and shell bars. Frequently recorded in mixed flocks with Bar-tailed Godwits.	High	Vulnerable	Not Listed
Green and Golden Bell Frog <i>Litoria aurea</i>	Inhabits marshes, dams and stream-sides, particularly those containing bull rushes (<i>Typha</i> spp.) or spike rushes (<i>Eleocharis</i> spp.). Optimum habitat includes water-bodies that are unshaded, free of predatory fish such as Plague Minnow (<i>Gambusia holbrooki</i>), have a grassy area nearby and diurnal sheltering sites available. Recorded within 10 km of the development footprint.	High	Endangered	Vulnerable

Species Credit Species	Habitat preferences and geographic distribution	Sensitivity to gain class	NSW listing status	National listing status
Square-tailed Kite <i>Lophoictinia isura</i> (breeding)	Inhabits timbered habitats including dry woodlands and open forests with preference for timbered watercourses. Feeds on passerines, especially honeyeaters and nestlings. Recorded within 10 km of the development footprint (Bionet).	Moderate	Vulnerable	Not Listed
Large Bentwing Bat <i>Miniopterus orianae oceanensis</i> (breeding)	Uses caves, derelict mines, storm-water tunnels, buildings and other manmade structures. Hunts in forested areas catching moths and other flying insects in tree tops. Recorded within 10 km of the development footprint (Bionet).	Very High	Vulnerable	Not Listed
Southern Myotis <i>Myotis macropus</i>	Roosts in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage. Forages over streams and pools catching small fish. Not recorded within 10 km of the development footprint (Bionet)	High	Vulnerable	Not Listed
Orange-bellied Parrot <i>Neophema chrysogaster</i>	Spends winter mostly within 3 km of the coast in sheltered coastal habitats including bays, lagoons, estuaries, coastal dunes and saltmarshes. Also inhabits small islands and peninsulas and occasionally saltworks and golf courses. Birds forage in low samphire herb land or taller coastal shrubland.	Moderate	Critically Endangered	Critically Endangered
Barking Owl <i>Ninox connivens</i> (breeding only)	Inhabits woodland and open forest including fragmented landscapes. Roosts in shaded tree canopies or thick understory. Needs large hollow bearing trees for breeding. Hunts small arboreal marsupials. Recorded within 10 km of the development footprint (Bionet).	High	Vulnerable	Not Listed

Species Credit Species	Habitat preferences and geographic distribution	Sensitivity to gain class	NSW listing status	National listing status
Eastern Curlew <i>(Numenius madagascariensis)</i>	Generally occupies coastal lakes, inlets, bays and estuarine habitats.	High	Not Listed	Critically Endangered
Eastern Osprey <i>Pandion cristatus</i> (Breeding)	Favour coastal areas, especially the mouths of large rivers, lagoons and lakes. Feed on fish over clear, open water. Nests are made high up in dead trees or in dead crowns of live trees, usually within one kilometre of the sea. Recorded within 10 km of the development footprint (Bionet).	Moderate	Vulnerable	Not Listed
Greater Glider <i>Petauroides volans</i>	Feeds exclusively on eucalypt leaves, buds, flowers and mistletoe. Shelters in tree hollows and will use up to 18 hollows in their home range. Home range 1-3ha.	High	Not Listed	Vulnerable
Greater Glider population <i>Petauroides volans</i>	Feeds exclusively on eucalypt leaves, buds, flowers and mistletoe. Shelters in tree hollows and will use up to 18 hollows in their home range. Home range 1-3ha.	High	Endangered	Not Listed
Squirrel Glider <i>Petaurus norfolcensis</i>	Forages amongst bi-pinnate acacia, autumn-winter flowering trees and shrubs such as Eucalyptus robusta and Banksia sp (integrifolia etc). Relies on large old trees with hollows for breeding and nesting. These trees are also critical for movement and typically need to be closely-connected (i.e. no more than 50 m apart). Not recorded within 10 km of the development footprint (Bionet).	High	Vulnerable	Not Listed
Brush-tailed Phascogale <i>Phascogale tapoatafa</i>	Prefer dry sclerophyll open forest with sparse groundcover of herbs, grasses, shrubs or leaf litter. Reliant on hollow bearing trees for habitat. Recorded within 10 km of the development footprint (Bionet).	High	Vulnerable	Not Listed

Species Credit Species	Habitat preferences and geographic distribution	Sensitivity to gain class	NSW listing status	National listing status
Koala <i>Phascolarctos cinereus</i> (Breeding)	Inhabits eucalypt woodlands and forests. Spends most time in trees but will descend to traverse open ground. Multiple records within 10 km of the development footprint (Bionet).	High	Vulnerable	Vulnerable
Long-nosed Potoroo <i>Potorous tridactylus</i>	Inhabits dense shrub cover or high canopy cover exceeding 70%. Six records within 10km with the closest record 4.3 km south.	High	Vulnerable	Vulnerable
Oval-leaved Pseudanthus <i>Pseudanthus ovalifolius</i>	This species is found in near coastal dry sclerophyll forest growing in sandy soil. Flowering occurs in September and October.	High	Endangered	Not Listed
Grey-headed Flying Fox <i>Pteropus poliocephalus</i> (Breeding)	Inhabits temperate rainforest, tall sclerophyll forest and woodlands, heaths and swamps, urban gardens and fruit crops. Camps close to water common in gullies and vegetation with dense canopy. Recorded within 10 km of the development footprint (Bionet)	High	Vulnerable	Vulnerable
Matted Bush-pea <i>Pultenaea pedunculata</i>	Found among woodland vegetation but plants have also been found on road batters and coastal cliffs. It is largely confined to loamy soils in dry gullies. On the far south coast the species favours sandy soils on headlands and slopes immediately above the beach. It can also occur in the rock crevices above the shoreline. Not recorded within 10 km of the development footprint.	N/A	Endangered	Not Listed
Coast Groundsel <i>Senecio spathulatus</i>	Coast Groundsel grows on frontal dunes. Not recorded within 10 km of the development footprint.	High	Endangered	Not Listed

Species Credit Species	Habitat preferences and geographic distribution	Sensitivity to gain class	NSW listing status	National listing status
Little Tern <i>Sternula albifrons</i> (Breeding)	Exclusively coastal, preferring sheltered environments; however may occur several kilometres from the sea in harbours, inlets and rivers. Nests in small, scattered colonies in low dunes or on sandy beaches just above high tide mark near estuary mouths or adjacent to coastal lakes and islands. Recorded within 10 km of the development footprint.	High	Endangered	Not Listed
Masked Owl <i>Tyto novaehollandiae</i> (Breeding)	Living or dead trees with hollows greater than 20 cm diameter. Recorded within 10 km of the development footprint.	High	Vulnerable	Not Listed
Hidden Violet <i>Viola cleistogamoides</i>	it occupies a variety of situations, often in wet sandy coastal heaths. Have also been found inland in heathland, woodland with a heathy understorey and grassy forests. Disturbed sites such as tracks, firebreaks and even lawns have also been colonised. Recorded within 10 km of the development footprint (Bionet).	High	Endangered	Not Listed
Narrow-leafed Wilsonia <i>Wilsonia backhousei</i>	Beaches and rock platforms adjacent to beaches, or anywhere saline. Recorded within 10 km of the development footprint (Bionet).	High	Vulnerable	Not Listed
Round-leafed Wilsonia <i>Wilsonia rotundifolia</i>	Coastal or inland lakes. Not recorded within 10 km of the development footprint.	High	Endangered	Not Listed

4.2.2 Exclusions based on habitat features and habitat quality

The following species credit species have been excluded from further assessment based on the lack of habitat features present at the development site (Table 4-4 below).

Table 4-4 Species credit species included and excluded based on habitat features

Species Credit Species	Relevant habitat inside the development footprint	Included or excluded	Reason for inclusion or exclusion
Regent Honeyeater <i>Anthochaera phrygia</i> (Breeding)	Presence of important mapped habitat	Excluded	No areas of important mapped habitat inside subject land. (6.4.17 BAM & BOAMS checked 21/07/20) –
Sanderling <i>Calidris alba</i> (Breeding)	Presence of important mapped habitat	Excluded	No areas of important mapped habitat inside subject land. (6.4.17 BAM & BOAMS checked 21/07/20)
Red Knot <i>Calidris canutus</i> (Breeding)	Presence of important mapped habitat	Excluded	No areas of important mapped habitat inside subject land. (6.4.17 BAM & BOAMS checked 21/07/20)
Curlew Sandpiper <i>Calidris ferruginea</i> (breeding)	Presence of important mapped habitat	Excluded	No areas of important mapped habitat inside subject land. (6.4.17 BAM & BOAMS checked 21/07/20)
Gang-gang Cockatoo <i>Callocephalon fimbriatum</i> (Breeding)	Medium hollows, 9 m above the ground	Excluded	No hollow bearing trees inside development footprint which are essential breeding habitat. (6.4.17 BAM) – TBDC Habitat Constraint Filter.
Glossy Black-Cockatoo <i>Calyptorhynchus lathami</i> (Breeding)	Living and dead trees with hollows >15 cm and >5 m above the ground.	Excluded	No hollow bearing trees inside development footprint which are essential breeding habitat. (6.4.17 BAM) – TBDC Habitat Constraint Filter.
Eastern Pygmy-possum <i>Cercartetus nanus</i>	Inhabits woodlands and heaths. Feeds on nectar and pollen from banksias, eucalypts and bottlebrushes. Shelters in dreys, hollows, abandoned bird nests and in shredded bark.	Excluded	Lack of key habitat components including trees, hollows and nectar resources inside the development footprint. (6.4.17 BAM) – TBDC Habitat & Ecology Tab.
Beach Stone-curlew <i>Esacus magnirostris</i>		Excluded	Closest breeding pair found at the Manning River near Taree therefore outside of geographical breeding zone.
Large-eared Pied Bat <i>Chalinolobus dwyeri</i>	Distribution restricted to north of Batemans Bay.	Excluded	Outside geographical limits within BAM Calculator.

Species Credit Species	Relevant habitat inside the development footprint	Included or excluded	Reason for inclusion or exclusion
Chef's Cap Correa <i>Correa baeuerlenii</i>	Geographically limited to north of Bega River, North of Tathra.	Excluded	Outside geographical limits within BAM Calculator.
White-bellied Sea-Eagle <i>Haliaeetus leucogaster</i> (Breeding)	Nests in tall living or dead trees.	Excluded	No large living or dead trees suitable for building stick nests inside development footprint. (6.4.17 BAM) – TBDC Habitat & Ecology Tab.
Square Raspwort <i>Haloragis exalata</i> <i>subsp. exalata</i>	Shaded and damp riparian habitat.	Excluded	No freshwater riparian habitat present inside the development footprint. (6.4.17 BAM) – TBDC Habitat & Ecology Tab.
Giant Burrowing Frog <i>Heleioporus australiacus</i>	Key habitat includes leaf litter. Can travel 300 m away from breeding sites which are first or second order streams.	Excluded	No freshwater riparian habitat within 300 m of the development footprint. (6.4.17 BAM) – TBDC Habitat & Ecology Tab.
Little Eagle <i>Hieraaetus morphnoides</i> (breeding only)	Nests in tall living trees.	Excluded	No tall living trees within development footprint. (6.4.17 BAM) – TBDC Habitat & Ecology Tab.
Swift Parrot <i>Lathamus discolor</i> (Breeding)	Included if there is important mapped habitat inside the development footprint.	Excluded	No important habitat mapping inside development footprint. (6.4.17 BAM & BOAMS checked 21/07/20).
Bar-tailed Godwit <i>Limosa lapponica baueri</i> (Breeding)	Presence of important mapped habitat	Excluded	No areas of important mapped habitat inside subject land. (6.4.17 BAM & BOAMS checked 21/07/20)
Black-tailed Godwit <i>Limosa limosa</i> (Breeding)	Presence of important mapped habitat	Excluded	No areas of important mapped habitat inside subject land. (6.4.17 BAM & BOAMS checked 21/07/20)
Bush Stone-curlew <i>Burhinus grallarius</i>	Sparse grassy ground layer and fallen timber.	Excluded	Although occasionally found in Mangrove habitat and sparsely timbered areas, there is no evidence at all of local occurrence (including Bionet records within 10km

Species Credit Species	Relevant habitat inside the development footprint	Included or excluded	Reason for inclusion or exclusion
			and no local bird groups have any records of Bush Stone-curlew from 1998-2019 – Per comm J.Miles). (6.4.17 BAM) – TBDC Habitat & Ecology Tab.
Black-tailed Godwit <i>Limosa limosa</i>	Included if there is important mapped habitat inside the development footprint.	Excluded	No important habitat mapping inside development footprint. (6.4.17 BAM & BOAMS checked 21/07/20)
Green and Golden Bell Frog <i>Litoria aurea</i>	Within 1 km of wet areas/Swamps.	Excluded	No freshwater riparian habitat within 1 km of development footprint. (6.4.17 BAM) – TBDC Habitat & Ecology Tab.
Square-tailed Kite <i>Lophoictinia isura</i> (Breeding)	Needs large tall trees near watercourses for nesting.	Excluded	No tall eucalypts observed within development footprint. (6.4.17 BAM) – TBDC Habitat & Ecology Tab.
Large Bentwing Bat <i>Miniopterus orianae oceanensis</i> (Breeding)	Uses caves, derelict mines, storm-water tunnels, buildings and other manmade structures.	Excluded	No caves, tunnels, mines, culverts present within development footprint. (6.4.17 BAM) – TBDC Habitat Constraint Filter.
Southern Myotis <i>Myotis macropus</i>	Roosts in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage. Forages over streams and pools catching small fish.	Excluded	No freshwater bodies within 200 m of development footprint and no hollow bearing trees. (6.4.17 BAM) – TBDC Habitat Constraint Filter.
Barking Owl <i>Ninox connivens</i> (Breeding)	Needs large hollow bearing trees for breeding.	Excluded	No large hollow bearing trees within development footprint. (6.4.17 BAM) – TBDC Habitat Constraint Breeding Filter.
Eastern Curlew <i>Numenius madagascariensis</i> (Breeding)	Presence of important mapped habitat	Excluded	No areas of important mapped habitat inside subject land. (6.4.17 BAM & BOAMS checked 21/07/20)

Species Credit Species	Relevant habitat inside the development footprint	Included or excluded	Reason for inclusion or exclusion
Eastern Osprey <i>Pandion cristatus</i> (Breeding)	Nests are made high up in dead trees or in dead crowns of live trees, usually within one kilometre of the sea.	Excluded	No living or dead trees (>15 m) inside development footprint. (6.4.17 BAM) – TBDC Habitat Constraint Breeding Filter.
Greater Glider <i>Petauroides volans</i>	Feeds exclusively on eucalypt buds and leaves and flowers.	Excluded	No mature eucalypts within development footprint. Existing eucalyptus lopped for OLS.
Greater Glider Population <i>Petauroides volans</i> (Eurobodalla Shire)	Population inside Eurobodalla Shire south of Moruya and north of Lake Coila.	Excluded	Outside geographic range within BAM Calculator.
Squirrel Glider <i>Petaurus norfolcensis</i>	Hollow bearing trees and nectar bearing plants.	Excluded	Lack of breeding and foraging habitat inside development footprint. (6.4.17 BAM) – TBDC Habitat & Ecology Tab.
Brush-tailed Phascogale <i>Phascogale tapoatafa</i>	Dry sclerophyll forest and hollow-bearing trees.	Excluded	Lack of breeding and foraging habitat inside development footprint. (6.4.17 BAM) – TBDC Habitat & Ecology Tab.
Koala <i>Phascolarctos cinereus</i>	Eucalypt woodland and forest with suitable feed trees.	Excluded	Lack of breeding and foraging habitat inside development footprint. No Koala use trees inside development footprint. (6.4.17 BAM) – TBDC Ecological data ‘assessment’ Tab.
Grey-headed Flying Fox <i>Pteropus poliocephalus</i> (Breeding)	Camps within forest close to water.	Excluded	No mature trees for roosting available inside the development footprint, no breeding camps. (6.4.17 BAM) – TBDC Habitat Constraint Breeding Filter.
Masked Owl <i>Tyto novaehollandiae</i> (Breeding)	Needs large hollow bearing trees for breeding or sometimes caves for nesting.	Excluded	No living or dead trees with large hollows inside development footprint. (6.4.17 BAM) – TBDC Habitat Constraint Breeding Filter.

Species Credit Species	Relevant habitat inside the development footprint	Included or excluded	Reason for inclusion or exclusion
Little Tern <i>Sternula albifrons</i> (Breeding)	Nest in small scattered colonies in low dunes or sandy beaches.	Excluded	Requires low dunes or sandy beaches just above the high tide mark for nesting. These niche habitats are absent from the development footprint (6.4.17 BAM) TBDC – Habitat & Ecology Tab.

4.2.3 Inclusions requiring confirmation of presence or absence

Fourteen species listed in Table 4-5 below are those that are considered to have habitats present at the development site. Surveys have been conducted for some of these species to confirm presence or absence whilst the assumption of 'presence' has been allocated to the other species. Presence was assumed for Pied Oystercatcher because there were existing records of these species inside the subject land (Ref: Appendix G, Wildlife Hazard Management Plan table 3 for Pied Oystercatcher and Ref: Far South Coast Birdwatchers Records from 10/1996 to 1/2019). As Pied and Sooty Oystercatchers often exist together, presence was assumed for Sooty Oystercatcher also. Long-nosed Potoroo and Southern Brown Bandicoot were unable to be surveyed before finalising Ver 4-1 of this report. Leafless Tongue Orchid is a recent candidate species added to version 54 of the BAM calculator and was assumed to be present within one vegetation zone inside the Ultimate EIS clearing area only. Targeted survey could not be completed at the time of providing BDAR V4-1 updates. As such, presence was assumed in suitable habitat for this species. For those species targeted for survey, the survey methodologies are provided below Table 4-5. Targeted survey locations are mapped on Figure 4-1A.

Table 4-5 Summary of species credit species surveyed at the development site

Species Credit Species	Relevant habitat inside the development footprint	Assumed to occur/survey/ expert report	Reason for inclusion or exclusion
Thick Lip Spider Orchid <i>Caladenia tessellata</i>	Found in grassy sclerophyll woodland on clay loam or sandy soils.	Surveyed October	PCT 659_Scrub has some habitat traits (woodland and sandy soils) so this will be targeted for survey.
Leafless Tongue Orchid <i>Cryptostylis hunteriana</i>	Bangalay sand forest scrub	Assumed present	PCT 659_Scrub has some marginal habitat traits (Woodland-heathy habitat) but unable to be surveyed at completion of BDAR V4-1 and therefore assumed present.
Australian Saltgrass <i>Distichlis distichophylla</i>	Salt marsh, saline areas or margins of these areas.	Surveyed October	PCT 920 and PCT 1126 will be targeted for survey.
Tangled Bedstraw <i>Galium australe</i>	Sand dunes, sand spits, shrubland and woodland.	Surveyed October	PCT 920 and 659 Scrub will be targeted for survey.
Sooty Oystercatcher <i>Haematopus fuliginosus</i>	Land within 100 m of estuarine habitat including beaches and muddy estuaries. Known records at airport.	Assumed present	All PCT 920 zones included as a species polygon for offsetting.
Pied Oystercatcher <i>Haematopus longirostris</i>	Land within 100 m of estuarine habitat including beaches and	Assumed present	All PCT 920 zones included as a species polygon for offsetting.

Species Credit Species	Relevant habitat inside the development footprint	Assumed to occur/survey/ expert report	Reason for inclusion or exclusion
	muddy estuaries. Known records at airport.		
Southern Brown Bandicoot (eastern) <i>Isoodon obesulus obesulus</i>	Bangalay scrub (west of the north runway).	Assumed present	PCT 659_Scrub has some habitat traits (thick groundcover with sandy soils).
Orange-bellied Parrot <i>Neophema chrysogaster</i>	Within 3 km of the coast in sheltered habitats including bays, lagoons, estuaries, coastal dunes and saltmarshes. Also inhabits golf courses. Birds forage in low samphire herb land or taller coastal shrubland.	Surveyed February	Mangroves PCT 920 will be targeted for survey.
Long-nosed Potoroo <i>Potorous tridactylus</i>	Dense shrub layer or high canopy cover exceeding 70%	Assumed present	PCT 659 Scrub has some habitat traits (thick groundcover and shrub layer with sandy soils).
Oval-leaved Pseudanthus <i>Pseudanthus ovalifolius</i>	Costal dry sclerophyll forest in sandy soil.	Surveyed October	PCT 659 Scrub will be targeted for survey.
Matted Bush-pea <i>Pultenaea pedunculata</i>	In woodland confined to loamy soils in dry gullies.	Surveyed October	PCT 659 Scrub will be targeted for survey.
Coast Groundsel <i>Senecio spathulatus</i>	Grows on frontal dunes.	Surveyed October	PCT 920/659 Scrub ecotone will be targeted for survey.
Hidden Violet <i>Viola cleistogamoides</i>	Wet sandy coastal and inland heaths including disturbed sites	Surveyed	PCT 659 Scrub will be targeted for survey.
Narrow-leafed Wilsonia <i>Wilsonia backhousei</i>	Adjacent to beaches and saline areas.	Surveyed October	PCT 659Scrub/920 ecotone and PCT 920 will be targeted for survey.
Round-leafed Wilsonia <i>Wilsonia rotundifolia</i>	Adjacent to beaches and saline areas.	Surveyed Oct/Nov	PCT 659Scrub/920 ecotone and PCT 920 will be targeted for survey.

4.2.4 Threatened Species survey

Targeted surveys were undertaken over 3 days on 15 October 2018 and 29 January 2019. Weather conditions recorded for these dates from the Bureau of Meteorology (BOM) at the Merimbula Weather Station are as follows:

Table 4-6 Weather Conditions onsite during targeted surveys

Date	Maximum Temperature (°C)	Minimum Temperature (°C)	Rainfall (mm)	Max Wind Gust (km/h)
15 Oct 2018	21.3	11.8	0.4	52
29 Jan 2019	28.8	18.7	2.6	37

Diurnal Birds

Orange-bellied Parrot

SURVEY EFFORT

Orange-bellied Parrots breed in Tasmania and only have minor foraging opportunities within the subject site. The Survey Guidelines for Threatened birds under EPBC Act were reviewed to gain guidance on survey effort and methodology to be used. It recommended area searches over a period of 20 hours for sites less than 50 ha (such as this site).

The time involved in conducting this level of survey effort was questionable because no records of Orange-bellied Parrots exist locally (i.e. a 10km Bionet Atlas search revealed no records and no local bird enthusiast records of Orange-bellied Parrot for the Far South Coast Region - pers comm J.Miles). The closest record is within Shoalhaven Local Government Area (over 300km away) being a record that is over 30 years old. As such, the probability of detecting an Orange-bellied Parrot is extremely low. In addition, the habitat surveyed is regularly disturbed by aircraft landing and taking off and is maintained for obstacle limitation surfaces which keeps the shrub layer simplified. In accordance with the Recovery Plan for Orange-bellied Parrot, they are most likely going to forage on Austral Seablight (*Sueda australis*) in saltmarsh environments and sand spits which was mostly absent from the development footprint.

As this species was difficult to exclude or include it was decided that a simplified survey effort should be conducted which involved a 500 m transect (zig zag back and forth as seen on Figure 4-2). This was conducted in suitable habitat to opportunistically survey for the Orange-bellied Parrot. It was completed between 8-10am on the morning of 29 January for 2 hours within PCT 920 (Zones 3 & 4).

SURVEY RESULTS

No Orange-bellied Parrots were found during targeted survey. Very little bird diversity was observed onsite during survey. The only birds observed during survey included Masked Lapwings, Welcome Swallows, Brown Thorn bills and Silver-eyes.

Threatened Flora

SURVEY EFFORT

Sandy beach front land coastal dune scrub

Caladenia tessellata, Galium australe, Pseudanthus ovalifolius, Senecio spathulatus, Viola cleistogamoides, Pultanea pedunculata, Distichlis distophylla

In accordance with the NSW Guide to Surveying Threatened Plants, 5 m transects were walked for the above species (Figure 4-1 & Figure 4-2) inside PCT 659 Bangalay Scrub Zone 2. This occurred on 15 October 2018 for approximately 1.5 hours. PCT 659 also graded into PCT 920 (Mangrove on sand) and this was specifically targeted also for presence of *Senecio spathulatus* and *Distichlis distophylla*.

SURVEY RESULTS

No candidate flora species were recorded during the survey.

Saltmarsh/Mangrove swamps

Wilsonia backhousei, Wilsonia rotundifolia

SURVEY EFFORT

In accordance with the NSW Guide to Surveying Threatened Plants, 5 m transects were walked for the above species inside PCT 920 River/Grey Mangrove (Zones 4 & 5 as can be seen in Figure 4-2 below). This occurred on 29 January 2019 for 2 hours.

SURVEY RESULTS

No candidate flora species were recorded during the survey.



Figure 4-1 Threatened Species Polygons and Targeted survey locations (north runway)

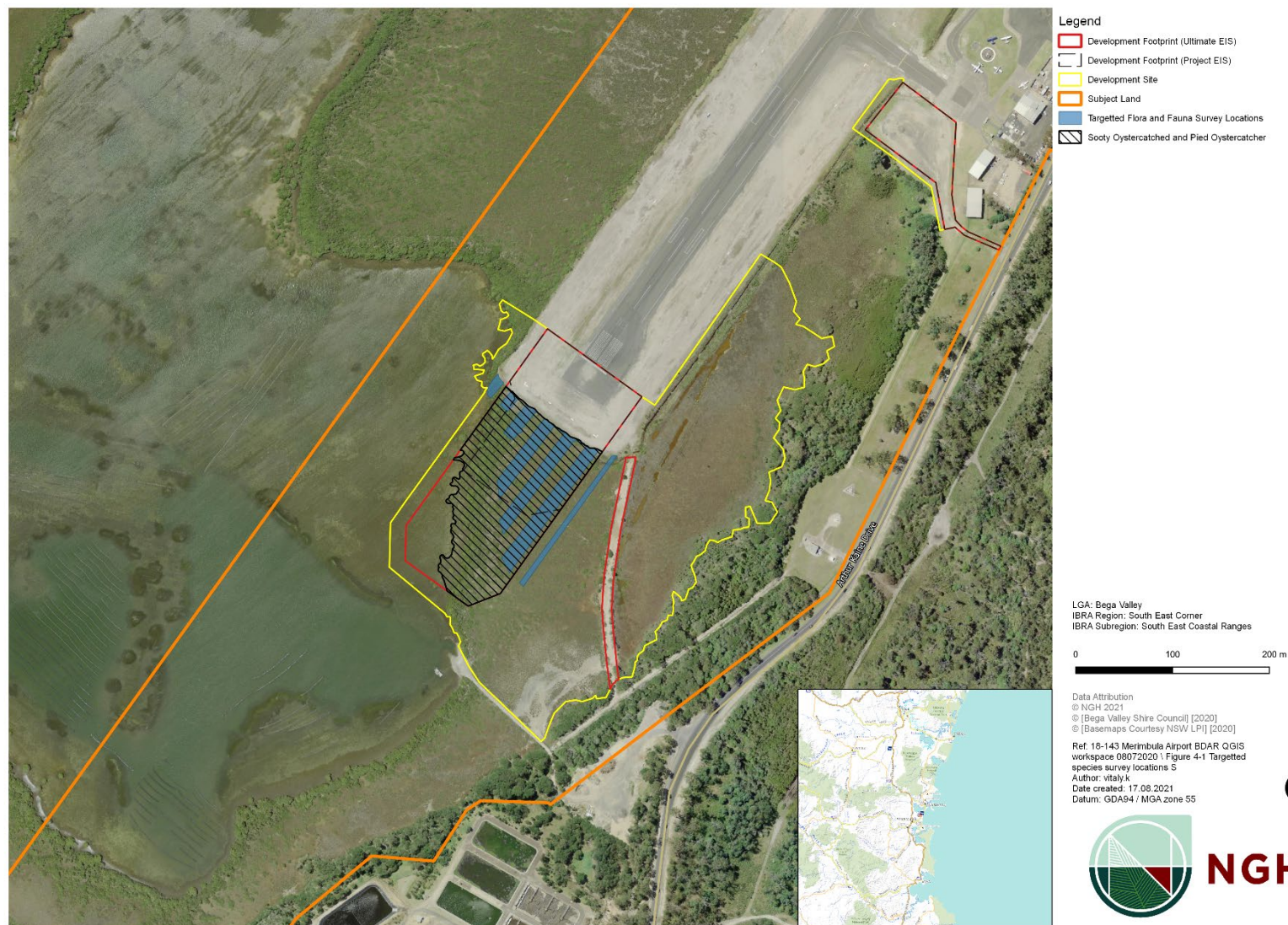


Figure 4-2 Threatened Species Polygons and Targeted survey locations (south runway)

5 MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

An EPBC protected matters report was undertaken on 18 September 2018 (10 km buffer of the development site) to identify Matters of National Environmental Significance (MNES) that have the potential to occur within the development site (refer to Appendix B). Relevant to Biodiversity these include:

- 3 listed Threatened Ecological Communities
- 71 listed Threatened species
- 53 listed Migratory species

The potential for these MNES to occur at the site are discussed below.

5.1 THREATENED ECOLOGICAL COMMUNITIES

Three threatened ecological communities were returned from the protected matters report. These were:

- Littoral Rainforest and Coastal Vine Thickets of Eastern Australia
- Lowland Grassy Woodland in the South East Corner Bioregion
- Subtropical and Temperate Coastal Saltmarsh

No Littoral Rainforest or Lowland Grassy Woodland occurs inside the subject land. There is a close association with Subtropical and Temperate Coastal Saltmarsh with two PCTs assessed inside the development footprint and site. Further investigations are detailed below.

PCT 1126 (Saltmarsh)

PCT 1126 (Vegetation Zone 6) inside the development footprint (north runway) was found to be an ecotone between PCTs 1126 and 659 and had a weak species match (around 13%) plant cover and the patch failed to meet the minimum patch size of 0.1 ha. Therefore, vegetation zone 6 does not classify as Subtropical and Temperate Coastal Saltmarsh.

Vegetation zone 8 (Artificial channel) is found between the existing south runway and more intact saltmarsh habitat (Vegetation zone 7). This zone was an ecotone between PCTs 920, 659 and 1126. As the site is highly modified and artificially constructed, it does not classify as Subtropical and Temperate Coastal Saltmarsh.

PCT 1126 (Vegetation zone 7) inside the development site (south runway) is dominated by *Juncus kraussii* and *Sarcocornia quinqueflora* and meets the definition of Subtropical and Temperate Coastal Saltmarsh (see table 5-1 below). Only 0.07 ha is within the development footprint. This is where the southern haul road corridor would be removed. As specified in chapter 6 of this report, indirect impacts are not expected to occur to this patch of saltmarsh habitat because of stringent design standards planned for constructing the south runway extension and haul road removal. Therefore, a condition threshold assessment was not undertaken because no indirect impacts are expected on Subtropical and Temperate Coastal Saltmarsh. A monitoring program is proposed after the south runway is constructed to monitor Vegetation Zone 7 and compare with baseline data to detect any changes to Saltmarsh habitat. Further details are provided in Chapter 6.4.1

Table 5-1 Is veg zone 7 defined as Subtropical and Temperate Coastal Saltmarsh?

Is vegetation (as listed on figure 6.2 of BDAR in yellow highlight) defined as Subtropical and Temperate Coastal Saltmarsh?	Response
KDC 1 - occurs south of 23° 37' S latitude - from the central Mackay coast on the east coast of Australia, southerly around to Shark Bay on the west coast of Australia (26° latitude), and including the Tasmanian coast and islands within the above range	Yes
KDC 2 - occurs on the coastal margin, along estuaries and coastal embayments and on low wave energy coasts	Yes
KDC 3 - occurs on places with at least some tidal connection, including rarely-inundated supratidal areas, intermittently opened or closed lagoons, and groundwater tidal influences, but not areas receiving only aerosol spray	Yes
KDC 4 - occurs on sandy or muddy substrate and may include coastal clay pans (and the like)	Yes
KDC 5 - consists of dense to patchy areas of characteristic coastal saltmarsh plant species (i.e. salt- tolerant herbs, succulent shrubs or grasses, that may also include bare sediment as part of the mosaic) and	Yes
KDC 6 - proportional cover by tree canopy such as mangroves, Melaleucas or Casuarinas is not greater than 50%, nor is proportional ground cover by seagrass greater than 50%.	Yes
Condition thresholds and survey guidelines	
Where the ecological community intergrades with an adjacent community, such as seagrass, mangroves, paperbark (Melaleuca spp.) and Casuarina spp. swamp, or freshwater marshes, then in this ecotone region, if 50% or more of the groundcover/understorey is comprised of coastal saltmarsh vegetation then it is considered to be the ecological community (refer field data sheet)	Further investigation required.
Patch size; a). Isolated coastal saltmarsh patch in landscape. Minimum size: ≥ 0.1 ha = EC b). Mosaic or cluster of coastal saltmarsh patches within terrain e.g. sand/mud/saltpan/ mangroves/ freshwater marshes, etc. Minimum sizes: Collective area of patches within the mosaic ≥ 0.1 ha = EC Distance between individual patches ≤ 30 m	Yes the patch is 5.67ha in area and therefore classifies as this TEC.
Does this patch legally classify as Subtropical and Temperate Coastal Saltmarsh?	YES

PCT 920 (Mangrove)

Mangrove Habitat PCT 920 (veg zones 3, 4, & 5) do not classify as Subtropical and temperate coastal Saltmarsh. This is justified in table 1 below. Table 1 compares the characteristics of this PCT within the subject land to the key diagnostic criteria and condition thresholds for EPBC Act Subtropical and Temperate Coastal Saltmarsh.

Table 5-2 Is PCT 920 defined as Subtropical and Temperate Saltmarsh?

Is PCT 920 Subtropical and Temperate Coastal Saltmarsh?	Response
Dey Diagnostic Criteria (KDC) 1 - occurs south of 23° 37' S latitude - from the central Mackay coast on the east coast of Australia, southerly around to Shark Bay on the west coast of Australia (26° latitude), and including the Tasmanian coast and islands within the above range	Yes
KDC 2 - occurs on the coastal margin, along estuaries and coastal embayments and on low wave energy coasts	Yes
KDC 3 - occurs on places with at least some tidal connection, including rarely-inundated supratidal areas, intermittently opened or closed lagoons, and groundwater tidal influences, but not areas receiving only aerosol spray	Yes
KDC 4 - occurs on sandy or muddy substrate and may include coastal clay pans (and the like)	Yes
KDC 5 - consists of dense to patchy areas of characteristic coastal saltmarsh plant species (i.e. salt- tolerant herbs, succulent shrubs or grasses, that may also include bare sediment as part of the mosaic) and	Yes
KDC 6 - proportional cover by tree canopy such as mangroves, Melaleucas or Casuarinas is not greater than 50%, nor is proportional ground cover by seagrass greater than 50%.	No
Condition thresholds and survey guidelines	
Where the ecological community intergrades with an adjacent community, such as seagrass, mangroves, paperbark (Melaleuca spp.) and Casuarina spp. swamp, or freshwater marshes, then in this ecotone region, if 50% or more of the groundcover/understorey is comprised of coastal saltmarsh vegetation then it is considered to be the ecological community (refer field data sheet)	NA as Patch is not EEC due to >50% mangrove. See BAM Plot Data in appendix A of the BDAR
Patch size; a) Isolated coastal saltmarsh patch in landscape. Minimum size: ≥ 0.1 ha = EC b) Mosaic or cluster of coastal saltmarsh patches within terrain e.g. sand/mud/saltpan/ mangroves/ freshwater marshes, etc. Minimum sizes: Collective area of patches within the mosaic ≥ 0.1 ha = EC Distance between individual patches ≤ 30 m	NA .
Does this patch legally classify as Subtropical and Temperate Coastal Saltmarsh?	No -

To conclude, PCT 920 inside the development footprint is not classified as EPBC Act listed Subtropical and Temperate Coastal Saltmarsh due to greater than 50% cover abundance of mangroves across the zone. As such, a condition threshold assessment is not required.

5.2 THREATENED SPECIES

Seventy-one threatened species were returned from the protected matters report. Of these, the following are considered to have the potential to utilise the habitats at the development site where a condition threshold assessment was undertaken (Appendix D) to determine whether referral to the Commonwealth was necessary. Important Areas Mapping (as downloaded from BOAMS) exists for Commonwealth listed threatened species for Bar-tailed Godwit and Eastern Curlew which is illustrated on figure 5-1 below.

- *Calidris canutus*, Red Knot
- *Limosa lapponica baueri*, Bar-tailed Godwit
- *Numenius madagascariensis*, Eastern Curlew

The assessment considered the impacts of the proposal against significant impact criteria listed under the EPBC Act 1999 and the EPBC Act Policy Statement 3.21—*Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species*.

The impacts of the proposal, specifically habitat loss, are considered minor in the context of the most suitable habitat (seagrass and saltmarsh) the species are likely to occur in is in poor condition and clearance is negligible (0.51 ha). A further 2.06 ha of mangrove habitat will be removed but this habitat is utilised to a lesser degree than the former mentioned habitats. In total 2.57ha will be directly cleared but approximately 280 ha of marine habitat will remain within the immediate locality. The location of the proposal at the end of the existing runway will not fragment or isolate habitat. The habitat affected is not considered important or unique to the migratory species. As Merimbula Lake supports a substantial amount of good quality marine habitat that will remain available within the locality the loss of 2.48 ha of vegetation is considered acceptable. This assessment has further identified mitigation measures to minimise the impacts and offset the loss of habitat.

The proposal is not considered likely to result in significant impact to the Eastern Curlew, Bar-tailed Godwit, or Red Knot and a Commonwealth referral under the EPBC Act is therefore not considered to be required.

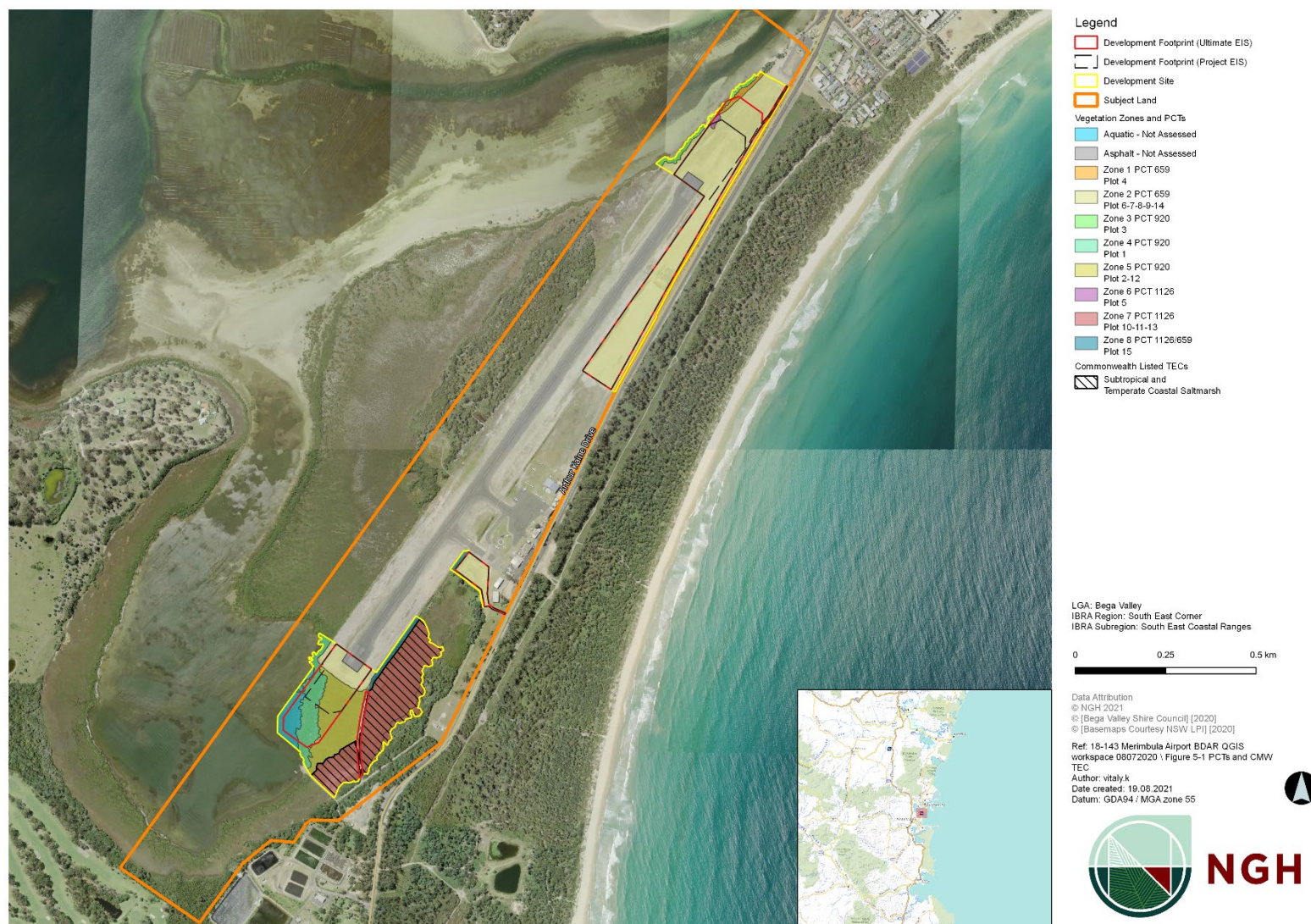


Figure 5-1 PCT mapping and Commonwealth Listed TEC (Subtropical and Temperate Coastal Saltmarsh)

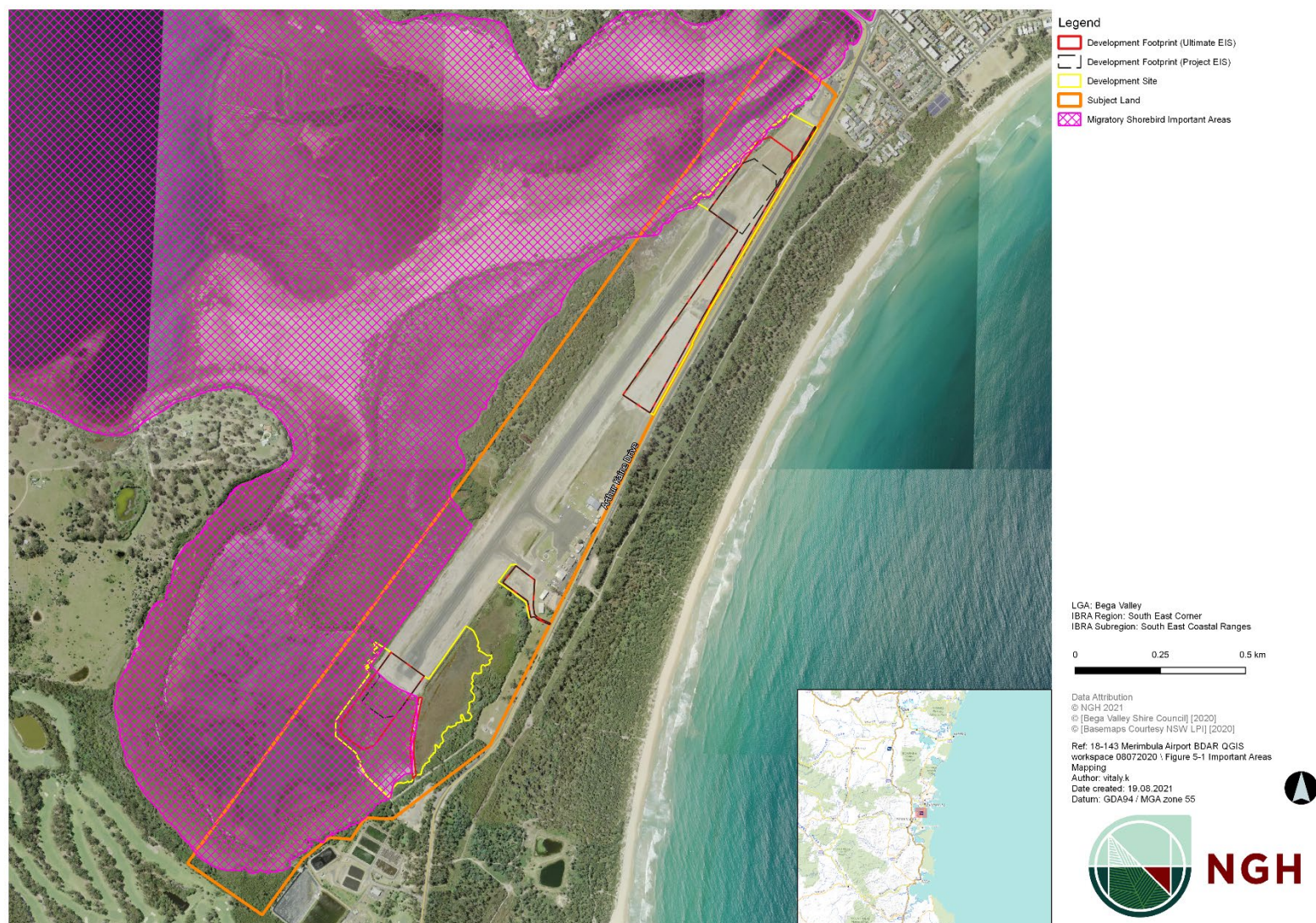


Figure 5-2 Important Areas Mapping for Bar-tailed Godwit and Eastern Curlew as downloaded from BOAMS (21-07-20)

5.3 MIGRATORY SPECIES

Many species rely on mangrove forests for breeding, resting and for feeding (Rog, Clarke and Cook 2016).

Fifty-three listed migratory species were returned from the protected matters report. Of these, the following may possibly occur at the site and are confirmed to directly utilise mudflats, mangroves or saltmarsh:

- *Calidris canutus*, Red Knot
- *Limosa lapponica*, Bar-tailed Godwit
- *Numenius madagascariensis*, Eastern Curlew
- *Pandion haliaetus*, Osprey

The project is considered to have negligible impact on this species, on the basis that all species are highly mobile and the specific impacts are small in the context of surrounding and suitable habitat. There are higher quality and less disturbed habitats not frequented by planes nearby which could be utilised by these species. As such, a condition threshold assessment for migratory species is not required and a referral to commonwealth is not warranted.

6 AVOID AND MINIMISE IMPACTS

6.1 CLEARING NATIVE VEGETATION AND HABITAT

6.1.1 Site selection – consideration of alternative locations/routes

The Bega Valley Shire Council has assessed the possibility of constructing an airport at alternative locations (Garret Barry Planning Services Pty Ltd 2011). It was concluded that there is no superior site within the Bega Valley Shire. Requirements in accommodating the airport in a new location included:

- land which was available to accommodate a runway of at least 1800m;
- surrounding land with equal or safer obstacle limitations to the existing Merimbula Airport; and
- development cannot encroach into a National Park.

A terrain model was built on the parameters above. Contour and related mapping data held by Council was also used to survey for sites that might address the above requirements.

Six potential sites showed some capacity but every site was dismissed due to inappropriate obstacle and land-based requirements. This conclusion was reached in the early stages of the project, prior to developing a costing or social use comparisons of sites that might be alternatives to Merimbula because:

- The topography of the shire is very hilly. There are very few areas where a strip of land is feasible for the necessary 1800 to 2000 m length of the runway required.
- The topography also creates unworkable obstacles in the path of all six sites considered.

As no alternative site could be found meeting the requirements above the existing runway was therefore considered the only feasible option for this proposal. Because the runway exists already, the extension must be located to the north and south of the existing runway. The impacts on environmentally sensitive land (ie mangrove and seagrass habitat) can only be mitigated by minimising the length of the proposed expansion. Detailed Erosion and Sediment Control Plans will need to be developed to ensure that imported fill does not leach into surrounding mangrove and seagrass habitat which is prevalent surrounding the south runway.

6.1.2 Proposal components – consideration of alternate modes or technologies

Alternatives to flights to or from Merimbula include bus and car travel, plus the Port of Eden is currently being developed for larger cruise ship operations. These alternatives are substantially slower, and not a preferred alternative to flight. The Merimbula airport considered to be the only form of public transport infrastructure linking it to three capital cities (Sydney, Melbourne and Canberra) within a reasonable travel time (AAC 2015).

A technical evaluation of plane types that can use the airport as it is currently designed found that the current runway cannot be used by planes larger than the ones used by the current operator. The perceived need for expansion is to allow larger planes (BVSC 2011, p.26) which would provide the ability to attract new airlines and thus competition to Merimbula Airport (AAC 2015). Based on this approach, the total number of flights is not expected to increase. The current passenger aircraft will be decommissioned when they reach the end of their operational life. The proposal responds to accommodating larger aircraft for increasing passenger numbers. The runway extensions will allow other

passenger airlines to consider servicing Merimbula airport and provide greater access to air travel to the local community.

6.1.3 Proposal planning phase – detailed design

The plan to extend the runway at Merimbula Airport has been the subject of a series of studies, including a desktop assessment (Ecological 2010), that investigated relevant legislation, flora and fauna, vegetation communities and offset options. This report made clear (p.33) that the proposal must consider: ‘(1) avoiding the impact; (2) have looked at mitigating the impact; and, (3) have put together an offset strategy to offset the impact.’

Since then, a study by Garret Barry Planning Services Pty Ltd (2011) has assessed possible alternative locations for an airport. A Draft Planning Proposal considered the relative importance of environments within the airport lands (BVSC 2011). A feasibility report addressed development options at the current site (Macroplan Australia 2011). A Master Plan was then conducted to further consider development options within the airport (Rehbien 2013), which was updated by Kleinfelder (2017).

These studies informed the site layout design and recommended avoiding and mitigating impacts on the environment where possible to do so by minimising the clearing footprint of the project and preserving vegetation that may be suitable for offset in nearby areas.

The final site layout and location has not been able to completely avoid all areas of biodiversity value because extending the runway requires clearing of vegetation and importing fill to accommodate a level runway within a portion of Merimbula Lake. This means some loss to mangrove habitat to accommodate the south runway. Direct impacts unable to be avoided have been offset in accordance with BAM.

BDAR Revisions (V2, V3, V4, V4-1):

BDAR V3 was updated to address agency and community submissions from the exhibition. Key changes now assessed in BDAR V3 relate to the development footprint and development site, as discussed below. This Submissions Report (NGH 2020) now articulates impacts of associated developments not assessed in as part of this proposal.

Development footprint

The development of a detailed works method has been undertaken since public exhibition of the EIS (including BDAR V2). The development footprint assessed in BDAR V3 reflects updated design and management planning with the aim of avoiding indirect impacts. This includes the construction of a geofabric lined rock wall, placed (not excavated) on the ground at low tide, to retain all disturbances and manage the release of water back into the estuary. The wall will be tied permanently to runway extensions to manage construction impacts. It will reduce impacts encroaching beyond the development footprint. A floating boom will be anchored to this wall during construction, as a risk management strategy.

Development site

The development site defined in BDAR V3 includes an area of increased inundation expected to be caused by the southern extension. Altered tidal regimes could also indirectly impact saltmarsh, mangrove and threatened shorebird habitat following runway extensions. Saltmarsh prefers highly saline areas which are not inundated regularly whilst mangroves prefer deeper saline or brackish aquatic habitats. To ameliorate changes to tidal inundation, it is proposed to add a small culvert (300mm diameter) along the

southern access track to offset hydraulic tidal volume exchange from existing conditions by about 2% for king tide, which happens five to ten times a year.

A king tide was modelled between 22 to 26 November 2018. The impact of one extra 300mm diameter culvert meant a maximum difference in inundation of about 1cm to 2cm, equating to an extra 0.1ha of inundation around the outer edges of the existing saltmarsh area. As it was a king tide, the expansion of tides is infrequent and at shallow depth. It is unlikely to promote a vegetation change from saltmarsh to mangroves. The tidal changes may promote additional saltmarsh over areas (0.1ha) of added inundation.

Mangroves occur at the deeper points around the culvert entrances where inundation is more frequent. The change in mangrove habitat is not expected to deviate from existing culverts as the inundation frequency and depth will only change very slightly (1-2cm). Any small spread in mangrove habitat is likely to be offset by spread of saltmarsh at the tidal inundation edges.

The hydrological modelling concludes the extent and frequency of the events would not be sufficient to affect terrestrial or aquatic habitat composition and as such this area is not considered in the development footprint but will be monitored to confirm the assumptions of this assessment.

The final design footprint and development site is detailed in Figure 6-1 below.

Impacts of associated developments

Obstacle Limitation Surface (OLS)

All airports must manage vegetation in line with CASA safety regulations. This includes a range of height limitations extending out from the runway. No changes to existing vegetation height Obstacle limitation Surfaces (OLS) will be required as a result of runway extensions.

Relationship to total number of flights

The number of flights per days at the Merimbula airport is dictated by the following inter-related factors:

1. Demand for flights.
2. Commercial operator's response to demand and the resulting price point.
3. Runway configuration, including the length of the runway, which impacts the size of craft, and therefore passenger numbers and costs.
4. Landside infrastructure, including terminal and parking capacity, which caps the number of passengers that can be accepted at any point.

Considering points 1 and 2, for the proposal to generate additional flight numbers, increased demand for flights must first occur. Currently, no more frequent flights are anticipated as there is no increased demand. The proposal is not a response to demand for additional flights. The proposal does however provide one of the factors necessary to respond to increasing passenger numbers in future; that being to utilise larger aircraft. It is reiterated that the proposal is required to expand the airport's ability to receive larger passenger aircraft and current aircrafts will be decommissioned into the future as it reaches the end of its operational life. It will allow other passenger airlines to consider providing a service through Merimbula, providing greater access to air travel to the local community. Increased demand in future is expected but is not tied to this proposal specifically.

Point 3 and 4 set predictable caps on passenger numbers and are therefore more appropriately linked to the assessment of additional flights. While the caps are clear, due to the uncertainties of Points 1 and 2 the likely timing of when these caps will be reached is not known. While the extended runways will allow a larger plane to take off and land, it does not follow that the proposal will generate a greater frequency of flights. To meet existing demand for passenger flights, the larger planes accommodated would be

more likely to reduce in number. To meet predicted increases in demand over time, the number is considered likely to increase. However, landside infrastructure limits the increase and is more closely connected to this outcome. This is set out in more detail in the Submissions Report (NGH 2020). Additional passenger numbers will not result from this proposal. Additional numbers will be a factor of demand and price points determined by commercial operators. An increase in flights is not a result of this proposal and additional flights are not assessed as part of the EIS or this Submissions Report.

Changes to flight size, frequency, impacts on collision risk

The proposal does not substantively increase the collision risks to surrounding fauna. At Merimbula airport, collision risk, particularly for shore birds foraging near to the flight path, can be summarised as a combination of:

- Proximity to the risk,
- Attractiveness (such as the presence or roosting or foraging habitat),
- Surface area available to collide with, and
- Frequency of flights.

The runway extension project will remove a limited area of terrestrial and aquatic habitat which might otherwise attract birds and other wildlife. The surrounding environment will continue to be managed under the existing adaptive wildlife management plan (refer below). The runway extension does have the potential to bring larger planes closer to shorebird habitats however, as above, the flight paths, heights as well as landing positions will not change from the current situation. The additional paved area created for the starter extensions (north and south) will be used for the commencement of the take-off only. Hence, as the plane becomes airborne at speed, at the end of the runway, it retains the same separation distances to surrounding features as the existing situation. The same applies to aircraft approaching the runway for landing. The difference to the current runway is the use of the extended area for the beginning of the take-off only. So the increased risk relates only to stationary or slow moving craft which will be in closer proximity to adjacent habitats. A larger plane may present a larger surface area with potential to collide with wildlife, in the air or on the ground. Equally, on an individual level, it may be more observable, louder and therefore more avoidable to wildlife. This is not considered likely to represent a substantive increase in risk. Note comments above on frequency of flights.

All airports are required to manage wildlife. Merimbula Airport's operating and safety system includes a Wildlife Hazard Management Plan (WHMP). A major review was undertaken in 2017. The WHMP is also subject to review as circumstances dictate (see discussion of the 2019 flying fox population below).

The adaptive management plan requires airport personal to retain evidence of wildlife strikes, to allow identification of species and determine recommendations for amendments to the WHMP where required.

It is noted that there was one fatality with an identified threatened shorebird species in the BDAR. This was for the Pied Oystercatcher, with one fatality in 2015. The 'zone of impact' for threatened shorebirds is within the approach and touch down areas of the current runways. It essentially relates to the Mangrove habitat directly adjoining the south runway. It is important to note that;

The development footprint (Ultimate EIS) in BDAR V4 includes removal of the southern haul road, adjacent to the southern runway extension. The existing southern access track was created in the 1950s and tidal flow into habitat surrounding this area has subsequently been restricted by the size of culverts (two of them) beneath the haul road. The road's removal may have benefits for improving hydrological function surrounding the southern extension by removing a barrier to flow. It results in:

- A very minor increase in native vegetation clearing (0.091 ha) to dismantle the road
- Removal of a key threatening process under both the BC and FM Acts:
 - BC Act: Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands.
 - FM Act: Installation and operation of instream structures and other mechanisms that alter natural flow regimes of rivers and streams.
- A 4.5 ha area of beneficial impact comprised of:
 - Saltmarsh: 3.57 ha
 - Bangalay and Swamp Oak Forest: 0.93 ha

This is considered part of Stage 2 works, but may be undertaken earlier.

The addition of one more 300mm diameter culvert is proposed to offset minor impacts of the southern extension for project EIS, to preserve consistent tidal flow regimes (variation of flow not greater than 2%) onsite. This action becomes redundant when the southern haul road is removed, as proposed during Stage 2 works.

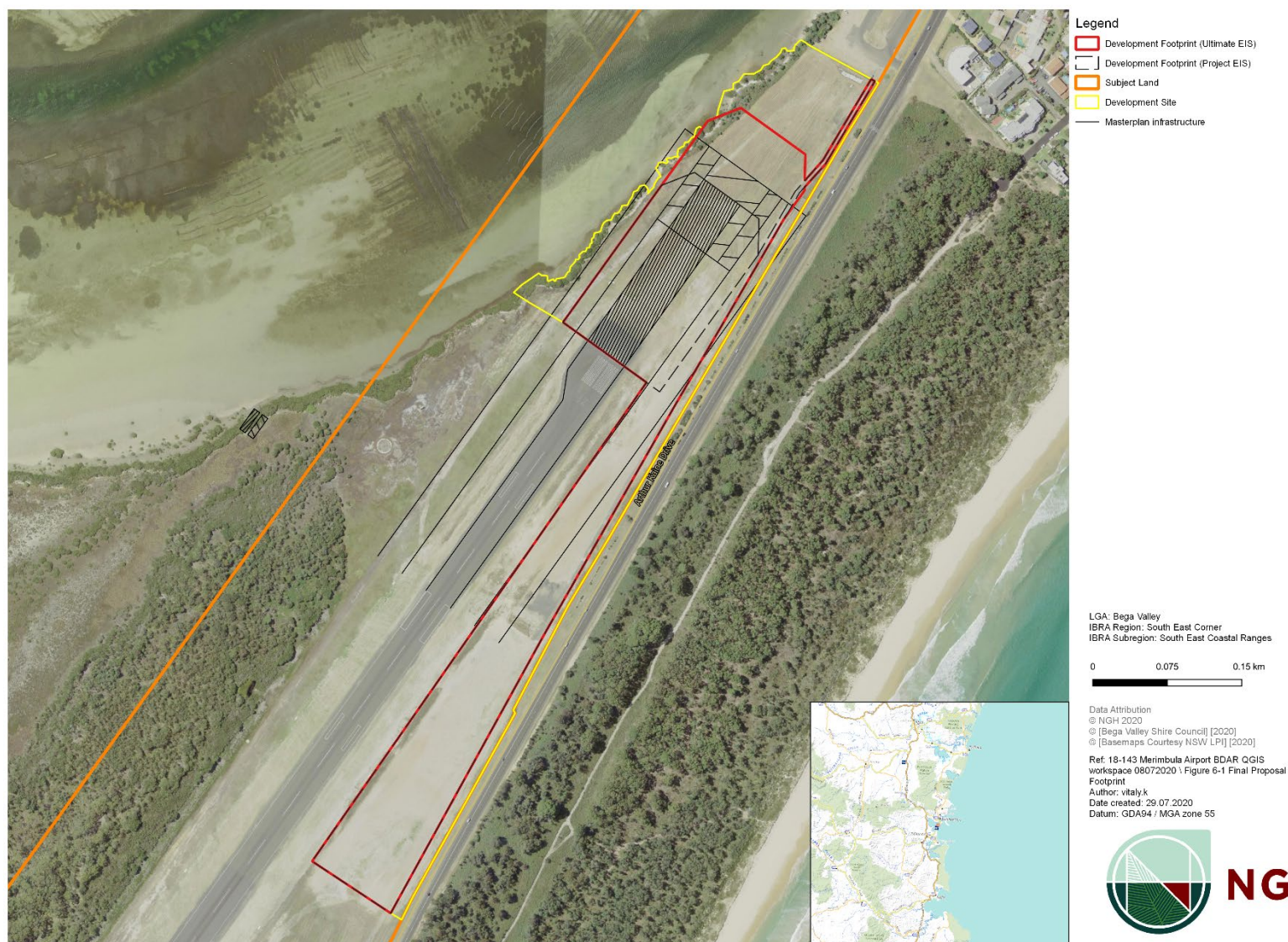


Figure 6-1 Final Proposal Footprint (North Runway)

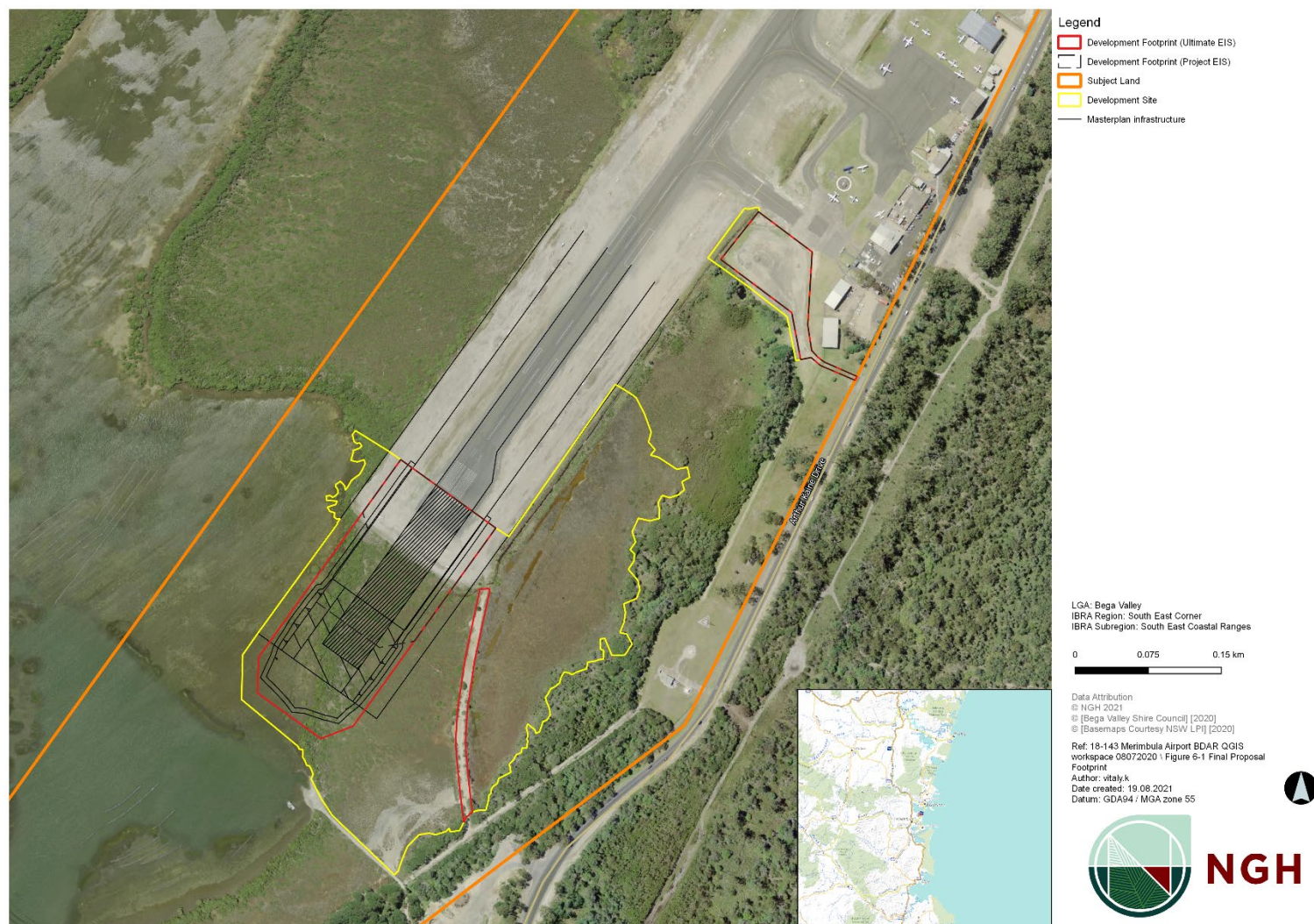


Figure 6-2 Proposal Footprint (South Runway)

6.2 PRESCRIBED BIODIVERSITY IMPACTS

Some projects can have impacts on biodiversity values that cannot be quantified or mitigated from the clearing of the vegetation itself. The *Biodiversity Conservation Regulation 2017* NSW (clause 6.1) identifies the general categories of prescribed biodiversity impacts which need to be assessed under the biodiversity offsets scheme. They include;

- a) Impacts of development on the habitat of threatened species or ecological communities associated with:
 - i. karst, caves, crevices, cliffs and other geological features of significance, or
 - ii. rocks, or
 - iii. human made structures, or
 - iv. non-native vegetation
- b) Impacts of development on the connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range
- c) Impacts of development on movement of threatened species that maintains their life cycle
- d) Impacts of development on water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities
- e) Impacts of wind turbine strikes on protected animals (not applicable to this development)
- f) Impacts of vehicle strikes on threatened species or on animals that are part of a TEC.

These are discussed in more detail below.

6.2.1 *Impacts of development on the habitat of threatened species or ecological communities associated with (a) i-iv.*

As verified by the field inspection, there are no occurrences of karst, caves, crevices, or cliffs in the development site. No occurrences of surface rock occur in the development site.

Merimbula airport contains many buildings including aeroplane hangers and the airport terminal and various sheds for storage of aviation fuel and other petroleum-based chemicals. It is not anticipated that any of these structures will be impacted by the proposed development as no infrastructure is located inside the development footprint. Some areas of exotic ground cover will be paved. This is not expected to have an impact on any threatened ecosystem or candidate species assessed under the BAM.

6.2.2 *Impacts of development on the connectivity of different areas of habitat or threatened species that facilitate the movement of these species across the range (b) and (c).*

The impact of extending the runway to the north will have minimal impact on habitat connectivity as most of the area to be impacted (95%) contains mown grasslands which are highly disturbed already and maintained for obstacle limitation for planes landing and taking off from Merimbula Airport. This area does not contain many habitat resources besides some possible foraging habitat for threatened raptors. Surrounding grasslands east of Arthur Kaine Drive (along fire trails easements) are not mown regularly are likely to contain more prey (ie rodents seeking shelter under taller tussock grasses and bracken fern). A small portion of bangalay dune scrub (2.5%) and sandy mangrove habitat (2.5% consisting of a 50 m long strip of vegetation adjoining Merimbula lakefront) will be removed to accommodate the north

runway extension. These areas contain a small strip of important habitat for shore dwelling fauna. As this proposal is increasing the length of existing runways there is no scope to avoid this. Where candidate species habitat is identified and impacted, species credits have been generated to compensate for the loss of habitat.

Impacts to the south are more extensive as most of the area inside the development footprint (~90%) contains intact and connecting mangrove mudflats extending north and south. The remaining 10% consists of aquatic seagrass within Merimbula Lake that is not subjected to assessment under the BAM. In relation to the mangrove habitat, clearing will provide a separation of mangrove mudflat habitat of around seventy metres to similar habitat present directly north east and south west of the development footprint. All threatened ecosystem and candidate species relying on mangrove mud flats (for example Sooty & Pied Oystercatcher and Beach Stone Curlew) are highly mobile and able to fly between patches of habitat. As such, the removal of mangrove habitat for the south runway extension is not likely to impact on connectivity of habitat for any candidate or ecosystem species addressed within this report. The clearing is not considered to impact on the movement of threatened species in a manner that would cause significant impacts.

6.2.3 Impacts of development on water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities (d).

Merimbula Lake is immediately adjacent to the site and will be partially filled to provide areas for the runway extension. The Lake is a nationally significant wetland as listed on the Department of Environmental and Heritage Website – NSW061 (DEE 2010) and known to sustain many threatened species.

Threatened species considered under the BAM which rely on good water quality and coastal water bodies include the following species;

- *Botaurus poiciloptilus*, Australasia Bittern
- *Calidris canutus*, Red Knot
- *Calidris ferruginea*, Curlew
- *Esacus magnirostris*, Beach Stone-curlew
- *Haliaeetus leucogaster*, White-bellied Sea-Eagle
- *Ixobrychus flavicollis*, Black Bittern
- *Limosa limosa*, Black-tailed Godwit
- *Pandion cristatus*, Eastern Osprey
- *Numenius madagascariensis*, Eastern Curlew
- *Sternula albifrons*, Little Tern

As above, Stage 2 (assessed in BDAR V4, Ultimate EIS) now also includes the removal of a haul road south of the project to improve hydrological function surrounding the southern extension by removing a barrier to flow. It results in:

- A very minor increase in native vegetation clearing (0.085 ha) to dismantle the road
- Removal of a key threatening process under both the BC and FM Acts:
 - BC Act: Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands.
 - FM Act: Installation and operation of instream structures and other mechanisms that alter natural flow regimes of rivers and streams.
- A 4.5 ha area of beneficial impact comprised of:

- Saltmarsh: 3.57 ha
- Bangalay and Swamp Oak Forest: 0.93 ha

The beneficial impacts of reestablishment of native vegetation in the area now occupied by the barrier (0.24 ha) and increased inundation to the east, modelled as 4.5 ha, have not been included in any way by this assessment.

A Construction Environment Management Plan will be required to minimise sedimentation into the lake during the clearing, importation of fill and construction phase of development. The plan will need to be consistent with Bega Valley Shire Council (BVSC) Soil and Water Management Guidelines (BVSC 2014). In addition to this, it is recommended that regular monitoring of turbidity and water quality is undertaken before and after construction to monitor water quality and ensure that Merimbula Lake is not impacted by the proposed activities. Further details are provided in Chapter 8 which aim to minimise these impacts.

The new runway extension is likely to change where stormwater flows at the site and but is unlikely to change tidal inundation to saltmarsh habitat (see figures 6-2 to 6-4 below; this issue is explored in the hydrological study undertaken by Southeast Environmental 2019, included with the EIS).

Stormwater from the runway, terminal and surrounds currently pass through constructed channels, then via culverts under the southern access road which flows into Merimbula lake. Overland flow from Arthur Kaine Drive also discharges into the saltmarsh habitat and discharges to Merimbula lake (via a culvert beneath the southern access road). The runway extension will alter flow paths causing flows to redirect to the south. This will increase the volume and velocity of water to a minor extent.

In relation to minimising impacts to saltmarsh habitat, it is recommended by Southeast Environmental (2019) that new flow paths be allowed to occur naturally. Creating a constructed channel would likely result in larger impacts compared to simply allowing a new flow path to form. Monitoring of flow changes post construction will address any remediation that may be required and is a recommendation of Southeast Environmental (2019). More details about monitoring are provided in Section 8.3 in the Biodiversity Conservation Management Plan.

The use of fuels and other chemicals on site during construction could pose a risk of surface water contamination in the event of a spill. Chemicals used onsite would include fuels and lubricants associated with construction machinery. These indirect impacts are manageable through the measures recommended in chapter 8.



Figure 6-3 Saltmarsh habitat east of south runway (left) and 300mm culvert under Southern Access Track.



Figure 6-4 Southern access track looking south (left) and looking north (right).

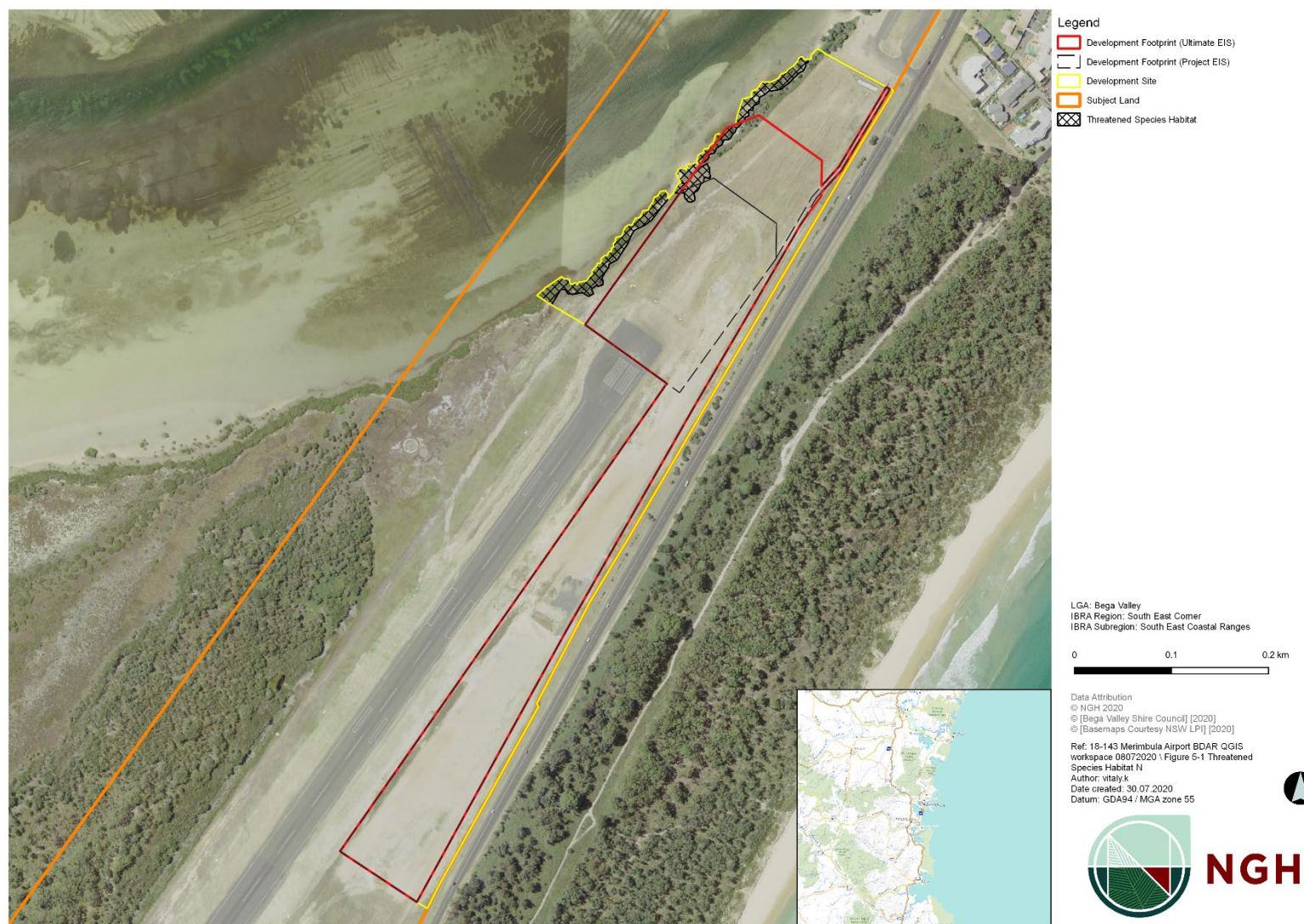


Figure 6-5 Location of Threatened Shorebird Habitat (North Runway)

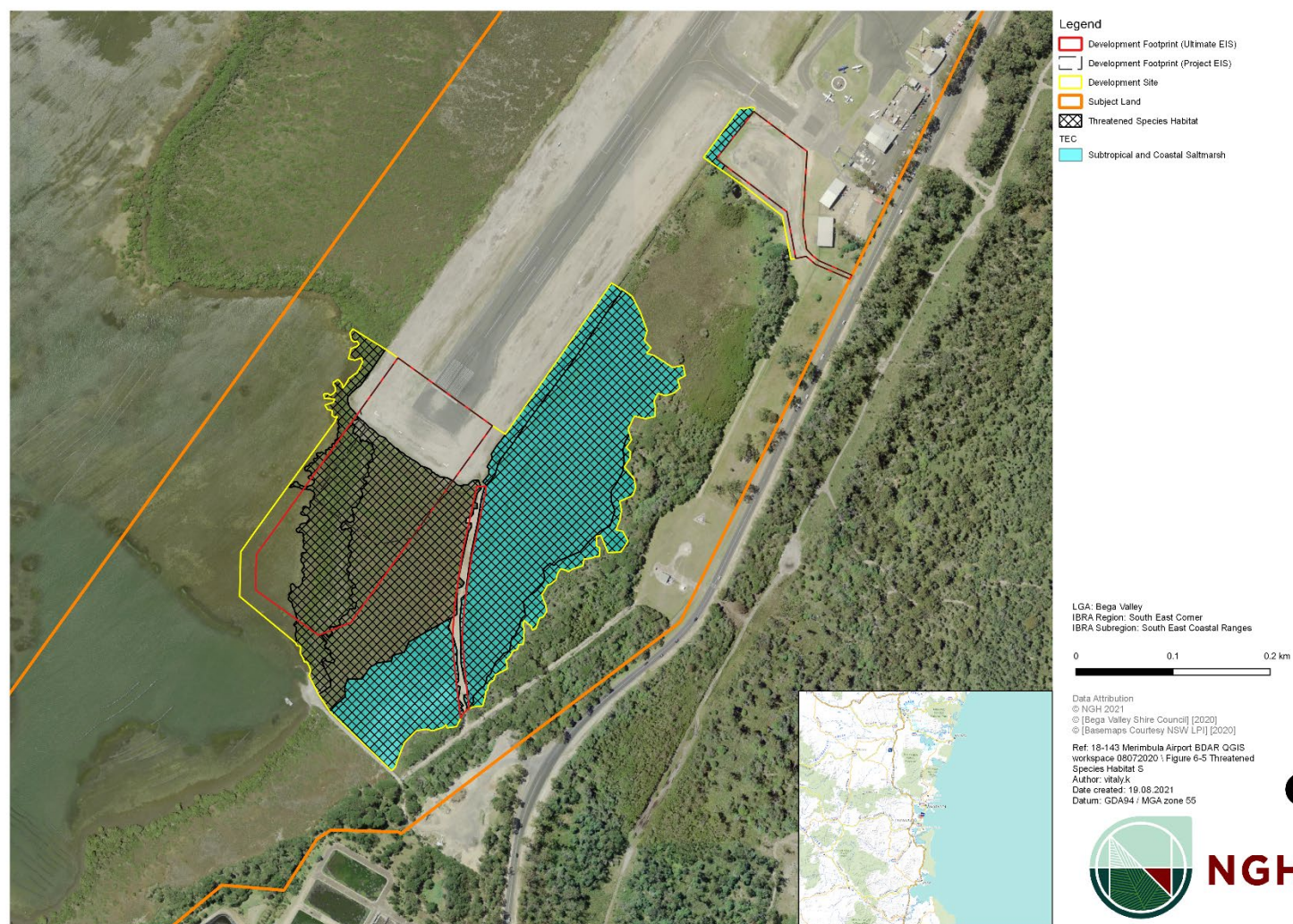


Figure 6-6 Location of TEC and Threatened Shorebird Habitat (South Runway)

6.2.4 Impacts of vehicle strikes on threatened species or on animals that are part of a TEC (f).

There is potential for airplanes to strike threatened birds during take-off and landing at Merimbula Airport, however Merimbula Airport expects no substantive increase in bird strikes from proposed runway extensions.

Merimbula Airport has an adaptive Wildlife Hazard Management Plan (WHMP), developed by Dr Jim Shields and Elisabeth Larsen of Local Environmental Solutions (LES). Dr Shields has a PhD in wildlife management and Ms Larsen has a degree in Environmental Management. The plan was first developed in 2004 and has been subject to scheduled reviews since that time. A major review was undertaken in 2017 not least due to the impending handover of aerodrome certification responsibility to Bega Valley Shire Council from its lessee. The WHMP is also subject to reviews as circumstances dictate (see discussion of the 2019 flying fox population below).

The plan requires airport personal to retain evidence of wildlife strikes, to allow LES to identify and record the species and determine recommendations for amendments to the WHMP. The growing trend at airports domestically and internationally is to recognise options for mutual safe co-existence, for instance at Merimbula this includes fauna that exists within vegetation cover.

One example of an unscheduled review of the WHMP was triggered by changing environmental circumstances that occurred in 2019. During that year, a colony of flying foxes were observed south of the airport that increased significantly for some months. LES was commissioned to assist BVSC to assess the risk, identify mitigation and update the WHMP. CASA was also identified of the risk and provided with a copy of the updated WHMP. A notice to pilots (a NOTAM) was also issued. The risk identification process included Council's natural resources officers.

It was quickly identified that the maximum height of the flying foxes' flight was underneath most of the obstacle limitation surface (OLS). Times of day when flying fox flight was most likely to occur was identified along with feed sources and most likely flight paths. A formal risk assessment was applied and the wildlife count procedures in the WHMP were updated. The mitigation measures included additional visual inspections of the flight paths from the aerodrome, including counts of flying foxes, when passenger airline aircraft were on route. Minimum numbers were identified for the purposes of triggering delays or cancellations of flights if needed.

In relation to ongoing development of wildlife management techniques, BVSC is a member of the Australian Airports Association. This gives it access to shared knowledge across most airport operators in Australia and updates on best practice from overseas. Through this interaction, BVSC is able to access the most recent developments in wildlife risk management at airports with other operators adapting to their specific circumstances through principles of coexistence, actions taken at the time of flight arrival to prevent collisions, manual systems and technology based systems

7 IMPACTS UNABLE TO BE AVOIDED OR UNCERTAIN

7.1 DIRECT IMPACTS CAUSED FROM CLEARING

The construction and operational phases of the proposal has the potential to impact biodiversity values at the site that cannot be avoided. This would occur through direct impacts such as removal of all native vegetation for hard stand areas (the runway). The runway extensions north and south will not alter the current vegetation maintenance required for OLS.

Table 7-1 Potential direct impacts to biodiversity during the construction and operational phases (Development footprint – Ultimate EIS)

Nature of impact	Extent	Frequency	Duration and timing	Consequence
Direct impacts				
Clearing of Bangalay Scrub, Saltmarsh and Mangrove vegetation, north end of the runway (where offsets required).	0.15 ha	Regular	Construction	• Direct loss of native flora and fauna habitat • Injury and mortality of fauna during clearing
Clearance of Mangrove and Saltmarsh vegetation, south end of the runway (where offsets required).	2.18 ha	Regular	Construction	• Direct loss of native flora and fauna habitat • Injury and mortality of fauna during clearing
Displacement of resident fauna during and after construction.	Unknown	Regular	Construction Operation	• Displacement of native fauna territories • Decline or relocation of local fauna populations/territories
Injury or death of fauna during construction.	Unknown	Regular	During clearing	• Direct loss of native fauna • Decline in local fauna populations

7.1.1 Changes in vegetation integrity scores

The changes in vegetation integrity scores as a result of clearing are documented for each vegetation zone in Table 7-2 below.

Table 7-2 Current and future vegetation integrity scores for each vegetation zone (Ultimate EIS) within the development site.

Zone ID	PCT	EEC and/or threatened species habitat?	Area (ha)	Current vegetation Integrity Score	Future vegetation Integrity Score
1	659 Scrub	Yes	0.07	50.8	0
2	659 Grass	No	8.44	8.0	0
3	920 Grey Mangrove (sand)	No	0.03	82.9	0
4	920 Grey Mangrove (mud)	No	1.00	69.9	0
5	920 River/Grey Mangrove	No	1.03	55.0	0
6	1126 Saltmarsh	Yes	0.05	75.4	0
7	1126 Saltmarsh	Yes	0.07	11.9	0

7.1.2 Loss of species credit species habitat or individuals

The loss of species credit species habitat or individuals as a result of clearing is documented in Table 7-3 below.

Table 7-3 Summary of species credit species (Ultimate EIS) loss at the development site

Species Credit Species	Biodiversity risk weighting	Area of habitat / count of individuals lost
Leafless Tongue Orchid <i>Cryptostylis hunteriana</i>	1.5	0.07 ha (north runway)
Sooty Oystercatcher <i>Haematopus fuliginosus</i>	2	0.03 ha (north runway) 2.03 ha (south runway)
Pied Oystercatcher <i>Haematopus longirostris</i>	2	0.03 ha (north runway) 2.03 ha (south runway)
Southern Brown Bandicoot <i>Isodon obesulus</i>	2	0.07 ha (north runway)
Long-nosed Potoroo <i>Potorous tridactylus</i>	2	0.07 ha (north runway)

7.1.3 Loss of hollow-bearing trees

No hollow-bearing trees are present inside the development site and therefore there will be no impact or loss of this resource onsite.

7.2 INDIRECT IMPACTS

Indirect impacts of the proposal could include soil and water contamination due to expose of acid sulfate prone soils, sedimentation during construction of runway extensions and displacement of residential fauna. There could also be an increase in the incidence of bird strikes at the airport as a result of increased frequency of flights and larger planes using the runways. Table 7-4 below details the broad categories of indirect impacts. Table 7-5 details the type, frequency, intensity, duration and consequence of indirect impacts of the proposal.

Table 7-4 Indirect Impact zones of the proposal

Nature of impact	Extent	Frequency	Duration and timing	Consequence
Indirect impacts				
Importation of fill for the south runway extension	20 m surrounding development footprint	Regular	Construction	- Direct loss of native flora and fauna habitat. - Injury and mortality of fauna during clearing. - Potential sedimentation of Merimbula Lake, affecting water quality if not managed appropriately.
Displacement of resident fauna	Unknown	Regular	Construction, operation	- Direct loss of native fauna - Decline in local fauna populations
Larger planes using the runway.	Incidental strikes by aircraft	Up to 5 strikes / year have been recorded	Operational Phase: Long-term	- Potential increase in bird strikes. - Increased disturbances to local fauna occupying the site.
Exposure of acid sulfate soils during construction.	~10 ha	Regular	During construction	- Leaching of acid sulfate substances into surrounding environment, including mangroves, saltmarsh and aquatic areas leading to a decline in water quality. - Death of surrounding mangroves and seagrass - Mortality of fauna using mudflats and adjoining Merimbula Lake
Altered hydrology in areas surrounding the disturbance footprint.	4.5 ha	Regular	Operational Phase: Long-term	Restoration of natural inundation areas each of the southern haul road address a key threatening process

Nature of impact	Extent	Frequency	Duration and timing	Consequence
Altered hydrology in areas surrounding the disturbance footprint.	0.1 ha	Infrequent ; 5-10 times per year	Operational Phase: Long-term	Altered tidal regimes could indirectly impact saltmarsh, mangrove and threatened shorebird habitat

Table 7-5 Potential indirect impacts to biodiversity during the construction and operational phases

Nature of impact	Extent	Frequency	Duration and timing	TEC, threatened species and habitats likely to be affected	Consequence to Biodiversity
Indirect impacts (those listed below are included in the BAM)					
Inadvertent impacts on adjacent habitat or vegetation	Unknown	Rare	Construction Phase: Short – term.	• PCT 659 Scrub • PCT 1126 Saltmarsh • PCT 920 Mangrove habitat • Shorebirds and Waders	• Accidental loss of native flora and fauna habitat (including Mangrove habitat and Dune scrub).
Reduced viability of adjacent habitat due to edge effects	Unknown	Permanent impact	Operational phase: Long-term.	• PCT 659 Scrub • PCT 1126 Saltmarsh • PCT 920 Mangrove habitat • Shorebirds and Waders	• Disturbances caused from runway extensions.
Reduced viability of adjacent habitat due to increased noise, dust and light	Unknown	Temporary (construction) Permanent impact (operation)	Construction Phase: Short – term.	• PCT 659 Scrub • PCT 1126 Saltmarsh • PCT 920 Mangrove habitat • Shorebirds and Waders	• Disturbances to native fauna through excessive dust, noise and light during construction. • Disturbances caused importation of fill affecting hydrological process of mangroves and saltmarsh.
Transport of weeds and pathogens from the site to adjacent vegetation	Unknown	Ongoing	Construction and operation: long-term	• PCT 659 Scrub • PCT 1126 Saltmarsh • PCT 920 Mangrove habitat • Shorebirds and Waders	• Introduction of new weed outbreaks on airport land and surrounding habitat.
Increased risk of starvation, exposure and loss of shade or shelter	Unknown	Permanent impact (operation)	Construction Phase: Short-term.	• PCT 920 Mangrove habitat • Shorebirds and Waders	• Loss of 2.04 ha of mangrove habitat and potential indirect impacts on surrounding mangrove habitat.

Nature of impact	Extent	Frequency	Duration and timing	TEC, threatened species and habitats likely to be affected	Consequence to Biodiversity
Rubbish dumping	Unknown	Occasional	Construction Phase: Short-term.	• PCT 659 Scrub • PCT 1126 Saltmarsh • PCT 920 Mangrove habitat • Shorebirds and Waders	• Contamination of surrounding habitat with rubbish associated with construction.
Disturbance to specialist breeding and foraging habitat, e.g. beach nesting for shorebirds.	Unknown	Permanent impact (operation)	Operational phase: Long-term.	• Shorebirds and Waders utilising Mangrove and saltmarsh habitat.	• Decline in populations of shorebirds.
Collision risk	OLS north and south runway	Occasional	Operational phase: Long-term.	• Shorebirds and Waders on approach and take-off zones	• Decline in populations of shorebirds.

7.3 PRESCRIBED BIODIVERSITY IMPACTS

Some projects can have impacts on biodiversity values that cannot be quantified or mitigated from the clearing of the vegetation itself. The *Biodiversity Conservation Regulation 2017* NSW (clause 6.1) identifies the general categories of prescribed biodiversity impacts which need to be assessed under the biodiversity offsets scheme. They include;

- a) Impacts of development on the habitat of threatened species or ecological communities associated with:
 - i. karst, caves, crevices, cliffs and other geological features of significance, or
 - ii. rocks, or
 - iii. human made structures, or
 - iv. non-native vegetation
- b) Impacts of development on the connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range
- c) Impacts of development on movement of threatened species that maintains their life cycle
- d) Impacts of development on water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities
- e) Impacts of wind turbine strikes on protected animals (not applicable to this development)
- f) Impacts of vehicle strikes on threatened species or on animals that are part of a TEC.

These are discussed in relation to unavoidable impacts in more detail below.

7.3.1 *Impacts of development on the habitat of threatened species or ecological communities associated with (a) i-iv.*

Key habitat features that will be impacted include;

- Mangrove swamps (mud substrate)
- Mangrove swamps (sandy substrate)
- Bangalay back dune scrub containing thick shrub and groundcover
- Seawater within Merimbula Lake

The greatest impact will occur on mangrove swamps (2.06 ha) within the development footprint on the southern runway. In reviewing aerial photography onsite, it is apparent that the removal of 2.06 ha of Mangrove habitat will impact less than 5% of the existing and adjoining mangrove habitat (in better condition and being less disturbed by airport activities) surrounding Merimbula Lake. As such, the clearing proposed is not expected to impact on the life-cycles of any Candidate species (assessed within the BDAR).

7.3.2 Impacts of development on the connectivity of different areas of habitat or threatened species that facilitate the movement of these species across the range (b) and (c).

Merimbula Lake is immediately adjacent to the site, and will be partially filled as part of the proposal. The Lake is a nationally significant wetland as listed on the Department of Environmental and Heritage Website - NSW061 (DEE 2010) and known to sustain many threatened species. Mangrove habitat fringes Merimbula Lake and is subjected to regular tidal inundation.

Threatened species identified within the BAM calculator which rely on good water quality and coastal wetlands include the following species;

- *Botaurus poiciloptilus*, Australasian Bittern
- *Calidris canutus*, Red Knot
- *Calidris ferruginea*, Curlew
- *Esacus magnirostris*, Beach Stone-curlew
- *Haliaeetus leucogaster*, White-bellied Sea-Eagle
- *Ixobrychus flavicollis*, Black Bittern
- *Limosa limosa*, Black-tailed Godwit
- *Pandion cristatus*, Eastern Osprey
- *Numenius madagascariensis*, Eastern Curlew
- *Sternula albifrons*, Little Tern

The loss of suitable habitat is seen to be less than a 5% loss on what will remain viable habitat for these species. Adjoining the mangroves is aquatic habitat which will require assessment in accordance with the NSW Fisheries Management Act 1994. Offset Policy applies to losses of aquatic habitat. Mitigation measures will be detailed in an Aquatic Assessment which will form part of the EIS report.

7.3.3 Impacts of development on water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities (d).

Specific additional investigations were undertaken after the public exhibition of the EIS and BDAR V2, in response to the feedback received as part of EIS stakeholder reviews. The outcomes of these studies have been used in several ways that are relevant to managing water quality and hydrological impacts:

- Detailed design work regarding works methods in and near waterways.
- Hydrological modelling of tidal exchange in relation to the southern starter extension and adjacent culverts.
- Water quality management plan development.
- Acid sulfate soil management plan development.

Table 7-6 summarises the additional areas of investigation and incorporation of their specific outcomes.

Table 7-6 Key areas of additional investigation informing water quality and hydrological impacts

	Study	Objective	Outcome
1	Additional engineering design work	Provide a more detailed works method to allow more certainty around direct and indirect impacts of the proposal.	Revised works method in discussion with hydrologists and ecologists provided greater certainty around direct and indirect impacts of the works footprint.
2	Additional hydrological modelling to counter minor impact of the southern extension	While minor and considered negligible, the 7% reduction in flow around the southern runway extension was of concern to some oyster lease holders. Any reduction in flow was of concern. The expansion of the culvert in the haul road was modelled and resulted in a still minor but positive impact on flow, which was more acceptable (2% increase).	Revised levels provided greater certainty around tidal movement Opportunity to revise model to allow consider revised tidal movements and potential changes to flow into saltmarsh area.
3	Water quality management plan	To further investigate means to manage water quality impacts to adjacent areas during construction	A clear set of management protocols with performance criteria that can be used by contractors to appropriately control water quality risks of the proposal. Improved certainty over the management of water quality.
4	Acid sulfate soils MP	To further investigate means to manage ASS onsite during construction	A clear set of management protocols with performance criteria that can be used by contractors to appropriately control ASS risks of the proposal. Improved certainty over the management of ASS.

7.3.4 Impacts of vehicle strikes on threatened species of animals or on animals that are part of a TEC (f)

Merimbula Airport has a Wildlife Hazard Management Plan (see Appendix F). This plan mentions the following threatened fauna having some probability of being struck by planes;

- Pied Oystercatcher,
- White-fronted Chat,
- White-bellied Sea Eagle,
- Glossy-black Cockatoo,
- Gang Gang Cockatoo and
- Grey-headed flying fox.

The objective of this plan is to minimise the incidence of wildlife strikes, which includes maintaining vegetation to minimise occupancy by wildlife, using harassment methods to keep birds off the flight strip, and maintaining efficient drainage of the flight strip and airfield (Airport Agencies 2017). There has been one threatened bird fatality being the Pied Oystercatcher, recorded in 2015, that was struck within the runway touch down area.

The plan includes specific actions for preventing impacts to the threatened species above:

For the Grey headed Flying Fox, the prescribed management actions are:

- Short term: Proactive management – when known presence in district, encourage airlines to avoid activity during the key risk period just after sunset.
- Long term: Coordination with Friends of Glebe Wetlands and Panboola Wetlands to monitor the presence of GHFF at the two colonies.

For the White-bellied Sea Eagle, the prescribed management actions are:

- Short term: - Removal of road-kill along Arthur Kaine Drive, changes to grass heights and use of harassment methods to keep birds (prey) out of the flight strip.
- Long term: - Better understanding of why these birds are attracted to the airfield.

For the Pied Oystercatcher, Glossy Black Cockatoo and Gang Gang Cockatoo the prescribed management method is use of harassment methods to keep birds out of the flight strip.

With existing prescribed management activities in place, the proposed development is not expected to substantially increase in the incidence of bird strikes but is largely unknown unless monitored into the future.

7.4 IMPACTS TO BIODIVERSITY VALUES THAT ARE UNCERTAIN

7.4.1 Increase in incidence of bird strikes

In relation to threatened shorebird collisions, possible impacts can be summarised as:

- Distance of foraging shorebirds to the risk,
- Attractiveness of habitat (such as roosting or foraging habitat) within the risk zone,
- Size of aeroplane to collide with, and
- Frequency of flights.

The current Wildlife Hazard Management Plan (dated 2017) provides a wildlife strike history from 2009 onwards. One threatened shorebird fatality exists for the Pied Oystercatcher in 2015. The 'zone of impact' for threatened shorebirds is within the approach and touch down areas of the current runways. It essentially relates to the Mangrove habitat directly adjoining the south runway. It is important to note;

- The south runway extension and 'zone of impact' is proposed to be extended into Mangrove habitat (and offset in the BDAR) and
- That the frequency of flights is not expected to increase,

The runway extension project will remove a limited area of terrestrial and aquatic habitat which might otherwise attract birds and other wildlife. The surrounding environment will continue to be managed under the existing adaptive wildlife management plan (See appendix F).

The runway extension has potential to bring larger planes over existing habitats. Flight paths, heights as well as landing positions will not change from current airport operations. The runway extensions both north and south will be used for take-off only. As planes become airborne at speed, at the end of the runway, it retains the same separation distances as previous airplane movements on the runway. The same applies to aircraft approaching the runway for landing. The difference to the current runway is the use of the extended area for the beginning of the take-off only. Increased risk relates only to stationary or slow-moving craft which are close to adjacent habitats.

A larger plane may present a larger surface area to collide with wildlife, in the air or on the ground. Equally, it could be argued that larger planes are more observable, louder and therefore more likely to be avoided by wildlife. Overall, larger planes are not likely to represent a substantive increase in risk.

7.4.2 Acid sulfate soils

There are acid sulfate soils over both the northern and southern parts of the development footprint according to NSW Planning portal data layers (refer to Figure 7-1). Any construction exposing soil substrates to the air could potentially impact on water quality values of mangrove and aquatic tidal habitat and Merimbula Lake. Any construction exposing soil substrates to the air will need to be managed in accordance with an Acid Sulfate Management Plan (a commitment of the project) to identify risks associated with all parts of construction within acid sulfate mapped areas. A plan has now been developed (appended to the submissions report that includes a clear set of management protocols with performance criteria that can be used by contractors to appropriately control ASS risks of the proposal. This provides improved certainty over the management of ASS. With appropriate management in place there is not expected to be additional impacts on threatened species caused by acid sulfate soil exposure.

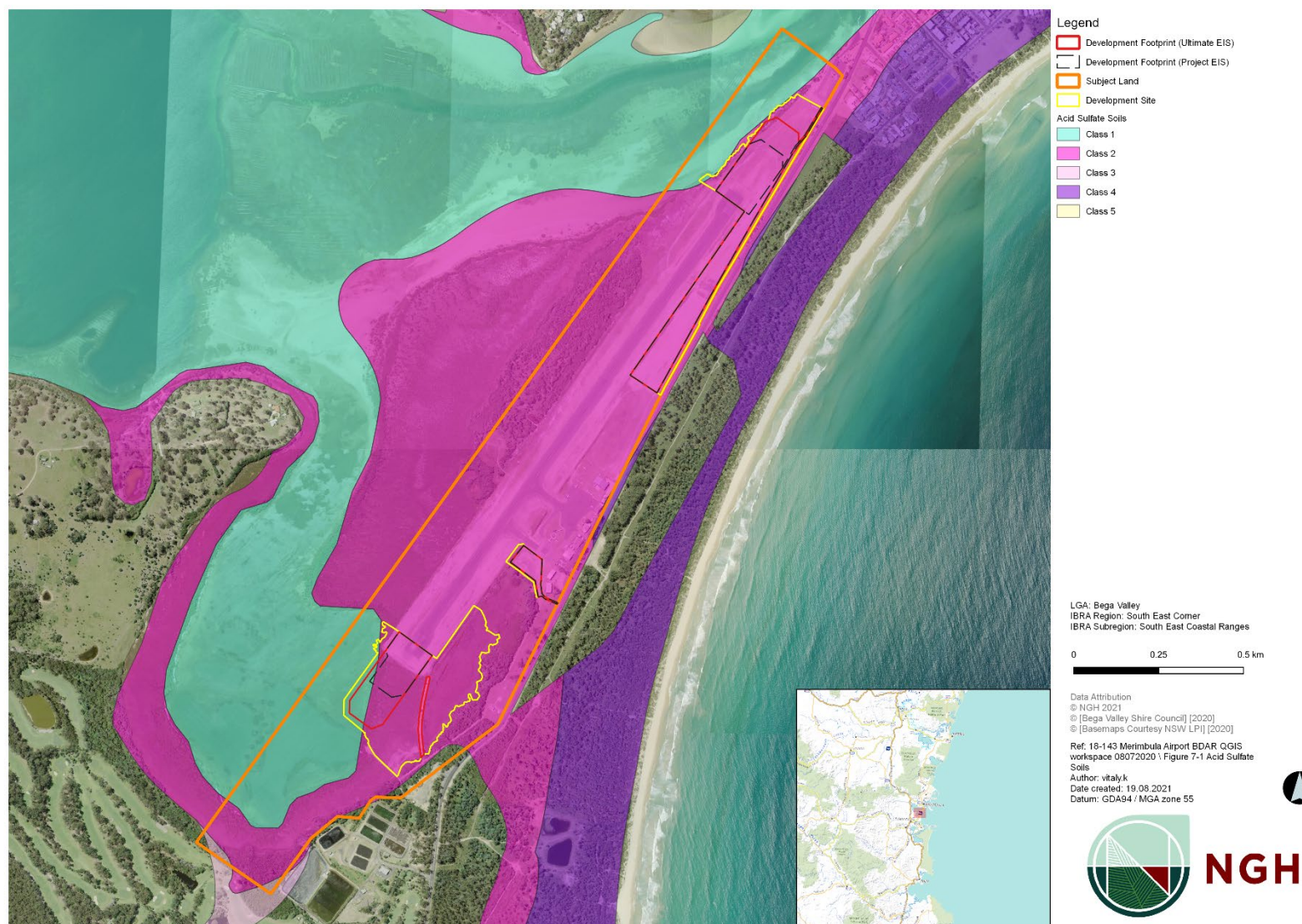


Figure 7-1 Acid Sulfate Soils Map

7.5 IMPACTS TO MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

The project is considered to have negligible impact on MNES, on the basis that all entities considered in Section 5 are highly mobile and the specific impacts are small in the context of surrounding and suitable habitat. There are higher quality and less disturbed habitats not frequented by planes nearby which could be utilised by these species. As such, the proposal is not considered likely to result in significant impact to the MNES and a Commonwealth referral under the EPBC Act is not considered to be required.

7.6 LIMITATIONS TO DATA, ASSUMPTIONS AND PREDICTIONS

Approximately ninety percent of the northern runway development footprint (PCT 659 Grass) consists of highly modified native vegetation that has been cleared and is subject to regular mowing. This has resulted in the presence of the groundcover stratum only with an absence of trees and shrubs. When observing adjoining native vegetation, it was assumed that the PCT would be a derived groundcover version of a forest or woodland vegetation formation. As key indicator species in the upper stratum are required for classifying the PCT, notes were taken in the field of adjoining tree species, especially those with similar landscape attributes, in order to gain clues of species likely to have occurred in the upper stratum prior to clearing.

Some vegetation zones (ie PCT 659 Scrub and PCT 920 Mangrove sand and PCT 1126 Artificial Channel) were very linear in nature such that a standard 20 by 20 metre floristic plot could not be undertaken within the area directly impacted. As such a 10 m by 40 metre floristic plot was laid within representative areas to best capture representative species within this zone. The Saltmarsh (PCT 1126) was very small (0.05 ha) consisting of shape not large enough for a full 20 m by 50 m plot. As such litter plots were conducted every 4 metres along the 20 m tape to sample leaf litter. On entry into the BAM calculator, it was discovered that this data was not required for PCT 1126 and 920.

It is important to note that PCT 920 Mangrove is defined as native vegetation under the BC Act (and assessed under the BAM) as well as being defined as marine vegetation in accordance with the Fisheries Management Act. As such, the requirement to offset PCT 920 Mangrove is requiring offsets under both the BAM as well as the FM Act.

8 MITIGATING AND MANAGING IMPACTS

8.1 MITIGATION MEASURES

A general summary of the key measures required to mitigate the impacts of the proposal are provided below. Mitigation measures proposed to manage impacts, including proposed techniques, timing, frequency, responsibility for implementing each measure, risk of failure and an analysis of the consequences of any residual impacts are provided in Table 8-1.

8.1.1 *Impacts from the clearing of vegetation and habitats*

- Induct all construction staff on mitigation measures to prevent environmental impacts through toolbox talks.
- Mark boundaries of clearing area with temporary fencing or similar prior to construction to minimise direct impacts to approved clearing areas.
- Don't stockpile or store topsoil or fill within the dripline of any mature trees.
- Don't stockpile or store topsoil or fill or any construction materials within riparian buffers.
- Avoid night works to prevent accidental clearing outside marked boundaries.
- Ensure disposal of vegetation removed does not impact on surrounding habitats.

8.1.2 *Mitigating the indirect impacts from clearing vegetation and habitats*

- All activities relating to the proposal would be undertaken with the objective of preventing visible dust emissions from the development site.
- A Weed Management Procedure should be developed and would include weed and pathogen hygiene protocols adopted to prevent introducing new weeds and pathogens onto the site from plant, machinery, and fill.
- Prepare a stormwater management plan for the site to prevent erosion and sedimentation into sensitive coastal wetlands and saltmarsh habitat.
- Avoid night works to minimise disturbances of noise and light to fauna occupying the riparian habitat.
- A Biodiversity Conservation Management Plan is recommended to monitor any changes to adjoining Saltmarsh habitat for the south runway.

8.1.3 *Prescribed and uncertain impacts*

- Monitoring of bird strikes should be continued (post any runway extensions) to assess any changes in bird strikes which may lead to further development of strategies to prevent birds strikes into the future.
- Ensure acid sulfate soil tests are conducted within all parts of the development footprint. Any acid sulfate soils must be managed in accordance with an acid sulfate management plan to prevent leaching into the surrounding environment including the environmentally sensitive Merimbula Lake.
- Annual monitoring of the saltmarsh habitat to assess any changes and possible impacts as a result of the south runway extension.

- Ensure clean fill is used during construction to elevate land for runway extensions and approved in accordance with a development consent from Council in accordance with requirements under the Protection of the Environment and Operations Act.

Table 8-1 Mitigation measures proposed to address all impacts on native vegetation and habitat

Mitigation measure	Proposed techniques	Timing	Frequency	Responsibility	Risk of failure	Risk and consequences of residual impacts
Indirect impacts on adjacent vegetation and riparian habitats						
Clearing protocols that identify vegetation to be retained, prevent inadvertent damage and reduce soil disturbance;	- Approved clearing limits to be clearly delineated with temporary fencing or similar prior to construction commencing. - No stockpiling or storage within dripline of any mature trees. - No stockpiling or storage within riparian buffers.	Prior to and during construction	Regular	Contractor	Low	Medium
Noise barriers or daily/seasonal timing of construction and operational activities to reduce impacts of noise	Avoid night works.	Construction	Regular	Contractor	Low	None
Light shields or daily/seasonal timing of construction and operational activities to reduce impacts of light spill	- Avoid Night Works - Direct lights away from vegetation.	Construction/ Operation	Regular	Contractor	Low	None
Adaptive dust monitoring programs to control air quality	- Daily monitoring of dust generated by construction activities. - Construction would cease if dust observed being blown from site until control measures were implemented. - All activities relating to the proposal would be undertaken with the objective of preventing visible dust emissions from the development site.	Construction	Regularly	Contractor	Moderate	Build-up of dust on vegetation within ephemeral waterways. Sedimentation into Merimbula Lake.
Temporary fencing to protect significant environmental features such as adjoining estuaries and Merimbula Lake	Prior to construction commencing, exclusion fencing and signage would be installed around habitat to be retained.	Construction	Regularly	Contractor	Low	None
Staff training and site briefing to communicate environmental features to be protected and measures to be implemented	- Site induction. - Toolbox talks.	Construction	Regular	Contractor	Moderate	Impacts to native vegetation if staff training not being followed

Mitigation measure	Proposed techniques	Timing	Frequency	Responsibility	Risk of failure	Risk and consequences of residual impacts
Preparation of a simple Vegetation Management Plan (VMP) for the site	- VMP to include; - Best practice removal and disposal of vegetation and topsoil containing weeds declared under the <i>Biosecurity Act 2015</i> during and after construction (ie African Lovegrass). - Reporting any occurrences of pathogens such as Myrtle Rust and Phytophthora. - VMP could include appropriate landscape plantings in line with Wildlife Hazard Management Plan (Appendix F)	Construction, operation	One off	Landowner	Moderate	May be hard to regulate the actions of adjacent residents.
Erosion and sediment controls	An erosion and sediment control plan would be prepared and implemented.	Construction	Regular	Contractor	Moderate	Impacts may occur if erosion and sedimentation control plan not implemented.
Stormwater management	A stormwater management plan would be prepared and implemented.	Construction	One off	Contractor	Low	Excessive discharge of stormwater laden sediment during rainfall events into the waterways to the south and east which may alter hydrological patterns of Merimbula Lake. Low risk if plan implemented.

Mitigation measure	Proposed techniques	Timing	Frequency	Responsibility	Risk of failure	Risk and consequences of residual impacts
Prescribed/uncertain biodiversity impacts						
Sediment barriers and spill management procedures to control the quality of water runoff released from the site into the receiving estuaries and Merimbula Lake	- An erosion and sediment control plan would be prepared and implemented. - Spill management procedures would be implemented. - Stormwater management plan prepared and implemented.	Construction	Regular	Contractor	Moderate	Impacts may occur to waterway if erosion and sedimentation control plan not implemented.
Monitor saltmarsh habitat for changes due to altered hydrology and tidal inundation.	Photo points and vegetation integrity plots conducted in saltmarsh before and one year after construction.	Pre and post construction.	Regular	Contractor	Moderate	Degradation of saltmarsh TEC going unnoticed.
Post development, manage wildlife (including threatened birds) in accordance with Merimbula Airport Wildlife Hazard Management Plan (see Appendix F)	- Reduce quality of grassland habitat/grass cutting. - Reduce roosting/nesting habitat - Preventative access fencing maintained. - Remove artificial temporary ponds or open water bodies. - Develop landscape guidelines. - Use harassment methods to deter wildlife from occupying the airport grounds. - Monitoring of wildlife issues onsite.	Operation	Regular	Contractor	Low	Higher incidence of wildlife strikes on aircraft using Merimbula Airport.
Undertake all construction activities exposing soil sediments in accordance with the Acid Sulfate Management Plan developed for Merimbula Airport (See EIS document)	Update once acid sulfate management plan completed.	Construction	Regular	Contractor	Low	Mortality and pollution (acid leachate) draining into adjoining mangrove swamp and Merimbula Lake.

8.2 ADAPTIVE MANAGEMENT STRATEGY

Details are provided for adaptive management strategies proposed to address impacts on biodiversity values that are uncertain (Section 7.4). Furthermore, a Biodiversity Conservation Management Plan is a recommendation of this report, set out in Section 8.3, to address uncertainty and link monitoring to further management actions if required in areas immediately surrounding the development footprint.

8.2.1 Increase in incidence of bird strikes

The airport has a Wildlife Hazard Management Plan to minimise the incidence of wildlife strikes, which includes maintaining vegetation to minimise occupancy by birds, using harassment methods to keep birds off the flight strip and maintaining efficient drainage of the flight strip and airfield (Airport Agencies 2017). The plan includes specific actions for several threatened species:

For the Grey headed Flying Fox, *Pteropus poliocephalus* (vulnerable in NSW), the prescribed management actions are:

- Short term: Proactive management – when known presence in district, encourage airlines to avoid activity during the key risk period just after sunset.
- Long term: Coordination with Friends of Glebe Wetlands and Panboola Wetlands to monitor the presence of GHFF at the two colonies.

For the White-bellied Sea Eagle, *Haliaeetus leucogaster* (vulnerable in NSW) the prescribed management actions are:

- Short term: - Removal of road kill along Arthur Kaine Drive, changes to grass heights and use of harassment methods to keep birds (prey) out of the flight strip.
- Long term: - Better under-standing of why these birds are attracted to the airfield.

For the Glossy Black Cockatoo, *Calyptorhynchus lathami* (vulnerable in NSW, endangered federally) and Gang Gang Cockatoo, *Callocephalon fimbriatum* (vulnerable in NSW), the prescribed management method is use of harassment methods to keep birds out of the flight strip.

Ongoing application of this strategy is recommended to manage bird strikes. In addition;

- During infrastructure design, features such as lattice structures and other perch or shelter opportunities for birds should be avoided or minimised.
- Vegetation management of grassland onsite should reduce habitat provision for raptors and raptor prey.
- Monitoring of habitat and refuge availability for birds should be undertaken regularly.
- Monitoring bird collisions. Any bird carcasses should be identified to species level. Any threatened species collisions should be reported to OEH and should trigger consideration of further actions to minimise collisions onsite.

8.2.2 Acid Sulfate Soils

There are class 1 acid sulfate soils over both the northern and southern parts of the development footprint according to NSW Planning portal data layers. It is a requirement of the Secretaries Environmental Assessment Requirements for an acid sulfate Management Plan to be prepared in accordance with the acid sulfate Soils Manual (Stone et al. 1998). At the time of completing this BDAR an acid sulfate soil management plan had not been completed yet.

Any construction exposing soil substrates to the air could potentially impact on water quality values of mangrove tidal habitat and Merimbula Lake. Any construction exposing soil substrates to the air will need to be managed in accordance with an acid sulfate Management Plan (a requirement of the SEARS) to identify risks associated with all parts of construction within acid sulfate mapped areas.

It is not possible to provide details at this point of time but it is envisaged that with appropriate management in place that there is not expected to be additional impacts on threatened species caused by acid sulfate soil exposure.

8.3 BIODIVERSITY CONSERVATION MANAGEMENT PLAN

The purpose of the Biodiversity Conservation Management Plan is to address uncertainty. It includes monitoring and triggers for specific management actions if adverse impacts are detected in areas immediately surrounding the development footprint. It identifies:

- Areas that should be monitored to detect any possible impacts on adjoining TEC and threatened shorebird habitat,

Refer to Table 8-2 below for management plan and Figure 8-1 for an illustration of areas of application. At this stage, the Biodiversity Conservation Management Plan only applies to stage one/Project EIS footprint. It is considered a draft, to be finalised in consultation with relevant agencies prior to construction.

Table 8-2 Biodiversity Conservation Management Plan

Area of application	Management Action to undertake	Timing/Frequency
Development footprint South Runway	• Comply with Acid sulfate management plan • Comply with Construction Environment Management Plan. • Ensure design standards of south runway comply with development consent and site plans.	• During construction
Indirect impact zone (twenty-metre buffer around Project EIS footprint (stage one))	• Acid sulfate testing • Phosphorus/Nitrogen testing • Establish photo monitoring points to detect any incidental changes to environment.	• Test and photograph in September and April each year.
Development site south runway	• BAM Monitoring plots inside Zone 7 to detect any changes to structure, function & composition of Saltmarsh post construction of the south runway. • Monitor surface water - Turbidity - Phosphorus/Nitrogen loads - Surface water flow - Acid sulfate	• Conduct BAM plot survey once per year in September. • Continue for five years following construction of the south runway.
Subject Land	• Ensure Wildlife Hazard Management Plan (WHMP) is reviewed undertaken every two years to address any new impacts associated with wildlife. • Ensure active management of airport grounds is in accordance with WHMP.	• Review every two years.
Monitoring Control Site	• Establish BAM Monitoring plots inside saltmarsh habitat directly west of runway tarmac/airport terminal to monitor for any changes to saltmarsh not related to runway extensions.	• Conduct BAM plot survey once per year in September. • Continue for five years following construction of the south runway



Figure 8-1 Areas of application for Biodiversity Conservation Management Plan

9 SERIOUS AND IRREVERSIBLE IMPACTS (SAII)

9.1 POTENTIAL SERIOUS AND IRREVERSIBLE IMPACT ENTITIES

The principles used to determine if a development will have serious and irreversible impacts, include impacts that:

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

9.1.1 Threatened ecological communities

No candidate SAI TECs will be impacted on by the proposal in accordance with Guidance to assist a decision-maker to determine a serious and irreversible impact.

9.1.2 Threatened species

The following species have SAI potential:

- *Anthochaera phrygia*, Regent Honeyeater [82338], Critically Endangered EPBC Act
- *Calidris ferruginea*, Curlew Sandpiper, Critically Endangered EPBC Act
- *Esacus magnirostris*, Beach Stone Curlew, Critically Endangered NSW
- *Lathamus discolor*, Swift Parrot, Critically Endangered EPBC Act
- *Chalinolobus dwyeri*, Large-eared Pied Bat, Vulnerable NSW
- *Miniopterus schreibersii oceanensis*, Eastern Bent-wing Bat, Vulnerable NSW
- *Neophema chrysogaster*, Orange-bellied Parrot, Critically Endangered EPBC/NSW
- *Numenius madagascariensis*, Eastern Curlew, Critically Endangered EPBC Act

No 'important mapped areas' habitat is present for Regent Honeyeater, Swift Parrot or Curlew Sandpiper within the development footprint. From conducting field work, the habitat is lacking in sufficient foraging resources to support these species. No swift parrots or Regent Honeyeaters or Curlew Sandpipers were observed incidentally and will therefore not be considered any further.

The Large-eared Pied Bat (*Chalinolobus dwyeri*) and Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*) roosts in caves, cliffs and old mines within well-timbered habitat. The development footprint lacks key habitat and therefore will not be considered any further.

Suitable habitat for the Orange-bellied Parrot (*Neophema chrysogaster*) was identified onsite. Targeted survey did not reveal any evidence of this species. In addition, no records of Orange-bellied Parrot have

been recorded south of Nowra in the last 20 years. It is therefore assumed that this species does not exist onsite or locally in the area.

EPBC Act threshold assessments have been completed for the Eastern Curlew. Refer to Section 5.2 and Appendix D. As Merimbula Lake supports a substantial amount of good quality marine habitat that will remain available within the locality, the loss of 2.18 ha of vegetation is considered acceptable. This assessment has further identified mitigation measures to minimise the impacts and offset the loss of habitat. The proposal is not considered likely to result in significant impact to the Eastern Curlew.

As local records are present of Beach Stone Curlew, this species will be subjected to a SAI assessment, which can be found in Appendix H. The conclusion to the assessment was that there is unlikely to be a serious and irreversible impact because;

- No records or evidence could be found of breeding individuals within Bega Valley LGA,
- Evidence suggests that existing records of Beach Stone Curlews are most likely of birds flying south or north that temporarily stop to rest or forage and
- The quantity of suitable foraging habitat (Mangroves and Saltmarsh) lost as a result of runway extensions is insignificant (<0.1%).

9.1.3 Additional potential entities

No further entities were identified as being impacted on by the proposal with the potential to becoming a serious and irreversible impact.

10 REQUIREMENTS TO OFFSET

10.1 IMPACTS REQUIRING OFFSET

Tables 10.1 to 10.4 provide details on the impacts requiring offset for the 'Project EIS' and 'Ultimate EIS' options as illustrated on figures 10-1 and 10-2.

10.1.1 Ecosystem credits

An offset is required for all impacts of development on PCTs that are associated with:

- a) a vegetation zone that has a vegetation integrity score ≥ 15 where the PCT is representative of an endangered or critically endangered ecological community, or
- b) 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
- c) a vegetation zone that has a vegetation integrity score ≥ 20 where the PCT is not representative of a TEC or associated with threatened species habitat.

The PCTs and vegetation zones requiring offset and the ecosystem credits required are documented in **Error! Reference source not found.** and mapped on Figure 10-1 & Figure 10-2. Note that vegetation zone 2 (PCT 659 Mown Grassland) and vegetation zone 7 (PCT 1126 Saltmarsh) is not included below because it does not need offsetting with its vegetation integrity score being less than 15.

Table 10-1 PCTs and vegetation zones that require offsets (Ultimate EIS)

Zone ID	PCT ID	PCT name	Zone area (ha)	Vegetation integrity score	Ecosystem credits required
1	659	Bangalay Scrub (Nth Runway) This vegetation zone contained cut Bangalay trees and thick groundcover including recently cut bangalay branches resulting from the pruning for OLS airport safety height limitations.	0.07	50.8	2
3	920	Grey Mangrove (Nth Runway) This vegetation zone was dominated by Grey Mangrove on the sandy shoreline of Merimbula Lake. No River Mangroves present.	0.03	82.9	1
4	920	Grey Mangrove (Sth Runway) This vegetation zone consisted of dominant Grey Mangrove established within anaerobic mud (not sand). Occasional River Mangrove present.	1.00	69.9	35
5	920	Grey & River Mangrove (Sth Runway)	1.03	55	28

		This vegetation zone consisted of equal distribution of Grey Mangrove and River Mangrove. Some saline herbs present as well.			
6	1126	Mown Saltmarsh (Nth Runway) This vegetation zone consisted of mown and degraded saltmarsh. There were many weeds including Buckhorn Plantain and Chilean Needle Grass occupying the site.	0.05	75.4	2

Table 10-2 PCTs and vegetation zones that require offsets (Project EIS)

Zone ID	PCT ID	PCT name	Zone area (ha)	Vegetation integrity score	Ecosystem credits required
4	920	Grey Mangrove (Sth Runway) This vegetation zone consisted of dominant Grey Mangrove established within anaerobic mud (not sand). Occasional River Mangrove present.	0.27	69.9	9
5	920	Grey & River Mangrove (Sth Runway) This vegetation zone consisted of equal distribution of Grey Mangrove and River Mangrove. Some saline herbs present as well.	0.69	55	19
6	1126	Mown Saltmarsh (Nth Runway) This vegetation zone consisted of mown and degraded saltmarsh. There were many weeds including Buckhorn Plantain and Chilean Needle Grass occupying the site.	0.02	75.4	1

Table 10-3 PCTs and Vegetation zones that only apply to ULTIMATE EIS, stage 2 clearing area

Zone ID	PCT ID	PCT name	Zone area (ha)	Vegetation integrity score	Ecosystem credits required (Ultimate – Project areas)
1	659	Bangalay Scrub (Nth Runway) This vegetation zone contained cut Bangalay trees and thick	0.07	50.8	2

Zone ID	PCT ID	PCT name	Zone area (ha)	Vegetation integrity score	Ecosystem credits required (Ultimate – Project areas)
		groundcover including recently cut bangalay branches resulting from the pruning for OLS airport safety height limitations.			
3	920	Grey Mangrove (Nth Runway) This vegetation zone was dominated by Grey Mangrove on the sandy shoreline of Merimbula Lake. No River Mangroves present.	0.03	82.9	1
4	920	Grey Mangrove (Sth Runway) This vegetation zone consisted of dominant Grey Mangrove established within anaerobic mud (not sand). Occasional River Mangrove present.	0.73	69.9	26
5	920	Grey & River Mangrove (Sth Runway) This vegetation zone consisted of equal distribution of Grey Mangrove and River Mangrove. Some saline herbs present as well.	0.31	55	9

The full Biodiversity Credit Report generated by the BAM Calculator is provided in Appendix E.

10.1.2 Species credits

An offset is required for the threatened species impacted by the development that require species credits. These species and the species credits required are documented in Table 10-4

Table 10-4 Species credit species that require offsets (Ultimate EIS).

Table 10-4 Species credit species that require offsets (Ultimate EIS)

Species Credit Species	Biodiversity risk weighting	Area of habitat OR count of individuals lost	Species credits required
Leafless Tongue Orchid <i>Cryptostylis hunteriana</i>	1.5	0.07ha (Veg Zone 1 – Bangalay)	1
Sooty Oystercatcher <i>Haematopus fuliginosus</i>	2	0.03 ha (Veg Zone 3 – Mangrove) 1.00 ha (Veg Zone 4 – Mangrove) 1.03 ha (Veg Zone 5 – Mangrove)	64
Pied Oystercatcher <i>Haematopus longirostris</i>	2	0.03 ha (Veg Zone 3 – Mangrove) 1.00 ha (Veg Zone 4 – Mangrove) 1.03 ha (Veg Zone 5 – Mangrove)	64
Southern Brown Bandicoot <i>Isodon obesulus obesulus</i>	2	0.07 ha (Veg Zone 1 - Bangalay)	2
Long-nosed Potoroo <i>Potorous tridactylus</i>	2	0.07 ha (Veg Zone 1 - Bangalay)	2

Table 10-5 Species credit species that require offsets (Project EIS)

Species Credit Species	Biodiversity risk weighting	Area of habitat OR count of individuals lost	Species credits required
Sooty Oystercatcher <i>Haematopus fuliginosus</i>	2	0.27ha (Veg Zone 4 – Mangrove) 0.69ha (Veg Zone 5 – Mangrove) 0.02ha (Veg Zone 6 – Saltmarsh)	29
Pied Oystercatcher <i>Haematopus longirostris</i>	2	0.27ha (Veg Zone 4 – Mangrove) 0.69ha (Veg Zone 5 – Mangrove) 0.02ha (Veg Zone 6 – Saltmarsh)	29

Table 10-6 Species Credit Species that only apply to ULTIMATE EIS, stage 2 clearing area

Species Credit Species	Biodiversity risk weighting	Area of habitat OR count of individuals lost	Species credits required
Leafless Tongue Orchid <i>Cryptostylis hunteriana</i>	1.5	0.07ha (Veg Zone 1 – Bangalay)	1
Sooty Oystercatcher <i>Haematopus fuliginosus</i>	2	0.27ha (Veg Zone 4 – Mangrove) 0.69ha (Veg Zone 5 – Mangrove) 0.02ha (Veg Zone 6 – Saltmarsh)	35
Pied Oystercatcher <i>Haematopus longirostris</i>	2	0.27ha (Veg Zone 4 – Mangrove) 0.69ha (Veg Zone 5 – Mangrove) 0.02ha (Veg Zone 6 – Saltmarsh)	35
Southern Brown Bandicoot <i>Isodon obesulus obesulus</i>	2	0.07 ha (Veg Zone 1 - Bangalay)	2
Long-nosed Potoroo <i>Potorous tridactylus</i>	2	0.07 ha (Veg Zone 1 - Bangalay)	2

The full Biodiversity Credit Report generated by the BAM Calculator for Ultimate EIS project area is provided in Appendix E.

10.1.3 Offsets required under the EPBC Act

Following an EPBC Act habitat evaluation and condition threshold assessment on four species (Eastern Curlew, Bar-tailed Godwit, Red Knot & Eastern Osprey), no referrals and hence no offsets are required under the EPBC Act. Refer to Appendix D for further details.

10.2 IMPACTS NOT REQUIRING OFFSET

Impacts to PCTs that do not meet the thresholds identified in Section 10.1.1 (a-c) do not require offsets. These PCTs and vegetation zones are identified in

Table 10-7 PCTs and vegetation zones that do not require offsets (Ultimate EIS) and mapped on Figure 10-1 & Figure 10-2 below. Note that vegetation zones 1, 3, 4, 5 & 6 require offsetting and can be viewed in Table 10-1 above.

Table 10-7 PCTs and vegetation zones that do not require offsets (Ultimate EIS)

Zone ID	PCT ID	PCT name	Zone area (ha)	Vegetation integrity score	Ecosystem credits required
2	659	Mown Grassland (Nth/Sth Runway) This vegetation zone consisted of groundcovers only which were managed like a lawn. This area is within the most intensively managed OLS vegetation management zone.	8.44	8	0
7	1126	Saltmarsh (Sth Runway haul road) This vegetation zone was only found adjacent to the south haulage road. It only contained two species so achieved a low VI score.	0.07	11.9	0

10.3 AREAS NOT ASSESSED

For the north and south runway, a small section of the development footprint consisting of asphalt (0.31 ha), dirt road for south haul road (0.14 ha) inside the development footprint does not require assessment (Figure 10-1).

For the south runway, two small sections of the development footprint consist of aquatic areas not assessed under BAM (Figure 10-2).

10.4 OVERLAPPING OFFSET REQUIREMENTS: OFFSET STRATEGY

As no significant impacts to Commonwealth entities are anticipated, no referral or Commonwealth offsets are proposed under the EPBC Act.

However, under NSW legislation offsets are generated by the project from the clearing of terrestrial vegetation (under the BC Act) and impacts on key fish habitat (under the FM Act). In the case of mangroves and saltmarsh vegetation, both Acts require offsets and stipulate different mechanisms to achieve them.

Large areas of similar vegetation and key fish habitat are owned by Council adjacent to the impact areas and it is the preference of the proponent that physical offsets be established in these areas. Where these are insufficient, secondary sites and monetary payments would be considered in accordance with the schemes endorsed under the BC and FM Act.

Due to the overlapping offset requirements and to ensure that the impact is not duplicated, the proponent proposes the following offset strategy:

10.4.1 BC Act

The retirement of these credits will be carried out in accordance with the NSW Biodiversity Offsets Scheme, and will be achieved by either:

- Retiring credits under the Biodiversity Offsets Scheme based on the like-for-like rules, or
- Making payments into the Biodiversity Conservation Fund using the offset payments

calculator, or

- c) Funding a biodiversity action that benefits the threaten entity(ies) impacted by the development. A stewardship investigation is currently underway, however offsets have not been finalised.

10.4.2 FM Act

The following entities generate offsets under the FM Act:

- Mangroves
- Saltmarsh
- Seagrass

As offsets for Mangroves and Saltmarsh will be secured and managed in perpetuity for biodiversity improvement, via the NSW Biodiversity Conservation Trust, it is proposed to only offset in accordance with the FM mechanism for:

- 0.30 ha seagrass (2:1 offset ratio)
- 0.10 ha seagrass within a mapped Coastal Wetland (10:1 offset ratio)

This will equate to a physical offset site(s) being assessed as providing sufficient area. If the offset site shows a shortfall in required offsets, the difference will be paid out by purchasing the remaining credits from DPI Fisheries, in accordance with the FM Act. Payment of any offset funds will be deposited into the Fish Conservation Trust Fund established under the FM Act and quarantined for use for site based offsets and/or supplementary measures where site-based offsets are not fully achievable in the catchment area.

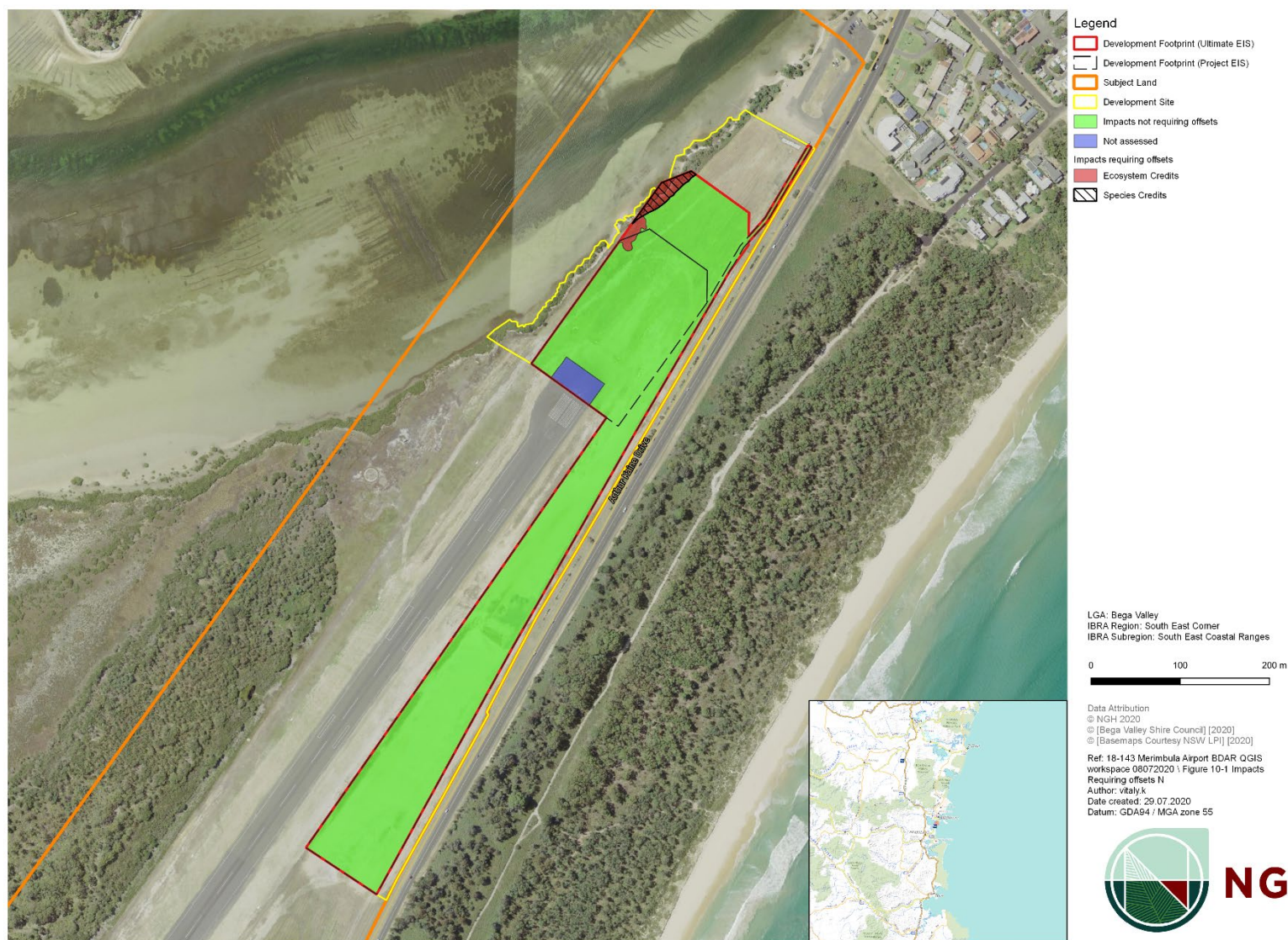


Figure 10-1 Impacts requiring offset, not requiring offset and not requiring assessment (north runway)

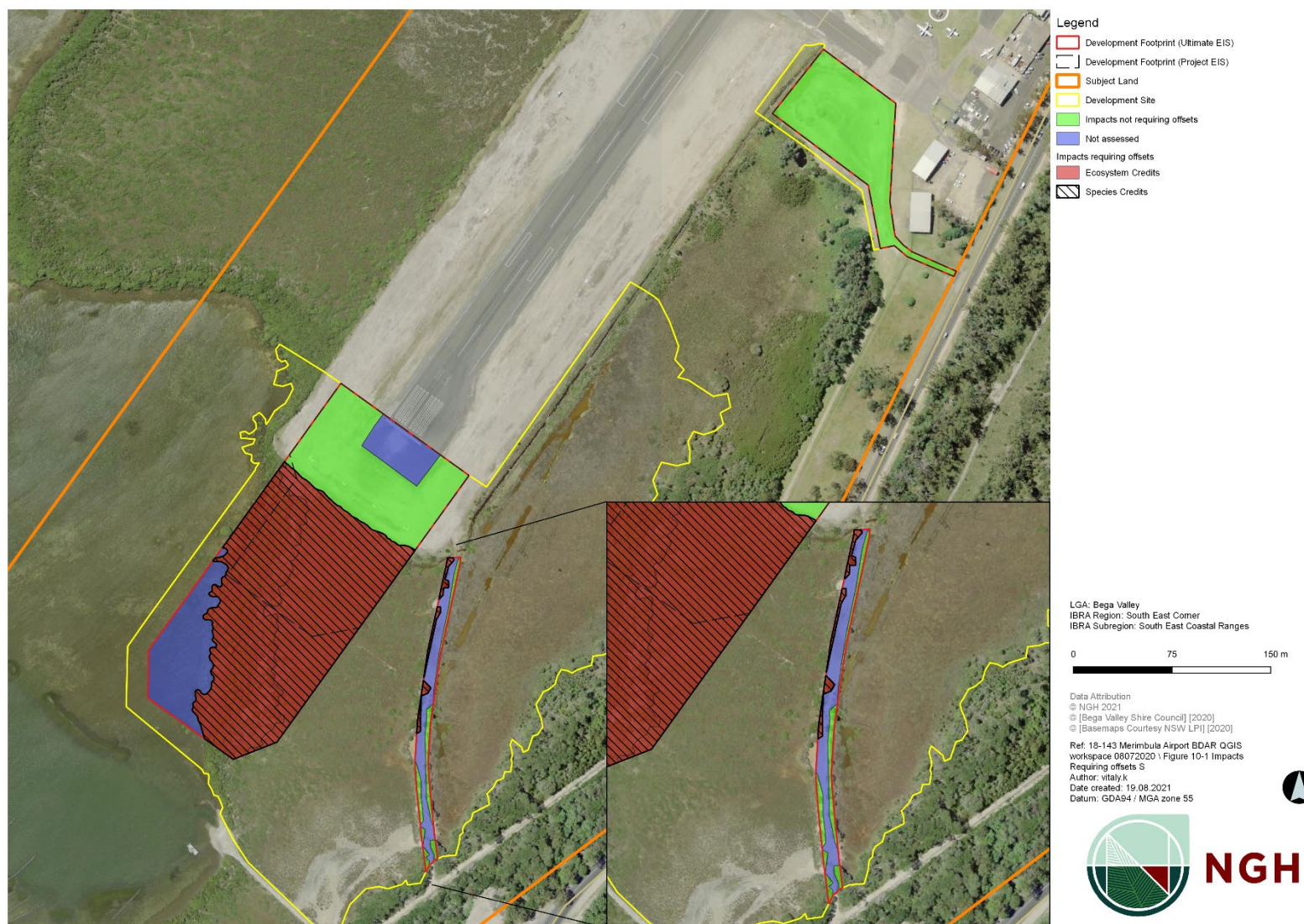


Figure 10-2 Impacts requiring offset, not requiring offset and not requiring assessment (south runway)

11 CONCLUSIONS

This Biodiversity Assessment Report (BDAR) has been prepared for the proponent Bega Valley Shire Council to assess the impacts of clearing native vegetation to extend the Merimbula Airport runways to the north and south. The BDAR is a requirement stipulated within the SEARs to address impacts to biodiversity.

The BDAR V2 was submitted and publicly exhibited with the Environmental Impact Statement (EIS) for this project. BDAR V3, was updated to address agency and community submissions from the exhibition. BDAR 3.1 corrected an error in the calculation of Beach Stone Curlew species credits. A DA modification to reflect BDAR V3.1 (specifically the removal of the Beach Stone Curlew from the consent requirements) was lodged on 2 August 2021. BDAR V4 updates the assessment to include the removal of a haul road south of the project. This is an environmental remediation action to improve hydrological function surrounding the southern extension by removing a barrier to flow. This BDAR V4.1 has been updated to address agency comments (DOC22/390518-5). There is no change to the assumption of 'presence' for species credit species as detailed in BDAR V4. There are some minor changes to text about inclusion of the Haul Rd into Ultimate EIS clearing areas. There has been inclusion of Leafless Tongue Orchid in revising updated BAM Calculations which is generating one species credit.

Updated BAM calculations (to reflect Version 54 of the calculator) for both 'project' and 'ultimate' EIS clearing areas can be seen in Appendix E and F of this report.

The project will likely proceed in stages, two clearing options have been run through the BAM Calculator. These include;

- 1) 'Ultimate EIS Footprint' (clearing of 10.68 ha in total, seven vegetation zones across the site)
- 2) 'Project EIS Footprint' (clearing of 8.61 ha in total, four vegetation zones across the site)

This BDAR report details the figures for the larger option 'Area of Ultimate EIS' and has been prepared and reviewed by persons accredited under the BAM, consistent with required field work methodologies and assessment requirements.

1) 'Ultimate EIS Footprint'

For the Ultimate EIS proposal, the clearing of 8.5 ha of (PCT 659) '*Bangalay - Old-man Banksia open forest on coastal sands, Sydney Basin Bioregion and South East Corner Bioregion*' generated 2 ecosystem credits. The clearing of 2.1 ha of (PCT 920) '*Mangrove Forests in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion*' generated 64 ecosystem Credits. The clearing of 0.05 ha of (PCT 1126) '*Saltmarsh in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion*' generated 2 ecosystem credits. The remaining area of the development footprint consisted of aquatic areas and asphalt, the dirt road of the south haulage track both of which did not need assessment under the BAM. The smaller bangalay scrub area of PCT 659 met the definition of the NSW TEC *Bangalay Sand Forest of the Sydney Basin and South East Corner bioregion*. No Commonwealth listed TECs will be impacted.

Targeted surveys were undertaken for candidate flora species where habitat elements were known to exist onsite. Of the flora species surveyed, none were found during targeted survey.

Most fauna candidate species identified in the calculator were excluded from further assessment due to inappropriate habitat or species being vagrant (such as Beach Stone-curlew). The Orange-bellied Parrot was surveyed onsite within appropriate habitat, where the results were that no

individuals were found and was therefore excluded from further assessment. All other species were assumed to exist onsite with inclusion of Leafless Tongue Orchid (new species present in version 54 of the BAM Calculator) requiring assessment under the BAM. This new species was unable to be surveyed during winter (and updates to BDAR V4.1) and was therefore assumed present within appropriate habitat. The result was that Pied and Sooty Oystercatcher generated 128 species credits (64 credits each), Southern Brown Bandicoot and Long-nosed Potoroo generated 4 species credits (2 credits each) and Leafless Tongue Orchid generated 1 species credit.

2) 'Project EIS Footprint'

For Project EIS, the clearing of 7.64 ha of PCT 659 '*Bangalay - Old-man Banksia open forest on coastal sands, Sydney Basin Bioregion and South East Corner Bioregion*' did not generate any ecosystem credits because the patch of bangalay scrub was excluded from the development footprint leaving only the highly degraded grassland for assessment. The clearing of 0.95 ha of (PCT 920) '*Mangrove Forests in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion*' generated 28 ecosystem Credits. The clearing of 0.02 ha of (PCT 1126) '*Saltmarsh in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion*' generated 1 ecosystem credit. The remaining 0.31 ha of the development footprint consisted of asphalt which was not assessed under the BAM.

Because the development footprint was reduced in area the omission of two vegetation zones occurred being Zone 1 (Bangalay Scrub) and Zone 3 (Mangrove Sand). The reduction in clearing meant that the Pied and Sooty Oystercatcher each generated 29 credits each and the Southern Brown Bandicoot and Long-nosed Potoroo no longer generated species credits due to vegetation zone 1 (Bangalay Scrub) being excluded from the development footprint.

The assessment has considered key environmental, social and economic criteria which is reported more fully within the Environmental Impact Statement for this project. Mitigation and management measures are proposed to adequately address impacts associated with the proposal, both directly and indirectly.

The retirement of credits for 'Stage 1 - Project EIS' occurred back in September 21. There is now the requirement to retire credits for the remaining 'Stage 2 – Ultimate EIS' area in accordance with the NSW Biodiversity Offsets Scheme and will be achieved by either;

- a) Retiring credits under the Biodiversity Offsets Scheme, or
- b) Making payments into the Biodiversity Conservation Fund using the offset payments calculator, or
- c) Funding a biodiversity action that benefits the threatened entity impacted by the development.

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<http://www.environment.gov.au/biodiversity/threatened/communities/pubs/118-conservation-advice.pdf>

APPENDIX A BAM FIELD DATA

A.1.1 Vegetation Integrity Plot Photos

Zone 1 PCT 659 Bangalay Scrub

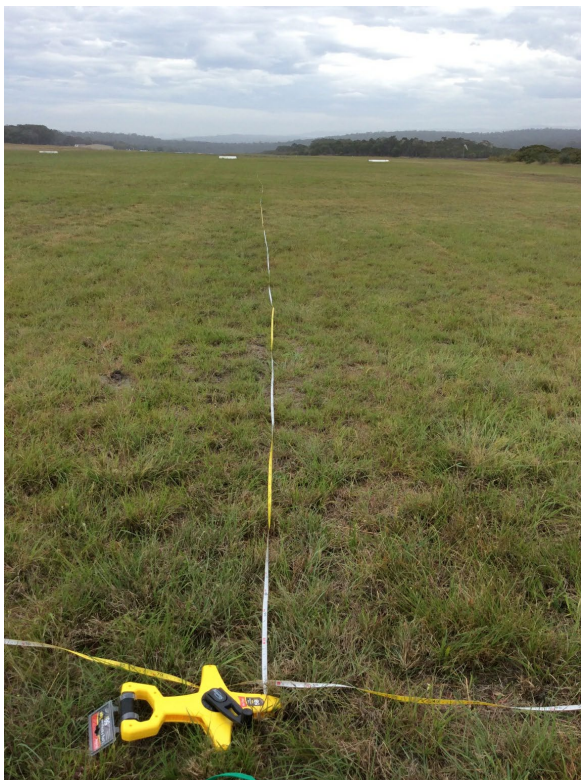


Head of plot



Tail of plot

Zone 2 PCT 659 Derived Grasslands



Head of plot



Tail of plot

Zone 3 PCT 920 Grey Mangrove (Sandy substrate)



Head of plot



Tail of plot

Zone 4 PCT 920 Grey Mangrove (Mud substrate)



Head of plot



Tail of plot

Zone 5 PCT 920 Grey/River Mangrove (Mud substrate)



Head of plot



Tail of plot

Zone 6 PCT 1126 Saltmarsh



Head of plot



Tail of plot

Zone 7 PCT 1126 Saltmarsh



Head of plot



Tail of plot

A.1.2 *Vegetation Integrity Plot Data*

BAM Site Field Survey									
Project:	18-143 Sth Merimbula A	Plot Identifier	Plot 4 Bangala	Pic 20x20		Pic 20x50			
Survey date:	15/10/2018		Compass Orientation (head of 10x40m plot)				South west		
Recorders	GYoung		PCT:	559					
GPS Easting	759118	GPS Northing	5912428		Datum	UTM	Zone	55	
Landform			Soils			Drainage & Slope			
Morphology	Sand dune		Soil Texture	Sand		Slope	2 degrees		
LandF Element			Soil Colour	White grey		Aspect	200		
LandF Pattern	Dunal		Soil Depth			Drainage	Well drained		
Microrelief			Geology	Aeolian		Watercourses	Merimbula Lake 10m away		
Plot Disturbance									
	Severity	Age	Observational Evidence						
Clearing	2	R	Bangalays pruned to 2m in height for OLS						
Cultivation	0								
Soil erosion	0								
Firewood	0								
Grazing	0								
Fire Damage	0								
Storm Damage	0								
Weediness	0								
Other	1	R	Rabbits - scats and burrows						
Severity: 0 = no evidence, 1=light, 2=moderate, 3=severe Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)									
Additional information									
Current land use									
Airport OLS									
Age class of trees (DBH range) , Condition of Vegetation, Hollows									
Saplings from mature bangalays pruned for OLS									
Disturbances (i.e. fire, grazing,ferals, clearing, logging, soil degradation, pollution, weeds, dieback)									
Pruning									
Significant and threatened species and communities (Note pop. size/area, structure, repro status, habit, habitat, threats, photos)									
Bangalay sand forest (disturbed)									
Dominant Species outside Plot		NA							

FUNCTION

Function attributes for		Plot 4 BangalayS						
BAM Attribute (20x20m plot)			BAM Attributes (1 x 1m Plots)					
Count of Native Richness	Stratum	Sum	Litter Cover	Tape length	% cover	Average %	Photos	
	Tree (TG)	1		5m	90%	57.00%		
	Shrub (SG)	6		15m	95%			
	Forb (FG)	4		25m	5%			
	Grass & grasslike (GG)	9		35m	50%			
	Fern (EG)	1		45m	45%			
	Other (OG)	3	Bare ground cover	5m	0%	24%		
	TOTAL	24		15m	0%			
BAM Attribute (20x20m plot)			25m	80%				
Count of cover abundance (native vascular plants)	Stratum	Sum	Cryptogam cover	35m	20%		0%	
	Tree (TG)	30		45m	20%			
	Shrub (SG)	4.4		Rock Cover	5m	0%		
	Forb (FG)	0.48			15m	0%		
	Grass & grasslike (GG)	18.7	25m		0%			
	Fern (EG)	20	35m		0%			
	Other (OG)	0.7	45m	0%				
	TOTAL Native	74.28	Rock Cover	5m	0%	0%		
	TOTAL 'HTE'	0.2		15m	0%			
			25m	0%				
			35m	0%				
			45m	0%				

BAM Attribute (20 x 50m plot) Tree Stem Counts			
DBH (cm)	Euc	Non Euc	Hollows
>80	0	0	0
50-79	0	0	0
30-49	0	0	0
20-29	4	0	0
10-19	5	5	0
5-9	0	0	0
<5	3	4	N/A
Length of logs (m)		19	

COMPOSITION & STRUCTURE

Species recorded for Plot 4 BangalaySc										
Abbreviation	Scientific Name	Common Name	Family	% Cover	Abundance	Exotic	Growth Form	High Threat?	EPBC Status	BCA Status
Kenn rubi	<i>Kennedia rubicunda</i>	Dusky Coral Pea	Fabaceae (Fab	0.5	20		Other (OG)	No		
Pter escu	<i>Pteridium esculentum</i>	Bracken	Dennstaedtiac	20	1000		Fern (EG)	No		
Impe cyli	<i>Imperata cylindrica</i>	Blady Grass	Poaceae	15	2000		Grass & grasslike (GG)	No		
Them tria	<i>Themeda triandra</i>		Poaceae	1.5	60		Grass & grasslike (GG)	No		
Baum junc	<i>Baumea juncea</i>		Cyperaceae	1	500		Grass & grasslike (GG)	No		
Euca botr	<i>Eucalyptus botryoides</i>	Bangalay	Myrtaceae	30	17		Tree (TG)	No		
Leuc lanc	<i>Leucopogon lanceolatus</i>		Ericaceae	0.5	2		Shrub (SG)	No		
Pitt undu	<i>Pittosporum undulatum</i>	Sweet Pittosporum	Pittosporaceae	0.5	7		Shrub (SG)	No		
Cyno dact	<i>Cynodon dactylon</i>	Common Couch	Poaceae	0.5	20		Grass & grasslike (GG)	No		
Eust lati	<i>Eustrephus latifolius</i>	Wombat Berry	Luzuriagaceae	0.1	2		Other (OG)	No		
Poa labi labi	<i>Poa labillardierei</i> var. <i>labi</i>	Tussock	Poaceae	0.1	10		Grass & grasslike (GG)	No		
Tetr tetr	<i>Tetragonia tetragonioide</i>	New Zealand Spinach	Aizoaceae	0.18	2		Forb (FG)	No		
Acac long soph	<i>Acacia longifolia</i> subsp. <i>s</i>	Coastal Wattle	Fabaceae (Mir	2	8		Shrub (SG)	No		
Cony bona	<i>Conyza bonariensis</i>	Fleabane	Asteraceae	0.1	5	*		No		
Poa	<i>Poa spp.</i>	Tinner leaf	Poaceae	0.1	20	*	Grass & grasslike (GG)	No		
Sarc quin quin	<i>Sarcocornia quinqueflora</i>	Samphire	Chenopodiaceae	1	15		Shrub (SG)	No		
Rhag cand cand	<i>Rhagodia candolleana</i> su		Chenopodiaceae	0.2	2		Shrub (SG)	No		
Penn clan	<i>Pennisetum clandestinum</i>	Kikuyu Grass	Poaceae	0.2	30	*		No		
Malu	<i>Malus spp.</i>	Apple tree	Malaceae	0.1	1	*		No		
Loma long	<i>Lomandra longifolia</i>	Spiny-headed Mat-rus	Lomandraceae	0.2	3		Grass & grasslike (GG)	No		
Gahn mela	<i>Gahnia melanocarpa</i>	Black Fruit Saw-sedge	Cyperaceae	0.2	1		Grass & grasslike (GG)	No		
Ehrh caly	<i>Ehrharta calycina</i>	Coolati grass	Poaceae	0.1	1	*		HTE		
Fici nodo	<i>Ficinia nodosa</i>	Club rush	Cyperaceae	0.1	20		Grass & grasslike (GG)	No		
Anth odor	<i>Anthoxanthum odoratum</i>	Sweet vernal grass	Poaceae	0.1	5	*		No		
Glyc clan	<i>Glycine clandestina</i>	Twining glycine	Fabaceae (Fab	0.1	4		Other (OG)	No		
Oxal	<i>Oxalis spp.</i>	Terenum	Oxalidaceae	0.1	2		Forb (FG)	No		
Tric	<i>Tricoryne spp.</i>		Anthericaceae	0.1	1		Forb (FG)	No		
Hydr laxi	<i>Hydrocotyle laxiflora</i>	Stinking Pennywort	Apiaceae	0.1	2		Forb (FG)	No		
Mono elli	<i>Monotoca elliptica</i>	Tree Broom-heath	Ericaceae	0.2	2		Shrub (SG)	No		
Nass nees	<i>Nassella neesiana</i>	Chilean Needle Grass	Poaceae	0.1	5	*		HTE		
	#N/A	#N/A	#N/A			#N/A		FALSE	#N/A	#N/A

BAM Site Field Survey									
Project:	18143 merim ap	Plot Identifier	Plot9_NthSth	Pic 20x20	8157	Pic 20x50	8158		
Survey date:	14/05/2020		Compass Orientation (head of 20x20 plot)				18 degrees north		
Recorders	GYoung		PCT:	659					
GPS Easting	758916	GPS Northing	5911957		Datum	GDA	Zone	55	
Landform			Soils			Drainage & Slope			
Morphology	Back dune		Soil Texture	Sandy		Slope	2 degrees		
LandF Element	Aeolean		Soil Colour	Light yellow		Aspect	Nw		
LandF Pattern	Dunal		Soil Depth			Drainage	Well drained		
Microrelief			Geology	Siliceos		Watercourses	None		
Plot Disturbance									
	Severity	Age	Observational Evidence						
Clearing	OLS	R	Pruning banksia						
Cultivation	0								
Soil erosion	0								
Firewood	0								
Grazing	1		Rabbits						
Fire Damage	0								
Storm Damage	0								
Weediness	3		Eragrostis curvula						
Other									
Severity: 0 = no evidence, 1=light, 2=moderate, 3=severe Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)									
Additional information									
Current land use									
Airport land 50m to runway									
Age class of trees (DBH range) , Condition of Vegetation, Hollows									
None									
Disturbances (i.e. fire, grazing,ferals, clearing, logging, soil degradation, pollution, weeds, dieback)									
Eragrostis curvula									
Significant and threatened species and communities (Note pop. size/area, structure, repro status, habit, habitat, threats, photos)									
Dominant Species outside Plot		E botroyoides, B integrifolia							

FUNCTION

Function attributes for		Plot9_NthSthGra					
BAM Attribute (20x20m plot)			BAM Attributes (1 x 1m Plots)				
Count of Native Richness	Stratum	Sum	Litter Cover	Tape length	% cover	Average %	Photos
	Tree (TG)	1		5m	10%	5.40%	8163
	Shrub (SG)	1		15m	7%		8162
	Forb (FG)	2		25m	10%		8163
	Grass & grasslike (GG)	2		35m	0%		8164
	Fern (EG)	0		45m	0%		8165
	Other (OG)	1	Bare ground cover	5m	50%	70%	
	TOTAL	7		15m	60%		
BAM Attribute (20x20m plot)		25m		40%			
Count of cover abundance (native vascular plants)	Stratum	Sum		35m	100%		
	Tree (TG)	0.1		45m	100%		
	Shrub (SG)	0.1	Cryptogam cover	5m	0%	0%	
	Forb (FG)	0.2		15m	0%		
	Grass & grasslike (GG)	0.3		25m	0%		
	Fern (EG)	0		35m	0%		
	Other (OG)	0.1		45m	0%		
	TOTAL Native	0.8	Rock Cover	5m	0%	0%	
TOTAL 'HTE'	80.1	15m		0%			
		25m		0%			
		35m		0%			
		45m		0%			
BAM Attribute (20 x 50m plot) Tree Stem Counts							
DBH (cm)	Euc	Non Euc	Hollows				
>80	0	0	0				
50-79	0	0	0				
30-49	0	0	0				
20-29	0	0	0				
10-19	0	0	0				
5-9	0	0	0				
<5	0	8	N/A				
Length of logs (m)		0					

COMPOSITION & STRUCTURE

Species recorded for Plot9_NthSthGrass										
Abbreviation	Scientific Name	Common Name	Family	% Cover	Abundance	Exotic	Growth Form	High Threat?	EPBC Status	BCA Status
Erag curv	<i>Eragrostis curvula</i>	African Lovegrass	Poaceae	80	5000	*		HTE		
Plan lanc	<i>Plantago lanceolata</i>	Lamb's Tongues	Plantaginaceae	0.1	15	*		No		
Sene mada	<i>Senecio madagascariensis</i>	Fireweed	Asteraceae	0.1	10	*		No		
Cyno dact	<i>Cynodon dactylon</i>	Common Couch	Poaceae	0.2	40		Grass & grasslike (GG)	No		
Axon fiss	<i>Axonopus fissifolius</i>	Narrow-leafed Carpet	Poaceae	0.1	5	*		HTE		
Hypo radi	<i>Hypochaeris radicata</i>	Catsear	Asteraceae	0.1	50	*		No		
Penn clan	<i>Pennisetum clandestinum</i>	Kikuyu Grass	Poaceae	5	30	*		No		
Junc fili	<i>Juncus filicaulis</i>		Juncaceae	0.1	20		Grass & grasslike (GG)	No		
Bank inte	<i>Banksia integrifolia</i>	Coast Banksia	Proteaceae	0.1	4		Tree (TG)	No		
Acac mear	<i>Acacia mearnsii</i>	Black Wattle	Fabaceae (Mir)	0.1	4		Shrub (SG)	No		
Oreo	<i>Oreomyrrhis spp.</i>		Apiaceae	0.1	40		Forb (FG)	No		
Kenn	<i>Kennedia spp.</i>		Fabaceae (Fab)	0.1	2		Other (OG)	No		
Wahl	<i>Wahlenbergia spp.</i>	Bluebell	Campanulaceae	0.1	20		Forb (FG)	No		
Plan coro	<i>Plantago coronopus</i>	Buck's-horn Plantain	Plantaginaceae	0.1	3	*		No		
Trif	<i>Trifolium spp.</i>	A Clover	Fabaceae (Fab)	0.1	10	*		No		
	#N/A	#N/A	#N/A			#N/A		FALSE	#N/A	#N/A

BAM Site Field Survey									
Project:	Merim Nth grassland	Plot Identifier	Plot 6 NthSth	Pic 20x20		Pic 20x50			
Survey date:	5/11/2018		Compass Orientation (head of 20x20 plot)				South south west		
Recorders	GYoung		PCT:	659					
GPS Easting	759090	GPS Northing	5912345		Datum	UTM	Zone	55	
Landform			Soils			Drainage & Slope			
Morphology	Beach sand		Soil Texture	Sandy		Slope	Flat		
LandF Element			Soil Colour	Light grey		Aspect			
LandF Pattern			Soil Depth			Drainage			
Microrelief			Geology	Aeolean		Watercourses			
Plot Disturbance									
	Severity	Age	Observational Evidence						
Clearing	3	R	Maximum OLS for planes landing/taking off						
Cultivation	0								
Soil erosion	0								
Firewood	0								
Grazing	0								
Fire Damage	0								
Storm Damage	0								
Weediness	2								
Other	0								
Severity: 0 = no evidence, 1=light, 2=moderate, 3=severe Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)									
Additional information									
Current land use									
OLS maintained grassland									
Age class of trees (DBH range) , Condition of Vegetation, Hollows									
No trees inside plot									
Disturbances (i.e. fire, grazing,ferals, clearing, logging, soil degradation, pollution, weeds, dieback)									
Regular mowing for OLS									
Significant and threatened species and communities (Note pop. size/area, structure, repro status, habit, habitat, threats, photos)									
None									
Dominant Species outside Plot		Banksia marginata, Euc botryoides - Bangalay related species							

FUNCTION

Function attributes for			Plot 6 NthSthGra					
BAM Attribute (20x20m plot)			BAM Attributes (1 x 1m Plots)					
Count of Native Richness	Stratum	Sum	Litter Cover	Tape length	% cover	Average %	Photos	
	Tree (TG)	0		5m	50%	28.00%	6610	
	Shrub (SG)	2		15m	25%		6610	
	Forb (FG)	3		25m	20%		6612	
	Grass & grasslike (GG)	8		35m	25%		6613	
	Fern (EG)	0		45m	20%		6614	
	Other (OG)	1	Bare ground cover	5m	0%	5%		
	TOTAL	14		15m	0%			
BAM Attribute (20x20m plot)			25m	20%				
Count of cover abundance (native vascular plants)	Stratum	Sum	35m	3%				
	Tree (TG)	0	Cryptogam cover	45m	0%	0%		
	Shrub (SG)	0.2		5m	0%			
	Forb (FG)	0.3		15m	0%			
	Grass & grasslike (GG)	53.9		25m	0%			
	Fern (EG)	0	35m	0%				
	Other (OG)	0.1	45m	0%				
	TOTAL Native	54.5	Rock Cover	5m	0%	0%		
	TOTAL 'HTE'	7.8		15m	0%			
			25m	0%				
			35m	0%				
			45m	0%				

BAM Attribute (20 x 50m plot) Tree Stem Counts			
DBH (cm)	Euc	Non Euc	Hollows
>80	0	0	0
50-79	0	0	0
30-49	0	0	0
20-29	0	0	0
10-19	0	0	0
5-9	0	0	0
<5	0	0	N/A
Length of logs (m)		0	

COMPOSITION & STRUCTURE

Species recorded for Plot 6 NthSthGrass										
Abbreviation	Scientific Name	Common Name	Family	% Cover	Abundance	Exotic	Growth Form	High Threat?	EPBC Status	BCA Status
Anth odor	<i>Anthoxanthum odoratum</i>	Sweet Vernal Grass	Poaceae	1.5	500	*		No		
Them tria	<i>Themeda triandra</i>		Poaceae	50	4000		Grass & grasslike (GG)	No		
Briz maxi	<i>Briza maxima</i>	Quaking Grass	Poaceae	0.1	80	*		No		
Hypo radi	<i>Hypochaeris radicata</i>	Catsear	Asteraceae	4	1500	*		No		
Aira cupa	<i>Aira cupaniana</i>	Silvery Hairgrass	Poaceae	0.1	200	*		No		
Trif dubi	<i>Trifolium dubium</i>	Yellow Suckling Clover	Fabaceae (Fab	0.1	100	*		No		
Plan lanc	<i>Plantago lanceolata</i>	Lamb's Tongues	Plantaginacea	0.5	400	*		No		
Cyno dact	<i>Cynodon dactylon</i>	Common Couch	Poaceae	1	100		Grass & grasslike (GG)	No		
Spor creb	<i>Sporobolus creber</i>	Slender Rat's Tail Grass	Poaceae	2	200		Grass & grasslike (GG)	No		
Acet vulg	<i>Acetosella vulgaris</i>	Sheep Sorrel	Polygonaceae	0.2	300	*		HTE		
Briz suba	<i>Briza subaristata</i>		Poaceae	0.3	300	*		HTE		
Plan debi	<i>Plantago debilis</i>	Shade Plantain	Plantaginacea	0.1	40		Forb (FG)	No		
Nass nees	<i>Nassella neesiana</i>	Chilean Needle Grass	Poaceae	7	60	*		HTE		
Romu rose aust	<i>Romulea rosea var. australis</i>	Onion Grass	Iridaceae	0.1	1	*		No		
Axon fiss	<i>Axonopus fissifolius</i>	Narrow-leafed Carpet	Poaceae	0.1	3	*		HTE		
Dich crin	<i>Dichelachne crinita</i>	Longhair Plumegrass	Poaceae	0.1	2		Grass & grasslike (GG)	No		
Sile gall	<i>Silene gallica</i>	French Catchfly	Caryophyllaceae	0.1	10	*		No		
Leuc lanc	<i>Leucopogon lanceolatus</i>		Ericaceae	0.1	1		Shrub (SG)	No		
Vulp	<i>Vulpia spp.</i>	Rat's-tail Fescue	Poaceae	0.5	400	*		No		
Micr unif	<i>Microtis unifolia</i>	Common Onion Orchid	Orchidaceae	0.1	20		Forb (FG)	No		P
Glyc taba	<i>Glycine tabacina</i>	Variable Glycine	Fabaceae (Fab	0.1	30		Other (OG)	No		
Baum junc	<i>Baumea juncea</i>		Cyperaceae	0.1	1		Grass & grasslike (GG)	No		
Fici nodo	<i>Ficinia nodosa</i>	Knobby Club-rush	Cyperaceae	0.1	1		Grass & grasslike (GG)	No		
Pasp dila	<i>Paspalum dilatatum</i>	Paspalum	Poaceae	0.2	10	*		HTE		
Penn clan	<i>Pennisetum clandestinum</i>	Kikuyu Grass	Poaceae	0.3	50	*		No		
Sisy sp.	<i>Sisyrinchium sp. A</i>	Scourweed	Iridaceae	0.1	1	*		No		
Luzu	<i>Luzula spp.</i>		Juncaceae	0.1	5		Grass & grasslike (GG)	No		
Petr dubi	<i>Petrorhagia dubia</i>		Caryophyllaceae	0.1	1	*		No		
Lagu ovat	<i>Lagurus ovatus</i>	Hare's Tail Grass	Poaceae	0.1	5	*		No		
Oxal pere	<i>Oxalis perennans</i>		Oxalidaceae	0.1	4		Forb (FG)	No		
Gamo	<i>Gamochaeta spp.</i>		Asteraceae	0.1	1	*		No		
Bank marg	<i>Banksia marginata</i>	Silver Banksia	Proteaceae	0.1	1		Shrub (SG)	No		
Oeno stri stri	<i>Oenothera stricta subsp.</i>		Onagraceae	0.1	3	*		No		
Zoys macr	<i>Zoysia macrantha</i>	Prickly Couch	Poaceae	0.5	200		Grass & grasslike (GG)	No		
	#N/A	#N/A	#N/A			#N/A		FALSE	#N/A	#N/A

BAM Site Field Survey									
Project:	merimbual airport	Plot Identifier	plot7 NthSthG	Pic 20x20		Pic 20x50			
Survey date:	23/11/2018		Compass Orientation (head of 20x20 plot)				East		
Recorders	J Miles		PCT:	659					
GPS Easting	758011	GPS Northing	5910849		Datum	UTM	Zone	55	
Landform			Soils			Drainage & Slope			
Morphology	artificial		Soil Texture	silty sand		Slope	0		
LandF Element			Soil Colour	grey		Aspect			
LandF Pattern			Soil Depth	shallow		Drainage	moderate		
Microrelief			Geology			Watercourses	20m (lake)		
Plot Disturbance									
	Severity	Age	Observational Evidence						
Clearing	3	R	Maintenance of land for airport OLS (maximum cover removed)						
Cultivation	0								
Soil erosion	0								
Firewood	0								
Grazing	0								
Fire Damage	0								
Storm Damage	0								
Weediness	0								
Other	0								
Severity: 0 = no evidence, 1=light, 2=moderate, 3=severe Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)									
Additional information									
Current land use									
Airport OLS for planes landing and taking off.									
Age class of trees (DBH range) , Condition of Vegetation, Hollows									
No trees, no shrubs									
Disturbances (i.e. fire, grazing,ferals, clearing, logging, soil degradation, pollution, weeds, dieback)									
Mowing of groundcover to maintain OLS for airport									
Significant and threatened species and communities (Note pop. size/area, structure, repro status, habit, habitat, threats, photos)									
None									
Dominant Species outside Plot		NA							

FUNCTION

Function attributes for	plot7 NthSthGra	
BAM Attribute (20x20m plot)		BAM Attributes (1 x 1m Plots)

Count of Native Richness	Stratum	Sum
	Tree (TG)	0
	Shrub (SG)	2
	Forb (FG)	0
	Grass & grasslike (GG)	4
	Fern (EG)	0
	Other (OG)	0
	TOTAL	6
BAM Attribute (20x20m plot)		
Count of cover abundance (native vascular plants)	Stratum	Sum
	Tree (TG)	0
	Shrub (SG)	0.2
	Forb (FG)	0
	Grass & grasslike (GG)	20.3
	Fern (EG)	0
	Other (OG)	0
	TOTAL Native	20.5
	TOTAL 'HTE'	10.5

BAM Attribute (20 x 50m plot) Tree Stem Counts			
DBH (cm)	Euc	Non Euc	Hollows
>80	0	0	0
50-79	0	0	0
30-49	0	0	0
20-29	0	0	0
10-19	0	0	0
5-9	0	0	0
<5	0	0	N/A
Length of logs (m)		0	

Litter Cover	Tape length	% cover	Average %	Photos
	5m	0%	11.00%	
	15m	20%		
	25m	20%		
	35m	10%		
	45m	5%		
Bare ground cover	5m	60%	24%	
	15m	0%		
	25m	10%		
	35m	2%		
Cryptogam cover	45m	50%	0%	
	5m	0%		
	15m	0%		
	25m	0%		
Rock Cover	35m	0%	1%	
	45m	0%		
	5m	5%		
	15m	0%		
	25m	0%		
	35m	0%		
	45m	1%		

COMPOSITION & STRUCTURE

Species recorded for plot7 NthSthGrass										
Abbreviation	Scientific Name	Common Name	Family	% Cover	Abundance	Exotic	Growth Form	High Threat?	EPBC Status	BCA Status
erag curv	<i>Eragrostis curvula</i>	African Lovegrass	Poaceae	10	100	*		HTE		
cyno dact	<i>Cynodon dactylon</i>	Common Couch	Poaceae	20	1000		Grass & grasslike (GG)	No		

penn clan	<i>Pennisetum clandestinum</i>	Kikuyu Grass	Poaceae	0.1	10	*		HTE		
pasp dila	<i>Paspalum dilatatum</i>	Paspalum	Poaceae	0.1	5	*		HTE		
briz suba	<i>Briza subaristata</i>		Poaceae	0.1	1	*		HTE		
spor afri	<i>Sporobolus africanus</i>	Parramatta Grass	Poaceae	0.1	5	*		No		
briz maxi	<i>Briza maxima</i>	Quaking Grass	Poaceae	0.1	1	*		No		
dich micr	<i>Dichelachne micrantha</i>	Shorthair Plumegrass	Poaceae	0.1	1		Grass & grasslike (GG)	No		
sten secu	<i>Stenotaphrum secundatum</i>	Buffalo Grass	Poaceae	0.1	1	*		HTE		
lach fili	<i>Lachnagrostis filiformis</i>		Poaceae	0.1	1		Grass & grasslike (GG)	No		
plan coro	<i>Plantago coronopus</i>	Buck's-horn Plantain	Plantaginaceae	20	1000	*		No		
disp cras	<i>Disphyma crassifolium</i> ss	Native pigface	Aizoaceae	5	500		Forb	No		
romu rose	<i>Romulea rosea</i>	Onion grass	ididaceae	0.1	20	#N/A		HTE		
cony suma	<i>Conyza sumatrensis</i>	Tall fleabane	Asteraceae	0.1	5	*		No		
leon	<i>Leontodon saxatilis</i>	Lesser Hawkbit	Asteraceae	2	500	*		No		
lotu subb	<i>Lotus subbiflorus</i>	Hairy Birds-foot Trefoil	Fabaceae (Fab	0.5	500	*		No		
gamo	<i>Gamochaeta americanur</i>		Asteraceae	0.1	20	*		No		
hypo radi	<i>Hypochaeris radicata</i>	Catsear	Asteraceae	0.1	50	*		No		
sene mada	<i>Senecio madagascariensi</i>	Fireweed	Asteraceae	0.1	20	*		No		
anag	<i>Anagallis arvensis</i>		Myrsinaceae	0.1	20	*		No		
acac long	<i>Acacia longifolia</i>		Fabaceae (Mir	0.1	1		Shrub (SG)	No		
rich	<i>Richardia spp.</i>		Rubiaceae	0.1	1	*		No		
medi	<i>Medicago spp.</i>	A Medic	Fabaceae (Fab	0.1	1	*		No		
sile gall	<i>Silene gallica</i>	French Catchfly	Caryophyllace	0.1	2	*		No		
cent eryt	<i>Centaurium erythraea</i>	Common Centaury	Gentianaceae	0.1	5	*		No		
gamo purp	<i>Gamochaeta purpurea</i>	Purple Cudweed	Asteraceae	0.1	1	*		No		
acac mear	<i>Acacia mearnsii</i>	Black Wattle	Fabaceae (Mir	0.1	1		Shrub (SG)	No		
cent tenu	<i>Centaurium tenuiflorum</i>	Branched Centaury, S	Gentianaceae	0.1	2	*		No		
both macr	<i>Bothriochloa macra</i>	Red Grass	Poaceae	0.1	5		Grass & grasslike (GG)	No		
plan lanc	<i>Plantago lanceolata</i>	Lamb's Tongues	Plantaginaceae	0.1	1	*		No		
	#N/A	#N/A	#N/A			#N/A		FALSE	#N/A	#N/A

BAM Site Field Survey									
Project:	Merimbula airport	Plot Identifier	Plot 8 NthSth	Pic 20x20		Pic 20x50			
Survey date:	23/11/2018		Compass Orientation (head of 20x20 plot)				East		
Recorders	J Miles		PCT:	659 DG					
GPS Easting	759024	GPS Northing	5912285		Datum	GDA	Zone	55	
Landform			Soils			Drainage & Slope			
Morphology	Artificial		Soil Texture	sand		Slope	0		
LandF Element			Soil Colour	grey		Aspect			
LandF Pattern			Soil Depth	moderate		Drainage	moderate		
Microrelief			Geology			Watercourses	10m - lake		
Plot Disturbance									
	Severity	Age	Observational Evidence						
Clearing	3	0							
Cultivation	0								
Soil erosion	0								
Firewood	0								
Grazing	0								
Fire Damage	0								
Storm Damage	0								
Weediness	2	R	African love grass						
Other	0								
Severity: 0 = no evidence, 1=light, 2=moderate, 3=severe Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)									
Additional information									
Current land use									
OLS for planes landing/taking off									
Age class of trees (DBH range) , Condition of Vegetation, Hollows									
No trees, no shrubs									
Disturbances (i.e. fire, grazing,ferals, clearing, logging, soil degradation, pollution, weeds, dieback)									
Airport mowing and Rabbits									
Significant and threatened species and communities (Note pop. size/area, structure, repro status, habit, habitat, threats, photos)									
None									
Dominant Species outside Plot		E. botryoides							

FUNCTION

Function attributes for		Plot 8 NthSthGra					
BAM Attribute (20x20m plot)			BAM Attributes (1 x 1m Plots)				
Count of Native Richness	Stratum	Sum	Litter Cover	Tape length	% cover	Average %	Photos
	Tree (TG)	0		5m	10%	10.20%	
	Shrub (SG)	2		15m	10%		
	Forb (FG)	3		25m	20%		
	Grass & grasslike (GG)	7		35m	10%		
	Fern (EG)	0		45m	1%		
	Other (OG)	0	Bare ground cover	5m	0%	2%	
	TOTAL	12		15m	0%		
BAM Attribute (20x20m plot)			25m	10%			
Count of cover abundance (native vascular plants)	Stratum	Sum	35m	1%			
	Tree (TG)	0	45m	0%			
	Shrub (SG)	0.2	Cryptogam cover	5m	0%	0%	
	Forb (FG)	0.3		15m	0%		
	Grass & grasslike (GG)	30.6		25m	0%		
	Fern (EG)	0		35m	0%		
	Other (OG)	0	45m	0%			
	TOTAL Native	31.1	Rock Cover	5m	0%	0%	
	TOTAL 'HTE'	50.4		15m	0%		
			25m	0%			
			35m	0%			
			45m	0%			

BAM Attribute (20 x 50m plot) Tree Stem Counts			
DBH (cm)	Euc	Non Euc	Hollows
>80	0	0	0
50-79	0	0	0
30-49	0	0	0
20-29	0	0	0
10-19	0	0	0
5-9	0	0	0
<5	0	0	N/A
Length of logs (m)		0	

COMPOSITION & STRUCTURE

Species recorded for Plot 8 NthSthGrass										
Abbreviation	Scientific Name	Common Name	Family	% Cover	Abundance	Exotic	Growth Form	High Threat?	EPBC Status	BCA Status
them tria	<i>Themeda triandra</i>		Poaceae	30	200		Grass & grasslike (GG)	No		
erag curv	<i>Eragrostis curvula</i>	African Lovegrass	Poaceae	50	200	*		HTE		
aira	<i>Aira spp.</i>	A Hairgrass	Poaceae	0.1	50	*		No		
anth odor	<i>Anthoxanthum odoratum</i>	Sweet Vernal Grass	Poaceae	0.5	200	*		No		
zoys macr	<i>Zoysia macrantha</i>	Prickly Couch	Poaceae	0.1	10		Grass & grasslike (GG)	No		
briz suba	<i>Briza subaristata</i>		Poaceae	0.1	2	*		HTE		
briz maxi	<i>Briza maxima</i>	Quaking Grass	Poaceae	0.1	1	*		No		
hypo radi	<i>Hypochaeris radicata</i>	Catsear	Asteraceae	10	1000	*		No		
plan coro	<i>Plantago coronopus</i>	Buck's-horn Plantain	Plantaginaceae	0.1	2	*		No		
plan lanc	<i>Plantago lanceolata</i>	Lamb's Tongues	Plantaginaceae	0.1	20	*		No		
leon	<i>Leontodon saxatilis</i>		Asteraceae	0.2	100	*		No		
oxal	<i>Oxalis spp.</i>		Oxalidaceae	0.1	50		Forb (FG)	No		
care	<i>Carex spp.</i>		Cyperaceae	0.1	1		Grass & grasslike (GG)	No		
acet vulg	<i>Acetosella vulgaris</i>	Sheep Sorrel	Polygonaceae	0.1	50	*		HTE		
dich repe	<i>Dichondra repens</i>	Kidney Weed	Convolvulaceae	0.1	1		Forb (FG)	No		
sile gall	<i>Silene gallica</i>	French Catchfly	Caryophyllaceae	0.1	10	*		No		
anag	<i>Anagallis arvensis</i>		Myrsinaceae	0.1	1	*		No		
gaza	<i>Gazania spp.</i>		Asteraceae	0.1	1	*		No		
cent eryt	<i>Centaurium erythraea</i>	Common Centaury	Gentianaceae	0.1	1	*		No		
oper aspe	<i>Opercularia aspera</i>	Coarse Stinkweed	Rubiaceae	0.1	2		Forb (FG)	No		
vulp	<i>Vulpia spp.</i>	Rat's-tail Fescue	Poaceae	0.1	50	*		No		
fici nodo	<i>Ficinia nodosa</i>	Knobby Club-rush	Cyperaceae	0.1	1		Grass & grasslike (GG)	No		
cyno dact	<i>Cynodon dactylon</i>	Common Couch	Poaceae	0.1	10		Grass & grasslike (GG)	No		
micr	<i>Micranthemum spp.</i>		Euphorbiaceae	0.1	2		Shrub (SG)	No		
trif arve	<i>Trifolium arvense</i>	Haresfoot Clover	Fabaceae (Fab)	0.1	1	*		No		
trif dubi	<i>Trifolium dubium</i>	Yellow Suckling Clover	Fabaceae (Fab)	0.1	20	*		No		
loma long	<i>Lomandra longifolia</i>	Spiny-headed Mat-rush	Lomandraceae	0.1	1		Grass & grasslike (GG)	No		
sten secu	<i>Stenotaphrum secundatum</i>	Buffalo Grass	Poaceae	0.1	1	*		HTE		
dich micr	<i>Dichelachne micrantha</i>	Shorthair Plumegrass	Poaceae	0.1	2		Grass & grasslike (GG)	No		
loma	<i>Lomandra multiflora</i>	Mat-rush	Lomandraceae	0.1	1			No		
mono elli	<i>Monotoca elliptica</i>	Tree Broom-heath	Ericaceae	0.1	1		Shrub (SG)	No		
oen	<i>Oenothera stricta</i>		Onagraceae	0.1	1	*		No		
petr nant	<i>Petrorhagia nanteuilii</i>	Proliferous Pink	Caryophyllaceae	0.1	2	*		No		
lagu ovat	<i>Lagurus ovatus</i>	Hare's Tail Grass	Poaceae	0.1	2	*		No		
pasp dila	<i>Paspalum dilatatum</i>	Paspalum	Poaceae	0.1	1	*		HTE		
	#N/A	#N/A	#N/A			#N/A		FALSE	#N/A	#N/A

BAM Site Field Survey									
Project:	18143	Plot Identifier	Plot14 NthSth	Pic 20x20	8232	Pic 20x50	8233		
Survey date:	14/05/2020		Compass Orientation (head of 20x20 plot)				224 degrees sw		
Recorders	GYoung		PCT:	659					
GPS Easting	758395	GPS Northing	591113		Datum	GDA	Zone	55	
Landform			Soils			Drainage & Slope			
Morphology			Soil Texture	Hard sand		Slope	Flat		
LandF Element			Soil Colour	Gravel muticolour		Aspect	Flat		
LandF Pattern			Soil Depth	Compacted		Drainage	Well drained		
Microrelief			Geology	Artificial		Watercourses	Artificial channel tail of plot		
Plot Disturbance									
	Severity	Age	Observational Evidence						
Clearing	3	O							
Cultivation	0								
Soil erosion	0								
Firewood	0								
Grazing	0								
Fire Damage	0								
Storm Damage	0								
Weediness	3	O							
Other									
Severity: 0 = no evidence, 1=light, 2=moderate, 3=severe Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)									
Additional information									
Current land use									
Stockpile wasteland									
Age class of trees (DBH range) , Condition of Vegetation, Hollows									
None									
Disturbances (i.e. fire, grazing,ferals, clearing, logging, soil degradation, pollution, weeds, dieback)									
Used for past construction activities									
Significant and threatened species and communities (Note pop. size/area, structure, repro status, habit, habitat, threats, photos)									
None									
Dominant Species outside Plot		B integrifolia, A floribunda, A mearnsii							

FUNCTION

Function attributes for			Plot14 NthSthGr	
BAM Attribute (20x20m plot)				
Count of Native Richness	Stratum	Sum		
	Tree (TG)	0		
	Shrub (SG)	0		
	Forb (FG)	0		
	Grass & grasslike (GG)	3		
	Fern (EG)	0		
	Other (OG)	0		
	TOTAL	3		
BAM Attribute (20x20m plot)				
Count of cover abundance (native vascular plants)	Stratum	Sum		
	Tree (TG)	0		
	Shrub (SG)	0		
	Forb (FG)	0		
	Grass & grasslike (GG)	25.2		
	Fern (EG)	0		
	Other (OG)	0		
	TOTAL Native	25.2		
	TOTAL 'HTE'	7.1		

BAM Attributes (1 x 1m Plots)				
Litter Cover	Tape length	% cover	Average %	Photos
	5m	1%	2.00%	8234
	15m	3%		8235
	25m	1%		8236
	35m	2%		8237
	45m	3%		8238
Bare ground cover	5m	0%	0%	
	15m	1%		
	25m	0%		
	35m	1%		
Cryptogam cover	45m	0%	0%	
	5m	0%		
	15m	0%		
	25m	0%		
Rock Cover	35m	0%	0%	
	45m	0%		
	5m	0%		
	15m	0%		
	25m	0%		

BAM Attribute (20 x 50m plot) Tree Stem Counts			
DBH (cm)	Euc	Non Euc	Hollows
>80	0	0	0
50-79	0	0	0
30-49	0	0	0
20-29	0	0	0
10-19	0	0	0
5-9	0	0	0
<5	0	0	N/A
Length of logs (m)		0	

COMPOSITION & STRUCTURE

Species recorded for Plot14 NthSthGrass										
Abbreviation	Scientific Name	Common Name	Family	% Cover	Abundance	Exotic	Growth Form	High Threat?	EPBC Status	BCA Status
Penn clan	<i>Pennisetum clandestinum</i>	Kikuyu Grass	Poaceae	60	5000	*		No		
Cyno dact	<i>Cynodon dactylon</i>	Common Couch	Poaceae	25	2000		Grass & grasslike (GG)	No		
Leon	<i>Leontodon spp.</i>		Asteraceae	0.1	200	*		No		
Plan coro	<i>Plantago coronopus</i>	Buck's-horn Plaintain	Plantaginacea	0.2	2000	*		No		
Trif subt	<i>Trifolium subterraneum</i>	Subterranean Clover	Fabaceae (Fab	0.1	20	*		No		
Pasp dila	<i>Paspalum dilatatum</i>	Paspalum	Poaceae	0.1	10	*		HTE		
Sene mada	<i>Senecio madagascariensis</i>	Fireweed	Asteraceae	0.1	10	*		No		
Erag curv	<i>Eragrostis curvula</i>	African Lovegrass	Poaceae	7	1000	*		HTE		
Erag brow	<i>Eragrostis brownii</i>	Brown's Lovegrass	Poaceae	0.1	1		Grass & grasslike (GG)	No		
Vici tetr	<i>Vicia tetrasperma</i>	Slender Vetch	Fabaceae (Fab	0.1	10	*		No		
Poa annu	<i>Poa annua</i>	Winter Grass	Poaceae	0.1	2	*		No		
Medi	<i>Medicago spp.</i>	A Medic	Fabaceae (Fab	0.1	2	*		No		
Plan lanc	<i>Plantago lanceolata</i>	Lamb's Tongues	Plantaginacea	0.1	2	*		No		
Spor creb	<i>Sporobolus creber</i>	Slender Rat's Tail Grass	Poaceae	0.1	2		Grass & grasslike (GG)	No		
	#N/A	#N/A	#N/A			#N/A		FALSE	#N/A	#N/A

BAM Site Field Survey									
Project:	18-143 Sth Merimbula A	Plot Identifier	Plot 3 NthMar	Pic 20x20		Pic 20x50			
Survey date:	15/10/2018		Compass Orientation (head of 20x20 plot)				South		
Recorders	GYoung		PCT:	920					
GPS Easting	759069	GPS Northing	5912395		Datum	UTM	Zone	55	
Landform			Soils			Drainage & Slope			
Morphology			Soil Texture	Beach sand		Slope	1 degree		
LandF Element	Tidal mangrove		Soil Colour	White to grey		Aspect	299 degrees		
LandF Pattern			Soil Depth			Drainage	Tidal		
Microrelief			Geology	Aeolian		Watercourses	Merimbula lake		
Plot Disturbance									
	Severity	Age	Observational Evidence						
Clearing	0								
Cultivation	0								
Soil erosion	0								
Firewood	0								
Grazing	0								
Fire Damage	0								
Storm Damage	0								
Weediness	0								
Other	2		Rubbish debris						
Severity: 0 = no evidence, 1=light, 2=moderate, 3=severe Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)									
Additional information									
Current land use									
Tidal mangrove - vacant land adj merimbula lake									
Age class of trees (DBH range) , Condition of Vegetation, Hollows									
Regen to mature grey mangrove									
Disturbances (i.e. fire, grazing,ferals, clearing, logging, soil degradation, pollution, weeds, dieback)									
Rubbish from high tide									
Significant and threatened species and communities (Note pop. size/area, structure, repro status, habit, habitat, threats, photos)									
None									
Dominant Species outside Plot		NA - Different PCT							

FUNCTION

Function attributes for		Plot 3 NthMangr						
BAM Attribute (20x20m plot)			BAM Attributes (1 x 1m Plots)					
Count of Native Richness	Stratum	Sum	Litter Cover	Tape length	% cover	Average %	Photos	
	Tree (TG)	1		5m	2%	0.60%		
	Shrub (SG)	2		15m	0%			
	Forb (FG)	1		25m	0%			
	Grass & grasslike (GG)	3		35m	1%			
	Fern (EG)	0		45m	0%			
	Other (OG)	0	Bare ground cover	5m	40%	67%		
	TOTAL	7		15m	95%			
BAM Attribute (20x20m plot)			25m	5%				
Count of cover abundance (native vascular plants)	Stratum	Sum	35m	94%				
	Tree (TG)	40	45m	100%				
	Shrub (SG)	4.5	Cryptogam cover	5m	0%	0%		
	Forb (FG)	0.1		15m	0%			
	Grass & grasslike (GG)	3.25		25m	0%			
	Fern (EG)	0		35m	0%			
	Other (OG)	0		45m	0%			
	TOTAL Native	47.85	Rock Cover	5m	0%	0%		
	TOTAL 'HTE'	0		15m	0%			
BAM Attribute (20 x 50m plot) Tree Stem Counts				25m	0%			
DBH (cm)	Euc	Non Euc	Hollows	35m	0%			
>80	0	0	0	45m	0%			
50-79	0	0	0					
30-49	0	0	0					
20-29	0	0	0					
10-19	0	2	0					
5-9	0	8	0					
<5	0	8	N/A					
Length of logs (m)		0						

COMPOSITION & STRUCTURE

Species recorded for Plot 3 NthMangrove										
Abbreviation	Scientific Name	Common Name	Family	% Cover	Abundance	Exotic	Growth Form	High Threat?	EPBC Status	BCA Status
Avic mari aust	<i>Avicennia marina subsp.</i>	Grey Mangrove	Acanthaceae	40	28		Tree (TG)	No		
Suae aust	<i>Suaeda australis</i>		Chenopodiaceae	1.5	8		Shrub (SG)	No		
Sarc quin quin	<i>Sarcocornia quinqueflora</i>		Chenopodiaceae	3	15		Shrub (SG)	No		
Horm bank	<i>Hormosira banksii</i>	Neptune's Necklace	Hormosiraceae	0.6	75			No		
Junc krau aust	<i>Juncus kraussii subsp. au</i>	Sea Rush	Juncaceae	2	40		Grass & grasslike (GG)	No		
Baum junc	<i>Baumea juncea</i>		Cyperaceae	0.5	35		Grass & grasslike (GG)	No		
Cyno dact	<i>Cynodon dactylon</i>	Common Couch	Poaceae	0.75	100		Grass & grasslike (GG)	No		
Tetr tetr	<i>Tetragonia tetragonioides</i>	New Zealand Spinach	Aizoaceae	0.1	1		Forb (FG)	No		
	#N/A	#N/A	#N/A			#N/A		FALSE	#N/A	#N/A

BAM Site Field Survey									
Project:	18-143 Sth Merimbula A	Plot Identifier	Plot 1 SthGMa	Pic 20x20		Pic 20x50			
Survey date:	15/10/2018		Compass Orientation (head of 20x20 plot)				180 south		
Recorders	GYoung		PCT:	920					
GPS Easting	757936	GPS Northing	5910779		Datum	UTM	Zone	55	
Landform			Soils			Drainage & Slope			
Morphology	Estuary		Soil Texture	Anaerobic mud		Slope	Flat		
LandF Element			Soil Colour	Black		Aspect	None		
LandF Pattern			Soil Depth			Drainage	Tidal		
Microrelief			Geology			Watercourses	Merimbula Lake		
Plot Disturbance									
	Severity	Age	Observational Evidence						
Clearing	0								
Cultivation	0								
Soil erosion	0								
Firewood	0								
Grazing	0								
Fire Damage	0								
Storm Damage	0								
Weediness	0								
Other	0								
Severity: 0 = no evidence, 1=light, 2=moderate, 3=severe Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)									
Additional information									
Current land use									
Estuarine vacant airport land									
Age class of trees (DBH range) , Condition of Vegetation, Hollows									
Old growth mangroves present									
Disturbances (i.e. fire, grazing,ferals, clearing, logging, soil degradation, pollution, weeds, dieback)									
None									
Significant and threatened species and communities (Note pop. size/area, structure, repro status, habit, habitat, threats, photos)									
Dominant Species outside Plot		Same as plot							

FUNCTION

Function attributes for			Plot 1 SthGMang	
BAM Attribute (20x20m plot)				
Count of Native Richness	Stratum	Sum		
	Tree (TG)	1		
	Shrub (SG)	2		
	Forb (FG)	1		
	Grass & grasslike (GG)	0		
	Fern (EG)	0		
	Other (OG)	0		
	TOTAL	4		
BAM Attribute (20x20m plot)				
Count of cover abundance (native vascular plants)	Stratum	Sum		
	Tree (TG)	40		
	Shrub (SG)	8.5		
	Forb (FG)	1		
	Grass & grasslike (GG)	0		
	Fern (EG)	0		
	Other (OG)	0		
	TOTAL Native	49.5		
	TOTAL 'HTE'	0		
	BAM Attribute (20 x 50m plot) Tree Stem Counts			
DBH (cm)	Euc	Non Euc	Hollows	
>80	0	0	0	
50-79	0	0	0	
30-49	0	0	0	
20-29	0	0	0	
10-19	0	2	0	
5-9	0	8	0	
<5	0	17	N/A	
Length of logs (m)		0		

BAM Attributes (1 x 1m Plots)					
Litter Cover	Tape length	% cover	Average %	Photos	
	5m	10%	9.00%		
	15m	5%			
	25m	15%			
	35m	5%			
	45m	10%			
Bare ground cover	5m	85%	85%		
	15m	90%			
	25m	80%			
	35m	90%			
Cryptogam cover	45m	80%			
	5m	5%		1%	
	15m	0%			
	25m	0%			
35m	0%				
Rock Cover	45m	0%	0%		
	5m	0%			
	15m	0%			
	25m	0%			
	35m	0%			

COMPOSITION & STRUCTURE

Species recorded for Plot 1 SthGMangrove										
Abbreviation	Scientific Name	Common Name	Family	% Cover	Abundance	Exotic	Growth Form	High Threat?	EPBC Status	BCA Status
Avic mari aust	<i>Avicennia marina subsp.</i>	Grey Mangrove	Acanthaceae	40	26		Tree (TG)	No		
Aegi corn	<i>Aegiceras corniculatum</i>	River Mangrove	Myrsinaceae	8	50		Shrub (SG)	No		
Sarc quin quin	<i>Sarcocornia quinqueflora</i>		Chenopodiaceae	0.5	30		Shrub (SG)	No		
Samo repe	<i>Samolus repens</i>	Creeping Brookweed	Primulaceae	1	500		Forb (FG)	No		
	#N/A	#N/A	#N/A			#N/A		FALSE	#N/A	#N/A

BAM Site Field Survey									
Project:	18-143 Sth Merimbula A	Plot Identifier	Plot 2 Sth RGN	Pic 20x20	GIS pro	Pic 20x50			
Survey date:	15/10/2018		Compass Orientation (head of 20x20 plot)						
Recorders	GYoung		PCT:	920					
GPS Easting	758161	GPS Northing	5910808		Datum	UTM	Zone	55	
Landform			Soils			Drainage & Slope			
Morphology	Estuarine		Soil Texture	Saline mud		Slope	Flat		
LandF Element	Tidal mudflats		Soil Colour	Brown on top black under		Aspect			
LandF Pattern			Soil Depth			Drainage	Tidal		
Microrelief			Geology	silt		Watercourses	Adjoins Merimbula lake		
Plot Disturbance									
	Severity	Age	Observational Evidence						
Clearing	1	R	Occasional pruning for OLS						
Cultivation	0								
Soil erosion	0								
Firewood	0								
Grazing	0								
Fire Damage	0								
Storm Damage	0								
Weediness	0								
Other	0								
Severity: 0 = no evidence, 1=light, 2=moderate, 3=severe Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)									
Additional information									
Current land use									
Airport OLS south runway									
Age class of trees (DBH range) , Condition of Vegetation, Hollows									
Young to old growth mangrove									
Disturbances (i.e. fire, grazing,ferals, clearing, logging, soil degradation, pollution, weeds, dieback)									
None									
Significant and threatened species and communities (Note pop. size/area, structure, repro status, habit, habitat, threats, photos)									
None									
Dominant Species outside Plot		Same as plot							

FUNCTION

Function attributes for		Plot 2 Sth RGMa					
BAM Attribute (20x20m plot)			BAM Attributes (1 x 1m Plots)				
Count of Native Richness	Stratum	Sum	Litter Cover	Tape length	% cover	Average %	Photos
	Tree (TG)	1		5m	5%	7.60%	
	Shrub (SG)	2		15m	3%		
	Forb (FG)	1		25m	5%		
	Grass & grasslike (GG)	0		35m	10%		
	Fern (EG)	0		45m	15%		
	Other (OG)	0	Bare ground cover	5m	60%	78%	
	TOTAL	4		15m	90%		
BAM Attribute (20x20m plot)			25m	80%			
Count of cover abundance (native vascular plants)	Stratum	Sum	35m	80%			
	Tree (TG)	25	Cryptogam cover	45m	80%	0%	
	Shrub (SG)	35		5m	0%		
	Forb (FG)	20		15m	0%		
	Grass & grasslike (GG)	0		25m	0%		
	Fern (EG)	0	35m	0%			
	Other (OG)	0	45m	0%			
	TOTAL Native	80	Rock Cover	5m	0%	0%	
	TOTAL 'HTE'	0		15m	0%		
			25m	0%			
			35m	0%			
			45m	0%			

BAM Attribute (20 x 50m plot) Tree Stem Counts			
DBH (cm)	Euc	Non Euc	Hollows
>80	0	0	0
50-79	0	0	0
30-49	0	0	0
20-29	0	0	0
10-19	0	0	0
5-9	0	0	0
<5	0	6	N/A
Length of logs (m)		0	

COMPOSITION & STRUCTURE

Species recorded for Plot 2 Sth RGMangrove										
Abbreviation	Scientific Name	Common Name	Family	% Cover	Abundance	Exotic	Growth Form	High Threat?	EPBC Status	BCA Status
Avic mari aust	<i>Avicennia marina subsp.</i>	Grey Mangrove	Acanthaceae	25	40		Tree (TG)	No		
Samo repe	<i>Samolus repens</i>	Creeping Brookweed	Primulaceae	20	5000		Forb (FG)	No		
Sarc quin quin	<i>Sarcocornia quinqueflora</i>		Chenopodiaceae	10	2000		Shrub (SG)	No		
Aegi corn	<i>Aegiceras corniculatum</i>	River Mangrove	Myrsinaceae	25	120		Shrub (SG)	No		
	#N/A	#N/A	#N/A			#N/A		FALSE	#N/A	#N/A

BAM Site Field Survey									
Project:	18143	Plot Identifier	Plot 9 RGM	Pic 20x20	8199	Pic 20x50	8201		
Survey date:	14/05/2020		Compass Orientation (head of 20x20 plot)				226 degrees sw		
Recorders	GYoung		PCT:	920					
GPS Easting	758038	GPS Northing	5910667		Datum	GDA	Zone	55	
Landform			Soils			Drainage & Slope			
Morphology	Mud		Soil Texture	Silt		Slope	flat		
LandF Element			Soil Colour	Dark brown		Aspect			
LandF Pattern			Soil Depth			Drainage			
Microrelief	Swampland		Geology	Anaerobic		Watercourses			
Plot Disturbance									
	Severity	Age	Observational Evidence						
Clearing	0								
Cultivation	0								
Soil erosion	0								
Firewood	0								
Grazing	0								
Fire Damage	0								
Storm Damage	0								
Weediness	0								
Other	0								
Severity: 0 = no evidence, 1=light, 2=moderate, 3=severe Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)									
Additional information									
Current land use									
Airport land									
Age class of trees (DBH range) , Condition of Vegetation, Hollows									
No trees									
Disturbances (i.e. fire, grazing,ferals, clearing, logging, soil degradation, pollution, weeds, dieback)									
Occasional rubbish from king tides									
Significant and threatened species and communities (Note pop. size/area, structure, repro status, habit, habitat, threats, photos)									
Slatmarsh adjoining 50 to east over access track									
Dominant Species outside Plot		M armillaris							

FUNCTION

Function attributes for			Plot 9 RGMangro						
BAM Attribute (20x20m plot)			BAM Attributes (1 x 1m Plots)						
Count of Native Richness	Stratum	Sum	Litter Cover	Tape length	% cover	Average %	Photos		
	Tree (TG)	0		5m	NA	#DIV/0!			
	Shrub (SG)	2		15m	NA				
	Forb (FG)	1		25m	NA				
	Grass & grasslike (GG)	1		35m	NA				
	Fern (EG)	0		45m	NA				
	Other (OG)	0	Bare ground cover	5m		#DIV/0!			
	TOTAL	4		15m					
BAM Attribute (20x20m plot)			Cryptogam cover	25m					
Count of cover abundance (native vascular plants)	Stratum	Sum		35m					
	Tree (TG)	0		45m					
	Shrub (SG)	55		Rock Cover	5m		#DIV/0!		
	Forb (FG)	40			15m				
	Grass & grasslike (GG)	0.1			25m				
	Fern (EG)	0			35m				
	Other (OG)	0		45m					
	TOTAL Native	95.1							
TOTAL 'HTE'	0								
BAM Attribute (20 x 50m plot) Tree Stem Counts									
DBH (cm)	Euc	Non Euc	Hollows						
>80	0	0	0						
50-79	0	0	0						
30-49	0	0	0						
20-29	0	0	0						
10-19	0	0	0						
5-9	0	0	0						
<5	0	0	N/A						
Length of logs (m)		0							

NA Mangrove

Mangrove G cover

8202

8206

NA Mangrove
Mangrove G cover
8202 8206

COMPOSITION & STRUCTURE

Species recorded for Plot 9 RGMangrove										
Abbreviation	Scientific Name	Common Name	Family	% Cover	Abundance	Exotic	Growth Form	High Threat?	EPBC Status	BCA Status
Aegi corn	<i>Aegiceras corniculatum</i>	River Mangrove	Myrsinaceae	5	60		Shrub (SG)	No		
samo repe	<i>Samolus repens</i>	Creeping Brookweed	Primulaceae	40	2000		Forb (FG)	No		
Sarc quin quin	<i>Sarcocornia quinqueflora</i>		Chenopodiaceae	50	5000		Shrub (SG)	No		
Junc	<i>Juncus spp.</i>	A Rush	Juncaceae	0.1	1		Grass & grasslike (GG)	No		
Avic mari aust	<i>Avicennia marina subsp.</i>	Grey Mangrove	Acanthaceae	15	25			No		
	#N/A	#N/A	#N/A			#N/A		FALSE	#N/A	#N/A

BAM Site Field Survey									
Project:	18-143 Sth Merimbula A	Plot Identifier	Plot 5 Saltmar	Pic 20x20		Pic 20x50			
Survey date:	15/10/2018		Compass Orientation (head of 20x20 plot)				208 Degrees		
Recorders	GYoung		PCT:	1126					
GPS Easting	759055	GPS Northing	5912359		Datum	UTM	Zone	55	
Landform			Soils			Drainage & Slope			
Morphology			Soil Texture	Sand		Slope	1 degree		
LandF Element			Soil Colour	Light grey		Aspect			
LandF Pattern			Soil Depth			Drainage	Moderate depression		
Microrelief			Geology	Aeolian		Watercourses	Merimbula Lake 20m to west		
Plot Disturbance									
	Severity	Age	Observational Evidence						
Clearing	3	R	Maxiumum OLS for planes landing and taking off						
Cultivation	0								
Soil erosion	0								
Firewood	0								
Grazing	1	R	Rabbits						
Fire Damage	0								
Storm Damage	0								
Weediness	2		Chilean needle grass						
Other									
Severity: 0 = no evidence, 1=light, 2=moderate, 3=severe Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)									
Additional information									
Current land use									
Mown grass beyond air strip									
Age class of trees (DBH range) , Condition of Vegetation, Hollows									
No trees or shrubs									
Disturbances (i.e. fire, grazing,ferals, clearing, logging, soil degradation, pollution, weeds, dieback)									
Rabbits/ regular mowing									
Significant and threatened species and communities (Note pop. size/area, structure, repro status, habit, habitat, threats, photos)									
Chilean needle grass									
Dominant Species outside Plot		NA small veg zone							

NOTE - 20x20m plot used for all attributes due to small size of PCT veg zone.

FUNCTION

Function attributes for		Plot 5 Saltmarsh					
BAM Attribute (20x20m plot)			BAM Attributes (1 x 1m Plots)				
Count of Native Richness	Stratum	Sum	Litter Cover	Tape length	% cover	Average %	Photos
	Tree (TG)	0		0m	50%	33.00%	
	Shrub (SG)	3		5m	10%		
	Forb (FG)	1		10m	30%		
	Grass & grasslike (GG)	8		15m	40%		
	Fern (EG)	0		20m	35%		
	Other (OG)	0	Bare ground cover	0m	40%	34%	
	TOTAL	12		5m	50%		
Count of cover abundance (native vascular plants)	BAM Attribute (20x20m plot)		10m	45%			
	Stratum	Sum	15m	5%			
	Tree (TG)	0	20m	30%			
	Shrub (SG)	3.2	Cryptogam cover	0m	0%	0%	
	Forb (FG)	4		5m	0%		
	Grass & grasslike (GG)	26		10m	0%		
	Fern (EG)	0		15m	0%		
	Other (OG)	0		20m	0%		
	TOTAL Native	33.2	Rock Cover	0m	0%	0%	
	TOTAL 'HTE'	2		5m	0%		
		10m		0%			
		15m		0%			
		20m		0%			
BAM Attribute (20 x 50m plot) Tree Stem Counts							
DBH (cm)	Euc	Non Euc	Hollows				
>80	0	0	0				
50-79	0	0	0				
30-49	0	0	0				
20-29	0	0	0				
10-19	0	0	0				
5-9	0	0	0				
<5	0	0	N/A				
Length of logs (m)		0					

COMPOSITION & STRUCTURE

Species recorded for Plot 5 Saltmarsh mown										
Abbreviation	Scientific Name	Common Name	Family	% Cover	Abundance	Exotic	Growth Form	High Threat?	EPBC Status	BCA Status
Nass nees	<i>Nassella neesiana</i>	Chilean Needle Grass	Poaceae	10	50	*		No		
Free	<i>Freesia spp.</i>		Iridaceae	2	150	*		No		
Acac long	<i>Acacia longifolia</i>		Fabaceae (Mit)	0.1	1		Shrub (SG)	No		
Cyno dact	<i>Cynodon dactylon</i>	Common Couch	Poaceae	20	1500		Grass & grasslike (GG)	No		
Plan coro	<i>Plantago coronopus</i>	Buck's-horn Plantain	Plantaginaceae	10	2000	*		No		
Baum junc	<i>Baumea juncea</i>		Cyperaceae	3	500		Grass & grasslike (GG)	No		
Sarc quin quin	<i>Sarcocornia quinqueflora</i>		Chenopodiaceae	3	500		Shrub (SG)	No		
Them tria	<i>Themeda triandra</i>		Poaceae	0.5	20		Grass & grasslike (GG)	No		
Sell radi	<i>Selliera radicans</i>	Swamp Weed	Goodeniaceae	4	3000		Forb (FG)	No		
Fici nodo	<i>Ficinia nodosa</i>	Knobby Club-rush	Cyperaceae	0.2	30		Grass & grasslike (GG)	No		
Junc krau aust	<i>Juncus kraussii subsp. australis</i>	Sea Rush	Juncaceae	0.1	10		Grass & grasslike (GG)	No		
Anth odor	<i>Anthoxanthum odoratum</i>	Sweet Vernal Grass	Poaceae	0.5	200	*		No		
Holc lana	<i>Holcus lanatus</i>	Yorkshire Fog	Poaceae	0.2	20	*		No		
Hypo radi	<i>Hypochaeris radicata</i>	Catsear	Asteraceae	0.1	10	*		No		
Axon fiss	<i>Axonopus fissifolius</i>	Narrow-leaved Carpet	Poaceae	2	60	*		HTE		
Lept juni	<i>Leptospermum juniperinum</i>	Prickly Tea-tree	Myrtaceae	0.1	1		Shrub (SG)	No		
Junc	<i>Juncus spp.</i>	A Rush	Juncaceae	0.1	1		Grass & grasslike (GG)	No		
Them tria	<i>Themeda triandra</i>		Poaceae	2	70		Grass & grasslike (GG)	No		
Spor creb	<i>Sporobolus creber</i>	Slender Rat's Tail Grass	Poaceae	0.1	3		Grass & grasslike (GG)	No		
Briz mino	<i>Briza minor</i>	Shivery Grass	Poaceae	0.1	10	*		No		
Cent eryt	<i>Centaurium erythraea</i>	Common Centaury	Gentianaceae	0.1	10	*		No		
	#N/A	#N/A	#N/A			#N/A		FALSE	#N/A	#N/A

BAM Site Field Survey									
Project:	18143	Plot Identifier	Plot 10 saltma	Pic 20x20	8214	Pic 20x50	8215		
Survey date:	14/05/2020		Compass Orientation (head of 20x20 plot)				274 degrees west		
Recorders	GYoung		PCT:	1126					
GPS Easting	758021	GPS Northing	5910593		Datum	AGD	Zone	55	
Landform			Soils			Drainage & Slope			
Morphology	Marshland		Soil Texture	Mud silt		Slope	Flat		
LandF Element			Soil Colour	Mid brown		Aspect	Flat		
LandF Pattern			Soil Depth			Drainage	Tidal		
Microrelief			Geology			Watercourses	Tidal to merim lake		
Plot Disturbance									
	Severity	Age	Observational Evidence						
Clearing	0								
Cultivation	0								
Soil erosion	0								
Firewood	0								
Grazing	0								
Fire Damage	0								
Storm Damage	0								
Weediness	0								
Other	mage from 4WD 10 years ago								
Severity: 0 = no evidence, 1=light, 2=moderate, 3=severe Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)									
Additional information									
Current land use									
Airport land									
Age class of trees (DBH range) , Condition of Vegetation, Hollows									
None									
Disturbances (i.e. fire, grazing,ferals, clearing, logging, soil degradation, pollution, weeds, dieback)									
As above									
Significant and threatened species and communities (Note pop. size/area, structure, repro status, habit, habitat, threats, photos)									
Saltmarsh									
Dominant Species outside Plot		M armillaris							

FUNCTION

Function attributes for			Plot 10 saltmarsh							
BAM Attribute (20x20m plot)					BAM Attributes (1 x 1m Plots)					
Count of Native Richness	Stratum	Sum		Litter Cover	Tape length	% cover	Average %	Photos		
	Tree (TG)	0			5m	NA Saltmarsh	#DIV/0!			
	Shrub (SG)	1			15m	NA Saltmarsh				
	Forb (FG)	0			25m	NA Saltmarsh				
	Grass & grasslike (GG)	0			35m	NA Saltmarsh				
	Fern (EG)	0			45m	NA Saltmarsh				
	Other (OG)	0		Bare ground cover	5m		#DIV/0!			
	TOTAL	1			15m					
BAM Attribute (20x20m plot)					25m					
Count of cover abundance (native vascular plants)	Stratum	Sum		Cryptogam cover	35m			#DIV/0!		
	Tree (TG)	0			45m					
	Shrub (SG)	70			Rock Cover	5m			#DIV/0!	
	Forb (FG)	0				15m				
	Grass & grasslike (GG)	0		25m						
	Fern (EG)	0		35m						
	Other (OG)	0		45m						
	TOTAL Native	70		5m						
	TOTAL 'HTE'	0		15m						
					25m					
BAM Attribute (20 x 50m plot) Tree Stem Counts										
DBH (cm)	Euc	Non Euc	Hollows							
>80	0	0	0							
50-79	0	0	0							
30-49	0	0	0							
20-29	0	0	0							
10-19	0	0	0							
5-9	0	0	0							
<5	0	0	N/A							
Length of logs (m)		0								

NASaltmarsh

Cover

Saltmarsh

8216

8220

NASaltmarsh
Cover Saltmarsh
8216 8220

COMPOSITION & STRUCTURE

Species recorded for Plot 10 saltmarsh										
Abbreviation	Scientific Name	Common Name	Family	% Cover	Abundance	Exotic	Growth Form	High Threat?	EPBC Status	BCA Status
Sarc quin quin	<i>Sarcocornia quinqueflora</i>		Chenopodiaceae	70	5000		Shrub (SG)	No		
Avic mari aust	<i>Avicennia marina subsp.</i>	Grey Mangrove	Acanthaceae	0.1	2			No		
	#N/A	#N/A	#N/A			#N/A		FALSE	#N/A	#N/A

BAM Site Field Survey									
Project:	18143	Plot Identifier	Plot 11 saltma	Pic 20x20	8178	Pic 20x50	8179		
Survey date:	14/05/2020		Compass Orientation (head of 20x20 plot)				32 degrees ne		
Recorders	GYoung		PCT:	1126					
GPS Easting	758122	GPS Northing	5910703		Datum	GDA	Zone	55	
Landform			Soils			Drainage & Slope			
Morphology			Soil Texture	Mud silt		Slope	Flat		
LandF Element			Soil Colour	Dark brown		Aspect	Flat		
LandF Pattern			Soil Depth			Drainage	Tidal warerlogged		
Microrelief			Geology	Mud		Watercourses			
Plot Disturbance									
	Severity	Age	Observational Evidence						
Clearing	0								
Cultivation	0								
Soil erosion	0								
Firewood	0								
Grazing	0								
Fire Damage	0								
Storm Damage	0								
Weediness	0								
Other									
Severity: 0 = no evidence, 1=light, 2=moderate, 3=severe Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)									
Additional information									
Current land use									
Airport land									
Age class of trees (DBH range) , Condition of Vegetation, Hollows									
No trees									
Disturbances (i.e. fire, grazing,ferals, clearing, logging, soil degradation, pollution, weeds, dieback)									
None									
Significant and threatened species and communities (Note pop. size/area, structure, repro status, habit, habitat, threats, photos)									
Saltmarsh tec									
Dominant Species outside Plot		M armillaris							

FUNCTION

Function attributes for			Plot 11 saltmarsh								
BAM Attribute (20x20m plot)					BAM Attributes (1 x 1m Plots)						
Count of Native Richness	Stratum	Sum			Litter Cover	Tape length	% cover	Average %	Photos		
	Tree (TG)	0				5m	NA saltmarsh	#DIV/0!			
	Shrub (SG)	2				15m	NA saltmarsh				
	Forb (FG)	2				25m	NA saltmarsh				
	Grass & grasslike (GG)	1				35m	NA saltmarsh				
	Fern (EG)	0				45m	NA saltmarsh				
	Other (OG)	0			Bare ground cover	5m		#DIV/0!			
	TOTAL	5				15m					
BAM Attribute (20x20m plot)					25m						
Count of cover abundance (native vascular plants)	Stratum	Sum			Cryptogam cover	35m			#DIV/0!		
	Tree (TG)	0				45m					
	Shrub (SG)	90.1				Rock Cover	5m			#DIV/0!	
	Forb (FG)	0.2					15m				
	Grass & grasslike (GG)	5			25m						
	Fern (EG)	0			35m						
	Other (OG)	0			45m						
	TOTAL Native	95.3			5m						
	TOTAL 'HTE'	0			15m						
					25m						
					35m						
					45m						

NA saltmars Cover shots
8180 8183

COMPOSITION & STRUCTURE

Species recorded for Plot 11 saltmarsh										
Abbreviation	Scientific Name	Common Name	Family	% Cover	Abundance	Exotic	Growth Form	High Threat?	EPBC Status	BCA Status
Sarc quin quin	<i>Sarcocornia quinqueflora</i>		Chenopodiaceae	90	5000		Shrub (SG)	No		
Junc	<i>Juncus spp.</i>	A Rush	Juncaceae	5	60		Grass & grasslike (GG)	No		
Trig stri	<i>Triglochin striata</i>	Streaked Arrowgrass	Juncaginaceae	0.1	15		Forb (FG)	No		
Samo repe	<i>Samolus repens</i>	Creeping Brookweed	Primulaceae	0.1	2		Forb (FG)	No		
Suae aust	<i>Suaeda australis</i>		Chenopodiaceae	0.1	1		Shrub (SG)	No		
	#N/A	#N/A	#N/A			#N/A		FALSE	#N/A	#N/A

BAM Site Field Survey									
Project:	18143	Plot Identifier	Plot 13 saltma	Pic 20x20	8185	Pic 20x50	8186		
Survey date:	14/05/2020		Compass Orientation (head of 20x20 plot)				22 degrees north		
Recorders	GYoung		PCT:	1126					
GPS Easting	758183	GPS Northing	5910831		Datum	GDA	Zone	55	
Landform			Soils			Drainage & Slope			
Morphology	Swamp		Soil Texture	Sandy mud		Slope	Flat		
LandF Element			Soil Colour	Mid brown		Aspect	Flat		
LandF Pattern			Soil Depth			Drainage	Waterlogged		
Microrelief			Geology	Muddy		Watercourses			
Plot Disturbance									
	Severity	Age	Observational Evidence						
Clearing	0								
Cultivation	0								
Soil erosion	0								
Firewood	0								
Grazing	0								
Fire Damage	0								
Storm Damage	0								
Weediness	0								
Other									
Severity: 0 = no evidence, 1=light, 2=moderate, 3=severe Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)									
Additional information									
Current land use									
Airport land									
Age class of trees (DBH range) , Condition of Vegetation, Hollows									
No trees									
Disturbances (i.e. fire, grazing,ferals, clearing, logging, soil degradation, pollution, weeds, dieback)									
None									
Significant and threatened species and communities (Note pop. size/area, structure, repro status, habit, habitat, threats, photos)									
Saltmarsh									
Dominant Species outside Plot		M armillaris							

FUNCTION

Function attributes for		Plot 13 saltmarsh						
BAM Attribute (20x20m plot)				BAM Attributes (1 x 1m Plots)				
Count of Native Richness	Stratum	Sum		Litter Cover	Tape length	% cover	Average %	Photos
	Tree (TG)	0			5m	NA saltmarsh	#DIV/0!	
	Shrub (SG)	1			15m	NA saltmarsh		
	Forb (FG)	0			25m	NA saltmarsh		
	Grass & grasslike (GG)	1			35m	NA saltmarsh		
	Fern (EG)	0			45m	NA saltmarsh		
	Other (OG)	0		Bare ground cover	5m	#DIV/0!		
	TOTAL	2			15m			
BAM Attribute (20x20m plot)				25m				
Count of cover abundance (native vascular plants)	Stratum	Sum		Cryptogam cover	35m		#DIV/0!	
	Tree (TG)	0			45m			
	Shrub (SG)	15			5m			
	Forb (FG)	0			15m			
	Grass & grasslike (GG)	85		25m				
	Fern (EG)	0	35m					
	Other (OG)	0	45m					
	TOTAL Native	100	Rock Cover	5m	#DIV/0!			
	TOTAL 'HTE'	0		15m				
			25m					
			35m					
			45m					
BAM Attribute (20 x 50m plot) Tree Stem Counts								
DBH (cm)	Euc	Non Euc	Hollows					

NA saltmars Cover pics
8187 8191

COMPOSITION & STRUCTURE

Species recorded for Plot 13 saltmarsh										
Abbreviation	Scientific Name	Common Name	Family	% Cover	Abundance	Exotic	Growth Form	High Threat?	EPBC Status	BCA Status
Junc	<i>Juncus spp.</i>	A Rush	Juncaceae	85	5000		Grass & grasslike (GG)	No		
Sarc quin quin	<i>Sarcocornia quinqueflora</i>		Chenopodiaceae	15	1000		Shrub (SG)	No		
	#N/A	#N/A	#N/A			#N/A		FALSE	#N/A	#N/A

BAM Site Field Survey									
Project:	18143 merim	Plot Identifier	15 Artificial ch	Pic 20x20	8240	Pic 20x50	8249		
Survey date:	14/05/2020		Compass Orientation (head of 20x20 plot)				18 degrees n		
Recorders	GYoung		PCT:	1126					
GPS Easting	758195	GPS Northing	5910849		Datum	GDA	Zone	55	
Landform			Soils			Drainage & Slope			
Morphology			Soil Texture	Combo mud hard fill		Slope	Flat		
LandF Element			Soil Colour			Aspect			
LandF Pattern			Soil Depth			Drainage			
Microrelief			Geology	Edge of runway batter		Watercourses	Artificial channel		
Plot Disturbance									
	Severity	Age	Observational Evidence						
Clearing	2	O							
Cultivation	0								
Soil erosion	0								
Firewood	0								
Grazing	0		Mowing						
Fire Damage	0								
Storm Damage	0								
Weediness	1	O							
Other	0								
Severity: 0 = no evidence, 1=light, 2=moderate, 3=severe Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)									
Additional information									
Current land use									
Artificial channel sth runway									
Age class of trees (DBH range) , Condition of Vegetation, Hollows									
Sapling									
Disturbances (i.e. fire, grazing,ferals, clearing, logging, soil degradation, pollution, weeds, dieback)									
OLS pruning									
Significant and threatened species and communities (Note pop. size/area, structure, repro status, habit, habitat, threats, photos)									
Saltmarsh ecotone									
Dominant Species outside Plot		M armillaris, sarcocornia, juncus sp, Acacia.							

Plot 10 X 100m	ECOTONAL 1126Saltmarsh/659Ban galayGrass
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FUNCTION

Function attributes for			15 Artificial chan	
BAM Attribute (20x20m plot)				
Count of Native Richness	Stratum	Sum		
	Tree (TG)	1		
	Shrub (SG)	4		
	Forb (FG)	2		
	Grass & grasslike (GG)	6		
	Fern (EG)	0		
	Other (OG)	0		
	TOTAL	13		
BAM Attribute (20x20m plot)				
Count of cover abundance (native vascular plants)	Stratum	Sum		
	Tree (TG)	0.1		
	Shrub (SG)	15.3		
	Forb (FG)	0.2		
	Grass & grasslike (GG)	55.2		
	Fern (EG)	0		
	Other (OG)	0		
	TOTAL Native	70.8		
	TOTAL 'HTE'	0.1		
BAM Attribute (20 x 50m plot) Tree Stem Counts				
DBH (cm)	Euc	Non Euc	Hollows	
>80	0	0	0	
50-79	0	0	0	
30-49	0	0	0	
20-29	0	0	0	
10-19	0	0	0	
5-9	0	0	0	
<5	0	0	N/A	
Length of logs (m)		200		

BAM Attributes (1 x 1m Plots)				
Litter Cover	Tape length	% cover	Average %	Photos
	20	5%	11.60%	8242
	40	10%		8243
	60	18%		8244
	80	20%		8245
	100	5%		8246
Bare ground cover	5m	0%	2%	
	15m	3%		
	25m	5%		
	35m	1%		
	45m	1%		
Cryptogam cover	5m	0%	0%	
	15m	0%		
	25m	0%		
	35m	0%		
	45m	0%		
Rock Cover	5m	0%	1%	
	15m	0%		
	25m	4%		
	35m	0%		
	45m	0%		

COMPOSITION & STRUCTURE

Species recorded for 15 Artificial channel										
Abbreviation	Scientific Name	Common Name	Family	% Cover	Abundance	Exotic	Growth Form	High Threat?	EPBC Status	BCA Status
Them tria	<i>Themeda triandra</i>		Poaceae	2	50		Grass & grasslike (GG)	No		
Bank inte	<i>Banksia integrifolia</i>	Coast Banksia	Proteaceae	0.1	3		Tree (TG)	No		
Cyno dact	<i>Cynodon dactylon</i>	Common Couch	Poaceae	15	1000		Grass & grasslike (GG)	No		
Acac long long	<i>Acacia longifolia subsp. l</i>	Sydney Golden Wattle	Fabaceae (Mi	0.2	4		Shrub (SG)	No		
Junc krau aust	<i>Juncus kraussii subsp. au</i>	Sea Rush	Juncaceae	30	5000		Grass & grasslike (GG)	No		
Pitt undu	<i>Pittosporum undulatum</i>	Sweet Pittosporum	Pittosporaceae	0.1	1		Shrub (SG)	No		
Plan lanc	<i>Plantago lanceolata</i>	Lamb's Tongues	Plantaginaceae	0.2	300	*		No		
Avic mari aust	<i>Avicennia marina subsp.</i>	Grey Mangrove	Acanthaceae	4	5			No		
Penn clan	<i>Pennisetum clandestinum</i>	Kikuyu Grass	Poaceae	15	2000	*		No		
Samo repe	<i>Samolus repens</i>	Creeping Brookweed	Primulaceae	0.1	40		Forb (FG)	No		
Phra aust	<i>Phragmites australis</i>	Common Reed	Poaceae	8	300		Grass & grasslike (GG)	No		
Spor creb	<i>Sporobolus creber</i>	Slender Rat's Tail Grass	Poaceae	0.1	5		Grass & grasslike (GG)	No		
Mela armi armi	<i>Melaleuca armillaris subsp.</i>	Bracelet Honey-myrtle	Myrtaceae	10	50		Shrub (SG)	No		
Lact serr	<i>Lactuca serriola</i>	Prickly Lettuce	Asteraceae	0.1	1	*		No		
Plan coro	<i>Plantago coronopus</i>	Buck's-horn Plantain	Plantaginaceae	0.1	60	*		No		
Seta	<i>Setaria spp.</i>		Poaceae	0.1	1	*	Grass & grasslike (GG)	No		
Sarc quin quin	<i>Sarcocornia quinqueflora</i>		Chenopodiaceae	5	1000		Shrub (SG)	No		
Samo repe	<i>Samolus repens</i>	Creeping Brookweed	Primulaceae	0.1	20		Forb (FG)	No		
Carp edul	<i>Carpobrotus edulis</i>	Glaucous Pigface	Aizoaceae	0.1	3	*		No		
Erag curv	<i>Eragrostis curvula</i>	African Lovegrass	Poaceae	0.1	6	*		HTE		
Rubu fru	<i>Rubus fruticosus sp. agg.</i>	Blackberry complex	Rosaceae	0.1	1	*		No		
	#N/A	#N/A	#N/A			#N/A		FALSE	#N/A	#N/A

APPENDIX B EPBC PROTECTED MATTERS SEARCH



EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about [Environment Assessments](#) and the EPBC Act including significance guidelines, forms and application process details.

Report created: 18/09/18 15:28:47

[Summary](#)

[Details](#)

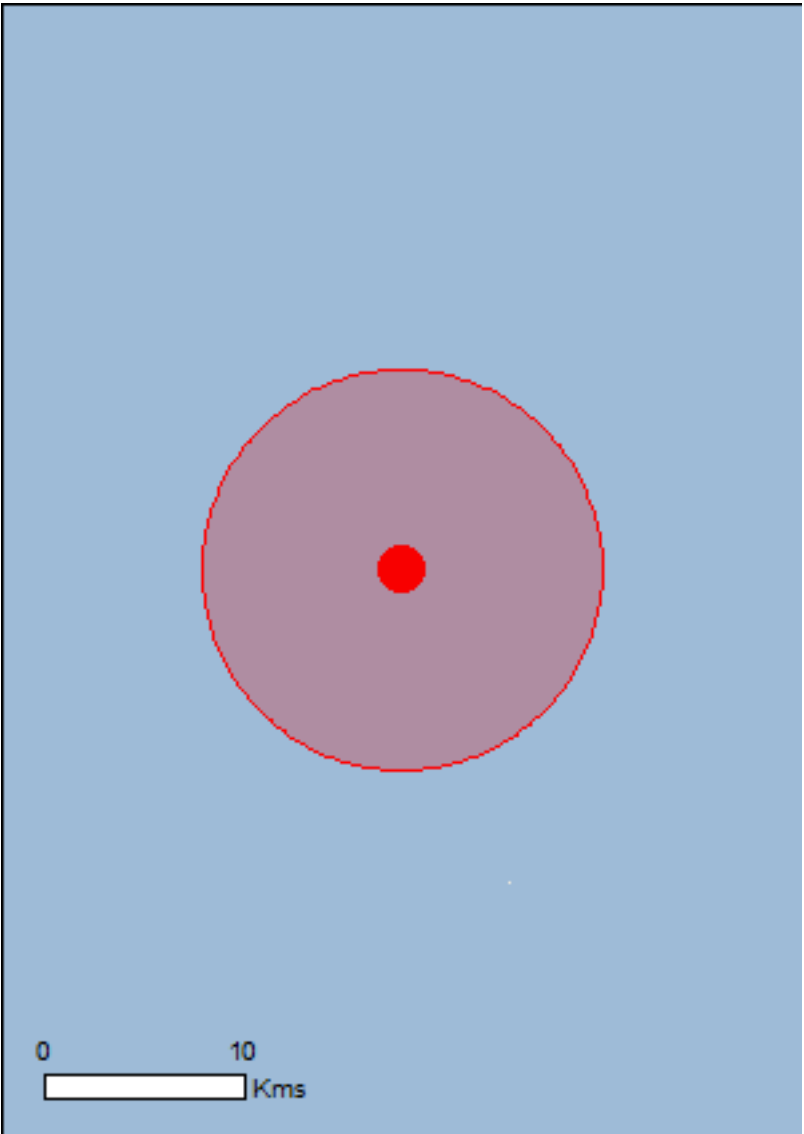
[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

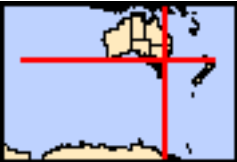
[Acknowledgements](#)



This map may contain data which are
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[Coordinates](#)

Buffer: 10.0Km



Summary

Matters of National Environmental Significance

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

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	3
Listed Threatened Species:	71
Listed Migratory Species:	53

Other Matters Protected by the EPBC Act

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

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

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

Commonwealth Land:	1
Commonwealth Heritage Places:	None
Listed Marine Species:	83
Whales and Other Cetaceans:	14
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

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

State and Territory Reserves:	6
Regional Forest Agreements:	1
Invasive Species:	37
Nationally Important Wetlands:	2
Key Ecological Features (Marine)	1

Details

Matters of National Environmental Significance

Listed Threatened Ecological Communities

[Resource Information]

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

Name	Status	Type of Presence
Littoral Rainforest and Coastal Vine Thickets of Eastern Australia	Critically Endangered	Community likely to occur within area
Lowland Grassy Woodland in the South East Corner Bioregion	Critically Endangered	Community likely to occur within area
Subtropical and Temperate Coastal Saltmarsh	Vulnerable	Community likely to occur within area

Listed Threatened Species

[Resource Information]

Name	Status	Type of Presence
Birds		
Anthochaera phrygia Regent Honeyeater [82338]	Critically Endangered	Species or species habitat known to occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Dasyornis brachypterus Eastern Bristlebird [533]	Endangered	Species or species habitat known to occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea antipodensis gibsoni Gibson's Albatross [82270]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely

Name	Status	Type of Presence
		to occur within area
Fregetta grallaria grallaria White-bellied Storm-Petrel (Tasman Sea), White-bellied Storm-Petrel (Australasian) [64438]	Vulnerable	Species or species habitat likely to occur within area
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat may occur within area
Halobaena caerulea Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area
Limosa lapponica baueri Bar-tailed Godwit (baueri), Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat may occur within area
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Bar-tailed Godwit (menzbieri) [86432]	Critically Endangered	Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Neophema chrysogaster Orange-bellied Parrot [747]	Critically Endangered	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat known to occur within area
Phoebastria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Pterodroma leucoptera leucoptera Gould's Petrel, Australian Gould's Petrel [26033]	Endangered	Species or species habitat may occur within area
Rostratula australis Australian Painted-snipe, Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Breeding likely to occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Species or species habitat may occur within area
Thalassarche bulleri platei Northern Buller's Albatross, Pacific Albatross [82273]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta cauta Shy Albatross, Tasmanian Shy Albatross [82345]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area

Name	Status	Type of Presence
Thalassarche cauta_steadii White-capped Albatross [82344]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thinornis rubricollis_rubricollis Hooded Plover (eastern) [66726]	Vulnerable	Species or species habitat known to occur within area
Fish		
Epinephelus daemeli Black Rockcod, Black Cod, Saddled Rockcod [68449]	Vulnerable	Species or species habitat may occur within area
Prototroctes maraena Australian Grayling [26179]	Vulnerable	Species or species habitat likely to occur within area
Frogs		
Heleioporus australiacus Giant Burrowing Frog [1973]	Vulnerable	Species or species habitat known to occur within area
Litoria aurea Green and Golden Bell Frog [1870]	Vulnerable	Species or species habitat known to occur within area
Litoria littlejohni Littlejohn's Tree Frog, Heath Frog [64733]	Vulnerable	Species or species habitat may occur within area
Mixophyes balbus Stuttering Frog, Southern Barred Frog (in Victoria) [1942]	Vulnerable	Species or species habitat likely to occur within area
Mammals		
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Dasyurus maculatus_maculatus (SE mainland population) Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat known to occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat known to occur within area
Isoodon obesulus_obesulus Southern Brown Bandicoot (eastern), Southern	Endangered	Species or species

Name	Status	Type of Presence
Brown Bandicoot (south-eastern) [68050]		habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Petauroides volans Greater Glider [254]	Vulnerable	Species or species habitat likely to occur within area
Petrogale penicillata Brush-tailed Rock-wallaby [225]	Vulnerable	Species or species habitat likely to occur within area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT) Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat likely to occur within area
Potorous tridactylus tridactylus Long-nosed Potoroo (SE mainland) [66645]	Vulnerable	Species or species habitat known to occur within area
Pseudomys fumeus Smoky Mouse, Konoom [88]	Endangered	Species or species habitat likely to occur within area
Pteropus poliocephalus Grey-headed Flying-fox [186]	Vulnerable	Roosting known to occur within area
Plants		
Acacia georgensis Bega Wattle [9848]	Vulnerable	Species or species habitat may occur within area
Amphibromus fluitans River Swamp Wallaby-grass, Floating Swamp Wallaby-grass [19215]	Vulnerable	Species or species habitat may occur within area
Caladenia tessellata Thick-lipped Spider-orchid, Daddy Long-legs [2119]	Vulnerable	Species or species habitat likely to occur within area
Correa baeuerlenii Chef's Cap [17007]	Vulnerable	Species or species habitat likely to occur within area
Cryptostylis hunteriana Leafless Tongue-orchid [19533]	Vulnerable	Species or species habitat likely to occur within area
Leionema ralstonii [64926]	Vulnerable	Species or species habitat likely to occur within area
Pomaderris parrisiae Parris' Pomaderris [22119]	Vulnerable	Species or species habitat likely to occur within area
Thesium australe Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species habitat likely to occur within area
Zieria formosa Shapely Zieria [56733]	Endangered	Species or species habitat likely to occur within area
Zieria parrisiae Parris's Zieria [56735]	Critically Endangered	Species or species habitat likely to occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding likely to occur

Name	Status	Type of Presence
within area		
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding likely to occur within area
Sharks		
Carcharias taurus (east coast population) Grey Nurse Shark (east coast population) [68751]	Critically Endangered	Species or species habitat likely to occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Listed Migratory Species		
[Resource Information]		
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardenna carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Foraging, feeding or related behaviour likely to occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Sternula albifrons Little Tern [82849]		Species or species habitat may occur within

Name	Threatened	Type of Presence area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta Tasmanian Shy Albatross [89224]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Migratory Marine Species		
Balaena glacialis australis Southern Right Whale [75529]	Endangered*	Species or species habitat known to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Caperea marginata Pygmy Right Whale [39]		Foraging, feeding or related behaviour likely to occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour known to occur within area

Name	Threatened	Type of Presence
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat may occur within area
Lamna nasus Porbeagle, Mackerel Shark [83288]		Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding likely to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat likely to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Migratory Terrestrial Species		
Cuculus optatus Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat known to occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat known to occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat likely to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Foraging, feeding or related behaviour may occur within area

Name	Threatened	Type of Presence
Gallinago megala Swinhoe's Snipe [864]		Foraging, feeding or related behaviour likely to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Foraging, feeding or related behaviour likely to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Foraging, feeding or related behaviour likely to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land	[Resource Information]
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The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land - Australian Telecommunications Commission

Listed Marine Species	[Resource Information]
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* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat likely to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species

Name	Threatened	Type of Presence
Calidris melanotos Pectoral Sandpiper [858]		habitat known to occur within area Species or species habitat may occur within area
Catharacta skua Great Skua [59472]		Species or species habitat may occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea gibsoni Gibson's Albatross [64466]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Foraging, feeding or related behaviour may occur within area
Gallinago megala Swinhoe's Snipe [864]		Foraging, feeding or related behaviour likely to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Foraging, feeding or related behaviour likely to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Halobaena caerulea Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat known to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within

Name	Threatened	Type of Presence area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat known to occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Neophema chrysogaster Orange-bellied Parrot [747]	Critically Endangered	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Foraging, feeding or related behaviour likely to occur within area
Pachyptila turtur Fairy Prion [1066]		Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Foraging, feeding or related behaviour likely to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat may occur within area
Sterna albifrons Little Tern [813]		Species or species habitat may occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta Tasmanian Shy Albatross [89224]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area

Name	Threatened	Type of Presence
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche sp. nov. Pacific Albatross [66511]	Vulnerable*	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Thinornis rubricollis Hooded Plover [59510]		Species or species habitat known to occur within area
Thinornis rubricollis rubricollis Hooded Plover (eastern) [66726]	Vulnerable	Species or species habitat known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area
Fish		
Heraldia nocturna Upside-down Pipefish, Eastern Upside-down Pipefish, Eastern Upside-down Pipefish [66227]		Species or species habitat may occur within area
Hippocampus abdominalis Big-belly Seahorse, Eastern Potbelly Seahorse, New Zealand Potbelly Seahorse [66233]		Species or species habitat may occur within area
Hippocampus breviceps Short-head Seahorse, Short-snouted Seahorse [66235]		Species or species habitat may occur within area
Hippocampus minotaur Bullneck Seahorse [66705]		Species or species habitat may occur within area
Hippocampus whitei White's Seahorse, Crowned Seahorse, Sydney Seahorse [66240]		Species or species habitat may occur within area
Histiogamphelus briggsii Crested Pipefish, Briggs' Crested Pipefish, Briggs' Pipefish [66242]		Species or species habitat may occur within area
Histiogamphelus cristatus Rhino Pipefish, Macleay's Crested Pipefish, Ring-back Pipefish [66243]		Species or species habitat may occur within area
Hypselognathus rostratus Knifesnout Pipefish, Knife-snouted Pipefish [66245]		Species or species habitat may occur within area
Kaupus costatus Deepbody Pipefish, Deep-bodied Pipefish [66246]		Species or species habitat may occur within area
Kimblaeus bassensis Trawl Pipefish, Bass Strait Pipefish [66247]		Species or species habitat may occur within area
Leptoichthys fistularius Brushtail Pipefish [66248]		Species or species habitat may occur within area
Lissocampus runa Javelin Pipefish [66251]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Maroubra perserrata Sawtooth Pipefish [66252]		Species or species habitat may occur within area
Mitotichthys semistriatus Halfbanded Pipefish [66261]		Species or species habitat may occur within area
Mitotichthys tuckeri Tucker's Pipefish [66262]		Species or species habitat may occur within area
Notiocampus ruber Red Pipefish [66265]		Species or species habitat may occur within area
Phyllopteryx taeniolatus Common Seadragon, Weedy Seadragon [66268]		Species or species habitat may occur within area
Solegnathus robustus Robust Pipehorse, Robust Spiny Pipehorse [66274]		Species or species habitat may occur within area
Solegnathus spinosissimus Spiny Pipehorse, Australian Spiny Pipehorse [66275]		Species or species habitat may occur within area
Stigmatopora argus Spotted Pipefish, Gulf Pipefish, Peacock Pipefish [66276]		Species or species habitat may occur within area
Stigmatopora nigra Widebody Pipefish, Wide-bodied Pipefish, Black Pipefish [66277]		Species or species habitat may occur within area
Stipecampus cristatus Ringback Pipefish, Ring-backed Pipefish [66278]		Species or species habitat may occur within area
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
Urocampus carinirostris Hairy Pipefish [66282]		Species or species habitat may occur within area
Vanacampus margaritifer Mother-of-pearl Pipefish [66283]		Species or species habitat may occur within area
Vanacampus phillipi Port Phillip Pipefish [66284]		Species or species habitat may occur within area
Vanacampus poecilolaemus Longsnout Pipefish, Australian Long-snout Pipefish, Long-snouted Pipefish [66285]		Species or species habitat may occur within area
Mammals		
Arctocephalus forsteri Long-nosed Fur-seal, New Zealand Fur-seal [20]		Species or species habitat may occur within area
Arctocephalus pusillus Australian Fur-seal, Australo-African Fur-seal [21]		Species or species habitat may occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding likely to occur within area

Name	Threatened	Type of Presence
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding likely to occur within area

Whales and other Cetaceans		[Resource Information]
Name	Status	Type of Presence
Mammals		
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Caperea marginata Pygmy Right Whale [39]		Foraging, feeding or related behaviour likely to occur within area
Delphinus delphis Common Dophin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat known to occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat likely to occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within

Extra Information

State and Territory Reserves	[Resource Information]
Name	State
Ben Boyd	NSW
Bournda	NSW
Bournda	NSW
Eden Region	NSW
Forestry Management Areas in Eden	NSW
South East Forest	NSW

Regional Forest Agreements [\[Resource Information \]](#)

Note that all areas with completed RFAs have been included.

Name	State
Eden RFA	New South Wales

Invasive Species [\[Resource Information \]](#)

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resources Audit, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Alauda arvensis Skylark [656]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species

Name	Status	Type of Presence
Turdus merula Common Blackbird, Eurasian Blackbird [596]		habitat likely to occur within area Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Lepus capensis Brown Hare [127]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Asparagus plumosus Climbing Asparagus-fern [48993]		Species or species habitat likely to occur within area
Asparagus scandens Asparagus Fern, Climbing Asparagus Fern [23255]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera subsp. rotundata Bitou Bush [16332]		Species or species habitat likely to occur within area
Cytisus scoparius Broom, English Broom, Scotch Broom, Common Broom, Scottish Broom, Spanish Broom [5934]		Species or species habitat likely to occur within area
Genista linifolia Flax-leaved Broom, Mediterranean Broom, Flax Broom [2800]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Genista monspessulana Montpellier Broom, Cape Broom, Canary Broom, Common Broom, French Broom, Soft Broom [20126]		Species or species habitat likely to occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892] Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Nassella neesiana Chilean Needle grass [67699]		Species or species habitat likely to occur within area
Nassella trichotoma Serrated Tussock, Yass River Tussock, Yass Tussock, Nassella Tussock (NZ) [18884]		Species or species habitat likely to occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Senecio madagascariensis Fireweed, Madagascar Ragwort, Madagascar Groundsel [2624]		Species or species habitat likely to occur within area
Ulex europaeus Gorse, Furze [7693]		Species or species habitat likely to occur within area

Nationally Important Wetlands		[Resource Information]
Name	State	
Merimbula Lake	NSW	
Pambula Estuarine Wetlands	NSW	

Key Ecological Features (Marine)	[Resource Information]
Key Ecological Features are the parts of the marine ecosystem that are considered to be important for the biodiversity or ecosystem functioning and integrity of the Commonwealth Marine Area.	

Name	Region
Upwelling East of Eden	South-east

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

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

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

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

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

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

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

Coordinates

-36.90525 149.89997

Acknowledgements

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

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

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

Please feel free to provide feedback via the [Contact Us](#) page.

APPENDIX C EPBC BROAD HABITAT EVALUATION

The following table lists the seventy-one threatened species known to have been recorded within 10km of the site, mentioned in the EPBC Act Protected Matters Report (DEE 2018), with reasoning based on data provided in conservation advice for each species (DEH 2018). Species highlighted in light blue are considered to have potential to exist onsite and will be investigated further.

Prescribed Matters Search – Broad Habitat Evaluation

Species name	Status	Type of presence	Considered to occur	Reason
Birds				
Anthochaera phrygia, Regent Honeyeater [82338]	Critically Endangered	Species or species habitat known to occur within area	No	Inappropriate habitat inside the development site. No trees or available nectar resources.
Botaurus poiciloptilus, Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area	No	Favours freshwater habitats (not saline wetlands which are present within the development site.
Calidris canutus, Red Knot , Knot [855]	Endangered	Species or species habitat known to occur within area	Possible	Red Knots gather in large flocks to forage on the coast in sandy estuaries with tidal mudflats. Recorded at Merimbula Lake town foreshore (2014) Pers Comm J.Miles
Calidris ferruginea, Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area	No*	Associated with intertidal mudflats in sheltered coastal areas but no records found in Merimbula district *(Pers Comm J.Miles)
Dasyornis brachypterus, Eastern Bristlebird [533]	Endangered	Species or species habitat known to occur within area	No	Habitat not associated with PCTs found
Diomedea antipodensis, Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	No	Associated with marine environments
Diomedea antipodensis gibsoni,	Vulnerable	Foraging, feeding or related behaviour likely	No	Associated with marine environments

Gibson's Albatross [82270]		to occur within area		
Diomedea epomophora, Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	No	Associated with marine environments
Diomedea exulans, Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	No	Associated with marine environments
Diomedea sanfordi, Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area	No	Associated with marine environments
Fregetta grallaria, White-bellied Storm-Petrel (Tasman Sea), White-bellied Storm-Petrel (Australasian) [64438]	Vulnerable	Species or species habitat likely to occur within area	No	Associated with marine environments and rocky islands
Grantiella picta, Painted Honeyeater [470]	Vulnerable	Species or species habitat known to occur within area	No	Habitat not associated with PCTs found
Halobaena caerulea, Blue Petrel [1059]	Vulnerable	Species or species habitat known to occur within area	No	Associated with marine environments
Lathamus discolor, Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area	No	Not associated with PCTs found
Limosa lapponica baueri, Bar-tailed Godwit (baueri), Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat may occur within area	Possible	LMBC important habitat mapping and presence of intertidal mudflats and estuaries inside development site.

Macronectes giganteus, Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area	No	Associated with marine environments
Macronectes halli, Northern Giant Petrel [1061]	Macronectes halli, Northern Giant Petrel [1061]	Species or species habitat may occur within area	No	Associated with marine environments
Neophema chrysogaster, Orange-bellied Parrot [747]	Critically Endangered	Species or species habitat may occur within area	Possible	Associated with Saltmarshes, grassed areas and forest. None found during targeted survey. No local records (pers comm J.Miles)
Numenius madagascariensis, Eastern Curlew , Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area	Possible	LMBC important habitat mapping and presence of intertidal mudflats and estuaries inside development site. Feeds on crabs and molluscs in intertidal mudflats
Pachyptila turtur subantarctica, Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat known to occur within area	No	Associated with marine environments
Phoebastria fusca, Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area	No	Associated with marine environments
Pterodroma leucoptera leucoptera, Gould's Petrel, Australian Gould's Petrel [26033]	Endangered	Species or species habitat may occur within area	No	Associated with marine environments
Rostratula australis, Australian Painted-snipe, Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area	Possible	Associated with Saltmarshes but no local records found within Merimbula. Pers comm J.Miles
Sternula nereis nereis, Australian Fairy Tern [82950]	Vulnerable	Breeding likely to occur within area	No	Not associated with PCTs found
Thalassarche bulleri, Buller's Albatross,	Vulnerable	Species or species habitat	No	Associated with marine environments

Pacific Albatross [64460]		may occur within area		
Thalassarche bulleri platei, Northern Buller's Albatross, Pacific Albatross [82273]	Vulnerable	Species or species habitat may occur within area	No	Associated with marine environments
Thalassarche cauta cauta, Shy Albatross, Tasmanian Shy Albatross [82345]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	No	Associated with marine environments
Thalassarche cauta steadii, White-capped Albatross [82344]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	No	Associated with marine environments
Thalassarche eremita, Chatham Albatross [64457]	Endangered	Foraging, feeding or related behaviour likely to occur within area	No	Associated with marine environments
Thalassarche impavida, Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area	No	Associated with marine environments
Thalassarche melanophris, Black- browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area	No	Associated with marine environments
Thalassarche salvini, Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	No	Associated with marine environments
Thinornis rubricollis rubricollis, Hooded Plover (eastern) [66726]	Vulnerable	Species or species habitat known to occur within area	No	Not associated with PCTs found
Fish, whales, sharks and turtles				

Epinephelus daemeli, Black Rockcod, Black Cod, Saddled Rockcod [68449]	Vulnerable	Species or species habitat may occur within area	No	Marine species
Prototroctes maraena, Australian Grayling [26179]	Vulnerable	Species or species habitat may occur within area	No	Freshwater aquatic species
Balaenoptera borealis, Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	No	Marine species
Balaenoptera musculus, Blue Whale [36]	Endangered	Species or species habitat likely to occur within area	No	Marine species
Balaenoptera physalus, Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	No	Marine species
Eubalaena australis, Southern Right Whale [40]	Endangered	Species or species habitat likely to occur within area	No	Marine species
Megaptera novaeangliae, Humpback Whale [38]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	No	Marine species
Caretta caretta, Loggerhead Turtle [1763]	Vulnerable	Foraging, feeding or related behaviour known to occur within area	No	Marine species
Chelonia mydas, Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour	No	Marine species

		known to occur within area		
Dermochelys coriacea, Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area	No	Marine species associated with beaches and rocky islands
Eretmochelys imbricata, Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour known to occur within area	No	Marine species
Natator depressus, Flatback Turtle [59257]	Vulnerable	Breeding likely to occur within area	No	Associated with marine environments and beaches
Carcharias taurus (east coast population), Grey Nurse Shark (east coast population) [68751]	Critically endangered	Species or species habitat may occur within area	No	Marine species
Carcharodon carcharias, White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area	No	Marine species
Rhincodon typus, Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area	No	Marine species
Frogs				
Heleioporus australiacus, Giant Burrowing Frog [1973]	Vulnerable	Species or species habitat known to occur within area	No	Not associated with PCTs found
Litoria aurea, Green and Golden Bell Frog [1870]	Vulnerable	Species or species habitat known to occur within area	No	Associated with Saltmarshes and Mangrove Swamps, but habitat is too saline
Litoria littlejohni, Littlejohn's Tree Frog, Heath Frog [64733]	Vulnerable	Species or species habitat may occur within area	No	Not associated with PCTs found

Mixophyes balbus, Stuttering Frog, Southern Barred Frog (in Victoria) [1942]	Vulnerable	Species or species habitat likely to occur within area	No	Not associated with PCTs found
Other Mammals				
Dasyurus maculatus maculatus (SE mainland population), Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat likely to occur within area	No	Although associated with Mangrove swamps, location lacks connectivity with suitable habitats
Isoodon obesulus obesulus, Southern Brown Bandicoot (eastern), (south-eastern) [68050]	Endangered	Species or species habitat likely to occur within area	No	Not associated with PCTs found
Petauroides volans, Greater Glider [254]	Vulnerable	Species or species habitat likely to occur within area	No	Lack of hollow bearing trees and eucalypt trees inside development site.
Petrogale penicillata, Brush-tailed Rock-wallaby [225]	Vulnerable	Species or species habitat likely to occur within area	No	Not associated with PCTs found
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT), Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat likely to occur within area	No	Not associated with PCTs found
Potorous tridactylus tridactylus, Long-nosed Potoroo (SE mainland) [66645]	Vulnerable	Species or species habitat likely to occur within area	No	Not associated with PCTs found
Pseudomys fumeus, Smoky Mouse, Konoom [88]	Endangered	Species or species habitat likely to occur within area	No	Not associated with PCTs found

Pteropus poliocephalus, Grey-headed Flying-fox [186]	Vulnerable	Roosting known to occur within area	No	Although local records exist, no flying fox camps or optimal foraging habitat inside development site.
Acacia georgensis, Bega Wattle [9848]	Vulnerable	Species or species habitat may occur within area	No	Not associated with PCTs found
Amphibromus fluitans, River Swamp Wallaby-grass, Floating Swamp Wallaby-grass [19215]	Vulnerable	Species or species habitat may occur within area	No	Not associated with PCTs found
Plants				
Caladenia tessellata, Thick-lipped Spider-orchid, Daddy Long-legs [2119]	Vulnerable	Species or species habitat may occur within area	Potential	PCT 659 Scrub may provide habitat but not found during targeted survey and no known records.
Correa baeuerlenii, Chef's Cap [17007]	Vulnerable	Species or species habitat may occur within area	No	Not associated with PCTs found
Cryptostylis hunteriana, Leafless Tongue-orchid [19533]	Vulnerable	Species or species habitat may occur within area	No	Not associated with PCTs found
Leionema ralstonii [64926]	Vulnerable	Species or species habitat may occur within area	No	Not associated with PCTs found
Pomaderris parrisiae, Parris' Pomaderris [22119]	Vulnerable	Species or species habitat may occur within area	No	Not associated with PCTs found
Thesium australe, Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species habitat may occur within area	No	Not associated with PCTs found
Zieria formosa, Shapely Zieria [56733]	Endangered	Species or species habitat may occur within area	No	Not associated with PCTs found

Zieria parrisiae, Parris's Zieria [56735]	Critically endangered	Species or species habitat may occur within area	No	Not associated with PCTs found
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APPENDIX D EPBC MNES ASSESSMENT

Eastern Curlew (Numenius madagascariensis) - Critically Endangered

The Eastern Curlew is found in all states, particularly the north, east, and south-east regions including Tasmania. The Eastern Curlew breeds in Russia and north-eastern China but its distribution is poorly known. During the non-breeding season a few birds occur in southern Korea and China, but most spend the non-breeding season in north, east and south-east Australia.

The Eastern Curlew generally occupies coastal lakes, inlets, bays and estuarine habitats, and in New South Wales is mainly found in intertidal mudflats and sometimes saltmarsh of sheltered coasts. It forages in or at the edge of shallow water, occasionally on exposed algal mats or waterweed, or on banks of beach-cast seagrass or seaweed. It roosts on sandy spits and islets, especially on dry beach sand near the high-water mark, and among coastal vegetation including low saltmarsh or mangroves (Department of the Environment 2019a).

Bar-tailed Godwit (Limosa lapponica baueri) - Vulnerable

The migration route of the Bar-tailed Godwit from its breeding grounds in the Arctic to its non-breeding grounds in the southern hemisphere covers over 11,000 km. Birds arrive in New South Wales between August and October and then leave between February and April, with a small number of individuals overwintering. The subspecies is most frequently recorded along major coastal river estuaries and sheltered embayments.

The Bar-tailed Godwit is a migratory wader and found mainly in coastal habitats such as large intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays. It often occurs around beds of seagrass, and sometimes in nearby saltmarsh or the outer margins of mangrove areas. It forages at low to mid tide in shallow water or along the water's edge on sandy substrates on intertidal flats, banks and beaches or on soft mud substrates. In NSW its high tide roost areas are on sandy beaches, sandbars, spits and near-coastal saltmarsh. It is rarely found on inland wetlands or in areas of short grass such as farmland, paddocks and airstrips (Department of the Environment 2019b).

Red Knot (Calidris canutus) – Endangered

The Red Knot is a non-breeding migratory visitor from Arctic regions of Siberia. It is capable of flying non-stop between north-eastern China and northern Australia. Birds arrive between September and October and leave between March and April, with a small number of individuals overwintering. In NSW it is recorded in small numbers along some of the major river estuaries and sheltered embayments of the coastline. The Australian habitats are used for birds to rest and replenish fat resources; large numbers arrive in September then most move south to Victoria by October.

The Red Knot usually forages in soft substrate near the edge of water on intertidal mudflats or sandflats exposed by low tide. It usually forages near the water's edge, with feeding activity regulated by the tide as birds closely follow the tide-edge (Department of the Environment 2019c).

Threshold assessment (Eastern Curlew, Bar-tailed Godwit and Red Knot)

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

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

The Merimbula Lake Wetland and surrounds is known to support individuals of the Eastern Curlew (Critically Endangered) and Bar-tailed Godwit (Vulnerable). The Lake is known as an important area mapping undertaken by OEH for these species. The Red Knot has potential to occur within the habitats at the proposal site.

Population estimates of migratory birds is difficult to confirm due to the widespread distribution of the species across several countries (Hansen *et al.* 2016). The latest population estimates for migratory shorebirds (Hansen *et al.* 2016) lists the East Asian-Australasian Flyway¹ (EAAF) population of the Eastern Curlew at 35 000, the Bar-tailed Godwit at 325 000, and the Red Knot at 110 000. The Bar-tailed Godwit has two subspecies but the report does not individualise population estimates for this species; however, the Commonwealth Species Profile and Threats Database (SPRAT) lists the *Limosa lapponica baueri* subspecies population at 155 000 (Department of the Environment 2019a).

A total of 2.48 ha of habitat consisting of saltmarsh (0.05 ha), mangroves (2.03 ha) and seagrass (0.40 ha) will be cleared for the proposal. All of these marine habitat types are suitable for foraging and roosting by these species, although the species appear to preference intertidal mudflats and seagrass over saltmarsh and mangroves for foraging (Department of the Environment 2019a; 2019b; 2019c). The direct loss of habitat through clearing, inundation and infilling reduces the availability of foraging and roosting sites is the greatest threat to these birds (Melville 1997). While the proposal will result in direct habitat loss of up to 2.48 ha, a total of approximately 280 ha of marine habitat will remain within the locality² comprising of 185 ha of seagrass, 60 ha of saltmarsh and 35 ha of mangroves. This 280 ha is considered substantial to sustain a population. As the population of the assessed birds are sizeable and the direct habitat loss is negligible in the context of that remaining within the locality, the proposal would not lead to a long-term decrease in the size of an important population for the Eastern Curlew, Bar-tailed Godwit or Red Knot.

Indirect loss for the species may occur due to changes in water quality, hydrology or structural changes near habitats (Department of the Environment, 2015) influencing the quality of foraging and roosting sites. The runway extensions will increase the hard surface areas for both the north and south runways which could result in hydrological and water quality changes. The impacts of the extensions on natural tidal and flooding regimes was modelled by Southeast (2019). The modelling revealed the increased surface area will have negligible impacts on the frequency and extent of tidal inundation of intertidal areas for the northern extension footprint, but will have localised impacts which will be confined to the airport boundary for the southern extension. Beyond the project footprint, impacts on tidal movement are not expected (southeast 2019). With the implementation of mitigation measures the proposal will not result in indirect impacts of foraging or roosting habitat for any species assessed.

- **Reduce the area of occupancy of an important population**

The loss of 2.48 ha of marine vegetation is considered acceptable given the abundant similar habitat that is available within the catchment. The loss of 0.05 ha of saltmarsh is negligible as it is in a highly degraded condition as a result of regular mowing on the edge of the existing airport. The loss of 0.40 ha of seagrass is

¹ A flyway represents the collective migration routes of waterbirds, including shorebirds, between their breeding and non-breeding areas. The East Asian - Australasian Flyway encompasses Australia, New Zealand and another 21 countries, spanning nearly 120 degrees of latitude north to the Arctic. Many of the migratory species occurring in Australia also occur in other flyways; however the EAAF is a distinct geographic flyway used for population estimates.

² Locality is defined as a 3 km buffer around the proposed development footprint for the purposes of this assessment.

considered negligible as it also degraded and in poor condition and there is abundant seagrass available within the lake.

- **Fragment an existing important population into two or more populations**

As the proposal is an extension of the existing northern and southern runways within the Merimbula Airport it will not fragment any population. The proposal will result in habitat clearance on the edge of the existing development (i.e. airport runways) increasing the footprint of already cleared land. The proposal will not occur within good quality habitat within an undeveloped landscape.

- **Adversely affect habitat critical to the survival of a species**

Merimbula Lake is listed as a Nationally Significant wetland listed under the EPBC Act for the substantial area of marine habitats it supports and the threatened fauna that exist there (Department of the Environment 2010). However, the site does not support habitat critical to the survival of the assessed species and the habitat to be affected is not listed as an internationally important site within the East Asian-Australasian Flyway population (Department of the Environment 2019b).

As mentioned above, the clearance of habitat will be localised to seagrass and saltmarsh that is already degraded and in poor condition. It is expected the species would utilise better quality habitat within the undeveloped areas of the lake where substantial habitat will still remain. Loss will also occur to mangrove habitat but as this vegetation type is abundant surrounding Merimbula Lake and within the locality, the loss is considered acceptable.

- **Disrupt the breeding cycle of an important population**

The Eastern Curlew, Bar-tailed Godwit, and Red Knot migrate to Australia during their non-breeding season and breed outside of Australia. The proposal will not influence the breeding cycle of any important population.

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

As mentioned, the proposal is located on the end of existing runways and is an extension of an already developed area and will not be located within good quality habitat, nor will it fragment contiguous vegetation. The minor amount of habitat to be removed will not result in a decline of the species as there is an abundance of good quality habitat remaining within the locality. This habitat outside the project footprint is likely to be preferred by the species over degraded habitat that occurs alongside an existing airport.

Further, the birds migrate to Australia to build up energy stores required for successful migration back to the northern hemisphere for breeding (Department of the Environment 2019a). As the proposal site is not used for breeding there will be no direct effects to population decline.

The three species generally feed within low- to mid-tide in shallow water or along the water's edges and within seagrass beds, and to a lesser extent in saltmarsh or the outer margins of mangrove areas. The minor amount of primary habitat (i.e. 0.40 ha of degraded seagrass) to be impacted by the proposal will not interfere with overall foraging success of these species. The habitats surrounding all of Merimbula Lake will continue to support good quality foraging resources allowing the species to sufficiently feed before they migrate back to their breeding grounds.

For these reasons the proposal will not modify, destroy, remove, isolate or decrease the availability or quality of habitat such that the species is likely to decline.

- **Result in invasive species that are harmful to a threatened species becoming established in the species' habitat or introduce disease that may cause the species to decline**

Of specific concern for migratory shorebirds is the introduction of exotic marine pests (i.e. exotic oysters or mussels) or marine flora (i.e. noxious algae *Caulerpa taxifolia*) resulting in loss of benthic food sources at important intertidal habitat (Department of the Environment, 2015). No noxious species were identified during the site inspection and are not known to occur there. To ensure no spread of *Caulerpa taxifolia* a mitigation measure for best hygiene practice has been prescribed of '*all wetted surfaces must be inspected for attached Caulerpa plants and cleaned thoroughly with fresh water before using at another location. Fragments of Caulerpa can remain viable for up to three days out of water, so extended storage out of the water is also recommended*'. The proposal is not expected to an invasive species or disease that would cause any species to decline.

- **Interfere substantially with the recovery of the species**

The Wildlife Conservation Plan for Migratory Shorebirds (Department of the Environment, 2015) provides a framework to guide the conservation of migratory shorebirds and their habitat in Australia and conservation throughout the EAAF. Objective 2 of the Plan: *Wetland habitats in Australia, on which migratory shorebirds depend, are protected and conserved* is relevant to this proposal. The impacts of the proposal were reviewed and were not considered to interfere with this objective. Merimbula Lake is not listed as an internationally important wetland but does provide valuable habitat to migratory shorebirds in general. While the proposal will remove a minor amount of habitat it will not further degrade or interfere with the ecological integrity of the Lake or its marine habitats. It is considered the locality will be able to support the same level of pre-construction shorebird numbers within Merimbula Lake wetland after construction. With the implementation of the controls and mitigation measures the proposal would not result in a direct or indirect impact such that it would interfere with the recovery of the species.

Conclusion

The assessment has considered the impacts of the proposal on the Eastern Curlew, Bar-tailed Godwit and Red Knot against significant impact criteria listed under the EPBC Act 1999 and the EPBC Act Policy Statement 3.21—*Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species*.

The impacts of the proposal, specifically habitat loss, are considered minor in the context of the most suitable habitat (seagrass and saltmarsh) the species are likely to occur is in poor condition and clearance is negligible (0.45 ha). A further 2.03 ha of mangrove habitat will be removed but this habitat is utilised to a lesser degree than the former mentioned habitats. In total 2.48 ha will be directly cleared but approximately 280 ha of marine habitat will remain within the immediate locality. The location of the proposal at the end of the existing runway will not fragment or isolate habitat. The habitat affected is not considered important or unique to the migratory species. As Merimbula Lake supports a substantial amount of good quality marine habitat that will remain available within the locality the loss of 2.48 ha of vegetation is considered acceptable. This assessment has further identified mitigation measures to minimise the impacts and offset the loss of habitat.

The proposal will not result in significant impact to the Eastern Curlew, Bar-tailed Godwit, or Red Knot and a Commonwealth referral under the EPBC Act is not required.

APPENDIX E BAM CALCULATOR REPORTS (ULTIMATE EIS)

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00012032/BAAS17086/18/00012970	Merimbula airport Ultimate EIS NthSth BDAR V4-1 July22	16/06/2022
Assessor Name	Report Created	BAM Data version *
Gillian Young	09/08/2022	54
Assessor Number	BAM Case Status	Date Finalised
BAAS17086	Finalised	09/08/2022
Assessment Revision	Assessment Type	BOS entry trigger
10	Part 4 Developments (General)	BOS Threshold: Area clearing threshold

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

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

Zone	Vegetation zone name	TEC name	Current Vegetation integrity score	Change in Vegetation integrity (loss / gain)	Area (ha)	Sensitivity to loss (Justification)	Species sensitivity to gain class	BC Act Listing status	EPBC Act listing status	Biodiversity risk weighting	Potential SAI	Ecosystem credits

Bangalay - Old-man Banksia open forest on coastal sands, Sydney Basin Bioregion and South East Corner Bioregion												
1	659_Plot4_Nth_Scrub	Bangalay Sand Forest of the Sydney Basin and South East Corner bioregions	50.8	50.8	0.07	PCT Cleared - 50%	High Sensitivity to Gain	Endangered Ecological Community	Not Listed	2.00		2
2	659_P6-7-8-9-14NtSthGras	Bangalay Sand Forest of the Sydney Basin and South East Corner bioregions	8	8.0	8.4	PCT Cleared - 50%	High Sensitivity to Gain	Endangered Ecological Community	Not Listed	2.00		0
											Subtotal	2
Estuarine mangrove forest												
3	920_Plot3_Nth_GMan grove	Not a TEC	82.9	82.9	0.03	PCT Cleared - 86%	High Sensitivity to Gain			2.00		1
4	920_Plot1_Sth_GMan grove	Not a TEC	69.9	69.9	1	PCT Cleared - 86%	High Sensitivity to Gain			2.00		35
5	920_Plot2_Sth_RGMan grove	Not a TEC	55	55.0	1	PCT Cleared - 86%	High Sensitivity to Gain			2.00		28
											Subtotal	64

BAM Credit Summary Report

Estuarine saltmarsh											
6	1126_Plot 5_Nth_Salt marsh	Not a TEC	75.4	75.4	0.05	PCT Cleared - 56%	High Sensitivity to Gain			1.75	2
7	1126_Plot 10_Sth_Salt marsh	Not a TEC	11.9	11.9	0.07	PCT Cleared - 56%	High Sensitivity to Gain			1.75	0
										Subtotal	2
										Total	68

Species credits for threatened species

Vegetation zone name	Habitat condition (Vegetation Integrity)	Change in habitat condition	Area (ha)/Count (no. individuals)	Sensitivity to loss (Justification)	Sensitivity to gain (Justification)	BC Act Listing status	EPBC Act listing status	Potential SAIL	Species credits
Cryptostylis hunteriana / Leafless Tongue Orchid (Flora)									
659_Plot4_Nth_Scrub	50.8	50.8	0.07	Biodiversity Conservation Act listing status	Ability to colonise improved habitat	Vulnerable	Vulnerable	False	1
								Subtotal	1
Haematopus fuliginosus / Sooty Oystercatcher (Fauna)									
920_Plot3_Nth_GMangrove	82.9	82.9	0.03			Vulnerable	Not Listed	False	1
920_Plot1_Sth_GMangrove	69.9	69.9	1			Vulnerable	Not Listed	False	35

BAM Credit Summary Report

920_Plot2_Sth_R GMangrove	55.0	55.0	1		Vulnerable	Not Listed	False	28
							Subtotal	64
<i>Haematopus longirostris / Pied Oystercatcher (Fauna)</i>								
920_Plot3_Nth_ GMangrove	82.9	82.9	0.03		Endangered	Not Listed	False	1
920_Plot1_Sth_ GMangrove	69.9	69.9	1		Endangered	Not Listed	False	35
920_Plot2_Sth_R GMangrove	55.0	55.0	1		Endangered	Not Listed	False	28
							Subtotal	64
<i>Isoodon obesulus obesulus / Southern Brown Bandicoot (eastern) (Fauna)</i>								
659_Plot4_Nth_ Scrub	50.8	50.8	0.07		Endangered	Endangered	False	2
							Subtotal	2
<i>Potorous tridactylus / Long-nosed Potoroo (Fauna)</i>								
659_Plot4_Nth_ Scrub	50.8	50.8	0.07		Vulnerable	Vulnerable	False	2
							Subtotal	2

BAM Candidate Species Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00012032/BAAS17086/18/00012970	Merimbula airport Ultimate EIS NthSth BDAR V4-1 July22	16/06/2022
Assessor Name	Report Created	BAM Data version *
Gillian Young	09/08/2022	54
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BAAS17086	Part 4 Developments (General)	Finalised
Assessment Revision	Date Finalised	BOS entry trigger
10	09/08/2022	BOS Threshold: Area clearing threshold

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

List of Species Requiring Survey

Name	Presence	Survey Months
<i>Caladenia tessellata</i> Thick Lip Spider Orchid	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☒ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
<i>Cryptostylis hunteriana</i> Leafless Tongue Orchid	Yes (assumed present)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
<i>Distichlis distichophylla</i> Australian Saltgrass	No (surveyed) *Survey months are outside of the months specified in Bionet.	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☒ Oct ☐ Nov ☐ Dec ☒ Survey month outside the specified months?

BAM Candidate Species Report

<i>Galium australe</i> Tangled Bedstraw	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☒ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
<i>Haematopus fuliginosus</i> Sooty Oystercatcher	Yes (assumed present)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
<i>Haematopus longirostris</i> Pied Oystercatcher	Yes (assumed present)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
<i>Isoodon obesulus obesulus</i> Southern Brown Bandicoot (eastern)	Yes (assumed present)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
<i>Neophema chrysogaster</i> Orange-bellied Parrot	No (surveyed)	☒ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
<i>Potorous tridactylus</i> Long-nosed Potoroo	Yes (assumed present)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?

BAM Candidate Species Report

<i>Pseudanthus ovalifolius</i> Oval-leafed Pseudanthus	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☒ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
<i>Pultenaea pedunculata</i> Matted Bush-pea	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☒ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
<i>Senecio spathulatus</i> Coast Groundsel	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☒ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
<i>Viola cleistogamoides</i> Hidden Violet	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☒ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
<i>Wilsonia backhousei</i> Narrow-leafed Wilsonia	No (surveyed)	☒ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
<i>Wilsonia rotundifolia</i> Round-leafed Wilsonia	No (surveyed)	☒ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☒ Nov ☐ Dec ☐ Survey month outside the specified months?

Threatened species Manually Added

None added

Threatened species assessed as not on site

Refer to BAR for detailed justification

Common name	Scientific name	Justification in the BAM-C
Barking Owl	<i>Ninox connivens</i>	Refer to BAR
Bar-tailed Godwit (baueri)	<i>Limosa lapponica baueri</i>	Refer to BAR
Beach Stone-curlew	<i>Esacus magnirostris</i>	Species is vagrant
Black-tailed Godwit	<i>Limosa limosa</i>	Refer to BAR
Brush-tailed Phascogale	<i>Phascogale tapoatafa</i>	Refer to BAR
Bush Stone-curlew	<i>Burhinus grallarius</i>	Habitat constraints
Chef's Cap Correa	<i>Correa baeuerlenii</i>	Geographic limitations
Curlew Sandpiper	<i>Calidris ferruginea</i>	Refer to BAR
Eastern Curlew	<i>Numenius madagascariensis</i>	Refer to BAR
Eastern Osprey	<i>Pandion cristatus</i>	Refer to BAR
Eastern Pygmy-possum	<i>Cercartetus nanus</i>	Refer to BAR
Gang-gang Cockatoo	<i>Callocephalon fimbriatum</i>	Refer to BAR
Giant Burrowing Frog	<i>Heleioporus australiacus</i>	Refer to BAR
Glossy Black-Cockatoo	<i>Calyptorhynchus lathami</i>	Refer to BAR
Greater Glider	<i>Petauroides volans</i>	Habitat constraints
Greater Glider population in the Eurobodalla local government area	<i>Petauroides volans</i> - endangered population	Habitat constraints
Green and Golden Bell Frog	<i>Litoria aurea</i>	Refer to BAR
Grey-headed Flying-fox	<i>Pteropus poliocephalus</i>	Refer to BAR
Koala	<i>Phascolarctos cinereus</i>	Habitat constraints
Large Bent-winged Bat	<i>Miniopterus orianae oceanensis</i>	Refer to BAR
Large-eared Pied Bat	<i>Chalinolobus dwyeri</i>	Geographic limitations
Little Eagle	<i>Hieraaetus morphnoides</i>	Refer to BAR

BAM Candidate Species Report

Little Tern	<i>Sternula albifrons</i>	Refer to BAR
Masked Owl	<i>Tyto novaehollandiae</i>	Refer to BAR
Red Knot	<i>Calidris canutus</i>	Refer to BAR
Regent Honeyeater	<i>Anthochaera phrygia</i>	Refer to BAR
Sanderling	<i>Calidris alba</i>	Refer to BAR
Southern Myotis	<i>Myotis macropus</i>	Refer to BAR
Square Raspwort	<i>Haloragis exalata</i> subsp. <i>exalata</i>	Refer to BAR
Square-tailed Kite	<i>Lophoictinia isura</i>	Refer to BAR
Squirrel Glider	<i>Petaurus norfolcensis</i>	Refer to BAR
Swift Parrot	<i>Lathamus discolor</i>	Refer to BAR
White-bellied Sea-Eagle	<i>Haliaeetus leucogaster</i>	Refer to BAR

BAM Predicted Species Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00012032/BAAS17086/18/00012970	Merimbula airport Ultimate EIS NthSth BDAR V4-1 July22	16/06/2022
Assessor Name	Report Created	BAM Data version *
Gillian Young	09/08/2022	54
Assessor Number	Assessment Type	BAM Case Status
BAAS17086	Part 4 Developments (General)	Finalised
Assessment Revision	BOS entry trigger	Date Finalised
10	BOS Threshold: Area clearing threshold	09/08/2022

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

Threatened species reliably predicted to utilise the site. No surveys are required for these species. Ecosystem credits apply to these species.

Common Name	Scientific Name	Vegetation Types(s)
Australasian Bittern	Botaurus poiciloptilus	920-Estuarine mangrove forest 1126-Estuarine saltmarsh
Barking Owl	Ninox connivens	659-Bangalay - Old-man Banksia open forest on coastal sands, Sydney Basin Bioregion and South East Corner Bioregion
Bar-tailed Godwit (baueri)	Limosa lapponica baueri	920-Estuarine mangrove forest 1126-Estuarine saltmarsh
Beach Stone-curlew	Esacus magnirostris	920-Estuarine mangrove forest 1126-Estuarine saltmarsh
Black Bittern	Ixobrychus flavicollis	920-Estuarine mangrove forest 1126-Estuarine saltmarsh
Black-tailed Godwit	Limosa limosa	920-Estuarine mangrove forest 1126-Estuarine saltmarsh
Curlew Sandpiper	Calidris ferruginea	920-Estuarine mangrove forest 1126-Estuarine saltmarsh
Dusky Woodswallow	Artamus cyanopterus cyanopterus	659-Bangalay - Old-man Banksia open forest on coastal sands, Sydney Basin Bioregion and South East Corner Bioregion

BAM Predicted Species Report

Dusky Woodswallow	Artamus cyanopterus cyanopterus	920-Estuarine mangrove forest
		1126-Estuarine saltmarsh
Eastern Coastal Free-tailed Bat	Micronomus norfolkensis	659-Bangalay - Old-man Banksia open forest on coastal sands, Sydney Basin Bioregion and South East Corner Bioregion
		920-Estuarine mangrove forest
		1126-Estuarine saltmarsh
Eastern Curlew	Numenius madagascariensis	920-Estuarine mangrove forest
		1126-Estuarine saltmarsh
Eastern Osprey	Pandion cristatus	920-Estuarine mangrove forest
		1126-Estuarine saltmarsh
Gang-gang Cockatoo	Callocephalon fimbriatum	659-Bangalay - Old-man Banksia open forest on coastal sands, Sydney Basin Bioregion and South East Corner Bioregion
Glossy Black- Cockatoo	Calyptorhynchus lathami	659-Bangalay - Old-man Banksia open forest on coastal sands, Sydney Basin Bioregion and South East Corner Bioregion
Greater Broad-nosed Bat	Scoteanax rueppellii	659-Bangalay - Old-man Banksia open forest on coastal sands, Sydney Basin Bioregion and South East Corner Bioregion
		920-Estuarine mangrove forest
		1126-Estuarine saltmarsh
Grey-headed Flying- fox	Pteropus poliocephalus	659-Bangalay - Old-man Banksia open forest on coastal sands, Sydney Basin Bioregion and South East Corner Bioregion
		920-Estuarine mangrove forest
		1126-Estuarine saltmarsh
Large Bent-winged Bat	Miniopterus orianae oceanensis	659-Bangalay - Old-man Banksia open forest on coastal sands, Sydney Basin Bioregion and South East Corner Bioregion
		920-Estuarine mangrove forest
		1126-Estuarine saltmarsh
Little Eagle	Hieraaetus morphnoides	659-Bangalay - Old-man Banksia open forest on coastal sands, Sydney Basin Bioregion and South East Corner Bioregion
		920-Estuarine mangrove forest
		1126-Estuarine saltmarsh

BAM Predicted Species Report

Little Lorikeet	Glossopsitta pusilla	659-Bangalay - Old-man Banksia open forest on coastal sands, Sydney Basin Bioregion and South East Corner Bioregion
Little Tern	Sternula albifrons	920-Estuarine mangrove forest 1126-Estuarine saltmarsh
Masked Owl	Tyto novaehollandiae	659-Bangalay - Old-man Banksia open forest on coastal sands, Sydney Basin Bioregion and South East Corner Bioregion
Red Knot	Calidris canutus	920-Estuarine mangrove forest 1126-Estuarine saltmarsh
Regent Honeyeater	Anthochaera phrygia	659-Bangalay - Old-man Banksia open forest on coastal sands, Sydney Basin Bioregion and South East Corner Bioregion
Sanderling	Calidris alba	1126-Estuarine saltmarsh
Spotted Harrier	Circus assimilis	1126-Estuarine saltmarsh
Spotted-tailed Quoll	Dasyurus maculatus	659-Bangalay - Old-man Banksia open forest on coastal sands, Sydney Basin Bioregion and South East Corner Bioregion 920-Estuarine mangrove forest
Square-tailed Kite	Lophoictinia isura	659-Bangalay - Old-man Banksia open forest on coastal sands, Sydney Basin Bioregion and South East Corner Bioregion
Swift Parrot	Lathamus discolor	659-Bangalay - Old-man Banksia open forest on coastal sands, Sydney Basin Bioregion and South East Corner Bioregion
Varied Sittella	Daphoenositta chrysoptera	659-Bangalay - Old-man Banksia open forest on coastal sands, Sydney Basin Bioregion and South East Corner Bioregion
White-bellied Sea-Eagle	Haliaeetus leucogaster	920-Estuarine mangrove forest 1126-Estuarine saltmarsh
White-fronted Chat	Epthianura albifrons	920-Estuarine mangrove forest 1126-Estuarine saltmarsh
White-throated Needletail	Hirundapus caudacutus	659-Bangalay - Old-man Banksia open forest on coastal sands, Sydney Basin Bioregion and South East Corner Bioregion 920-Estuarine mangrove forest 1126-Estuarine saltmarsh

BAM Predicted Species Report

Yellow-bellied Sheath-tail-bat	Saccolaimus flaviventris	659-Bangalay - Old-man Banksia open forest on coastal sands, Sydney Basin Bioregion and South East Corner Bioregion
		920-Estuarine mangrove forest

Threatened species Manually Added

None added

Threatened species assessed as not within the vegetation zone(s) for the PCT(s)

Common Name	Scientific Name	Plant Community Type(s)
Yellow-bellied Glider	Petaurus australis	659-Bangalay - Old-man Banksia open forest on coastal sands, Sydney Basin Bioregion and South East Corner Bioregion

Threatened species assessed as not within the vegetation zone(s) for the PCT(s)

Refer to BAR for detailed justification

Common Name	Scientific Name	Justification in the BAM-C
Yellow-bellied Glider	Petaurus australis	Refer to BAR

BAM Vegetation Zones Report

Proposal Details

Assessment Id	Assessment name	BAM data last updated *
00012032/BAAS17086/18/00012970	Merimbula airport Ultimate EIS NthSth BDAR V4-1 July22	16/06/2022
Assessor Name	Report Created	BAM Data version *
Gillian Young	09/08/2022	54
Assessor Number	Assessment Type	BAM Case Status
BAAS17086	Part 4 Developments (General)	Finalised
Assessment Revision	Date Finalised	BOS entry trigger
10	09/08/2022	BOS Threshold: Area clearing threshold

* 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.

Vegetation Zones

#	Name	PCT	Condition	Area	Minimum number of plots	Management zones
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BAM Vegetation Zones Report

1	659_Plot4_Nth_Scrub	659-Bangalay - Old-man Banksia open forest on coastal sands, Sydney Basin Bioregion and South East Corner Bioregion	Plot4_Nth_Scrub	0.07		
2	659_P6-7-8-9-14NtSthGras	659-Bangalay - Old-man Banksia open forest on coastal sands, Sydney Basin Bioregion and South East Corner Bioregion	P6-7-8-9-14NtSthGras	8.44		
3	920_Plot3_Nth_GMangrove	920-Estuarine mangrove forest	Plot3_Nth_GMangrove	0.03		
4	920_Plot1_Sth_GMangrove	920-Estuarine mangrove forest	Plot1_Sth_GMangrove	1		
5	920_Plot2_Sth_RGMangrove	920-Estuarine mangrove forest	Plot2_Sth_RGMangrove	1.03	1	
6	1126_Plot5_Nth_Saltmarsh	1126-Estuarine saltmarsh	Plot5_Nth_Saltmarsh	0.05		
7	1126_Plot10_Sth_Saltmarsh	1126-Estuarine saltmarsh	Plot10_Sth_Saltmarsh	0.07	1	

BAM Biodiversity Credit Report (Like for like)

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00012032/BAAS17086/18/00012970	Merimbula airport Ultimate EIS NthSth BDAR V4-1 July22	16/06/2022
Assessor Name	Assessor Number	BAM Data version *
Gillian Young	BAAS17086	54
Proponent Names	Report Created	BAM Case Status
Bega Valley Shire Council, Bega Valley Shire Council	09/08/2022	Finalised
Assessment Revision	Assessment Type	Date Finalised
10	Part 4 Developments (General)	09/08/2022
BOS entry trigger	* 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.	
BOS Threshold: Area clearing threshold		

Potential Serious and Irreversible Impacts

Name of threatened ecological community	Listing status	Name of Plant Community Type/ID
Nil		
Species		
Nil		

Additional Information for Approval

BAM Biodiversity Credit Report (Like for like)

PCT Outside Ibra Added

None added

PCTs With Customized Benchmarks

PCT
No Changes

Predicted Threatened Species Not On Site

Name
Petaurus australis / Yellow-bellied Glider

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

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	HBT Cr	No HBT Cr	Total credits to be retired
659-Bangalay - Old-man Banksia open forest on coastal sands, Sydney Basin Bioregion and South East Corner Bioregion	Bangalay Sand Forest of the Sydney Basin and South East Corner bioregions	8.5	0	2	2
920-Estuarine mangrove forest	Not a TEC	2.1	0	64	64
1126-Estuarine saltmarsh	Not a TEC	0.1	0	2	2

BAM Biodiversity Credit Report (Like for like)

659-Bangalay - Old-man Banksia open forest on coastal sands, Sydney Basin Bioregion and South East Corner Bioregion	Like-for-like credit retirement options					
	Name of offset trading group	Trading group	Zone	HBT	Credits	IBRA region
	Bangalay Sand Forest of the Sydney Basin and South East Corner bioregions This includes PCT's: 659, 1793, 1794	-	659_Plot4_Nth_Scrub	No	2	South East Coastal Ranges, Bateman, Bungonia, East Gippsland Lowlands, Kybayan-Gourock, Monaro and Snowy Mountains. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Bangalay Sand Forest of the Sydney Basin and South East Corner bioregions This includes PCT's: 659, 1793, 1794	-	659_P6-7-8-9-14NtSthGras	No	0	South East Coastal Ranges, Bateman, Bungonia, East Gippsland Lowlands, Kybayan-Gourock, Monaro and Snowy Mountains. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
920-Estuarine mangrove forest	Like-for-like credit retirement options					
	Class	Trading group	Zone	HBT	Credits	IBRA region

BAM Biodiversity Credit Report (Like for like)

	Mangrove Swamps This includes PCT's: 915, 916, 917, 918, 919, 920	Mangrove Swamps >=70% and <90%	920_Plot3_Nth_GMangrove	No	1	South East Coastal Ranges, Bateman, Bungonia, East Gippsland Lowlands, Kybayan-Gourock, Monaro and Snowy Mountains. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Mangrove Swamps This includes PCT's: 915, 916, 917, 918, 919, 920	Mangrove Swamps >=70% and <90%	920_Plot1_Sth_GMangrove	No	35	South East Coastal Ranges, Bateman, Bungonia, East Gippsland Lowlands, Kybayan-Gourock, Monaro and Snowy Mountains. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Mangrove Swamps This includes PCT's: 915, 916, 917, 918, 919, 920	Mangrove Swamps >=70% and <90%	920_Plot2_Sth_RGMangrove	No	28	South East Coastal Ranges, Bateman, Bungonia, East Gippsland Lowlands, Kybayan-Gourock, Monaro and Snowy Mountains. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

BAM Biodiversity Credit Report (Like for like)

1126-Estuarine saltmarsh	Like-for-like credit retirement options					
	Class	Trading group	Zone	HBT	Credits	IBRA region
	Saltmarshes This includes PCT's: 1125, 1126	Saltmarshes $\geq 50\%$ and $< 70\%$	1126_Plot5_Nth_Saltmarsh	No	2	South East Coastal Ranges, Bateman, Bungonia, East Gippsland Lowlands, Kybayan-Gourock, Monaro and Snowy Mountains. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Saltmarshes This includes PCT's: 1125, 1126	Saltmarshes $\geq 50\%$ and $< 70\%$	1126_Plot10_St h_Saltmarsh	No	0	South East Coastal Ranges, Bateman, Bungonia, East Gippsland Lowlands, Kybayan-Gourock, Monaro and Snowy Mountains. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Species Credit Summary

BAM Biodiversity Credit Report (Like for like)

Species	Vegetation Zone/s	Area / Count	Credits
Cryptostylis hunteriana / Leafless Tongue Orchid	659_Plot4_Nth_Scrub	0.1	1.00
Haematopus fuliginosus / Sooty Oystercatcher	920_Plot3_Nth_GMangrove, 920_Plot1_Sth_GMangrove, 920_Plot2_Sth_RGMangrove	2.1	64.00
Haematopus longirostris / Pied Oystercatcher	920_Plot3_Nth_GMangrove, 920_Plot1_Sth_GMangrove, 920_Plot2_Sth_RGMangrove	2.1	64.00
Isoodon obesulus obesulus / Southern Brown Bandicoot (eastern)	659_Plot4_Nth_Scrub	0.1	2.00
Potorous tridactylus / Long-nosed Potoroo	659_Plot4_Nth_Scrub	0.1	2.00

Credit Retirement Options

Like-for-like credit retirement options

Cryptostylis hunteriana / Leafless Tongue Orchid	Spp	IBRA subregion
	Cryptostylis hunteriana / Leafless Tongue Orchid	Any in NSW
Haematopus fuliginosus / Sooty Oystercatcher	Spp	IBRA subregion
	Haematopus fuliginosus / Sooty Oystercatcher	Any in NSW
Haematopus longirostris / Pied Oystercatcher	Spp	IBRA subregion
	Haematopus longirostris / Pied Oystercatcher	Any in NSW

BAM Biodiversity Credit Report (Like for like)

Isoodon obesulus obesulus / Southern Brown Bandicoot (eastern)	Spp	IBRA subregion
	Isoodon obesulus obesulus / Southern Brown Bandicoot (eastern)	Any in NSW
Potorous tridactylus / Long-nosed Potoroo	Spp	IBRA subregion
	Potorous tridactylus / Long-nosed Potoroo	Any in NSW

BAM Biodiversity Credit Report (Variations)

Proposal Details

Assessment Id

00012032/BAAS17086/18/00012970

Assessor Name

Gillian Young

Proponent Name(s)

Bega Valley Shire Council, Bega Valley Shire Council

Assessment Revision

10

BOS entry trigger

BOS Threshold: Area clearing threshold

Proposal Name

Merimbula airport Ultimate EIS NthSth BDAR V4-1 July22

Assessor Number

BAAS17086

Report Created

09/08/2022

Assessment Type

Part 4 Developments (General)

BAM data last updated *

16/06/2022

BAM Data version *

54

BAM Case Status

Finalised

Date Finalised

09/08/2022

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

Potential Serious and Irreversible Impacts

Name of threatened ecological community	Listing status	Name of Plant Community Type/ID
Nil		
Species		
Nil		

Additional Information for Approval

PCT Outside Ibra Added

None added

PCTs With Customized Benchmarks

BAM Biodiversity Credit Report (Variations)

PCT

No Changes

Predicted Threatened Species Not On Site

Name

Petaurus australis / Yellow-bellied Glider

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

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	HBT Cr	No HBT Cr	Total credits to be retired
659-Bangalay - Old-man Banksia open forest on coastal sands, Sydney Basin Bioregion and South East Corner Bioregion	Bangalay Sand Forest of the Sydney Basin and South East Corner bioregions	8.5	0	2	2.00
920-Estuarine mangrove forest	Not a TEC	2.1	0	64	64.00
1126-Estuarine saltmarsh	Not a TEC	0.1	0	2	2.00

659-Bangalay - Old-man Banksia open forest on coastal sands, Sydney Basin Bioregion and South East Corner Bioregion

Like-for-like credit retirement options

Class	Trading group	Zone	HBT	Credits	IBRA region
Bangalay Sand Forest of the Sydney Basin and South East Corner bioregions This includes PCT's: 659, 1793, 1794	-	659_Plot4_Nth_Scrub	No	2	South East Coastal Ranges, Bateman, Bungonia, East Gippsland Lowlands, Kybayan-Gourock, Monaro and Snowy Mountains. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

BAM Biodiversity Credit Report (Variations)

	Bangalay Sand Forest of the Sydney Basin and South East Corner bioregions This includes PCT's: 659, 1793, 1794	-	659_P6-7-8-9-14NtSthGras	No	0	South East Coastal Ranges, Bateman, Bungonia, East Gippsland Lowlands, Kybayan-Gourock, Monaro and Snowy Mountains. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options					
	Formation	Trading group	Zone	HBT	Credits	IBRA region
	Dry Sclerophyll Forests (Shrubby sub-formation)	Tier 3 or higher threat status	659_Plot4_Nth_Scrub	No	2	IBRA Region: South East Corner, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Dry Sclerophyll Forests (Shrubby sub-formation)	Tier 3 or higher threat status	659_P6-7-8-9-14NtSthGras	No	0	IBRA Region: South East Corner, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
920-Estuarine mangrove forest	Like-for-like credit retirement options					
	Class	Trading group	Zone	HBT	Credits	IBRA region

BAM Biodiversity Credit Report (Variations)

	Mangrove Swamps This includes PCT's: 915, 916, 917, 918, 919, 920	Mangrove Swamps $\geq 70\%$ and $< 90\%$	920_Plot3_ Nth_GMan grove	No	1	South East Coastal Ranges,Bateman, Bungonia, East Gippsland Lowlands, Kybeyan-Gourock, Monaro and Snowy Mountains. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Mangrove Swamps This includes PCT's: 915, 916, 917, 918, 919, 920	Mangrove Swamps $\geq 70\%$ and $< 90\%$	920_Plot1_ Sth_GMan grove	No	35	South East Coastal Ranges,Bateman, Bungonia, East Gippsland Lowlands, Kybeyan-Gourock, Monaro and Snowy Mountains. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Mangrove Swamps This includes PCT's: 915, 916, 917, 918, 919, 920	Mangrove Swamps $\geq 70\%$ and $< 90\%$	920_Plot2_ Sth_RGMan grove	No	28	South East Coastal Ranges,Bateman, Bungonia, East Gippsland Lowlands, Kybeyan-Gourock, Monaro and Snowy Mountains. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options					
Formation		Trading group	Zone	HBT	Credits	IBRA region

BAM Biodiversity Credit Report (Variations)

	Saline Wetlands	Tier 2 or higher threat status	920_Plot3_Nth_GMan grove	No	1	IBRA Region: South East Corner, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Saline Wetlands	Tier 2 or higher threat status	920_Plot1_Sth_GMan grove	No	35	IBRA Region: South East Corner, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Saline Wetlands	Tier 2 or higher threat status	920_Plot2_Sth_RGMa ngrove	No	28	IBRA Region: South East Corner, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
1126-Estuarine saltmarsh	Like-for-like credit retirement options					
	Class	Trading group	Zone	HBT	Credits	IBRA region
	Saltmarshes This includes PCT's: 1125, 1126	Saltmarshes >=50% and <70%	1126_Plot5_Nth_Saltm arsh	No	2	South East Coastal Ranges,Bateman, Bungonia, East Gippsland Lowlands, Kybayan-Gourock, Monaro and Snowy Mountains. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

BAM Biodiversity Credit Report (Variations)

	Saltmarshes This includes PCT's: 1125, 1126	Saltmarshes >=50% and <70%	1126_Plot1 0_Sth_Salt marsh	No	0	South East Coastal Ranges,Bateman, Bungonia, East Gippsland Lowlands, Kybeyan-Gourock, Monaro and Snowy Mountains. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Variation options						
Formation	Trading group	Zone	HBT	Credits	IBRA region	
Saline Wetlands	Tier 3 or higher threat status	1126_Plot5 _Nth_Saltm arsh	No	2	IBRA Region: South East Corner, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.	
Saline Wetlands	Tier 3 or higher threat status	1126_Plot1 0_Sth_Salt marsh	No	0	IBRA Region: South East Corner, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.	

Species Credit Summary

Species	Vegetation Zone/s	Area / Count	Credits
Cryptostylis hunteriana / Leafless Tongue Orchid	659_Plot4_Nth_Scrub	0.1	1.00
Haematopus fuliginosus / Sooty Oystercatcher	920_Plot3_Nth_GMangrove, 920_Plot1_Sth_GMangrove, 920_Plot2_Sth_RGMangrove	2.1	64.00

BAM Biodiversity Credit Report (Variations)

Haematopus longirostris / Pied Oystercatcher	920_Plot3_Nth_GMangrove, 920_Plot1_Sth_GMangrove, 920_Plot2_Sth_RGMangrove	2.1	64.00
Isoodon obesulus obesulus / Southern Brown Bandicoot (eastern)	659_Plot4_Nth_Scrub	0.1	2.00
Potorous tridactylus / Long-nosed Potoroo	659_Plot4_Nth_Scrub	0.1	2.00

Credit Retirement Options Like-for-like options

Cryptostylis hunteriana / Leafless Tongue Orchid	Spp		IBRA region
	Cryptostylis hunteriana /Leafless Tongue Orchid		Any in NSW
	Variation options		
	Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
	Flora	Vulnerable	South East Coastal Ranges, Bateman, Bungonia, East Gippsland Lowlands, Kybayan-Gourock, Monaro and Snowy Mountains. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Haematopus fuliginosus / Sooty Oystercatcher	Spp		IBRA region
	Haematopus fuliginosus /Sooty Oystercatcher		Any in NSW
	Variation options		

BAM Biodiversity Credit Report (Variations)

	Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
	Fauna	Vulnerable	South East Coastal Ranges, Bateman, Bungonia, East Gippsland Lowlands, Kybayan-Gourock, Monaro and Snowy Mountains. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Haematopus longirostris/ Pied Oystercatcher	Spp		IBRA region
	Haematopus longirostris /Pied Oystercatcher		Any in NSW
	Variation options		
	Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
	Fauna	Endangered	South East Coastal Ranges, Bateman, Bungonia, East Gippsland Lowlands, Kybayan-Gourock, Monaro and Snowy Mountains. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

BAM Biodiversity Credit Report (Variations)

Isoodon obesulus obesulus / Southern Brown Bandicoot (eastern)	Spp		IBRA region
	Isoodon obesulus obesulus /Southern Brown Bandicoot (eastern)		Any in NSW
	Variation options		
	Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
	Fauna	Endangered	South East Coastal Ranges, Bateman, Bungonia, East Gippsland Lowlands, Kybeyan-Gourock, Monaro and Snowy Mountains. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Potorous tridactylus / Long-nosed Potoroo	Spp		IBRA region
	Potorous tridactylus /Long-nosed Potoroo		Any in NSW
	Variation options		
	Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

BAM Biodiversity Credit Report (Variations)

	Fauna	Vulnerable	South East Coastal Ranges, Bateman, Bungonia, East Gippsland Lowlands, Kybeyan-Gourock, Monaro and Snowy Mountains. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
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APPENDIX F BAM CALCULATOR REPORTS (PROJECT EIS)

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00012032/BAAS17086/18/00012970	Merimbula airport Project EIS NthSth BDAR V4-1 July22	16/06/2022
Assessor Name	Report Created	BAM Data version *
Gillian Young	09/08/2022	54
Assessor Number	BAM Case Status	Date Finalised
BAAS17086	Locked	To be finalised
Assessment Revision	Assessment Type	BOS entry trigger
9	Part 4 Developments (General)	BOS Threshold: Area clearing threshold

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

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

Zone	Vegetation zone name	TEC name	Current Vegetation integrity score	Change in Vegetation integrity (loss / gain)	Area (ha)	Sensitivity to loss (Justification)	Species sensitivity to gain class	BC Act Listing status	EPBC Act listing status	Biodiversity risk weighting	Potential SAI	Ecosystem credits
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BAM Credit Summary Report

Bangalay - Old-man Banksia open forest on coastal sands, Sydney Basin Bioregion and South East Corner Bioregion												
1	659_Plot6-7-8_NthSthGras	Bangalay Sand Forest of the Sydney Basin and South East Corner bioregions	9	9.0	7.6	PCT Cleared - 50%	High Sensitivity to Gain	Endangered Ecological Community	Not Listed	2.00		0
										Subtotal		0
Estuarine mangrove forest												
2	920_Plot1_Sth_GMangrove	Not a TEC	69.9	69.9	0.27	PCT Cleared - 86%	High Sensitivity to Gain			2.00		9
3	920_Plot2_Sth_RGMangrove	Not a TEC	55	55.0	0.69	PCT Cleared - 86%	High Sensitivity to Gain			2.00		19
										Subtotal		28
Estuarine saltmarsh												
4	1126_Plot5_Nth_Saltmarsh	Not a TEC	75.4	75.4	0.02	PCT Cleared - 56%	High Sensitivity to Gain			1.75		1
										Subtotal		1
										Total		29

Species credits for threatened species

BAM Credit Summary Report

Vegetation zone name	Habitat condition (Vegetation Integrity)	Change in habitat condition	Area (ha)/Count (no. individuals)	Sensitivity to loss (Justification)	Sensitivity to gain (Justification)	BC Act Listing status	EPBC Act listing status	Potential SAI	Species credits
<i>Haematopus fuliginosus / Sooty Oystercatcher (Fauna)</i>									
1126_Plot5_Nth_Saltmarsh	75.4	75.4	0.02			Vulnerable	Not Listed	False	1
920_Plot1_Sth_GMangrove	69.9	69.9	0.27			Vulnerable	Not Listed	False	9
920_Plot2_Sth_RGMangrove	55.0	55.0	0.69			Vulnerable	Not Listed	False	19
								Subtotal	29
<i>Haematopus longirostris / Pied Oystercatcher (Fauna)</i>									
1126_Plot5_Nth_Saltmarsh	75.4	75.4	0.02			Endangered	Not Listed	False	1
920_Plot1_Sth_GMangrove	69.9	69.9	0.27			Endangered	Not Listed	False	9
920_Plot2_Sth_RGMangrove	55.0	55.0	0.69			Endangered	Not Listed	False	19
								Subtotal	29

BAM Candidate Species Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00012032/BAAS17086/18/00012970	Merimbula airport Project EIS NthSth BDAR V4-1 July22	16/06/2022
Assessor Name	Report Created	BAM Data version *
Gillian Young	09/08/2022	54
Assessor Number	Assessment Type	BAM Case Status
BAAS17086	Part 4 Developments (General)	Locked
Assessment Revision	Date Finalised	BOS entry trigger
9	To be finalised	BOS Threshold: Area clearing threshold

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List of Species Requiring Survey

Name	Presence	Survey Months
<i>Distichlis distichophylla</i> Australian Saltgrass	No (surveyed) *Survey months are outside of the months specified in Bionet.	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☒ Oct ☐ Nov ☐ Dec ☒ Survey month outside the specified months?
<i>Galium australe</i> Tangled Bedstraw	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☒ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
<i>Haematopus fuliginosus</i> Sooty Oystercatcher	Yes (assumed present)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?

BAM Candidate Species Report

<i>Haematopus longirostris</i> Pied Oystercatcher	Yes (assumed present)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
<i>Neophema chrysogaster</i> Orange-bellied Parrot	No (surveyed)	☒ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
<i>Pseudanthus ovalifolius</i> Oval-leafed Pseudanthus	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☒ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
<i>Pultenaea pedunculata</i> Matted Bush-pea	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☒ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
<i>Senecio spathulatus</i> Coast Groundsel	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☒ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
<i>Viola cleistogamoides</i> Hidden Violet	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☒ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?

BAM Candidate Species Report

<i>Wilsonia backhousei</i> Narrow-leafed Wilsonia	No (surveyed)	☒ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec
		☐ Survey month outside the specified months?
<i>Wilsonia rotundifolia</i> Round-leafed Wilsonia	No (surveyed)	☒ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☒ Nov ☐ Dec
		☐ Survey month outside the specified months?

Threatened species Manually Added

None added

Threatened species assessed as not on site

Refer to BAR for detailed justification

Common name	Scientific name	Justification in the BAM-C
Barking Owl	Ninox connivens	Refer to BAR
Bar-tailed Godwit (baueri)	Limosa lapponica baueri	Refer to BAR
Beach Stone-curlew	Esacus magnirostris	Species is vagrant
Black-tailed Godwit	Limosa limosa	Refer to BAR
Brush-tailed Phascogale	Phascogale tapoatafa	Refer to BAR
Bush Stone-curlew	Burhinus grallarius	Habitat constraints
Chef's Cap Correa	Correa baeuerlenii	Geographic limitations
Curlew Sandpiper	Calidris ferruginea	Refer to BAR
Eastern Curlew	Numenius madagascariensis	Refer to BAR
Eastern Osprey	Pandion cristatus	Refer to BAR
Eastern Pygmy-possum	Cercartetus nanus	Refer to BAR
Gang-gang Cockatoo	Callocephalon fimbriatum	Refer to BAR
Giant Burrowing Frog	Heleioporus australiacus	Refer to BAR
Glossy Black-Cockatoo	Calyptorhynchus lathami	Refer to BAR

BAM Candidate Species Report

Greater Glider	Petauroides volans	Habitat constraints
Greater Glider population in the Eurobodalla local government area	Petauroides volans - endangered population	Habitat constraints
Green and Golden Bell Frog	Litoria aurea	Refer to BAR
Grey-headed Flying-fox	Pteropus poliocephalus	Refer to BAR
Koala	Phascolarctos cinereus	Refer to BAR
Large Bent-winged Bat	Miniopterus orianae oceanensis	Refer to BAR
Large-eared Pied Bat	Chalinolobus dwyeri	Geographic limitations
Leafless Tongue Orchid	Cryptostylis hunteriana	Habitat degraded
Little Eagle	Hieraaetus morphnoides	Refer to BAR
Little Tern	Sternula albifrons	Refer to BAR
Long-nosed Potoroo	Potorous tridactylus	Refer to BAR
Masked Owl	Tyto novaehollandiae	Refer to BAR
Red Knot	Calidris canutus	Refer to BAR
Regent Honeyeater	Anthochaera phrygia	Refer to BAR
Sanderling	Calidris alba	Refer to BAR
Southern Brown Bandicoot (eastern)	Isodon obesulus obesulus	Habitat constraints
Southern Myotis	Myotis macropus	Refer to BAR
Square Raspwort	Haloragis exalata subsp. exalata	Refer to BAR
Square-tailed Kite	Lophoictinia isura	Refer to BAR
Squirrel Glider	Petaurus norfolcensis	Refer to BAR
Swift Parrot	Lathamus discolor	Refer to BAR
Thick Lip Spider Orchid	Caladenia tessellata	Refer to BAR
White-bellied Sea-Eagle	Haliaeetus leucogaster	Refer to BAR

BAM Predicted Species Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00012032/BAAS17086/18/00012970	Merimbula airport Project EIS NthSth BDAR V4-1 July22	16/06/2022
Assessor Name	Report Created	BAM Data version *
Gillian Young	09/08/2022	54
Assessor Number	Assessment Type	BAM Case Status
BAAS17086	Part 4 Developments (General)	Locked
Assessment Revision	BOS entry trigger	Date Finalised
9	BOS Threshold: Area clearing threshold	To be finalised

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

Threatened species reliably predicted to utilise the site. No surveys are required for these species. Ecosystem credits apply to these species.

Common Name	Scientific Name	Vegetation Types(s)
Australasian Bittern	Botaurus poiciloptilus	920-Estuarine mangrove forest 1126-Estuarine saltmarsh
Barking Owl	Ninox connivens	659-Bangalay - Old-man Banksia open forest on coastal sands, Sydney Basin Bioregion and South East Corner Bioregion
Bar-tailed Godwit (baueri)	Limosa lapponica baueri	920-Estuarine mangrove forest 1126-Estuarine saltmarsh
Beach Stone-curlew	Esacus magnirostris	920-Estuarine mangrove forest
Black Bittern	Ixobrychus flavicollis	920-Estuarine mangrove forest 1126-Estuarine saltmarsh
Black-tailed Godwit	Limosa limosa	920-Estuarine mangrove forest
Curlew Sandpiper	Calidris ferruginea	920-Estuarine mangrove forest
Dusky Woodswallow	Artamus cyanopterus cyanopterus	659-Bangalay - Old-man Banksia open forest on coastal sands, Sydney Basin Bioregion and South East Corner Bioregion 920-Estuarine mangrove forest 1126-Estuarine saltmarsh

BAM Predicted Species Report

Eastern Coastal Free-tailed Bat	Micronomus norfolkensis	659-Bangalay - Old-man Banksia open forest on coastal sands, Sydney Basin Bioregion and South East Corner Bioregion
		920-Estuarine mangrove forest
		1126-Estuarine saltmarsh
Eastern Curlew	Numenius madagascariensis	920-Estuarine mangrove forest
		1126-Estuarine saltmarsh
Eastern Osprey	Pandion cristatus	920-Estuarine mangrove forest
		1126-Estuarine saltmarsh
Greater Broad-nosed Bat	Scoteanax rueppellii	659-Bangalay - Old-man Banksia open forest on coastal sands, Sydney Basin Bioregion and South East Corner Bioregion
		920-Estuarine mangrove forest
		1126-Estuarine saltmarsh
Grey-headed Flying-fox	Pteropus poliocephalus	920-Estuarine mangrove forest
Large Bent-winged Bat	Miniopterus orianae oceanensis	659-Bangalay - Old-man Banksia open forest on coastal sands, Sydney Basin Bioregion and South East Corner Bioregion
		920-Estuarine mangrove forest
		1126-Estuarine saltmarsh
Little Eagle	Hieraaetus morphnoides	659-Bangalay - Old-man Banksia open forest on coastal sands, Sydney Basin Bioregion and South East Corner Bioregion
		920-Estuarine mangrove forest
		1126-Estuarine saltmarsh
Little Tern	Sternula albifrons	920-Estuarine mangrove forest
		1126-Estuarine saltmarsh
Red Knot	Calidris canutus	920-Estuarine mangrove forest
		1126-Estuarine saltmarsh
Spotted Harrier	Circus assimilis	1126-Estuarine saltmarsh
Spotted-tailed Quoll	Dasyurus maculatus	659-Bangalay - Old-man Banksia open forest on coastal sands, Sydney Basin Bioregion and South East Corner Bioregion
		920-Estuarine mangrove forest
Square-tailed Kite	Lophoictinia isura	659-Bangalay - Old-man Banksia open forest on coastal sands, Sydney Basin Bioregion and South East Corner Bioregion

BAM Predicted Species Report

White-bellied Sea-Eagle	Haliaeetus leucogaster	920-Estuarine mangrove forest
		1126-Estuarine saltmarsh
White-fronted Chat	Epthianura albifrons	920-Estuarine mangrove forest
White-throated Needle-tail	Hirundapus caudacutus	659-Bangalay - Old-man Banksia open forest on coastal sands, Sydney Basin Bioregion and South East Corner Bioregion
		920-Estuarine mangrove forest
		1126-Estuarine saltmarsh
Yellow-bellied Sheath-tail-bat	Saccolaimus flaviventris	659-Bangalay - Old-man Banksia open forest on coastal sands, Sydney Basin Bioregion and South East Corner Bioregion
		920-Estuarine mangrove forest

Threatened species Manually Added

None added

Threatened species assessed as not within the vegetation zone(s) for the PCT(s)

Common Name	Scientific Name	Plant Community Type(s)
Beach Stone-curlew	Esacus magnirostris	1126-Estuarine saltmarsh
Black-tailed Godwit	Limosa limosa	1126-Estuarine saltmarsh
Curlew Sandpiper	Calidris ferruginea	1126-Estuarine saltmarsh
Gang-gang Cockatoo	Callocephalon fimbriatum	659-Bangalay - Old-man Banksia open forest on coastal sands, Sydney Basin Bioregion and South East Corner Bioregion
Glossy Black-Cockatoo	Calyptorhynchus lathami	659-Bangalay - Old-man Banksia open forest on coastal sands, Sydney Basin Bioregion and South East Corner Bioregion
Grey-headed Flying-fox	Pteropus poliocephalus	659-Bangalay - Old-man Banksia open forest on coastal sands, Sydney Basin Bioregion and South East Corner Bioregion
		1126-Estuarine saltmarsh
Little Lorikeet	Glossopsitta pusilla	659-Bangalay - Old-man Banksia open forest on coastal sands, Sydney Basin Bioregion and South East Corner Bioregion
Masked Owl	Tyto novaehollandiae	659-Bangalay - Old-man Banksia open forest on coastal sands, Sydney Basin Bioregion and South East Corner Bioregion

BAM Predicted Species Report

Regent Honeyeater	<i>Anthochaera phrygia</i>	659-Bangalay - Old-man Banksia open forest on coastal sands, Sydney Basin Bioregion and South East Corner Bioregion
Sanderling	<i>Calidris alba</i>	1126-Estuarine saltmarsh
Swift Parrot	<i>Lathamus discolor</i>	659-Bangalay - Old-man Banksia open forest on coastal sands, Sydney Basin Bioregion and South East Corner Bioregion
Varied Sittella	<i>Daphoenositta chrysoptera</i>	659-Bangalay - Old-man Banksia open forest on coastal sands, Sydney Basin Bioregion and South East Corner Bioregion
White-fronted Chat	<i>Epthianura albifrons</i>	1126-Estuarine saltmarsh
Yellow-bellied Glider	<i>Petaurus australis</i>	659-Bangalay - Old-man Banksia open forest on coastal sands, Sydney Basin Bioregion and South East Corner Bioregion

Threatened species assessed as not within the vegetation zone(s) for the PCT(s)

Refer to BAR for detailed justification

Common Name	Scientific Name	Justification in the BAM-C
Gang-gang Cockatoo	<i>Callocephalon fimbriatum</i>	Refer to BAR
Glossy Black-Cockatoo	<i>Calyptorhynchus lathami</i>	Refer to BAR
Little Lorikeet	<i>Glossopsitta pusilla</i>	Refer to BAR
Masked Owl	<i>Tyto novaehollandiae</i>	Refer to BAR
Regent Honeyeater	<i>Anthochaera phrygia</i>	Refer to BAR
Sanderling	<i>Calidris alba</i>	Refer to BAR
Swift Parrot	<i>Lathamus discolor</i>	Refer to BAR
Varied Sittella	<i>Daphoenositta chrysoptera</i>	Refer to BAR
Yellow-bellied Glider	<i>Petaurus australis</i>	Refer to BAR

BAM Vegetation Zones Report

Proposal Details

Assessment Id	Assessment name	BAM data last updated *
00012032/BAAS17086/18/00012970	Merimbula airport Project EIS NthSth BDAR V4-1 July22	16/06/2022
Assessor Name	Report Created	BAM Data version *
Gillian Young	09/08/2022	54
Assessor Number	Assessment Type	BAM Case Status
BAAS17086	Part 4 Developments (General)	Locked
Assessment Revision	Date Finalised	BOS entry trigger
9	To be finalised	BOS Threshold: Area clearing threshold

* 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.

Vegetation Zones

#	Name	PCT	Condition	Area	Minimum number of plots	Management zones
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BAM Vegetation Zones Report

1	659_Plot6-7-8_NthSthGras	659-Bangalay - Old-man Banksia open forest on coastal sands, Sydney Basin Bioregion and South East Corner Bioregion	Plot6-7-8_NthSthGras	7.64		
2	920_Plot1_Sth_GM angrove	920-Estuarine mangrove forest	Plot1_Sth_GMangrove	0.27		
3	920_Plot2_Sth_RG Mangrove	920-Estuarine mangrove forest	Plot2_Sth_RGMangrove	0.69		
4	1126_Plot5_Nth_Saltmarsh	1126-Estuarine saltmarsh	Plot5_Nth_Saltmarsh	0.02		

BAM Biodiversity Credit Report (Like for like)

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00012032/BAAS17086/18/00012970	Merimbula airport Project EIS NthSth BDAR V4-1 July22	16/06/2022
Assessor Name	Assessor Number	BAM Data version *
Gillian Young	BAAS17086	54
Proponent Names	Report Created	BAM Case Status
Bega Valley Shire Council, Bega Valley Shire Council	09/08/2022	Locked
Assessment Revision	Assessment Type	Date Finalised
9	Part 4 Developments (General)	To be finalised
BOS entry trigger	* 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.	
BOS Threshold: Area clearing threshold		

Potential Serious and Irreversible Impacts

Name of threatened ecological community	Listing status	Name of Plant Community Type/ID
Nil		
Species		
Nil		

Additional Information for Approval

BAM Biodiversity Credit Report (Like for like)

PCT Outside Ibra Added

None added

PCTs With Customized Benchmarks

PCT

No Changes

Predicted Threatened Species Not On Site

Name

Calidris alba / Sanderling

Calyptorhynchus lathami / Glossy Black-Cockatoo

Lathamus discolor / Swift Parrot

Tyto novaehollandiae / Masked Owl

Anthochaera phrygia / Regent Honeyeater

Callocephalon fimbriatum / Gang-gang Cockatoo

Glossopsitta pusilla / Little Lorikeet

Daphoenositta chrysoptera / Varied Sittella

Petaurus australis / Yellow-bellied Glider

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

BAM Biodiversity Credit Report (Like for like)

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	HBT Cr	No HBT Cr	Total credits to be retired	
659-Bangalay - Old-man Banksia open forest on coastal sands, Sydney Basin Bioregion and South East Corner Bioregion	Bangalay Sand Forest of the Sydney Basin and South East Corner bioregions	7.6	0	0	0	
920-Estuarine mangrove forest	Not a TEC	1.0	0	28	28	
1126-Estuarine saltmarsh	Not a TEC	0.0	0	1	1	
659-Bangalay - Old-man Banksia open forest on coastal sands, Sydney Basin Bioregion and South East Corner Bioregion	Like-for-like credit retirement options					
	Name of offset trading group	Trading group	Zone	HBT	Credits	IBRA region
	Bangalay Sand Forest of the Sydney Basin and South East Corner bioregions This includes PCT's: 659, 1793, 1794	-	659_Plot6-7-8_NthSthGras	No	0	South East Coastal Ranges, Bateman, Bungonia, East Gippsland Lowlands, Kybeyan-Gourock, Monaro and Snowy Mountains. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
920-Estuarine mangrove forest	Like-for-like credit retirement options					
	Class	Trading group	Zone	HBT	Credits	IBRA region

BAM Biodiversity Credit Report (Like for like)

	Mangrove Swamps This includes PCT's: 915, 916, 917, 918, 919, 920	Mangrove Swamps >=70% and <90%	920_Plot1_Sth_ GMangrove	No	9	South East Coastal Ranges, Bateman, Bungonia, East Gippsland Lowlands, Kybayan-Gourock, Monaro and Snowy Mountains. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Mangrove Swamps This includes PCT's: 915, 916, 917, 918, 919, 920	Mangrove Swamps >=70% and <90%	920_Plot2_Sth_ RGMangrove	No	19	South East Coastal Ranges, Bateman, Bungonia, East Gippsland Lowlands, Kybayan-Gourock, Monaro and Snowy Mountains. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
1126-Estuarine saltmarsh	Like-for-like credit retirement options					
	Class	Trading group	Zone	HBT	Credits	IBRA region

BAM Biodiversity Credit Report (Like for like)

	Saltmarshes This includes PCT's: 1125, 1126	Saltmarshes >=50% and <70%	1126_Plot5_Nth h_Saltmarsh	No	1	South East Coastal Ranges, Bateman, Bungonia, East Gippsland Lowlands, Kybeyan-Gourock, Monaro and Snowy Mountains. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Species Credit Summary

Species	Vegetation Zone/s	Area / Count	Credits
Haematopus fuliginosus / Sooty Oystercatcher	1126_Plot5_Nth_Saltmarsh, 920_Plot1_Sth_GMangrove, 920_Plot2_Sth_RGMangrove	1.0	29.00
Haematopus longirostris / Pied Oystercatcher	1126_Plot5_Nth_Saltmarsh, 920_Plot1_Sth_GMangrove, 920_Plot2_Sth_RGMangrove	1.0	29.00

Credit Retirement Options

Like-for-like credit retirement options

Haematopus fuliginosus / Sooty Oystercatcher	Spp	IBRA subregion

BAM Biodiversity Credit Report (Like for like)

	Haematopus fuliginosus / Sooty Oystercatcher	Any in NSW
Haematopus longirostris / Pied Oystercatcher	Spp	IBRA subregion
	Haematopus longirostris / Pied Oystercatcher	Any in NSW

BAM Biodiversity Credit Report (Variations)

Proposal Details

Assessment Id

00012032/BAAS17086/18/00012970

Assessor Name

Gillian Young

Proponent Name(s)

Bega Valley Shire Council, Bega Valley Shire Council

Assessment Revision

9

BOS entry trigger

BOS Threshold: Area clearing threshold

Proposal Name

Merimbula airport Project EIS NthSth BDAR V4-1 July22

Assessor Number

BAAS17086

Report Created

09/08/2022

Assessment Type

Part 4 Developments (General)

BAM data last updated *

16/06/2022

BAM Data version *

54

BAM Case Status

Locked

Date Finalised

To be finalised

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

Potential Serious and Irreversible Impacts

Name of threatened ecological community	Listing status	Name of Plant Community Type/ID
Nil		
Species		
Nil		

Additional Information for Approval

PCT Outside Ibra Added

None added

PCTs With Customized Benchmarks

BAM Biodiversity Credit Report (Variations)

PCT

No Changes

Predicted Threatened Species Not On Site

Name
Calidris alba / Sanderling
Calyptorhynchus lathami / Glossy Black-Cockatoo
Lathamus discolor / Swift Parrot
Tyto novaehollandiae / Masked Owl
Anthochaera phrygia / Regent Honeyeater
Callocephalon fimbriatum / Gang-gang Cockatoo
Glossopsitta pusilla / Little Lorikeet
Daphoenositta chrysoptera / Varied Sittella
Petaurus australis / Yellow-bellied Glider

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

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	HBT Cr	No HBT Cr	Total credits to be retired
659-Bangalay - Old-man Banksia open forest on coastal sands, Sydney Basin Bioregion and South East Corner Bioregion	Bangalay Sand Forest of the Sydney Basin and South East Corner bioregions	7.6	0	0	0.00
920-Estuarine mangrove forest	Not a TEC	1.0	0	28	28.00
1126-Estuarine saltmarsh	Not a TEC	0.0	0	1	1.00

BAM Biodiversity Credit Report (Variations)

659-Bangalay - Old-man Banksia open forest on coastal sands, Sydney Basin Bioregion and South East Corner Bioregion	Like-for-like credit retirement options					
	Class	Trading group	Zone	HBT	Credits	IBRA region
	Bangalay Sand Forest of the Sydney Basin and South East Corner bioregions This includes PCT's: 659, 1793, 1794	-	659_Plot6-7-8_NthSthGras	No	0	South East Coastal Ranges,Bateman, Bungonia, East Gippsland Lowlands, Kybayan-Gourock, Monaro and Snowy Mountains. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options					
920-Estuarine mangrove forest	Formation	Trading group	Zone	HBT	Credits	IBRA region
	Dry Sclerophyll Forests (Shrubby sub-formation)	Tier 3 or higher threat status	659_Plot6-7-8_NthSthGras	No	0	IBRA Region: South East Corner, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Like-for-like credit retirement options					
	Class	Trading group	Zone	HBT	Credits	IBRA region
	Mangrove Swamps This includes PCT's: 915, 916, 917, 918, 919, 920	Mangrove Swamps >=70% and <90%	920_Plot1_Sth_GMangrove	No	9	South East Coastal Ranges,Bateman, Bungonia, East Gippsland Lowlands, Kybayan-Gourock, Monaro and Snowy Mountains. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

BAM Biodiversity Credit Report (Variations)

	Mangrove Swamps This includes PCT's: 915, 916, 917, 918, 919, 920	Mangrove Swamps $\geq 70\%$ and $< 90\%$	920_Plot2_ Sth_RGMan grove	No	19	South East Coastal Ranges, Bateman, Bungonia, East Gippsland Lowlands, Kybayan-Gourock, Monaro and Snowy Mountains. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options					
	Formation	Trading group	Zone	HBT	Credits	IBRA region
	Saline Wetlands	Tier 2 or higher threat status	920_Plot1_ Sth_GMan grove	No	9	IBRA Region: South East Corner, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Saline Wetlands	Tier 2 or higher threat status	920_Plot2_ Sth_RGMan grove	No	19	IBRA Region: South East Corner, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
1126-Estuarine saltmarsh	Like-for-like credit retirement options					
	Class	Trading group	Zone	HBT	Credits	IBRA region

BAM Biodiversity Credit Report (Variations)

	Saltmarshes This includes PCT's: 1125, 1126	Saltmarshes >=50% and <70%	1126_Plot5 _Nth_Saltm arsh	No		1 South East Coastal Ranges,Bateman, Bungonia, East Gippsland Lowlands, Kybeyan-Gourock, Monaro and Snowy Mountains. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Variation options						
	Formation	Trading group	Zone	HBT	Credits	IBRA region
	Saline Wetlands	Tier 3 or higher threat status	1126_Plot5 _Nth_Saltm arsh	No	1	IBRA Region: South East Corner, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Species Credit Summary

Species	Vegetation Zone/s	Area / Count	Credits
Haematopus fuliginosus / Sooty Oystercatcher	1126_Plot5_Nth_Saltmarsh, 920_Plot1_Sth_GMangrove, 920_Plot2_Sth_RGMangrove	1.0	29.00
Haematopus longirostris / Pied Oystercatcher	1126_Plot5_Nth_Saltmarsh, 920_Plot1_Sth_GMangrove, 920_Plot2_Sth_RGMangrove	1.0	29.00

Credit Retirement Options Like-for-like options

Haematopus fuliginosus / Sooty Oystercatcher	Spp	IBRA region
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BAM Biodiversity Credit Report (Variations)

	Haematopus fuliginosus /Sooty Oystercatcher		Any in NSW
	Variation options		
	Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
	Fauna	Vulnerable	South East Coastal Ranges, Bateman, Bungonia, East Gippsland Lowlands, Kybayan-Gourock, Monaro and Snowy Mountains. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Haematopus longirostris / Pied Oystercatcher	Spp		IBRA region
	Haematopus longirostris /Pied Oystercatcher		Any in NSW
	Variation options		
	Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

BAM Biodiversity Credit Report (Variations)

	Fauna	Endangered	South East Coastal Ranges, Bateman, Bungonia, East Gippsland Lowlands, Kybayan-Gourock, Monaro and Snowy Mountains. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
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APPENDIX G WILDLIFE HAZARD MANAGEMENT PLAN



Merimbula Airport Wildlife Hazard Management Plan



Photo: OEH 2017

Prepared by:
Airport Agencies Pty Ltd
September 2017

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Disclaimer

The Merimbula Airport Wildlife Hazard Management Plan (the Plan) is provided for the purpose of information only. The contents of this Plan are for the information of the party to whom it is addressed (the Addressee) and for no other purpose.

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By way of accepting this Plan the Addressee acknowledges that the information contained in the Plan is particular to Merimbula Airport and may not be suitable for use at other airports.

Any inquires should be addressed to Airport Agencies Pty Ltd, 371 Arthur Kaine Dr, Merimbula 2548, NSW.

Authority

This Plan has been prepared in compliance with Section 89 (I) and Schedule 10 of the Civil Aviation Safety Regulations 1988 for licenced Aerodromes and forms part of the Aerodrome Manual for Merimbula Airport.

The organisation responsible for coordinating this Wildlife Hazard Management Plan is Bega Valley Shire Council.

Abbreviations

AAA	Australian Airport Association
AHD	Australian Height Datum
ARO	Airport Reporting Officer
ATSB	Air Transport Safety Board
BVSC	Bega Valley Shire Council
CASA	Civil Aviation Safety Authority
CASR	Civil Aviation Safety Regulations
CTAF	Common Traffic Advisory Frequency
DME	Australian Distance Measuring System
FOD	Foreign Object Debris
GA	General Aviation
MOS	Manual of Standards
NDB	Non Directional Beacon
NOTAM	Notice to Airmen
NPWS	NSW National Parks and Wildlife Service
OEH	NSW Office of the Environment and Heritage
RPT	Regular Public Transport
TACAN	Tactical Air Navigation System
VOR	VHF Omni Directional Radio Range
WHMP	Wildlife Hazard Management Plan

1 Background

1.2 Function

The purpose of this Wildlife Hazard Management Plan (WHMP), is to document and define the risk that wildlife pose to air traffic at the Merimbula Airport and to set objectives and procedures in place for the systematic management of that risk. It aims to support the requirements of Appendix 1 to *Civil Aviation Safety Regulations* (CASR 1998), subparagraph 139.095(a) (ii) in relation to the content of the Aerodrome Manual.

It also aims to fulfil the requirements of Manual of Standards (MOS) Part 139, Section 10.14.12: “10.14.1.2 Where regular monitoring confirms existence of a bird or animal hazard to aircraft operations, or when The Civil Aviation Safety Authority (CASA) so directs, the aerodrome operator must produce a bird or animal hazard management plan, which would be included as part of the Aerodrome Manual.”

1.3 Policy

Merimbula Airport is committed to ensuring the safety of aircraft using the aerodrome. While the safety of aircraft at Merimbula Airport is paramount, it is not possible to prevent all wildlife strikes. The WHMP aims to reduce the frequency and severity of strikes by focusing management efforts on species and habitats that constitute significant hazards to aircraft that operate at Merimbula Airport.

1.4 Goals and Objectives

The goal of this WHMP is to protect passengers, flight crews, aircraft and operational capability by reducing the frequency of collisions between aircraft and wildlife on and in the vicinity of the aerodrome.

The objectives of the WHMP are to:

- Reduce infringements of critical airspace by high and moderate risk wildlife species.
- Ensure compliance with all relevant airport operational and environmental legislation and regulations.
- Ensure that adequate systems are in place to define roles, responsibilities and procedures for managing wildlife risks at Merimbula Airport.
- Define the methods by which wildlife hazards are managed at Merimbula Airport.

1.5 The Airport

Merimbula Airport is situated in the coastal town of Merimbula, in southern New South Wales. A description of the airport is provided in **Table 1** below.

Table 1. Merimbula Airport: general information.

	Description
Airport location	Merimbula Airport (149°55'E, 36°55'S) is situated 1 km south of the town of Merimbula, on a coastal flat between Merimbula Lake and the Pacific Ocean.
Surrounding land use(s)/geography	The Airport is bounded to the north by residential development and the town of Merimbula. The areas to the west and the south consist of fringing mangrove, tidal saltmarsh, freshwater wetlands and the Merimbula Lake. Further to the south are areas zoned for industrial use (Water Treatment Plant) and the Pambula Merimbula Golf Club. The airport is bounded by Arthur Kaine Drive to the east and coastal forest/woodland (approx. 500 m wide) across which lies Merimbula Beach and the Pacific Ocean. The Merimbula Lake lake fauna is diverse and abundant, and includes most popular estuarine recreational fish species. Merimbula is a regionally important tourist and oyster aquaculture centre. Recreational activities are centred around the lake entrance area, the town centre and sheltered estuary beaches.
Elevation	The airport is low lying with levels ranging from 1.0 m to 4.5 m above sea level.
Airport ownership	Merimbula Airport is owned by Bega Valley Shire Council.
Airport operator	Bega Valley Shire Council.
Traffic profile	Regular Public Transport (RPT) operators include Regional Express with daily services to Sydney, Melbourne and Moruya using SAAB 340 aircrafts, and Free Spirit Airlines with a service to Melbourne that operates on a variable schedules. The airport also supports the operations of General Aviation (GA) aircraft, including Air Ambulance, the Rural Fire Service, the Australian Defense Force, state agencies, freight and Charter operators, as well as local and visiting private recreational pilots. A total of approximately 9,000 aircraft movements was recorded in 2016, including both RPT and GA aircraft.
Runways	The Main Runway 3/21 is 1,602 m long by 30 m wide, and lies within a 1,722 m by 90 m graded strip. The runway is classified as Code 3. The runway was resurfaced in 2015.
Navigation aids	A Non-Directional Beacon (NDB) is located on the airport site to the south of the passenger terminal building adjacent to Arthur Kaine Drive. The DME is co-located with the NDB. Both the NDB and VOR/DME are owned and operated by Airservices Australia.
Communications	Merimbula Airport is an uncontrolled airport which operates without an air traffic control tower. The Airport operates between the hours of 0530 – 2200 hrs EST. CTAF procedures apply outside hours.
Climate	The average temperature varies throughout the year from 24.6°C to 13.7°C in summer to 16.8°C to 4.4°C in winter. The mean annual rainfall is 829mm on an average 62.9 rain days.

2 Wildlife Hazard Assessment

Merimbula Airport has adopted a three-step approach to assessing and reducing the risk posed by wildlife to aircraft:

1. **Hazard identification** – broad assessment of the airport’s hazard profile, including aircraft movements, the habitat and activities that attract wildlife both on and off the airport, the species most observed on and off the airport, and the trends observed in wildlife strikes.
2. **Risk assessment** – a risk assessment based on the information available on wildlife numbers, behaviour, characteristics and/or strikes for each species encountered on and around the airport.
3. **Wildlife Management Plan** – a plan comprising actions for each of the highest risk species, supported by a summary of their relevant characteristics, identified by key airport staff that help the airport reduce the degree of risk and meet its wildlife management goals and objectives.

2.1 Hazard Identification

2.1.1 Aircraft movement and types

Generally, the more aircraft movements at an aerodrome the greater the chances of wildlife strike. Different aircraft have different susceptibility to wildlife strikes. Large turbo fan aircraft tend to fly fast, have a large frontal surface area, have a great sucking power through their engines, rendering them more likely to strike wildlife than propeller driven aircraft. In Australia, Regular Public Transport aircraft are 16 times more likely to report a strike than general aviation aircraft¹. On the other hand, light aircraft are not subject to the same rigorous design standards imposed on commercial jet aircraft. It is therefore important to identify current and projected trends for aircraft movements, as provided in **Table 2** below.

Table 2. Merimbula Airport: approximate aircraft movements in 2016 and 2020 (projected).

Aircraft Category	Aircraft movements (approximately)	
	2016	2020 (projected) ²
RPT	3500	4000
Helicopter	30	40
Military	100	100
General Aviation	5500	7000
Grand Total	9000	11500

¹ ATSB 2008. An analysis of Australian birdstrike occurrences 2002 to 2006.

² BVSC 2016. Merimbula Airport Master Plan 2033.

2.1.2 On airport hazards

Habitats

Habitat types at Merimbula Airport that can be attractive to wildlife are identified in **Figure 1** and include:

- **Grassland**

Grassland is the most extensive habitat on the Merimbula Aerodrome. The 30-50 m grassy verges of the airstrip and lawns around the building complex are maintained by mowing. Primary species are introduced grasses, but native sedges, rushes and some succulents from the adjacent wetlands also occur. Vegetation height varies from 1 to 15 cm. Cover is patchy (generally between 50 and 100%).

The grassland attracts an eclectic group of bird species which exploit this habitat. These include ground feeding parrots such as the Galah (*Cacatua roseicapella*) and Eastern Rosella (*Platycercus elegans*), as well as Australian Magpie (*Gymnorhina tibicen*), Masked Lapwing (*Vanellus milesi*), Richard's Pipit (*Anthus novaezeelandiae*), White-fronted Chat (*Ephthianura albifrons*), Australian Magpie Lark (*Grallina cyanoleuca*) and European Starling (*Sternella vulgaris*). Avian predators hunting for prey in the grassland include the Whistling Kite (*Haliastur sphenurus*), Wedge-tail Eagle (*Aquila audax*), Square-tailed Kite (*Lophoictinia isura*) and Nankeen Kestrel (*Falco cenchroides*).

The mammals observed on the aerodrome include herbivores that feed on the grassland, and their predators. The most common mammal is the Eastern Grey Kangaroo (*Macropus giganteus*). The introduced European Rabbit (*Oryctolagus cuniculus*) and the European Brown Hare (*Lepus europaeus*) occur from time to time. Bandicoot spp. have been observed in wet weather, and a Wombat (*Vombatus ursinus*) has been reported on one occasion. Mammalian predators observed include the introduced Red Fox (*Vulpes vulpes*), feral Dogs (*Canis familiaris*) and feral Cats (*Felis catus*). It is also likely that a variety of small mammals inhabit various grassland habitats, but none constitute an aircraft hazard.

- **Tidal wetland/saltmarsh habitat**

Natural saltmarshes occur around the edges of the grassy verge to the south and west of the runway, where the estuarine mudflats are exposed to intermittent tidal inundation. Mangroves are invading the saltmarsh with small sprouts and shrub-size growth to 1 m.

A small area of artificial wetland, probably brackish in nature, occurs to the south of the building complex and east of the runway verge. Native grasses, forbes, sedges, rushes and succulents comprise the vegetation, which varies from 10 cm to 75 cm in height. Cover is patchy, but generally dense (>80% ground cover) with some open patches (50% cover). The artificial wetland is created by a drainage ditch which runs parallel to the runway from the southern buildings. This drain is up to 1 m in depth and usually contains standing water. It leads directly into Merimbula Lake at the south end of the runway. At the north end of the runway, ephemeral wetlands form in poorly drained areas. There are also at least four constructed watering points at 200 metre intervals to the west of the runway.

As a general rule, birds in search of food, drink, shelter and bathing opportunities are attracted to all airport water features: shorelines, marshes, wetlands, ditches and watering points. At Merimbula Airport, due to the proximity of larger areas of aquatic habitat, water birds and shorebirds (waders) are an especially diverse and abundant group of birds. The Wood Duck

(*Chenonetta jubatta*), Pacific Black Duck (*Anas superciliosus*), and Australian White Ibis (*Threskiornis sancta*) use open water, grass verges and lawns. The White-faced Heron (*Ardea novaehollandiae*) and the White Ibis use waterways and wet grassy habitat for foraging. The Black Swan (*Cygnus atratus*) and the Australian Pelican (*Pelecanus wconspicillatus*) use the open water habitat of Merimbula Lake. Shorebirds such as the Pied Oystercatcher (*Haematopus longirostris*) and the Red-capped Plover (*Charadrius ruficapillus*) use the wetland, grassland and runway habitat commonly.

- **Coastal woodland habitat (South Coast Sand Dry Sclerophyll Forest, Keith 2009)**

Woodland of Blackbutt (*Eucalyptus pilularis*) and Acacia spp. occurs at the northwest end of the runway and at the far south corner of the aerodrome property. Trees are less than 20 m in height and widely spaced. A Blackbutt-Banksia woodland occurs in patches on the dune to the east of the highway.

A diverse group of small, mainly passerine, birds use the woodland and forest habitat. Bell Miners (*Manorina melanophrys*), Red Wattlebirds (*Anthochaera carunculata*) and White-naped Honeyeaters (*Melithreptus lunatus*) are typical species. A variety of arboreal parrots, including Rainbow Lorikeets (*Trichoglossus haematodus*), Crimson Rosella (*Platycercus elegans elegans*), Yellow-tailed Black Cockatoo (*Calyptorhynchus funereus*) and the Swift Parrot (*Lathamus discolor*) have been observed in the forest and woodland habitat at Merimbula Airport.

- **Mangrove and Tea-tree habitat**

Between the saltmarsh and the lake shore, Tea-tree thickets and fringing mangrove forest occur patchily where the vegetation is exposed to tidal inundation in varying degree. Vegetation height is generally between two and three metres. A Tea-tree thicket occurs near the south-east corner of the aerodrome. Mangrove/Tea-tree habitat contains flowering tree species which can attract fruit bats (*Pteropus spp.*). Mangrove/Tea-tree habitat may also be used as nesting habitat for colonial waterbirds such as White Ibis and Cormorant spp.

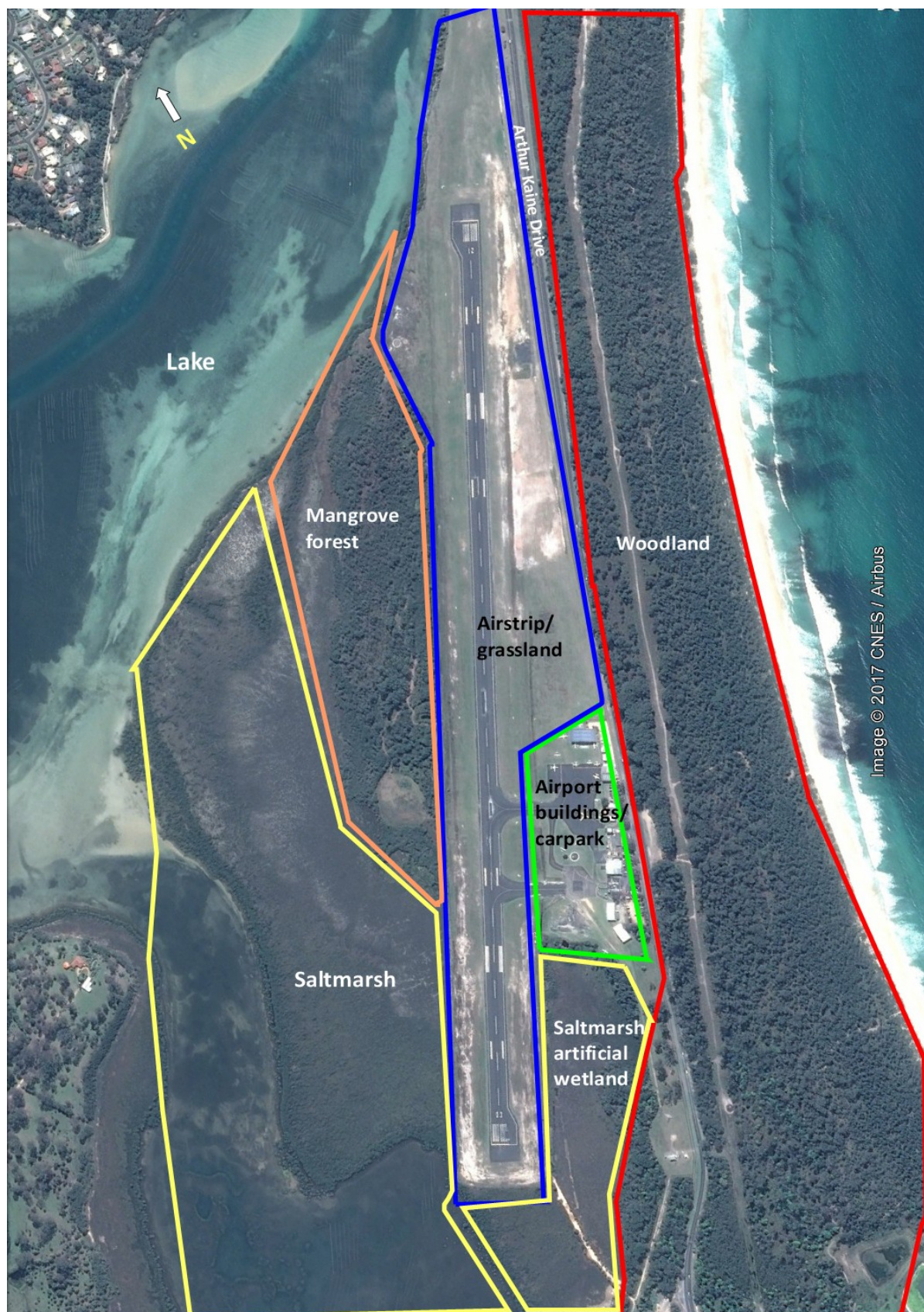
- **Buildings and other various developed habitats**

Various building structures occupying the central-eastern part of the aerodrome (air socks, aerial, pump apparatus, building ledges) provide habitat for perching, roosting and nesting birds. The Welcome Swallow (*Hirundo neoxena*) forages aerially, particularly around buildings where it can find nest sites.

The runway, apron and car-park provide flat surfaces that are attractive to some birds, and retain heat after sunset, which may provides some thermal attraction in cold weather to Wood Ducks (Baker pers. comm.). The aerodrome has a café with outside seating, and scavenging birds (Australian Magpie, Australian Raven and Silver Gull, amongst others) can be attracted by food remains and deliberate feeding.

Birds of prey (raptors) are frequently seen in the airspace above the aerodrome, where they use thermals to gain altitude and apparently also forage. Species observed include Whistling Kite, Wedge-tailed Eagle, White-breasted Sea Eagle (*Haliaeetus leucogaster*) and Square-tailed Kite.

Figure 1. Habitat types at Merimbula Airport that can be attractive to wildlife.



Activities

Activities at Merimbula Airport that can be attractive to wildlife include:

- **Grassland mowing:** Mowing activities attract Whistling Kites in search of potential prey and creates a preferential habitat for Masked Lapwings, the Australian Wood Duck, Australian Magpie, Magpie-Lark, Richard's Pipit, European Starling, White-fronted Chat and ground feeding parrots such as the Galah and Eastern Rosella.
- **Runway Lights:** Runway lights are known to attract insects and insectivorous birds and bats to the runway strip. During rainy periods, frogs are also attracted to the lights by the insects, this in turn attracts nocturnal avian predators, such as the Tawny Frogmouth (*Podargus strigoides*) and Silver Gulls.
- **Waste bins and cafe:** Scavenging birds, including Magpies, Silver Gulls, Australian Raven and White Ibis amongst others can be attracted by food remains and deliberate feeding at the Airport cafe.
- **Reseeding** following runway and taxi way upgrades attract seed-eating birds, including finches, starlings, pigeons and parrots amongst others.
- **Clearing and levelling of sites** for developments which expose soil and cause depressions attract waterbirds (White-fronted Heron, White Ibis) and other birds (Wood duck, Pacific Black Duck amongst others).
- **Stockpiling of soil** exposes invertebrates to birds such as Magpies, Masked Lapwings and White Ibis and provide habitat for fox dens.

Natural Phenomena

Natural phenomena that attract wildlife at Merimbula Airport include:

- **Thermal air currents:** Birds of prey (raptors) are frequently seen in the airspace above the aerodrome, where they use thermals to gain altitude and also forage. Species observed include Wedge-tailed Eagle, White-breasted Sea Eagle, Square-tailed Kite and Whistling Kite.
- **Ponding after rain:** After heavy rains, ponding on the airfield flats may attract waterbirds (White-fronted Heron, White Ibis) and other birds (Wood Duck, Pacific Black Duck amongst others). These ephemeral water bodies attract frogs and invertebrates which, in turn, attract their predators. These avian predators are largely diurnal, and so risk is concentrated during daylight hours.
- **Breeding colonies in the mangrove:** White Ibis and other colonial nesters may use the mangrove fringe as breeding habitat. Such colonies occur elsewhere in mangroves around Merimbula Lake.
- **Nectar-producing vegetation:** The Sugar Gum (*Eucalyptus cladocalyx*) planted along the Arthur Kaine Drive and other nectar producing vegetation on the airport may attract nectar feeding birds, including small to medium sized passerines and parrots. Grey-headed Flying Foxes may also exploit this food source when they are present in the district during the summer months.
- **Termite swarms:** Some species of white ants or termites have a flying reproductive state when swarms emerge from their nest and move about to establish new colonies. These swarms can settle on the runway and provide a prey source for predatory birds. These swarms usually occur in the first warm, moist days of spring but can happen at anytime of year given the appropriate climatic conditions.

- **Outbreaks of African Black Beetles** (*Heteronychus arator*) are uncommon in the area but do occur. In 2001, such an event caused an invasion of many species of ground foraging birds in the district.

2.1.3 Off airport hazards

Habitat types and activities occurring in the vicinity of Merimbula Airport that can be attractive to wildlife are identified in **Figure 2** on p. 15 and include:

Pambula Merimbula Golf Course

The Pambula Merimbula Golf Club occupies approximately 300 ha of land adjacent to and south of the aerodrome. Land tenure is rental from the Airport. Large areas of grassy habitat occur on the golf course; other habitats include woodland, forest, and water features. Large numbers of Grey Kangaroos occupy the golf course (>1000 estimated by groundskeeper in September 2017). Wood Ducks are also abundant on the course. Regular discussions have been held between the airport manager, the golf club directors and the course manager with regard to joint management issues concerning wildlife.

Interviews, inspection and daytime counts were undertaken at the golf course in September 2017. The course manager provided valuable information based on observations and club records. The following details are relevant to this plan:

- There are approximately 2,000 members of the Golf Club.
- The primary purpose of club management and the course is to achieve excellence in standards for golfing.
- The Kangaroo is the mascot and symbol of the club. There is considerable eco-tourism value associated with kangaroos in particular and wildlife in general.
- The Bega Valley Shire Council Water Treatment Plant provides an unlimited supply of nutrient enriched waste water which acts as a constant low grade fertiliser.
- Due to its irrigation regime (daily), the golf course provides excellent habitat for grazing animals.
- Approximately 1000 kangaroos at minimum occupy the golf course on a permanent basis (from day time counts and discussion with the course management).
- Other mammals on the course include the Swamp Wallaby, Red Fox, European Rabbit, European Brown Hare, Echidna (*Tachyglossus aculeatus*), and a suite of small mammal species. The Yellow-bellied Glider (*Petaurus australis*) is also present on the golf course.
- Management and monitoring of kangaroos consists of monthly reports prepared by the course manager to note aggressive behaviour and general status.
- Kangaroos breed year round, have become acclimated to humans, and have no apparent sources of mortality other than old age and car crashes.
- Little information is available on kangaroo movements. No regular movements to the aerodrome have been observed, and it is unlikely that this is the case given current population pressure; the golf course is very good habitat, whilst the aerodrome offers marginal to fair habitat.
- Kangaroos damage the golf course by eating and destroying plantings, “shadow boxing” with trees and golf markers, digging up bunkers and defecating abundantly.
- Wood Ducks breed prolifically on and around the golf course and large numbers are present on

the course seasonally, with populations declining to low numbers two to three times per year.

- Birds associated with aquatic habitat (Australian Coot (*Fulica atra australis*), Purple Swamphen (*Gallinule porphyrio*), White Ibis, White-faced Herons, amongst others) are present near water features, inundated parts of the course, and during particularly wet weather.
- No large birds of prey have been observed regularly on the golf course, but there is an abandoned Wedge-tailed Eagle nest on the course (last occupied in the mid-1980's)
- In spring of 2001, an outbreak of African Black Beetles (*Heteronychus arator*) caused an invasion of many species of ground foraging birds, particularly those listed above. The beetle forms grubs under ground, which are highly attractive to these and other species. Two dry springs in a row are a suspected cause of the beetle outbreak, and contingency plans for future control have been made by the Club.
- Goannas and snakes also occur on the golf course.

Water Treatment Plant

The Merimbula Water Treatment Plant is also adjacent to and south of the airport and the settling ponds provide regular aquatic habitat for birds. Treated water is used to irrigate the golf course, and the nutrient enriched water provides high quality forage for grazing animals. There are approximately 3 ha of open water on the settling ponds, which are frequently used by the Pacific Black Duck and Chestnut Teal (*Anas castanea*), amongst other species. The Treatment Plant grounds, between the aerodrome and the golf course, are used by kangaroos for grazing and shelter. No significant movements of kangaroos between the Treatment Plant and the Airport have been observed.

Merimbula Lake and Wetlands

Merimbula Lake borders the aerodrome property to the west, comprising a shallow tidal lake (to 4 m depth) and the channel of Merimbula Creek. The lake has the following characteristics (OEH 2017):

- Catchment Area: 37.9 km²
- Estuary Area: 5.6 km²
- Average depth: 2.6 m
- Entrance Characteristics: Open and naturally drained along the northern side.
- Estuary Vegetation:

Type	Area (km ²)
Mangroves	0.377
Seagrass	2.297
Saltmarsh	0.629

The estuary habitat provided by the lake and ocean comprise an attractant to a wide range of water birds. Fishing on the lake, with subsequent processing activity on shore, also attracts birds such as the Australian Pelican and the Silver Gull.

Panboola Water Bird Sanctuary

A water bird sanctuary (Panboola) has been established on a former dairy farm approximately 1.5 km from the south end of the airport. Panboola is being rehabilitated with community assistance as a wetland for the purposes of nature conservation, protection and restoration of habitat for birds and other indigenous flora and fauna, and for community education and enjoyment.

Large areas of pasture have been replanted to native vegetation. Fresh water billabongs lead to saline areas within and around the former racecourse, then through saltmarsh and mangroves to the tidal Pambula River and the Ben Boyd National Park beyond.

Panboola provides habitat for the Wood Duck, other ducks seasonally, White Ibis, Egret spp., White-faced Heron, Australian Coot, the Purple Swamphen. Avian predators are common in the bird sanctuary.

Forest habitat

Merimbula Airport occurs within a generally forested environment. State and privately owned forest occupy most of the landscape, and this provides habitat for a variety of terrestrial and arboreal species which may constitute a wildlife hazard. In particular, the forested areas are a perpetual source area for populations of the Eastern Grey Kangaroo.

Directly adjacent to the airport, Blackbutt (*E. pilularis*) forest with an acacia and banksia understorey occurs between the highway and the Pacific Ocean. Canopy height is 25-30 m. A grassy ground layer predominates. A line of eucalyptus (*E. cladocalyx*) lines the highway to the east of the building complex, south to the aerodrome boundary. This forest habitat contains trees and shrubs (*Eucalyptus* spp., *Grevillea* spp., and *Banksia* spp.) which can attract birds and fruit bats. Flowering occurs all through the year. Birds occurring in this forest habitat are predominantly small to medium sized passerines and parrots.

Merimbula Waste and Recycling Depot

A major Waste and Recycling Depot that services Merimbula, Pambula and Tura Beach is located 1.8 km to the north from the Merimbula Airport. This provides a foraging resource for a variety of birds, in particular the White Ibis, Australian Raven and to a certain extent the Magpie.

Fish cleaning facility

Fish cleaning facilities are well known bird attractants. The Merimbula fish cleaning facility is located on a platform on the Merimbula Lake, approximately 1 km north of the Airport (see **Figure 2**). There is also a possibility for this activity to take place near the boat ramp located at the north end of the runway.

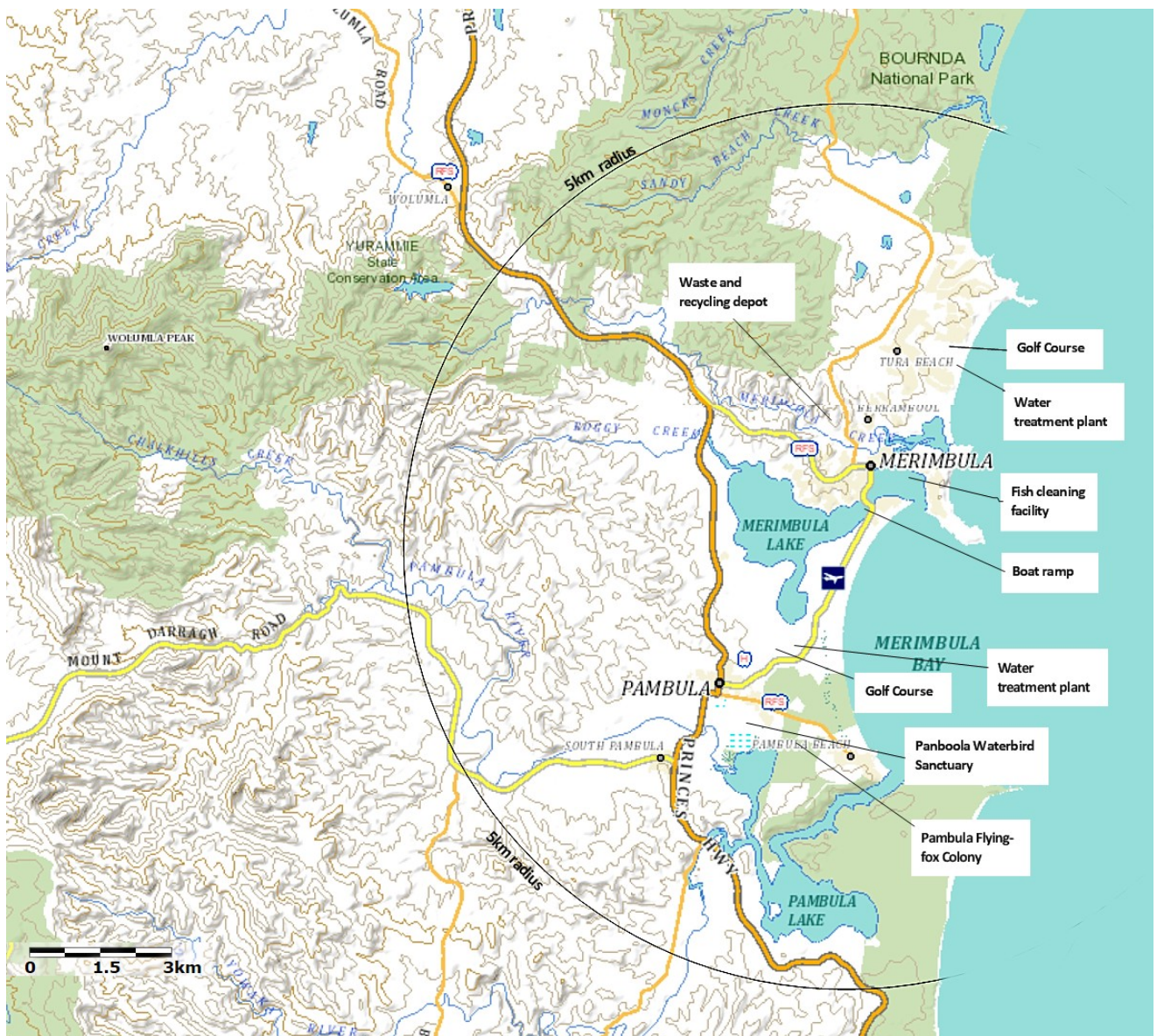
The fishing club at Pambula (2.2 km south east) has a fish processing facility. At present this is not close enough or large enough to pose any direct wildlife hazard.

Grey-headed Flying Fox camps

Flying Foxes occupy several camps in the district, including a major maternity camp in Bega (Glebe Park Lagoon), which is listed as a Nationally Important Camp, and several smaller camps in Bald Hills, Pambula South, Candelo and Chinnock. The risk associated with Grey-headed Flying Foxes is restricted to the periods of the year when the bats are present in the area, generally in response to the flowering of major food plants. The Bega camp, for instance, usually forms in October and increase gradually in size through the spring and summer months, peaking in February (2017).

The Grey-headed Flying Fox are nocturnal, leaving their camps shortly after sunset in search of food. They feed primarily on blossoms and fruit in canopy vegetation, and supplement this diet with leaves. Major food plants include the fruit and blossom of rainforest species, especially *Ficus* spp., and blossoms of myrtaceous species such as *Eucalyptus*, *Corymbia* and *Angophora*, *melaleucas*, *banksias* and *Syzygium* spp. The woodland strip to the east of the airstrip contains many of these food plants, including Swamp Mahogany (*Eucalyptus robusta*).

Figure 2. Off airport hazards



2.1.4 Wildlife strike history

Wildlife strike records are an important source of information for determining the hazards present at airports. The information collected allows an assessment of species struck and trends across years, seasons, months and time of the day.

At Merimbula Airport there has been a total of 18 confirmed strikes and 2 suspected strikes recorded between 2009 and July 2017. For 2016, total strikes reported per 10,000 aircraft movements have been calculated at 1.8, down from 4.5 in 2015. Damaging strikes to aircraft result in costs to operators, and potentially compromise safety. Therefore these are the most important strikes to prevent. A summary of annual strike trends is given in **Table 3**, a more detailed analysis of strike data in **Table 4**, and charts showing strike trends are provided below.

Table 3. Merimbula Airport: annual wildlife strike trend summary 2009 – July 2017.

Year	Total No. Strikes	No. Strikes / 10,000 aircraft movements	Species
2017	3	2.7	Whistling Kite, House Sparrow, unknown
2016	2	1.8	Whistling Kite both strike events
2015	5	4.5	Whistling Kite, Wood Duck, Masked Lapwing, Pied Oystercatcher, unknown
2014	1	0.9	Silver Gull
2013	5	4.5	Masked Lapwing, Wood Duck, House Sparrow, Crimson Rosella, unknown
2012	0	0	
2011	0	0	
2010	1	0.9	Masked Lapwing
2009	1	0.9	Masked Lapwing

Table 4. Merimbula Airport: detailed wildlife strike analysis summary for 2015-2016.

Species	Total no. strikes in 2015-16	No. strikes / 10,000 aircraft movements 2015-16	Annual strike trend 2009-17	When/where strikes mostly occur		
				Month/season	Time(s) of day	Location on airport
Whistling Kite	3	2.7	Increasing	January, May, June	8am and 11.30am	Approaches and touch down areas
Wood Duck	1	0.9	No change	January/summer	9.15pm, dusk	Runway – touch down area
Masked Lapwing	1	0.9	No change	August/winter	3.55pm	Runway – touch down area
Pied Oystercatcher	1	0.9	No change	November/summer	1.40pm	Runway – touch down area
Wood Duck	1	0.9	No change	January/summer	9.15pm, after dark	Runway – after landing
Unknown	1	0.9	No change	December/summer	9pm, after dark	Runway – touch down area

Figure 3. Merimbula Airport: total no of strikes 2009 – July 2017.

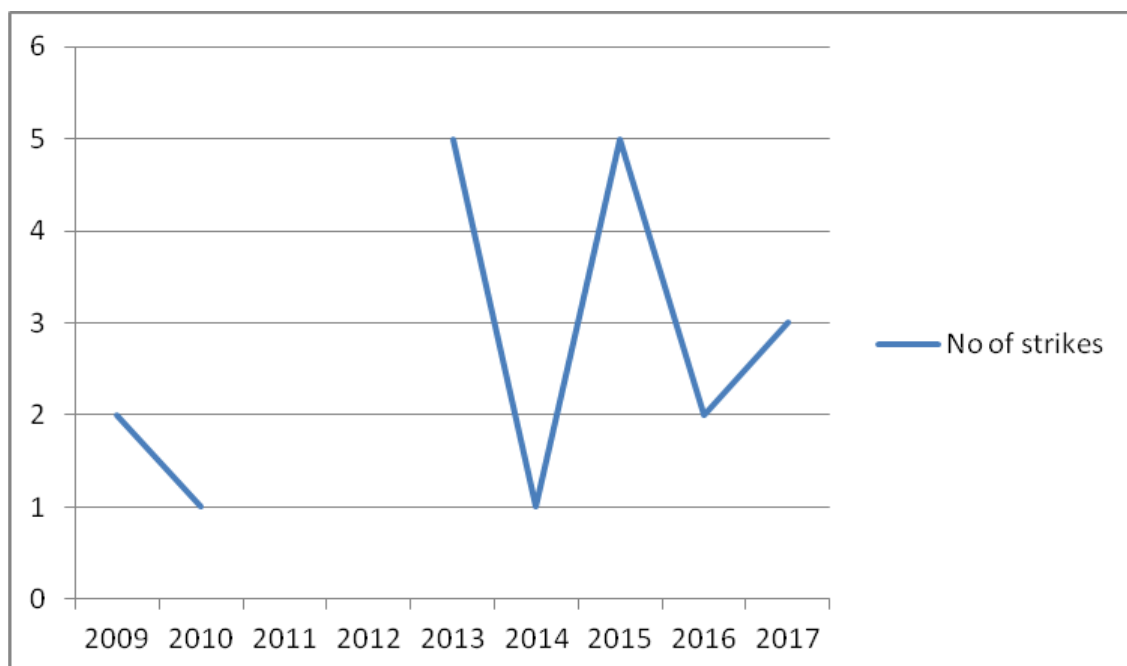
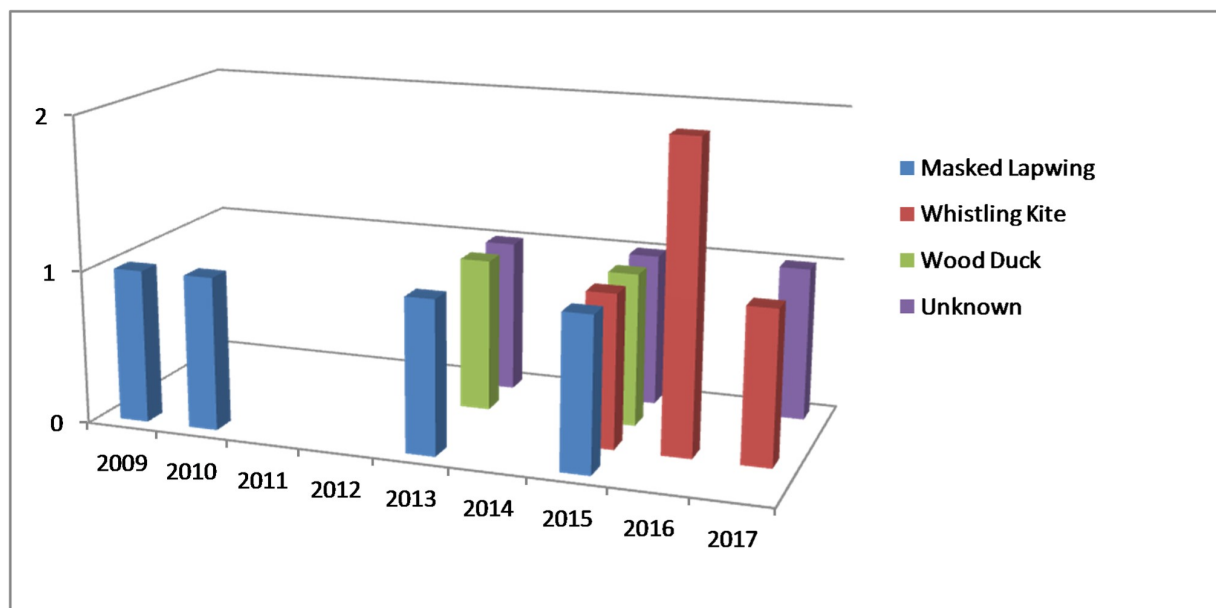


Figure 4. Merimbula Airport: strike trends for most commonly struck birds (2009 – July 2017).



2.2 Ranking Species by Risk

The risk assessment model described by Paton (2010) was adopted to develop a risk ranking of species for Merimbula Airport (see **Table 5**). The model assesses the probability and consequences of a strike event in relation to a bird species' body mass, flocking characteristics and flight behaviour, and to abundance data collected on or near the Merimbula airport since 2004 (frequency of occurrence, area of occurrence and strike history). Both quantitative and qualitative data of abundances and strikes were used to rank the probability of a species being involved in a strike.

Table 5. Risk ranking of species for Merimbula Airport.

Consequence of a strike	Probability/ Likelihood of a strike			
	VERY HIGH	HIGH	MODERATE	LOW
EXTREME		Galah	Australian White Ibis Red Fox Eastern Grey Kangaroo Black Swan Australian Pelican Pacific Black Duck	Swamp Wallaby Silver Gull [#] Feral Dog Grey-headed Flying Fox
VERY HIGH	Masked Lapwing [#] Wood Duck [#]			Wedge-tail Eagle White Bellied Sea Eagle Great Cormorant Glossy Black Cockatoo Gang Gang Cockatoo Feral Cat
HIGH	Australian Magpie Whistling Kite [*]		Common Starling Peewee/Magpie Lark	Square Tailed Kite Pacific Golden Plover Crimson Rosella [#]
MODERATE	Yellow-tailed Black Cockatoo Pied Oystercatcher [#]		Rainbow Lorikeet	Unidentified raptor Peregrine Falcon Brown Falcon Laughing Kookaburra Great Egret House Sparrow [#] Crested Pigeon Nankeen Kestrel
LOW		Australian Raven White-faced Heron Welcome Swallow		Sand Piper Red Capped Plover Little Wattlebird Hooded Plover Common Bronzewing Pigeon
VERY LOW	Richard's Pipit		Willy Wagtail	White Fronted Chat Red Browed Finch Grey Fantail

[#] indicates the species was involved in strikes.

^{*} indicates the species was involved in multiple strikes and was moved up one probability category (High to Very High)

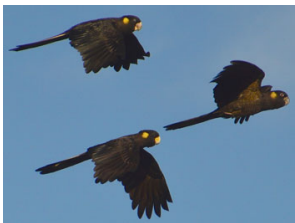
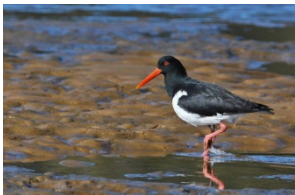
High risk:	Immediate action required to reduce the current risk.
Moderate risk:	Review current management practices and options for additional action required.
Low risk:	Review current management practices and options for additional action required.
Very low risk:	No further action beyond current management is required.

2.3 Wildlife Hazard Management Plan

Table 6 below presents a summary of the species that were ranked as High, Moderate and Low risk species at Merimbula Airport in the risk assessment in Table 5. The summary contains an overview of the key hazard information from Section 2.1. and management actions proposed for each species.

Table 6. Risk summary of species for Merimbula Airport

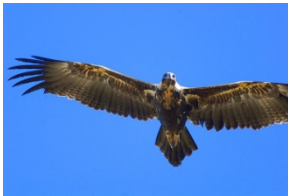
Rank	Species	Description	Habitat/Diet	Strike history	Management actions
1. High Risk	Australian Wood Duck 	Size range: 44-50 cm Description: Dark brown head and mottled breast (M). White stripes above and below the eye and mottled underparts (F). Behaviour: Forages mostly on land. Flocks of 10-20 common. Perch on logs and in trees. Nest: Tree hollows.	Habitat: Grasslands, open woodlands, wetlands, flooded pastures, urban parks Diet: Grasses, grains, clover and other herbs, occasionally insects.	Very common in the district. Large breeding population on the Golf Course and Water Treatment Plant. Strikes last 5 years: 2 Strikes last 12 months: 1 Increasing or decreasing risk: No change	Short term: - Changes to grass heights - Use of harassment methods to keep birds out of the flight strip Long term: Off airport mgt coordinated w stakeholders to manage breeding population. - Maintain efficient drainage of flight strip and airfield
2. High Risk	Masked Lapwing 	Size range: 33-38 cm Description: White breast, brown wings and back, black crown. Yellow wattles covering the face. Behaviour: Normally seen feeding in pairs or family groups. Nest: A simple scrape in the ground away from ground cover, often in exposed locations. Aggressive defence of nesting site and chicks.	Habitat: Grasslands, marshes, mudflats, beaches, urban parks. Diet: Insects and their larvae, earth-worms. Most food is obtained from just below the ground surface.	Constant presence on airport. At least two resident breeding pairs. Strikes last 5 years: 2 Strikes last 12 months: 1 Increasing or decreasing risk: No change	- Changes to grass heights - Use of harassment methods to keep birds out of the flight strip - Removal of eggs
3. High Risk	Whistling Kite 	Size range: 50-60 cm Description: light brown head and underparts, with pale streaks, and dark sandy-brown wings with paler undersides. Behaviour: Soars in a lazy circling flight pattern to search for prey. Nest: Prefers tall trees for nesting.	Habitat: Woodlands, open country and particularly wetlands. Also common where carrion (dead animals) can be found (e.g. road sides, rubbish dumps). Diet: Varied diet, taking small mammals, birds, fish, reptiles, amphibians, crustaceans, insects and carrion. Most food items are taken either from the ground or from the water surface, though insects are sometimes hawked from the air.	Common in the district and frequently seen hunting near and on the airfield. Strikes last 5 years: 4 Strikes last 12 months: 3 Increasing or decreasing risk: Increasing	Short term: - Removal of road kill along Arthur Kaine Drive - Changes to grass heights - Use of harassment methods to keep birds out of the flight strip Long term: Better understanding of why these birds are attracted to the airfield.

Rank	Species	Description	Habitat/Diet	Strike history	Management actions
4. High Risk	Galah 	Size range: 35-36 cm Description: Rose-pink head, neck and underparts, pale-pink crown, grey back, wings and under tail. Behaviour: Noisy fast flocks, bouncing acrobatic flight. Shelter during the day in trees and shrubs. Huge flocks congregate and roost together at night. Nest: Tree hollow or similar.	Habitat: Prefers a variety of timbered habitats, usually near water. Diet: Varied diet, mostly seeds and grasses, usually feeding on the ground. Flocks may travel long distances in search of favourable feeding grounds.	Frequent visitor in the district. Strikes last 5 years 0 Strikes last 12 months 0 Increasing or decreasing risk: No change	- Changes to grass heights - Use of harassment methods to keep birds out of the flight strip
5. High Risk	Australian Magpie 	Size range: 37-43 cm Description: Black and white. Plumage pattern varies across its range. Nape, upper tail and shoulder are white in males, grey in females. Behaviour: Searches for food on ground. Pairs or trios. Aggressive during breeding season. Nest: Platform of sticks and twigs on outer branches of trees, up to 15 m above ground.	Habitat: Found wherever there is a combination of trees and adjacent open areas. Diet: Invertebrates (earthworms, millipedes, snails, spiders and scorpions), insects and their larvae (cockroaches, ants, beetles, moths and caterpillars).	Constant presence on airstrip, at least two resident breeding pairs. Strikes last 5 years 0 Strikes last 12 months 0 Increasing or decreasing risk: No change	- Changes to grass heights - Use of harassment methods to keep birds out of the flight strip - Reduce perching opportunities, eg w bird spikes
6. Moderate Risk	Yellow-tailed Black Cockatoo 	Size range: 55-65 cm Description: Mostly black plumage. Yellow cheek patch and yellow panels on the tail. Behaviour: Small to large flocks. Deep, slow wing beats. Make long journeys flying at a considerable height while calling to each other. Pairs, trios comprising a pair and their young, or small groups. Nest: Large tree hollow.	Habitat: Occurs in a variety of habitat types, but favours eucalypt woodland and pine plantations. Diet: Seeds of native trees and pine cones. Also feed on the seeds of ground plants. Some insects also eaten.	Uncommon visitor on airstrip. Common in the district. Strikes last 5 years 0 Strikes last 12 months 0 Increasing or decreasing risk: No change	- Changes to grass heights - Use of harassment methods to keep birds out of the flight strip
7. Moderate Risk	Pied Oystercatcher 	Size range: 50 cm Description: Black with a white breast and belly. Bright orange-red bill, eye-rings and legs and a red eye. Behaviour: Searches for food on the ground, usually in pairs. Fast flight. Nest: Shallow scrapes made in open areas near the shore.	Habitat: Mudflats, sandbanks and sandy ocean beaches. Occasionally found in estuarine mudflats and short pasture. Diet: Feed on bivalve molluscs. Food is found by sight, or by probing in the mud.	Uncommon visitor on airstrip. Common in the district. Strikes last 5 years 1 Strikes last 12 months 1 Increasing or decreasing risk: No change	Short term: - Changes to grass heights - Use of harassment methods to keep birds out of the flight strip Long term: Maintain efficient drainage of flight strip and airfield.

Rank	Species	Description	Habitat/Diet	Strike history	Management actions
8. Moderate Risk	Australian White Ibis 	<i>Size range:</i> 69-76 cm <i>Description:</i> Bald black head and neck and a long curved beak. <i>Behaviour:</i> Searches for food on the ground. Usually in groups. <i>Nest:</i> Nest in large colonies (often with other water birds, incl. herons, great egrets, spoonbills or cormorants) generally near a body of water such as river, swamp or lake.	<i>Habitat:</i> Swamps, lagoons, floodplains and grasslands. Also successful inhabitant of urban parks and gardens. <i>Diet:</i> Terrestrial and aquatic invertebrates, particularly crayfish and mussels, and human scraps.	Common in the district. Strikes last 5 years 0 Strikes last 12 months 0 Increasing or decreasing risk: No change	Short term: - Changes to grass heights - Use of harassment methods to keep birds out of the flight strip Long term: Off airport mgt coordinated w stakeholders mgt breeding pop and reduce food supply. - Maintain efficient drainage of flight strip and airfield
9. Moderate Risk	Red Fox 	<i>Size range:</i> 2.2 – 14 kg <i>Behaviour:</i> Most active at dusk and dawn. Stable home ranges within particular areas or itinerant with no fixed abode. <i>Den:</i> Dug in steep banks of water bodies, ditches, depressions, gutters, in rock clefts and neglected human environments. Reproduce once a year, litter size up to six cubs.	<i>Habitat:</i> Forests and grasslands, adapt well to human environments. <i>Diet:</i> Omnivorous opportunist, scavenger. Highly varied diet. Small mammals, birds, reptiles, insects, invertebrates, fruit and berries, human waste.	Breeding pair observed north of airport. Gain access to airfield occasionally. Strikes last 5 years 0 Strikes last 12 months 0 Increasing or decreasing risk. No change	Short term: - Removal of road kill along Arthur Kaine Drive Long term: Off airport management coordinated w stakeholders to manage breeding population and reduce food supply.
10. Moderate Risk	Eastern Grey Kangaroo 	<i>Size range:</i> Males up to 60kg <i>Description:</i> Grey in colour, larger than the swamp wallaby. <i>Behaviour:</i> Most active at dusk and dawn. Rest in the shade during the day. Occur in groups.	<i>Habitat:</i> Grasslands, forests, adapt well to human habitation. Large population resident at the Merimbula/Pambula Golf Course. <i>Diet:</i> Herbivorous, favouring grasses but will eat a range of plants, including in some cases, fungi.	Very common in the district, large breeding population on the Golf Course. Gain access to airfield occasionally. Strikes last 5 years 0 Strikes last 12 months 0 Increasing or decreasing risk. No change	Short term: - Maintenance of fencing - Removal of individuals as required Long term: Off airport management coordinated through stakeholder meetings to manage breeding population at Golf Course.
11. Moderate Risk	Black Swan 	<i>Size range:</i> 120-140 cm <i>Description:</i> Mostly black, white wing tip visible in flight, red beak. <i>Behaviour:</i> pairs or small colonies feed in shallow wetlands. Common on the Merimbula Lake. <i>Nest:</i> placed either on a small island or floated in deeper water.	<i>Habitat:</i> Prefers larger salt, brackish or fresh waterways and permanent wetlands, requiring 40 m or more of clear water to take off. <i>Diet:</i> Algae and weeds, obtained by plunging the neck into water up to 1 m deep. Will occasionally graze on land.	Very common in the district. Common in the Merimbula Lake, west and north of the airport. Strikes last 5 years 0 Strikes last 12 months 0 Increasing or decreasing risk: No change	- Changes to grass heights - Use of harassment methods to keep birds out of the flight strip

Rank	Species	Description	Habitat/Diet	Strike history	Management actions
12. Moderate Risk	Australian Pelican 	Size range: 152-188 cm Description: White body, black wingtips. Behaviour: Plunge-dives while swimming on the surface of the water to feed. Work in groups to drive fish to shallower water, where they snatch their prey. May beg for hand-outs from humans. Roost on mudflats, sandbars, beaches, reefs, jetties. Nest: After rainfall in inland areas.	Habitat: Occurs primarily in larger expanses of open water without dense aquatic vegetation, including rivers, estuaries and swamps. Diet: Predominantly fish, but also insects and aquatic crustaceans and other birds. May beg for hand-outs from humans.	Common in the district. Presence in the lake and occasionally seen flying near the airstrip. Strikes last 5 years: 0 Strikes last 12 months: 0 Increasing or decreasing risk: No change	Short term: - Use of harassment methods to keep birds out of the flight strip Long term: - Maintain efficient drainage of flight strip and airfield - Off airport management coordinated with stakeholders
13. Moderate Risk	Pacific Black Duck 	Size range: 50–60 cm Description: Dark body, paler head with a dark crown and facial stripes. Green speculum and pale underwing shown in flight. All plumages are similar. Behaviour: Dabbling duck, feeds primarily on the surface of the water or by tipping headfirst into the water. Pairs or small flocks. Mixes with other ducks. Nest: Hidden in tall grass or rushes.	Habitat: Frequents all types of water, forest pools to tidal mudflats. Diet: Seeds of aquatic plants, small crustaceans, molluscs and aquatic insects.	Strikes last 5 years: 0 Strikes last 12 months: 0 Increasing or decreasing risk: No change	Short term: - Use of harassment methods to keep birds out of the flight strip Long term: - Maintain efficient drainage of flight strip and airfield
9. Moderate risk	Common Starling 	Size range: 50–60 cm Description: Black with purple and green shine, white spots on tips of the body feathers. Behaviour: Often seen searching for seeds and insects on grass fields and lawns, mainly on the ground and often in vast flocks. Nest: Any type of hollow, incl. tree hollows and house roof voids.	Habitat: Frequents all types of water, forest pools to tidal mudflats. Diet: Seeds and insects on lawns and in grass fields. Other food includes spiders, worms, human scraps and fruit crops.	Strikes last 5 years: 0 Strikes last 12 months: 0 Increasing or decreasing risk: No change	- Changes to grass heights - Use of harassment methods to keep birds out of the flight strip
10. Moderate risk	Peewee/Magpie Lark 	Size range: 20-22 cm Description: Black and white, white beak. Behaviour: Mostly ground-dwelling. Usually seen foraging on the ground. Solitary or pairs. Nest: Bowl-shaped mudnest on a horizontal branch, often up to 20 m above the ground.	Habitat: Frequents almost any habitat including urban areas, except rainforests and dry deserts. Diet: Insects and their larvae, earthworms and freshwater invertebrates.	Strikes last 5 years: 0 Strikes last 12 months: 0 Increasing or decreasing risk: No change	- Changes to grass heights - Use of harassment methods to keep birds out of the flight strip

Rank	Species	Description	Habitat/Diet	Strike history	Management actions
11. Moderate risk	Rainbow Lorikeet 	<i>Size range:</i> 28-32 cm <i>Description:</i> Distinctive, colourful plumage, bright red beak. <i>Behaviour:</i> High energy small parrot, often seen in loud and fast-moving flocks, feeding on flowers of shrubs, or in communal roosts at dusk. <i>Nest:</i> Usually in tree hollow.	<i>Habitat:</i> Found in a wide range of habitats incl. urban areas. Largely sedentary with some nomadic movements in response to seasonal flowering or fruiting of plants. <i>Diet:</i> Nectar and pollen, fruits, seeds and some insects.	<i>Strikes last 5 years:</i> 0 <i>Strikes last 12 months:</i> 0 <i>Increasing or decreasing risk:</i> No change	- Manage food source on airport and in vicinity of airport
12. Low risk	Australian Raven 	<i>Size range:</i> 46-53 cm <i>Description:</i> Black plumage, white eyes. <i>Behaviour:</i> Usually seen in pairs or small flocks. <i>Nest:</i> Bowl-shaped structure of sticks sited high in a tree, or occasionally man-made structure.	<i>Habitat:</i> Found in all habitat types. Common in urban areas. <i>Diet:</i> Omnivorous and opportunistic. Mainly carnivorous, but also eats grains, fruits, insects, small animals, eggs, refuse and carrion.	<i>Strikes last 5 years:</i> 0 <i>Strikes last 12 months:</i> 0 <i>Increasing or decreasing risk:</i> No change	- Manage food sources on airport and in vicinity of airport
13. Low risk	White-faced Heron 	<i>Size range:</i> 60-70 cm <i>Description:</i> Light blue-grey in colour, white face <i>Behaviour:</i> Hunting for food by stalking prey, searching among damp crevices or simply standing in the water and watching for movement. Slow, bouncing flight. Usually solitary. <i>Nest:</i> Untidy shallow bowl, made of sticks, usually placed on a leafy branch 5–12 m high.	<i>Habitat:</i> Anywhere where there is water, from tidal mudflats and coastal reefs to moist grasslands and gardens. <i>Diet:</i> Wide variety of prey, including fish, insects and amphibians.	<i>Strikes last 5 years:</i> 0 <i>Strikes last 12 months:</i> 0 <i>Increasing or decreasing risk:</i> No change	<i>Short term:</i> - Changes to grass heights - Use of harassment methods to keep birds out of the flight strip. <i>Long term:</i> - Maintain efficient drainage of flight strip and airfield
14. Low risk	Welcome Swallow 	<i>Size range:</i> 15 cm <i>Description:</i> Metallic blue-black above, light grey below, rust on the forehead, throat and upper breast, forked tail. <i>Behaviour:</i> Busy bird, catching prey on the wing. Feeds in groups and large flocks. <i>Nest:</i> Open cup of mud and grass, attached to a suitable structure, such as a vertical rock wall or building. Readily breeds close to human habitation.	<i>Habitat:</i> Wide variety of habitats, except for dense forest. <i>Diet:</i> Insects caught on the wing.	<i>Strikes last 5 years:</i> 0 <i>Strikes last 12 months:</i> 0 <i>Increasing or decreasing risk:</i> No change	- Reduce perching and nesting opportunities, eg with bird spikes

Rank	Species	Description	Habitat/Diet	Strike history	Management actions
15. Low risk	Grey Headed Flying Fox 	Size range: 1m wingspan, approx 2kg Description: dark-grey body with a light-grey head and a reddish-brown neck collar of fur. Behaviour: Nocturnal. Leaves the roost at dusk, approx. 20min. after sunset., returns just before sunrise. Travels up to 50 km a night to feed on pollen, nectar and fruit. Usually seen in small groups. Nest: Roosting camps/colonies.	Habitat: Presence correlates with flowering/fruitle events. Diet: Consumes fruit, flowers, nectar and pollens of around 187 plant species, including Eucalyptus, (particularly Eucalyptus gummifera, Eucalyptus muellerana, Eucalyptus globoidea and Eucalyptus botryoides) and fruits from a wide range of rainforest trees, including members of the Ficus genus.	Risk tends to correlate with seasonal migrations. Local camps in Bega, Pambula, Candelo, Chinnock. Occupied mostly in the summer months, peaking in February. Strikes last 5 years: 0 Strikes last 12 months: 0 Increasing or decreasing risk: No change	Short term: Proactive management – when known presence in district, encourage airlines to avoid activity during the key risk period just after sunset. Long term: Coordination with Friends of Glebe Wetlands and Panboola Wetlands to monitor the presence of GHFF at the two colonies.
16. Low risk	Swamp Wallaby 	Size range: Males up to 17kg Description: a small macropod marsupial, dark fur. Behaviour: Usually solitary. Prefers thick undergrowth in forests and woodlands, or shelter during the day in thick grass or ferns, emerging at night to feed.	Habitat: Shrubs, forests, adapt well to human habitation.. Diet: Shrubs, pasture, agricultural crops, and native and exotic vegetation. Appears to prefer shrubs and bushes rather than grazing. This is unusual in wallabies and other macropods, which typically prefer grazing.	Strikes last 5 years: 0 Strikes last 12 months: 0 Increasing or decreasing risk: No change	- Maintenance of fencing - Removal of individuals as required
17. Low risk	Feral Dog 	Size range: 10 – 20 kg Behaviour: Most active at dusk and dawn. Either stable home ranges within particular areas or itinerant with no fixed abode. Occasionally gain access to airfield.	Habitat: Forests and grasslands, adapt well to human environments. Diet: Omnivorous opportunist, scavenger. Highly varied diet. Small mammals, birds, reptiles, insects, invertebrates, fruit and berries, human waste.	Occasionally seen on airstrip. Strikes last 5 years: 0 Strikes last 12 months: 0 Increasing or decreasing risk: No change	Short term: - Maintenance of fencing - Removal of individuals as required Long term: Manage food sources on airport and in vicinity of airport.
18. Low risk	Wedge-tailed Eagle 	Size range: 87-105 cm Description: Brown-black body, long wings (wingspan 2.3 m), wedge-shaped tail, feathered legs. Behaviour: Highly aerial, soaring for hours without a wing beat, regularly reaching 1,800 m (5,900 ft) and sometimes higher. Most prey is captured on the ground in gliding attacks or (less often) in the air. Nest: Prefers tall trees for nesting.	Habitat: Prefers wooded and forested land and open country. Common where carrion (dead animals) can be found (e.g. road sides, rubbish dumps). Diet: Carrion, lizards, birds (weighing over 100 g) and mammals (usually weighing over 500 g), particularly rabbits and hares.	Common in the district and frequently seen near the airstrip. Strikes last 5 years: 0 Strikes last 12 months: 0 Increasing or decreasing risk: No change	Short term: - Removal of road kill along Arthur Kaine Drive - Changes to grass heights - Use of harassment methods to keep birds (pray) out of the flight strip Long term: Better understanding of why these birds are attracted to the airfield.

Rank	Species	Description	Habitat/Diet	Strike history	Management actions
19. Low risk	White Bellied Sea Eagle 	Size range: Up to 90 cm Description: Long wings (wingspan 2.2 m), white breast, under wing coverts and tail. Immature birds have brown plumage, gradually replaced by white until the age of six years. The call is a loud goose-like honking. Behaviour: Generally territorial. Feeds alone, in pairs, or in family groups. Nest: Usually in forks of large trees overlooking water.	Habitat: Common on the coast. Generally sedentary and territorial, although it may travel long distances. Diet: Variety of animal prey, incl. carrion, aquatic animals, birds, such as little penguins, coots and shearwaters, and mammals (incl. flying foxes). It often catches fish by flying low over the water and grasping it in its talons.	Common in district and near the airstrip. Strikes last 5 years: 0 Strikes last 12 months: 0 Increasing or decreasing risk: No change	Short term: - Removal of road kill along Arthur Kaine Drive. - Changes to grass heights. - Use of harassment methods to keep birds (prey) out of the flight strip. Long term: Better understanding of why these birds are attracted to the airfield.
20. Low risk	Great Cormorant 	Size range: 70-90 cm Description: almost entirely black in plumage, apart from a white chin. Behaviour: Excellent swimmer. Captures its food in shallow underwater. Dives normally lasting up to one minute. Solitary or in small groups. Nest: stick nest on low tree or ground. Breed in colonies near water.	Habitat: A very common and widespread bird. Feeds on the sea, in estuaries and freshwater lakes and rivers. May travel long distances. Diet: Mainly fish, supplemented in freshwater by crustaceans, various aquatic insects and frogs.	Common in district and near the airstrip. Strikes last 5 years: 0 Strikes last 12 months: 0 Increasing or decreasing risk: No change	Short term: - use of harassment methods to keep birds out of the flight strip Long term: - Maintain efficient drainage of flight strip and airfield
21. Low risk	Glossy Black Cockatoo 	Size range: 45-50 cm Description: The smallest of the black cockatoos. It has a brown-black head, neck and underparts, red or orange-red tail panels and a dull black body. Behaviour: Seen flying with slow wing beats while calling in a subdued voice. Often in trios comprising a pair and their young, or small groups. Nest: In tree hollows.	Habitat: Highly dependent on the distribution of Allocasuarina species. Found in woodland dominated by Allocasuarina and in open forests where it forms a substantial middle layer. Diet: Feeds almost exclusively on Allocasuarina seeds. May also eat wood-boring larvae.	Uncommon visitor on airstrip. Common in the district. Strikes last 5 years: 0 Strikes last 12 months: 0 Increasing or decreasing risk: No change	- Use of harassment methods to keep birds out of the flight strip
22. Low risk	Gang Gang Cockatoo 	Size range: 34-35 cm Description: small grey cockatoo w. wispy crest. Adult male has a red head and crest, rest of body slate-grey. Female all grey. Behaviour: Mainly arboreal. Larger flocks outside the breeding season; other times in small family groups. Nest: In young solid trees, using their beaks to excavate nesting cavities.	Habitat: Tall mountain forests and woodlands w. dense understorey. In winter, lower altitudes and drier, more open forests, incl. roadsides, parks and gardens. Diet: seeds of native and introduced trees and shrubs. Prefers eucalypts, wattles and introduced hawthorns. Also berries, fruits, nuts, insects and larvae.	Uncommon visitor on airstrip. Common in the district. Strikes last 5 years: 0 Strikes last 12 months: 0 Increasing or decreasing risk: No change	- Use of harassment methods to keep birds out of the flight strip

Rank	Species	Description	Habitat/Diet	Strike history	Management actions
23. Low risk	Feral Cat 	Size range: 2 – 5 kg Behaviour: Most active at night. Either stable home ranges within particular areas or itinerant with no fixed abode. Occasionally gain access to airfield.	Habitat: Forests and grasslands, adapt well to human environments. Diet: Carnivore. Hunts live pray. Small mammals, birds, reptiles.	Strikes last 5 years 0 Strikes last 12 months 0 Increasing or decreasing risk: No change	Short term: - Maintenance of fencing - Removal of individuals as required Long term: - Manage food sources on airport and in vicinity of airport
24. Low risk	Square-tailed Kite 	Size range: 50-55 cm Description: White face, sharp cornered, square cut tail. Wings set well forward, with deep fingered outer wing. Tail is twisted in flight. Behaviour: Often seen circling above tree tops. Generally solitary. Nest: Sticks lined with green eucalyptus leaves. Usually nests nearby water.	Habitat: Canopy-dwelling predator. Forested woodlands, well forested urban areas. Diet: Avian prey, part. smaller birds and eggs, and small mammals such as mice, insects, molluscs (snails), and reptiles.	Common in the district and near airstrip. Strikes last 5 years: 0 Strikes last 12 months: 0 Increasing or decreasing risk: No change	- Changes to grass heights
25. Low risk	Pacific Golden Plover 	Size range: 23-26 cm Description: Slender upright shorebird (wader). Golden brown, black flecks. Rounded head, slim neck, short fine black bill and long legs. Behaviour: Searching for food, solitary or in small, loose groups. Nest: Breeds in the Northern Hemisphere.	Habitat: Muddy, rocky and sandy wetlands, shores, grass fields, saltmarsh, coastal golf courses, estuaries and lagoons. Diet: Molluscs, insects, worms, crustaceans, lizards and is known to eat birds' eggs and small fish.	Visitor in district during summer months. Strikes last 5 years: 0 Strikes last 12 months: 0 Increasing or decreasing risk: No change	- Changes to grass heights - Use of harassment methods to keep birds out of the flight strip
26. Low risk	Crimson Rosella 	Size range: 32-36 cm Description: Crimson (red) plumage and bright blue cheeks and wing feathers. Behaviour: Normally seen in small flocks. Nest: Tree hollows or similar, incl.nest boxes.	Habitat: Normally associated with tall eucalypt and wetter forests. Adapted to human habitation. Diet: Forage in trees, bushes, and on the ground for fruit, seeds, nectar, berries, and nuts. Also insects and their larvae.	Common in district and near the airstrip. Strikes last 5 years: 0 Strikes last 12 months: 0 Increasing or decreasing risk: No change	Short term: - Changes to grass heights Long term: - Manage food source on airport and in vicinity of airport

Rank	Species	Description	Habitat/Diet	Strike history	Management actions
27. Low risk	Richard's Pipit 	Size range: 16-18 cm Description: Mainly brown above and pale below. Slender bird which often stands very upright on the ground. Behaviour: Feeds on the ground in a jerky, darting motion, stopping to perch on low stones or shrubs, wagging their tails up and down. Will also make short flights to catch flying insects. Nest: Made of grass or moss and is built on the ground under a grass tussock.	Habitat: Bird of open country, particularly flat lowland areas. Inhabits grassland and cultivated land, preferring more fertile, moist habitats.. Diet: Insectivorous.	Strikes last 5 years: 0 Strikes last 12 months: 0 Increasing or decreasing risk: No change	- Changes to grass heights. - Use of harassment methods to keep birds out of the flight strip

3 Wildlife Management Measures

3.1 Roles and Responsibilities

The Airport Manager will be responsible for the overall coordination, supervision and management of the Wildlife Hazard Management Plan. This includes allocating resources, designating responsibility, coordinating training, and reviewing performance of the WHMP's implementation.

The Airport Manager will be responsible for implementing the WHMP at Merimbula Airport. This includes obtaining permits, providing training, monitoring bird numbers, collating strike data, auditing conformance to the WHMP, and drafting reports for review by senior management.

The development and implementation of a staff training program in the core elements of the WHMP is a regulatory requirement. Furthermore, effective wildlife management is critically dependant on staff with the tools, knowledge and motivation to safely and effectively fulfil the requirements of the Aerodrome Manual.

Table 7. Staff training program

Training Module	Position(s)	Frequency	Method of Training Delivery
General awareness	All Airside Staff	Part of induction or as required	Internal
Regulations and standards	All Airside Staff	Part of induction or as required	Internal
Risk and liability	All Airside Staff	Part of induction or as required	Internal
Ecology and behaviour of key species	All Airside Staff	Part of induction or as required	Training course or one-on-one delivery
Active and passive wildlife management techniques	Airport Safety Officers	As required	Practical/one-on-one
Firearm safety	All licensed staff	As required	Practical/one-on-one
Wildlife census techniques	Airport Safety Officers	As required	Practical/one-on-one
Wildlife database	Airport Safety Officers	As required	Practical/one-on-one
Strike reporting	Airport Safety Officers	As required	Practical/one-on-one
Safety and use of deterrent devices	Airport Safety Officers	As required	Practical/one-on-one

3.2 Wildlife Hazard Reporting

In the event of identified risk on or in the vicinity of the airport steps will be taken to remove, or alternatively advise pilots of the hazard (see **Table 8**).

A bird hazard warning notice is included in the En Route Supplement Australia (ERSA). Where a wildlife hazard is present that cannot be effectively managed by Airport Management, pilots are informed of additional risk levels. Where there is a significant increase in risk the Airport arranges a NOTAM to be issued. The NOTAM must provide specific information on species, period of risk, likely location and flight path.

Table 8. Wildlife hazard reporting

Task	Description	Frequency	Responsible	Procedure/Reference
Reporting hazard (immediate)	Notify pilots of additional risk levels. The Merimbula Airport ARO is also notified.	As required	ARO	N/A
Reporting hazard via NOTAM	Issue NOTAMs where risks are significantly increased.	As required	ARO	N/A

Bird and animal strike reports are essential for understanding and managing risks. Strikes need to be accurately categorised and reported. Strikes are reported regardless of strike confirmation, location or damage. All strike reports are forwarded to the ATSB and also entered into the Merimbula Airport Wildlife Database. The steps in processing and reporting strikes are detailed in **Table 9**.

To assist in identifying the species involved carcasses or remains (feathers or fragments) are collected, where possible, and stored for possible further analysis which may provide information relevant to the wildlife hazard management program.

Table 9. Wildlife strike processing and reporting

Task	Description	Frequency	Responsible	Procedure/Reference
Recording strikes	Record every strike they become aware.	As required	ARO	Strike reporting procedure WHMP-03
Reporting strikes	Forward all reports to ATSB and provide copies to the Merimbula Airport Manager for entry into the strike database.	As required	ARO	Strike reporting procedure WHMP-03
Data management	Maintain electronic records of wildlife strikes and review monthly to assess changes in populations	Ongoing	ARO	N/A
Strike remains	Collect struck remains when possible and store them for annual analysis by the ornithological consultant	As required	ARO	Identification and handling of remains procedure WHMP-04

3.3 Stakeholder Consultation

Stakeholder consultation is important for sharing information, identifying risks and ensuring stakeholders are engaged in collaborative management of the wildlife hazards at the Airport. Merimbula Airport conducts stakeholder meetings on an annual basis. Wildlife issues and management are included in the agenda of these meetings. Relevant on and off airport stakeholders are invited to participate in these meetings. Participants include but are not limited to representative from the following:

- Department of Environment and Heritage
- Bega Valley Shire Council
- National Parks and Wildlife Service
- Merimbula Air Service
- Regional Express (REX)
- Spirit Airlines
- Merimbula Aircraft Maintenance
- Royal Flying Doctor Service
- Other GA operators
- Pambula-Merimbula Golf Club

3.4 Wildlife Management Measures

Strategies for reducing the risk of strikes at Merimbula Airport focus on managing wildlife populations on and surrounding the airport. Management measures, summarised in the sections below, can be classified into the following two categories:

- **Passive management** – modifying habitats or other aspects of the environment to indirectly remove or reduce the number of birds in the risky areas; or
- **Active management** – directly removing or reducing the numbers of birds or animals in the risky areas.

3.4.1 Passive management

Passive management methods employed at Merimbula Airport include:

1. Reduce quality of grassland habitat /grass cutting

The quality of grassland habitat can be kept to a minimum cutting to a height of 15-30 cm. The species and groups which currently use this habitat are, in general, adapted to or prefer short grass (Galah, Australian Wood Duck, Australian Magpie, Magpie-lark, White-fronted Chat, Richard's Pipit). In periods of high rainfall, White Ibis and White-faced Heron use tall grass, but they also use short grass, i.e. the status quo in terms of these two species will be maintained. Grass cutting should be timed to prevent seed-head development.

Alterations to grass cutting height need to be monitored to ensure changes do not increase the risk of a wildlife strike.

2. Reduce waste and prohibit hand feeding

Some species, particularly the Australian Magpie and the Silver Gull, are well adapted to scavenging and 'begging' for food. As a tourist destination, travellers at the Merimbula Airport are sometimes inclined to feed these and other species. Sign posting and public management can be used to deter this activity. Costs include sign construction, erection and maintenance, as well as human resources for public management. Waste storage must be maintained at a high standard.

3. Reduce availability of carrion food source

This recommendation can easily be achieved by removing carcasses from the aerodrome or highway. Costs come from labour.

4. Reduce quality of roosting, loafing, perching and nesting habitat

This management technique aims at removing roosting, loafing and perching habitats from the airport or altering these areas so they no longer appeal to wildlife. In most cases, wildlife shelter—once identified—can be effectively managed through little cost and effort. Within the airport environment, roosting, loafing, perching and nesting habitat can be natural, including shrubs, woodland and perch trees; and artificial, including buildings, hangars, taxiways, parking garages, aircraft movement areas, signs and equipment. The management techniques include:

Trees	– Remove all undergrowth – Thin treetops to make them less attractive as roosting sites – Inspect trees frequently for colonies of nesting birds
Buildings	– Eliminate holes, crevices, roosting ledges and general access to buildings – Block, cover and seal all holes, crevices and drains by using screening, concrete or brickwork – Apply special materials (eg bird spikes) to perches to keep birds away – Slope ledges to eliminate roosting and nesting sites by using boards, plastic sheeting and concrete – Perform routine inspections of all airside buildings and structures
Aircraft movement areas and taxiways	– Carry out inspections and remove all materials that attract birds – Put bird spikes on runway lights, approach lights, taxiway and apron lights to eliminate perching and nesting sites

5. Prevent access/Maintain fencing

The airside fences serve primarily as a security barrier however they also keep out a variety of mammals (native and feral), including macropods, foxes and feral dogs.

6. Remove artificial drains and any temporary ponds or open bodies of water

At present the drainage from the runway is carried in an artificial waterway constructed for this purpose. The standing water in the drain is a constant attractant to known wildlife hazards (Wood Duck, White-faced Heron, Masked Lapwing). This feature is one of the most significant permanent wildlife attractants on the aerodrome. Removal and replacement with an underground (or similar) runway may be expensive but when costs are amortised over several years this may be the least costly means of reducing this known hazard.

At present there is a small risk associated with the artificial watering points to the west of the runway. If these watering points are reopened, they should be fitted with bird repellent wires or other suitable measures.

7. Develop landscaping guidelines

The Airport's landscaping guidelines should include a list of plants recommended for use around the airport grounds which are known to not be attractive to birds and wildlife. New species not listed in the landscaping guidelines can be planted provided it is demonstrated not to have a high nectar yielding flower, attractive fruits or pest plant traits.

The effectiveness of these guidelines is difficult to measure qualitatively; however, appropriate plant and tree selection reduces food and habitat sources available to nectar feeding specialists such as parrots, honeyeaters and Flying Foxes. Potential Food sources for Flying Foxes requires special consideration.

3.4.2 Active management

Active management methods employed at Merimbula Airport include:

1. Remove hazard by direct action (harassment)

Removal by harassment with a vehicle on 'wildlife patrols' or 'runway sweeps' is a well-known method for immediate dispersal of ground dwelling wildlife. This technique is currently used with success to remove White Ibis and White-faced Heron from the airport on a needs basis. Costs involve human resources, fuel, and vehicle running time.

A variety of other techniques could prove effective if there is a requirement to increase the level of hazard reduction from ground dwelling birds. These include laser cannons, pyrotechnics, trained dogs, audio repellents (alarm calls), radio controlled small aircraft, and visual repellents. However, most of these methods are relatively costly and subject to reduced effectiveness over time due to habituation and cost. ***Trained dogs could be an exception and this is the most likely alternative if vehicle harassment becomes ineffective.***

2. Direct intervention (removing eggs, nest destruction)

Habitat quality for some species (Masked Lapwing in particular) can be reduced by direct intervention (removing eggs; nest destruction). This will require a license from the NSW National Parks and Wildlife Service; such licenses are routinely granted for this aggressive and common species. Costs come from human resources at the airport and time spent administering the license procedures with NPWS.

3. Remove immediate hazard from kangaroos by culling individuals posing the risk

This only involves individual animals that pose a clear and/or persistent danger to aircraft operations as indicated by continued presence on the aerodrome or presence during operations. Carcasses are disposed offsite.

This is current practice, and demonstrably feasible. Costs are low (ammunition, human resources, firearms) but administration of licenses is time consuming. Maintaining current practices is essential (licenses, authorities, actions). The current arrangement of monitoring the presence of

kangaroos by on-site observation should be formalised and responsibility delegated appropriately. ***It is important that all dispersal and culling actions and their outcomes are recorded. This provides a historical record for comparison and analysis and may provide evidence of adequate wildlife hazard management in case of litigation.***

4. Reduce source populations of kangaroos

As land management responsibility for the source populations of kangaroos does not reside with Merimbula Airport, this requires a cooperative program with adjacent land managers (Pambula Merimbula Golf Course) and relevant agencies (NPWS, OEH). Culling is an unlikely means of reducing populations in the long term due to social and regulatory factors.

At present, there are populations of kangaroos in the vicinity of the aerodrome which have no apparent biological controls and unlimited foraging resources. As populations increase, the airport will come under more pressure from kangaroo risk. Culling and fencing will be effective for reducing risk in the short term, but long-term population management programs are required to lower risk. Such programs are feasible, using a variety of population control measures, but can be costly and require long term commitments.

5. Monitor mangroves and other suitable habitat for new nesting colonies

Although there are currently no colonies of nesting water birds on or adjacent to the airport, these nesting colonies could be established in the future. Regular monitoring to note the development of nesting colonies near the aerodrome should take place.

6. Monitor access points and natural barriers to the aerodrome

The sand pad on the main access road provides information on kangaroos that may enter the property. The sand pad is also a source of objective data for an ongoing monitoring program for kangaroo movement.

The saltmarsh at the south-west end of the runway is maintained as a natural barrier to kangaroo movement. The wildlife hazard associated (grazing attractant, access) with the artificial wetland to the south east of the runway should be removed by drainage and construction of permanent barriers to movement.

3.4.3 Off-site issues

1. Merimbula Waste and Recycling Depot

The hazard from the food source and roosting habitat provided at the Waste and Recycling Depot north of Merimbula with regard to White Ibis has been reduced due to the fact that this is now operated as a depot and not as open land fill. The old land fill has been covered and does not attract birds to the same degree.

2. Golf Courses (Merimbula and Tura Beach) and Water Treatment Plants (Merimbula and Tura Beach)

The neighbouring Golf Course and Water Treatment Plant host source populations of Wood Ducks which occur infrequently on the airport, but sometimes in high numbers. The Wood Duck is a tolerated but nuisance species on the Golf Course. The control of source populations is a long-term

project and will require further work by all land managers. However, the risk ranking and results of the census indicate that the risk is high and persistent. Workable solutions for reducing the current high risk must be reached.

3. Fish cleaning facility

The decision to locate the floating fish-cleaning platform to the lake area west of Bar Beach, and not next to the boat launching ramp, was a good decision with regards to wildlife hazards on the airport. No significant increase in bird activity has been observed near the Airport as a result of the construction of the facility.

4 Monitoring and Review

4.1 Monitoring

Monitoring is a critically important tool in wildlife management at Merimbula Airport. Effective monitoring provides essential information that assists our staff to adapt the program, as required, to shifts in hazard and level of risk. It also provides evidence of (a) conformance to regulatory and other standards and (b) efficacy of the WHMP in minimizing wildlife strike risk to aviation.

4.1.1 Routine hazard monitoring

Routine detection of hazards in the field is achieved through regular runway and runway strip inspections and during airside wildlife surveillance. Both aspects are important to ensure early detection of wildlife hazards in airside areas, particularly inside runway strips.

The frequency of wildlife monitoring (beyond the activities detailed in **Table 10** below) is a matter of professional judgement by the ARO and depends on wildlife numbers, species composition, weather and aircraft activity at the time.

Table 10. Routine monitoring activities

Task	Description	Frequency	Responsible	Procedure/ Reference
Wildlife patrols (routine)	Conduct airside wildlife management and surveillance patrols	Daily - ongoing	ARO	Wildlife hazard surveillance procedure - WHMP-02
Wildlife patrols (post strike)	Conduct airside wildlife management and surveillance patrols	Daily - ongoing	ARO	Strike reporting procedure - WHMP-03
Wildlife patrols, data management	Record all strikes, management, surveillance and inspection actions in relevant logs and forms	Daily - ongoing	ARO	Wildlife hazard surveillance procedure - WHMP-02 Strike reporting procedure - WHMP-03
Wildlife counts (staff)	Conduct wildlife census	DAILY	ARO	Wildlife count procedure - WHMP-01
Wildlife counts , data management	Maintain electronic records of wildlife counts and review monthly to assess changes in populations	Ongoing	ARO	Wildlife count procedure - WHMP-01

Wildlife management and surveillance patrols are conducted by the ARO daily and following reports of a strike. Standard data is entered into the Merimbula Airport Wildlife Database and includes areas of the airport patrolled, numbers, location and species of birds/wildlife seen, action taken to disperse the birds/wildlife, results of the action. More general information such as the name of the officer on duty, time on and off duty, weather conditions etc are recorded at the start of a duty period.

Wildlife strike data is logged as described in **WHMP-03 Wildlife Strike Reporting**.

Formal standardised wildlife counts are conducted by ARO daily and are used to monitor short term trends in wildlife numbers and hazards. Data is entered into the Merimbula Airport Wildlife Database by the ARO and analysed by an external aviation ecologist/ ornithologist on an annual basis to monitor short to medium term and seasonal trends. Outcomes from the data analysis are used to update individual species risk profiles and, where possible, assess the effectiveness of management actions.

4.1.2 Record keeping

Merimbula Airport recognises the strength of its monitoring program is in good record keeping. Records of the above monitoring activities are kept in relevant logs, spreadsheets and database to provide evidence of management actions and to demonstrate WHMP processes are in place to routinely detect and, where feasible, remove hazards.

All records are legible, accessible and stored in a secure environment that prevents loss or damage.

4.2 Reporting

Routine reporting ensures that all staff and managers are equipped with the information needed to adapt hazard management activities and the WHMP when required. The following regular reports will be generated and distributed to relevant staff by the Airport Manager:

- Minutes of yearly stakeholder meetings
- Updated assessments of risk using updated strike and monitoring data observations

4.3 Review

CASR Sections 139.230(f)(iii) and 139.230 (h)(ii) and MOS Part 139 Section 10.14.1.5 together require the WHMP to be reviewed at least annually. To ensure the Merimbula Airport WHMP remains effective and is updated to fulfil future requirements the following processes have been established.

4.3.1 Annual review

The CASR requirement to review the WHMP at least as part of each technical inspection means that Merimbula Airport is mandated to ensure it is reviewed annually. The review involves key personnel, including executive management, and is supported, where necessary, by a suitably qualified and experienced consultant. The annual update of the WHMP will:

- Ensure compliance with all current legislation;

- Update the assessment of risk using updated strike and monitoring data observations;
- Ensure all procedures, roles, responsibilities and associations listed are current and relevant, and
- Ensure all management actions undertaken by Merimbula Airport are appropriate and listed in the WHMP.

Key outcomes of the most recent annual review for 2017 were as follows:

- Revision of the WHMP using the national template;
- Use of the Wildlife Database to carry out statistical analysis and risk assessments, and
- Identification of risk species using a qualitative assessment.

4.3.2 Major review

A major review of the WHMP will be undertaken on a 5 yearly basis and is the responsibility of Airport Manager. The review will result in a complete revision and reissue of the document. The review will be supported, where necessary, by a suitably qualified and experienced consultant.

Major reviews will take the place of annual updates in the years they occur.

5 References

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6 Appendices

Appendix 1 – Wildlife Management Procedures

- WHMP – 01 Wildlife Count Procedure
- WHMP – 02 Wildlife Hazard Surveillance Procedure
- WHMP – 03 Strike Reporting Procedure
- WHMP – 04 Identification and Handling of Remains Procedure
- WHMP – 05 Wildlife Dispersal Procedure
- WHMP – 06 Wildlife Culling Procedure

Appendix 2 – Licence and Permit Requirements

Appendix 1 – Wildlife Management Procedures

WHMP-01 Wildlife Count Procedure

Objective	To assist in the detection and subsequent removal of hazards and to provide data for comparison of numbers and locations of wildlife.
Responsibilities	ARO
Frequency	DAILY
Equipment	Vehicle, Binoculars, Bird ID field guide

Consistent application of the Wildlife Count Procedure is essential for obtaining quality data to be used for analysing for trends. If hazardous conditions are identified during the course of a count, it will allow for its timely removal using active dispersal techniques.

Procedure

1. The person doing wildlife counts must always follow the same route.
2. The aerodrome is divided into 11 Wildlife Count Areas.
3. Within each Area, stop the vehicle at the same marked location each time and scan the entire Area using binoculars.
4. Record all species and numbers observed on a Wildlife Count Form. Information to be recorded includes:
 - Date
 - Name of observer
 - Time of commencement of the count
 - Weather conditions
 - Species and number observed
 - Area recorded (including birds transiting the airfield)
 - Notes on anything that may cause additional attractions, eg nesting events, flowering events.
5. The form includes frequently observed bird species and allows room for additional species and as well as unidentifiable bird types. Mammals such as rabbits, hares, kangaroos or foxes are also recorded.
6. Transfer the data into the Merimbula Airport Wildlife Database for ongoing trend analysis.

Attachments

1. Merimbula Airport Wildlife Count Form
2. Merimbula Airport Wildlife Count Area Map

Merimbula Airport WILDLIFE COUNT FORM

WILDLIFE MONITORING MERIMBULA AERODROME				
OBSERVER:				
DATE:	TIME:	TEMP:	WIND:	RAIN:
SPECIES	NO. OF INDIVIDUALS	ACTIVITY	LOCATION	ALTITUDE
Example	1,5,10	R,F,B	A,B,C	1,2,1
Australian Magpie				
Willie wagtail				
Masked lapwing				
Wood duck				
Pacific black duck				
White ibis				
White-faced heron				
Welcome swallow				
Australian pelican				
Galah				
Rainbow lorikeet				
Richard's pipit				
Black swan				
Peewie/Magpielark				
Common starling				
Eastern grey kangaroo				
Feral Dog				
Red Fox				
Feral Cat				
SANDPLOT NORTH	NO. OF INDIVIDUALS	ACTIVITY	LOCATION	MAJOR FLOWERING?
Eastern grey kangaroo		T	N	Yes No
Swamp wallaby		T	N	
Feral Dog		T	N	Where?
Red Fox		T	N	
Feral Cat		T	N	
SANDPLOT SOUTH	NO. OF INDIVIDUALS	ACTIVITY	LOCATION	MANGROVE NESTING?
Eastern grey kangaroo		T	S	Yes No
Swamp wallaby		T	S	
Feral Dog		T	S	Where?
Red Fox		T	S	
Feral Cat		T	S	

CODES

TIME CODES	TEMP CODES	ACTIVITY CODES	LOCATION CODE
1: Morning	1: <10	Feeding	A: Airport buildings, carpark, trees
2: Mid-morning	2: 11-15	Breeding	B: Forest on East side of highway
3: Afternoon	3: 16-20	Resting	C: Runway South
4: Evening	4: 21-25	Shelter	D: Runway North
	5: >25	Aerial	E: Grass South
		Dead	F: Grass North
		Tracks seen	G: Artificial wetland
WIND CODES	RAIN CODES	ALTITUDE CODES	H: Mangroves and lake
1: Calm	1: No rain last 24 hrs	1: On ground	I: Lake, carpark, boatramp North
2: Light	2: last 24 hrs	2: 0-50m	N: Sandplot North
3: Moderate	3: During survey	3: 50-100m	S: Sandplot South
4: Strong		4: Above 100m	

Merimbula Airport WILDLIFE COUNT AREA MAP



WHMP-02 Wildlife Hazard Surveillance Procedure

Objective	To detect birds and other wildlife airside and landside that may pose a hazard to aircraft. To locate eggs and nests of birds. To locate remains of birds and other animals.
Responsibilities	ARO
Frequency	DAILY During periods of high bird activity constant surveillance and dispersal may be required.
Equipment	Vehicle, Binoculars, Radio equipment, Bird ID Field Guide

The airside and relevant landside areas should be checked regularly for birds. Records must be kept to show the areas of the airport patrolled; numbers; location species of birds seen; action taken to disperse the birds and results. Where no wildlife is observed a note should be made to identify the times of patrols and the locations covered. This information may be used to provide evidence of adequate wildlife hazard management in the event of litigation.

Regular inspections are important to ensure early detection of bird and other wildlife hazards. They also assist with the locating eggs and nests or remains that may be the result of a bird or other wildlife strike. Detection and removal of remains will minimise the risks of Foreign Object Debris (FOD).

The timing of such inspection should be before each blocks of high aircraft activity throughout the day and prior to larger aircraft movements with particular emphasis on jet aircraft.

Staff who observe birds nesting on airport (Airside or Landside) should report the location of the nest to the Airport Manager. Based on the species and location a call will be made on whether or not the eggs are to be removed and nest destroyed or if the bird will be left alone. This will be based on the risk the species poses to aviation safety.

Procedure

1. Inspect pavements, grassed areas, and flight paths for bird activity and search for eggs, nests and animal remains.
2. Where hazardous bird/wildlife activity is observed, immediately proceed with Wildlife Dispersal Procedure WHMP– 05.
3. If there is an imminent threat to aircraft safety, proceed with Wildlife Culling Procedure WHMP-06.
4. Where a serious hazard remains despite all efforts, refer the matter to the Merimbula Airport Manager.
5. If no activity observed log an entry in the wildlife surveillance and dispersal record form (Wildlife Dispersal Procedure WHMP– 05) to show the time of the inspection and areas patrolled.

Attachment

Nil (see Wildlife Surveillance and Dispersal Record Form (See WHMP-05))

WHMP-03 Strike Reporting Procedure

Objective	To accurately record all possible information on bird and other wildlife strikes
Responsibilities	ARO
Frequency	As required, within 72 hours of strike
Equipment	Vehicle, Wildlife Strike Form

Strike reports provide one of the most important pieces of information regarding the risks posed by birds and other wildlife to aircraft. It is essential that all possible sources of information are investigated and details accurately recorded.

Procedure

1. Always complete a strike report form with as much information possible.
2. Where a pilot report indicates a strike has or may have occurred, examine the areas where the strike was reported to have occurred for evidence of carcasses or remains.
3. Contact operator or ground crews to organise inspection of the aircraft for remains, evidence of strike such as blood smear or damage to the aircraft.
4. Process all remains found as per WHMP - 04 (Identification and Handling of Remains).
5. Categorise the strike according to the definitions for confirmation and strike location (see Glossary).
6. Submit forms to ATSB and Merimbula Airport for inclusion in respective databases.

Attachments

ATSB Aviation Accident or Incident Notification Form

Note: Reports can be completed and submitted online at

<https://www.atsb.gov.au/notifications/ReportOccurrence.aspx>

<https://www.atsb.gov.au/notifications/ReportOccurrence.aspx>

Wildlife strikes:
Was a bird or animal involved? ☐ No ☐ Yes No. of birds ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 ☐ 11 ☐ 12 ☐ 13 ☐ 14 ☐ 15 ☐ 16 ☐ 17 ☐ 18 ☐ 19 ☐ 20 ☐ 21 ☐ 22 ☐ 23 ☐ 24 ☐ 25 ☐ 26 ☐ 27 ☐ 28 ☐ 29 ☐ 30 ☐ 31 ☐ 32 ☐ 33 ☐ 34 ☐ 35 ☐ 36 ☐ 37 ☐ 38 ☐ 39 ☐ 40 ☐ 41 ☐ 42 ☐ 43 ☐ 44 ☐ 45 ☐ 46 ☐ 47 ☐ 48 ☐ 49 ☐ 50 ☐ 51 ☐ 52 ☐ 53 ☐ 54 ☐ 55 ☐ 56 ☐ 57 ☐ 58 ☐ 59 ☐ 60 ☐ 61 ☐ 62 ☐ 63 ☐ 64 ☐ 65 ☐ 66 ☐ 67 ☐ 68 ☐ 69 ☐ 70 ☐ 71 ☐ 72 ☐ 73 ☐ 74 ☐ 75 ☐ 76 ☐ 77 ☐ 78 ☐ 79 ☐ 80 ☐ 81 ☐ 82 ☐ 83 ☐ 84 ☐ 85 ☐ 86 ☐ 87 ☐ 88 ☐ 89 ☐ 90 ☐ 91 ☐ 92 ☐ 93 ☐ 94 ☐ 95 ☐ 96 ☐ 97 ☐ 98 ☐ 99 ☐ 100 ☐ 101 ☐ 102 ☐ 103 ☐ 104 ☐ 105 ☐ 106 ☐ 107 ☐ 108 ☐ 109 ☐ 110 ☐ 111 ☐ 112 ☐ 113 ☐ 114 ☐ 115 ☐ 116 ☐ 117 ☐ 118 ☐ 119 ☐ 120 ☐ 121 ☐ 122 ☐ 123 ☐ 124 ☐ 125 ☐ 126 ☐ 127 ☐ 128 ☐ 129 ☐ 130 ☐ 131 ☐ 132 ☐ 133 ☐ 134 ☐ 135 ☐ 136 ☐ 137 ☐ 138 ☐ 139 ☐ 140 ☐ 141 ☐ 142 ☐ 143 ☐ 144 ☐ 145 ☐ 146 ☐ 147 ☐ 148 ☐ 149 ☐ 150 ☐ 151 ☐ 152 ☐ 153 ☐ 154 ☐ 155 ☐ 156 ☐ 157 ☐ 158 ☐ 159 ☐ 160 ☐ 161 ☐ 162 ☐ 163 ☐ 164 ☐ 165 ☐ 166 ☐ 167 ☐ 168 ☐ 169 ☐ 170 ☐ 171 ☐ 172 ☐ 173 ☐ 174 ☐ 175 ☐ 176 ☐ 177 ☐ 178 ☐ 179 ☐ 180 ☐ 181 ☐ 182 ☐ 183 ☐ 184 ☐ 185 ☐ 186 ☐ 187 ☐ 188 ☐ 189 ☐ 190 ☐ 191 ☐ 192 ☐ 193 ☐ 194 ☐ 195 ☐ 196 ☐ 197 ☐ 198 ☐ 199 ☐ 200 ☐ 201 ☐ 202 ☐ 203 ☐ 204 ☐ 205 ☐ 206 ☐ 207 ☐ 208 ☐ 209 ☐ 210 ☐ 211 ☐ 212 ☐ 213 ☐ 214 ☐ 215 ☐ 216 ☐ 217 ☐ 218 ☐ 219 ☐ 220 ☐ 221 ☐ 222 ☐ 223 ☐ 224 ☐ 225 ☐ 226 ☐ 227 ☐ 228 ☐ 229 ☐ 230 ☐ 231 ☐ 232 ☐ 233 ☐ 234 ☐ 235 ☐ 236 ☐ 237 ☐ 238 ☐ 239 ☐ 240 ☐ 241 ☐ 242 ☐ 243 ☐ 244 ☐ 245 ☐ 246 ☐ 247 ☐ 248 ☐ 249 ☐ 250 ☐ 251 ☐ 252 ☐ 253 ☐ 254 ☐ 255 ☐ 256 ☐ 257 ☐ 258 ☐ 259 ☐ 260 ☐ 261 ☐ 262 ☐ 263 ☐ 264 ☐ 265 ☐ 266 ☐ 267 ☐ 268 ☐ 269 ☐ 270 ☐ 271 ☐ 272 ☐ 273 ☐ 274 ☐ 275 ☐ 276 ☐ 277 ☐ 278 ☐ 279 ☐ 280 ☐ 281 ☐ 282 ☐ 283 ☐ 284 ☐ 285 ☐ 286 ☐ 287 ☐ 288 ☐ 289 ☐ 290 ☐ 291 ☐ 292 ☐ 293 ☐ 294 ☐ 295 ☐ 296 ☐ 297 ☐ 298 ☐ 299 ☐ 300 ☐ 301 ☐ 302 ☐ 303 ☐ 304 ☐ 305 ☐ 306 ☐ 307 ☐ 308 ☐ 309 ☐ 310 ☐ 311 ☐ 312 ☐ 313 ☐ 314 ☐ 315 ☐ 316 ☐ 317 ☐ 318 ☐ 319 ☐ 320 ☐ 321 ☐ 322 ☐ 323 ☐ 324 ☐ 325 ☐ 326 ☐ 327 ☐ 328 ☐ 329 ☐ 330 ☐ 331 ☐ 332 ☐ 333 ☐ 334 ☐ 335 ☐ 336 ☐ 337 ☐ 338 ☐ 339 ☐ 340 ☐ 341 ☐ 342 ☐ 343 ☐ 344 ☐ 345 ☐ 346 ☐ 347 ☐ 348 ☐ 349 ☐ 350 ☐ 351 ☐ 352 ☐ 353 ☐ 354 ☐ 355 ☐ 356 ☐ 357 ☐ 358 ☐ 359 ☐ 360 ☐ 361 ☐ 362 ☐ 363 ☐ 364 ☐ 365 ☐ 366 ☐ 367 ☐ 368 ☐ 369 ☐ 370 ☐ 371 ☐ 372 ☐ 373 ☐ 374 ☐ 375 ☐ 376 ☐ 377 ☐ 378 ☐ 379 ☐ 380 ☐ 381 ☐ 382 ☐ 383 ☐ 384 ☐ 385 ☐ 386 ☐ 387 ☐ 388 ☐ 389 ☐ 390 ☐ 391 ☐ 392 ☐ 393 ☐ 394 ☐ 395 ☐ 396 ☐ 397 ☐ 398 ☐ 399 ☐ 400 ☐ 401 ☐ 402 ☐ 403 ☐ 404 ☐ 405 ☐ 406 ☐ 407 ☐ 408 ☐ 409 ☐ 410 ☐ 411 ☐ 412 ☐ 413 ☐ 414

WHMP-04 Identification and Handling of Remains Procedure

Objective	To safely collect and store bird and other wildlife remains.	
	To accurately obtain as much information from bird and wildlife remains found at Merimbula Airport.	
Responsibilities	ARO	
Frequency	As required	
Equipment	Vehicle	Disinfectant
	Tongs/tweezers	Freezer
	Re-sealable bags	Gloves
	Labels	Reference book
	Hand wash	

For determining trends in strikes at Merimbula Airport, it is essential to wherever possible identify the species involved. In order to accurately assess both the cause of death and identification of the species, carcass retrieval is essential. This information ultimately aids in better wildlife management on airport.

Procedure

1. Locate remains.
2. Follow the procedures below for each type of remains found. All remains should be stored for annual analysis by consultant.
3. All strikes and carcasses should be reported, follow Procedure WHMP-03– Strike Reporting.

Whole Carcasses (collect sample for professional identification)

1. Depending on size of sample - use disposable gloves, thick gloves or a pair of tongs to collect remains from runway, ground, aircraft etc and seal carcass in plastic bag (taking care not to contaminate the outside of the bag).
2. Remove gloves and dispose, wash hands.
3. Disinfect tongs and tweezers.
4. Fill out strike form and place inside a separate sealed plastic bag with the carcass.
5. Freeze in designated bird carcass freezer for analysis by consultant at a later date.
6. Bird carcasses taken during culling will be handled as outlined above. Where more than one specimen of a common and easily identifiable species is culled, one will be placed in a bag, tagged and frozen and the others disposed of appropriately (e.g. buried to exclude scavenging animals, or to landfill).
7. Follow Procedure WHMP-03– Strike Reporting.

Feathers and fragments (collect sample for professional identification)

1. Use disposable gloves.
2. If single feathers, or with small amounts of flesh attached, place in re-sealable bag.
3. Remove gloves and dispose, wash hands.
4. Fill out strike form with all details and staple to bag.
5. Freeze in designated bird carcass freezer for analysis by consultant at a later date.
6. Follow Procedure WHMP-03– Strike Reporting.

Safety Considerations

Dead animals may carry diseases harmful to humans. Wear gloves and if necessary disposable coveralls when handling carcasses or biological materials. Avoid direct skin contact with biological materials and avoid contaminating your normal work clothing. Ensure that the outside of sample bags, vehicles and freezers are not contaminated. Wear a mask and eye protection if there is a risk of body fluids or organic material misting into the atmosphere. Wash hands thoroughly when you are done.

If an animal is sick or injured, it may be necessary to humanely destroy the animal then process the carcass according to the procedures below. Seek veterinary advice if required and regularly liaise with local wildlife authorities to ensure your species knowledge and euthanasia competency is adequate. Regular competency checks will help avoid unnecessary euthanasia of an endangered species or delayed euthanasia of a suffering individual.

Flying Foxes and microbats may carry viruses that can cause serious disease in man and particular care must be taken when handling dead bats.

A sick or injured bat should only be handled by suitably experienced and vaccinated persons.

If a person is bitten or scratched by a bat,

- The wound should be immediately washed with soap or disinfectant and water for at least five minutes
- Seek medical advice immediately.

Attachments

Nil

WHMP-05 Wildlife Dispersal Procedure

Objective	To remove immediate wildlife hazards from the airport.
Responsibilities	ARO
Frequency	As required
Equipment	As required [e.g. vehicle (lights, siren, horn), lures, shotgun and ammunition (live and bird frite), gas cannons, bird distress callers, dogs, raptors, starters pistol and caps]

Dispersal of wildlife hazards is an integral aspect of active management as areas on the airport will remain attractive to some species and early detection and immediate removal of hazards is essential to effective management of risks.

Detection is achieved during wildlife counts (Wildlife Count Procedure WHMP-01) and wildlife hazard surveillance (Wildlife Surveillance Procedure WHMP-02). Personnel should be present on the airport and equipped to manage wildlife hazards as required for scheduled counts and inspections and also during routine daily surveillance.

The following details are recorded: time; areas of the airport patrolled; numbers, location and species of wildlife seen; action taken to disperse the wildlife; results of the action.

Some important guidelines to be followed when dispersing wildlife:

1. Dispersal needs to be most intense at the end of the breeding season to discourage young wildlife from foraging at the airport. Young are easily deterred from airports providing they recognise the airport as an unattractive and threatening environment (note that different species breed at different times of the year).
2. Do not allow settling wildlife to feed in order to discourage regular visitation. It is easier and more effective to harass newcomers to the airport than birds that have established their territory on-site.
3. Concentrate dispersal activities for most species in the early morning and mid afternoon, prior to peak feeding periods. Early morning harassment discourages visitors settling in for the day.
4. It may be necessary to continuously patrol and disperse during periods where aircraft movements are scheduled closely together.
5. Where wildlife identify a particular vehicle as a risk and move to a different airside location, consider undertaking dispersal in a different type of vehicle (e.g. tractor).

Procedure

1. Identify wildlife requiring dispersal.
2. Position yourself between the runways and the wildlife to ensure dispersal is away from aircraft manoeuvring areas.
3. Choose the most appropriate equipment for the task (See attached equipment overview)
4. Check for no aircraft activity.
5. Activate equipment.
6. Determine effectiveness.

7. Continue until hazard is successfully removed.
8. Record details on Merimbula Airport Wildlife Surveillance and Dispersal Record Form.
9. Where a serious hazard remains refer to WHMP-06 Wildlife Culling.

Attachments

- Equipment Overview
- Firearm Safety Guidelines
- Merimbula Airport Wildlife Surveillance and Dispersal Record Form

Equipment Overview

1. There are a number of options available for undertaking dispersal and all will be used at various times to limit the likelihood of birds habituating to any one option.
2. Vehicle siren lights and horn can be used to herd and disperse birds.
3. Arm waving, lures and stock whips are inexpensive and sometimes effective means of dispersing flocks of some species of birds. The arm wave requires the officer to stand on high ground or a vehicle and flap both arms slowly at around 1 beat per second. Flocks respond as if to a predator such as a raptor and disperse. A well used stock whip lets off a sound similar to that of a firearm and is an effective tool for dispersing some species.
4. Bird distress calls transmitted by megaphone or other equipment can also be effective but must be used by trained personnel to ensure the most effective outcome as different distress calls can either attract or disperse a flock, dependent on the species.
5. Trained dispersal animals, such as dogs and raptors, must only be used by trained specialists to avoid creating additional risk to aircraft.
6. Pyrotechnics (Bird Frite) is a very useful tool for dispersal. To reduce the chance of habituation, use as few shots as possible to achieve the required effect and ensure the cartridge explodes as close to the wildlife as possible.

Firearms Safety Guidelines

Firearms are provided for the purpose of harassing, dispersing, and when necessary, culling of wildlife (refer to Merimbula Airport Firearms Policy). Under no circumstances will they be used for any other purpose.

Care is to be taken when harassing birds and the following rules must be observed:

1. The location of the hazard in relation to any aircraft in the vicinity, whether landing, taking-off, taxiing, etc. A gun shall not be fired in the direction of or in the vicinity of any aircraft.
2. A strict watch is to be maintained for any personnel working in the vicinity, particularly people on foot whose clothing may blend in with the background.
3. Never carry a loaded gun in the vehicle or fire from the vehicle.
4. Particular care to be taken when using a gun in the vicinity of any buildings, aerals, runway lights, windsocks, etc.
5. A strict watch must be kept for helicopter and fuel tanker traffic.
6. Never fire in the direction of any vehicle moving on the perimeter road or at any houses, vehicles, etc. in the vicinity of the boundary fence.
7. When using Bird Frite shell ammunition in dry, hot conditions, care must be taken to ensure that the spent cartridge casing (which has a tendency to smoulder) does not set off a grass fire.

- 8.** Guns must be thoroughly cleaned and oiled daily, preferably as soon as practicable after use.
- 9.** When not being carried in a vehicle, guns and ammunition must be stored in a locked cupboard (refer to Merimbula Airport Firearms Policy).
- 10.** Wear ear and eye protection when discharging firearms.

WHMP-06 Wildlife Culling Procedure

Objective	To remove immediate bird and wildlife hazards from the airport.
Responsibilities	ARO
Frequency	As required
Equipment	Firearm Ammunition Permits Current culling authority/license from State/Territory Department Current weapons license necessary for weapons use

Culling is an effective last option management technique that is used to remove persistent individuals of moderate or high risk species or where there is an imminent safety hazard. Culling is an essential part of the WHMP as it not only removes targeted individuals but reinforces the effectiveness of dispersal actions by demonstrating to resident birds that the airport is not a safe feeding area.

Where possible culling should target young inexperienced birds, during and after the breeding season and naive vagrants. Culling should be applied sparingly to groups of birds, particularly territorial species such as Australian Magpies as these birds can reduce the presence of other species.

Remove hazards from the airside area as soon as possible after they are detected. Staff are to be equipped with firearms and live ammunition suitable for wildlife culling, these are carried during the shift in a lockable storage container in vehicles.

Destroy nesting material and any eggs on the airport, with permits as required, to discourage birdnesting activities. Where nesting is found on or within buildings or structures on airport land, arrange with relevant staff to have nests removed. Where possible these areas should be modified to exclude future nesting attempts.

Seek the help of specialised agencies as necessary to assist with safe removal of some animals (such as foxes or hares/rabbits).

Where wildlife hazards cannot be immediately removed and may impede aircraft safety, the hazard is communicated immediately to the Airport Manager. NOTAMs may be issued or where necessary the runway closed.

Procedure

1. Identify birds requiring culling.

NB If the species is listed as rare/threatened/protected do not cull. Other dispersal methods must be used to remove the problem individual. If the hazard persists, liaise with the Airport Manager. These species are:

- Wedge-tailed Eagle
- White-bellied Sea Eagle
- Square-tail Kite
- Glossy Black Cockatoo
- Gang Gang Cockatoo
- Rails – all species

- Waders – all species
 - Owls – all species
 - Grey-headed Flying Fox
2. Position yourself between the critical areas and the flock/individual to ensure dispersal is away from runway and flight strips.
 3. Choose the most appropriate firearm for the task.
 4. Check for nearby human and vehicular activity.
 5. Cull individuals.
 6. Determine effectiveness.
 7. Continue until hazard is successfully removed.
 8. Record ammunition usage on the firearms issue register form and species culled on the Wildlife surveillance and dispersal record form.
 9. Where a serious hazard remains despite all efforts, refer the matter to the Airport Manager. NOTAMs may be issued or where the risk is extreme the runway closed.

Safety Considerations

- Where culling requires access to movement areas, it may be required to delay aircraft movements.
- Culling will aim to direct the remaining birds away from runways and flight strips.
- All bird and wildlife culling must be undertaken humanely and safely.

Attachments

- Licence and permit requirements

Appendix 2 – Licence and Permit Requirements

Permits are required for the management of wildlife hazards at Merimbula Airport:

1. Permits from State/Territory Department to harm native wildlife (see **Wildlife Culling procedure WHMP-06**).
2. Firearms licences from State/Territory Police are also required to deal with wildlife as set out in this procedure.

Actions under these permits and licences require the airport or personnel to adhere to specific conditions, refer to current permits for details. Originals of permits and licences are kept on file by the Merimbula Airport.

Merimbula Airport approves the use of firearms for bird and animal hazard control only by those officers whose duties involve bird and animal dispersal and culling and who are licensed to use Merimbula Airport- owned firearms.

Firearms Licence Holder Details

Name	Firearms Licence #	Category	Expiry
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APPENDIX H CONSULTATION

NGH Staff involved in BDAR

Name	Title	Qualifications	Roles
Brooke Marshall	Manager	• Certified Environmental Practitioner (CEnvP) • BAM Assessor Training – Accreditation in progress • B. Natural Resources (First Class Honours)	Review and approval of BDAR
Dave Maynard	Principal Ecologist	• BAM Accredited Assessor • B Science (Ecology, First Class Honours)	Direction in BAM assessment and BDAR. Approval of BDAR
Gillian Young	Senior Ecologist	• BAM Accredited Assessor • B. Nat Res (Second Class Honours)	Field work including PCT identification, vegetation mapping, vegetation plots and threatened fauna surveys. Main author and assessor of the BDAR report. Author of BAM Calculator report. AOS assessment for EPBC listed CEECs onsite.
Jackie Miles	Ecological Consultant	• B. Sci (Honours) • 25 years ecological experience.	Conducted two BAM plots and undertook initial vegetation stratification onsite. Assisted with filtering of Candidate shorebird species.
Tony Hastings	Environmental Consultant - Ecologist	• B Env Sci (Honours) • Diploma (Nat Res Mgt)	Writing parts of the BDAR report. Field work assistant GIS Mapping (BDAR)
Byron Heffernan	Environmental Consultant	• B. Sci (First Class Honours)	GIS Mapping (V2 BDAR)

Vitaly Kolin	Environmental Consultant/GIS Specialist	BSc (Earth Science - Hons 1)	GIS Mapping V3 BDAR
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Email from Shannon Simpson dated 14/12/2018

LMBC-3418 FW: BDAR Enquiry - Important mapped areas habitat for candidate species

Hi Gillian

The site is not within important areas for Regent Honeyeater, Swift Parrot, Sanderling, Curlew Sandpiper or Black-tailed godwit, however it has been identified as important habitat for the federally listed Bar-tailed Godwit and Eastern Curlew.

Important area mapping has not yet been finalised for Beach stone-curlew so it should be treated as a species credit and surveyed as per section 6 of the BAM.

I have included a screen shot of the mapping for you information.

Regards
Shannon



From: OEH ROD LMBC Support Mailbox

Sent: Tuesday, 20 November 2018 3:31 PM

To: Shannon Simpson <shannon.simpson@environment.nsw.gov.au>

Subject: LMBC-3418 FW: BDAR Enquiry - Important mapped areas habitat for candidate species

Hi Shannon

See below – can you please assist ? Thanks in advance

Kind regards,

Pauline Ellem

**Land Management and Biodiversity Conservation
Contact Service Centre**

Conservation Program
Office of Environment and Heritage
T: 1800 931 717
E: lmbc.support@environment.nsw.gov.au

Please ensure you keep all cc'ed parties included in any replies to this email.



From: Gillian Young <gillian.y@ngHENvironmental.com.au>
Sent: Tuesday, 20 November 2018 2:08 PM
To: OEH ROD LMBC Support Mailbox <lmbc.support@environment.nsw.gov.au>
Cc: Brooke Marshall <brooke.m@ngHENvironmental.com.au>
Subject: BDAR Enquiry - Important mapped areas habitat for candidate species

Hi there,

I am undertaking a BAM assessment for Merimbula Airport. Specifically Lot 100 DP 1201186.

I have the following candidate species which have come up in the calculator as being associated with 'important mapped areas' to proceed with assessment. Could I please get more information and any possible mapping that would cover the above lot or within 500m of the above lot for the following species;

- 1) Regent Honeyeater
- 2) Sanderling
- 3) Curlew Sandpiper
- 4) Beach Stone Curlew
- 5) Swift Parrot
- 6) Black-tailed Godwit

Thanks so much,

Regards

Gill.

Gillian Young | Senior Ecologist
Accredited NSW BAM Assessor (BAAS17086)

Our ref: DOC20/160238

Your ref: DA2019.359

The General Manager
Bega Valley Shire Council
PO Box 492
Bega NSW 2550

Attention: Mark Fowler

06 March 2020

Dear Mr Fowler

**Subject: Integrated Development Application No 2019.359
Merimbula Airport runway extension at 371 Arthur Kaine Drive, Merimbula**

We have assessed the application for the above integrated development application and have considered matters raised during the site inspection with council and the consultants on 20 February 2020. Our comments below relate to Aboriginal cultural heritage, biodiversity and flooding matters.

Aboriginal cultural heritage

The Department has reviewed the information provided to date and is stopping the deemed refusal 'clock' on this integrated development application as we require further information in relation to Aboriginal cultural heritage matters under the *National Parks and Wildlife Act 1974*.

The Aboriginal Cultural Heritage Assessment Report (ACHAR), dated September 2019, does not provide enough information for the Department to assess the impact of the development on Aboriginal cultural heritage values in order to issue general terms of approval (GTAs).

Our concerns relate to the proposed works; mapping; additional survey requirements; Aboriginal community consultation; and revisions to the ACHAR to comply with Department requirements and guidelines. The information required is outlined in detail in Attachment 1.

Biodiversity

The Department has reviewed the Biodiversity Development Assessment Report (BDAR) and are also providing comments that were raised at the site inspection on the 20 February 2020 with council and the consultants.

Further Biodiversity comments can be found within Attachment 2.

Flooding matters

It is recommended that further investigations and mitigation measures are considered in relation to changes to tidal flow associated with the southern runway extension. The proposal should also be incorporated into the options assessment for the Merimbula Lake and Back Lake Floodplain Risk Management Study & Plan.

Further flooding comments can be found within Attachment 3.

The Department is available to meet with Council and the consultants to discuss any matters raised in this letter in more detail.

If you have any questions about this advice please contact Jackie Taylor on 6229 7089 for Aboriginal Cultural Heritage or Nicola Hargraves on 02 6229 7195 for biodiversity matters or at rog.southeast@environment.nsw.gov.au.

Yours sincerely

A handwritten signature in blue ink, appearing to read 'Allison Treweek'.

ALLISON TREWEEK
Senior Team Leader – Planning
South East Branch
Biodiversity and Conservation

Attachment 1 – More detailed comments regarding Aboriginal cultural heritage for Merimbula Airport runway extension

Before the Department can consider issuing GTAs we require the following information. Please note that for the Department to issue GTAs, the Aboriginal Cultural Heritage Assessment Report (ACHAR) must satisfy all Aboriginal Heritage Impact Permit (AHIP) application requirements.

1. Mapping

- a. A map clearly indicating the development footprint and entire land that will be subject to the future AHIP application must be provided.

Any Aboriginal objects that will be subject to harm (including harm from ongoing maintenance activities, remediation works, revegetation or similar) should be included in this AHIP application area.

Advice provided during the site inspection on 20 February 2020 is that an existing haul road/ access track to the south of the runway may be upgraded or removed in the future. Additional areas within the Airport precinct may also be used for temporary compound sites or stockpiling of materials. The Department requires these areas to be mapped and assessed so they can be considered as part of this current development application.

2. Additional Aboriginal objects were located during the 20 February 2020 site inspection

- a. Aboriginal objects were located along an existing haul road/ access track to the south of the runway and in the area proposed for the southern runway extension. These objects must be considered and included in the Aboriginal cultural heritage assessment if they will be harmed by the proposed works.

The Department is preparing Aboriginal site recording forms for input into the Aboriginal Heritage Information Management System (AHIMS) and can provide a copy of this information to the consultant and council on request.

3. Additional survey and further investigations

- a. The Department requires clarification of the activities and areas that will be impacted by the current development.
- b. Archaeological survey must have been conducted over the entire area proposed for an AHIP and we recommend survey and assessment be undertaken for all areas proposed for impact to avoid potential delays in the future. The report already recommends that areas proposed for additional ground disturbance works should be subject to survey.
- c. Based on the close proximity of 4 Aboriginal burials within a 1km radius of the Airport there is a high potential for Aboriginal burials to occur within the development area. The Department requires additional information about how the potential for burials will be managed. We advise that additional research is needed to determine how much of the ground surface was removed during levelling of the airport to estimate depth at which ground disturbance could encounter burials.
- d. Further consideration should be given to the undertaking of a subsurface testing program to assist in determining the level of disturbance across the Airport site. If subsurface testing is warranted, then the results of the testing program will be required for the Department to consider issuing GTAs.

4. Aboriginal community consultation

- a. The report recommends that additional consultation with Eden Local Aboriginal Land Council is undertaken regarding the request for monitoring of all initial ground disturbance works. The Department advises that this should occur at an early stage of the project. Please note that a finalised ACHAR that addresses all AHIP requirements including proposed impacts and proposed AHIP area must go through the consultation process.
- b. As the project is at the development application stage, it is recommended that regular consultation occurs (no gaps of six months or longer) with the Registered Aboriginal Parties so ensure that consultation remains continuous.
- c. Copies of all consultation correspondence must be forwarded to the Department as part of the AHIP application process.

5. Archaeological Studies

- a. Additional reports must be included in the literature review section of the ACHAR. These reports should include subsurface testing results in the region as well as a summary of any regionally significant sites. Additional reports should include but not be limited to the following:
 - Egloff, B. 1988 Merimbula Effluent Disposal Works Archaeological Investigations. Report to DPWS.
 - ERM Australia 2005 Merimbula Aboriginal Archaeological Assessment. A report for the Bega Valley Sewerage Program (Merimbula Sewerage Scheme Augmentation).
 - Kuskie, P. 1995 An archaeological assessment of land adjacent to Merimbula Airport, Far South Coast, New South Wales. A report to Bega Valley Shire Council.

6. Proposed Activity

- a. Advice provided during the site inspection on 20 February 2020 is that additional areas around the Airport may be impacted as a result of the proposed runway extension. The Department recommends these areas be mapped and assessed as part of this current development application. Activities that may also harm Aboriginal objects such as ongoing maintenance, remediation works, revegetation or similar should also be considered and assessed.
- b. An updated ACHAR must be submitted that assesses all areas proposed for impact.

7. Other revisions to the ACHAR

- a. All other sections of the ACHAR must be revised and updated, where relevant, following clarification of the proposed development activity and impacts to Aboriginal objects along with the results of any additional research, survey, investigations and Aboriginal consultation.

Attachment 2 – More detailed comments regarding biodiversity for Merimbula Airport runway extension

BCD have outlined our core concerns regarding this application and issues that were raised at the site inspection so that they are able to be addressed.

Study area to be expanded to consider potential indirect and prescribed impacts:

A revised study area that encompasses all potential indirect and prescribed impacts would be required to comply with Biodiversity Assessment Method (BAM) (S9). This should include consideration of any impacts associated with increased frequency and size of flights over any important habitat such as shorebird habitat any airport management activities required or likely to occur between the direct impacts of expanded runway, increased obstacle surface limitation, fill batter edges and the remaining habitats to be undisturbed.

Avoidance:

Avoid (BAM S8) is of key importance to prescribed impacts. Avoidance and minimisation of impacts must be reconsidered and applied where possible after revision of the study area (above).

Uncertain indirect/prescribed impacts associated with the proposal (BAM S9)

- Confirmation of the buffer required to mitigate ongoing indirect impacts to threatened species habitats and saltmarsh/mangroves. Including impacts that may be associated with altered hydrology, surface runoff, sedimentation from the filling of land and ongoing maintenance of any edge or buffer to habitats. This should be reflected in the BAM calculator as an altered VI score for affected vegetation zones and justified in the BDAR.
- Bird strikes as a result of increased size and frequency with details of species /locations to be considered in relation to any predicted increase in impact.
- Adaptive management for the potential impacts associated with the above should be included in a conservation management plan that provides a minimum of the following: baseline data on vegetation condition, and schedule of works including prioritised actions, responsibilities, timeframes and monitoring and report requirements. The requirements for the CMP should be included in the BDAR.

Serious and Irreversible Impact assessment

The assessment for the Beach Stone-curlew is incomplete. BCD are unable to locate the complete assessment for the impacts to this species and its breeding habitat. More information should be provided.

Offsets under the Biodiversity Conservation Act

We note that there are inconsistencies with the offsets required. Currently there are offset requirements under both the Fisheries Management Act (FM Act) and the Biodiversity Conservation Act (BC Act). Specific details on the offsetting of the mangrove and saltmarsh communities need to be clarified.

Data still required for our assessment:

- Veg zones must be included in the calculator (BOAMS)
- Shapefiles yet to be provided

Attachment 3 – More detailed comments regarding Floodplain risk management and coastal processes for Merimbula Airport runway extension

Floodplain Risk Management

BVSC is currently undertaking the Merimbula Lake and Back Lake Floodplain Risk Management Study & Plan (FRMS&P). It is recommended that BVSC determine the matter consistent with its Merimbula Lake and Back Lake FRMS&P by incorporating the proposal in the options assessment.

Coastal Processes

The Surface Water Report (Appendix F) notes that the extension of the southern runway (particularly Stage 2 works) is considered likely to impede tidal flow into the areas east of the extension and into the saltmarsh area north-east of the southern access path. It is recommended that, as noted in the Surface Water Report, further investigations are undertaken into the impacts of the proposed southern extension works to tidal flows and if necessary, recommendations are incorporated into the proposal design.

We also recommend that a more extensive long-term (5-10 year) monitoring program be established to determine (and ameliorate) if there are impacts to the saltmarsh area as a result of changed hydrology and altered tidal flows. The monitoring program currently included in the Aquatic Ecology Assessment report is only for 12 months following construction.

We note that a Coastal Management Program (CMP) is currently being developed by BVSC and includes the Merimbula airport area. The proposal should be consistent with actions proposed in the CMP.

2 July 2020

Allison Treweek
Senior Team Leader - Planning
South East Branch
Biodiversity & Conservation
11 Farrer Place
Queanbeyan NSW 2620



Cc: Nicola Hargraves
rog.southeast@environment.nsw.gov.au

Dear Allison

Re: 18-143 Progress towards completion of the BDAR for Merimbula Airport Runway Extension

This letter is intended to update you on progress toward completing the Biodiversity Development Assessment Report (BDAR) for the Merimbula Airport Runway Extension proposal; being assessed as Regional Development.

Since receiving submissions to the Environmental Impact Statement (EIS), key additional work on the assessment of this proposal has included:

- **Additional specialist investigations:**
 - a. With reference to biodiversity impacts, the most relevant have been additional engineering design work and hydrological modelling.
- **Assessing three changes to the proposal that have affected impact areas:**
 - a. Temporary construction impact areas
 - b. Refined runway extension design and works method: which has resulted in a smaller overall impact area and certainty regarding containment of impacts on the receiving environment within this footprint.
 - c. Culvert increase proposed to counter minor reduction in tidal flow at the southern runway extension.
- **Investigating direct and indirect impact assumptions. Key matters that relate to Biodiversity Conservation Division (BCD) comments included:**
 - a. Impacts on adjacent habitats (terrestrial and aquatic)
 - b. Impacts on flight frequency
 - c. Resultant impacts on shorebird habitat and collision risks
 - d. Provision of data (shp files of vegetation zones)

Please find attached a summary of these matters and a draft response table, intended to form part of the Submissions Report.

At this time, we seek any comments you have on this approach to ensure that the finalised BDAR and response table will meet all BCD requirements.



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NSW • ACT • QLD • VIC

ABN 31 124 444 622 ACN 124 444 622

Please contact me directly to discuss or provide an email response to guide our further work.

Our intended date of lodgement is 2 weeks.

Yours sincerely,

A handwritten signature in black ink, appearing to read 'G. Young', with a stylized flourish at the end.

Gillian Young
Senior Ecologist
M 0409 832 608

1. Key areas of additional investigation

Specific additional investigations were undertaken as part of the Submissions Report, in response to the feedback received from the public as well as agencies. The outcomes of these studies have been used in three ways:

- To inform the changes to the proposal
- To assess the changes to the proposal
- To respond to specific issues raised in more detail

Table 1-1 summarises the additional areas of investigation and incorporation of their specific outcomes.

Table 1-1 Key areas of additional investigation, to be included in the Submissions Report

	Study	Objective	Outcome
1	Additional engineering design work	Provide a more detailed works method to allow more certainty around direct and indirect impacts of the proposal.	Revised works method in discussion with hydrologists and ecologists provided greater certainty around direct and indirect impacts of the works footprint to be included in the assessment.
2	Additional hydrological modelling to counter minor impact of the southern extension	While minor and considered negligible, the 7% reduction in flow around the southern runway extension was of concern to some oyster lease holders. Any reduction in flow was of concern. The expansion of the culvert in the haul road was modelled and resulted in a still minor but positive impact on flow, which was more acceptable (2% increase).	Specific inundation changes can be clearly characterised and included in the assessment.
3	Updated BDAR, June 2020	To address any changes to the proposal and to provide additional clarity around direct impact and indirect impacts that may result from the proposal.	Updated proposal assessed. A new development site boundary now exists in the BDAR. The development site provides a spatial reference for discussing 'avoidance of indirect impacts', 'prescribed impacts', 'adaptive wildlife management' and for describing airport maintenance procedures relating to runway extensions. It also allows for discussion on management of threatened species and adjoining saltmarsh TEC. Added areas of the development site have been surveyed with an additional seven BAM plots completed. Data collected inside the development site can be used for future monitoring purposes (and described in a Biodiversity Conservation Management Plan) to analyse any changes to vegetation after development (with two control sites also established). More certainty regarding potential for SAIL impacts on Beach Stone Curlew.

4	Addendum to the ACHAR, June 2020	To address any changes to the proposal.	Updated proposal assessed.
5	Water quality management plan	To further investigate means to manage and monitor water quality impacts to adjacent areas during construction.	Improved certainty over the management of water quality.
6	Acid sulfate soils MP	To further investigate means to manage ASS onsite during construction	Improved certainty over the management of ASS.

2. Proposal changes since EIS exhibition

Three key changes to the proposal will be assessed in the Submissions Report and supporting studies. They are noted below, with the key implications for the BDAR:

2.1. Temporary construction impact areas: now included in the assessment.

These areas have been verified to contain vegetation that does not meet the criteria for offsets in accordance with the BAM. This will be mapped and demonstrated with reference to plot data in the updated BDAR. Key changes that result in the BDAR include:

- Additional area inside the updated development footprint for Zone 2, PCT 659 Grassland. Two new BAM plots conducted.
- Vegetation Zone 7 (PCT 1126 Saltmarsh – Good) added to development site. Four new BAM plots conducted.
- Vegetation Zone 8 (PCT 1126 Channel – Artificial) added to development site. One new BAM plot conducted.
- Increase in area for Vegetation Zone 5 (PCT 920 RGMangrove Mud Sth) into the development site. One new BAM plot conducted.

2.2. Refined runway extension design and works method:

Based on additional design work, this has resulted in a smaller overall impact area and certainty regarding containment of impacts on the receiving environment within this footprint. The updated areas will be mapped and demonstrated with reference to plot data in the updated BDAR.

At this stage of the assessment it is expected that a slight reduction in the number of ecosystem credits generated for PCT 920 Mangrove will result.

2.3. Culvert increase proposed to counter minor reduction in tidal flow at the southern runway extension

The resultant inundation impacts have been modelled in the updated hydrological assessment and now form part of the assessment. In summary, regarding the extent of impacts, the area to the east of the southern access road is dominated by Saltmarsh. The addition of a small culvert (300mm diameter) to offset the hydraulic interference of the runway extension increases tidal volume exchange from existing conditions by about 2% for a king tide event. These occur about 5-10 times per year and the maximum difference in inundation depth is modelled to be 1cm - 2cm. This equates to an extra 1000sqm of inundation area at the outer edges of the existing saltmarsh area. As this is a king tide, the newly inundated area is inundated infrequently and at shallow depth, which is unlikely to promote a vegetation change from saltmarsh to mangroves, and if anything will promote additional saltmarsh over these spaces.

In areas where mangroves currently exist, at the deeper points around the culvert entrances, these areas are preferred as inundation is more frequent. It is unlikely that there will be significant spread from these spaces as the inundation frequency will remain and depth will only change very slightly (1-2cm). Any small spread in

mangrove in these more frequently inundated areas is likely to be offset by spread of saltmarsh at the tidal inundation edges. Therefore, impacts on saltmarsh habitat are considered negligible.

The updated areas will be mapped and discussed in the updated BDAR.

3. Clarifications regarding the proposal

In response to submission, several clarifications will be made regarding the proposal and its impacts, in the Submissions Report, to ensure the proposal and its impacts are properly understood by the public and assessing agencies. Those of relevance to the biodiversity impact assessment and BCD comments are set out below.

3.1. Relationship to total number of flights

The total number of flights is not expected to increase as a consequence of the proposal. The proposal will allow larger aircraft to take off, addressing a serious issue for the airport as the current passenger aircraft will be decommissioned when they reach the end of their operational life. The runway extensions will allow other passenger airlines to consider servicing Merimbula airport and providing greater access to air travel to the local community. Increased demand in future is expected and flight numbers will be tied to demand and commercial decisions, but **neither are a consequence of this proposal**.

Increasing flight numbers are more closely tied to airport terminal infrastructure and will be assessed as part of separate proposals relating to this. More information will be provided in the Submission Report around this issue.

3.2. No impact on Obstacle Limitation Surfaces (OLS)

The 2013 Masterplan for the airport identified the need to extend the existing runway to accommodate a greater range of airline aircraft in order to both preserve existing service levels and allow for future changes and ensure compliance with relevant runway specifications (Rehbein Airport Consulting, 2013).

The proposed runway upgrade 'starter extensions' are a non-conventional airstrip model that utilises performance-based provisions in current and impending aviation legislation but does not further increase the need for vegetation management in the surrounding area...and has a smaller footprint at the southern (more environmentally sensitive) end of the runway than a conventional runway model (Kleinfelder, 2017).

The extension at both ends (starter extensions) provides aircraft with the additional runway length prior to accelerating for take-off. **Management of vegetation for the various OLS zones will not change from its present management regime if development proceeds with runway extensions.**

3.3. Haul road removal, adjacent to the southern runway, not proposed

The southern access track was created in the 1950s and tidal flow into this area has subsequently been restricted by the size of culverts (two of them) beneath the haul road. The road's removal may have benefits, but it is not proposed nor assessed as part of the proposal. It is noted that this idea was discussed onsite by BCD and Fisheries staff but **it does not form part of this proposal**.

It is noted that the addition of one 300mm diameter culvert is now proposed to offset minor impacts of the southern extension, to preserve consistent tidal flow regimes (variation of flow not greater than 2%) onsite and that this will be assessed in the updated BDAR.

3.4. No substantive impact on wildlife collision risks

The proposal does not substantively increase the collision risks to surrounding fauna. At Merimbula airport, collision risk, particularly for shore birds foraging near to the flight path, can be summarised as a combination of:

- Proximity to the risk,
- Attractiveness (such as the presence or roosting or foraging habitat),
- Surface area available to collide with, and
- Frequency of flights.

The runway extension project will remove a limited area of terrestrial and aquatic habitat which might otherwise attract birds and other wildlife. The surrounding environment will continue to be managed under the existing adaptive wildlife management plan (refer below). The runway extension does have the potential to bring larger planes closer to shorebird habitats however, as above, the flight paths, heights as well as landing positions will not change from the current situation. The additional paved area created for the starter extensions (north and south) will be used for *the commencement of the take off only*. Hence, as the plane becomes airborne at speed, at the end of the runway, it retains the same separation distances with regard to surrounding features as the existing situation. The same applies to aircraft approaching the runway for landing. The difference to the current runway is the use of the extended area for the beginning of the take off only. So the increased risk relates only to stationary or slow moving craft which will be in closer proximity to adjacent habitats. A larger plane may present a larger surface area with potential to collide with wildlife, in the air or on the ground. Equally, on an individual level, it may be more observable, louder and therefore more avoidable to wildlife. This is not considered likely to represent a substantive increase in risk. Note comments above on frequency of flights.

All airports are required to manage wildlife. Merimbula Airport's operating and safety system includes a Wildlife Hazard Management Plan (WHMP). A major review was undertaken in 2017. The WHMP is also subject to review as circumstances dictate (see discussion of the 2019 flying fox population below).

The adaptive management plan requires airport personal to retain evidence of wildlife strikes, to allow identification of species and determine recommendations for amendments to the WHMP where required.

It is noted that there was one fatality with an identified threatened shorebird species in the BDAR. This was for the Pied Oystercatcher, with one fatality in 2015. The 'zone of impact' for threatened shorebirds is within the approach and touch down areas of the current runways. It essentially relates to the Mangrove habitat directly adjoining the south runway. It is important to note that;

- The south runway extension is proposed to be extended into Mangrove habitat (and offset in the BDAR) and
- the frequency of flights is not expected to increase,

It is not likely that runway extensions will increase the risks of bird strike on threatened shorebirds.

3.5. Outcomes

To address the issues above in the BDAR, more detail on avoidance of impacts, prescribed impacts, adaptive management on threatened species habitat and adjoining TECs will be included; specifically considering;

- flight frequency
- size of aircraft
- collision risk/bird strikes
- areas of predicted increased impact
- species most at risk
- justification for preventing indirect impacts on the receiving environment.

- Present and future details on Obstacle Limitation Surfaces (OLS)
- Management of fill batter edges (around runway extensions)
- Remaining undisturbed habitats inside airport land

4. Draft BCD response table

The Submissions Report and updated BDAR will include information requested by the BCD. This table below is NGH's current draft response. We would appreciate early BCD comments to ensure that the final updated BDAR submitted will meet all of BCD's requirements.

Table 1. Draft BCD response table:

BCD comment	Response and changes made to the updated BDAR
Modifying the Study Area to consider potential indirect and prescribed impacts	Some changes to the development footprint (as defined under BAM) have occurred, which include: • Incorporation of access areas for the north and south runway, • Inclusion of temporary construction areas, • A slight reduction in the southern runway development footprint, resulting in a smaller impact area. All maps and clearing statistics are updated in the BDAR to reflect these changes.
Demonstrating avoidance and more detail provided about uncertain, indirect and prescribed impacts associated with the proposal (BAM S9)	• Addition of a 'development site' layer into the BDAR as a spatial reference to further discuss the 'avoid, minimise and mitigate' hierarchy and to describe 'prescribed impact' assumptions. It also identifies the area for discussion around 'adaptive management', including areas to monitor for indirect impacts. Refer to Ch 7.3 & Ch 8 BDAR. • Details are provided about avoiding indirect impacts on threatened shorebird habitat and adjoining TECs including areas of the airport land containing saltmarsh and mangroves. • Discussions are provided to justify minimal impacts to hydrology (tidal flows), surface runoff, sedimentation from the filling and edge effects on habitat. • Details are given about the culverts under the southern access track (next to the southern runway), their current influence of tidal regimes and future design plans proposed for the southern access track to maintain the same tidal regimes to avoid indirectly impacting the receiving saltmarsh habitat. Details are provided on future culvert design to prevent significant alteration to tidal flows into adjoining saltmarsh (Ch 6.1.3). • The Merimbula Airport Wildlife Management Plan can be used to demonstrate an 'adaptive management strategy' (Ch 8.2) for bird strikes, including information about i. flight frequency ii. size of aircraft iii. collision risk/bird strikes iv. areas of predicted increased impact v. species most at risk vi. justification for preventing indirect impacts on the receiving environment. • Further details can be provided about airport management activities (Ch 6.2.1) including; a. Obstacle Limitation Surfaces (OLS) b. Management of fill batter edges (around runway extensions) c. Management of remaining undisturbed habitats inside airport land

	• A Conservation Management Plan (New Ch 8.2.3 'Conservation Management Plan') can be developed to monitor habitat including saltmarsh and mangroves, especially around the southern runway. To ensure impacts are avoided, it is proposed to collect baseline monitoring data in environmentally sensitive areas and detail the schedule of works proposed including prioritised actions, responsibilities, time frames and frequency of monitoring report requirements.
Conduct a Serious and Irreversible Impact Assessment for Beach Stone Curlew.	A serious and irreversible impact assessment (Appendix H) will be undertaken for the Beach Stone Curlew.
Offsetting impacts (particularly where Fisheries Management Act and Biodiversity Conservation Act requirements overlap)	Specific advice provided in Ch 10.4 of the existing BDAR is not proposed to be amended.
Provide BDAR GIS spatial data	The BOAMS system currently does not accept GIS file uploads. A zipped folder of BDAR related GIS files associated with the latest V3 BDAR will be attached.

APPENDIX I SAII ASSESSMENT

As per clause 6.7 of the Biodiversity Regulation 2017, 'An impact is to be regarded as serious and irreversible if it is likely to contribute significantly to the risk of a threatened species or ecological community becoming extinct because:

- a) it will cause a further decline of the species or ecological community that is currently observed, estimated, inferred or reasonably suspected to be in a rapid rate of decline, or
- b) it will further reduce the population size of the species or ecological community that is currently observed, estimated, inferred or reasonably suspected to have a very small population size, or
- c) it is an impact on the habitat of the species or ecological community that is currently observed, estimated, inferred or reasonably suspected to have a very limited geographic distribution, or
- d) the impacted species or ecological community is unlikely to respond to measures to improve its habitat and vegetation integrity and therefore its members are not replaceable.

For the purpose of this clause, a **decline** of a species or ecological community is a continuing or projected decline in:

- i. the abundance of the taxon, or
- ii. the geographic distribution and habitat quality of the species or ecological community.

In accordance with the BAM, an accredited assessor must identify every potential SAIL entity that is listed in the *Guidance to assist a decision-maker to determine a serious and irreversible impact* that would be impacted on by the proposed development. In the case of the proposed Merimbula Airport, a summary of species listed as SAIL is presented in Chapter 9. Of the eight species listed, Beach Stone Curlew, *Esacus magnirostris*, is the only species with potential for serious and irreversible impact. This species is listed according to Principle (b) above.

Beach Stone Curlew, Esacus magnirostris

Beach Stone-curlews are found exclusively along the coast, on a wide range of beaches, islands, reefs and in estuaries, and may often be seen at the edges of or near mangroves (OEH 2019).

Foraging & Breeding habitat

- They forage in the intertidal zone of beaches and estuaries, on islands, flats, banks and spits of sand, mud, gravel or rock, and among mangroves (OEH, 2019).
- Beach Stone-curlews breed above the littoral zone, at the backs of beaches, or on sandbanks and islands, among low vegetation of grass, scattered shrubs or low trees; also among open mangroves (OEH 2019).

According to the BAM Section 10.2.3 the following information must be provided to assist the decision maker to decide on whether a SAIL is likely regarding a threatened species:

a) the action and measures taken to avoid the direct and indirect impact on the potential entity for an SAIL

Avoidance of direct impacts

To avoid extension of the runways, Bega Valley Shire Council assessed the possibility of constructing an airport at alternative locations (Garret Barry Planning Services Pty Ltd 2011). It was concluded that no other superior sites occur within the Bega Valley Shire. The essential elements needed in accommodating the airport included:

- land large and long enough to accommodate a runway of at least 1800m;
- flat terrain for safer obstacle limitations for landing; and
- ensuring development does not encroach into National Parks.

A terrain model was built on the parameters above. Contour and related mapping data held by Council was used to survey for sites that might address the above requirements. Six sites showed potential, however, every site was dismissed due to inappropriate obstacle and land-based requirements. This conclusion was reached in the early stages of the project around 2011.

As no alternative sites for a new airport location could be found, the option to extend the existing runway was therefore considered the only feasible option available to cater for larger planes to use (i.e. safely take off) the airport. Because there is already an existing runway, the proposed extension must therefore be located north and south of the existing runway.

Given the airport upgrades require an extension of the existing runway to achieve a minimum runway length of 1800m, it will be necessary for the runway to be extended at both ends (as an 1,800m length runway cannot be feasibly achieved by an extension at one end only of the existing runway). Additionally, because of the current location of the runway and its proximity to adjacent mangrove mudflat and mangrove beach habitats, as well as surrounding (heavily managed) saltmarsh grassland vegetation, impacts to these vegetation communities and their associated habitats are unavoidable if Merimbula Airport want to cater for larger planes. Efforts have been made to minimise vegetation clearing as much as possible and there will be no further disturbances to native vegetation for Obstacle Limitation Services (OLS) beyond the development footprint proposed.

Other impacts could also include direct injury/mortality to any resident individuals present during the construction activities within the vegetation areas proposed to be cleared for the runway extension. Measures that will be taken to avoid this type of impact include the preparation of a CEMP that will include actions such as pre-clearance surveys as well as having a fauna spotter/catcher present during the vegetation clearing in these areas as an additional safeguard for avoiding injury or mortality.

Avoidance of indirect impacts

Potential indirect impacts to the Beach Stone Curlew associated with construction and operation of a longer runway could include the following:

1. Impacts of increased noise to resident Beach Stone Curlew from larger (thus louder) aircraft;

The runways already occur so there is a certain level of aircraft noise already generated for both the north and south runways. The maximum size of aircraft using the runway include aeroplanes able to accommodate 34 passengers (Saab 340, Rehbein Airport Consulting 2017). Increases in the size of

aeroplanes is proposed to accommodate aeroplanes able to have 74 passengers (Dash 8-Q400). The difference in noise emissions between the larger and smaller aircraft is not expected to cause a significant change in noise emissions.

2. Impacts of increased stormwater runoff into Beach Stone Curlew habitat,

The development footprint construction methodology includes the construction of a geofabric lined rock wall, placed (not excavated) on the ground at low tide. This will retain all disturbances and manage the release of water into surrounding habitat. The wall will be retained permanently, thus managing the potential for additional impacts beyond the development footprint. A floating boom will be anchored to the wall during construction as a risk management strategy however, no indirect impacts are anticipated on the outer side of the wall. The geofabric lined wall will manage all water flow associated with the runway extension. As such, no indirect impacts as a result on increase stormwater runoff to Beach Stone Curlew habitat are anticipated.

3. Changes to tidal regimes affecting mangrove habitat.

Habitat east of the southern access road is dominated by saltmarsh and habitat to the west of southern access road is dominated by mangroves. Saltmarsh prefers habitats that are on the fringes of tidal inundation, whilst mangroves prefer habitat that is regularly inundated by saline or brackish water.

The south runway extension is not likely to alter tides by more than about 2% for a king tide event. These occur about 5-10 times per year. For the king tide period modelled between 22/11/18 to the 26/11/18, the impact of one extra 300mm diameter culvert (which is proposed) will mean a maximum difference to tidal depths of about 1cm to 2cm, or an extra 1000 sqm of inundation around outer edges of the existing saltmarsh area. As this is a king tide, the newly inundated area is inundated infrequently and at shallow depth, which is unlikely to promote a vegetation change from saltmarsh to mangroves, and if anything will promote additional saltmarsh over these spaces.

In areas where mangroves currently exist, at the deeper points around the culvert entrances are unlikely to be significantly altered such that there will be significant change in mangrove habitat. Any small spread in mangroves around culverts is likely to be offset by spread of saltmarsh at the tidal inundation edges. Therefore indirect impacts on adjoining saltmarsh and mangrove habitat is negligible and unlikely to affect foraging habitat for the Beach Stone Curlew.

b) the size of the local population directly and indirectly impacted by the development, clearing or biodiversity certification

The guidance document to assist a decision maker states that a 'Population' is defined as '*the total number of mature individuals in New South Wales*' (IUCN 2017). Population size is measured as the number of individuals known, estimated or inferred to be capable of reproduction.

The Scientific Committee Determination for Beach Stone Curlew lists 'eight known populations' which are dispersed in north NSW, among the major river estuaries:

1. Richmond River,
2. Belongil Creek (historically),
3. Clarence River,
4. Sandon River,

5. Woolli River,
6. Corindi River,
7. Nambucca River and
8. Manning River.

Each of the eight locations above can be defined as a 'local population' with each site separated by a distance ranging from 10 to 150 km (mostly 20-50 km) (Rohweder 2003). According to this determination, there is no identifiable local population in the NSW south coast region.

The Scientific Committee Determination also mentions that 'single transient birds' have been observed at several locations between Sydney and the Victorian border, that have been remote from known breeding sites. As such, it is important to differentiate between;

- 'local population areas and areas' as stipulated by the above confirmed sites, and
- Areas used by transient BSCs during migration.

A reliable population assessment needs standardised and systematic survey which is capable of being repeated on several occasions (i.e. surveys conducted generally at the same locations and during the same time of year/seasonal conditions). Due to lack of systematic survey, it has been very difficult quantifying local populations for Beach Stone Curlews in the Merimbula and surrounding area with information available. Several sightings of Bush Stone Curlews around the Merimbula have mostly included only a single individual and no records found of breeding pairs. Beach Stone Curlew sightings have been sporadic, with recorded observations of the species rarely being made during consecutive seasons in the same area.

Beach Stone Curlews are known for their long-distance movements. Journal references suggest that birds can move up to 27km in one day (Hole, et al. 2001). It is possible that existing records at separate locations could in fact be a sighting of the same bird. Consequently, the total number of sightings made of individuals cannot be summed together to provide an estimate of the population size.

In assessing the information presented above, a local population for this assessment will be defined as counting '**any observed pairs of adult birds**' from various surveys conducted in the local area. To try and estimate the size of a local population, we have reviewed the Atlas of Living Australia (ALA), Bionet, Far South Coast Birdwatchers (FSCB). These are summarised below. It is noted that perhaps the most reliable set of data is that from the FSCB.

Targeted Field Survey – Merimbula Airport

No incidental observations of Beach Stone Curlews were observed through any of the survey programs undertaken at Merimbula airport. This included some survey for Orange-bellied Parrot in prime mangrove habitat that would be suitable for Beach Stone Curlew and no observations of curlews during BAM surveys in mangrove/saltmarsh habitat.

Bionet Atlas records

Two observations of Beach Stone Curlew are present locally around Merimbula Lake. The first record was dated Aug 2018 and was an observation from the Merimbula Lake boardwalk. Its located 440 m to the north west of the northern runway. The second record is located 20.3km south of the southern runway. The record is an observed pair of Beach Stone Curlews on the northern part of whale beach taken in May 2019.

Atlas of Living Australia

The Atlas of Living Australia is Australia's national biodiversity database. It provides free, online access to information about Australia's biodiversity. It supports research, environmental monitoring, conservation planning, education, and biosecurity activities. A collaboration between CSIRO, Australia's museums and herbaria, universities, and the Australian Government established the Atlas of Living Australia (ALA); a national project focused on making biodiversity information accessible and usable.

Records for the Atlas of Living Australia map are generally consistent with those locations sighted by FSCB surrounding Merimbula Airport (see below).

Far South Coast Birdo (FSCB) records

Experienced ecologist Jackie Miles provided the following records of Beach Stone Curlew from the Far South Coast Birdwatchers Club. A list of records (GPS coordinates unknown) are provided below. **It should be noted that there may be observer bias for records taken as most volunteers live on the coastal strip. Certain areas get routinely surveyed and there is bias in which species are logged over other bird species depending on the observer's interests. This last factor can make rare species appear quite common, as they have more sightings recorded than much more common species.**

The various sightings taken of Beach Stone Curlews are illustrated below (within or surrounding Merimbula) where Beach Stone Curlews have been sighted, including the number of individuals seen during each occasion (source: FSCB):

Location	Dates	Number of individuals
Merimbula and Merimbula Lake	1/9/98	1
	5/8/03	1
Merimbula Lake South side	7/4/18	1
Top Lake Merimbula	5/8/18	1
Spencer River Park Merimbula	16/3/16 to 22/3/16	1
	27/10/17	1
	10/4/16-15/5/16	1
	21/7/18	1
Towamba River mouth	30/11/17	1
Kiah Spit	7/7/17	1
Merimbula north Boat ramp	22/7/17	1
Severs Beach Pambula River	14/12/02	1
Mogareeka	2/1/18	2
	17/02/02	1
Moruya River	26/12/02	1

Mallacoota	3/10/03	1
Pambula River mouth	2/3/03	1
Pambula Lake	30/1/18	1
Wallaga Lake south	17/11/12	1
Nullica River Mouth	16/11/13	1
Kiah Spit	3/5/17	2

As can be seen from the list above, typically only a single bird was seen on each occasion, with very few observations made of pairs of birds (two occasions). Additionally, there appears to be no clear pattern of use or occupation of a site by the species given the varying locations and infrequency of observations of low numbers of birds.

Estimate of population size

It is estimated that there are no breeding pairs of Beach Stone Curlews in the local area. The information indicates that the Beach Stone Curlews are likely transient in their use of habitat within Merimbula Airport and surrounds and include transient birds as noted in the Scientific Committee Determination between Sydney and the Victorian border. No literature or evidence gathered suggests any existing breeding populations around Merimbula.

Scientific literature and available records indicate the most southerly known breeding pairs of beach stone-curlews is Port Stephens and a pair at the mouth of the Manning River near Forster (Hole *et al.* 2001).

c) the extent to which the impact exceeds any threshold for the potential entity

There are currently no known thresholds specified for this species (TSSC, 2011; NSW Government 2019).

d) the likely impact (including direct and indirect impacts) that the development, clearing or biodiversity certification will have on the habitat of the local population, including but not limited to:

i. an estimate of the change in habitat available to the local population as a result of the proposed development

As referenced above, no known breeding populations of BSC exist in the local area. Instead sightings are most likely of transient BSCs. BSCs are likely to utilise the Mangrove and Saltmarsh vegetation communities onsite as foraging and temporary roosting habitat.

SELLS Biometric vegetation mapping of saltmarsh and mangrove was used to estimate the percentage loss of foraging habitat in the local area. It is estimated that 89.6 ha of Mangrove habitat (SR614) and 116.1 ha of Saltmarsh habitat (SR575) occur within 10km of the development site which totals 205.7 ha. Impacts to BSC habitat is summarised below.

Direct impacts (Ultimate EIS)

South Runway = 0.9ha which includes vegetation comprising zones 4 and 5 (Grey Mangrove & River Mangrove habitat). This equates to less than 0.5% loss of foraging habitat.

North Runway = 0.01ha, veg zone 6. This equates to less than 0.1% loss of foraging habitat. Evidence suggests that Beach Stone Curlews prefer to utilise undisturbed habitats (OEH 2019) and if this is the case then they are not likely to utilise any habitat around the north runway due to intensive management for obstacle limitation surfaces (airport safety).

Given the above impacts, an estimated loss of 0.5% of foraging/refuge habitat is estimated for the Beach Stone Curlew.

Indirect impacts

No indirect impacts to Beach Stone Curlew Habitat are anticipated (Refer to section a) above)

ii. the proposed loss, modification, destruction or isolation of the available habitat used by the local population, and

As previously stated, there is no known or reported “local population” of the BSC present in the Far South Coast region, and consequently, there is no recognised breeding habitat present in the area that would be affected by the proposed development. As such, it is likely that adjacent/nearby areas of Mangrove and Saltmarsh vegetation are used (infrequently/occasionally) as only foraging and possible roosting habitat.

It is estimated that a 0.5% loss of foraging habitat will occur on available Mangrove or Saltmarsh vegetation communities. Consequently, the proposed development is not expected to result in large enough losses, destruction, modification, isolation or fragmentation of foraging and roosting habitat areas. Furthermore, given the implementation of recommended management/mitigation measures, the proposal is also considered unlikely to result in any indirect impacts that would remove, destroy, modify or isolate additional habitat mentioned.

iii. modification of habitat required for the maintenance of processes important to the species’ life cycle, genetic diversity and long-term evolutionary development. *BioNet Atlas records or other documented, quantifiable means must be used by the assessor to estimate what percentage of the species’ population and habitat is likely to be lost in the long term within the IBRA subregion due to the direct and indirect impacts of the development*

As stipulated above in section d), it is estimated that there will be a 0.5% direct loss of foraging and temporary roosting habitat for BSC in the local area and no loss to any breeding populations. Section a) summarizes existing records of Beach Stone Curlew within Merimbula. The sporadic records suggest that Merimbula Airport itself, is not particularly favoured habitat, over other locations. Also, there is adjoining habitat which will remain available for any existing BSCs. As no breeding pairs can be confirmed from information available, no impacts are anticipated on genetic diversity. Individuals of BSCs will still be able to freely interact with other individuals thus ensuring long-term evolutionary development.

e) The likely impact on the ecology of the local population. At a minimum, address breeding, foraging, roosting and movement pathways

The proposed development is considered unlikely to result in any (local) population level impacts, because there is no evidence of a “local” population in the Far South Coast region (as described previously in section a).

Individuals have been reported close to the airport are most likely using habitat for foraging and temporary roosting. As stated in previous sections above, it is estimated that the proposed development would remove 0.5% of foraging and temporary roosting habitat available in the area. Consequently, the proposed development is not expected to result in significant reductions to foraging habitat for the species, particularly given that the large extent of available habitat is required to support only a few transient individuals.

As the BSC is a highly mobile species, and that there is already an existing airport operation at the site, combined with the retention/protection of adjacent areas of potential foraging and roosting habitat, the proposed development is not considered likely to result in any impacts to movement (flight) pathways.

f) A description of the extent to which the local population will become fragmented or isolated as a result of the proposed development.

As stated previously, no known local populations of BSC are considered to exist in the Far South Coast region. Individuals are most likely transient birds passing through the area.

The extent of removal of potential habitat is therefore limited to foraging and temporary roosting habitat only which is estimated to be a 0.5% loss. As mentioned in (b) above, BSCs are highly mobile and capable of travelling great distances by air. They would be capable of moving past any areas of disturbance into adjacent habitat.

The Merimbula Airport has been in operation since the late 1960’s. Consequently, any resident individuals in the area would already have some adaptation/tolerance of aircraft in this area. The proposed development, whilst incorporating larger planes, is not expected to result in an increase in the number or frequency of aircraft taking off and landing at the airport.

Given the above, the proposed development is not likely to result in fragmentation of a local population and is also not expected to result in any fragmentation or restriction of movement of individuals between populations.

g) The relationship of the local population to other population/populations of the species. This must include consideration of the interaction and importance of the local population to other population/populations for factors such as breeding, dispersal and genetic viability/diversity, and whether the local population is at the limit of the species’ range.

As defined above, a “local population” of the species is not likely to exist in the local area, or within the South Coast region more broadly. Individuals that have been observed in the nearby areas to the development are likely single transient birds, probably dispersing juveniles between Sydney, Central Coast NSW and the Victorian border and are remote from known breeding sites in northern NSW (TSSC, 2011).

Consequently, the relationship of birds seen in the Merimbula area to other populations are likely to be interactions of individuals between populations. The importance of this dispersal in relation to genetic diversity is unknown/not reported, and the reasons for the dispersal are similarly unknown, in that individuals could be dispersing for a variety of reasons such as increased competition within the existing populations, or, that it could simply be a behavioural trait of some individuals to become transient.

The location is not believed to be at the limit of the species' range, as there are numerous sightings in Victoria, including records as far south as Melbourne, and extending west into South Australia (ALA, 2020).

Importantly, the proposed development is considered unlikely to disrupt or otherwise substantially affect the ability of transient birds to move through the region. Important factors such as dispersal for maintaining genetic diversity of populations are not likely to be substantially affected by the development.

h) The extent to which the proposed development will lead to an increase in threats and indirect impacts, including impacts from invasive flora and fauna, that may in turn lead to a decrease in the local population.

The listed Key threats to the BSC include:

- Predation of eggs and chicks by foxes and dogs. They also disturb foraging habitat
- Disturbances by trampling or removal by humans. 4WDs are a threat at some sites.
- Disturbance to nesting and foraging habitat by domestic dogs.
- Inundation of nests by high tides, storms and other flooding.
- Predation of eggs and chicks by avian predators (corvids and gulls).
- vulnerable to extinction via stochastic events.
- 'Predation, habitat degradation, competition and disease transmission by Feral Pigs, *Sus scrofa*

Of the above listed threats, the ones considered applicable include predation by foxes, dogs (and possibly cats) and potential predation by avian predators. An extension of runway will not increase these already existing threats.

In terms of flora threats, there is very little evidence of weed invasion within saltmarsh or mangrove habitat inside the Merimbula Airport from conducting BAM plots onsite. Species were all native and no weeds were observed in saltmarsh or mangrove habitat. It is considered unlikely that any invasive flora would become established due to runway extensions.

The following management actions are recommended to monitor and manage existing threats;

- Clean fill must be used for runway extensions.
- Undertake regular management of foxes, dogs and cats through trapping/baiting.
- Ensure vegetation is maintained (where permitted in line with OLS) so there is adequate cover/shelter for any individuals of BSC to avoid predation by avian predators.
- Manage sediment and erosion run-off to ensure existing vegetation cover and habitat is preserved for BSC.

These management actions will be included in an adaptive management plan for the site. No key threat related impacts are anticipated.

i) An estimate of the area, or number of populations and size of populations that is in the reserve system in NSW, the IBRA region and the IBRA subregion.

The numbers of areas sustaining 'populations with breeding pairs' is estimated to be between 10-16 in NSW. This is an estimate based on the scientific literature below. It is not known how many populations occur within reserves.

As stated previously, the Scientific Committee Determination for Beach Stone Curlew lists eight known populations which are dispersed in north NSW, and among the major river estuaries resident adults appear to be sedentary and each occupied site is separated by 10 to 150 km (mostly 20-50 km) (Rohweder 2003).

A survey was undertaken to determine the population size and number of potential breeding pairs of Beach Stone-curlews *Esacus neglectus* in New South Wales. The survey involved foot, canoe and vehicle surveys of 22 sites, from the Tweed River south to the Manning River. This included seven known breeding sites, thirteen non-breeding sites, and three sites where the species had not previously been recorded. Survey sites included both ocean beaches and estuaries. Sixteen Beach Stone-curlews were recorded during the survey: thirteen adults, one fledgling and two chicks. At least one of the chicks fledged after the survey period. At the time of the survey BSCs were incubating single eggs at both the Clarence River and Manning River (Farquhar Inlet). The fate of these eggs was not known. BSCs were recorded at eight of the twenty-two sites sampled, all records being at estuarine sites. The results of the study suggest that the population of Beach Stone-curlews has increased over the past decade, although the population remains low. Active management of breeding and potential breeding sites is required if further increases in population are to occur.

A recent survey in NSW counted thirteen adults at eight sites, plus one fledgling and two chicks (Rohweder 2003). Although the survey mainly targeted sites where the species was previously known to breed, there is a relatively high level of confidence in this estimate because the sites were each surveyed intensively, occupied locations have been known to ornithologists for decades and the surveyor widely sought unpublished observations. Furthermore the limited area of linear beaches improves the accuracy of visual searches. Rohweder (2003) allows that his survey effort may have missed some stone-curlews, yet clearly the total number of mature birds in NSW is extremely low.

The Australian population is believed to be stable (Garnett & Crowley 2000). Although the numbers in NSW were thought to have increased slightly over the past decade (Rohweder 2003), the different number of birds in Rohweder's survey (thirteen adults) compared with earlier estimates of ten birds (Smith 1991) may be related to survey effort.

Single transient birds which are probably dispersing juveniles have been observed at several locations between Sydney and the Victorian border, remote from known breeding sites. It is likely that similar levels of dispersal occur in northern NSW (Scientific Committee Determination).

j) The measures proposed to contribute to the recovery of the species in the IBRA subregion.

There are no specific measures proposed to contribute to the recovery of the species in the region. As described previously, there is considered to be no local "population" of the species in this subregion, but rather only transient/vagrant individuals moving between populations in central/northern NSW and Victoria that occasionally take up (likely short-term) residence in the area. Given this, and that the proposed development will not directly impact (i.e. remove, reduce, modify or fragment) any areas of habitat for the

species, combined with the management measures previously described (i.e. sediment and erosion, weed and pest fauna controls etc), the proposed development is considered unlikely to result in a significant impact to the species. Given these, it is not considered necessary that the development contribute to the broader recovery objectives of the species across the subregion.

Notwithstanding the above, the project will assist to some extent in the recovery by ensuring that existing areas of habitat within the airport lands will be managed appropriately, including the management of pest/predator fauna types that may present a threat to the species.

Of additional note, under the Saving Our Species (SOS) program which identifies recovery objectives for the species, The BSC has been assigned to the Site-managed species management stream under the *Saving our Species (SoS)* program. This means that the recovery objectives are identified on a site-by-site basis, and based on the identified/specific Priority Management Sites. For the BSC, there are eight Priority Management sites and all are located in central/northern NSW) or a Contributing Site. Consequently, there are no identified recovery objectives for the species in the south coast of NSW.



Figure 1.1 Map of Beach Stone-curlew occurrence and priority management sites(s) Source: Saving Our Species (NSW Government)