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ROYAL HASKONING DHV

Birubi Point Tourist Interchange

BIODIVERSITY ASSESSMENT

Job No: 180525

Date: 20 June 2018

COAST ECOLOGY
ENVIRONMENTAL ASSESSMENTS

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Birubi Point Tourist Interchange, Biodiversity Assessment

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EXECUTIVE SUMMARY

Royal Haskoning DHV engaged coast ecology to prepare a Biodiversity Assessment for the proposed Birubi Point Tourist interchange at Lot 312 DP 753204 on the corner of James Paterson Street and Gan Gan Road at Anna Bay (hereafter referred to as the Subject Site; Figure 1).

The proposed transport interchange will be developed by Port Stephen's Council and will cater for the growing demand in international and domestic tourism activities at Birubi Point. The proposed works will comprise sand removal and levelling of ground. Buildings and signage will be constructed following completion of civil engineering works. Building will comprise retail units, amenities and toilet blocks.

The Biodiversity Conservation Act and Biodiversity Regulation lists development thresholds to determine when the Biodiversity Offset Scheme (BOS) applies to local developments and are based on:

- Area Criteria or
- Biodiversity Values Map

Subject Site and proposed works fall under the Area Criteria threshold and therefore does not trigger entry into the BOS.

A small portion of the Subject Site has been identified on the Biodiversity Map as land of high biodiversity value (marked as orange on the Biodiversity Values Map). The client has requested information from the Land Management and Biodiversity Conservation (LMBC) Contact Service Centre regarding the reason for this inclusion and are currently awaiting a response. Depending on the reason for this inclusion, or whether the client is able to alter the design plans to avoid impact on this area of high biodiversity value, a Biodiversity Development Assessment Report (BDAR) and entry into the BOS may be required.

Vegetation communities on the Subject Site include:

- Cheese Tree/ Smooth-Barked Apple/ Bangalay Disturbed Open Forest
- Coastal Sand Scrub

Also mapped are areas of:

- Disturbed Vegetation
- Cleared Areas
- Sand Dunes

These communities are not consistent with the definitions of any listed endangered/threatened ecological communities under state or commonwealth legislation.

State Legislation

The BioNet search of threatened flora and fauna previously recorded in the broader study area returned a total of 2,291 records of 43 species. Of these, 11 species (1 flora, 10 fauna) were considered to have potential habitat on the Subject Site.

An assessment of significance of impact under the Biodiversity Conservation Act concluded….

Incomplete – awaiting response from LMBC

Commonwealth Legislation

Under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), actions that have, or are likely to have, a significant impact on a matter of national environmental significance (MNES) require approval from the Australian Government Minister for the Environment (the Minister).

The Study Area does not contain any World Heritage Properties, National Heritage Places, Great Barrier Reef Marine Park or Commonwealth Marine Areas. It does contain two Wetland of International Importance (Hunter Estuary Wetlands; Myall Lakes), seven listed threatened ecological communities, 80 listed threatened species and 74 listed migratory species.

The Subject Site does not form part of the Hunter Estuary Wetland or Myall Lakes and the proposal is unlikely to impact these wetlands. Following a site inspection and habitat assessment, the Subject Site does not contain any threatened ecological communities.

The Subject Site has potential habitat for the following threatened species:

1.	*Dasyurus maculatus*	Spotted-tailed Quoll	E
2.	*Phascolarctos cinereus*	Koala	V
3.	*Pseudomys novaehollandiae*	New Holland Mouse	V
4.	*Pteropus poliocephalus*	Grey-headed Flying-fox	V

Following an assessment of significance of impact, it was concluded that the proposed works (clearing of 0.27 ha of vegetation) will not substantially impact upon these species as the Subject Site does not provide important habitat features for these species. The Subject Site lacks primary feed trees for Koalas, does not contain roost sites for the Grey-headed Flying-fox, lacks den sites for the Spotted-tailed Quoll and the stage of vegetation succession is not preferred by the New Holland Mouse. Subsequently, the Subject Site does not support an important population of these species.

Based on the above assessment it is considered that a referral to SEWPaC is not required.

CONTENTS

1. INTRODUCTION

Royal Haskoning DHV engaged coast ecology to prepare a Biodiversity Assessment for the proposed Birubi Point Tourist interchange at Lot 312 DP 753204 on the corner of James Paterson Street and Gan Gan Road at Anna Bay (hereafter referred to as the Subject Site; Figure 1).

2. SUBJECT SITE/STUDY AREA

The Subject Site (Figure 2) is at the northern end of extensive sand dunes that stretch between Stockton Beach and Anna Bay in the Port Stephens Local Government Area (LGA). The dunes have been subjected to extensive erosion from natural and anthropogenic forces along with alterations to the species composition of the vegetation through weed invasion.

The Study Area (Figure 1) is defined as a 10 x 10 km area centred on *The Subject Site* and includes the broader local area which may be impacted upon, either directly or indirectly by the proposed works. Database searches are conducted within this Study Area limit (Figures 4&5).

3. PROPOSED WORKS

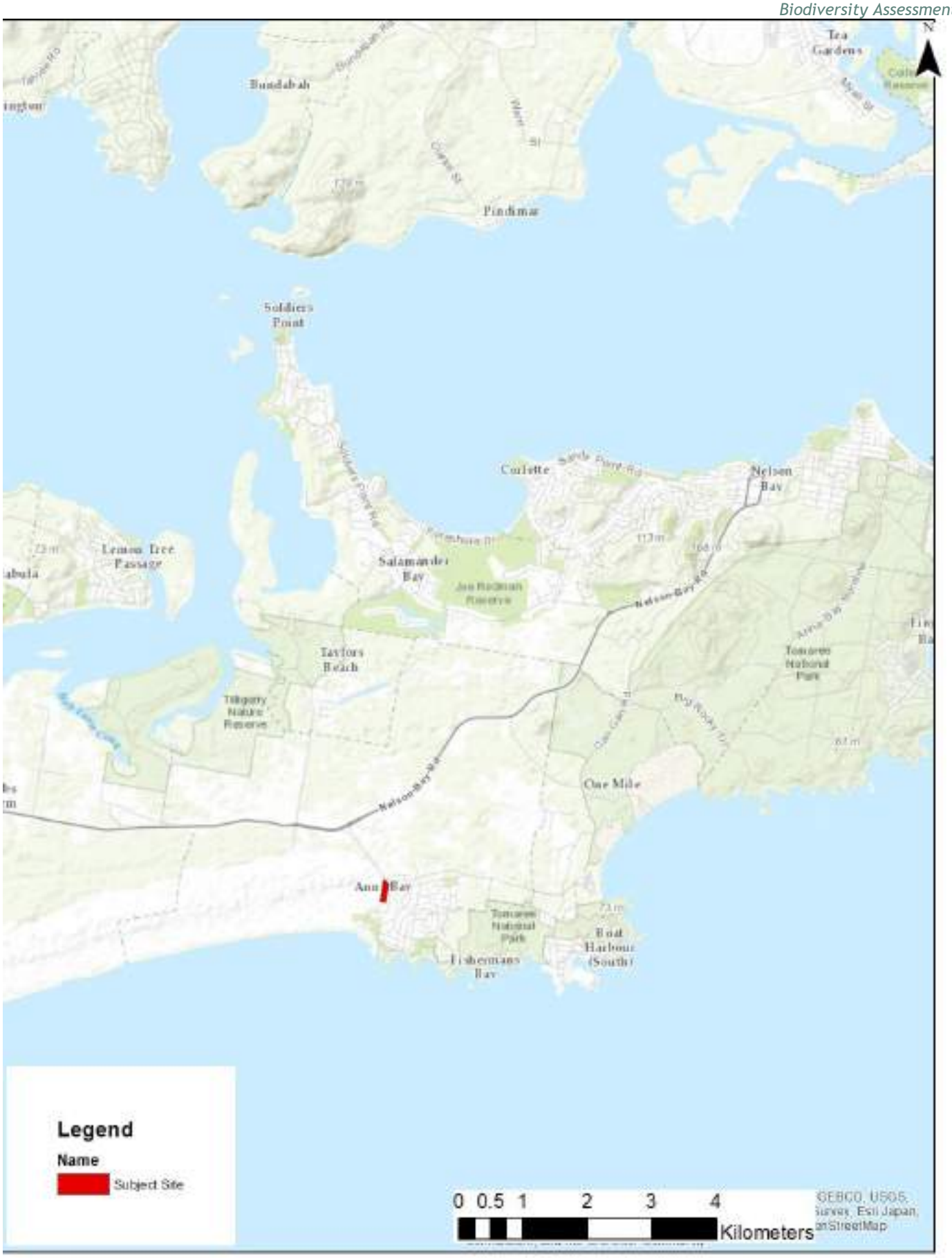
The transport interchange will be developed by Port Stephen's Council and will cater for the growing demand in international and domestic tourism activities at the Worimi Conservation Lands and Birubi Point. The demand for sand dune adventure tourism and cultural heritage experiences has grown to such a point that urgent planning for a transport interchange is being co-funded by the NSW Government's Tourism Demand Driver Infrastructure Fund and Port Stephens Council.

The proposed works will comprise sand removal and levelling of ground in the northern portion of the Subject Site closest to Gan Gan Road. The southern portion of the Subject Site is contained in the Aboriginal Place designation and excluded from development.

Excavated material will be removed and stored off site. A sediment fence will be installed along the western boundary of the site with planting of native species on either side to stabilise the fence and provide screening. Once established with vegetation, the fencing would create a buffer for the interchange from the prevailing winds and sand drift.

A compacted road base sealed with asphalt will be constructed for access routes and parking bays within the transport intersection. Site stormwater drainage and water quality management infrastructure will be incorporated. Buildings and signage will be constructed following completion of civil engineering works. Building will comprise retail units, amenities and toilet blocks.

The *Area of Impact* includes the footprint for the works (Map 1; Figure 3).



COAST ECOLOGY
ENVIRONMENTAL ASSESSMENTS

Figure 1. Locality
Biodiversity Assessment
Birubi Point Proposed Tourist Interchange

COAST ECOLOGY
ENVIRONMENTAL ASSESSMENTS

Figure 2. Subject Site
Biodiversity Assessment
Birubi Point Proposed Tourist Interchange

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Figure 3. Area of Impact
Biodiversity Assessment
Birubi Point Proposed Tourist Interchange

Map 1. Proposed Interchange in Stage A

4. DESKTOP STUDIES

4.1 RELEVANT LEGISLATION

In June 2014 the NSW Government began a review and subsequent reform of the Biodiversity Legislation. In November 2016 the Biodiversity Conservation Act (BC Act) and amendments to the Local Land Services Act (LLS Act) were passed by Parliament. The new legislation commenced on the 25th August 2017 however there were some exceptions to the commencement date.

4.1.1 BIODIVERSITY CONSERVATION ACT 2016

The purpose of the Biodiversity Conservation Act 2016 (BC Act) is to:

- Conserve biodiversity on a bioregional and state scale
- Maintain the quality of ecosystems
- Enhance the ability of ecosystems to adapt to climate change
- Improve and support knowledge, data and resource sharing in the community
- Assess the extinction risk of species and ecological communities
- Identify key threatening processes
- Regulate human-wildlife interactions, based on risk
- Slow the rate of biodiversity loss, and conserve threatened species

The key elements of the BC Act are:

- It introduces Biodiversity Offset Scheme (BOS) which expands offsets beyond major projects to include other types of developments
- Provides a consistent Biodiversity Assessment Method (BAM)
- It introduces flexible offset delivery options
- Assessors are required to be an Accredited Person
- It consolidates Private Land Conservation Agreement types
- It introduces Areas of Outstanding Biodiversity Value (AOBV)

Activities that fall under Part 5 of the EP&A Act can choose to opt in to the BOS if an Assessment of Significance (5-part test) is significant. Alternatively, assessment can continue down the Species Impact Statement (SIS) pathway.

Activities that fall under Part 4 of the EP&A Act must enter into the BOS if the proposal triggers the BOS development thresholds described below in Section 4.1.2.

4.1.2 BIODIVERSITY CONSERVATION REGULATION

The Biodiversity Conservation Regulation 2017 (BC Regulation) provides details on:

- Clearing thresholds and Biodiversity Values Map for application of the BOS
- Principles for consideration of serious and irreversible impacts (SII)
- Rules for meeting biodiversity offset obligation
- Biodiversity Certification criteria
- Compliance provisions.

The BOS development thresholds are used to determine when the BOS applies to local developments and are based on:

- Area Criteria or
- Biodiversity Values Map

For proposals that do not trigger the threshold, a ‘test of significance’ is required. If this indicates a likely significant impact, the Biodiversity Assessment Methodology Order 2017 (BAM) applies.

The Area Criteria are set out in Table 1 below.

Table 1. Biodiversity Offset Scheme Thresholds – Area Criteria

Minimum lot size associated with the property	Threshold for clearing, above which the BAM and offsets scheme apply
Less than 1 ha	0.25 ha or more
1 ha and less than 40 ha	0.5 ha or more
40 ha and less than 1000 ha	1 ha or more
1000 ha or greater	2 ha or more

Part 7 of the BC Regulation (section 7.4) refers to

(1) Proposed development exceeds the biodiversity offsets scheme threshold for the purposes of Part 7 of the Act if it is or involves:

> (a) the clearing of **native vegetation** of an area declared by clause 7.2 as exceeding the threshold, or
>
> (b)the clearing of **native vegetation**, or other action prescribed by clause 6.1, on land included on the Biodiversity Values Map published under clause 7.3

The minimum lot size associated with the property (i.e. size of the Subject Site being Lot 312 DP 753204) is approximately 3.2 ha. The Area of Impact (Figure 3) for the current proposal is approximately 1.2 ha and within this *Area of Impact*, there is 0.27 ha of native vegetation (See Table 4 for vegetation calculations). Thus, the area of native vegetation to be cleared (0.27 ha) is below the clearing threshold (0.5 ha) for entry into the BOS.

A small portion of the Subject Site has also been identified on the Biodiversity Map as land of high biodiversity value (marked as orange on the Biodiversity Values Map) (Map 2: viewed 04/06/2018: see below https://www.lmbc.nsw.gov.au/Maps/index.html?viewer=BVMap). The client has requested information from the Land Management and Biodiversity Conservation (LMBC) Contact Service Centre regarding the reason for this inclusion and are currently awaiting a response.

In the interim, it is speculated that this land was included on the Biodiversity Values Map as it has been mapped as preferred Koala Habitat under the Koala Habitat Planning Map which is part of the Koala Plan of Management adopted by Council (June 2001). Following a site assessment, this area is not considered to represent potential or core koala habitat (refer Section 4.1.4). Exclusion of this land from the Biodiversity Values Map may take time, however if the client wishes to amend the *Area of Impact* to avoid the high biodiversity value areas, then the approval process can proceed without entering the BOS.

In the event that entry into the BOS is required for the proposed works, a Biodiversity Development Assessment Report (BDAR) is required which is undertaken using the Biodiversity Assessment Methodology (BAM). This would result in a monetary offset for the clearing of native vegetation and additional survey and reporting would be required under this format.

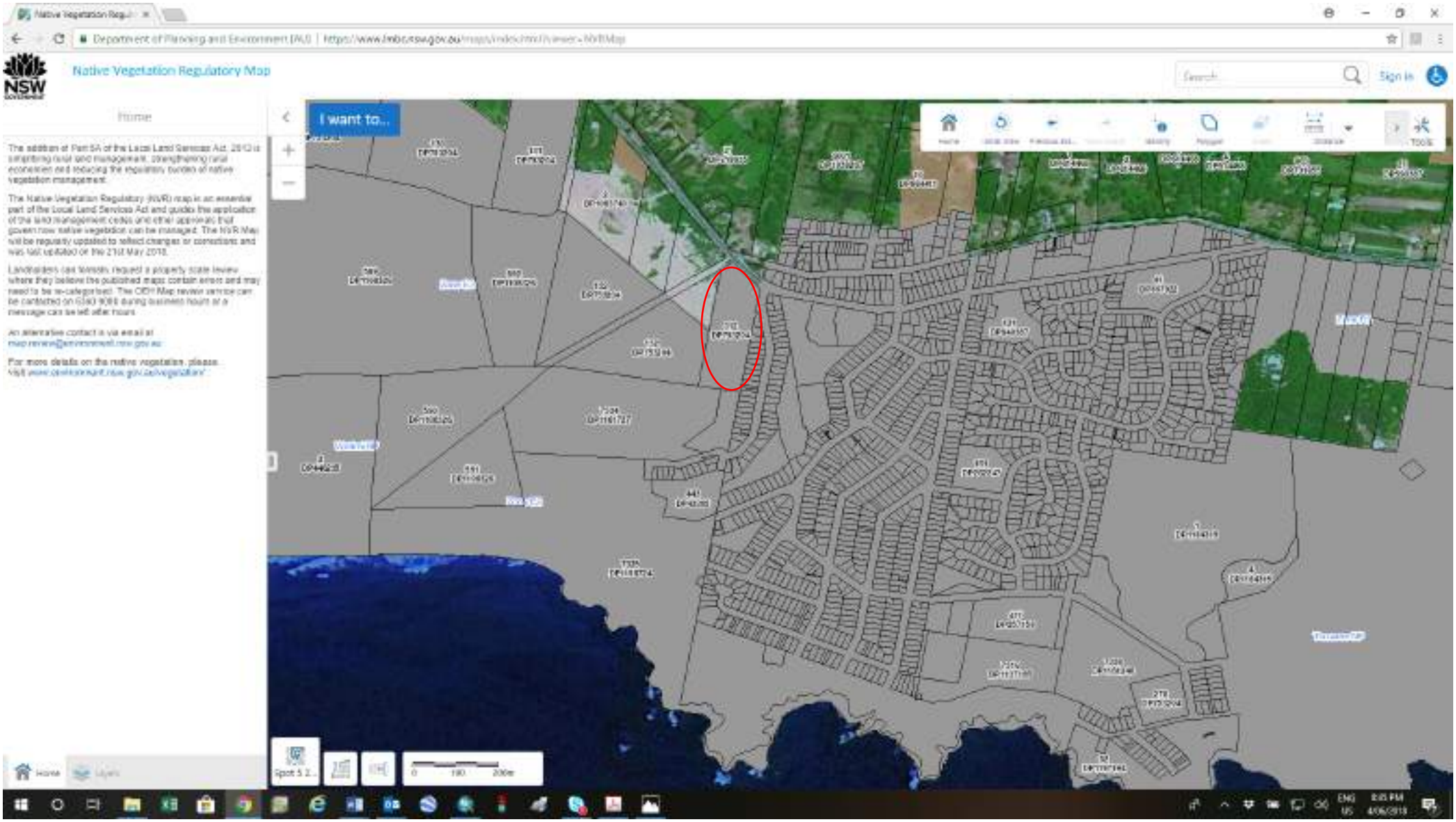
4.1.3 LOCAL LAND SERVICES ACT 2013

The LLS Act only applies to rural land.

In addition, the Subject Site is mapped as *Land Excluded from LLS Act* and it has not been mapped on the Native Vegetation Regulatory Map (Map 3: viewed 04/06/2018: https://www.lmbc.nsw.gov.au/maps/index.html?viewer=NVRMap).

Map 2. Biodiversity Values Map

Map 3. Native Vegetation Regulatory Map



4.1.4 SEPP 44 KOALA HABITAT PROTECTION

The provisions of SEPP 44 Koala Habitat Protection apply to all lands within Newcastle Local Government Area.

This Policy aims to encourage the proper conservation and management of areas of natural vegetation that provide habitat for koalas to ensure a permanent free-living population over their present range and reverse the current trend of koala population decline:

(a) by requiring the preparation of plans of management before development consent can be granted in relation to areas of core koala habitat, and

(b) by encouraging the identification of areas of core koala habitat, and

(c) by encouraging the inclusion of areas of core koala habitat in environment protection zones.

In this Policy:

core koala habitat means an area of land with a resident population of koalas, evidenced by attributes such as breeding females (that is, females with young) and recent sightings of and historical records of a population.

potential koala habitat means areas of native vegetation where the trees of the types listed in Schedule 2 constitute at least 15% of the total number of trees in the upper or lower strata of the tree component.

Land to which this Part applies

This Part applies to land:

(a) that is land to which this Policy applies, and

(b) that is land in relation to which a development application has been made, and

(c) that:

(i) has an area of more than 1 hectare, or

(ii) has, together with any adjoining land in the same ownership, an area of more than 1 hectare,

whether or not the development application applies to the whole, or only part, of the land.

The Subject Site is 3.2 hectares, thus SEPP 44 is triggered.

Step 1—Is the land potential koala habitat?

The Subject Site does not contain any schedule 2 Feed Tree under this SEPP nor does it contain *main koala food trees* listed under North Coast (Hunter-Central Rivers, Northern Rivers) by Office of Environment and Heritage (NSW OEH, undated). A portion of the Subject Site is mapped as Swamp Mahogany-Paperbark Forest (LHCCREMS, 2000: Figure 6) however following a site inspection, the vegetation was not consistent with the mapping and no Swamp Mahogany were present. Two Bangalay *Eucalyptus botryoides* were however present and this species is similar in appearance to Swamp Mahogany.

Thus, preferred feed trees do not contribute more than 15% of the total number of trees present. As such, The Subject Site does contain potential koala habitat.

Step 2—Is the land core koala habitat?

Actives searches for koala scat were undertaken at the base of all native trees within the three vegetation quadrats. No scats, scratches or signs of koala utilisation were recorded. A resident population is considered unlikely on The Subject Site however it may be used by dispersing males on occasion, given the proximity of known koala habitat in the Port Stephens region.

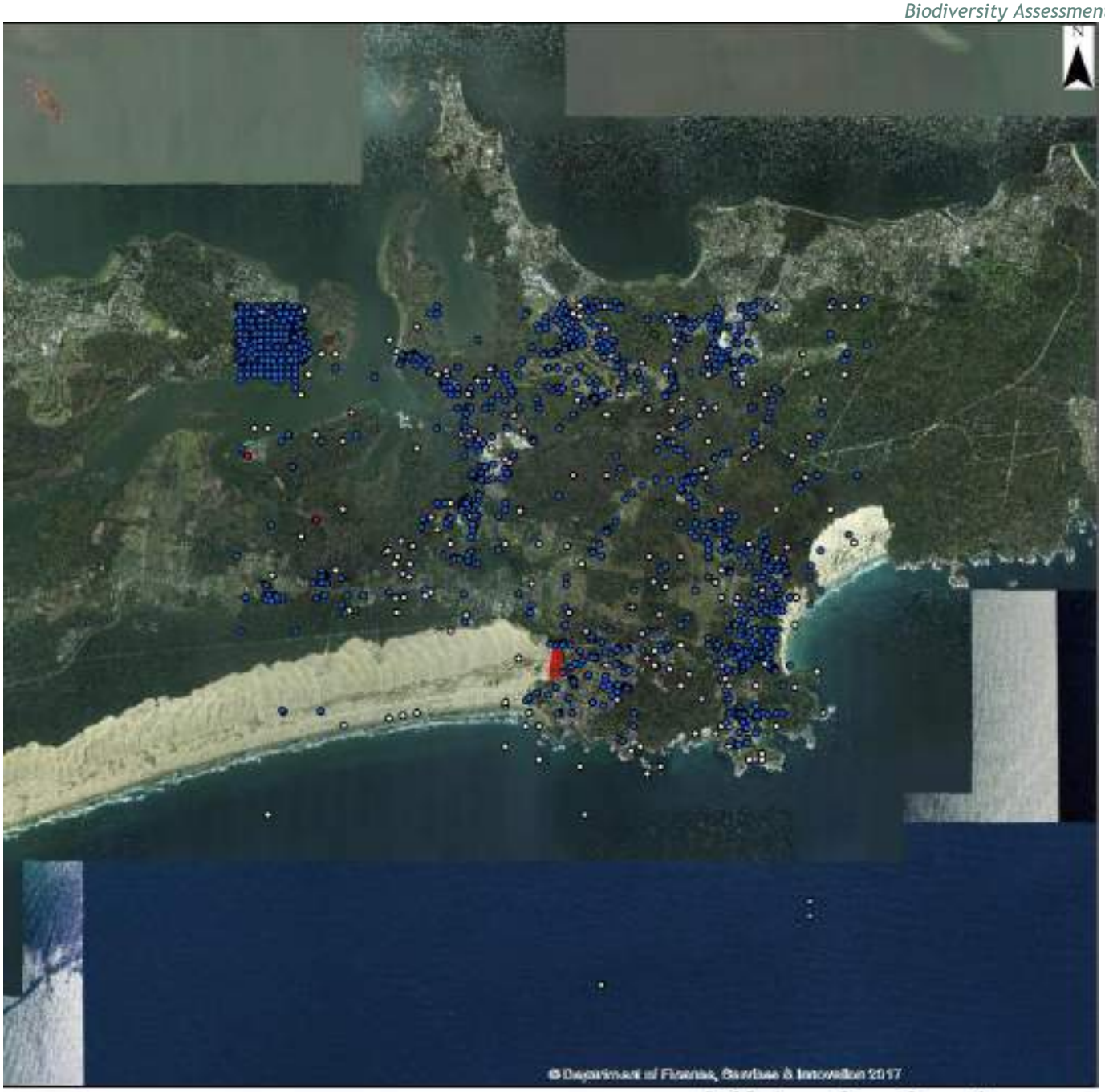
Thus, it is considered that the Subject Site does not constitute core koala habitat and as such, further koala assessment is not required.

4.2 DATABASE SEARCHES

A database search was conducted within a 10 x 10 km area centred on the Subject Site from the following databases:

- BioNet website for the Atlas of NSW Wildlife. BioNet is a portal for accessing government held information about plants and animals in NSW. It is supported by several NSW government held agencies including Office of Environment and Heritage (OEH) (National Parks and Wildlife and Royal Botanic Gardens and Domain Trust), Department of Primary Industries (Forests NSW and Fisheries NSW) and the Australian Museum. BioNet contains records for threatened species and endangered ecological communities listed under the Threatened Species Conservation Act 1995 (TSC Act) and the Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act) which have been recorded within the locality. The search was conducted on 31/05/2018 using search coordinates: North: -32.73, West: 152.03, East: 152.13, South: -32.83. It returned a total of 2,291 records of 43 species. Species listed as being part of the bilateral migratory bird agreements with China (CAMBA), Japan (JAMBA) and Republic of Korea (ROKAMBA) are also listed http://www.bionet.nsw.gov.au/
- Australian Government: Department of the Environment Protected Matters Search Tool for Matters of National Environmental Significance (NES) listed under the Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act) that may occur in the Study Area. a region search was conducted on 05/06/2018 under Port Stephens Council LGA http://www.environment.gov.au/epbc/protected-matters-search-tool

A full list of threatened species (pursuant to the TSC Act) and Endangered Ecological Communities (EECs) recorded in the Study Area from database searches are provided in tables A1 and A2 (Appendix A) respectively. The locations of threatened fauna and flora previously recorded within a 10 km radius of the Study Area are shown in Figures 4 and 5 respectively. Results of the protected matters search tool are provided in Tables A3, A4 and A5 (Appendix A).



Legend

- Subject Site
- Barking Owl
- Black-necked Stork
- Brush-tailed Phascogale
- Bush Stone-curlew
- Cattle Egret
- Dusky Woodswallow
- Eastern Bentwing-bat
- Eastern Cave Bat
- Eastern False Pipistrelle
- Eastern Freetail-bat
- Eastern Grass Owl
- Emu NSW PS LGA
- Giant Dragonfly
- Glossy Black-Cockatoo
- Greater Broad-nosed Bat
- Green Turtle
- Grey-headed Flying-fox
- Hawksbill Turtle
- Humpback Whale
- Koala
- Little Bentwing-bat
- Little Lorikeet
- Loggerhead Turtle
- Masked Owl
- New Holland Mouse
- Northern Giant-Petrel
- Pied Oystercatcher
- Powerful Owl
- Short-tailed Shearwater
- Shy Albatross
- Southern Myotis
- Spotted-tailed Quoll
- Squirrel Glider
- Swift Parrot
- Varied Sittella
- Wallum Froglet
- Wedge-tailed Shearwater
- Whimbrel
- White-bellied Sea-Eagle
- White-throated Needletail

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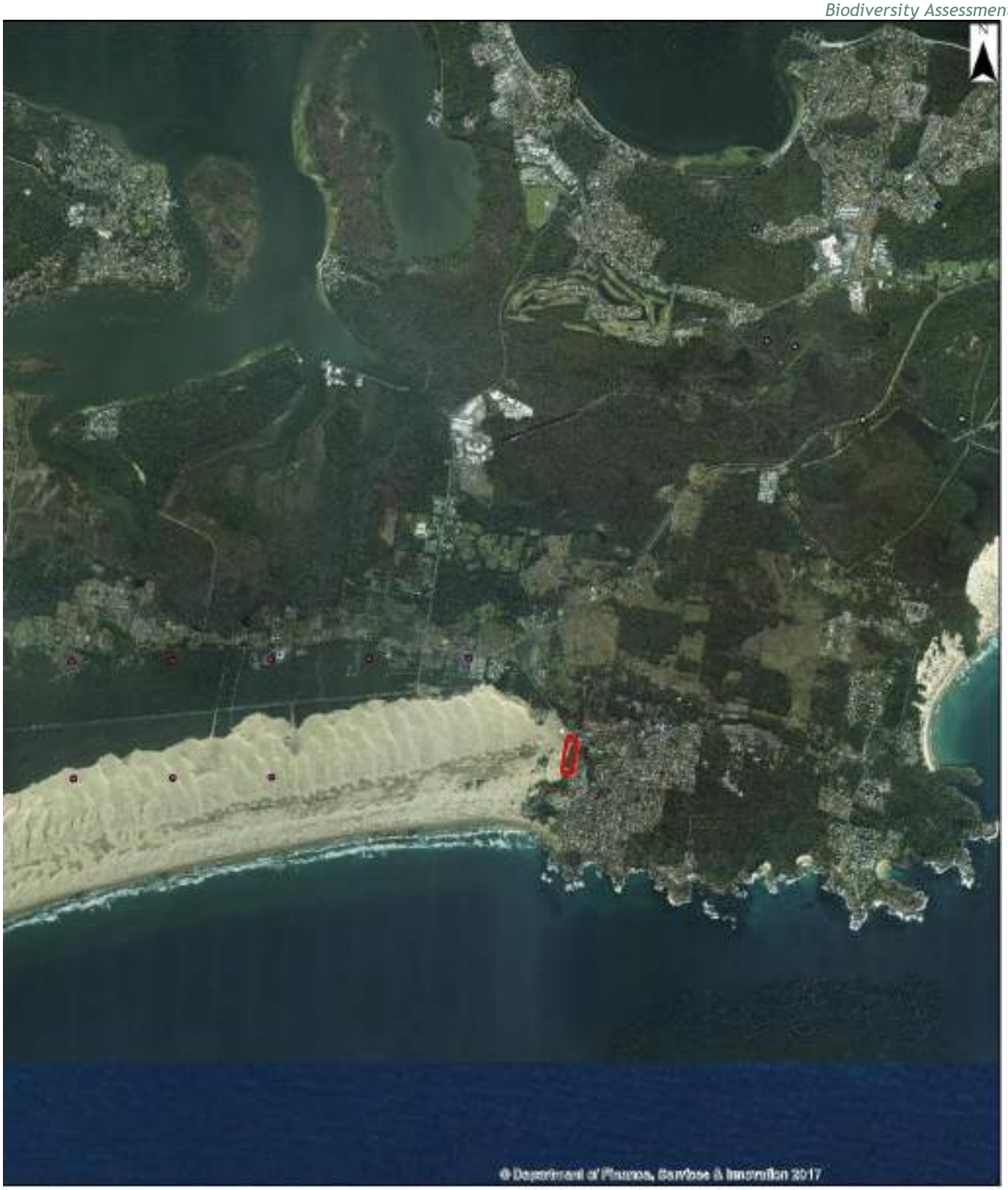
Figure 4. Threatened Fauna recorded within a 10x10km radius of the Subject Site: BioNet 04/06/2018, Biodiversity Assessment
Birubi Point Proposed Tourist Interchange



Legend

Subject Site
Callistemon linearifolius
Diuris praecox
Diuris arenaria
Eucalyptus pa
0 0.325 0.65 1.3 1.95 2.6
Kilometers

Figure 5. Threatened Flora recorded within a 10x10km radius of the Subject Site: BioNet 04/06/2018, Biodiversity Assessment Birubi Point Proposed Tourist Interchange

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4.3 VEGETATION MAPPING

The Lower Hunter Central Coast Regional Environmental Management Strategy (LHCCREMS) Vegetation Survey, Classification and Mapping report (Report: April 2000, mapping 2002) identified four vegetation communities within the Subject Site (Figure 6). Table A6 (Appendix A) lists these vegetation communities and provides a brief description of each, including their legal status.

One of the communities mapped by LHCCREMS (Swamp Mahogany – Paperbark Swamp Forest) falls under the definition of a listed Endangered Ecological Community under the Biodiversity Conservation Act (BC Act): *Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions*" Endangered Ecological Community (EEC).

Following a site inspection, the Subject Site was not mapped as having this EEC as the Subject Site does not have the characteristic species of this EEC such as Swamp Mahogany E. robusta and Paperbark *Melaleuca quinquenervia*. This is discussed further in Section 6.2.1.

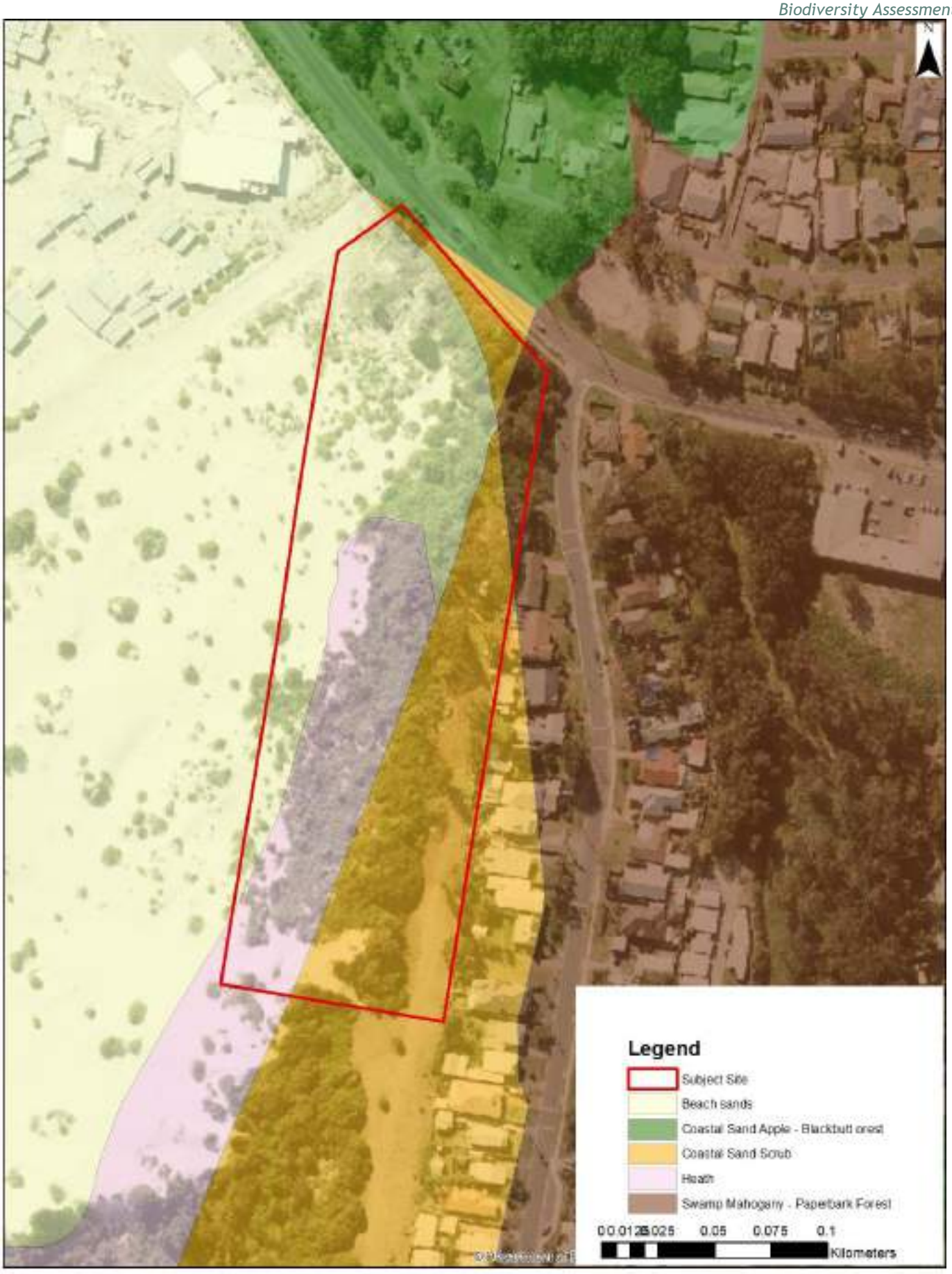

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Figure 6. Vegetation Mapping: LHCCREMS 2000
Biodiversity Assessment
Birubi Point Proposed Tourist Interchange

COAST ECOLOGY
ENVIRONMENTAL ASSESSMENTS

Figure 7. Vegetation Mapping: Coast Ecology
Biodiversity Assessment
Birubi Point Proposed Tourist Interchange

5. FIELD SURVEYS

Field surveys were undertaken on 7 June 2018 within the Area of Impact on the Subject Site. Three vegetation quadrats were established to assess vegetation integrity and condition. Opportunistic fauna sightings were also undertaken.

A copy of quadrat data sheets is provided in Appendix D and a full species list is provided in Table A7 (Appendix A).

5.1 VEGETATION MAPPING

The vegetation across the Subject Site had a high level of weed invasion. In the north eastern corner of the Subject Site, the vegetation was mapped as 'disturbed' due to the high percent cover of exotic species. The area behind existing residents along James Paterson Street has been cleared for lawn and an access track and was subsequently mapped as 'cleared areas'. In addition, the sand dunes which had isolated clumps of bitou bush were not mapped as vegetated. This is consistent with LHCCRES mapping which also did not map the sand dunes as vegetated.

Areas that are not native vegetation do not require further assessment (Section 5.1.1.5 BAM).

Vegetation communities on the Subject Site include (refer Figure 7):

- Cheese Tree/ Smooth-Barked Apple/ Bangalay Disturbed Open Forest
- Coastal Sand Scrub

Also mapped are areas of:

- Disturbed Vegetation
- Cleared Areas
- Sand Dunes

5.1.1 CHEESE TREE/ SMOOTH-BARKED APPLE/ BANGALAY DISTURBED OPEN FOREST

This community has been highly disturbed through encroaching garden/lawns, a vehicle access track and invasive exotic species.

Upper Stratum: 8-25m height range

The upper canopy is dominated by Cheese Tree *Glochidion ferdinandii* and Smooth-barked Apple *Angophora costata*. There are also 2 large Bangalay *Eucalyptus botryoides* located over a kikuyu lawn adjoining a residential dwelling along with individual Rough-barked Apple *Angophora floribunda* and *Pittosporum undulatum*. Exotic canopy species were numerous and had a high percent cover and included Coral Tree *Erythrina x sykesii**, Liquid amber *Liquidambar styraciflua** and Camphor laurel *Cinnamomum camphora**.

Middle Stratum: 1-8m height range

The middle stratum was sparse and native species included Coffee Bush *Breynia oblongifolia* and Gymea Lily *Doryanthes excelsa*. Exotic species in the middle stratum included Lantana *Lantana camara**.

Lower Stratum: 0-1m height range

The lower stratum was dominated by Wandering Jew *Tradescantia fluminensis**. Other exotic herbs include chickweed *Stellaria media**. Exotic grasses were dominant such as Kikuyu *Pennisetum clandestinum**, African Veldt Grass *Ehrharta erecta**, Guinea Grass *Penicium maximum** and Winter Grass *Poa annua**. There were also planted garden exotics such as Bromeliad, succulents, dracaena and yuccas within the community.

Status/PCT:

It is difficult to assign this community to a Plant Community Type (PCT) under the BioNet Vegetation Classification as it has been highly modified through clearing and exotic invasion. The dominant native canopy species have similarities with the PCT's listed in Table 2.

Table 2. Plant Community Types with similarities to vegetation from the Cheese Tree/Smooth-barked Apple/Bangalay Open Forest

PCT ID	Common Name	Scientific Name	Comment
1645	Old Man Banksia - Rough-barked Apple - Bangalay shrubby open forest on coastal sands of the Central Coast	*Angophora floribunda , Eucalyptus botryoides / Banksia serrata , Glochidion ferdinandi , Allocasuarina littoralis , Macrozamia communis , Platysace lanceolata , Breynia oblongifolia , Monotoca elliptica , Acacia suaveolens , Hardenbergia violacea / Lomandra longifolia , Dianella caerulea , Pomax umbellata , Themeda australis , Pteridium esculentum*	This PCT is not known from the Port Stephens area and a number of canopy species are absent from the Subject Site.
1648	Smooth-barked Apple - Blackbutt heathy open forest of the Tomaree Peninsula	*Angophora costata , Corymbia gummifera , Eucalyptus pilularis / Banksia serrata , Acacia terminalis , Bossiaea rhombifolia , Dillwynia retorta , Eriostemon australasius , Acacia suaveolens , Ricinocarpos pinifolius , Acacia ulicifolia , Persoonia levis / Themeda australis , Leucopogon ericoides , Tetratheca ericifolia , Hypolaena fastigiata , Pteridium esculentum , Epacris pulchella.*	A number of characteristic species are absent from the Subject Site
1793	Smooth-barked Apple - Bangalay / Tuckeroo - Cheese Tree open forest on coastal sands of the Sydney basin	*Angophora costata, Eucalyptus botryoides , Banksia integrifolia / Elaeocarpus reticulatus , Banksia integrifolia , Cupaniopsis anacardioides , Glochidion ferdinandi / Lomandra longifolia , Pteridium esculentum , Dianella caerulea , Imperata cylindrica var. major*	This PCT is not known from the Port Stephens area however this PCT has the most consistencies with the species recorded in this community on the Subject Site.

5.1.2 DISTURBED VEGETATION

This vegetation could not be assigned a native vegetation community description due to the high percentage of weeds present in all strata.

Upper Stratum: 3-15m height range

Only one isolated Smooth-barked Apple was observed outside the quadrat in the upper stratum.

Middle Stratum: 1-3m height range

Native species in the middle stratum of this quadrat were limited to three species: Coastal Tea tree *Leptospermum laevigatum*, Green Wattle *Acacia irrorata* and Coastal Wattle *Acacia longifolia subsp. sophorae*. Exotics in the middle stratum consisted of high threat exotics such as Castor Oil Plant *Ricinus communis**, Lantana *L. camara** and Bitou Bush *C. monilifer*a,*

Lower Stratum: 0-1m height range

Lower stratum species within the quadrat consisted entirely of exotic species, including spiny Burr Grass *Cenchrus echinatus**, Panic Veldtgrass *Ehrharta erecta**, Paspalum *Paspalum dilatatum**, Cobblers Pegs *Bidens Pilosa** and Khaki weed *Alternanthera pungens**.

This community was not assigned a PCT due to its highly disturbed nature and lack of native canopy species.

5.1.3 COASTAL SAND SCRUB

The Coastal Sand Scrub community on the Subject Site has been highly impacted by Bitou Bush *C. monilifera** and Coral Trees *Erythrina x sykesii**.

Upper Stratum: 2-20m height range

A number of Coral Trees *E. sykesii** occur in this community. No other upper canopy species were present in the quadrat and few natives occurred across the community.

Middle Stratum: 1-2m height range

This stratum is largely dominated by Bitou Bush *C. monilifera** however some natives still occur in this stratum including Coastal Wattle *A. longifolia subsp sophorae* and Coastal Tea tree *L. laevigatum*.

Lower Stratum: 0-1m height range

The lower stratum is sparse, consisting either of bare sand, or exotic species such as Beach Evening Primrose *Oenothera drummondii**, American Searocket *Cakile edentula**, Pennywort *Hydrocotyle bonariensis** *and* Sea Spurge *Euphorbia paralias**.

Status/PCT

It is difficult to assign this community to a Plant Community Type (PCT) under the BioNet Vegetation Classification as it has been highly modified through dune erosion and exotic invasion. The dominant native species have similarities with the PCT's listed in Table 3.

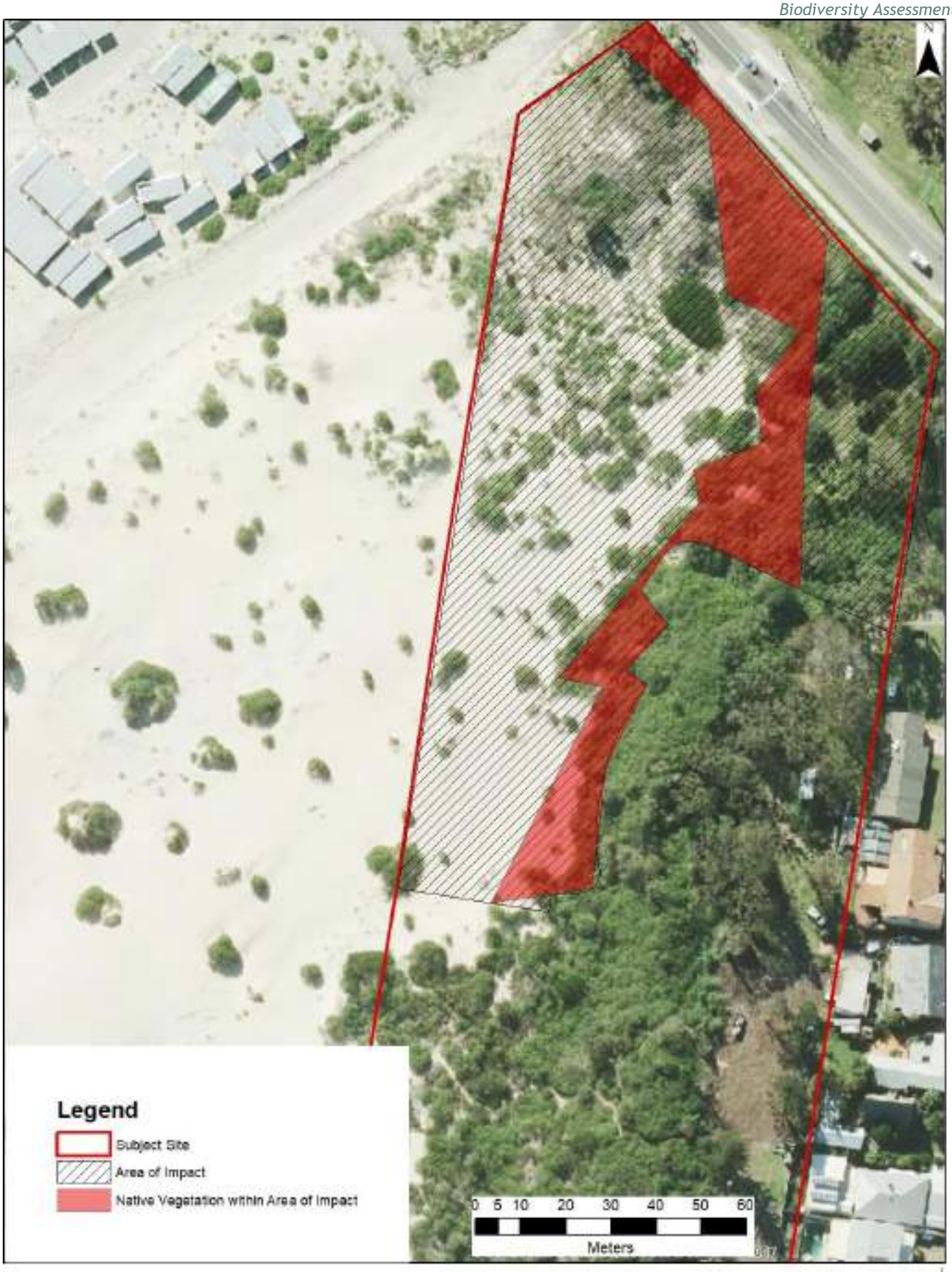
Table 3. Plant Community Types with similarities to vegetation from the Coastal Sand Scrub

PCT ID	Common Name	Scientific Name	Comment
772	Coast Banksia - Coast Wattle dune scrub of the Sydney Basin Bioregion and South East Corner Bioregion	*Banksia integrifolia subsp. integrifolia , Leptospermum laevigatum / Acacia longifolia subsp. sophorae , Leucopogon parviflorus , Rhagodia candolleana subsp. candolleana , Breynia oblongifolia / Actites megalocarpa , Carpobrotus glaucescens , Isolepis nodosa , Lomandra longifolia*	This PCT is not known from the Port Stephens area however the Subject Site contains many of the species listed in this PCT.
784	Coastal headland heaths of the NSW North Coast Bioregion	*Acacia longifolia subsp. sophorae , Banksia integrifolia subsp. integrifolia / Leucopogon parviflorus / Pimelea linifolia , Pultenaea maritima , Themeda australis , Imperata cylindrica var. major*	This PCT does occur in the Port Stephens LGA however a number of species are absent from the Subject Site
1821	Coastal Foredune Wattle Scrub	*Acacia longifolia , Leptospermum laevigatum , Banksia integrifolia , Monotoca elliptica , Leucopogon parviflorus , Breynia oblongifolia , Rhagodia candolleana / Spinifex sericeus , Carpobrotus glaucescens , Ficinia nodosa , Pelargonium australe , Dianella congesta , Dichondra repens , Scaevola calendulacea*	This PCT is not known from the Port Stephens area however the Subject Site contains many of the species listed in this PCT.

The area of native vegetation within the Subject Site and within the Area of Impact is calculated and summarised in Table 4.

Table 4. Area of Native Vegetation

Vegetation Community	m^2 in Subject Site	m^2 in Area of Impact
Cheese Tree/ Smooth-Barked Apple/ Bangalay Disturbed Open Forest	767	
Disturbed Vegetation	1,785	
Coastal Sand Scrub	5,388	
Cleared Areas	1,110	
Sand Dunes	8,097	
Total	17,147	2,725



COAST ECOLOGY
ENVIRONMENTAL ASSESSMENTS

Figure 8. Native Vegetation within the Area of Impact
Biodiversity Assessment
Birubi Point Proposed Tourist Interchange

5.2 HABITAT ASSESSMENT

The Subject Site provides habitat for a range of common bird species and drainage lines along the perimeter of the roads provided some habitat for amphibians

The Subject Site provides potential foraging habitat for forest bats however it lacks hollow bearing trees and as such does not provide roosting or nesting habitat for hollow dependant species including forest bats, parrots, owls or arboreal mammals.

The Subject Site provides habitat for native and exotic ground dwelling mammals.

5.3 FAUNA

Fauna surveys were limited to opportunistic sightings of diurnal bird species and common frog species. Large paw prints, likely belonging to unaccompanied domestic dogs, were observed in the sand dunes and sand scrub.

Common birds observed during vegetation plots are listed in Table 5.

Table 5. Opportunistic Fauna Sightings (07/06/2018)

Common Name	Scientific Name
BIRDS	
Eastern Spinebill	*Acanthorhynchus tenuirostris*
Little Wattlebird	*Anthochaera chrysoptera*
Australian Raven	*Corvus coronoides*
Eastern Yellow Robin	*Eopsaltria australis*
Bar-shouldered Dove	*Geopelia humeralis*
Australian Magpie	*Gymnorhina tibicen*
White-bellied Sea-Eagle	*Haliaeetus leucogaster*
Welcome Swallow	*Hirundo neoxena*
Superb Fairy-wren	*Malurus cyaneus*
Eastern Rosella	*Platycercus eximius*
AMPHIBIANS	
Common Eastern Froglet	*Crinia signifera*

6. ASSESSMENT OF SIGNIFICANCE: BC ACT

A habitat assessment of threatened flora and fauna reported on BioNet is provided in Table A8 (Appendix A). Species with potential habitat on the Subject Site were considered further in an Assessment of Significance (5 part test) in Appendix B. A summary of threatened species and endangered ecological communities with potential habitat on the Subject Site are listed in Table 6.

Table 6. Threatened Species and Endangered Ecological Communities with potential habitat on the Subject Site

Scientific Name	Common Name	NSW Status	Comm. Status	Records
Crinia tinnula	Wallum Froglet	V,P		69
Artamus cyanopterus cyanopterus	Dusky Woodswallow	V,P		2
Glossopsitta pusilla	Little Lorikeet	V,P		5
Dasyurus maculatus	Spotted-tailed Quoll	V,P	E	12
Miniopterus australis	Little Bentwing-bat	V,P		16
Phascolarctos cinereus	Koala	V,P	V	1,947
Pseudomys novaehollandiae	New Holland Mouse	P	V	7
Pteropus poliocephalus	Grey-headed Flying-fox	V,P	V	18
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V,P		2
Diuris arenaria	Sand Doubletail	E1,P		175

6.1 THREATENED SPECIES

TO BE COMPLETED FOLLOWING ADVICE FROM LMBC AND DETERMINATION REGARDING THE PREPARATION OF A BDAR

6.2 ENDANGERED ECOLOGICAL COMMUNITIES

Table A2 lists Endangered Ecological Communities (EECs) with potential to occur in the Study Area as recorded on BioNet. None of these EECs were identified on the Subject Site.

6.2.1 Swamp Sclerophyll Forest EEC

Vegetation Mapping by LHCCREMS (2000) maps Swamp Mahogany – Paperbark Swamp Forest as occurring on the Subject Site. This community falls under the definition of a listed Endangered Ecological Community under the Biodiversity Conservation Act (BC Act): *Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions*" Endangered Ecological Community (EEC).

This EEC is associated with humic clay loams and sandy loams, on waterlogged or periodically inundated alluvial flats and drainage lines associated with coastal floodplains. It generally occurs below 20 m (though sometimes up to 50 m) elevation. The composition of the community is primarily determined by the frequency and duration of waterlogging and the texture, salinity nutrient and moisture content of the soil, and latitude. The composition and structure of the understorey is influenced by grazing and fire history, changes to hydrology and soil salinity and other disturbance, and may have a substantial component of exotic grasses, vines and forbs.

This swamp community has an open to dense tree layer of eucalypts and paperbarks although some remnants now only have scattered trees as a result of partial clearing. The trees may exceed 25 m in height but can be considerably shorter in regrowth stands or under conditions of lower site quality where the tree stratum is low and dense. For example, stands dominated by *Melaleuca ericifolia* typically do not exceed 8 m in height. The community also includes some areas of fernland and tall reedland or sedgeland, where trees are very sparse or absent.

The most widespread and abundant dominant trees include *Eucalyptus robusta* (swamp mahogany), *Melaleuca quinquenervia* (paperbark) and, south from Sydney, *Eucalyptus botryoides* (bangalay) and *Eucalyptus longifolia* (woollybutt). Other trees may be scattered throughout at low abundance or may be locally common at few sites, including *Callistemon salignus* (sweet willow bottlebrush), *Casuarina glauca* (swamp oak) and *Eucalyptus resinifera* subsp. *Hemilampra* (red mahogany), *Livistona australis* (cabbage palm) and *Lophostemon suaveolens* (swamp turpentine).

A layer of small trees may be present, including *Acacia irrorate* (green wattle), *Acmena smithii* (lilly pilly), *Elaeocarpus reticulatus* (blueberry ash), *Glochidion ferdinandi* (cheese tree), *Melaleuca linariifolia* and *M. styphelioides* (paperbarks).

Shrubs include *Acacia longifolia, Dodonaea triquetra, Ficus coronata, Leptospermum polygalifolium* subsp. *Polygalifolium* and *Melaleuca* spp. Occasional vines include *Parsonsia straminea, Morinda jasminoides* and *Stephania japonica* var. *discolor*.

The groundcover is composed of abundant sedges, ferns, forbs, and grasses including *Gahnia clarkei, Pteridium esculentum, Hypolepis muelleri, Calochlaena dubia, Dianella caerulea, Viola hederacea, Lomandra longifolia, Entolasia marginate* and *Imperata cylindrica*.

On sites downslope of lithic substrates or with soils of clay-loam texture, species such as *Allocasuarina littoralis, Banksia oblongifolia, B. spinulosa, Ptilothrix deusta* and *Themeda australis*, may also be present in the understorey.

Following a site assessment, the Subject Site did not contain Swamp Mahogany, Melaleucas or Woolybutt. It did contain two isolated Bangalay however this species is typically only characteristic of this community south of Sydney. The Subject Site also contained Cheese Tree however this is a commonly occurring tree in many vegetation communities and is not a

characteristic species of the Swamp Sclerophyll EEC. The substrate of the Subject Site is sand and is not characteristic of a waterlogged or periodically inundated alluvial floodplain.

TO BE COMPLETED FOLLOWING ADVICE FROM LMBC AND DETERMINATION REGARDING THE PREPARATION OF A BDAR

7. ASSESSMENT OF SIGNIFICANCE: EPBC ACT

Under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), actions that have, or are likely to have, a significant impact on a matter of national environmental significance (MNES) require approval from the Australian Government Minister for the Environment (the Minister).

The Study Area does not contain any World Heritage Properties, National Heritage Places, Great Barrier Reef Marine Park or Commonwealth Marine Areas. It does contain two Wetland of International Importance (Hunter Estuary Wetlands; Myall Lakes), seven listed threatened ecological communities, 80 listed threatened species and 74 listed migratory species.

The Subject Site does not form part of the Hunter Estuary Wetland or Myall Lakes and the proposal is unlikely to impact these wetlands. Following a site inspection and habitat assessment, the Subject Site does not contain any threatened ecological communities.

The Subject Site has potential habitat for the following threatened species:

1.	*Dasyurus maculatus*	Spotted-tailed Quoll	E
2.	*Phascolarctos cinereus*	Koala	V
3.	*Pseudomys novaehollandiae*	New Holland Mouse	V
4.	*Pteropus poliocephalus*	Grey-headed Flying-fox	V

Following an assessment of significance of impact, it was concluded that the proposed works (clearing of 0.27 ha of vegetation) will not substantially impact upon these species as the Subject Site does not provide important habitat features for these species. The Subject Site lacks primary feed trees for Koalas, does not contain roost sites for the Grey-headed Flying-fox, lacks den sites for the Spotted-tailed Quoll and the stage of vegetation succession is not preferred by the New Holland Mouse. Subsequently, the Subject Site does not support an important population of these species.

Based on the above assessment it is considered that a referral to SEWPaC is not required.

8. RECOMMENDATIONS

9. REFERENCES

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10. APPENDIX A: DESKTOP RESULTS

Table A1. BioNet Search Results for threatened species listed under the TSC Act and EPBC Act with a 10 x 10 km Area.

Scientific Name	Common Name	NSW status	Comm. status	Records
FAUNA				
Crinia tinnula	Wallum Froglet	V,P		69
Caretta caretta	Loggerhead Turtle	E1,P	E	1
Chelonia mydas	Green Turtle	V,P	V	3
Eretmochelys imbricata	Hawksbill Turtle	P	V	2
Dromaius novaehollandiae	Emu population in the New South Wales North Coast Bioregion and Port Stephens local government area	E2,P		1
Hirundapus caudacutus	White-throated Needletail	P	C,J,K	4
Thalassarche cauta	Shy Albatross	V,P	V	1
Ardenna pacificus	Wedge-tailed Shearwater	P	J	1
Ardenna tenuirostris	Short-tailed Shearwater	P	J,K	2
Macronectes halli	Northern Giant-Petrel	V,P	V	1
Ephippiorhynchus asiaticus	Black-necked Stork	E1,P		3
Ardea ibis	Cattle Egret	P	C,J	1
Haliaeetus leucogaster	White-bellied Sea-Eagle	V,P	C	73
Burhinus grallarius	Bush Stone-curlew	E1,P		13
Haematopus fuliginosus	Sooty Oystercatcher	V,P		5
Haematopus longirostris	Pied Oystercatcher	E1,P		3
Numenius phaeopus	Whimbrel	P	C,J,K	1
^^*Calyptorhynchus lathami*	Glossy Black-Cockatoo	V,P,2		1
Glossopsitta pusilla	Little Lorikeet	V,P		5
Lathamus discolor	Swift Parrot	E1,P,3	CE	11
Ninox connivens	Barking Owl	V,P,3		1
Ninox strenua	Powerful Owl	V,P,3		11
Tyto longimembris	Eastern Grass Owl	V,P,3		1
Tyto novaehollandiae	Masked Owl	V,P,3		7
Daphoenositta chrysoptera	Varied Sittella	V,P		3
Artamus cyanopterus cyanopterus	Dusky Woodswallow	V,P		2
Dasyurus maculatus	Spotted-tailed Quoll	V,P	E	12
Phascogale tapoatafa	Brush-tailed Phascogale	V,P		10
Phascolarctos cinereus	Koala	V,P	V	###
Petaurus norfolcensis	Squirrel Glider	V,P		23
Pteropus poliocephalus	Grey-headed Flying-fox	V,P	V	18
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V,P		2
Mormopterus norfolkensis	Eastern Freetail-bat	V,P		3
Chalinolobus dwyeri	Large-eared Pied Bat	V,P	V	2
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V,P		4
Miniopterus australis	Little Bentwing-bat	V,P		16
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V,P		3
Myotis macropus	Southern Myotis	V,P		2
Scoteanax rueppellii	Greater Broad-nosed Bat	V,P		10
Vespadelus troughtoni	Eastern Cave Bat	V,P		2
Pseudomys novaehollandiae	New Holland Mouse	P	V	7
Megaptera novaeangliae	Humpback Whale	V,P	V	2

Scientific Name	Common Name	NSW status	Comm. status	Records
Petalura gigantea	Giant Dragonfly	E1		2
Crinia tinnula	Wallum Froglet	V,P		69
Caretta caretta	Loggerhead Turtle	E1,P	E	1
Chelonia mydas	Green Turtle	V,P	V	3
Eretmochelys imbricata	Hawksbill Turtle	P	V	2
Dromaius novaehollandiae	Emu population in the New South Wales North Coast Bioregion and Port Stephens local government area	E2,P		1
Hirundapus caudacutus	White-throated Needletail	P	C,J,K	4
Thalassarche cauta	Shy Albatross	V,P	V	1
Ardenna pacificus	Wedge-tailed Shearwater	P	J	1
Ardenna tenuirostris	Short-tailed Shearwater	P	J,K	2
Macronectes halli	Northern Giant-Petrel	V,P	V	1
Ephippiorhynchus asiaticus	Black-necked Stork	E1,P		3
Ardea ibis	Cattle Egret	P	C,J	1
Haliaeetus leucogaster	White-bellied Sea-Eagle	V,P	C	73
Burhinus grallarius	Bush Stone-curlew	E1,P		13
Haematopus fuliginosus	Sooty Oystercatcher	V,P		5
Haematopus longirostris	Pied Oystercatcher	E1,P		3
Numenius phaeopus	Whimbrel	P	C,J,K	1
^^*Calyptorhynchus lathami*	Glossy Black-Cockatoo	V,P,2		1
Glossopsitta pusilla	Little Lorikeet	V,P		5
Lathamus discolor	Swift Parrot	E1,P,3	CE	11
Ninox connivens	Barking Owl	V,P,3		1
Ninox strenua	Powerful Owl	V,P,3		11
Tyto longimembris	Eastern Grass Owl	V,P,3		1
Tyto novaehollandiae	Masked Owl	V,P,3		7
Daphoenositta chrysoptera	Varied Sittella	V,P		3
Artamus cyanopterus cyanopterus	Dusky Woodswallow	V,P		2
Dasyurus maculatus	Spotted-tailed Quoll	V,P	E	12
Phascogale tapoatafa	Brush-tailed Phascogale	V,P		10
Phascolarctos cinereus	Koala	V,P	V	###
Petaurus norfolcensis	Squirrel Glider	V,P		23
Pteropus poliocephalus	Grey-headed Flying-fox	V,P	V	18
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V,P		2
Mormopterus norfolkensis	Eastern Freetail-bat	V,P		3
Chalinolobus dwyeri	Large-eared Pied Bat	V,P	V	2
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V,P		4
Miniopterus australis	Little Bentwing-bat	V,P		16
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V,P		3
Myotis macropus	Southern Myotis	V,P		2
Scoteanax rueppellii	Greater Broad-nosed Bat	V,P		10
Vespadelus troughtoni	Eastern Cave Bat	V,P		2
Pseudomys novaehollandiae	New Holland Mouse	P	V	7
Megaptera novaeangliae	Humpback Whale	V,P	V	2
Petalura gigantea	Giant Dragonfly	E1		2
Crinia tinnula	Wallum Froglet	V,P		69
Caretta caretta	Loggerhead Turtle	E1,P	E	1
Chelonia mydas	Green Turtle	V,P	V	3
Eretmochelys imbricata	Hawksbill Turtle	P	V	2

Scientific Name	Common Name	NSW status	Comm. status	Records
Dromaius novaehollandiae	Emu population in the New South Wales North Coast Bioregion and Port Stephens local government area	E2,P		1
Hirundapus caudacutus	White-throated Needletail	P	C,J,K	4
Thalassarche cauta	Shy Albatross	V,P	V	1
Ardenna pacificus	Wedge-tailed Shearwater	P	J	1
Ardenna tenuirostris	Short-tailed Shearwater	P	J,K	2
Macronectes halli	Northern Giant-Petrel	V,P	V	1
Ephippiorhynchus asiaticus	Black-necked Stork	E1,P		3
Ardea ibis	Cattle Egret	P	C,J	1
Haliaeetus leucogaster	White-bellied Sea-Eagle	V,P	C	73
Burhinus grallarius	Bush Stone-curlew	E1,P		13
Haematopus fuliginosus	Sooty Oystercatcher	V,P		5
Haematopus longirostris	Pied Oystercatcher	E1,P		3
Numenius phaeopus	Whimbrel	P	C,J,K	1
^^*Calyptorhynchus lathami*	Glossy Black-Cockatoo	V,P,2		1
Glossopsitta pusilla	Little Lorikeet	V,P		5
Lathamus discolor	Swift Parrot	E1,P,3	CE	11
Ninox connivens	Barking Owl	V,P,3		1
Ninox strenua	Powerful Owl	V,P,3		11
Tyto longimembris	Eastern Grass Owl	V,P,3		1
Tyto novaehollandiae	Masked Owl	V,P,3		7
Daphoenositta chrysoptera	Varied Sittella	V,P		3
Artamus cyanopterus cyanopterus	Dusky Woodswallow	V,P		2
Dasyurus maculatus	Spotted-tailed Quoll	V,P	E	12
Phascogale tapoatafa	Brush-tailed Phascogale	V,P		10
Phascolarctos cinereus	Koala	V,P	V	###
Petaurus norfolcensis	Squirrel Glider	V,P		23
Pteropus poliocephalus	Grey-headed Flying-fox	V,P	V	18
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V,P		2
Mormopterus norfolkensis	Eastern Freetail-bat	V,P		3
Chalinolobus dwyeri	Large-eared Pied Bat	V,P	V	2
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V,P		4
Miniopterus australis	Little Bentwing-bat	V,P		16
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V,P		3
Myotis macropus	Southern Myotis	V,P		2
Scoteanax rueppellii	Greater Broad-nosed Bat	V,P		10
Vespadelus troughtoni	Eastern Cave Bat	V,P		2
Pseudomys novaehollandiae	New Holland Mouse	P	V	7
Megaptera novaeangliae	Humpback Whale	V,P	V	2
Petalura gigantea	Giant Dragonfly	E1		2
FLORA				
Callistemon linearifolius	Netted Bottle Brush	V,P,3		1
Eucalyptus parramattensis subsp. decadens		V,P	V	3
^^*Diuris arenaria*	Sand Doubletail	E1,P,2		175

Scientific Name	Common Name	NSW status	Comm. status	Records
^^*Diuris praecox*	Rough Doubletail	V,P,2	V	667
Callistemon linearifolius	Netted Bottle Brush	V,P,3		1

V=Vulnerable, E=Endangered, P=Protected, C=CAMBA, J-JAMBA, K= ROKAMBA

Table A2. Endangered Ecological Communities under the TSC Act and EPBC Act within the Study Area.

Common Name	NSW status	Comm. status
Coastal Saltmarsh in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E3	V
Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E3	
Hunter Lowland Redgum Forest in the Sydney Basin and New South Wales North Coast Bioregions	E3	
Littoral Rainforest in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E3	CE
Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions	E3	CE
River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E3	
Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E3	
Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E3	
Sydney Freshwater Wetlands in the Sydney Basin Bioregion	E3	
Themeda grassland on seacliffs and coastal headlands in the NSW North Coast, Sydney Basin and South East Corner Bioregions	E3	

E = Endangered, CE = Critically Endangered

Table A3. Protected Matters Search Tool Summary for Matters of National Environmental Significance under the EPBC Act within the Study Area.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Significance:	2
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Threatened Ecological Communities:	7
Threatened Species:	80
Migratory Species:	74

Table A4. Protected Matters Search Tool Results for Threatened Species listed under the EPBC Act within the Study Area.

Scientific Name	Common Name	Status
Birds		
Anthochaera Phrygia	Regent Honeyeater	E
Botaurus poiciloptilus	Australasian Bittern	E
Calidris canutus	Red Knot	E
Calidris ferruginea	Curlew Sandpiper	CE
Calidris tenuirostris	Great Knot	CE
Charadrius leschenaultia	Greater Sand Plover	V
Charadrius mongolus	Lesser Sand Plover	E

Dasyornis brachypterus	Eastern Bristlebird	E
Diomedea epomophora epomophora	Southern Royal Albatross	V
Diomedea epomophora sanfordi	Northern Royal Albatross	E
Diomedea exulans antipodensis	Antipodean Albatross	V
Diomedea exulans gibsoni	Gibson's Albatross	V
Diomedea exulans (sensu lato)	Wandering Albatross	V
Erythrotriorchis radiatus	Red Goshawk	V
Fregetta grallaria grallaria	White-bellied Storm-Petrel (Tasman Sea)	V
Grantiella picta	Painted Honeyeater	V
Lathamus discolor	Swift Parrot	E
Limosa lapponica baueri	Bar-tailed Godwit	V
Limosa lapponica menzbieri	Northern Siberian Bar-tailed Godwit	CE
Macronectes giganteus	Southern Giant-Petrel	E
Macronectes halli	Northern Giant-Petrel	V
Numenius madagascariensis	Eastern Curlew	CE
Pachyptila turtur subantarctica	Fairy Prion (southern)	V
Phoebetria fusca	Sooty Albatross	V
Pterodroma leucoptera leucoptera	Gould’s Petrel	E
Pterodroma neglecta neglecta	Kermadec Petrel	V
Rostratula australis	Australian Painted Snipe	E
Thalassarche bulleri	Buller's Albatross,	V
Thalassarche bulleri platei	Northern Bullller’s Albatross	V
Thalassarche cauta cauta	Shy Albatross,	V
Thalassarche cauta salvini	Salvin's Albatross	V
Thalassarche cauta steadi	White-capped Albatross	V
Thalassarche eremita	Chatham albatross	E
Thalassarche melanophris	Black-browed Albatross	V
Thalassarche melanophris impavida	Campbell Albatross	V
Thalassarche melanophris	Black-browed Albatross	V
Fish		
Epinephelus daemelii	Black Rockcod,	V
Amphibians		
Heleioporus australiacus	Giant Burrowing Frog	V
Litoria aurea	Green and Golden Bell Frog	V
Mixophyes balbus	Stuttering Frog	V
Mammals		
Chalinolobus dwyeri	Large-eared Pied Bat,	V
Dasyurus maculatus maculatus	Spotted-tail Quoll,	E
Petauroides volans	Greater Glider	V
Petrogale penicillate	Brush-tailed Rock-wallaby	V
Phascolarctos cinereus	Koala	V
Potorous tridactylus tridactylus	Long-nosed Potoroo	V
Pseudomys novaehollandiae	New Holland Mouse	V
Pteropus poliocephalus	Grey-headed Flying-fox	V
Plants		
Angophora inopina	Charmhaven Apple	V
Asperula asthenes	Trailing Woodruff	V
Asterolasia elegans		E
Caladenia tessellate	Thick-lipped Spider-orchid	V
Commersonia prostrata	Dwarf Kerrawang	E
Cryptostylis hunteriana	Leafless Tongue-orchid	V
Cynanchum elegans	White-flowered Wax Plant	E

Dichanthium setosum	Bluegrass	V
Diuris praecox	Newcastle Doubletail	V
Eucalyptus camfieldii	Camfield's Stringybark	V
Eucalyptus glaucina	Slaty Red Gum	V
Eucalyptus parramattensis subsp decadens	Earp's Gum	V
Euphrasia arguta		CE
Grevillea parviflora subsp. parviflora	Small-flower Grevillea	V
Melaleuca biconvexa	Biconvex	V
Persicaria elatior	Knotweed	V
Phaius australis	Lesser swamp-orchid	E
Prasophyllum sp. Wybong	a leek orchid	CE
Prostanthera densa	Vilous Mintbush	V
Syzygium paniculatum	Magenta Lilly Pilly	V
Tetratheca juncea	Black-eyed Susan	V
Thesium austral	Austral Toadflax	V
Reptiles		
Caretta caretta	Loggerhead Turtle	E
Chelonia mydas	Green Turtle	V
Dermochelys coriacea	Leatherback Turtle	E
Eretmochelys imbricata	Hawksbill Turtle	V
Natator depressus	Flatback Turtle	V

Table A5. Protected Matters Search Tool Results for Migratory Species listed under the EPBC Act with 10 km of the Study Area.

Scientific Name	Common Name	Status
Terrestrial Species		
Cuculus optatus	Oriental Cuckoo	M
Hirundapus caudacutus	White-throated Needletail	M
Monarcha melanopsis	Black-faced Monarch	M
Monarcha trivirgatus	Spectacled Monarch	M
Motacilla flava	Yellow Wagtail	M
Myiagra cyanoleuca	Satin Flycatcher	M
Rhipidura rufifrons	Rufous Fantail	M
Wetlands Species		
Actitis hypoleucos	Common Sandpiper	M
Arenaria interpres	Ruddy Turnstone	M
Calidris acuminata	Sharp-tailed Sandpiper	M
Calidris alba	Sanderling	M
Calidris canutus	Red Knot	M
Calidris ferruginea	Curlew Sandpiper	M, CE
Calidris melanotos	Pectoral Sandpiper	M
Calidris ruficollis	Red-necked Stint	M
Calidris tenuirostris	Great Knot	M
Charadrius bicinctus	Double-banded Plover	M
Charadrius leschenaultia	Greater Sand Plover	V
Charadrius mongolus	Lesser Sand Plover,	M
Gallinago hardwickii	Latham's Snipe,	M
Gallinago megala	Swinhoe's Snipe	M
Gallinago stenura	Pin-tailed Snipe	M
Limicola falcinellus	Broad-billed Sandpiper	
Heteroscelus brevipes	Grey-tailed Tattler	M
Limosa lapponica	Bar-tailed Godwit	M

Limosa limosa	Black-tailed Godwit	M
Numenius madagascariensis	Eastern Curlew	M, CE
Numenius minutus	Little Curlew	M
Numenius phaeopus	Whimbrel	M
Pandion haliaetus	Osprey	M
Philomachus pugnax	Ruff	M
Pluvialis fulva	Pacific Golden Plover	M
Pluvialis squatarola	Grey Plover	M
Tringa nebularia	Common Greenshank	M
Tringa brevipes	Grey-tailed Tattler	
Tringa stagnatilis	Marsh Sandpiper,	M
Xenus cinereus	Terek Sandpiper	M

Table A6. Vegetation Mapped within 1 km of the Study Area (LHCCREMS, 2002)

MU	Name	Description	Legal Status
	Beach Sands	Not described	
MU 33	Coastal Sand Apple-Blackbutt Forest	Coastal Sand Apple-Blackbutt Forest occurs principally on Holocene sands, where protection from direct coastal salt-laden winds is available. It occupies dunes of higher elevations with improved soil development. Typically it takes the form of an open forest with a moderately open, shrubby understorey. *Angophora costata* and *Eucalyptus pilularis* are the key canopy species, the presence and abundance of each in the canopy is variable, and it is not uncommon for one to almost completely dominate. It has been found in a study of sand communities of the Eurundree Sandmass that *Angophora costata* often dominates where the water table is close to the surface (Myerscough & Carolin, 1986). The shrub stratum is highly dependent on recent fire history however where present it is often composed of *Banksia serrata*, *Acacia ulicifolia*, and *Dillwynia retorta*. A combination of herbs, ferns and grasses inhabit the understorey. *Pteridium esculentum* is the most dominant however others such as *Gonocarpus teucrioides*, *Aotus ericoides* and *Themeda australis* are usually associated. This assemblage is widespread across the Tomago-Stockton Sandmass in the Port Stephens Shire. It extends along the narrow sand coastal strip south of Newcastle to the Central Coast wherever conditions are optimal. Map Unit 34 Wallum Heath Woodland is the most floristically similar assemblage within the region although structurally they are distinct. A number of canopy and shrub species are common to both assemblages including *Acacia ulicifolia, Dillwynnia retorta, Angophora Costata, Corymbia gummifera and E. signata*. Sandmining and urban development has cleared or altered some of the former extent of this community.	
MU34a	Coastal Sand Wallum Woodland - Heath Heath	This dry woodland - heath assemblage is marked by the dominance of Wallum Banksia (*Banksia aemula)*. It occurs largely on Pleistocene sands across the Tomago Coastal Plain, perched dunes of Bouddi Peninsula (Mc Rae, 1990) and coastal headlands east of Lake Macquarie. Structurally, this community varies from heathland in exposed areas of low relief and to low open forest in areas of increased shelter. As Heathland (mapped as MU34a where API delineates structural variation), a shrub layer of *Banksia aemula*, *Leptospermum*	

		trinervium, *Isopogon anemonifolius*, and *Ricinocarpus pinifolius* to a height of 2 metres dominates this community. Where it forms a woodland *Angophora costata* and *Corymbia gummifera* emerge above the heathland as low trees to a height of 10 metres. Where this community occurs as low open forest, the canopy can also include *Eucalyptus piperita*, and *Eucalyptus signata*. A large example of this form is found in Port Stephens across the Tomago Sandbeds. Where this occurs the understorey is somewhat less dense than the heathland variation, it still contains Wallum Banksia however includes shrubs such as *Leptospermum trinervium, Acacia ulicifolia* and *Lambertia formosa*. Where fire is frequent *Pteridium esculentum* can dominate the understorey. This community type is related to Map Unit 33: Coastal Sand Apple Blackbutt Forest which oocurs on higher dunes of deeper soils. Close similarity with Map Unit 49 Wallum Clay Heath is apparent. However it is distinguished by its marked abundance of *Melaleuca sieberi* and moisture tolerant sedges in the lowest stratum.	
MU37	Swamp Mahogany - Paperbark Swamp Forest	Swamp Mahogany - Paperbark Swamp Forest occurs in areas of impeded drainage near coastal swamps, lagoons and along drainage lines on alluvial flats of Quaternary sands and sediments. Structurally, this community ranges from open forest to forest with *Eucalyptus robusta* and *Melaleuca quinquenervia* forming the key diagnostic species either in combination or as monospecific stands. There are four main variations within this group that have been identified; • The first is typified by an open forest of *Eucalyptus robusta* and *Melaleuca quinquinervia* with high abundances of *Pteridium esculentum* and *Imperata cylindrica* in the understorey. This often occurs where fire has been recent or frequent near urban environments. • The second is a wet form where the canopy remains the same however the understorey is characterised by a high abundance of *Gahnia clarkei*. This is typical of the drier coastal plains at Wyong. • The third is a group localised around Gosford, it contains mesic elements such as *Glochidion ferdinandii*, *Livistona australis* and also can contain *Melaleuca biconvexa* in the canopy. This is generally on alluvial sediments of the Gosford Wyong area. • Finally the fourth is another wet form with mesic elements as the previous but with a high abundance of ferns in the lowest stratum such as *Blechnum indicum* and *Hypolepis muelleri*. This is common on the coastal sands at Belmont and at Tomago in the Port Stephens Shire. It is not uncommon for *Casuarina glauca* and *Livistona australis* to be included in the canopy especially in areas close to estuarine fringes. Other canopy species can merge where drainage is improved however are not diagnostic for this community. This community most closely relates to Map Unit 68: Swamp Oak – Sedge Forest through similar floristic composition and Map Unit 94: Redgum- Roughbarked Apple Foreshores Forest. Where mesic elements are well developed	EEC

		this assemblage will merge with Map Unit 5 Alluvial Tall Moist Forest. Similar Forest Ecosystems are not described by NPWS (1999(a)) although the assemblage is likely to be extensively though patchily distributed along the north coast of NSW.	
MU50	Coastal Sand Scrub	Coastal Sand Scrub occurs on deep Quaternary sands usually on foredunes. It is a relatively dense, low community subject to desiccating salt winds. Floristically it is quite simple with *Leptospermum laevigatum* occurring with a very high frequency to form the main canopy species alongside *Banksia integrifolia subsp integrifolia*, *Myoporum boninense subsp australe*, and *Acacia sophorae* amongst others. Where more nutrients and shelter are available *Angophora costata* (often Mallee from) can occur as a small tree. Fleshy ground covers such as *Carpobrotus glaucescens* and *Scaevola calenulace* are widespread and often occur with *Monotocca elliptica* and *Lomandra longifolia*. Coastal Sand Scrub occurs along the coast from Port Stephens to Gosford. It has been heavily cleared and modified by urban development and sandmining. In some instances eg. Munmorah SRA, some species of this assemblage have been used in regeneration. This community generally merges with Map Unit 33 and 34 where shelter and soil podzolisation is increased on the leeward side of the dunes (Myerscough & Carolin, 1986). Coastal Sand Scrub is a feature of most coastal environments along NSW.	

* EEC is an Endangered Ecological Community listed under the NSW Biodiversity Conservation Act

Table A7. Flora recorded within the Subject Site on 07/06/2018

Scientific Name	Common Name	% cover		
		Plot 1	Plot 2	Plot 3
Acacia longifolia var. *sophorae*	Coastal Wattle		0.2	0.3
Acacia irrorata	Green Wattle		12.5	
*Ailanthus altissima**	Tree of Heaven		1	
*Alternanthera pungens**	Khaki Weed		0.1	
Angophora costata	Smooth-barked Apple	8		
Angophora floribunda	Rough-barked Apple	5		
Anthemis cotula	Stinking chamomile		6	
*Araucaria heterophylla**	Norfolk Island Pine			
*Asparagus aethiopicus**	Asparagus Fern			
Banksia integrifolia subsp. *integrifolia*	Coast Banksia			
*Bidens pilosa**	Cobbler's Pegs		0.1	
Breynia oblongifolia	Coffee Bush	1.1		
*Bryophyllum delagoense**	Mother of Millions			
*Cakile edentula**	American Sea Rocket			0.1
Carpobrotus glaucescens	Pigface			
Cenchrus echinatus	Spiny Burr Grass	0.1	0.1	
Chrysanthemoides monilifera subsp. *monilifera**	Bitou Bush		0.1	8
*Cinnamomum camphora**	Camphor Laurel	1		

Dichondra repens	Kidney Weed	0.5		
Doryanthes excelsa	Gymea Lily	0.1		
*Ehrharta erecta**	Panic Veldtgrass	0.1	0.5	
*Erythrina x sykesii**	Coral Tree	10		1
Eucalyptus botryoides	Bangalay	5		
*Euphorbia paralias**	Sea Spurge			0.1
*Festuca elatior**			3	
Ficinia (Isolepis) nodosa	-			
Ficus sp	Fig Tree			
Glochidion ferdinandii	Cheese Tree	10		
*Hydrocotyle bonariensis**	Pennywort			0.1
*Hypochaeris radicata**	Flatweed		0.1	
*Lantana camara**	Lantana	5	5	
Leptospermum laevigatum	Coast Tea-tree		10	2
*Liquidambar styraciflua**	Liquidambar	15		
Livistona australis	Cabbage Tree Palm			
Mentha sp.*	Mint	0.1		
*Nephrolepis cordifolia**	Fish-bone Fern			
Oenothera drummondii	Beach Evening Primrose		0.1	0.1
*Panicium maximus**	Guinea Grass	0.1	5	
*Paspalum dilatatum **	Paspalum		0.2	
*Pennisetum clandestinum **	Kikuyu	30		
Pittosporum undulatum	Sweet Pittosporum	3		
*Plantago lanceolata**	Ribwort		0.1	
*Poa annua**	Winter Grass	0.1		
*Ricinus communis**	Castor Oil Plant		0.6	
Rumex sagitata	Turkey Rhubarb		0.1	
*Setaria gracilis**	Slender Pigeon Grass		0.1	
*Stellaria media**	Common Chickweed	0.6	0.1	
*Tagetes minuta**	Stinking Roger		0.1	
*Tecoma capensis**	Cape Honeysuckle		3	
*Tradescantia fluminensis**	Wandering Jew	15		
*Verbena bonariensis**	Purpletop		0.1	
Wahlenbergia communis	Tufted Bluebell		0.1	
*Yucca aloifolia**	Dagger Plant	0.1		

Table A8. Habitat Assessment of Threatened Species Recorded in the Study Area

Family	Scientific Name	Common Name	NSW status	Comm. status	Habitat Preference	Records	Likelihood of Occurrence
AMPHIBIANS							
Myobatrachidae	*Crinia tinnula*	Wallum Froglet	V,P		Wallum Froglets are found in a wide range of habitats, usually associated with acidic swamps on coastal sand plains. They typically occur in sedgelands and wet heathlands. They can also be found along drainage lines within other vegetation communities and disturbed areas, and occasionally in swamp sclerophyll forests. The species breeds in swamps with permanent water as well as shallow ephemeral pools and drainage ditches. Breeding is thought to peak in the colder months, but can occur throughout the year following rain. Eggs of 1.1-1.2mm are deposited in water with a pH of <6 and tadpoles take 2-6 months to develop into frogs. Wallum Froglets shelter under leaf litter, vegetation, other debris or in burrows of other species. Shelter sites are wet or very damp and often located near the water's edge. Males may call throughout the year and at any time of day, peaking following rain.	69	Potential habitat in drainage lines outside of Subject Site boundary.
REPTILES							
Cheloniidae	*Caretta caretta*	Loggerhead Turtle	E1,P	E	Loggerhead Turtles are ocean-dwellers, foraging in deeper water for fish, jellyfish and bottom-dwelling animals. The female comes ashore to lay her eggs in a hole dug on the beach in tropical regions during the warmer months. Identifiable all year but lay eggs on beaches during summer. Nesting is around Great Barrier Reef and Ningaloo Reef	1	Unlikely. Outside of nesting habitat range.
Cheloniidae	*Chelonia mydas*	Green Turtle	V,P	V	Ocean-dwelling species spending most of its life at sea. Carnivorous when young but as adults they feed only on marine plant material. Eggs laid in holes dug in beaches throughout their range. In Australia, there are seven regional populations of green turtles that nest in different areas; the southern Great	3	Unlikely. Outside of nesting habitat range.

					Barrier Reef, the northern Great Barrier Reef, the Coral Sea, the Gulf of Carpentaria, Western Australia's north-west shelf, the Ashmore and Cartier Reefs and Scott Reef.		
AVES							
Apodidae	*Hirundapus caudacutus*	White-throated Needletail	P	C,J,K	In Australia, the White-throated Needletail is almost exclusively aerial, from heights of less than 1 m up to more than 1000 m above the ground. The White-throated Needletail is widespread in eastern and south-eastern Australia. After breeding in eastern Siberia, north-eastern China and Japan, the species leaves the breeding grounds between late August and October, flying singly or in scattered flocks and enter Australia via the Torres Strait, usually during September and October.	4	Unlikely. Aerial species
Diomedeidae	*Thalassarche cauta*	Shy Albatross	V,P	V	This pelagic or ocean-going species inhabits subantarctic and subtropical marine waters, spending the majority of its time at sea. While at sea, it soars on strong winds and when calm, individuals may rest on the ocean, in groups during the breeding season or as individuals at other times. Occasionally the species occurs in continental shelf waters, in bays and harbours. The species feeds on fish, crustaceans, offal and squid and may forage in mixed-species flocks. Food may be caught by seizing prey from the water's surface while swimming, by landing on top of prey, diving for prey beneath the water and by scavenging behind fishing vessels. Known breeding locations include Albatross Island off Tasmania, Auckland Island, Bounty Island and The Snares, off New Zealand, where nesting colonies of 6-500 nests occur and may contain other species such as the Australian Gannet. Located on sheltered sides of islands, on cliffs and ledges, in crevices and slopes, nests are used annually and consist of a mound of mud, bones, plant matter and rocks. Parents are territorial while nesting, having both defensive and mating displays. Breeding occurs September-December, when a single egg is laid and incubated for 72 days. Both parents feed and guard the young for approximately 5 months before they fledge and become independent.	1	Unlikely. No nesting habitat on the Subject Site.
Procellariidae	*Ardenna pacificus*	Wedge-tailed Shearwater	P	J	The Wedge-tailed Shearwater is a pelagic, marine bird known from tropical and subtropical waters. The Wedge-	1	Unlikely.

					tailed Shearwater breeds on the east and west coasts of Australia and on off-shore islands. The species is common in the Indian Ocean, the Coral Sea and the Tasman Sea.		No nesting habitat on the Subject Site.
Procellariidae	*Ardenna tenuirostris*	Short-tailed Shearwater	P	J,K	Short-tailed Shearwater breeds on the east and west coasts of Australia and on off-shore islands. Breeds from October-April in a sparse of grass, leaves in burrows 0.5-2m long, usually under tussocks, typically in island colonys. Migrates from May-August to North Pacific (Pizzey, 2006).	2	Unlikely. No nesting habitat on the Subject Site.
Procellariidae	*Macronectes halli*	Northern Giant-Petrel	V,P	V	Breeding in Australian territory is limited to Macquarie Island and occurs during spring and summer. Adults usually remain near the breeding colonies throughout the year (though some do travel widely) while immature birds make long and poorly known circumpolar and trans-oceanic movements. Hence most birds recorded in NSW coastal waters are immature birds. Northern Giant-Petrels seldom breed in colonies but rather as dispersed pairs, often amidst tussocks in dense vegetation and areas of broken terrain. A single chick is raised and although breeding occurs annually, approximately 30% of the potential breeding population do not nest. There are marked differences in diet between the sexes. Females obtain most of their prey live from the sea, while males also scavenge from the carcases of penguins and seals on land. At sea, both sexes are aggressive opportunists, feeding on fish, cephalopods, birds and crustaceans, including euphausiids or krill, and regularly scavenge on fishing vessels. During the vulnerable early chick phase adult birds utilise land-based carrion resources (e.g. seals) extensively.	1	Unlikely. No nesting habitat on the Subject Site.
Ciconiidae	*Ephippiorhynchus asiaticus*	Black-necked Stork	E1,P		Floodplain wetlands (swamps, billabongs, watercourses and dams) of the major coastal rivers are the key habitat in NSW for the Black-necked Stork. Secondary habitat includes minor floodplains, coastal sandplain wetlands and estuaries. Storks usually forage in water 5-30cm deep for vertebrate and invertebrate prey. Eels regularly contribute the greatest biomass to their diet, but they feed on a wide variety of animals, including other fish, frogs and	3	Unlikely. No suitable habitat on the Subject Site.

					invertebrates (such as beetles, grasshoppers, crickets and crayfish). Black-necked Storks build large nests high in tall trees close to water. Trees usually provide clear observation of the surroundings and are at low elevation (reflecting the floodplain habitat). In NSW, breeding activity occurs May - January; incubation May - October; nestlings July - January; fledging from September. Parents share nest duties and in one study about 1.3-1.7 birds were fledged per nest. The NSW breeding population has been estimated at about 75 pairs. Territories are large and variable in size. They have been estimated to average about 9,000ha, ranging from 3,000-6,000ha in high quality habitat and 10,000-15,000ha in areas where habitat is poor or dispersed.		
Accipitridae	*Haliaeetus leucogaster*	White-bellied Sea-Eagle	P	C	The White-bellied Sea-Eagle is distributed along the coastline (including offshore islands) of mainland Australia and Tasmania. It also extends inland along some of the larger waterways, especially in eastern Australia. The White-bellied Sea-Eagle feeds opportunistically on a variety of fish, birds, reptiles, mammals and crustaceans, and on carrion and offal.	73	Unlikely. No suitable nesting trees on the Subject Site.
Burhinidae	*Burhinus grallarius*	Bush Stone-curlew	E1,P		Inhabits open forests and woodlands with a sparse grassy groundlayer and fallen timber. Largely nocturnal, being especially active on moonlit nights. Feed on insects and small vertebrates, such as frogs, lizards and snakes. Nest on the ground in a scrape or small bare patch. Two eggs are laid in spring and early summer.	13	Unlikely. No suitable habitat on the Subject Site.
Haematopodidae	*Haematopus fuliginosus*	Sooty Oystercatcher	V,P		Favours rocky headlands, rocky shelves, exposed reefs with rock pools, beaches and muddy estuaries. Forages on exposed rock or coral at low tide for foods such as limpets and mussels. 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.	5	Unlikely. No suitable habitat on the Subject Site.

Haematopodidae	*Haematopus longirostris*	Pied Oystercatcher	E1,P		Favours intertidal flats of inlets and bays, open beaches and sandbanks. Forages on exposed sand, mud and rock at low tide, for molluscs, worms, crabs and small fish. The chisel-like bill is used to pry open or break into shells of oysters and other shellfish. Nests mostly on coastal or estuarine beaches although occasionally they use saltmarsh or grassy areas. Nests are shallow scrapes in sand above the high tide mark, often amongst seaweed, shells and small stones. Two to three eggs are laid between August and January. The female is the primary incubator and the young leave the nest within several days.	3	Unlikely. No suitable habitat on the Subject Site.
Scolopacidae	*Numenius phaeopus*	Whimbrel	P	C,J,K	The Whimbrel is a regular migrant to Australia and New Zealand, with a primarily coastal distribution. There are also scattered inland records of Whimbrels in all regions. It is found in all states but is more common in the north. The Whimbrel breeds in north and west Alaska. The Whimbrel generally forages on intertidal mudflats, along the muddy banks of estuaries and in coastal lagoons, either in open unvegetated areas or among mangroves. They sometimes forage on sandy beaches or among rocks. It has occasionally been sighted feeding on exposed coral or rocky reefs and rock platforms. It is known to probe holes and crevices among rubble and on reef flats, but not on reef crests.	1	Unlikely. No suitable habitat on the Subject Site.
Cacatuidae	*Calyptorhynchus lathami*	Glossy Black-Cockatoo	V,P,2		Inhabits open forest and woodlands of the coast and the Great Dividing Range where stands of sheoak occur. Black Sheoak (Allocasuarina littoralis) and Forest Sheoak (A. torulosa) are important foods. Inland populations feed on a wide range of sheoaks, including Drooping Sheoak, Allocasuaraina diminuta, and A. gymnathera. Belah is also utilised and may be a critical food source for some populations. In the Riverina, birds are associated with hills and rocky rises supporting Drooping Sheoak, but also recorded in open woodlands dominated by Belah (Casuarina cristata).	1	Unlikely. No suitable habitat on the Subject Site.

					Feeds almost exclusively on the seeds of several species of she-oak (Casuarina and Allocasuarina species), shredding the cones with the massive bill. Dependent on large hollow-bearing eucalypts for nest sites. A single egg is laid between March and May.		
Psittacidae	*Glossopsitta pusilla*	Little Lorikeet	V,P		Forages primarily in the canopy of open Eucalyptus forest and woodland, yet also finds food in Angophora, Melaleuca and other tree species. Riparian habitats are particularly used, due to higher soil fertility and hence greater productivity. Isolated flowering trees in open country, e.g. paddocks, roadside remnants and urban trees also help sustain viable populations of the species. Feeds mostly on nectar and pollen, occasionally on native fruits such as mistletoe, and only rarely in orchards Gregarious, travelling and feeding in small flocks (<10), though often with other lorikeets. Flocks numbering hundreds are still occasionally observed and may have been the norm in past centuries. Roosts in treetops, often distant from feeding areas. Nests in proximity to feeding areas if possible, most typically selecting hollows in the limb or trunk of smooth-barked Eucalypts. Entrance is small (3 cm) and usually high above the ground (2–15 m). These nest sites are often used repeatedly for decades, suggesting that preferred sites are limited. Riparian trees often chosen, including species like Allocasuarina. Nesting season extends from May to September. In years when flowering is prolific, Little Lorikeet pairs can breed twice, producing 3-4 young per attempt. However, the survival rate of fledglings is unknown.	5	Potential foraging habitat only.
Psittacidae	*Lathamus discolor*	Swift Parrot	E1,P,3	E	Migrates to the Australian south-east mainland between March and October. On the mainland they occur in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. Favoured feed trees include winter flowering species such as Swamp Mahogany *Eucalyptus robusta*, Spotted Gum	11	Unlikely. No suitable habitat on the Subject Site.

				Corymbia maculata, Red Bloodwood *C. gummifera*, Mugga Ironbark *E. sideroxylon*, and White Box *E. albens*. Commonly used lerp infested trees include Inland Grey Box E. microcarpa, Grey Box E. moluccana and Blackbutt E. pilularis. Return to some foraging sites on a cyclic basis depending on food availability. Following winter they return to Tasmania where they breed from September to January, nesting in old trees with hollows and feeding in forests dominated by Tasmanian Blue Gum Eucalyptus globulus. Identifiable from March to September.		
Strigidae	*Ninox connivens*	Barking Owl	V,P,3	Inhabits woodland and open forest, including fragmented remnants and partly cleared farmland. It is flexible in its habitat use, and hunting can extend in to closed forest and more open areas. Sometimes able to successfully breed along timbered watercourses in heavily cleared habitats (e.g. western NSW) due to the higher density of prey on these fertile soils. Roost in shaded portions of tree canopies, including tall midstorey trees with dense foliage such as Acacia and Casuarina species. During nesting season, the male perches in a nearby tree overlooking the hollow entrance. Preferentially hunts small arboreal mammals such as Squirrel Gliders and Ringtail Possums, but when loss of tree hollows decreases these prey populations the owl becomes more reliant on birds, invertebrates and terrestrial mammals such as rodents and rabbits. Can catch bats and moths on the wing, but typically hunts by sallying from a tall perch. Requires very large permanent territories in most habitats due to sparse prey densities. Monogamous pairs hunt over as much as 6000 hectares, with 2000 hectares being more typical in NSW habitats. Two or three eggs are laid in hollows of large, old trees. Living eucalypts are preferred though dead trees are also used. Nest sites are used repeatedly over years by a pair, but they may switch sites if disturbed by predators (e.g. goannas).	1	Unlikely. No suitable habitat on the Subject Site.

				Nesting occurs during mid-winter and spring but is variable between pairs and among years. As a rule of thumb, laying occurs during August and fledging in November. The female incubates for 5 weeks, roosts outside the hollow when chicks are 4 weeks old, then fledging occurs 2-3 weeks later. Young are dependent for several months. Territorial pairs respond strongly to recordings of Barking Owl calls from up to 6 km away, though humans rarely hear this response farther than 1.5 km. Because disturbance reduces the pair's foraging time, and can pull the female off her eggs even on cold nights, recordings should not be broadcast unnecessarily nor during the nesting season. Calls at all time of year, but strongest response in March-June. Avoid early nesting (July-Sept) when surveys pull the female off eggs on cold nights.		
Strigidae	*Ninox strenua*	Powerful Owl	V,P,3	The Powerful Owl inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. The Powerful Owl requires large tracts of forest or woodland habitat but can occur in fragmented landscapes as well. The species breeds and hunts in open or closed sclerophyll forest or woodlands and occasionally hunts in open habitats. It roosts by day in dense vegetation comprising species such as Turpentine Syncarpia glomulifera, Black She-oak Allocasuarina littoralis, Blackwood Acacia melanoxylon, Rough-barked Apple Angophora floribunda, Cherry Ballart Exocarpus cupressiformis and a number of eucalypt species. The main prey items are medium-sized arboreal marsupials, particularly the Greater Glider, Common Ringtail Possum and Sugar Glider. There may be marked regional differences in the prey taken by Powerful Owls. For example in southern NSW, Ringtail Possum make up the bulk of prey in the lowland or coastal habitat. At higher elevations, such as the tableland forests, the Greater Glider may constitute almost all of the prey for a pair of Powerful Owls. Flying foxes are important prey in some areas; birds comprise about 10-50% of the diet depending on the availability of preferred mammals. As most prey species require hollows and a shrub layer, these are important habitat components for the owl.	11	Unlikely. No suitable habitat on the Subject Site.

				Pairs of Powerful Owls demonstrate high fidelity to a large territory, the size of which varies with habitat quality and thus prey densities. In good habitats a mere 400 can support a pair; where hollow trees and prey have been depleted the owls need up to 4000 ha. Powerful Owls nest in large tree hollows (at least 0.5 m deep), in large eucalypts (diameter at breast height of 80-240 cm) that are at least 150 years old. While the female and young are in the nest hollow the male Powerful Owl roosts nearby (10-200 m) guarding them, often choosing a dense "grove" of trees that provide concealment from other birds that harass him. Powerful Owls are monogamous and mate for life. Nesting occurs from late autumn to mid-winter, but is slightly earlier in north-eastern NSW (late summer - mid autumn). Clutches consist of two dull white eggs and incubation lasts approximately 38 days. Identifiable all year.		
Tytonidae	*Tyto longimembris*	Eastern Grass Owl	V,P,3	Eastern Grass Owls are found in areas of tall grass, including grass tussocks, in swampy areas, grassy plains, swampy heath, and in cane grass or sedges on flood plains. They rest by day in a 'form' - a trampled platform in a large tussock or other heavy vegetative growth. If disturbed they burst out of cover, flying low and slowly, before dropping straight down again into cover. Always breeds on the ground. Nests are found in trodden grass, and often accessed by tunnels through vegetation. Breeding season is highly variable and dependent on environmental conditions, but in NSW nesting most typically occurs in autumn or winter.	1	Unlikely. No suitable habitat on the Subject Site.
Tytonidae	*Tyto novaehollandiae*	Masked Owl	V,P,3	Lives in dry eucalypt forests and woodlands from sea level to 1100 m. A forest owl, but often hunts along the edges of forests, including roadsides. The typical diet consists of tree-dwelling and ground mammals, especially rats. Pairs have a large home-range of 500 to 1000 hectares.	7	Unlikely. No suitable habitat on the Subject Site.

				Roosts and breeds in moist eucalypt forested gullies, using large tree hollows or sometimes caves for nesting. Identifiable all year.		
Neosittidae	*Daphoenositta chrysoptera*	Varied Sittella	V,P	Inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland. Feeds on arthropods gleaned from crevices in rough or decorticating bark, dead branches, standing dead trees and small branches and twigs in the tree canopy. Builds a cup-shaped nest of plant fibres and cobwebs in an upright tree fork high in the living tree canopy, and often re-uses the same fork or tree in successive years. Generation length is estimated to be 5 years.	3	Unlikely. No suitable habitat on the Subject Site.
Artamidae	*Artamus cyanopterus cyanopterus*	Dusky Woodswallow	V,P	The Dusky Woodswallow is widespread in eastern, southern and southwestern Australia. In New South Wales it is widespread from coast to inland, including the western slopes of the Great Dividing Range and farther west. It is sparsely scattered in, or largely absent from, much of the Upper Western region The Dusky Woodswallow is often reported in woodlands and dry open sclerophyll forests, usually dominated by eucalypts, including mallee associations. It has also been recorded in shrublands and heathlands and various modified habitats, including regenerating forests; very occasionally in moist forests or rainforests. At sites where Dusky Woodswallows are recorded the understorey is typically open with sparse eucalypt saplings, acacias and other shrubs, including heath. The ground cover may consist of grasses, sedges or open ground, often with coarse woody debris. Birds are also often observed in farm land, usually at the edges of forest or woodland or in roadside remnants or wind breaks with dead timber. In western New South Wales this species is primarily associated with River Red Gum/Black Box/Coolibah open forest/woodland associated with larger river/creek systems and is less common and far more patchily distributed in other communities such as mallee and cypress-pine woodland.	2	Potential habitat on the Subject Site
MAMMALS						

Dasyuridae	*Dasyurus maculatus*	Spotted-tailed Quoll	V,P	E	Recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Individual animals use hollow-bearing trees, fallen logs, small caves, rock outcrops and rocky-cliff faces as den sites. Mostly nocturnal, although will hunt during the day; spends most of the time on the ground, although also an excellent climber and will hunt possums and gliders in tree hollows and prey on roosting birds. Use communal 'latrine sites', often on flat rocks among boulder fields, rocky cliff-faces or along rocky stream beds or banks. Such sites may be visited by multiple individuals and can be recognised by the accumulation of the sometimes characteristic 'twisty-shaped' faeces deposited by animals. A generalist predator with a preference for medium-sized (500g-5kg) mammals. Consumes a variety of prey, including gliders, possums, small wallabies, rats, birds, bandicoots, rabbits, reptiles and insects. Also eats carrion and takes domestic fowl. Females occupy home ranges up to about 750 hectares and males up to 3500 hectares. Are known to traverse their home ranges along densely vegetated creeklines. Average litter size is five; both sexes mature at about one year of age. Life expectancy in the wild is about 3-4 years.	12	Potential habitat on the Subject Site
Dasyuridae	*Phascogale tapoatafa*	Brush-tailed Phascogale	V,P		Prefer dry sclerophyll open forest with sparse groundcover of herbs, grasses, shrubs or leaf litter. Also inhabit heath, swamps, rainforest and wet sclerophyll forest. Agile climber foraging preferentially in rough barked trees of 25 cm DBH or greater. Feeds mostly on arthropods but will also eat other invertebrates, nectar and sometimes small vertebrates. Females have exclusive territories of approximately 20 - 40 ha, while males have overlapping territories often greater than 100 ha. Nest and shelter in tree hollows with entrances 2.5 - 4 cm wide and use many different hollows over a short time span.	10	Unlikely. No nesting habitat (i.e. hollow bearing trees) on the Subject Site.

					Mating occurs May - July; males die soon after the mating season whereas females can live for up to three years but generally only produce one litter.		
Phascolarctidae	*Phascolarctos cinereus*	Koala	V,P	V	Inhabit eucalypt woodlands and forests. Feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species. Inactive for most of the day, feeding and moving mostly at night. Spend most of their time in trees, but will descend and traverse open ground to move between trees. Home range size varies with quality of habitat, ranging from less than two ha to several hundred hectares in size. Generally solitary, but have complex social hierarchies based on a dominant male with a territory overlapping several females and sub-ordinate males on the periphery. Females breed at two years of age and produce one young per year.	1947	Potential habitat for dispersing males only as the Subject Site is not considered potential koala habitat under the SEPP 44 definition.
Petauridae	*Petaurus norfolcensis*	Squirrel Glider	V,P		Inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas. Prefers mixed species stands with a shrub or Acacia midstorey. Live in family groups of a single adult male one or more adult females and offspring. Require abundant tree hollows for refuge and nest sites. Diet varies seasonally and consists of Acacia gum, eucalypt sap, nectar, honeydew and manna, with invertebrates and pollen providing protein.	23	Unlikely. No nesting habitat (i.e. hollow bearing trees) on the Subject Site.
Pteropodidae	*Pteropus poliocephalus*	Grey-headed Flying-fox	V,P	V	Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy. Individual camps may have tens of thousands of animals and are used for mating, and for giving birth and rearing young. Annual mating commences in January and conception occurs in April or May; a single young is born in October or	18	Potential foraging habitat only.

					November. Site fidelity to camps is high; some camps have been used for over a century. Can travel up to 50 km from the camp to forage; commuting distances are more often <20 km. Feed on the nectar and pollen of native trees, in particular Eucalyptus, Melaleuca and Banksia, and fruits of rainforest trees and vines. Also forage in cultivated gardens and fruit crops.		
Emballonuridae	*Saccolaimus flaviventris*	Yellow-bellied Sheathtail-bat	V,P		Roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows. When foraging for insects, flies high and fast over the forest canopy, but lower in more open country. Forages in most habitats across its very wide range, with and without trees; appears to defend an aerial territory. Breeding has been recorded from December to mid-March, when a single young is born. Seasonal movements are unknown; there is speculation about a migration to southern Australia in late summer and autumn.	2	Potential foraging habitat
Molossidae	*Mormopterus norfolkensis*	Eastern Freetail-bat	V,P		Occur in dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range. Roost mainly in tree hollows but will also roost under bark or in man-made structures. Usually solitary but also recorded roosting communally, probably insectivorous.	3	Unlikely. Subject Site does not contain the preferred habitat. No roosting habitat (i.e. hollow bearing trees) on the Subject Site.
Vespertilionidae	*Chalinolobus dwyeri*	Large-eared Pied Bat	V,P	V	Roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (Petrochelidon ariel), frequenting low to mid-elevation dry open forest and woodland close to these features. Females have been recorded raising young in maternity roosts (c. 20-40 females) from November through to January in roof domes in sandstone caves and overhangs. They remain loyal to the same cave over many years. Found in well-timbered areas containing gullies. The relatively short, broad wing combined with the low weight per unit area of wing indicates manoeuvrable flight. This species probably forages for small, flying insects below the forest canopy. Likely to hibernate through the coolest months.	2	Unlikely. Subject Site does not contain the preferred habitat. No roosting habitat (i.e. caves) on the Subject Site.

				It is uncertain whether mating occurs early in winter or in spring.		
Vespertilionidae	*Falsistrellus tasmaniensis*	Eastern False Pipistrelle	V,P	Prefers moist habitats, with trees taller than 20 m. Generally roosts in eucalypt hollows, but has also been found under loose bark on trees or in buildings. Hunts beetles, moths, weevils and other flying insects above or just below the tree canopy. Hibernates in winter. Females are pregnant in late spring to early summer. Identifiable from mid spring to mid autumn.	4	Unlikely. Subject Site does not contain preferred habitat. No roosting habitat (i.e. hollow bearing trees) on the Subject Site.
Vespertilionidae	*Miniopterus australis*	Little Bentwing-bat	V,P	Moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub. Generally found in well-timbered areas. Little Bentwing-bats roost in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats. They often share roosting sites with the Common Bentwing-bat and, in winter, the two species may form mixed clusters. In NSW the largest maternity colony is in close association with a large maternity colony of Eastern Bentwing-bats (Miniopterus schreibersii) and appears to depend on the large colony to provide the high temperatures needed to rear its young. Maternity colonies form in spring and birthing occurs in early summer. Males and juveniles disperse in summer. Only five nursery sites /maternity colonies are known in Australia. Identifiable Mid spring to mid-autumn	16	Potential foraging habitat.
Vespertilionidae	*Miniopterus schreibersii oceanensis*	Eastern Bentwing-bat	V,P	Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures. Form discrete populations centred on a maternity cave that is used annually in spring and summer for the birth and rearing of young. Maternity caves have very specific temperature and humidity regimes. At other times of the year, populations disperse within about 300 km range of maternity caves. Cold caves are used for hibernation in southern Australia. Breeding or roosting colonies can number from 100 to 150,000 individuals.	3	Unlikely. Subject Site does not contain preferred habitat. No roosting habitat on the Subject Site.

				Hunt in forested areas, catching moths and other flying insects above the tree tops. hibernate from June to August		
Vespertilionidae	*Myotis macropus*	Southern Myotis	V,P	Generally roost in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage. Forage over streams and pools catching insects and small fish by raking their feet across the water surface. In NSW females have one young each year usually in November or December. Identifiable from October to March	2	Unlikely. Subject Site does not contain preferred habitat. No roosting habitat on the Subject Site.
Vespertilionidae	*Scoteanax rueppellii*	Greater Broad-nosed Bat	V,P	Utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest. Although this species usually roosts in tree hollows, it has also been found in buildings. Forages after sunset, flying slowly and directly along creek and river corridors at an altitude of 3 - 6 m. Open woodland habitat and dry open forest suits the direct flight of this species as it searches for beetles and other large, slow-flying insects; this species has been known to eat other bat species. Little is known of its reproductive cycle, however a single young is born in January; prior to birth, females congregate at maternity sites located in suitable trees, where they appear to exclude males during the birth and raising of the single young. Identifiable mid spring to mid autumn	10	Unlikely. Subject Site does not contain preferred habitat. No roosting habitat on the Subject Site.
Vespertilionidae	*Vespadelus troughtoni*	Eastern Cave Bat	V,P	Very little is known about the biology of this uncommon species. A cave-roosting species that is usually found in dry open forest and woodland, near cliffs or rocky overhangs; has been recorded roosting in disused mine workings, occasionally in colonies of up to 500 individuals. Occasionally found along cliff-lines in wet eucalypt forest and rainforest. Little is understood of its feeding or breeding requirements or behaviour.	2	Unlikely. Subject Site does not contain preferred habitat. No roosting habitat on the Subject Site.

Muridae	*Pseudomys novaehollandiae*	New Holland Mouse	P	V	Known to inhabit open heathlands, woodlands and forests with a heathland understorey and vegetated sand dunes. It is a social animal, living predominantly in burrows shared with other individuals. Distribution is patchy in time and space, with peaks in abundance during early to mid stages of vegetation succession typically induced by fire	7	Potential habitat
Petaluridae	*Petalura gigantea*	Giant Dragonfly	E1		Live in permanent swamps and bogs with some free water and open vegetation. Adults emerge from late October and are short-lived, surviving for one summer after emergence. Adults spend most of their time settled on low vegetation on or adjacent to the swamp. They hunt for flying insects over the swamp and along its margins. Adults fly over the swamp and along its margins hunting for flying insects. Males sometimes congregate waiting for females to mate with. Females lay eggs into moss, under other soft ground layer vegetation, and into moist litter and humic soils, often associated with groundwater seepage areas within appropriate swamp and bog habitats. The species does not utilise areas of standing water wetland, although it may utilise suitable boggy areas adjacent to open water wetlands. Larvae dig long branching burrows under the swamp. Larvae are slow growing and the larval stage may last 10 years or more. It is thought that larvae leave their burrows at night and feed on insects and other invertebrates on the surface and also use underwater entrances to hunt for food in the aquatic vegetation.	2	Unlikely. Subject Site does not contain preferred habitat.
Casuariidae	*Dromaius novaehollandiae*	Emu population in the New South Wales North Coast Bioregion and Port Stephens local government area	E2,P		On the NSW north coast, Emus occur in a range of predominantly open lowland habitats, including grasslands, heathland, shrubland, open and shrubby woodlands, forest, and swamp and sedgeland communities, as well as the ecotones between these habitats. They also occur in plantations of tea-tree and open farmland, and occasionally in littoral rainforest. Emus are omnivorous, taking a wide range of seeds and fruits, invertebrates (mainly insects) and foliage and other plant material. They take material directly from plants or bend down to take items from the ground, picking up the food and tossing them back in the throat before swallowing. The population of Emus in the NSW North Coast Bioregion and Port Stephens LGA is of significant conservation value as the last known population in northern coastal NSW, and	1	Unlikely. Only one recorded occurrence of this species in the Study Area.

					for the role that birds play in dispersing large seeds of native plant species, and over long distances. Most breeding occurs in late autumn and winter, but better data are needed for the north-eastern NSW population. Eggs are laid on a platform of grass, twigs, leaves and bark on the ground, often at the base of some vegetation and with good views from the nest. Incubation and all parental care is by the male. Young are precocial and covered in down at hatching. They can walk within 5 to 24 hours of hatching.		
Family **PLANTS**	**Scientific Name**	**Common Name**	**NSW status**	**Comm. status**	**Habitat Preference**	**Records**	**Likelihood of Occurrence**
Myrtaceae	*Callistemon linearifolius*	Netted Bottle Brush	V,P,3		Grows in dry sclerophyll forest on the coast and adjacent ranges. Flowers spring – summer.	1	Unlikely. Subject Site does not provide suitable habitat for this species.
Myrtaceae	*Eucalyptus parramattensis subsp. decadens*		V,P	V	Generally occupies deep, low-nutrient sands, often those subject to periodic inundation or where water tables are relatively high. It occurs in dry sclerophyll woodland with dry heath understorey. It also occurs as an emergent in dry or wet heathland. Often where this species occurs, it is a community dominant. In the Kurri Kurri area, E. parramattensis subsp. decadens is a characteristic species of 'Kurri Sand Swamp Woodland in the Sydney Basin Bioregion', an endangered ecological community under the TSC Act. In the Tomago Sandbeds area, the species is usually associated with the 'Tomago Swamp Woodland' as defined by NSW NPWS (2000). Very little is known about the biology or ecology of this species. Flowers from November to January. Propagation mechanisms are currently poorly known. Seed dispersal is likely to be effected by wind and animals. Likely to be sensitive to over-frequent fire, however there is evidence (i.e. coppicing, epicormic shoots) that the species may be tolerant of low intensity fires. The species has a canopy stored seed bank for dispersal after fire events.	3	Unlikely. Not recorded on the Subject Site during surveys.
Orchidaceae	^^*Diuris praecox*	Rough Doubletail	V,P,2	V	Grows on hills and slopes of near-coastal districts in open forests which have a grassy to fairly dense understorey. Exists as subterranean tubers most of the year. It produces leaves and flowering stems in winter. Undetectable except when in flower between July and August depending on prevailing climatic conditions.	667	Unlikely. No suitable habitat on the Subject Site..

Orchidaceae	*Diuris arenaria*	Sand Doubletail	E1,P,2	Sand Doubletail is a small ground orchid. The light purple to mauve flowers appear between August and September and are 20-30 mm wide. There are usually two 15-50 cm long by 2-6 mm wide leaves that grow from the base of the plant. Sand Doubletail is known from the Tomaree Peninsula near Newcastle. This species occurs in coastal heath and dry grassy eucalypt forest on sandy flats. Grows in gently undulating country in eucalypt forest with a grassy understorey on clay soil.	175	Potential habitat on the Subject Site.

11. APPENDIX B: ASSESSMENT OF SIGNIFICANCE: BC ACT

INCOMPLETE – awaiting response from LMBC.

Following review of BioNet and a site inspection/habitat assessment, the following species are considered to have potential habitat on the Subject Site and as such are subjected to an assessment of significance of impact from the proposed tourist interchange.

If a significant impact is likely, the Biodiversity Assessment Methodology (BAM) must be applied.

Crinia tinnula	Wallum Froglet	V,P
Artamus cyanopterus cyanopterus	Dusky Woodswallow	V,P
Glossopsitta pusilla	Little Lorikeet	V,P
Dasyurus maculatus	Spotted-tailed Quoll	V,P
Miniopterus australis	Little Bentwing-bat	V,P
Phascolarctos cinereus	Koala	V,P
Pseudomys novaehollandiae	New Holland Mouse	P
Pteropus poliocephalus	Grey-headed Flying-fox	V,P
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V,P
Diuris arenaria	Sand Doubletail	E1,P

Unless otherwise cited, information was obtained from the OEH species profiles and references contained therein. http://www.environment.nsw.gov.au/threatenedSpeciesApp/

Effects on a Threatened Species

(a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

11.1.1 Wallum Froglet

Wallum Froglets are small (to about 20mm) and extremely variable in colour and pattern. They range from light grey or brown to dark grey above and usually white or light brown below (sparsely flecked or heavily mottled with darker patches). They have a relatively pointed snout that projects beyond the lower jaw. A fine median line of white dots often occurs on the underside on the throat that may continue across the belly. They have no webbing on their feet and toe pads are absent. Pupils are horizontal. The call is a distinctive short high-pitched ringing 'tching..tching..', heard throughout the year, particularly following rain.

Wallum Froglets are found along the coastal margin from Litabella National Park in south-east Queensland to Kurnell in Sydney.

Wallum Froglets are found in a wide range of habitats, usually associated with acidic swamps on coastal sand plains. They typically occur in sedgelands and wet heathlands. They can also be found along drainage lines within other vegetation communities and disturbed areas, and occasionally in swamp sclerophyll forests.

The species breeds in swamps with permanent water as well as shallow ephemeral pools and drainage ditches. Breeding is thought to peak in the colder months, but can occur

throughout the year following rain. Eggs of 1.1-1.2mm are deposited in water with a pH of <6 and tadpoles take 2-6 months to develop into frogs.

Wallum Froglets shelter under leaf litter, vegetation, other debris or in burrows of other species. Shelter sites are wet or very damp and often located near the water's edge. Males may call throughout the year and at any time of day, peaking following rain.

11.1.2 Little Lorikeet

The Little Lorikeet is a small (16-19 cm; 40 g) bright green parrot, with a red face surrounding its black bill and extending to the eye. The undertail is olive-yellow with a partly concealed red base, and the underwing coverts are bright green. The mantle is imbued with light brown. The call in flight is diagnostically different from other lorikeets, being a shrill and rolling screech: 'zit-zit' or 'zzet'. Although difficult to observe while foraging high in treetops, a flock's constantly chattering contact calls give it away. Flight is fast, direct and through or above the canopy.
The Little Lorikeet is distributed widely across the coastal and Great Divide regions of eastern Australia from Cape York to South Australia. NSW provides a large portion of the species' core habitat, with lorikeets found westward as far as Dubbo and Albury. Nomadic movements are common, influenced by season and food availability, although some areas retain residents for much of the year and 'locally nomadic' movements are suspected of breeding pairs.

- Forages primarily in the canopy of open Eucalyptus forest and woodland, yet also finds food in Angophora, Melaleuca and other tree species. Riparian habitats are particularly used, due to higher soil fertility and hence greater productivity.
- Isolated flowering trees in open country, e.g. paddocks, roadside remnants and urban trees also help sustain viable populations of the species.
- Feeds mostly on nectar and pollen, occasionally on native fruits such as mistletoe, and only rarely in orchards
- Gregarious, travelling and feeding in small flocks (<10), though often with other lorikeets. Flocks numbering hundreds are still occasionally observed and may have been the norm in past centuries.
- Roosts in treetops, often distant from feeding areas.
- Nests in proximity to feeding areas if possible, most typically selecting hollows in the limb or trunk of smooth-barked Eucalypts. Entrance is small (3 cm) and usually high above the ground (2–15 m). These nest sites are often used repeatedly for decades, suggesting that preferred sites are limited. Riparian trees often chosen, including species like Allocasuarina.
- Nesting season extends from May to September. In years when flowering is prolific, Little Lorikeet pairs can breed twice, producing 3-4 young per attempt. However, the survival rate of fledglings is unknown.

11.1.3 Dusky Woodswallow

The dusky woodswallow is a medium-sized bird (16-19.5 cm, 35 g), with a longish tail. Mostly dark grey-brown, merging to blackish on the tail, with a small black-brown mask. Bluish bill with a black tip. Upper-wings are a dark blue-grey with a white leading edge. Conspicuous white corners on the tail. In flight the dark grey-brown under-body contrasts with the whitish under-wing. Juveniles may be distinguished by white streaking on the body and whitish tips on wing feathers. Immature individuals are similar to adults but retain pale-

tipped wing feathers. No seasonal variation in appearance is evident, and sexes are alike. Calls consist of brassy chirps, chirups, a soft low 'vut vut' and a brisk 'peet peet'. Also known to mimic other birds, including the rufous whistler and grey shrike-thrush.

Dusky woodswallows are widespread in eastern, southern and south western Australia. The species occurs throughout most of New South Wales, but is sparsely scattered in, or largely absent from, much of the upper western region. Most breeding activity occurs on the western slopes of the Great Dividing Range.

Primarily inhabit dry, open eucalypt forests and woodlands, including mallee associations, with an open or sparse understorey of eucalypt saplings, acacias and other shrubs, and ground-cover of grasses or sedges and fallen woody debris. It has also been recorded in shrublands, heathlands and very occasionally in moist forest or rainforest. Also found in farmland, usually at the edges of forest or woodland.

Primarily eats invertebrates, mainly insects, which are captured whilst hovering or sallying above the canopy or over water. Also frequently hovers, sallies and pounces under the canopy, primarily over leaf litter and dead timber. Also occasionally take nectar, fruit and seed.

Depending on location and local climatic conditions (primarily temperature and rainfall), the dusky woodswallow can be resident year round or migratory. In NSW, after breeding, birds migrate to the north of the state and to southeastern Queensland, while Tasmanian birds migrate to southeastern NSW after breeding. Migrants generally depart between March and May, heading south to breed again in spring. There is some evidence of site fidelity for breeding. Although dusky woodswallows generally breed as solitary pairs or occasionally in small flocks, large flocks may form around abundant food sources in winter. Large flocks may also form before migration, which is often undertaken with other species.

Nest is an open, cup-shape, made of twigs, grass, fibrous rootlets and occasionally casuarina needles, and may be lined with grass, rootlets or infrequently horsehair, occasionally unlined. Nest sites vary greatly, but generally occur in shrubs or low trees, living or dead, horizontal or upright forks in branches, spouts, hollow stumps or logs, behind loose bark or in a hollow in the top of a wooden fence post. Nest sites may be exposed or well concealed by foliage.

11.1.4 Spotted-tailed Quoll

The Spotted-tailed Quoll is about the size of a domestic cat, from which it differs most obviously in its shorter legs and pointed face. The average weight of an adult male is about 3500 grams and an adult female about 2000 grams. It has rich-rust to dark-brown fur above, with irregular white spots on the back and tail, and a pale belly. The spotted tail distinguishes it from all other Australian mammals, including other quoll species. However, the spots may be indistinct on juvenile animals.
The range of the Spotted-tailed Quoll has contracted considerably since European settlement. It is now found in eastern NSW, eastern Victoria, south-east and north-eastern Queensland, and Tasmania. Only in Tasmania is it still considered relatively common.

- Recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline.
- Individual animals use hollow-bearing trees, fallen logs, small caves, rock outcrops and rocky-cliff faces as den sites.

- Mostly nocturnal, although will hunt during the day; spends most of the time on the ground, although also an excellent climber and will hunt possums and gliders in tree hollows and prey on roosting birds.
- Use communal 'latrine sites', often on flat rocks among boulder fields, rocky cliff-faces or along rocky stream beds or banks. Such sites may be visited by multiple individuals and can be recognised by the accumulation of the sometimes characteristic 'twisty-shaped' faeces deposited by animals.
- A generalist predator with a preference for medium-sized (500g-5kg) mammals. Consumes a variety of prey, including gliders, possums, small wallabies, rats, birds, bandicoots, rabbits, reptiles and insects. Also eats carrion and takes domestic fowl.
- Females occupy home ranges up to about 750 hectares and males up to 3500 hectares. Are known to traverse their home ranges along densely vegetated creeklines.
- Average litter size is five; both sexes mature at about one year of age. Life expectancy in the wild is about 3-4 years.

11.1.5 Koala

The Koala is an arboreal marsupial with fur ranging from grey to brown above, and is white below. It has large furry ears, a prominent black nose and no tail. It spends most of its time in trees and has long, sharp claws, adapted for climbing. Adult males weigh 6 - 12 kg and adult females weigh 5 - 8 kg. During breeding, males advertise with loud snarling coughs and bellows.
The Koala has a fragmented distribution throughout eastern Australia from north-east Queensland to the Eyre Peninsula in South Australia. In NSW it mainly occurs on the central and north coasts with some populations in the west of the Great Dividing Range. It was briefly historically abundant in the 1890s in the Bega District on the south coast of NSW, although not elsewhere, but it now occurs in sparse and possibly disjunct populations. Koalas are also known from several sites on the southern tablelands.

- Inhabit eucalypt woodlands and forests.
- Feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species.
- Inactive for most of the day, feeding and moving mostly at night.
- Spend most of their time in trees, but will descend and traverse open ground to move between trees.
- Home range size varies with quality of habitat, ranging from less than two ha to several hundred hectares in size.
- Generally solitary, but have complex social hierarchies based on a dominant male with a territory overlapping several females and sub-ordinate males on the periphery.
- Females breed at two years of age and produce one young per year.

11.1.6 Grey-headed Flying-fox

The Grey-headed Flying-fox is the largest Australian bat, with a head and body length of 23 - 29 cm. It has dark grey fur on the body, lighter grey fur on the head and a russet

collar encircling the neck. The wing membranes are black and the wingspan can be up to 1 m. It can be distinguished from other flying-foxes by the leg fur, which extends to the ankle.
Grey-headed Flying-foxes are generally found within 200 km of the eastern coast of Australia, from Rockhampton in Queensland to Adelaide in South Australia. In times of natural resource shortages, they may be found in unusual locations.

- Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops.
- Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy.
- Individual camps may have tens of thousands of animals and are used for mating, and for giving birth and rearing young.
- Annual mating commences in January and conception occurs in April or May; a single young is born in October or November.
- Site fidelity to camps is high; some camps have been used for over a century.
- Can travel up to 50 km from the camp to forage; commuting distances are more often <20 km.
- Feed on the nectar and pollen of native trees, in particular Eucalyptus, Melaleuca and Banksia, and fruits of rainforest trees and vines.
- Also forage in cultivated gardens and fruit crops.

11.1.7 Yellow-bellied Sheathtail-bat

The Yellow-bellied Sheathtail-bat is a very distinctive, large, insectivorous bat up to 87 mm long. It has long, narrow wings, a glossy, jet-black back, and a white to yellow belly extending to the shoulders and just behind the ear. Characteristically, it has a flattened head and a sharply-pointed muzzle. The tail is covered with an extremely elastic sheath that allows variation in the tail-membrane area. Males have a prominent throat pouch; females have a patch of bare skin in the same place.
The Yellow-bellied Sheathtail-bat is a wide-ranging species found across northern and eastern Australia. In the most southerly part of its range - most of Victoria, south-western NSW and adjacent South Australia - it is a rare visitor in late summer and autumn. There are scattered records of this species across the New England Tablelands and North West Slopes.

- Roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows.
- When foraging for insects, flies high and fast over the forest canopy, but lower in more open country.
- Forages in most habitats across its very wide range, with and without trees; appears to defend an aerial territory.
- Breeding has been recorded from December to mid-March, when a single young is born.
- Seasonal movements are unknown; there is speculation about a migration to southern Australia in late summer and autumn.

11.1.8 Little Bentwing-bat

Little Bentwing-bats are small dark chocolate brown insectivorous bats with a body length of about 45 mm. The tip of the wing is formed by a particularly long joint of the third finger, folded back and bent under the wing while the bat is at rest. The fur is long and thick, especially over the crown and around the neck, and is slightly lighter in colour on the belly. They have distinctly short muzzles, and short, rounded roughly triangular shaped ears. Distinguished from the Common Bentwing-bat by its smaller size.
East coast and ranges of Australia from Cape York in Queensland to Wollongong in NSW.

- Moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub. Generally found in well-timbered areas.
- Little Bentwing-bats roost in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats.
- They often share roosting sites with the Common Bentwing-bat and, in winter, the two species may form mixed clusters.
- In NSW the largest maternity colony is in close association with a large maternity colony of Eastern Bentwing-bats (Miniopterus schreibersii) and appears to depend on the large colony to provide the high temperatures needed to rear its young.
- Maternity colonies form in spring and birthing occurs in early summer. Males and juveniles disperse in summer.
- Only five nursery sites /maternity colonies are known in Australia.
- Identifiable Mid spring to mid-autumn

11.1.9 New Holland Mouse

The New Holland Mouse is a small native rodent similar in size and appearance to the introduced House Mouse. It can be distinguished from the House Mouse by its dusky-brown tail which is longer than the rest of the body and darker on the dorsal surface, the absence of a notch on the upper incisors, and the absence of a distinctive ‘mousy’ odour. The New Holland Mouse has a fragmented distribution across Tasmania, Victoria, New South Wales and Queensland. Genetic evidence indicates that the New Holland Mouse once formed a single continuous population on mainland Australia and the distribution of recent subfossils further suggest that the species has undergone a large range contraction since European settlement. Total population size of mature individuals is now estimated to be less than 10,000 individuals although, given the number of sites from which the species is known to have disappeared between 1999 and 2009, it is likely that the species’ distribution is actually smaller than current estimates.

- Known to inhabit open heathlands, woodlands and forests with a heathland understorey and vegetated sand dunes
- It is a social animal, living predominantly in burrows shared with other individuals
- Distribution is patchy in time and space, with peaks in abundance during early to mid stages of vegetation succession typically induced by fire

11.1.10 Diuris arenaria

Sand Doubletail is a small ground orchid. The light purple to mauve flowers appear between August and September and are 20-30 mm wide. There are usually two 15-50 cm long by 2-6 mm wide leaves that grow from the base of the plant.

Sand Doubletail is known from the Tomaree Peninsula near Newcastle. This species occurs in coastal heath and dry grassy eucalypt forest on sandy flats. Grows in gently undulating country in eucalypt forest with a grassy understorey on clay soil.

In NSW North Coast, the Sand Doubletail is known to be associated with the following vegetation formations and classes.

Coastal Dune Dry Sclerophyll Forests

- Smooth-barked Apple - Blackbutt - Old Man Banksia woodland on coastal sands of the Central and Lower North Coast
- Smooth-barked Apple - Blackbutt heathy open forest of the Tomaree Peninsula
- Smooth-barked Apple - White Stringybark - Red Mahogany - Melaleuca sieberi shrubby open forest on lowlands of the lower North Coast

Freshwater wetlands

- Fern-leaf Banksia - Prickly-leaved Paperbark-Tantoon - Leptocarpus tenax wet heath on coastal sands of the Central Coast and lower North Coast

<u>Effects on an Endangered Ecological Community</u>

(b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

<u>Effect on Habitat of a Threatened Species</u>

(c) in relation to the habitat of a threatened species or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality

(d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),

The Subject Site has not been declared as an area of outstanding biodiversity value.

<u>Constitutes a Key Threatening Process</u>

(e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process

The proposal does contribute to the Key Threatening Process *Clearing of Native Vegetation*.

Concluding Comments and Recommendations

12. APPENDIX C: ASSESSMENT OF SIGNIFICANCE: EPBC ACT

A Protected Matters search was undertaken on 05/06/2018 within a 10x10 km area centred on the Subject Site to determine the likely occurrence of Matters of National Environmental Significance.

A summary of matters of National Environmental Significance is provided in Table A3 (Appendix 1), results of the Protected Matters Search Tool Results for Threatened Species listed under the EPBC Act with 10 km of the Study Area are provided in Table A4 (Appendix 1) and results of the Protected Matters Search Tool Results for Migratory Species listed under the EPBC Act with 10 km of the Study Area are provided in Table A5 (Appendix A).

The Study Area does not contain any World Heritage Properties, National Heritage Places, Great Barrier Reef Marine Park or Commonwealth Marine Areas. It does contain two Wetland of International Importance (Hunter Estuary Wetlands; Myall Lakes), seven listed threatened ecological communities, 80 listed threatened species and 74 listed migratory species.

Following a site inspection and habitat assessment:

The Subject Site does not form part of the Hunter Estuary Wetland or Myall Lakes and the proposal is unlikely to impact these wetlands.

The Subject Site does not contain the threatened ecological communities:

1. Central Hunter Valley eucalypt forest and woodland (CE)
2. Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community (E)
3. Littoral Rainforest and Coastal Vine Thickets of Eastern Australia (CE)
4. Lowland Rainforest of Subtropical Australia (CE)
5. Posidonia australis seagrass meadows of the Manning-Hawkesbury ecoregion (E)
6. Subtropical and Temperate Coastal Saltmarsh (V)
7. White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (CE)

The Subject Site has potential habitat for:

5.	*Dasyurus maculatus*	Spotted-tailed Quoll	E
6.	*Phascolarctos cinereus*	Koala	V
7.	*Pseudomys novaehollandiae*	New Holland Mouse	V
8.	*Pteropus poliocephalus*	Grey-headed Flying-fox	V

CE – Critically Endangered, E=Endangered, V – Vulnerable under the EPBC Act

Significant Impact Guidelines (DEHWA, 2009) have been prepared in order to decide whether an action is likely to have a significant impact. In determining the nature and magnitude of an action's impact, it is important to consider matters such as:

- all on-site and off-site impacts,
- all direct and indirect impacts,
- the frequency and duration of the action,
- the total impact which can be attributed to that action over the entire geographic area affected, and over time,
- the sensitivity of the receiving environment, and

- the degree of confidence with which the impacts of the action are known and understood.

12.1 ENDANGERED THREATENED SPECIES

The following threatened species have potential habitat within the Study Area:

1. *Dasyurus maculatus* Spotted-tailed Quoll E

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

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

The proposed action will not result in a reduction in size of the population of this species as the Subject Site provides poor quality foraging and roosting habitat and the Spotted tailed Quoll is unlikely to rely on the Subject Site for breeding/nesting.

b) reduce the area of occupancy of the species

The proposed works require the clearing of approximately 0.27 ha of native vegetation however the Subject Site is considered sub-optimal habitat and this species is not known to have occurred in the Subject Site. The Subject Site does not occur at the limit of distribution or area of occupancy for this species.

c) fragment an existing population into two or more populations

The Subject Site provides only limited habitat and as it adjoins residential areas, it will not result in further fragmentation of a population if present.

d) adversely affect habitat critical to the survival of a species

The Subject Site does not represent critical habitat to the Spotted-tailed Quoll.

e) disrupt the breeding cycle of a population

The Subject Site does not provide suitable dens sites or nesting habitat for this species and as such, the proposal will not disrupt its breeding cycle.

f) modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

As the Subject Site provides sub-optimal habitat for this species, the proposal will not alter the habitat to the extent that this species is likely to decline.

g) result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat

The Subject Site is already impacted by Bitou Bush however the proposed clearing of the site is unlikely to result in the establishment of any new invasive species.

h) introduce disease that may cause the species to decline, or

The proposed works will not result in an introduction of a disease that may cause this species to decline.

i) interfere with the recovery of the species.

The proposal will not affect the recovery of these species.

12.2 VULNERABLE THREATENED SPECIES

Vulnerable species within the Study Area:

1.	*Phascolarctos cinereus*	Koala	V
2.	*Pseudomys novaehollandiae*	New Holland Mouse	V
3.	*Pteropus poliocephalus*	Grey-headed Flying-fox	V

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

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

Under the meaning of the Act, an "important" population is one that is necessary for a species' long-term survival and recovery, and may include key source populations for breeding and dispersal, populations necessary for maintaining genetic diversity and populations near the limit of the species range.

The Subject Site does not support an important population of Koalas as it lacks potential koala habitat (as defined under SEPP 44) and it provides only foraging habitat for the Grey-headed Flying-fox. The majority of records for New Holland Mouse are over 20 years old with the exception of one record from 2015 near Salamander Bay. Distribution of New Holland Mouse is patchy in time and space, with peaks in abundance during early to mid stages of vegetation succession typically induced by fire. The Subject Site is not in the early to mid stages of vegetation succession and there is no evidence of recent fire. Thus, the Subject Site is considered unlikely to support an important population of New Holland Mouse.

b) reduce the area of occupancy of an important population

As discussed, the Subject Site does not support an important population of Koala, Grey-headed Flying-fox or New Holland Mouse so the removal of 0.27 ha of vegetation is unlikely to reduce the area of occupancy of an important population.

c) fragment an existing important population into two or more populations

The Subject Site adjoins residential areas thus further clearing will not contribute to fragmentation of habitat or an important population.

d) adversely affect habitat critical to the survival of a species

The Subject Site provides potential, but sub-optimal habitat for these species. As such, the proposal will not effect habitat critical to their survival.

e) disrupt the breeding cycle of an important population

The Subject Site does not provide breeding habitat for Grey-headed Flying-fox and does not support an important population of any of the three vulnerable species.

f) modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

The habitat on the Subject Site is not considered important to the survival of these species and as such, the removal of 0.27ha of native vegetation is unlikely to lead to a species decline.

g) result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat

The proposed works will not result in an introduction of a invasive species that may cause

these species to decline.

h) introduce disease that may cause the species to decline, or

The proposed works will not result in an introduction of a disease that may cause these species to decline.

i) interfere substantially with the recovery of the species.

The proposed works will not interfere with the recovery of this species.

12.3 CONCLUSION

The proposed works (clearing of 0.27 ha of vegetation) will not substantially impact upon the endangered Spotted tailed Quoll or the vulnerable Koala, Grey-headed Flying-fox or New Holland Mouse with potential habitat in the broader Study Area as the Subject Site does not provide important habitat features for these species. The Subject Site lacks primary feed trees for Koalas, does not contain roost sites for the Grey-headed Flying-fox, lacks den sites for the Spotted-tailed Quoll and the stage of vegetation succession is not preferred by the New Holland Mouse. Subsequently, the Subject Site does not support an important population of these species.

Based on the above assessment it is considered that a referral to SEWPaC is not required.

13. APPENDIX D. VEGETATION DATA SHEETS

ROYAL HASKONING DHV

Birubi Information Centre

BIODIVERSITY ASSESSMENT

Job No: 180525

Date: 17 October 2018

COAST ECOLOGY
ENVIRONMENTAL ASSESSMENTS

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Birubi Information Centre, Biodiversity Assessment

Issue	Date	Description	Author	Reviewed By
A	20/06/2018	DRAFT	KM	NL
B	27/06/2018	FINAL	KM	PSC
C	03/07/2018	FINAL – incorporated response from LMBC Contact Service Centre regarding the BVMap	KM	NL
D	11/09/2018	FINAL – updated with Councils comments	KM	PSC
E	17/10/2018	FINAL – updated including SEPP Coastal Management	KM	PSC

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EXECUTIVE SUMMARY

Royal Haskoning DHV engaged coast ecology to prepare a Biodiversity Assessment for the proposed Birubi Information Centre at Lot 312 DP 753204 on the corner of James Paterson Street and Gan Gan Road at Anna Bay (hereafter referred to as the *Subject Site*; Figure 1).

The proposed Information Centre and transport interchange will be developed by Port Stephen's Council and will cater for the growing demand in international and domestic tourism activities at Birubi Point. The proposed works will comprise sand removal and levelling the ground. Buildings and signage will be constructed following completion of civil engineering works and will comprise of retail units, amenities and toilet blocks.

The impact of the proposed works on threatened species, populations and communities (i.e. 7-part test) have been considered in accordance with the Threatened Species Conservation Act.

Vegetation communities on the *Subject Site* include:

- Cheese Tree/ Smooth-Barked Apple/ Bangalay Disturbed Open Forest
- Disturbed Coastal Sand Scrub

Also mapped are:

- Cleared Areas
- Sand Dunes

These communities are not consistent with the definitions of any listed endangered/threatened ecological communities under state or commonwealth legislation.

State Legislation

The BioNet search of threatened flora and fauna previously recorded in the broader *Study Area* returned a total of 2,291 records of 43 species. Of these, 15 species (2 flora, 13 fauna) were considered to have potential habitat on the *Subject Site*.

An assessment of significance of impact (Appendix B) under the Threatened Species Conservation Act concluded that the removal of approximately 0.28 ha of Disturbed Coastal Sand Scrub is unlikely to have an adverse effect on the life cycle of these species such that a viable local population of the species is likely to be placed at risk of extinction. The proposed clearing will not result in further modification of the vegetation as it is already highly modified through weed invasion, nor will it result in fragmentation or isolation of habitat as the *Subject Site* is already partially isolated. The habitat to be removed is not considered important to the long-term survival of the species as it provides only sub-optimal habitat for Wallum Froglet as it lacks acid swamp, there is only limited foraging habitat for Dusky Woodswallow, there is no suitable habitat for hollow dependent species such as the Little Lorikeet, Powerful Owl, Masked Owl, there are no suitable den sites for Spotted-tailed Quoll and there are limited records, there are nil to limited suitable roost sites for threatened Forest Bats, there are no preferred feed trees for Koalas and it is not a known roost site for Grey-headed Flying-fox. The *Subject Site* is sub-optimal for *Diuris praecox* and *Diuris arenaria* as it lacks dense grassy understory however there have been nearby records of *D. praecox*. This species flowers during winter and was not recorded on the *Subject Site* during surveys conducted in in *Area of Impact* in June 2018. Thus, the *Subject Site* is not considered important habitat for any of the threatened species considered to have potential habitat on the *Subject Site*.

With regards to Endangered Ecological Communities, LHCCREMS (2002) mapped the *Subject Site* as containing a small portion of Swamp Mahogany – Paperbark Forest which is consistent with *Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions*" Endangered Ecological Community (EEC). Following a site assessment however, the *Subject Site* did not contain Swamp Mahogany,

Melaleucas or Woolybutt which are characteristic species of this EEC. It did contain two isolated Bangalay however this species is typically only characteristic of the EEC south of Sydney. The *Subject Site* also contained Cheese Tree however this is a commonly occurring tree in many vegetation communities and is not a characteristic species of the Swamp Sclerophyll EEC. The substrate of the *Subject Site* is predominantly sand and is not characteristic of a waterlogged or periodically inundated alluvial floodplain. As such, it was considered that this EEC did not occur on the *Subject Site*.

Commonwealth Legislation

Under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), actions that have, or are likely to have, a significant impact on a matter of national environmental significance (MNES) require approval from the Australian Government Minister for the Environment (the Minister).

The *Study Area* does not contain any World Heritage Properties, National Heritage Places, Great Barrier Reef Marine Park or Commonwealth Marine Areas. It does contain two Wetland of International Importance (Hunter Estuary Wetlands; Myall Lakes), seven listed threatened ecological communities, 80 listed threatened species and 74 listed migratory species.

The *Subject Site* does not form part of the Hunter Estuary Wetland or Myall Lakes and the proposal is unlikely to impact these wetlands. Following a site inspection and habitat assessment, the *Subject Site* does not contain any threatened ecological communities.

The *Subject Site* has potential habitat for the following threatened species:

- *Dasyurus maculatus* Spotted-tailed Quoll E
- *Phascolarctos cinereus* Koala V
- *Pseudomys novaehollandiae* New Holland Mouse V
- *Pteropus poliocephalus* Grey-headed Flying-fox V

Following an assessment of significance of impact, it was concluded that the proposed works (clearing of 0.28 ha of vegetation) will not substantially impact upon the endangered Spotted tailed Quoll or the vulnerable Koala, Grey-headed Flying-fox, New Holland Mouse or *D. praecox* with potential habitat in the broader *Study Area* as the *Subject Site* does not provide important habitat features for these species. The *Subject Site* lacks primary feed trees for Koalas, does not contain roost sites for the Grey-headed Flying-fox, lacks den sites for the Spotted-tailed Quoll and the stage of vegetation succession is not preferred by the New Holland Mouse. *Diuris praecox* prefers a dense grassy understory which is lacking on the *Subject Site*. Subsequently, it is considered that the *Subject Site* does not support an important population of these species.

Based on the above assessment it is considered that a referral to Department of the Environment and Energy is not required.

The subject site is mapped as being located within the environmental use area under *State Environmental Planning Policy (Coastal Management) 2018* and associated interactive maps. Consideration of Clause 13 concluded that mitigation measures such as appropriate erosion and sediment control measures and stabilisation of the soil with mulch and planting will minimise the potential impacts of the works on the coastal area.

CONTENTS

1. INTRODUCTION

Royal Haskoning DHV engaged Coast Ecology to prepare a Biodiversity Assessment for the proposed Birubi Information Centre at Lot 312 DP 753204 on the corner of James Paterson Street and Gan Gan Road at Anna Bay (hereafter referred to as the *Subject Site*; Figure 1).

2. SUBJECT SITE/STUDY AREA

The *Subject Site* (Figure 2) is at the northern end of extensive sand dunes that stretch between Stockton Beach and Anna Bay in the Port Stephens Local Government Area (LGA). The dunes have been subjected to extensive erosion from natural and anthropogenic forces along with alterations to the species composition of the vegetation through weed invasion.

The Study Area (Figure 1) is defined as a 10 x 10 km area centred on *The Subject Site* and includes the broader local area which may be impacted upon, either directly or indirectly by the proposed works. Database searches are conducted within this *Study Area* limit.

3. PROPOSED WORKS

On behalf of Port Stephens Council, an Information Centre is proposed for the *Subject Site*, Lot 312 DP753024. This site has been identified through a process of master planning and community engagement. It is located on Crown Land in a RU2 zone, adjacent to E2 and RE1 lands and the Birubi Point Aboriginal Place. The site is a disturbed area of dune landscape that is framed by vegetation along Gan Gan Road and James Paterson Road. The proposed information centre has been designed as a functional asset that resolves current parking and congestion issues around visitor activity at Birubi Point.

The asset consists of 1,325m^2 of sheltered space and provides space for dune operators and amenities, including public toilets and a kiosk. The site has 50 car parking spaces, including 3 disabled spaces, 10 coach parking spaces with a drop-off zone that can accommodate 2 coaches, and provisions for pedestrians and cyclists. The proposal includes site specific Architecture and Landscape design that is integrated with sustainable water solutions. Heritage considerations, traffic management and an ecological assessment have also been incorporated into the proposed outcome.

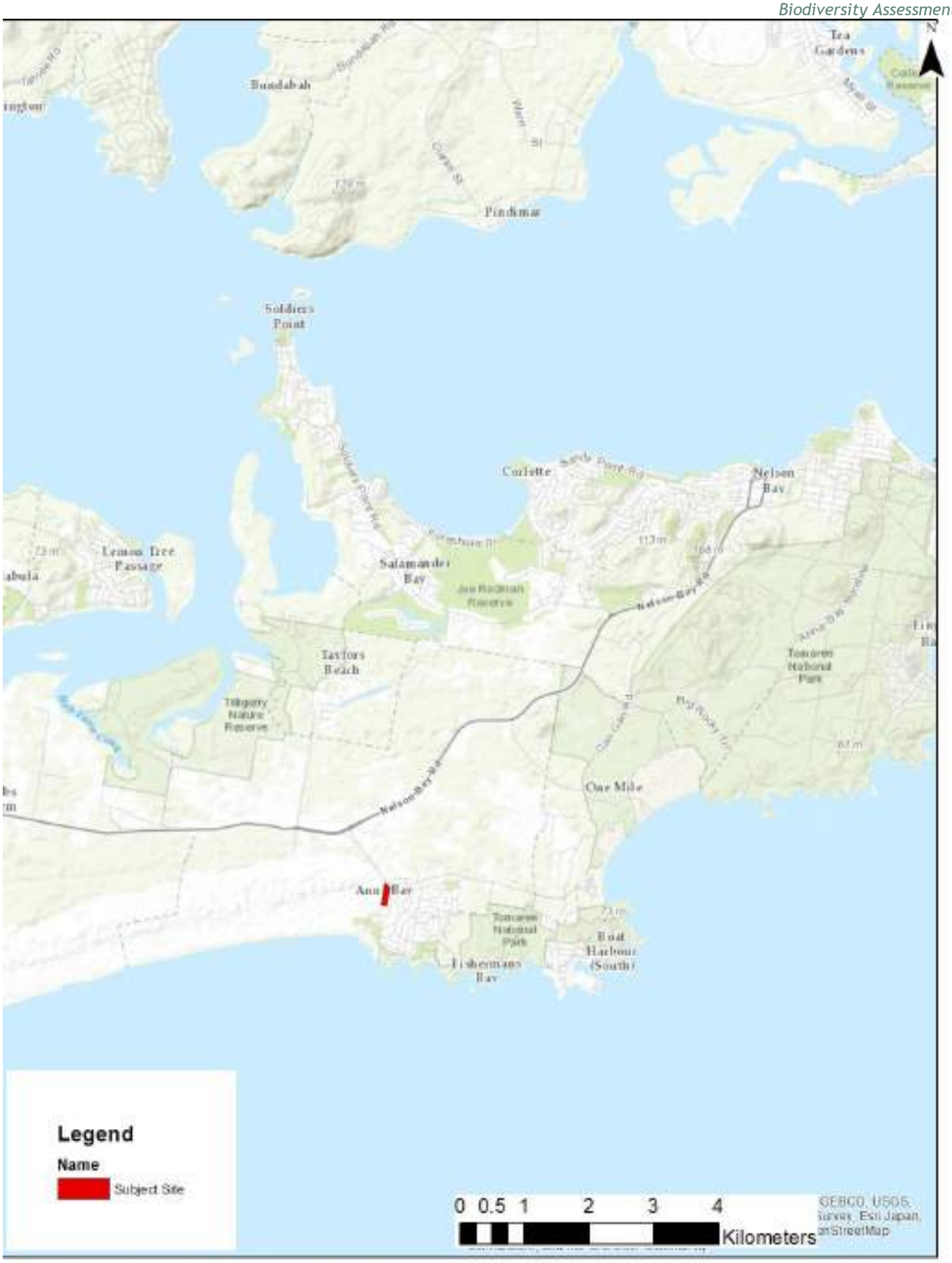
The demand for sand dune adventure tourism and cultural heritage experiences has grown to such a point that urgent planning for a transport interchange is being co-funded by the NSW Government's Tourism Demand Driver Infrastructure Fund and Port Stephens Council.

The proposed works will comprise sand removal and levelling of ground in the northern portion of the *Subject Site* closest to Gan Gan Road. The southern portion of the *Subject Site* is contained in the Aboriginal Place designation and excluded from development.

Excavated material will be removed and stored off site. A sediment fence will be installed along the western boundary of the site with planting of native species on either side to stabilise the fence and provide screening. Once established with vegetation, the fencing would create a buffer for the interchange from the prevailing winds and sand drift.

A compacted road base sealed with asphalt will be constructed for access routes and parking bays within the transport intersection. Site stormwater drainage and water quality management infrastructure will be incorporated. Buildings and signage will be constructed following completion of civil engineering works.

The *Area of Impact* includes the footprint for the works (Map 1; Figure 2).



COAST ECOLOGY
ENVIRONMENTAL ASSESSMENTS

Figure 1. Locality
Biodiversity Assessment
Birubi Information Centre

COAST ECOLOGY
ENVIRONMENTAL ASSESSMENTS

Figure 2. Subject Site & Area of Impact
Biodiversity Assessment
Birubi Information Centre

Map 1. Proposed Interchange in Stage A

4. DESKTOP STUDIES

4.1 RELEVANT LEGISLATION

In June 2014 the NSW Government began a review and subsequent reform of the Biodiversity Legislation. In November 2016 the Biodiversity Conservation Act (BC Act) and amendments to the Local Land Services Act (LLS Act) were passed by Parliament. The new legislation commenced on the 25th August 2017 however there were some exceptions to the commencement date. Port Stephens Council is a nominated Interim Designated Area under the Biodiversity Conservation Act 2016 (BC Act) until 25 November 2018. As such, the Threatened Species Conservation Act 1995 (TSC Act) still applies.

In addition, the NSW Coastal Reforms have resulted in the repeal of the Coastal Protection Act, 1979 and the commencement of the Coastal Management Act, 2016. This includes the commencement of the State Environmental Planning Policy (Coastal Management) 2018 which updates and consolidates into one integrated policy SEPP 14 (Coastal Wetlands), SEPP 26 (Littoral Rainforests) and SEPP 71 (Coastal Protection), including clause 5.5. of the Standard Instrument – Principal Local Environmental Plan. These policies are now repealed.

4.1.1 THREATENED SPECIES CONSERVATION ACT 1995

The objects of this Act are as follows:

a) to conserve biological diversity and promote ecologically sustainable development, and

b) to prevent the extinction and promote the recovery of threatened species, populations and ecological communities, and

c) to protect the critical habitat of those threatened species, populations and ecological communities that are endangered, and

d) to eliminate or manage certain processes that threaten the survival or evolutionary development of threatened species, populations and ecological communities, and

e) to ensure that the impact of any action affecting threatened species, populations and ecological communities is properly assessed, and

f) to encourage the conservation of threatened species, populations and ecological communities by the adoption of measures involving co-operative management.

A Threatened Species Assessment in accordance with Section 5A of the *EP&A Act* has been undertaken and is provided in Appendix B and summarised in Section 6 of this report. This assessment determined that the proposal is not likely to have a significant effect on threatened species, populations or ecological communities or their habitats and a Species Impact Statement is not required for the proposal.

4.1.2 SEPP 44 KOALA HABITAT PROTECTION

The provisions of SEPP 44 Koala Habitat Protection apply to all lands within Newcastle Local Government Area.

This Policy aims to encourage the proper conservation and management of areas of natural vegetation that provide habitat for koalas to ensure a permanent free-living population over their present range and reverse the current trend of koala population decline:

(a) by requiring the preparation of plans of management before development consent can be granted in relation to areas of core koala habitat, and

(b) by encouraging the identification of areas of core koala habitat, and

(c) by encouraging the inclusion of areas of core koala habitat in environment protection zones.

In this Policy:

core koala habitat means an area of land with a resident population of koalas, evidenced by attributes such as breeding females (that is, females with young) and recent sightings of and historical records of a population.

potential koala habitat means areas of native vegetation where the trees of the types listed in Schedule 2 constitute at least 15% of the total number of trees in the upper or lower strata of the tree component.

Land to which this Part applies

This Part applies to land:

(a) that is land to which this Policy applies, and

(b) that is land in relation to which a development application has been made, and

(c) that:

(i) has an area of more than 1 hectare, or

(ii) has, together with any adjoining land in the same ownership, an area of more than 1 hectare,

whether or not the development application applies to the whole, or only part, of the land.

The *Subject Site* is 3.2 hectares, thus SEPP 44 is triggered.

Step 1—Is the land potential koala habitat?

The *Subject Site* does not contain any schedule 2 Feed Tree under this SEPP nor does it contain *main koala food trees* listed under North Coast (Hunter-Central Rivers, Northern Rivers) by Office of Environment and Heritage (NSW OEH, undated). A small portion of the *Subject Site* is mapped as Swamp Mahogany-Paperbark Forest (LHCCREMS, 2000: Figure 5) however following a site inspection, the vegetation was not consistent with the mapping and no Swamp Mahogany were present. Two Bangalay *Eucalyptus botryoides* were however present and this species is similar in appearance to Swamp Mahogany.

Thus, preferred feed trees do not contribute more than 15% of the total number of trees present. As such, The *Subject Site* does contain potential koala habitat.

Step 2—Is the land core koala habitat?

Actives searches for koala scat were undertaken at the base of all native trees within the three vegetation quadrats. No scats, scratches or signs of koala utilisation were recorded. A resident population is considered unlikely on The *Subject Site* however it may be used by dispersing males on occasion, given the proximity of known core koala habitat in the Port Stephens region.

Thus, it is considered that the *Subject Site* does not constitute core koala habitat. Further assessment of potential impacts of the works on Koalas is provided in Section 6.0 of this report in accordance with the Port Stephens Council Comprehensive Koala Plan of Management (PSC CKPoM, 2002) and the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) referral guidelines.

4.2 COASTAL MANAGEMENT SEPP

The Coastal Management SEPP gives effect to the objectives of the Coastal Management Act 2016 from a land use planning perspective, by specifying how development proposals are to be assessed if they fall within the coastal zone. Detailed interactive maps accompany the SEPP.

The Subject Site falls within the Coastal Environment Area which is part of the Coastal Management zone. As such, Coastal Management SEPP is triggered. Consideration of development on land within the coastal environment area is provided in Section 6.4 of this report.

4.3 DATABASE SEARCHES

A database search was conducted within a 10 x 10 km area centred on the *Subject Site* from the following databases:

- BioNet website for the Atlas of NSW Wildlife. BioNet is a portal for accessing government held information about plants and animals in NSW. It is supported by several NSW government held agencies including Office of Environment and Heritage (OEH) (National Parks and Wildlife and Royal Botanic Gardens and Domain Trust), Department of Primary Industries (Forests NSW and Fisheries NSW) and the Australian Museum. BioNet contains records for threatened species and endangered ecological communities listed under the Threatened Species Conservation Act 1995 (TSC Act) and the Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act) which have been recorded within the locality. The search was conducted on 31/05/2018 using search coordinates: North: -32.73, West: 152.03, East: 152.13, South: -32.83. It returned a total of 2,291 records of 43 fauna species and 846 records of 4 flora species. Species listed as being part of the bilateral migratory bird agreements with China (CAMBA), Japan (JAMBA) and Republic of Korea (ROKAMBA) are also listed http://www.bionet.nsw.gov.au/
- Australian Government: Department of the Environment Protected Matters Search Tool for Matters of National Environmental Significance (NES) listed under the Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act) that may occur in the *Study Area*. a region search was conducted on 05/06/2018 under Port Stephens Council LGA http://www.environment.gov.au/epbc/protected-matters-search-tool

A full list of threatened species (pursuant to the TSC Act) and Endangered Ecological Communities (EECs) recorded in the *Study Area* from database searches are provided in tables A1 and A2 (Appendix A) respectively. The locations of threatened fauna and flora previously recorded within a 10 km radius of the *Study Area* are shown in Figures 3 and 4 respectively. Results of the protected matters search tool are provided in Tables A3, A4 and A5 (Appendix A).

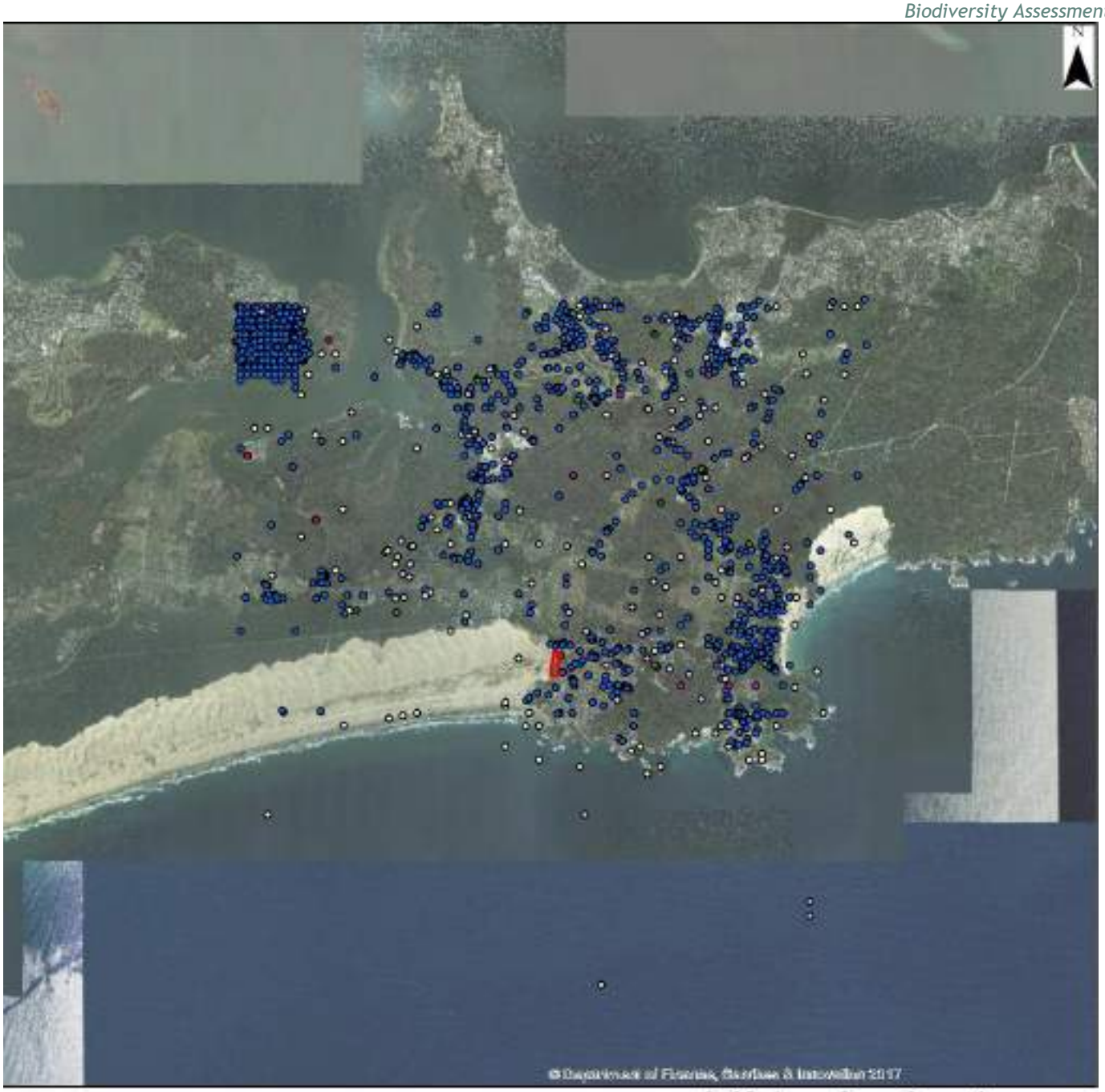


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Figure 3. Threatened Fauna recorded within a 10x10km radius of the Subject Site: BioNet 04/06/2018, Biodiversity Assessment
Birubi Information Centre

COAST ECOLOGY
ENVIRONMENTAL ASSESSMENTS

Figure 4. Threatened Flora recorded within a 10x10km radius of the Subject Site: BioNet 04/06/2018, Biodiversity Assessment Birubi Information Centre

4.4 VEGETATION MAPPING

The Lower Hunter Central Coast Regional Environmental Management Strategy (LHCCREMS) Vegetation Survey, Classification and Mapping report (Report: April 2000, mapping 2002) identified four vegetation communities within the *Subject Site* (Figure 5). Table A6 (Appendix A) lists these vegetation communities and provides a brief description of each, including their legal status.

One of the communities mapped by LHCCREMS (Swamp Mahogany – Paperbark Swamp Forest) falls under the definition of a listed Endangered Ecological Community under the Threatened Species Conservation Act (TSC Act): *Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions*" Endangered Ecological Community (EEC).

Following a site inspection, the *Subject Site* was not mapped as having this EEC as the *Subject Site* does not have the characteristic species of this EEC such as Swamp Mahogany *E. robusta* and Paperbark *Melaleuca quinquenervia*. This is discussed further in Section 6.2.1.

In addition, the *Area of Impact* does not include the vegetation mapped by LHCCREMS as Swamp Mahogany – Paperbark Forest.

COAST ECOLOGY
ENVIRONMENTAL ASSESSMENTS

Figure 5. Vegetation Mapping: LHCCREMS 2000
Biodiversity Assessment
Birubi Information Centre

5. FIELD SURVEYS

Field surveys were undertaken on 7 June 2018 within the *Area of Impact* on the *Subject Site*. Three vegetation quadrats were established to assess vegetation integrity and condition. Opportunistic fauna sightings were also undertaken.

A copy of quadrat data sheets is provided in Appendix D and a full species list is provided in Table A7 (Appendix A).

5.1 VEGETATION MAPPING

The vegetation across the *Subject Site* had a high level of weed invasion, particularly in the north eastern corner of the *Subject Site*. The area behind existing residents along James Paterson Street has been cleared for lawn and an access track and was subsequently mapped as 'cleared areas'. In addition, the sand dunes which had isolated clumps of bitou bush were not mapped as vegetated. This is consistent with LHCCRES mapping which also did not map the sand dunes as vegetated.

Areas that are not native vegetation do not require further assessment or inclusion in BAM calculations (Section 5.1.1.5 BAM).

Vegetation communities on the *Subject Site* include (refer Figure 6):

- Cheese Tree/ Smooth-Barked Apple/ Bangalay Disturbed Open Forest
- Disturbed Coastal Sand Scrub

Also mapped are areas of:

- Cleared Areas
- Sand Dunes

5.1.1 CHEESE TREE/ SMOOTH-BARKED APPLE/ BANGALAY DISTURBED OPEN FOREST

This community has been highly disturbed through encroaching garden/lawns, a vehicle access track and invasive exotic species.

Upper Stratum: 8-25m height range

The upper canopy is dominated by Cheese Tree *Glochidion ferdinandii* and Smooth-barked Apple *Angophora costata*. There are also 2 large Bangalay *Eucalyptus botryoides* located over a kikuyu lawn adjoining a residential dwelling along with individual Rough-barked Apple *Angophora floribunda* and *Pittosporum undulatum*. Exotic canopy species were numerous and had a high percent cover and included Coral Tree *Erythrina x sykesii**, Liquid amber *Liquidambar styraciflua** and Camphor laurel *Cinnamomum camphora**.

Middle Stratum: 1-8m height range

The middle stratum was sparse and native species included Coffee Bush *Breynia oblongifolia* and Gymea Lily *Doryanthes excelsa*. Exotic species in the middle stratum included Lantana *Lantana camara**.

Lower Stratum: 0-1m height range

The lower stratum was dominated by Wandering Jew *Tradescantia fluminensis**. Other exotic herbs include chickweed *Stellaria media**. Exotic grasses were dominant such as Kikuyu *Pennisetum clandestinum**, African Veldt Grass *Ehrharta erecta**, Guinea Grass *Penicium maximum** and Winter Grass *Poa annua**. There were also planted garden exotics such as Bromeliad, succulents, dracaena and yuccas within the community.

Status/PCT:

It is difficult to assign this community to a Plant Community Type (PCT) under the BioNet Vegetation Classification as it has been highly modified through clearing and exotic invasion. The dominant native canopy species have similarities with the PCT's listed in Table 2.

Table 2. Plant Community Types with similarities to vegetation from the Cheese Tree/Smooth-barked Apple/Bangalay Open Forest

PCT ID	Common Name	Scientific Name	Comment
1645	Old Man Banksia - Rough-barked Apple - Bangalay shrubby open forest on coastal sands of the Central Coast	*Angophora floribunda , Eucalyptus botryoides / Banksia serrata , Glochidion ferdinandi , Allocasuarina littoralis , Macrozamia communis , Platysace lanceolata , Breynia oblongifolia , Monotoca elliptica , Acacia suaveolens , Hardenbergia violacea / Lomandra longifolia , Dianella caerulea , Pomax umbellata , Themeda australis , Pteridium esculentum*	This PCT is not known from the Port Stephens area and a number of canopy species are absent from the *Subject Site*.
1648	Smooth-barked Apple - Blackbutt heathy open forest of the Tomaree Peninsula	*Angophora costata , Corymbia gummifera , Eucalyptus pilularis / Banksia serrata , Acacia terminalis , Bossiaea rhombifolia , Dillwynia retorta , Eriostemon australasius , Acacia suaveolens , Ricinocarpos pinifolius , Acacia ulicifolia , Persoonia levis / Themeda australis , Leucopogon ericoides , Tetratheca ericifolia , Hypolaena fastigiata , Pteridium esculentum , Epacris pulchella.*	A number of characteristic species are absent from the *Subject Site*
1793	Smooth-barked Apple - Bangalay / Tuckeroo - Cheese Tree open forest on coastal sands of the Sydney basin	*Angophora costata, Eucalyptus botryoides , Banksia integrifolia / Elaeocarpus reticulatus , Banksia integrifolia , Cupaniopsis anacardioides , Glochidion ferdinandi / Lomandra longifolia , Pteridium esculentum , Dianella caerulea , Imperata cylindrica var. major*	This PCT is not known from the Port Stephens area however this PCT has the most consistencies with the species recorded in this community on the *Subject Site*.

5.1.2 DISTURBED COASTAL SAND SCRUB

The Coastal Sand Scrub community on the *Subject Site* has been highly impacted by Bitou Bush *C. monilifera** and Coral Trees *Erythrina x sykesii**. The north eastern corner (between Gan Gan Rd and James Paterson St) had a very high percent cover of weed species (Quadrat Centreline 2; Figure 6).

Upper Stratum: 2-20m height range

A number of Coral Trees *E. sykesii** occur in this community. Isolated *A. costata* Smooth-barked Apple were observed near Quadrat centreline 2 and isolated *Eucalyptus pilularis* Blackbutt occur along Gan Gan Road. No other upper canopy species were present in the quadrat and very few native canopy species occurred across the community.

Middle Stratum: 1-2m height range

This stratum is largely dominated by Bitou Bush *C. monilifera** however some natives still occur in this stratum including Coastal Wattle *A. longifolia subsp sophorae* and Coastal Tea tree *L. laevigatum*. Green Wattle *Acacia irrorata* also occurred near James Paterson St. Other exotics in the middle stratum consisted of high threat exotics such as Castor Oil Plant *Ricinus communis** and Lantana *L. camara**.

Lower Stratum: 0-1m height range

The lower stratum is sparse, consisting either of bare sand, or exotic species such as Beach Evening Primrose *Oenothera drummondii**, American Searocket *Cakile edentula**, Pennywort *Hydrocotyle bonariensis** *and* Sea Spurge *Euphorbia paralias**. In the north east of the *Subject Site*, the lower stratum consisted entirely of exotic species, including spiny Burr Grass *Cenchrus echinatus**, Panic Veldtgrass *Ehrharta erecta**, Paspalum *Paspalum dilatatum**, Cobblers Pegs *Bidens Pilosa** and Khaki weed *Alternanthera pungens**.

Status/PCT

It is difficult to assign this community to a Plant Community Type (PCT) under the BioNet Vegetation Classification as it has been highly modified through dune erosion and exotic invasion. The dominant native species have similarities with the PCT's listed in Table 3.

Table 3. Plant Community Types with similarities to vegetation from the Coastal Sand Scrub

PCT ID	Common Name	Scientific Name	Comment
772	Coast Banksia - Coast Wattle dune scrub of the Sydney Basin Bioregion and South East Corner Bioregion	*Banksia integrifolia subsp. integrifolia , Leptospermum laevigatum / Acacia longifolia subsp. sophorae , Leucopogon parviflorus , Rhagodia candolleana subsp. candolleana , Breynia oblongifolia / Actites megalocarpa , Carpobrotus glaucescens , Isolepis nodosa , Lomandra longifolia*	This PCT is not known from the Port Stephens area however the *Subject Site* contains many of the species listed in this PCT.
784	Coastal headland heaths of the NSW North Coast Bioregion	*Acacia longifolia subsp. sophorae , Banksia integrifolia subsp. integrifolia / Leucopogon parviflorus / Pimelea linifolia , Pultenaea maritima , Themeda australis , Imperata cylindrica var. major*	This PCT does occur in the Port Stephens LGA however a number of species are absent from the *Subject Site*
1821	Coastal Foredune Wattle Scrub	*Acacia longifolia , Leptospermum laevigatum , Banksia integrifolia , Monotoca elliptica , Leucopogon parviflorus , Breynia oblongifolia , Rhagodia candolleana / Spinifex sericeus , Carpobrotus glaucescens , Ficinia nodosa , Pelargonium australe , Dianella congesta , Dichondra repens , Scaevola calendulacea*	This PCT is not known from the Port Stephens area however the *Subject Site* contains many of the species listed in this PCT.

The area of native vegetation within the *Subject Site* and within the *Area of Impact* is calculated and summarised in Table 4 and shown in Figure 7.

Table 4. Area of Native Vegetation

Vegetation Community	m^2 in *Subject Site*	m^2 in *Area of Impact*
Cheese Tree/ Smooth-Barked Apple/ Bangalay Disturbed Open Forest	676	0
Coastal Sand Scrub	7,178	2,792
Cleared Areas	1,201	0
Sand Dunes	8,097	7,724
Total	17,152	10,516

COAST ECOLOGY
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Figure 6. Vegetation Mapping: Coast Ecology
Biodiversity Assessment
Birubi Information Centre

COAST ECOLOGY
ENVIRONMENTAL ASSESSMENTS

Figure 7. Native Vegetation within the Area of Impact
Biodiversity Assessment
Birubi Information Centre

5.2 HABITAT ASSESSMENT

The *Subject Site* provides habitat for a range of common bird species and drainage lines along the perimeter of the roads provided some habitat for amphibians

The *Subject Site* provides potential foraging habitat for forest bats however it lacks hollow bearing trees and as such does not provide roosting or nesting habitat for hollow dependant species including forest bats, parrots, owls or arboreal mammals.

The *Subject Site* provides habitat for native and exotic ground dwelling mammals.

5.3 FAUNA

Fauna surveys were limited to opportunistic sightings of diurnal bird species and common frog species. Large paw prints, likely belonging to unaccompanied domestic dogs, were observed in the sand dunes and sand scrub.

Common birds observed during vegetation plots are listed in Table 5.

Table 5. Opportunistic Fauna Sightings (07/06/2018)

Common Name	Scientific Name
BIRDS	
Eastern Spinebill	*Acanthorhynchus tenuirostris*
Little Wattlebird	*Anthochaera chrysoptera*
Australian Raven	*Corvus coronoides*
Eastern Yellow Robin	*Eopsaltria australis*
Bar-shouldered Dove	*Geopelia humeralis*
Australian Magpie	*Gymnorhina tibicen*
White-bellied Sea-Eagle	*Haliaeetus leucogaster*
Welcome Swallow	*Hirundo neoxena*
Superb Fairy-wren	*Malurus cyaneus*
Eastern Rosella	*Platycercus eximius*
AMPHIBIANS	
Common Eastern Froglet	*Crinia signifera*

6. ASSESSMENT

6.1 ASSESSMENT OF SIGNIFICANCE: TSC ACT

A habitat assessment of threatened flora and fauna reported on BioNet is provided in Table A8 (Appendix A). Species with potential habitat on the *Subject Site* were considered further in an Assessment of Significance (7-part test) in Appendix B. A summary of threatened species and endangered ecological communities with potential habitat on the *Subject Site* are listed in Table 6.

Table 6. Threatened Species and Endangered Ecological Communities with potential habitat on the Subject Site

Scientific Name	Common Name	Status TSC Act	Status EPBC Act	Records
Crinia tinnula	Wallum Froglet	V,P		69
Haliaeetus leucogaster	White-bellied Sea-Eagle	V,P	C	73
Glossopsitta pusilla	Little Lorikeet	V,P		5
Ninox strenua	Powerful Owl	V,P,3		11
Tyto novaehollandiae	Masked Owl	V,P,3		7
Artamus cyanopterus cyanopterus	Dusky Woodswallow	V,P		2
Dasyurus maculatus	Spotted-tailed Quoll	V,P	E	12
Phascolarctos cinereus	Koala	V,P	V	###
Pteropus poliocephalus	Grey-headed Flying-fox	V,P	V	18
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V,P		2
Mormopterus norfolkensis	Eastern Freetail-bat	V,P		3
Miniopterus australis	Little Bentwing-bat	V,P		16
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V,P		3
Pseudomys novaehollandiae	New Holland Mouse	P	V	7
Diuris praecox	Rough Doubletail	V,P	V	667
Diuris arenaria	Sand Doubletail	E1,P		175

6.1.1 THREATENED SPECIES

The BioNet search of threatened flora and fauna previously recorded in the broader *Study Area* returned a total of 2,291 records of 43 species. Of these, 15 species (2 flora, 13 fauna) were considered to have potential habitat on the *Subject Site*.

An assessment of significance of impact (Appendix B) under the Threatened Species Conservation Act concluded that the removal of approximately 0.28 ha of Disturbed Coastal Sand Scrub is unlikely to have an adverse effect on the life cycle of these species such that a viable local population of the species is likely to be placed at risk of extinction. The proposed clearing will not result in further modification of the vegetation as it is already highly modified through weed invasion, nor will it result in fragmentation or isolation of habitat as the *Subject Site* is already partially isolated. The habitat to be removed is not considered important to the long-term survival of the species as it provides only sub-optimal habitat for Wallum Froglet as it lacks acid swamp, there is only limited foraging habitat for Dusky Woodswallow, there is no suitable habitat for hollow dependent species such as the Little Lorikeet, Powerful Owl, Masked Owl, there are no suitable den sites for Spotted-tailed Quoll and there are limited records, there are nil to limited suitable roost sites for Forest Bats, there are no preferred feed trees for Koalas and it is not a known roost site for Grey-headed Flying-fox. The *Subject Site* is sub-optimal for *Diuris praecox* and *Diuris arenaria* as it lacks dense grassy understory however there have been nearby records of *D. praecox*. This species flowers during winter and was not recorded on the *Subject Site* during surveys conducted in in *Area of Impact* in June. Thus, the *Subject Site* is not considered important habitat for any of the threatened species considered to have potential habitat on the *Subject Site*.

6.1.2 ENDANGERED ECOLOGICAL COMMUNITIES

Table A2 lists Endangered Ecological Communities (EECs) with potential to occur in the *Study Area* as recorded on BioNet. None of these EECs were identified on the *Subject Site*.

6.1.2.1 Swamp Sclerophyll Forest EEC

Vegetation Mapping by LHCCREMS (2000) maps Swamp Mahogany – Paperbark Swamp Forest as occurring in a small portion in the north east of the *Subject Site*. This community falls under the definition of a listed Endangered Ecological Community under the Threatened Species Conservation Act (TSC Act): *Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions*" Endangered Ecological Community (EEC).

This EEC is associated with humic clay loams and sandy loams, on waterlogged or periodically inundated alluvial flats and drainage lines associated with coastal floodplains. It generally occurs below 20 m (though sometimes up to 50 m) elevation. The composition of the community is primarily determined by the frequency and duration of waterlogging and the texture, salinity nutrient and moisture content of the soil, and latitude. The composition and structure of the understorey is influenced by grazing and fire history, changes to hydrology and soil salinity and other disturbance, and may have a substantial component of exotic grasses, vines and forbs.

This swamp community has an open to dense tree layer of eucalypts and paperbarks although some remnants now only have scattered trees as a result of partial clearing. The trees may exceed 25 m in height but can be considerably shorter in regrowth stands or under conditions of lower site quality where the tree stratum is low and dense. For example, stands dominated by *Melaleuca ericifolia* typically do not exceed 8 m in height. The community also includes some areas of fernland and tall reedland or sedgeland, where trees are very sparse or absent.

The most widespread and abundant dominant trees include *Eucalyptus robusta* (swamp mahogany), *Melaleuca quinquenervia* (paperbark) and, south from Sydney, *Eucalyptus botryoides* (bangalay) and *Eucalyptus longifolia* (woollybutt). Other trees may be scattered throughout at low abundance or may be locally common at few sites, including *Callistemon salignus* (sweet willow bottlebrush), *Casuarina glauca* (swamp oak) and *Eucalyptus resinifera* subsp. *Hemilampra* (red mahogany), *Livistona australis* (cabbage palm) and *Lophostemon suaveolens* (swamp turpentine).

A layer of small trees may be present, including *Acacia irrorate* (green wattle), *Acmena smithii* (lilly pilly), *Elaeocarpus reticulatus* (blueberry ash), *Glochidion ferdinandi* (cheese tree), *Melaleuca linariifolia* and *M. styphelioides* (paperbarks).

Shrubs include *Acacia longifolia, Dodonaea triquetra, Ficus coronata, Leptospermum polygalifolium* subsp. *Polygalifolium* and *Melaleuca* spp. Occasional vines include *Parsonsia straminea, Morinda jasminoides* and *Stephania japonica* var. *discolor*.

The groundcover is composed of abundant sedges, ferns, forbs, and grasses including *Gahnia clarkei, Pteridium esculentum, Hypolepis muelleri, Calochlaena dubia, Dianella caerulea, Viola hederacea, Lomandra longifolia, Entolasia marginate* and *Imperata cylindrica*.

On sites downslope of lithic substrates or with soils of clay-loam texture, species such as *Allocasuarina littoralis, Banksia oblongifolia, B. spinulosa, Ptilothrix deusta* and *Themeda australis*, may also be present in the understorey.

Following a site assessment, the *Subject Site* did not contain Swamp Mahogany, Melaleucas or Woolybutt. It did contain two isolated Bangalay however this species is typically only characteristic of this community south of Sydney. The *Subject Site* also contained Cheese Tree however this is a commonly occurring tree in many vegetation communities and is not a characteristic species of the Swamp Sclerophyll EEC. The substrate of the Disturbed Coastal Sand Scrub is sand. The landform of the Cheese Tree/ Smooth-Barked Apple/ Bangalay Disturbed Open Forest is a slope and not characteristic of a waterlogged or periodically

inundated alluvial floodplain. As such, it was considered that this EEC did not occur on the *Subject Site*.

6.2 ASSESSMENT OF SIGNIFICANCE: EPBC ACT

Under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), actions that have, or are likely to have, a significant impact on a matter of national environmental significance (MNES) require approval from the Australian Government Minister for the Environment (the Minister).

The *Study Area* does not contain any World Heritage Properties, National Heritage Places, Great Barrier Reef Marine Park or Commonwealth Marine Areas. It does contain two Wetland of International Importance (Hunter Estuary Wetlands; Myall Lakes), seven listed threatened ecological communities, 80 listed threatened species and 74 listed migratory species.

The *Subject Site* does not form part of the Hunter Estuary Wetland or Myall Lakes and the proposal is unlikely to impact these wetlands. Following a site inspection and habitat assessment, the *Subject Site* does not contain any threatened ecological communities.

The *Subject Site* has potential habitat for the following threatened species:

1.	*Dasyurus maculatus*	Spotted-tailed Quoll	E
2.	*Phascolarctos cinereus*	Koala	V
3.	*Pseudomys novaehollandiae*	New Holland Mouse	V
4.	*Pteropus poliocephalus*	Grey-headed Flying-fox	V

Following an assessment of significance of impact, it was concluded that the proposed works (clearing of 0.28 ha of vegetation) will not substantially impact upon these species as the *Subject Site* does not provide important habitat features for these species. The *Subject Site* lacks primary feed trees for Koalas, does not contain roost sites for the Grey-headed Flying-fox, lacks den sites for the Spotted-tailed Quoll and the stage of vegetation succession is not preferred by the New Holland Mouse. Subsequently, the *Subject Site* does not support an important population of these species.

Based on the above assessment it is considered that a referral to Department of the Environment and Energy is not required.

6.2.1 KOALA HABITAT ASSESSMENT

In accordance with the EPBC Act referral guidelines for the vulnerable koala (DoE, 2014), Table 7 provides a habitat assessment and score for the Subject Site. An impact area that scores five or more using the habitat assessment tool in the referral guidelines is highly likely to contain habitat critical to the survival of the koala.

Table 7. Koala Habitat Assessment in accordance with the EPBC Act

Attribute	Score	Habitat Appraisal	
Koala Occurrence	1	Desktop	• The EPBC PMST report identified the koala as 'known to occur' in the study area. • NSW BioNET map revealed 194 koala records in a 10 km radius of the site, the closest being 1 km from the impact area. • The Atlas of Living Australia did not have any koala records in the study area.
		On-ground	• Coast Ecology carried out a Spot Assessment Technique (SAT) along with searches for scratchings. Both were conducted on all native trees within the site, which were few. Equal effort was allocated within the impact area and outside the impact area along with active diurnal searches in each native tree on the Subject Site. • No Koalas were observed on the Subject Site during surveys.
Vegetation structure and composition	0	Desktop	The Subject Site was mapped by LHCCREMS as mostly Beach Sands, Coastal Sand Scrub, Heath followed by a small patch of Swamp Mahogany – Paperbark Forest and Coastal Sand Apple-Blackbutt Forest.
		On-ground	The vegetation on the Subject Site within the area of impact was defined by Coast Ecology as Coastal Sand Scrub. Habitat assessments undertaken during the on-ground surveys revealed no koala food tree species on the Subject Site. There were no signs of past or present koala utilising the Subject Site with no scats or scratches observed.
Habitat Connectivity	0	• The area of koala habitat proposed to be cleared is not part of a contiguous landscape. The adjoining Swamp Mahogany – Paperbark Forest mapped by LHCCREMS covers approximately 40 ha however it occurs within residential areas and as such contains barriers.	
Key existing threats	1	Desktop	• The Subject Site scored 0 for koala occurrence and is likely to have some degree of dog or vehicle threat present.
		On-ground	• No further investigation into the presence of threats was carried out. Threats may be present as the area is residential and there is likely to be vehicle traffic and dogs.
Recovery Value	0	The Interim recovery objectives include: • Protect and conserve large, connected areas of koala habitat, particularly large, connected areas that support koalas that are: o Of sufficient size to be genetically robust / operate as a viable sub-population OR o free of disease or have a very low incidence of disease OR – breeding. • Maintain corridors and connective habitat that allow movement of koalas between large areas of habitat. As the Subject Site is not a large connected area of koala habitat nor does it maintain corridors that allows movement, the habitat is unlikely to be important for achieving the interim recovery objectives.	
Total	**2**	**Decision: Habitat is not critical to the survival of the koala—assessment of significance not required.**	

The loss of <two hectares of marginal quality habitat critical to the survival (habitat score of < 5) is highly unlikely to have a significant impact on the koala for the purposes of the EPBC Act (DoE, 2014).

6.3 COMPREHENSIVE KOALA PLAN OF MANAGEMENT (PSC)

Under the Port Stephens Council Comprehensive Koala Plan of Management 2001 and associated maps (PSC CKPoM), the majority of the Subject Site has been mapped as "mainly cleared" however a small portion in the north east of the Subject Site has been identified as "preferred koala habitat. The area mapped as "preferred Koala habitat" was likely based on vegetation mapping by LHCCREMS which mapped a small portion in the north east corner of the Subject Site as Swamp Mahogany-Paperbark Forest. However, following a site inspection, there were no Swamp Mahogany on the Subject Site and the vegetation was not consistent with this community (refer Section 6.1.2.1 for further discussion). Regardless, the *Area of Impact* excludes both the area mapped as "preferred koala habitat" and the area mapped as "50m Buffer over Cleared" on the Koala Habitat Planning Map (2001).

Table 8 considers the performance criteria for development applications in accordance with Appendix 4 of the PSC CKPoM.

Table 8. Performance Criteria for development applications in accordance with the PSC CKPoM

Performance Criteria	Complies?
a) Minimise the removal or degradation of native vegetation within Preferred Koala Habitat or Habitat Buffers;	Yes, The Area of Impact does not include areas mapped as Preferred Koala Habitat.
b) Maximise retention and minimise degradation of native vegetation within Supplementary Koala Habitat and Habitat Linking Areas;	Yes, The Area of Impact does not include areas mapped as either Supplementary Koala Habitat or Habitat Linking Areas.
c) Minimise the removal of any individuals of preferred koala food trees, where ever they occur on a development site. In the Port Stephens LGA these tree species are Swamp Mahogany (*Eucalyptus robusta*), Parramatta Red Gum (*Eucalyptus parramattensis*), and Forest Red Gum (*Eucalyptus tereticornis*), and hybrids of any of these species. An additional list of tree species that may be important to koalas based on anecdotal evidence is included in Appendix 8	Yes, No preferred koala food trees require removal under the proposal.
d) Make provision, where appropriate, for restoration or rehabilitation of areas identified as Koala Habitat including Habitat Buffers and Habitat Linking Areas over Mainly Cleared Land. In instances where Council approves the removal of koala habitat (in accordance with dot points 1-4 of the above waive clause), and where circumstances permit, this is to include measures which result in a "net gain" of koala habitat on the site and/or adjacent land;	Yes, This report has recommended that the landscape plan include planting of Swamp Mahogany *Eucalyptus robusta*.
e) Make provision for long term management and protection of koala habitat including both existing and restored habitat;	Yes, There is currently no existing koala habitat on the Subject Site. Any Swamp Mahogany planted on the Subject Site will be managed and maintained with like for like planting as part of the implementation of the Landscape Plan.

f) Not compromise the potential for safe movement of koalas across the site. This should include maximising tree retention generally and minimising the likelihood that the proposal would result in the creation of barriers to koala movement, such as would be imposed by certain types of fencing. The preferred option for minimising restrictions to safe koala movement is that there be no fencing (of a sort that would preclude koalas) associated with dog free developments within or adjacent to Preferred or Supplementary Koala Habitat, Habitat Buffers or Habitat Linking Areas. Suitable fencing for such areas could include: I. fences where the bottom of the fence is a minimum of 200 mm above ground level that would allow koalas to move underneath; II. fences that facilitate easy climbing by koalas; for example, sturdy chain mesh fences, or solid style fences with timber posts on both sides at regular intervals of approximately 20m; or III. open post and rail or post and wire (definitely not barbed wire on the bottom strand). However, where the keeping of domestic dogs has been permitted within or adjacent to Preferred or Supplementary Koala Habitat, Habitat Buffers or Habitat Linking Areas, fencing of a type that would be required to contain dogs (and which may also preclude koalas) should be restricted to the designated building envelope. Fences which are intended to preclude koalas should be located away from any trees which now or in the future could allow koalas to cross the fence.	N/A As the site is not considered to be Preferred Koala habitat, Supplementary Koala Habitat, Habitat Buffers or Habitat Linking Areas, fencing requirements do not apply.
g) Be restricted to identified envelopes which contain all buildings and infrastructure and fire fuel reduction zone. Generally there will be no clearing on the site outside these envelopes. In the case of applications for subdivision, such envelopes should be registered as a restriction on the title, pursuant to the Conveyancing Act 1919; and	Yes, This has been included in the recommendations of this report.
h) Include measures to effectively minimise the threat posed to koalas by dogs, motor vehicles and swimming pools by adopting the following minimum standards. I. The development must include measures that effectively abate the threat posed to koalas by dogs through prohibitions or restrictions on dog ownership. Restrictions on title may be appropriate. II. The development must include measures that effectively minimise the threat posed to koalas from traffic by restricting motor vehicle speeds, where appropriate, to 40 kph or less. III. The development must reduce the risk of koala mortality by drowning in backyard swimming pools. Appropriate measures could include: trailing a length of stout rope (minimum diameter of 50mm), which is secured to a stable poolside fixture, in the swimming pool at all times; designing the pool in such a way that koalas can readily escape; or enclosing the pool with a fence that precludes koalas. This last option should include locating the fence away from any trees which koalas could use to cross the fence.	Noted. Restrictions on dog ownership and/or backyard swimming pools have been included in the recommendations of this report. Restriction of motor vehicle speeds to <40km/hr has been included in the recommendations of this report.

6.4 SEPP COASTAL MANAGEMENT

The subject site is mapped as being located within the environmental use area. As such, consideration of the provisions under Clause 13 of *State Environmental Planning Policy (Coastal Management) 2018* is required.

Division 3 Coastal environment area

13 Development on land within the coastal environment area

1. Development consent must not be granted to development on land that is within the coastal environment area unless the consent authority has considered whether the proposed development is likely to cause an adverse impact on the following:

    a) the integrity and resilience of the biophysical, hydrological (surface and groundwater) and ecological environment,

The Subject Site is dominated by exotic vegetation and as such, the integrity and resilience of the site is already compromised. The proposed clearing of mainly exotic vegetation is unlikely to impact the hydrological or ecological environment and while the biophysical environment will be impacted through clearing, it is considered unlikely to have an adverse impact on the integrity and resilience of this environment.

    b) coastal environmental values and natural coastal processes,

Following development of the Subject Site, landscaping will use native vegetation endemic to the coastal zone, which will improve the coastal environmental value of the site. The Subject Site is approximately 1 km from the coastline and as such, works are considered unlikely to interfere with natural coastal processes. Consideration of the impacts of wind blow sand have been provided in the REF.

    c) the water quality of the marine estate (within the meaning of the *Marine Estate Management Act 2014*), in particular, the cumulative impacts of the proposed development on any of the sensitive coastal lakes identified in Schedule 1,

The proposed works are approximately 1 km from the ocean and as such are unlikely to impact water quality through overland flows, however there may be potential impacts to the water quality through increased turbidity and mobilisation of sandy sediments via the drainage line along James Paterson Street. Erosion and sediment control measures will be put in place prior to the commencement of works to ensure any potential impacts are minimised.

    d) marine vegetation, native vegetation and fauna and their habitats, undeveloped headlands and rock platforms,

The proposed works will not impact marine vegetation, native vegetation or undeveloped headlands or rock platforms. Works do have the potential to impact native fauna through the removal of vegetation, however adjoining native vegetation of better quality will continue to provide habitat for native fauna. Clearing of vegetation commencing from Gan Gan Road and heading towards secure vegetation would minimise impacts on ground dwelling fauna.

    e) existing public open space and safe access to and along the foreshore, beach, headland or rock platform for members of the public, including persons with a disability,

The proposed works will improve access and useability of the coastal area following completion of works.

    f) Aboriginal cultural heritage, practices and places,

It is assumed that a due diligence aboriginal assessment has been undertaken for the proposed works as part of the REF.

The following mitigation measures would reduce the risk of impacts on aboriginal cultural heritage, practices and places:

- During soil excavation, earth works, vegetation clearing and leaf litter removal, workers should be observant and keep a look out for surface shell, bone, rocks or any other Aboriginal Cultural Heritage material.
- If Aboriginal Cultural Heritage sites or material including bones or shell are discovered, work should cease. The area should then be avoided and the Office of Environment and Heritage (OEH) and the local aboriginal land council (LALC) should be notified immediately.

g) the use of the surf zone.

There is no surf zone at the Subject Site. The proposed works will improve access to the surf zone.

2. Development consent must not be granted to development on land to which this clause applies unless the consent authority is satisfied that:

   a) the development is designed, sited and will be managed to avoid an adverse impact referred to in subclause (1), or

   b) if that impact cannot be reasonably avoided—the development is designed, sited and will be managed to minimise that impact, or

   c) if that impact cannot be minimised—the development will be managed to mitigate that impact.

Mitigation measures such as appropriate erosion and sediment control measures, stabilisation of the soil with mulch and planting will minimise the potential impacts of the works on the coastal area.

3. This clause does not apply to land within the Foreshores and Waterways Area within the meaning of *Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005*.

N/A

7. RECOMMENDATIONS

- Any native trees within the *Area of Impact* are to be retained where possible, with barrier fencing installed around the base (to the circumference of the crown) to protect the root system during works.
- Appropriate erosion and sediment control measures are to be put in place prior to commencement of any works.
- Clearing of vegetation is to commence from Gan Gan Road, heading towards vegetated areas to allow ground dwelling fauna to escape to secure vegetation.
- Landscaping within the *Subject Site* and around its perimeter should use only local, native species that naturally occur in the Coastal Sand Scrub community (as defined by LHCCREMS, 2000). Species should be selected from each stratum (upper, mid, low) to reflect the natural community. Suitable species for planting include:

  Upper

  Angophora costata

  Eucalyptus robusta

  Mid

  Leptospermum laevigatum

  Banksia integrifolia subsp integrifolia

  Myoporum boninense subsp australe

  Acacia sophorae

  Banksia serrata

Cupaniopsis anacardioides

Banksia oblongifolia

Banksia aemula

Low (<1m) Strata

Carpobrotus glaucescens

Monotoca elliptica

Lomandra longifolia

Correa reflexa var reflexa

Scaevola calendulacea

Rhagodia candolleana subsp candolleana

- Swamp Mahogany *E. robusta*, should also be included in landscaping to supplement habitat for the local koala population. This recommendation is in accordance with Performance Criteria e), Appendix 4 of the CKPoM.
- No additional clearing is to be permitted outside of the *Area of Impact* marked in Figure 2&7 which is in accordance with Performance Criteria g), Appendix 4 of the CKPoM.
- Any pools are to be designed in such a way that koalas can readily escape; or enclosing the pool with a fence that precludes koalas.
- Restrictions on dog ownership in residential units include keeping of dogs indoors at night.
- Motor vehicles are to be restricted to 40km/hr to reduce the risk of Koala strikes in accordance with Performance Criteria h), Appendix 4 of the CKPoM.

8. REFERENCES

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9. APPENDIX A: DESKTOP RESULTS

Table A1. BioNet Search Results for threatened species listed under the TSC Act and EPBC Act with a 10 x 10 km Area.

Scientific Name	Common Name	NSW status	Comm. status	Records
FAUNA				
Crinia tinnula	Wallum Froglet	V,P		69
Caretta caretta	Loggerhead Turtle	E1,P	E	1
Chelonia mydas	Green Turtle	V,P	V	3
Eretmochelys imbricata	Hawksbill Turtle	P	V	2
Dromaius novaehollandiae	Emu population in the New South Wales North Coast Bioregion and Port Stephens local government area	E2,P		1
Hirundapus caudacutus	White-throated Needletail	P	C,J,K	4
Thalassarche cauta	Shy Albatross	V,P	V	1
Ardenna pacificus	Wedge-tailed Shearwater	P	J	1
Ardenna tenuirostris	Short-tailed Shearwater	P	J,K	2
Macronectes halli	Northern Giant-Petrel	V,P	V	1
Ephippiorhynchus asiaticus	Black-necked Stork	E1,P		3
Ardea ibis	Cattle Egret	P	C,J	1
Haliaeetus leucogaster	White-bellied Sea-Eagle	V,P	C	73
Burhinus grallarius	Bush Stone-curlew	E1,P		13
Haematopus fuliginosus	Sooty Oystercatcher	V,P		5
Haematopus longirostris	Pied Oystercatcher	E1,P		3
Numenius phaeopus	Whimbrel	P	C,J,K	1
^^*Calyptorhynchus lathami*	Glossy Black-Cockatoo	V,P,2		1
Glossopsitta pusilla	Little Lorikeet	V,P		5
Lathamus discolor	Swift Parrot	E1,P,3	CE	11
Ninox connivens	Barking Owl	V,P,3		1
Ninox strenua	Powerful Owl	V,P,3		11
Tyto longimembris	Eastern Grass Owl	V,P,3		1
Tyto novaehollandiae	Masked Owl	V,P,3		7
Daphoenositta chrysoptera	Varied Sittella	V,P		3
Artamus cyanopterus cyanopterus	Dusky Woodswallow	V,P		2
Dasyurus maculatus	Spotted-tailed Quoll	V,P	E	12
Phascogale tapoatafa	Brush-tailed Phascogale	V,P		10
Phascolarctos cinereus	Koala	V,P	V	###
Petaurus norfolcensis	Squirrel Glider	V,P		23
Pteropus poliocephalus	Grey-headed Flying-fox	V,P	V	18
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V,P		2
Mormopterus norfolkensis	Eastern Freetail-bat	V,P		3
Chalinolobus dwyeri	Large-eared Pied Bat	V,P	V	2
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V,P		4
Miniopterus australis	Little Bentwing-bat	V,P		16
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V,P		3
Myotis macropus	Southern Myotis	V,P		2
Scoteanax rueppellii	Greater Broad-nosed Bat	V,P		10
Vespadelus troughtoni	Eastern Cave Bat	V,P		2
Pseudomys novaehollandiae	New Holland Mouse	P	V	7
Megaptera novaeangliae	Humpback Whale	V,P	V	2

Scientific Name	Common Name	NSW status	Comm. status	Records
Petalura gigantea	Giant Dragonfly	E1		2
Crinia tinnula	Wallum Froglet	V,P		69
Caretta caretta	Loggerhead Turtle	E1,P	E	1
Chelonia mydas	Green Turtle	V,P	V	3
Eretmochelys imbricata	Hawksbill Turtle	P	V	2
Dromaius novaehollandiae	Emu population in the New South Wales North Coast Bioregion and Port Stephens local government area	E2,P		1
Hirundapus caudacutus	White-throated Needletail	P	C,J,K	4
Thalassarche cauta	Shy Albatross	V,P	V	1
Ardenna pacificus	Wedge-tailed Shearwater	P	J	1
Ardenna tenuirostris	Short-tailed Shearwater	P	J,K	2
Macronectes halli	Northern Giant-Petrel	V,P	V	1
Ephippiorhynchus asiaticus	Black-necked Stork	E1,P		3
Ardea ibis	Cattle Egret	P	C,J	1
Haliaeetus leucogaster	White-bellied Sea-Eagle	V,P	C	73
Burhinus grallarius	Bush Stone-curlew	E1,P		13
Haematopus fuliginosus	Sooty Oystercatcher	V,P		5
Haematopus longirostris	Pied Oystercatcher	E1,P		3
Numenius phaeopus	Whimbrel	P	C,J,K	1
^^*Calyptorhynchus lathami*	Glossy Black-Cockatoo	V,P,2		1
Glossopsitta pusilla	Little Lorikeet	V,P		5
Lathamus discolor	Swift Parrot	E1,P,3	CE	11
Ninox connivens	Barking Owl	V,P,3		1
Ninox strenua	Powerful Owl	V,P,3		11
Tyto longimembris	Eastern Grass Owl	V,P,3		1
Tyto novaehollandiae	Masked Owl	V,P,3		7
Daphoenositta chrysoptera	Varied Sittella	V,P		3
Artamus cyanopterus cyanopterus	Dusky Woodswallow	V,P		2
Dasyurus maculatus	Spotted-tailed Quoll	V,P	E	12
Phascogale tapoatafa	Brush-tailed Phascogale	V,P		10
Phascolarctos cinereus	Koala	V,P	V	###
Petaurus norfolcensis	Squirrel Glider	V,P		23
Pteropus poliocephalus	Grey-headed Flying-fox	V,P	V	18
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V,P		2
Mormopterus norfolkensis	Eastern Freetail-bat	V,P		3
Chalinolobus dwyeri	Large-eared Pied Bat	V,P	V	2
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V,P		4
Miniopterus australis	Little Bentwing-bat	V,P		16
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V,P		3
Myotis macropus	Southern Myotis	V,P		2
Scoteanax rueppellii	Greater Broad-nosed Bat	V,P		10
Vespadelus troughtoni	Eastern Cave Bat	V,P		2
Pseudomys novaehollandiae	New Holland Mouse	P	V	7
Megaptera novaeangliae	Humpback Whale	V,P	V	2
Petalura gigantea	Giant Dragonfly	E1		2
Crinia tinnula	Wallum Froglet	V,P		69
Caretta caretta	Loggerhead Turtle	E1,P	E	1
Chelonia mydas	Green Turtle	V,P	V	3
Eretmochelys imbricata	Hawksbill Turtle	P	V	2

Scientific Name	Common Name	NSW status	Comm. status	Records
Dromaius novaehollandiae	Emu population in the New South Wales North Coast Bioregion and Port Stephens local government area	E2,P		1
Hirundapus caudacutus	White-throated Needletail	P	C,J,K	4
Thalassarche cauta	Shy Albatross	V,P	V	1
Ardenna pacificus	Wedge-tailed Shearwater	P	J	1
Ardenna tenuirostris	Short-tailed Shearwater	P	J,K	2
Macronectes halli	Northern Giant-Petrel	V,P	V	1
Ephippiorhynchus asiaticus	Black-necked Stork	E1,P		3
Ardea ibis	Cattle Egret	P	C,J	1
Haliaeetus leucogaster	White-bellied Sea-Eagle	V,P	C	73
Burhinus grallarius	Bush Stone-curlew	E1,P		13
Haematopus fuliginosus	Sooty Oystercatcher	V,P		5
Haematopus longirostris	Pied Oystercatcher	E1,P		3
Numenius phaeopus	Whimbrel	P	C,J,K	1
^^*Calyptorhynchus lathami*	Glossy Black-Cockatoo	V,P,2		1
Glossopsitta pusilla	Little Lorikeet	V,P		5
Lathamus discolor	Swift Parrot	E1,P,3	CE	11
Ninox connivens	Barking Owl	V,P,3		1
Ninox strenua	Powerful Owl	V,P,3		11
Tyto longimembris	Eastern Grass Owl	V,P,3		1
Tyto novaehollandiae	Masked Owl	V,P,3		7
Daphoenositta chrysoptera	Varied Sittella	V,P		3
Artamus cyanopterus cyanopterus	Dusky Woodswallow	V,P		2
Dasyurus maculatus	Spotted-tailed Quoll	V,P	E	12
Phascogale tapoatafa	Brush-tailed Phascogale	V,P		10
Phascolarctos cinereus	Koala	V,P	V	###
Petaurus norfolcensis	Squirrel Glider	V,P		23
Pteropus poliocephalus	Grey-headed Flying-fox	V,P	V	18
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V,P		2
Mormopterus norfolkensis	Eastern Freetail-bat	V,P		3
Chalinolobus dwyeri	Large-eared Pied Bat	V,P	V	2
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V,P		4
Miniopterus australis	Little Bentwing-bat	V,P		16
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V,P		3
Myotis macropus	Southern Myotis	V,P		2
Scoteanax rueppellii	Greater Broad-nosed Bat	V,P		10
Vespadelus troughtoni	Eastern Cave Bat	V,P		2
Pseudomys novaehollandiae	New Holland Mouse	P	V	7
Megaptera novaeangliae	Humpback Whale	V,P	V	2
Petalura gigantea	Giant Dragonfly	E1		2
FLORA				
Callistemon linearifolius	Netted Bottle Brush	V,P,3		1
Eucalyptus parramattensis subsp. decadens		V,P	V	3
^^*Diuris arenaria*	Sand Doubletail	E1,P,2		175

Scientific Name	Common Name	NSW status	Comm. status	Records
^^*Diuris praecox*	Rough Doubletail	V,P,2	V	667
Callistemon linearifolius	Netted Bottle Brush	V,P,3		1

V=Vulnerable, E=Endangered, P=Protected, C=CAMBA, J-JAMBA, K= ROKAMBA

Table A2. Endangered Ecological Communities under the TSC Act and EPBC Act within the Study Area.

Common Name	NSW status	Comm. status
Coastal Saltmarsh in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E3	V
Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E3	
Hunter Lowland Redgum Forest in the Sydney Basin and New South Wales North Coast Bioregions	E3	
Littoral Rainforest in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E3	CE
Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions	E3	CE
River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E3	
Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E3	
Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E3	
Sydney Freshwater Wetlands in the Sydney Basin Bioregion	E3	
Themeda grassland on seacliffs and coastal headlands in the NSW North Coast, Sydney Basin and South East Corner Bioregions	E3	

E = Endangered, CE = Critically Endangered

Table A3. Protected Matters Search Tool Summary for Matters of National Environmental Significance under the EPBC Act within the Study Area.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Significance:	2
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Threatened Ecological Communities:	7
Threatened Species:	80
Migratory Species:	74

Table A4. Protected Matters Search Tool Results for Threatened Species listed under the EPBC Act within the Study Area.

Scientific Name	Common Name	Status
Birds		
Anthochaera Phrygia	Regent Honeyeater	E
Botaurus poiciloptilus	Australasian Bittern	E
Calidris canutus	Red Knot	E
Calidris ferruginea	Curlew Sandpiper	CE
Calidris tenuirostris	Great Knot	CE
Charadrius leschenaultia	Greater Sand Plover	V
Charadrius mongolus	Lesser Sand Plover	E

Dasyornis brachypterus	Eastern Bristlebird	E
Diomedea epomophora epomophora	Southern Royal Albatross	V
Diomedea epomophora sanfordi	Northern Royal Albatross	E
Diomedea exulans antipodensis	Antipodean Albatross	V
Diomedea exulans gibsoni	Gibson's Albatross	V
Diomedea exulans (sensu lato)	Wandering Albatross	V
Erythrotriorchis radiatus	Red Goshawk	V
Fregetta grallaria grallaria	White-bellied Storm-Petrel (Tasman Sea)	V
Grantiella picta	Painted Honeyeater	V
Lathamus discolor	Swift Parrot	E
Limosa lapponica baueri	Bar-tailed Godwit	V
Limosa lapponica menzbieri	Northern Siberian Bar-tailed Godwit	CE
Macronectes giganteus	Southern Giant-Petrel	E
Macronectes halli	Northern Giant-Petrel	V
Numenius madagascariensis	Eastern Curlew	CE
Pachyptila turtur subantarctica	Fairy Prion (southern)	V
Phoebetria fusca	Sooty Albatross	V
Pterodroma leucoptera leucoptera	Gould’s Petrel	E
Pterodroma neglecta neglecta	Kermadec Petrel	V
Rostratula australis	Australian Painted Snipe	E
Thalassarche bulleri	Buller's Albatross,	V
Thalassarche bulleri platei	Northern Bullller’s Albatross	V
Thalassarche cauta cauta	Shy Albatross,	V
Thalassarche cauta salvini	Salvin's Albatross	V
Thalassarche cauta steadi	White-capped Albatross	V
Thalassarche eremita	Chatham albatross	E
Thalassarche melanophris	Black-browed Albatross	V
Thalassarche melanophris impavida	Campbell Albatross	V
Thalassarche melanophris	Black-browed Albatross	V
Fish		
Epinephelus daemelii	Black Rockcod,	V
Amphibians		
Heleioporus australiacus	Giant Burrowing Frog	V
Litoria aurea	Green and Golden Bell Frog	V
Mixophyes balbus	Stuttering Frog	V
Mammals		
Chalinolobus dwyeri	Large-eared Pied Bat,	V
Dasyurus maculatus maculatus	Spotted-tail Quoll,	E
Petauroides volans	Greater Glider	V
Petrogale penicillate	Brush-tailed Rock-wallaby	V
Phascolarctos cinereus	Koala	V
Potorous tridactylus tridactylus	Long-nosed Potoroo	V
Pseudomys novaehollandiae	New Holland Mouse	V
Pteropus poliocephalus	Grey-headed Flying-fox	V
Plants		
Angophora inopina	Charmhaven Apple	V
Asperula asthenes	Trailing Woodruff	V
Asterolasia elegans		E
Caladenia tessellate	Thick-lipped Spider-orchid	V
Commersonia prostrata	Dwarf Kerrawang	E
Cryptostylis hunteriana	Leafless Tongue-orchid	V
Cynanchum elegans	White-flowered Wax Plant	E

Dichanthium setosum	Bluegrass	V
Diuris praecox	Newcastle Doubletail	V
Eucalyptus camfieldii	Camfield's Stringybark	V
Eucalyptus glaucina	Slaty Red Gum	V
Eucalyptus parramattensis subsp decadens	Earp's Gum	V
Euphrasia arguta		CE
Grevillea parviflora subsp. parviflora	Small-flower Grevillea	V
Melaleuca biconvexa	Biconvex	V
Persicaria elatior	Knotweed	V
Phaius australis	Lesser swamp-orchid	E
Prasophyllum sp. Wybong	a leek orchid	CE
Prostanthera densa	Vilous Mintbush	V
Syzygium paniculatum	Magenta Lilly Pilly	V
Tetratheca juncea	Black-eyed Susan	V
Thesium austral	Austral Toadflax	V
Reptiles		
Caretta caretta	Loggerhead Turtle	E
Chelonia mydas	Green Turtle	V
Dermochelys coriacea	Leatherback Turtle	E
Eretmochelys imbricata	Hawksbill Turtle	V
Natator depressus	Flatback Turtle	V

Table A5. Protected Matters Search Tool Results for Migratory Species listed under the EPBC Act with 10 km of the Study Area.

Scientific Name	Common Name	Status
Terrestrial Species		
Cuculus optatus	Oriental Cuckoo	M
Hirundapus caudacutus	White-throated Needletail	M
Monarcha melanopsis	Black-faced Monarch	M
Monarcha trivirgatus	Spectacled Monarch	M
Motacilla flava	Yellow Wagtail	M
Myiagra cyanoleuca	Satin Flycatcher	M
Rhipidura rufifrons	Rufous Fantail	M
Wetlands Species		
Actitis hypoleucos	Common Sandpiper	M
Arenaria interpres	Ruddy Turnstone	M
Calidris acuminata	Sharp-tailed Sandpiper	M
Calidris alba	Sanderling	M
Calidris canutus	Red Knot	M
Calidris ferruginea	Curlew Sandpiper	M, CE
Calidris melanotos	Pectoral Sandpiper	M
Calidris ruficollis	Red-necked Stint	M
Calidris tenuirostris	Great Knot	M
Charadrius bicinctus	Double-banded Plover	M
Charadrius leschenaultia	Greater Sand Plover	V
Charadrius mongolus	Lesser Sand Plover,	M
Gallinago hardwickii	Latham's Snipe,	M
Gallinago megala	Swinhoe's Snipe	M
Gallinago stenura	Pin-tailed Snipe	M
Limicola falcinellus	Broad-billed Sandpiper	
Heteroscelus brevipes	Grey-tailed Tattler	M
Limosa lapponica	Bar-tailed Godwit	M

Limosa limosa	Black-tailed Godwit	M
Numenius madagascariensis	Eastern Curlew	M, CE
Numenius minutus	Little Curlew	M
Numenius phaeopus	Whimbrel	M
Pandion haliaetus	Osprey	M
Philomachus pugnax	Ruff	M
Pluvialis fulva	Pacific Golden Plover	M
Pluvialis squatarola	Grey Plover	M
Tringa nebularia	Common Greenshank	M
Tringa brevipes	Grey-tailed Tattler	
Tringa stagnatilis	Marsh Sandpiper,	M
Xenus cinereus	Terek Sandpiper	M

Table A6. Vegetation Mapped within 1 km of the Study Area (LHCCREMS, 2002)

MU	Name	Description	Legal Status
	Beach Sands	Not described	
MU 33	Coastal Sand Apple-Blackbutt Forest	Coastal Sand Apple-Blackbutt Forest occurs principally on Holocene sands, where protection from direct coastal salt-laden winds is available. It occupies dunes of higher elevations with improved soil development. Typically it takes the form of an open forest with a moderately open, shrubby understorey. *Angophora costata* and *Eucalyptus pilularis* are the key canopy species, the presence and abundance of each in the canopy is variable, and it is not uncommon for one to almost completely dominate. It has been found in a study of sand communities of the Eurundree Sandmass that *Angophora costata* often dominates where the water table is close to the surface (Myerscough & Carolin, 1986). The shrub stratum is highly dependent on recent fire history however where present it is often composed of *Banksia serrata*, *Acacia ulicifolia*, and *Dillwynia retorta*. A combination of herbs, ferns and grasses inhabit the understorey. *Pteridium esculentum* is the most dominant however others such as *Gonocarpus teucrioides*, *Aotus ericoides* and *Themeda australis* are usually associated. This assemblage is widespread across the Tomago-Stockton Sandmass in the Port Stephens Shire. It extends along the narrow sand coastal strip south of Newcastle to the Central Coast wherever conditions are optimal. Map Unit 34 Wallum Heath Woodland is the most floristically similar assemblage within the region although structurally they are distinct. A number of canopy and shrub species are common to both assemblages including *Acacia ulicifolia, Dillwynnia retorta, Angophora Costata, Corymbia gummifera and E. signata*. Sandmining and urban development has cleared or altered some of the former extent of this community.	
MU34a	Coastal Sand Wallum Woodland - Heath Heath	This dry woodland - heath assemblage is marked by the dominance of Wallum Banksia (*Banksia aemula)*. It occurs largely on Pleistocene sands across the Tomago Coastal Plain, perched dunes of Bouddi Peninsula (Mc Rae, 1990) and coastal headlands east of Lake Macquarie. Structurally, this community varies from heathland in exposed areas of low relief and to low open forest in areas of increased shelter. As Heathland (mapped as MU34a where API delineates structural variation), a shrub layer of *Banksia aemula*, *Leptospermum*	

		trinervium, *Isopogon anemonifolius*, and *Ricinocarpus pinifolius* to a height of 2 metres dominates this community. Where it forms a woodland *Angophora costata* and *Corymbia gummifera* emerge above the heathland as low trees to a height of 10 metres. Where this community occurs as low open forest, the canopy can also include *Eucalyptus piperita*, and *Eucalyptus signata*. A large example of this form is found in Port Stephens across the Tomago Sandbeds. Where this occurs the understorey is somewhat less dense than the heathland variation, it still contains Wallum Banksia however includes shrubs such as *Leptospermum trinervium, Acacia ulicifolia* and *Lambertia formosa*. Where fire is frequent *Pteridium esculentum* can dominate the understorey. This community type is related to Map Unit 33: Coastal Sand Apple Blackbutt Forest which oocurs on higher dunes of deeper soils. Close similarity with Map Unit 49 Wallum Clay Heath is apparent. However it is distinguished by its marked abundance of *Melaleuca sieberi* and moisture tolerant sedges in the lowest stratum.	
MU37	Swamp Mahogany - Paperbark Swamp Forest	Swamp Mahogany - Paperbark Swamp Forest occurs in areas of impeded drainage near coastal swamps, lagoons and along drainage lines on alluvial flats of Quaternary sands and sediments. Structurally, this community ranges from open forest to forest with *Eucalyptus robusta* and *Melaleuca quinquenervia* forming the key diagnostic species either in combination or as monospecific stands. There are four main variations within this group that have been identified; • The first is typified by an open forest of *Eucalyptus robusta* and *Melaleuca quinquinervia* with high abundances of *Pteridium esculentum* and *Imperata cylindrica* in the understorey. This often occurs where fire has been recent or frequent near urban environments. • The second is a wet form where the canopy remains the same however the understorey is characterised by a high abundance of *Gahnia clarkei*. This is typical of the drier coastal plains at Wyong. • The third is a group localised around Gosford, it contains mesic elements such as *Glochidion ferdinandii*, *Livistona australis* and also can contain *Melaleuca biconvexa* in the canopy. This is generally on alluvial sediments of the Gosford Wyong area. • Finally the fourth is another wet form with mesic elements as the previous but with a high abundance of ferns in the lowest stratum such as *Blechnum indicum* and *Hypolepis muelleri*. This is common on the coastal sands at Belmont and at Tomago in the Port Stephens Shire. It is not uncommon for *Casuarina glauca* and *Livistona australis* to be included in the canopy especially in areas close to estuarine fringes. Other canopy species can merge where drainage is improved however are not diagnostic for this community. This community most closely relates to Map Unit 68: Swamp Oak – Sedge Forest through similar floristic composition and Map Unit 94: Redgum- Roughbarked Apple Foreshores Forest. Where mesic elements are well developed	EEC

		this assemblage will merge with Map Unit 5 Alluvial Tall Moist Forest. Similar Forest Ecosystems are not described by NPWS (1999(a)) although the assemblage is likely to be extensively though patchily distributed along the north coast of NSW.	
MU50	Coastal Sand Scrub	Coastal Sand Scrub occurs on deep Quaternary sands usually on foredunes. It is a relatively dense, low community subject to desiccating salt winds. Floristically it is quite simple with *Leptospermum laevigatum* occurring with a very high frequency to form the main canopy species alongside *Banksia integrifolia subsp integrifolia*, *Myoporum boninense subsp australe*, and *Acacia sophorae* amongst others. Where more nutrients and shelter are available *Angophora costata* (often Mallee from) can occur as a small tree. Fleshy ground covers such as *Carpobrotus glaucescens* and *Scaevola calenulace* are widespread and often occur with *Monotocca elliptica* and *Lomandra longifolia*. Coastal Sand Scrub occurs along the coast from Port Stephens to Gosford. It has been heavily cleared and modified by urban development and sandmining. In some instances eg. Munmorah SRA, some species of this assemblage have been used in regeneration. This community generally merges with Map Unit 33 and 34 where shelter and soil podzolisation is increased on the leeward side of the dunes (Myerscough & Carolin, 1986). Coastal Sand Scrub is a feature of most coastal environments along NSW.	

* EEC is an Endangered Ecological Community listed under the NSW Threatened Species Conservation Act

Table A7. Flora recorded within the Subject Site on 07/06/2018

Scientific Name	Common Name	% cover		
		Plot 1	Plot 2	Plot 3
Acacia longifolia var. *sophorae*	Coastal Wattle		0.2	0.3
Acacia irrorata	Green Wattle		12.5	
*Ailanthus altissima**	Tree of Heaven		1	
*Alternanthera pungens**	Khaki Weed		0.1	
Angophora costata	Smooth-barked Apple	8		
Angophora floribunda	Rough-barked Apple	5		
Anthemis cotula	Stinking chamomile		6	
*Araucaria heterophylla**	Norfolk Island Pine			
*Asparagus aethiopicus**	Asparagus Fern			
Banksia integrifolia subsp. *integrifolia*	Coast Banksia			
*Bidens pilosa**	Cobbler's Pegs		0.1	
Breynia oblongifolia	Coffee Bush	1.1		
*Bryophyllum delagoense**	Mother of Millions			
*Cakile edentula**	American Sea Rocket			0.1
Carpobrotus glaucescens	Pigface			
Cenchrus echinatus	Spiny Burr Grass	0.1	0.1	
Chrysanthemoides monilifera subsp. *monilifera**	Bitou Bush		0.1	8
*Cinnamomum camphora**	Camphor Laurel	1		

Dichondra repens	Kidney Weed	0.5		
Doryanthes excelsa	Gymea Lily	0.1		
*Ehrharta erecta**	Panic Veldtgrass	0.1	0.5	
Eriobotrya japonica	Loquat			
*Erythrina x sykesii**	Coral Tree	10		1
Eucalyptus botryoides	Bangalay	5		
Eucalyptus pilularis	Blackbutt			
*Euphorbia paralias**	Sea Spurge			0.1
*Festuca elatior**			3	
Ficinia (Isolepis) nodosa	-			
Ficus sp	Fig Tree			
Glochidion ferdinandii	Cheese Tree	10		
*Hydrocotyle bonariensis**	Pennywort			0.1
*Hypochaeris radicata**	Flatweed		0.1	
*Lantana camara**	Lantana	5	5	
Leptospermum laevigatum	Coast Tea-tree		10	2
*Liquidambar styraciflua**	Liquidambar	15		
Livistona australis	Cabbage Tree Palm			
Mentha sp.*	Mint	0.1		
*Nephrolepis cordifolia**	Fish-bone Fern			
Oenothera drummondii	Beach Evening Primrose		0.1	0.1
*Panicium maximus**	Guinea Grass	0.1	5	
*Paspalum dilatatum **	Paspalum		0.2	
*Pennisetum clandestinum **	Kikuyu	30		
Persea Americana	Avocado			
Pittosporum undulatum	Sweet Pittosporum	3		
*Plantago lanceolata**	Ribwort		0.1	
*Poa annua**	Winter Grass	0.1		
*Ricinus communis**	Castor Oil Plant		0.6	
Rumex sagitata	Turkey Rhubarb		0.1	
*Setaria gracilis**	Slender Pigeon Grass		0.1	
*Stellaria media**	Common Chickweed	0.6	0.1	
*Tagetes minuta**	Stinking Roger		0.1	
*Tecoma capensis**	Cape Honeysuckle		3	
*Tradescantia fluminensis**	Wandering Jew	15		
*Verbena bonariensis**	Purpletop		0.1	
Wahlenbergia communis	Tufted Bluebell		0.1	
*Yucca aloifolia**	Dagger Plant	0.1		

Table A8. Habitat Assessment of Threatened Species Recorded in the Study Area

Family	Scientific Name	Common Name	NSW status	Comm. status	Habitat Preference	Records	Likelihood of Occurrence
AMPHIBIANS							
Myobatrachidae	*Crinia tinnula*	Wallum Froglet	V,P		Wallum Froglets are found in a wide range of habitats, usually associated with acidic swamps on coastal sand plains. They typically occur in sedgelands and wet heathlands. They can also be found along drainage lines within other vegetation communities and disturbed areas, and occasionally in swamp sclerophyll forests. The species breeds in swamps with permanent water as well as shallow ephemeral pools and drainage ditches. Breeding is thought to peak in the colder months, but can occur throughout the year following rain. Eggs of 1.1-1.2mm are deposited in water with a pH of <6 and tadpoles take 2-6 months to develop into frogs. Wallum Froglets shelter under leaf litter, vegetation, other debris or in burrows of other species. Shelter sites are wet or very damp and often located near the water's edge. Males may call throughout the year and at any time of day, peaking following rain.	69	Moderate. Potential habitat in drainage lines outside of *Subject Site* boundary.
REPTILES							
Cheloniidae	*Caretta caretta*	Loggerhead Turtle	E1,P	E	Loggerhead Turtles are ocean-dwellers, foraging in deeper water for fish, jellyfish and bottom-dwelling animals. The female comes ashore to lay her eggs in a hole dug on the beach in tropical regions during the warmer months. Identifiable all year but lay eggs on beaches during summer. Nesting is around Great Barrier Reef and Ningaloo Reef	1	Low. Outside of nesting habitat range.
Cheloniidae	*Chelonia mydas*	Green Turtle	V,P	V	Ocean-dwelling species spending most of its life at sea. Carnivorous when young but as adults they feed only on marine plant material.	3	Low. Outside of nesting habitat range.

					Eggs laid in holes dug in beaches throughout their range. In Australia, there are seven regional populations of green turtles that nest in different areas; the southern Great Barrier Reef, the northern Great Barrier Reef, the Coral Sea, the Gulf of Carpentaria, Western Australia's north-west shelf, the Ashmore and Cartier Reefs and Scott Reef.		
AVES							
Apodidae	*Hirundapus caudacutus*	White-throated Needletail	P	C,J,K	In Australia, the White-throated Needletail is almost exclusively aerial, from heights of less than 1 m up to more than 1000 m above the ground. The White-throated Needletail is widespread in eastern and south-eastern Australia. After breeding in eastern Siberia, north-eastern China and Japan, the species leaves the breeding grounds between late August and October, flying singly or in scattered flocks and enter Australia via the Torres Strait, usually during September and October.	4	Low. Aerial species
Diomedeidae	*Thalassarche cauta*	Shy Albatross	V,P	V	This pelagic or ocean-going species inhabits subantarctic and subtropical marine waters, spending the majority of its time at sea. While at sea, it soars on strong winds and when calm, individuals may rest on the ocean, in groups during the breeding season or as individuals at other times. Occasionally the species occurs in continental shelf waters, in bays and harbours. The species feeds on fish, crustaceans, offal and squid and may forage in mixed-species flocks. Food may be caught by seizing prey from the water's surface while swimming, by landing on top of prey, diving for prey beneath the water and by scavenging behind fishing vessels. Known breeding locations include Albatross Island off Tasmania, Auckland Island, Bounty Island and The Snares, off New Zealand, where nesting colonies of 6-500 nests occur and may contain other species such as the Australian Gannet. Located on sheltered sides of islands, on cliffs and ledges, in crevices and slopes, nests are used annually and consist of a mound of mud, bones, plant matter and rocks. Parents are	1	Low. No nesting habitat on the *Subject Site*.

					territorial while nesting, having both defensive and mating displays. Breeding occurs September-December, when a single egg is laid and incubated for 72 days. Both parents feed and guard the young for approximately 5 months before they fledge and become independent.		
Procellariidae	*Ardenna pacificus*	Wedge-tailed Shearwater	P	J	The Wedge-tailed Shearwater is a pelagic, marine bird known from tropical and subtropical waters. The Wedge-tailed Shearwater breeds on the east and west coasts of Australia and on off-shore islands. The species is common in the Indian Ocean, the Coral Sea and the Tasman Sea.	1	Low. No nesting habitat on the *Subject Site*.
Procellariidae	*Ardenna tenuirostris*	Short-tailed Shearwater	P	J,K	Short-tailed Shearwater breeds on the east and west coasts of Australia and on off-shore islands. Breeds from October-April in a sparse of grass, leaves in burrows 0.5-2m long, usually under tussocks, typically in island colonys. Migrates from May-August to North Pacific (Pizzey, 2006).	2	Low. No nesting habitat on the *Subject Site*.
Procellariidae	*Macronectes halli*	Northern Giant-Petrel	V,P	V	Breeding in Australian territory is limited to Macquarie Island and occurs during spring and summer. Adults usually remain near the breeding colonies throughout the year (though some do travel widely) while immature birds make long and poorly known circumpolar and trans-oceanic movements. Hence most birds recorded in NSW coastal waters are immature birds. Northern Giant-Petrels seldom breed in colonies but rather as dispersed pairs, often amidst tussocks in dense vegetation and areas of broken terrain. A single chick is raised and although breeding occurs annually, approximately 30% of the potential breeding population do not nest. There are marked differences in diet between the sexes. Females obtain most of their prey live from the sea, while males also scavenge from the carcases of penguins and seals on land. At sea, both sexes are aggressive opportunists, feeding on fish, cephalopods, birds and crustaceans, including euphausiids or krill, and regularly scavenge on fishing vessels.	1	Low. No nesting habitat on the *Subject Site*.

					During the vulnerable early chick phase adult birds utilise land-based carrion resources (e.g. seals) extensively.		
Ciconiidae	*Ephippiorhynchus asiaticus*	Black-necked Stork	E1,P		Floodplain wetlands (swamps, billabongs, watercourses and dams) of the major coastal rivers are the key habitat in NSW for the Black-necked Stork. Secondary habitat includes minor floodplains, coastal sandplain wetlands and estuaries. Storks usually forage in water 5-30cm deep for vertebrate and invertebrate prey. Eels regularly contribute the greatest biomass to their diet, but they feed on a wide variety of animals, including other fish, frogs and invertebrates (such as beetles, grasshoppers, crickets and crayfish). Black-necked Storks build large nests high in tall trees close to water. Trees usually provide clear observation of the surroundings and are at low elevation (reflecting the floodplain habitat). In NSW, breeding activity occurs May - January; incubation May - October; nestlings July - January; fledging from September. Parents share nest duties and in one study about 1.3-1.7 birds were fledged per nest. The NSW breeding population has been estimated at about 75 pairs. Territories are large and variable in size. They have been estimated to average about 9,000ha, ranging from 3,000-6,000ha in high quality habitat and 10,000-15,000ha in areas where habitat is poor or dispersed.	3	Low. No suitable habitat on the *Subject Site* as it lacks water features.
Accipitridae	*Haliaeetus leucogaster*	White-bellied Sea-Eagle	P	C	The White-bellied Sea-Eagle is distributed along the coastline (including offshore islands) of mainland Australia and Tasmania. It also extends inland along some of the larger waterways, especially in eastern Australia. The White-bellied Sea-Eagle feeds opportunistically on a variety of fish, birds, reptiles, mammals and crustaceans, and on carrion and offal. Breeding habitat consists of mature tall open forest, open forest, tall woodland, and swamp sclerophyll forest close to foraging habitat. Nest trees are typically large emergent eucalypts and often have emergent dead branches or large dead trees nearby which are used as 'guard roosts'. Nests are large	73	Moderate. While this species may be observed overhead, there is no suitable roosting or breeding habitat or nesting trees on the *Subject Site*. Potential foraging habitat only.

					structures built from sticks and lined with leaves or grass.		
Burhinidae	*Burhinus grallarius*	Bush Stone-curlew	E1,P		Inhabits open forests and woodlands with a sparse grassy groundlayer and fallen timber. Largely nocturnal, being especially active on moonlit nights. Feed on insects and small vertebrates, such as frogs, lizards and snakes. Nest on the ground in a scrape or small bare patch. Two eggs are laid in spring and early summer.	13	Low. No suitable habitat on the *Subject Site* as it lacks open forest with a sparse grassy groundlayer.
Haematopodidae	*Haematopus fuliginosus*	Sooty Oystercatcher	V,P		Favours rocky headlands, rocky shelves, exposed reefs with rock pools, beaches and muddy estuaries. Forages on exposed rock or coral at low tide for foods such as limpets and mussels. 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.	5	Low. No suitable habitat on the *Subject Site*.
Haematopodidae	*Haematopus longirostris*	Pied Oystercatcher	E1,P		Favours intertidal flats of inlets and bays, open beaches and sandbanks. Forages on exposed sand, mud and rock at low tide, for molluscs, worms, crabs and small fish. The chisel-like bill is used to pry open or break into shells of oysters and other shellfish. Nests mostly on coastal or estuarine beaches although occasionally they use saltmarsh or grassy areas. Nests are shallow scrapes in sand above the high tide mark, often amongst seaweed, shells and small stones. Two to three eggs are laid between August and January. The female is the primary incubator and the young leave the nest within several days.	3	Low. No suitable habitat on the *Subject Site*.
Scolopacidae	*Numenius phaeopus*	Whimbrel	P	C,J,K	The Whimbrel is a regular migrant to Australia and New Zealand, with a primarily coastal distribution. There are also scattered inland records of Whimbrels in all regions. It is found in all states but is more common in the north. The Whimbrel breeds in north and west Alaska. The Whimbrel generally forages on intertidal mudflats, along the muddy banks of estuaries and in coastal	1	Low. No suitable habitat on the *Subject Site*.

				lagoons, either in open unvegetated areas or among mangroves. They sometimes forage on sandy beaches or among rocks. It has occasionally been sighted feeding on exposed coral or rocky reefs and rock platforms. It is known to probe holes and crevices among rubble and on reef flats, but not on reef crests.		
Cacatuidae	*Calyptorhynchus lathami*	Glossy Black-Cockatoo	V,P,2	Inhabits open forest and woodlands of the coast and the Great Dividing Range where stands of sheoak occur. Black Sheoak (Allocasuarina littoralis) and Forest Sheoak (A. torulosa) are important foods. Inland populations feed on a wide range of sheoaks, including Drooping Sheoak, Allocasuaraina diminuta, and A. gymnathera. Belah is also utilised and may be a critical food source for some populations. In the Riverina, birds are associated with hills and rocky rises supporting Drooping Sheoak, but also recorded in open woodlands dominated by Belah (Casuarina cristata). Feeds almost exclusively on the seeds of several species of she-oak (Casuarina and Allocasuarina species), shredding the cones with the massive bill. Dependent on large hollow-bearing eucalypts for nest sites. A single egg is laid between March and May.	1	Low. No suitable habitat (including lack of feed trees) on the *Subject Site*.
Psittacidae	*Glossopsitta pusilla*	Little Lorikeet	V,P	Forages primarily in the canopy of open Eucalyptus forest and woodland, yet also finds food in Angophora, Melaleuca and other tree species. Riparian habitats are particularly used, due to higher soil fertility and hence greater productivity. Isolated flowering trees in open country, e.g. paddocks, roadside remnants and urban trees also help sustain viable populations of the species. Feeds mostly on nectar and pollen, occasionally on native fruits such as mistletoe, and only rarely in orchards Gregarious, travelling and feeding in small flocks (<10), though often with other lorikeets. Flocks numbering hundreds are still occasionally observed and may have been the norm in past centuries. Roosts in treetops, often distant from feeding areas.	5	Moderate Potential foraging habitat only.

					Nests in proximity to feeding areas if possible, most typically selecting hollows in the limb or trunk of smooth-barked Eucalypts. Entrance is small (3 cm) and usually high above the ground (2–15 m). These nest sites are often used repeatedly for decades, suggesting that preferred sites are limited. Riparian trees often chosen, including species like Allocasuarina. Nesting season extends from May to September. In years when flowering is prolific, Little Lorikeet pairs can breed twice, producing 3-4 young per attempt. However, the survival rate of fledglings is unknown.		
Psittacidae	*Lathamus discolor*	Swift Parrot	E1,P,3	E	Migrates to the Australian south-east mainland between March and October. On the mainland they occur in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. Favoured feed trees include winter flowering species such as Swamp Mahogany *Eucalyptus robusta*, Spotted Gum *Corymbia maculata*, Red Bloodwood *C. gummifera*, Mugga Ironbark *E. sideroxylon*, and White Box *E. albens*. Commonly used lerp infested trees include Inland Grey Box E. microcarpa, Grey Box E. moluccana and Blackbutt E. pilularis. Return to some foraging sites on a cyclic basis depending on food availability. Following winter they return to Tasmania where they breed from September to January, nesting in old trees with hollows and feeding in forests dominated by Tasmanian Blue Gum Eucalyptus globulus. Identifiable from March to September.	11	Low. No suitable feed trees on the *subject site* and does not breed on the mainland.
Strigidae	*Ninox connivens*	Barking Owl	V,P,3		Inhabits woodland and open forest, including fragmented remnants and partly cleared farmland. It is flexible in its habitat use, and hunting can extend in to closed forest and more open areas. Sometimes able to successfully breed along timbered watercourses in heavily cleared habitats (e.g. western NSW) due to the higher density of prey on these fertile soils. Roost in shaded portions of tree canopies, including tall midstorey trees with dense foliage such as Acacia	1	Low. No suitable nesting or roosting habitat as the *Subject Site* does not have habitat trees or dense foliage

				and Casuarina species. During nesting season, the male perches in a nearby tree overlooking the hollow entrance. Preferentially hunts small arboreal mammals such as Squirrel Gliders and Ringtail Possums, but when loss of tree hollows decreases these prey populations the owl becomes more reliant on birds, invertebrates and terrestrial mammals such as rodents and rabbits. Can catch bats and moths on the wing, but typically hunts by sallying from a tall perch. Requires very large permanent territories in most habitats due to sparse prey densities. Monogamous pairs hunt over as much as 6000 hectares, with 2000 hectares being more typical in NSW habitats. Two or three eggs are laid in hollows of large, old trees. Living eucalypts are preferred though dead trees are also used. Nest sites are used repeatedly over years by a pair, but they may switch sites if disturbed by predators (e.g. goannas). Nesting occurs during mid-winter and spring but is variable between pairs and among years. As a rule of thumb, laying occurs during August and fledging in November. The female incubates for 5 weeks, roosts outside the hollow when chicks are 4 weeks old, then fledging occurs 2-3 weeks later. Young are dependent for several months. Territorial pairs respond strongly to recordings of Barking Owl calls from up to 6 km away, though humans rarely hear this response farther than 1.5 km. Because disturbance reduces the pair's foraging time, and can pull the female off her eggs even on cold nights, recordings should not be broadcast unnecessarily nor during the nesting season. Calls at all time of year, but strongest response in March-June. Avoid early nesting (July-Sept) when surveys pull the female off eggs on cold nights.		
Strigidae	*Ninox strenua*	Powerful Owl	V,P,3	The Powerful Owl inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. The Powerful Owl requires large tracts of forest or woodland habitat but can occur in fragmented	11	Moderate. No suitable nesting or roosting habitat as the *Subject Site* does not have habitat trees or dense foliage

landscapes as well. The species breeds and hunts in open or closed sclerophyll forest or woodlands and occasionally hunts in open habitats. It roosts by day in dense vegetation comprising species such as Turpentine Syncarpia glomulifera, Black She-oak Allocasuarina littoralis, Blackwood Acacia melanoxylon, Rough-barked Apple Angophora floribunda, Cherry Ballart Exocarpus cupressiformis and a number of eucalypt species.

The main prey items are medium-sized arboreal marsupials, particularly the Greater Glider, Common Ringtail Possum and Sugar Glider. There may be marked regional differences in the prey taken by Powerful Owls. For example in southern NSW, Ringtail Possum make up the bulk of prey in the lowland or coastal habitat. At higher elevations, such as the tableland forests, the Greater Glider may constitute almost all of the prey for a pair of Powerful Owls. Flying foxes are important prey in some areas; birds comprise about 10-50% of the diet depending on the availability of preferred mammals. As most prey species require hollows and a shrub layer, these are important habitat components for the owl.

Pairs of Powerful Owls demonstrate high fidelity to a large territory, the size of which varies with habitat quality and thus prey densities. In good habitats a mere 400 can support a pair; where hollow trees and prey have been depleted the owls need up to 4000 ha.

Powerful Owls nest in large tree hollows (at least 0.5 m deep), in large eucalypts (diameter at breast height of 80-240 cm) that are at least 150 years old. While the female and young are in the nest hollow the male Powerful Owl roosts nearby (10-200 m) guarding them, often choosing a dense "grove" of trees that provide concealment from other birds that harass him.

Powerful Owls are monogamous and mate for life. Nesting occurs from late autumn to mid-winter, but is slightly earlier in north-eastern NSW (late summer - mid autumn). Clutches consist of two dull white eggs and incubation lasts approximately 38 days.

Identifiable all year.

Tytonidae	*Tyto longimembris*	Eastern Grass Owl	V,P,3	Eastern Grass Owls are found in areas of tall grass, including grass tussocks, in swampy areas, grassy plains, swampy heath, and in cane grass or sedges on flood plains. They rest by day in a 'form' - a trampled platform in a large tussock or other heavy vegetative growth. If disturbed they burst out of cover, flying low and slowly, before dropping straight down again into cover. Always breeds on the ground. Nests are found in trodden grass, and often accessed by tunnels through vegetation. Breeding season is highly variable and dependent on environmental conditions, but in NSW nesting most typically occurs in autumn or winter.	1	Unlikely. No suitable habitat as the *Subject Site* lacks tall grass.
Tytonidae	*Tyto novaehollandiae*	Masked Owl	V,P,3	Lives in dry eucalypt forests and woodlands from sea level to 1100 m. A forest owl, but often hunts along the edges of forests, including roadsides. The typical diet consists of tree-dwelling and ground mammals, especially rats. Pairs have a large home-range of 500 to 1000 hectares. Roosts and breeds in moist eucalypt forested gullies, using large tree hollows or sometimes caves for nesting. Identifiable all year.	7	Moderate. No suitable nesting or roosting habitat as the *Subject Site* does not have habitat trees or dense foliage
Neosittidae	*Daphoenositta chrysoptera*	Varied Sittella	V,P	Inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland. Feeds on arthropods gleaned from crevices in rough or decorticating bark, dead branches, standing dead trees and small branches and twigs in the tree canopy. Builds a cup-shaped nest of plant fibres and cobwebs in an upright tree fork high in the living tree canopy, and often re-uses the same fork or tree in successive years. Generation length is estimated to be 5 years.	3	Low. No suitable habitat on the *Subject Site* as it lacks rough barked eucalypts

Artamidae	*Artamus cyanopterus cyanopterus*	Dusky Woodswallow	V,P		The Dusky Woodswallow is widespread in eastern, southern and southwestern Australia. In New South Wales it is widespread from coast to inland, including the western slopes of the Great Dividing Range and farther west. It is sparsely scattered in, or largely absent from, much of the Upper Western region The Dusky Woodswallow is often reported in woodlands and dry open sclerophyll forests, usually dominated by eucalypts, including mallee associations. It has also been recorded in shrublands and heathlands and various modified habitats, including regenerating forests; very occasionally in moist forests or rainforests. At sites where Dusky Woodswallows are recorded the understorey is typically open with sparse eucalypt saplings, acacias and other shrubs, including heath. The ground cover may consist of grasses, sedges or open ground, often with coarse woody debris. Birds are also often observed in farm land, usually at the edges of forest or woodland or in roadside remnants or wind breaks with dead timber. In western New South Wales this species is primarily associated with River Red Gum/Black Box/Coolibah open forest/woodland associated with larger river/creek systems and is less common and far more patchily distributed in other communities such as mallee and cypress-pine woodland.	2	Moderate Potential habitat on the *Subject Site*
MAMMALS							
Dasyuridae	*Dasyurus maculatus*	Spotted-tailed Quoll	V,P	E	Recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Individual animals use hollow-bearing trees, fallen logs, small caves, rock outcrops and rocky-cliff faces as den sites. Mostly nocturnal, although will hunt during the day; spends most of the time on the ground, although also an excellent climber and will hunt possums and gliders in tree hollows and prey on roosting birds. Use communal 'latrine sites', often on flat rocks among boulder fields, rocky cliff-faces or along rocky stream beds or banks. Such sites may be visited by multiple individuals and can be recognised by the	12	Moderate Potential habitat on the *Subject Site*

					accumulation of the sometimes characteristic 'twisty-shaped' faeces deposited by animals. A generalist predator with a preference for medium-sized (500g-5kg) mammals. Consumes a variety of prey, including gliders, possums, small wallabies, rats, birds, bandicoots, rabbits, reptiles and insects. Also eats carrion and takes domestic fowl. Females occupy home ranges up to about 750 hectares and males up to 3500 hectares. Are known to traverse their home ranges along densely vegetated creeklines. Average litter size is five; both sexes mature at about one year of age. Life expectancy in the wild is about 3-4 years.		
Dasyuridae	*Phascogale tapoatafa*	Brush-tailed Phascogale	V,P		Prefer dry sclerophyll open forest with sparse groundcover of herbs, grasses, shrubs or leaf litter. Also inhabit heath, swamps, rainforest and wet sclerophyll forest. Agile climber foraging preferentially in rough barked trees of 25 cm DBH or greater. Feeds mostly on arthropods but will also eat other invertebrates, nectar and sometimes small vertebrates. Females have exclusive territories of approximately 20 - 40 ha, while males have overlapping territories often greater than 100 ha. Nest and shelter in tree hollows with entrances 2.5 - 4 cm wide and use many different hollows over a short time span. Mating occurs May - July; males die soon after the mating season whereas females can live for up to three years but generally only produce one litter.	10	Low No nesting habitat (i.e. hollow bearing trees) on the *Subject Site* nor does the site represent open forest with sparse groundcover of herbs, grasses or shrubs.
Phascolarctidae	*Phascolarctos cinereus*	Koala	V,P	V	Inhabit eucalypt woodlands and forests. Feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species. Inactive for most of the day, feeding and moving mostly at night. Spend most of their time in trees, but will descend and traverse open ground to move between trees. Home range size varies with quality of habitat, ranging from less than two ha to several hundred hectares in size. Generally solitary, but have complex social	1947	Moderate Potential habitat for dispersing males only as the *Subject Site* is not considered potential koala habitat under the SEPP 44 definition.

					hierarchies based on a dominant male with a territory overlapping several females and sub-ordinate males on the periphery. Females breed at two years of age and produce one young per year.		
Petauridae	*Petaurus norfolcensis*	Squirrel Glider	V,P		Inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas. Prefers mixed species stands with a shrub or Acacia midstorey. Live in family groups of a single adult male one or more adult females and offspring. Require abundant tree hollows for refuge and nest sites. Diet varies seasonally and consists of Acacia gum, eucalypt sap, nectar, honeydew and manna, with invertebrates and pollen providing protein.	23	Low No nesting habitat (i.e. hollow bearing trees) on the *Subject Site* and no suitable foraging habitat.
Pteropodidae	*Pteropus poliocephalus*	Grey-headed Flying-fox	V,P	V	Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy. Individual camps may have tens of thousands of animals and are used for mating, and for giving birth and rearing young. Annual mating commences in January and conception occurs in April or May; a single young is born in October or November. Site fidelity to camps is high; some camps have been used for over a century. Can travel up to 50 km from the camp to forage; commuting distances are more often <20 km. Feed on the nectar and pollen of native trees, in particular Eucalyptus, Melaleuca and Banksia, and fruits of rainforest trees and vines. Also forage in cultivated gardens and fruit crops.	18	Moderate Potential foraging habitat only.
Emballonuridae	*Saccolaimus flaviventris*	Yellow-bellied Sheathtail-bat	V,P		Roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows. When foraging for insects, flies high and fast over the forest canopy, but lower in more open country. Forages in most habitats across its very wide range, with and without trees; appears to	2	Moderate Potential foraging habitat

					defend an aerial territory. Breeding has been recorded from December to mid-March, when a single young is born. Seasonal movements are unknown; there is speculation about a migration to southern Australia in late summer and autumn.		
Molossidae	*Mormopterus norfolkensis*	Eastern Freetail-bat	V,P		Occur in dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range. Roost mainly in tree hollows but will also roost under bark or in man-made structures. Usually solitary but also recorded roosting communally, probably insectivorous.	3	Moderate *Subject Site* does not contain the preferred roosting habitat (i.e. hollow bearing trees)
Vespertilionidae	*Chalinolobus dwyeri*	Large-eared Pied Bat	V,P	V	Roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (Petrochelidon ariel), frequenting low to mid-elevation dry open forest and woodland close to these features. Females have been recorded raising young in maternity roosts (c. 20-40 females) from November through to January in roof domes in sandstone caves and overhangs. They remain loyal to the same cave over many years. Found in well-timbered areas containing gullies. The relatively short, broad wing combined with the low weight per unit area of wing indicates manoeuvrable flight. This species probably forages for small, flying insects below the forest canopy. Likely to hibernate through the coolest months. It is uncertain whether mating occurs early in winter or in spring.	2	Low *Subject Site* does not contain the preferred habitat of well timbered areas and gullies. No roosting habitat (i.e. caves) on the *Subject Site*.
Vespertilionidae	*Falsistrellus tasmaniensis*	Eastern False Pipistrelle	V,P		Prefers moist habitats, with trees taller than 20 m. Generally roosts in eucalypt hollows, but has also been found under loose bark on trees or in buildings. Hunts beetles, moths, weevils and other flying insects above or just below the tree canopy. Hibernates in winter. Females are pregnant in late spring to early summer. Identifiable from mid spring to mid autumn.	4	Low *Subject Site* does not contain preferred moist habitat and there are no roosting habitat (i.e. hollow bearing trees) on the *Subject Site*.
Vespertilionidae	*Miniopterus australis*	Little Bentwing-bat	V,P		Moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense	16	Moderate Potential foraging habitat.

				coastal forests and banksia scrub. Generally found in well-timbered areas. Little Bentwing-bats roost in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats. They often share roosting sites with the Common Bentwing-bat and, in winter, the two species may form mixed clusters. In NSW the largest maternity colony is in close association with a large maternity colony of Eastern Bentwing-bats (Miniopterus schreibersii) and appears to depend on the large colony to provide the high temperatures needed to rear its young. Maternity colonies form in spring and birthing occurs in early summer. Males and juveniles disperse in summer. Only five nursery sites /maternity colonies are known in Australia. Identifiable Mid spring to mid-autumn		
Vespertilionidae	*Miniopterus schreibersii oceanensis*	Eastern Bentwing-bat	V,P	Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures. Form discrete populations centred on a maternity cave that is used annually in spring and summer for the birth and rearing of young. Maternity caves have very specific temperature and humidity regimes. At other times of the year, populations disperse within about 300 km range of maternity caves. Cold caves are used for hibernation in southern Australia. Breeding or roosting colonies can number from 100 to 150,000 individuals. Hunt in forested areas, catching moths and other flying insects above the tree tops. hibernate from June to August	3	Moderate. *Subject Site* does not contain preferred roosting habitat on the *Subject Site*.
Vespertilionidae	*Myotis macropus*	Southern Myotis	V,P	Generally roost in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage. Forage over streams and pools catching insects and small fish by raking their feet across the water surface.	2	Low. *Subject Site* does not contain preferred habitat such as streams or pools for foraging or suitable roosting habitat.

					In NSW females have one young each year usually in November or December. Identifiable from October to March		
Vespertilionidae	*Scoteanax rueppellii*	Greater Broad-nosed Bat	V,P		Utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest. Although this species usually roosts in tree hollows, it has also been found in buildings. Forages after sunset, flying slowly and directly along creek and river corridors at an altitude of 3 - 6 m. Open woodland habitat and dry open forest suits the direct flight of this species as it searches for beetles and other large, slow-flying insects; this species has been known to eat other bat species. Little is known of its reproductive cycle, however a single young is born in January; prior to birth, females congregate at maternity sites located in suitable trees, where they appear to exclude males during the birth and raising of the single young. Identifiable mid spring to mid autumn	10	Low *Subject Site* does not contain preferred foraging habitat such as creeks or rivers nor does it contain extensive native vegetation. No roosting habitat on the *Subject Site*.
Vespertilionidae	*Vespadelus troughtoni*	Eastern Cave Bat	V,P		Very little is known about the biology of this uncommon species. A cave-roosting species that is usually found in dry open forest and woodland, near cliffs or rocky overhangs; has been recorded roosting in disused mine workings, occasionally in colonies of up to 500 individuals. Occasionally found along cliff-lines in wet eucalypt forest and rainforest. Little is understood of its feeding or breeding requirements or behaviour.	2	Low *Subject Site* does not contain preferred habitat near cliffs or rocky overhangs. No roosting habitat (i.e. caves) on the *Subject Site*.
Muridae	*Pseudomys novaehollandiae*	New Holland Mouse	P	V	Known to inhabit open heathlands, woodlands and forests with a heathland understorey and vegetated sand dunes. It is a social animal, living predominantly in burrows shared with other individuals. Distribution is patchy in time and space, with peaks in abundance during early to mid stages of vegetation succession typically induced by fire	7	Moderate Potential habitat
Petaluridae	*Petalura gigantea*	Giant Dragonfly	E1		Live in permanent swamps and bogs with some free water and open vegetation. Adults emerge from late October and are short-lived, surviving for one summer	2	Low

				after emergence. Adults spend most of their time settled on low vegetation on or adjacent to the swamp. They hunt for flying insects over the swamp and along its margins. Adults fly over the swamp and along its margins hunting for flying insects. Males sometimes congregate waiting for females to mate with. Females lay eggs into moss, under other soft ground layer vegetation, and into moist litter and humic soils, often associated with groundwater seepage areas within appropriate swamp and bog habitats. The species does not utilise areas of standing water wetland, although it may utilise suitable boggy areas adjacent to open water wetlands. Larvae dig long branching burrows under the swamp. Larvae are slow growing and the larval stage may last 10 years or more. It is thought that larvae leave their burrows at night and feed on insects and other invertebrates on the surface and also use underwater entrances to hunt for food in the aquatic vegetation.		*Subject Site* does not contain preferred habitat such as permanent swamps and bogs.
Casuariidae	*Dromaius novaehollandiae*	Emu population in the New South Wales North Coast Bioregion and Port Stephens local government area	E2,P	On the NSW north coast, Emus occur in a range of predominantly open lowland habitats, including grasslands, heathland, shrubland, open and shrubby woodlands, forest, and swamp and sedgeland communities, as well as the ecotones between these habitats. They also occur in plantations of tea-tree and open farmland, and occasionally in littoral rainforest. Emus are omnivorous, taking a wide range of seeds and fruits, invertebrates (mainly insects) and foliage and other plant material. They take material directly from plants or bend down to take items from the ground, picking up the food and tossing them back in the throat before swallowing. The population of Emus in the NSW North Coast Bioregion and Port Stephens LGA is of significant conservation value as the last known population in northern coastal NSW, and for the role that birds play in dispersing large seeds of native plant species, and over long distances. Most breeding occurs in late autumn and winter, but better data are needed for the north-eastern NSW population. Eggs are laid on a platform of grass, twigs, leaves and bark on the ground, often at the base of some vegetation and with good views from the nest. Incubation and all parental care is by the male. Young are precocial and covered in down at hatching. They can walk within 5 to 24 hours of hatching.	1	Low Only one recorded occurrence of this species in the *Study Area*.

Family PLANTS	Scientific Name	Common Name	NSW status	Comm. status	Habitat Preference	Records	Likelihood of Occurrence
Myrtaceae	*Callistemon linearifolius*	Netted Bottle Brush	V,P,3		Grows in dry sclerophyll forest on the coast and adjacent ranges. Flowers spring – summer.	1	Unlikely. *Subject Site* does not provide suitable habitat for this species and not recorded during surveys.
Myrtaceae	*Eucalyptus parramattensis subsp. decadens*		V,P	V	Generally occupies deep, low-nutrient sands, often those subject to periodic inundation or where water tables are relatively high. It occurs in dry sclerophyll woodland with dry heath understorey. It also occurs as an emergent in dry or wet heathland. Often where this species occurs, it is a community dominant. In the Kurri Kurri area, E. parramattensis subsp. decadens is a characteristic species of 'Kurri Sand Swamp Woodland in the Sydney Basin Bioregion', an endangered ecological community under the TSC Act. In the Tomago Sandbeds area, the species is usually associated with the 'Tomago Swamp Woodland' as defined by NSW NPWS (2000). Very little is known about the biology or ecology of this species. Flowers from November to January. Propagation mechanisms are currently poorly known. Seed dispersal is likely to be effected by wind and animals. Likely to be sensitive to over-frequent fire, however there is evidence (i.e. coppicing, epicormic shoots) that the species may be tolerant of low intensity fires. The species has a canopy stored seed bank for dispersal after fire events.	3	Unlikely. Not recorded on the *Subject Site* during surveys.
Orchidaceae	^^*Diuris praecox*	Rough Doubletail	V,P,2	V	Grows on hills and slopes of near-coastal districts in open forests which have a grassy to fairly dense understorey. Exists as subterranean tubers most of the year. It produces leaves and flowering stems in winter. Undetectable except when in flower between July and August depending on prevailing climatic conditions.	667	Moderate Potential habitat on the *Subject Site* and a number of nearby records.
Orchidaceae	*Diuris arenaria*	Sand Doubletail	E1,P,2		Sand Doubletail is a small ground orchid. The light purple to mauve flowers appear between August and September and are 20-30 mm wide. There are usually two 15-50 cm long by 2-6 mm wide leaves that grow from the base of the plant. Sand Doubletail is known from the Tomaree Peninsula near Newcastle. This species occurs in coastal heath and dry grassy eucalypt forest on sandy flats. Grows in gently undulating country in eucalypt forest with a grassy understorey on clay soil.	175	Moderate Potential habitat on the Subject Site.

10. APPENDIX B: ASSESSMENT OF SIGNIFICANCE: BC ACT

Following review of BioNet and a site inspection and habitat assessment, the following species are considered to have potential habitat on the *Subject Site* and as such are subjected to an assessment of significance of impact from the proposed information centre.

Scientific Name	Common Name	Status TSC Act	Records
Crinia tinnula	Wallum Froglet	V,P	69
Haliaeetus leucogaster	White-bellied Sea-Eagle	V,P	73
Glossopsitta pusilla	Little Lorikeet	V,P	5
Ninox strenua	Powerful Owl	V,P,3	11
Tyto novaehollandiae	Masked Owl	V,P,3	7
Artamus cyanopterus cyanopterus	Dusky Woodswallow	V,P	2
Dasyurus maculatus	Spotted-tailed Quoll	V,P	12
Phascolarctos cinereus	Koala	V,P	###
Pteropus poliocephalus	Grey-headed Flying-fox	V,P	18
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V,P	2
Mormopterus norfolkensis	Eastern Freetail-bat	V,P	3
Miniopterus australis	Little Bentwing-bat	V,P	16
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V,P	3
Diuris praecox	Rough Doubletail	V,P	
Diuris arenaria	Sand Doubletail	E1,P	

Unless otherwise cited, information was obtained from the OEH species profiles and references contained therein.
http://www.environment.nsw.gov.au/threatenedSpeciesApp/

Effects on a Threatened Species

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

10.1.1 Wallum Froglet

Wallum Froglets are small (to about 20mm) and extremely variable in colour and pattern. They range from light grey or brown to dark grey above and usually white or light brown below (sparsely flecked or heavily mottled with darker patches). They have a relatively pointed snout that projects beyond the lower jaw. A fine median line of white dots often occurs on the underside on the throat that may continue across the belly. They have no webbing on their feet and toe pads are absent. Pupils are horizontal. The call is a distinctive short high-pitched ringing 'tching..tching..', heard throughout the year, particularly following rain.

Wallum Froglets are found along the coastal margin from Litabella National Park in south-east Queensland to Kurnell in Sydney.

Wallum Froglets are found in a wide range of habitats, usually associated with acidic swamps on coastal sand plains. They typically occur in sedgelands and wet heathlands. They can also be found along drainage lines within other vegetation communities and disturbed areas, and occasionally in swamp sclerophyll forests.

The species breeds in swamps with permanent water as well as shallow ephemeral pools and drainage ditches. Breeding is thought to peak in the colder months but can occur throughout the year following rain. Eggs of 1.1-1.2mm are deposited in water with a pH of <6 and tadpoles take 2-6 months to develop into frogs.

Wallum Froglets shelter under leaf litter, vegetation, other debris or in burrows of other species. Shelter sites are wet or very damp and often located near the water's edge. Males may call throughout the year and at any time of day, peaking following rain.

The *Subject Site* does not contain acid swamps, permanent water or shallow ephemeral pools. The drainage lines outside of the *Subject Site* are isolated from their preferred habitat and are unlikely to provide important habitat if any for this species. Drainage lines will not be directly impacted by works. Potential indirect impacts will be mitigated through the implementation of appropriate erosion and sediment control measures. Thus, the proposed works are considered unlikely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

10.1.2 White-bellied Sea-eagle

The White-bellied Sea-Eagle is a large eagle that has long broad wings and a short, wedge-shaped tail. Both sexes are similar in appearance but females are larger than the males. Juveniles are brown with lighter markings. White-bellied Sea-eagles may be solitary, or live in pairs or small family groups consisting of a pair of adults and dependent young.

The White-bellied Sea-eagle is distributed around the Australian coastline, including Tasmania, and well inland along rivers and wetlands of the Murray Darling Basin. In New South Wales it is widespread along the east coast, and along all major inland rivers and waterways.

Habitats are characterised by the presence of large areas of open water including larger rivers, swamps, lakes, and the sea. Occurs at sites near the sea or sea-shore, such as around bays and inlets, beaches, reefs, lagoons, estuaries and mangroves; and at, or in the vicinity of freshwater swamps, lakes, reservoirs, billabongs and saltmarsh. Terrestrial habitats include coastal dunes, tidal flats, grassland, heathland, woodland, and forest (including rainforest). Breeding habitat consists of mature tall open forest, open forest, tall woodland, and swamp sclerophyll forest close to foraging habitat. Nest trees are typically large emergent eucalypts and often have emergent dead branches or large dead trees nearby which are used as ‘guard roosts’. Nests are large structures built from sticks and lined with leaves or grass. Feed mainly on fish and freshwater turtles, but also waterbirds, reptiles, mammals and carrion. Hunts its prey from a perch or whilst in flight (by circling slowly, or by sailing along 10–20 m above the shore). Prey is usually carried to a feeding platform or (if small) consumed in flight, but some items are eaten on the ground. May be solitary, or live in pairs or small family groups consisting of a pair of adults and dependent young. Typically lays two eggs between June and September with young birds remaining in the nest for 65-70 days.

The *Subject Site* may contain marginal foraging habitat for this species and it is likely that this species is seen flying overhead, however the site lacks important habitat features such as large emergent trees suitable for roosting, breeding and nesting. As such, the Subject Site does not support an important population or pair of this species and thus, the proposed works are considered unlikely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

10.1.3 Little Lorikeet

The Little Lorikeet is a small (16-19 cm; 40 g) bright green parrot, with a red face surrounding its black bill and extending to the eye. The undertail is olive-yellow with a partly concealed red base, and the underwing coverts are bright green. The mantle is imbued with light brown. The call in flight is diagnostically different from other lorikeets, being a shrill and rolling screech: ‘zit-zit’ or ‘zzet’. Although difficult to observe while foraging high in treetops, a flock’s constantly chattering contact calls give it away. Flight is fast, direct and through or above the canopy.

The Little Lorikeet is distributed widely across the coastal and Great Divide regions of eastern Australia from Cape York to South Australia. NSW provides a large portion of the species' core habitat, with lorikeets found westward as far as Dubbo and Albury. Nomadic movements are common, influenced by season and food availability, although some areas retain residents for much of the year and 'locally nomadic' movements are suspected of breeding pairs.

- Forages primarily in the canopy of open Eucalyptus forest and woodland, yet also finds food in Angophora, Melaleuca and other tree species. Riparian habitats are particularly used, due to higher soil fertility and hence greater productivity.
- Isolated flowering trees in open country, e.g. paddocks, roadside remnants and urban trees also help sustain viable populations of the species.
- Feeds mostly on nectar and pollen, occasionally on native fruits such as mistletoe, and only rarely in orchards
- Gregarious, travelling and feeding in small flocks (<10), though often with other lorikeets. Flocks numbering hundreds are still occasionally observed and may have been the norm in past centuries.
- Roosts in treetops, often distant from feeding areas.
- Nests in proximity to feeding areas if possible, most typically selecting hollows in the limb or trunk of smooth-barked Eucalypts. Entrance is small (3 cm) and usually high above the ground (2–15 m). These nest sites are often used repeatedly for decades, suggesting that preferred sites are limited. Riparian trees often chosen, including species like Allocasuarina.
- Nesting season extends from May to September. In years when flowering is prolific, Little Lorikeet pairs can breed twice, producing 3-4 young per attempt. However, the survival rate of fledglings is unknown.

The *Subject Site* does not provide nesting habitat for this species as it lacks hollow-bearing trees, and it provides only limited foraging habitat in the Cheese Tree/Smooth-barked Apple/Bangalay Forest. The potential foraging habitat will not be impacted by the proposed works. Thus, the proposed works are considered unlikely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

10.1.4 Dusky Woodswallow

The dusky woodswallow is a medium-sized bird (16-19.5 cm, 35 g), with a longish tail. Mostly dark grey-brown, merging to blackish on the tail, with a small black-brown mask. Bluish bill with a black tip. Upper-wings are a dark blue-grey with a white leading edge. Conspicuous white corners on the tail. In flight the dark grey-brown under-body contrasts with the whitish under-wing. Juveniles may be distinguished by white streaking on the body and whitish tips on wing feathers. Immature individuals are similar to adults but retain pale-tipped wing feathers. No seasonal variation in appearance is evident, and sexes are alike. Calls consist of brassy chirps, chirups, a soft low 'vut vut' and a brisk 'peet peet'. Also known to mimic other birds, including the rufous whistler and grey shrike-thrush.

Dusky woodswallows are widespread in eastern, southern and south western Australia. The species occurs throughout most of New South Wales, but is sparsely scattered in, or largely absent from, much of the upper western region. Most breeding activity occurs on the western slopes of the Great Dividing Range.

Primarily inhabit dry, open eucalypt forests and woodlands, including mallee associations, with an open or sparse understorey of eucalypt saplings, acacias and other shrubs, and ground-cover of grasses or sedges and fallen woody debris. It has also been recorded in

shrublands, heathlands and very occasionally in moist forest or rainforest. Also found in farmland, usually at the edges of forest or woodland.

Primarily eats invertebrates, mainly insects, which are captured whilst hovering or sallying above the canopy or over water. Also frequently hovers, sallies and pounces under the canopy, primarily over leaf litter and dead timber. Also occasionally take nectar, fruit and seed.

Depending on location and local climatic conditions (primarily temperature and rainfall), the dusky woodswallow can be resident year round or migratory. In NSW, after breeding, birds migrate to the north of the state and to southeastern Queensland, while Tasmanian birds migrate to southeastern NSW after breeding. Migrants generally depart between March and May, heading south to breed again in spring. There is some evidence of site fidelity for breeding. Although dusky woodswallows generally breed as solitary pairs or occasionally in small flocks, large flocks may form around abundant food sources in winter. Large flocks may also form before migration, which is often undertaken with other species.

Nest is an open, cup-shape, made of twigs, grass, fibrous rootlets and occasionally casuarina needles, and may be lined with grass, rootlets or infrequently horsehair, occasionally unlined. Nest sites vary greatly, but generally occur in shrubs or low trees, living or dead, horizontal or upright forks in branches, spouts, hollow stumps or logs, behind loose bark or in a hollow in the top of a wooden fence post. Nest sites may be exposed or well concealed by foliage.

The *Subject Site* provides only limited foraging habitat and the habitat is considered sub-optimal as it is highly impacted by exotic invasion and native species have a low percent cover. There are only 2 recorded occurrences of this species in the north east of the *Study Area*. Thus, the *Subject Site* is not considered important habitat for this species and the proposed works are considered unlikely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

10.1.5 Powerful Owl

The Powerful Owl is the largest owl in Australasia. It is a typical hawk-owl, with large yellow eyes and no facial-disc. Adults reach 60 cm in length, have a wingspan of up to 140 cm and weigh up to 1.45 kilograms. Males are larger than females. The upper parts of the Powerful Owl are dark, greyish-brown with indistinct off-white bars. The underparts are whitish with dark greyish-brown V-shaped markings. Juvenile Powerful Owls have a white crown and underparts that contrasts with its small, dark streaks and dark eye patches. The call of this species may be heard at any time of the year, but it is more vocal during the autumn breeding season. It has a slow, deep and resonant double hoot, with the female's being higher pitched and expressing an upward inflection on the second note.

The Powerful Owl is endemic to eastern and south-eastern Australia, mainly on the coastal side of the Great Dividing Range from Mackay to south-western Victoria. In NSW, it is widely distributed throughout the eastern forests from the coast inland to tablelands, with scattered records on the western slopes and plains suggesting occupancy prior to land clearing. Now at low densities throughout most of its eastern range, rare along the Murray River and former inland populations may never recover.

The Powerful Owl inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest.

The Powerful Owl requires large tracts of forest or woodland habitat but can occur in fragmented landscapes as well. The species breeds and hunts in open or closed sclerophyll forest or woodlands and occasionally hunts in open habitats. It roosts by day in dense vegetation comprising species such as Turpentine Syncarpia glomulifera, Black She-oak

Allocasuarina littoralis, Blackwood *Acacia melanoxylon*, Rough-barked Apple *Angophora floribunda*, Cherry Ballart *Exocarpus cupressiformis* and a number of eucalypt species.

The main prey items are medium-sized arboreal marsupials, particularly the Greater Glider, Common Ringtail Possum and Sugar Glider. There may be marked regional differences in the prey taken by Powerful Owls. For example in southern NSW, Ringtail Possum make up the bulk of prey in the lowland or coastal habitat. At higher elevations, such as the tableland forests, the Greater Glider may constitute almost all of the prey for a pair of Powerful Owls. Flying foxes are important prey in some areas; birds comprise about 10-50% of the diet depending on the availability of preferred mammals. As most prey species require hollows and a shrub layer, these are important habitat components for the owl.

Pairs of Powerful Owls demonstrate high fidelity to a large territory, the size of which varies with habitat quality and thus prey densities. In good habitats a mere 400 can support a pair; where hollow trees and prey have been depleted the owls need up to 4000 ha.

Powerful Owls nest in large tree hollows (at least 0.5 m deep), in large eucalypts (diameter at breast height of 80-240 cm) that are at least 150 years old. While the female and young are in the nest hollow the male Powerful Owl roosts nearby (10-200 m) guarding them, often choosing a dense "grove" of trees that provide concealment from other birds that harass him.

Powerful Owls are monogamous and mate for life. Nesting occurs from late autumn to mid-winter but is slightly earlier in north-eastern NSW (late summer - mid autumn). Clutches consist of two dull white eggs and incubation lasts approximately 38 days. They are identifiable all year.

The *Subject Site* may contain foraging habitat for this species however the site lacks important habitat features such as large hollow-bearing trees suitable for nesting. As such, the Subject Site does not support an important population or pair of this species and thus, the proposed works are considered unlikely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

10.1.6 Masked Owl

A medium-sized owl to 40 - 50 cm long, with dark eyes set in a prominent flat, heart-shaped facial disc that is encircled by a dark border. The feet are large and powerful, with fully feathered legs down to the toes. The owl exists in several colour forms, with wide variation in plumage. The upperparts are grey to dark brown with buff to rufous mottling and fine, pale spots. The wings and tail are well barred. The underparts are white to rufous-brown with variable dark spotting. The palest birds have a white face with a brown patch around each eye; the darkest birds have a chestnut face. The dark form of the Masked Owl is much browner than the Sooty Owl Tyto tenebricosa.

Extends from the coast where it is most abundant to the western plains. Overall records for this species fall within approximately 90% of NSW, excluding the most arid north-western corner. There is no seasonal variation in its distribution.

This species lives in dry eucalypt forests and woodlands from sea level to 1100 m. A forest owl, but often hunts along the edges of forests, including roadsides. The typical diet consists of tree-dwelling and ground mammals, especially rats. Pairs have a large home-range of 500 to 1000 hectares. Roosts and breeds in moist eucalypt forested gullies, using large tree hollows or sometimes caves for nesting.

The Subject Site may contain foraging habitat for this species however the site lacks important habitat features such as large hollow-bearing trees or caves suitable for nesting. As such, the Subject Site does not support an important population or pair of this species and thus, the proposed works are considered unlikely to have an adverse effect on the life

cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

10.1.7 Spotted-tailed Quoll

The Spotted-tailed Quoll is about the size of a domestic cat, from which it differs most obviously in its shorter legs and pointed face. The average weight of an adult male is about 3500 grams and an adult female about 2000 grams. It has rich-rust to dark-brown fur above, with irregular white spots on the back and tail, and a pale belly. The spotted tail distinguishes it from all other Australian mammals, including other quoll species. However, the spots may be indistinct on juvenile animals.
The range of the Spotted-tailed Quoll has contracted considerably since European settlement. It is now found in eastern NSW, eastern Victoria, south-east and north-eastern Queensland, and Tasmania. Only in Tasmania is it still considered relatively common.

- Recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline.tr
- Individual animals use hollow-bearing trees, fallen logs, small caves, rock outcrops and rocky-cliff faces as den sites.
- Mostly nocturnal, although will hunt during the day; spends most of the time on the ground, although also an excellent climber and will hunt possums and gliders in tree hollows and prey on roosting birds.
- Use communal 'latrine sites', often on flat rocks among boulder fields, rocky cliff-faces or along rocky stream beds or banks. Such sites may be visited by multiple individuals and can be recognised by the accumulation of the sometimes characteristic 'twisty-shaped' faeces deposited by animals.
- A generalist predator with a preference for medium-sized (500g-5kg) mammals. Consumes a variety of prey, including gliders, possums, small wallabies, rats, birds, bandicoots, rabbits, reptiles and insects. Also eats carrion and takes domestic fowl.
- Females occupy home ranges up to about 750 hectares and males up to 3500 hectares. Are known to traverse their home ranges along densely vegetated creeklines.
- Average litter size is five; both sexes mature at about one year of age. Life expectancy in the wild is about 3-4 years.

The *Subject Site* lack denning opportunity for this species however may provide marginal foraging habitat. There have been limited recent records of this species in the Study Area, and the *Subject Site* is considered unlikely to provide important habitat for this species. Thus, the proposed works are considered unlikely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

10.1.8 Koala

The Koala is an arboreal marsupial with fur ranging from grey to brown above, and is white below. It has large furry ears, a prominent black nose and no tail. It spends most of its time in trees and has long, sharp claws, adapted for climbing. Adult males weigh 6 - 12 kg and adult females weigh 5 - 8 kg. During breeding, males advertise with loud snarling coughs and bellows.
The Koala has a fragmented distribution throughout eastern Australia from north-east Queensland to the Eyre Peninsula in South Australia. In NSW it mainly occurs on the central and north coasts with some populations in the west of the Great Dividing Range. It

was briefly historically abundant in the 1890s in the Bega District on the south coast of NSW, although not elsewhere, but it now occurs in sparse and possibly disjunct populations. Koalas are also known from several sites on the southern tablelands.

- Inhabit eucalypt woodlands and forests.
- Feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species.
- Inactive for most of the day, feeding and moving mostly at night.
- Spend most of their time in trees, but will descend and traverse open ground to move between trees.
- Home range size varies with quality of habitat, ranging from less than two ha to several hundred hectares in size.
- Generally solitary, but have complex social hierarchies based on a dominant male with a territory overlapping several females and sub-ordinate males on the periphery.
- Females breed at two years of age and produce one young per year.

The *Subject Site* lacks the preferred feed trees of this species (as listed in schedule 2 of SEPP 44) nor does it contain primary species listed in the Australian Koala Foundation (AKF, 2012) Trees that will save the Koala. Thus, the *Subject Site* is not defined as potential koala habitat. During site inspections, the base and trunks of canopy trees were inspected for signs of koalas such as scratch marks or scat however there was no evidence of use. While the Study Area is known Koala habitat, the *Subject Site* is considered unlikely to provide important habitat for this species. Thus, the proposed works are considered unlikely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

10.1.9 Grey-headed Flying-fox

The Grey-headed Flying-fox is the largest Australian bat, with a head and body length of 23 - 29 cm. It has dark grey fur on the body, lighter grey fur on the head and a russet collar encircling the neck. The wing membranes are black and the wingspan can be up to 1 m. It can be distinguished from other flying-foxes by the leg fur, which extends to the ankle.

Grey-headed Flying-foxes are generally found within 200 km of the eastern coast of Australia, from Rockhampton in Queensland to Adelaide in South Australia. In times of natural resource shortages, they may be found in unusual locations.

- Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops.
- Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy.
- Individual camps may have tens of thousands of animals and are used for mating, and for giving birth and rearing young.
- Annual mating commences in January and conception occurs in April or May; a single young is born in October or November.
- Site fidelity to camps is high; some camps have been used for over a century.
- Can travel up to 50 km from the camp to forage; commuting distances are more often <20 km.
- Feed on the nectar and pollen of native trees, in particular Eucalyptus, Melaleuca and Banksia, and fruits of rainforest trees and vines.

- Also forage in cultivated gardens and fruit crops.

The *Subject Site* provides some foraging habitat for this species through the presence of native trees however it is not a roost/nesting location. Thus, the proposed works are considered unlikely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

10.1.10 Yellow-bellied Sheathtail-bat

The Yellow-bellied Sheathtail-bat is a very distinctive, large, insectivorous bat up to 87 mm long. It has long, narrow wings, a glossy, jet-black back, and a white to yellow belly extending to the shoulders and just behind the ear. Characteristically, it has a flattened head and a sharply-pointed muzzle. The tail is covered with an extremely elastic sheath that allows variation in the tail-membrane area. Males have a prominent throat pouch; females have a patch of bare skin in the same place.
The Yellow-bellied Sheathtail-bat is a wide-ranging species found across northern and eastern Australia. In the most southerly part of its range - most of Victoria, south-western NSW and adjacent South Australia - it is a rare visitor in late summer and autumn. There are scattered records of this species across the New England Tablelands and North West Slopes.

- Roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows.
- When foraging for insects, flies high and fast over the forest canopy, but lower in more open country.
- Forages in most habitats across its very wide range, with and without trees; appears to defend an aerial territory.
- Breeding has been recorded from December to mid-March, when a single young is born.
- Seasonal movements are unknown; there is speculation about a migration to southern Australia in late summer and autumn.

The *Subject Site* lacks habitat trees and buildings for roosting. No burrows were observed during site inspections however it is noted that due to the density of vegetation, not all of the site was traversed. The *Subject Site* provides some foraging habitat for this species however as it is not dense native vegetation, it is unlikely to provide important foraging habitat. The proposed works require the clearing of 0.27 ha of disturbed coastal scrub. Thus, the proposed works are considered unlikely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

10.1.11 Eastern Freetail-bat

The Eastern Freetail-bat has dark brown to reddish brown fur on the back and is slightly paler below. Like other freetail-bats it has a long (3 - 4 cm) bare tail protruding from the tail membrane. Freetail-bats are also known as mastiff-bats, having hairless faces with wrinkled lips and triangular ears. They weigh up to 10 grams.

The Eastern Freetail-bat is found along the east coast from south Queensland to southern NSW.

The occur in dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range and roost mainly in tree hollows but will also roost under bark or in man-made structures. Usually solitary but also recorded roosting communally, probably insectivorous.

The *Subject Site* lacks habitat trees and buildings for roosting. The *Subject Site* provides

some foraging habitat for this species however as it is not dense native vegetation, it is unlikely to provide important foraging habitat. The proposed works require the clearing of 0.27 ha of disturbed coastal scrub. Thus, the proposed works are considered unlikely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

10.1.12 Little Bentwing-bat

Little Bentwing-bats are small dark chocolate brown insectivorous bats with a body length of about 45 mm. The tip of the wing is formed by a particularly long joint of the third finger, folded back and bent under the wing while the bat is at rest. The fur is long and thick, especially over the crown and around the neck, and is slightly lighter in colour on the belly. They have distinctly short muzzles, and short, rounded roughly triangular shaped ears. Distinguished from the Common Bentwing-bat by its smaller size.
East coast and ranges of Australia from Cape York in Queensland to Wollongong in NSW.

- Moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub. Generally found in well-timbered areas.
- Little Bentwing-bats roost in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats.
- They often share roosting sites with the Common Bentwing-bat and, in winter, the two species may form mixed clusters.
- In NSW the largest maternity colony is in close association with a large maternity colony of Eastern Bentwing-bats (Miniopterus schreibersii) and appears to depend on the large colony to provide the high temperatures needed to rear its young.
- Maternity colonies form in spring and birthing occurs in early summer. Males and juveniles disperse in summer.
- Only five nursery sites /maternity colonies are known in Australia.
- Identifiable Mid spring to mid-autumn

The *Subject Site* lacks suitable roosting habitat and foraging habitat on the *Subject Site* is sub-optimal as it does not consist of moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests, banksia scrub or well-timbered areas. The *Subject Site* provides some foraging habitat for this species however as it is not well-timbered vegetation, it is unlikely to provide important foraging habitat. Thus, the proposed works are considered unlikely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

10.1.13 Eastern Bentwing-bat

The Eastern Bentwing-bat has chocolate to reddish-brown fur on its back and slightly lighter coloured fur on its belly. It has a short snout and a high 'domed' head with short round ears. The wing membranes attach to the ankle, not to the base of the toe. The last bone of the third finger is much longer than the other finger-bones giving the "bent wing" appearance. It weighs up to 20 grams, has a head and body length of about 6 cm and a wingspan of 30 - 35 cm.

Eastern Bentwing-bats occur along the east and north-west coasts of Australia.

- Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures.

- Form discrete populations centred on a maternity cave that is used annually in spring and summer for the birth and rearing of young.
- Maternity caves have very specific temperature and humidity regimes.
- At other times of the year, populations disperse within about 300 km range of maternity caves.
- Cold caves are used for hibernation in southern Australia.
- Breeding or roosting colonies can number from 100 to 150,000 individuals.
- Hunt in forested areas, catching moths and other flying insects above the tree tops.
- Hibernate from June to August

The Subject Site lacks suitable roosting habitat such as caves and man made structures. The Subject Site provides some foraging habitat for this species however as it is not well-timbered vegetation, it is unlikely to provide important foraging habitat. Thus, the proposed works are considered unlikely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

10.1.14 Diuris praecox

A terrestrial herb with two or three linear leaves, 15 - 35 cm long, 3 - 5 mm wide, folded flat together lengthwise. Raceme 20 - 40 cm high, 6 - 10-flowered. Flowers nodding, yellow with a few dark brown markings at the base of the dorsal sepal and labellum, ca 2.5 cm across. Dorsal sepal narrow-ovate, 9 - 11 mm long, 4.5 - 6 mm wide, obliquely erect. Lateral sepals linear to lanceolate, 12 - 15 mm long, 1.5 - 2 mm wide, bent sharply downward, parallel. Petals obliquely erect, widely divergent, curved backwards; lamina narrow-elliptic to ovate, 8 - 12 mm long, 5 - 6 mm wide; claw 4 - 6 mm long, blackish. Labellum (median petal) 9 - 12 mm long; lateral lobes linear to more or less obovate, 3 - 4 mm long, 0.8 - 1.4 mm wide.

This species is known from between Bateau Bay and Smiths Lake where it grows on hills and slopes of near-coastal districts in open forests which have a grassy to fairly dense understorey. Exists as subterranean tubers most of the year. It produces leaves and flowering stems in winter.

In NSW North Coast, the Rough Doubletail is known to be associated with the following vegetation formations and classes.

Coastal Dune Dry Sclerophyll Forests

- Red Bloodwood - Smooth-barked Apple heathy woodland on coastal sands of the Central and lower North Coast
- Scribbly gum - Wallum Banksia - Prickly-leaved Paperbark heathy coastal woodland on coastal lowlands
- Smooth-barked Apple - Blackbutt - Old Man Banksia woodland on coastal sands of the Central and Lower North Coast
- Smooth-barked Apple - Blackbutt heathy open forest of the Tomaree Peninsula
- Smooth-barked Apple - White Stringybark - Red Mahogany - Melaleuca sieberi shrubby open forest on lowlands of the lower North Coast

The *Subject Site* is located nearby to a number of records, however the Coastal Sand Scrub on the *Subject Site* is sand and does not contain a grassy to fairly dense understory. In addition, surveys were conducted during the flowering period of this species (7 June 2018) when it is identifiable and no individuals were recorded. As the *Subject Site* provides only sub-optimal habitat, and there were no observations of this species in the *Subject Site*, the

proposed works are considered unlikely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

10.1.15 Diuris arenaria

Sand Doubletail is a small ground orchid. The light purple to mauve flowers appear between August and September and are 20-30 mm wide. There are usually two 15-50 cm long by 2-6 mm wide leaves that grow from the base of the plant.

Sand Doubletail is known from the Tomaree Peninsula near Newcastle. This species occurs in coastal heath and dry grassy eucalypt forest on sandy flats. Grows in gently undulating country in eucalypt forest with a grassy understorey on clay soil.

In NSW North Coast, the Sand Doubletail is known to be associated with the following vegetation formations and classes.

Coastal Dune Dry Sclerophyll Forests

- Smooth-barked Apple - Blackbutt - Old Man Banksia woodland on coastal sands of the Central and Lower North Coast
- Smooth-barked Apple - Blackbutt heathy open forest of the Tomaree Peninsula
- Smooth-barked Apple - White Stringybark - Red Mahogany - Melaleuca sieberi shrubby open forest on lowlands of the lower North Coast

Freshwater wetlands

- Fern-leaf Banksia - Prickly-leaved Paperbark-Tantoon - Leptocarpus tenax wet heath on coastal sands of the Central Coast and lower North Coast

The *Subject Site* is located in known habitat (Tomarre Peninsula) however the Disturbed Coastal Sand Scrub lacks a grassy understory on clay soil. There are only 2 records of this species in the north east of the broader *Study Area*. As the *Subject Site* provides only sub-optimal habitat and there are limited records of this species, the proposed works are considered unlikely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Effects on an Endangered Population

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

N/A

Effects on an Endangered Ecological Community

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

N/A

Effect on Habitat of a Threatened Species

(d) in relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

The proposed works requires the clearing of approximately 2,792m^2 (0.28 ha) of Disturbed Coastal Sand Scrub. The condition of this vegetation has already been modified through weed invasion so the works are unlikely to further modify the composition. Proposed planting around the perimeter of the *Subject Site* may improve the quality of the vegetation in the immediate vicinity.

The *Subject Site* and Area of Impact are at the south-eastern end of the existing Coastal Sand Scrub. To the north and north east, it is bordered by roads and to the east residential areas. The southern portion of the *Subject Site* is part of the Birubi Point Aboriginal Place and will not be impacted by this development. As such, the proposed works will not result in the further fragmentation or isolation of habitat.

The Disturbed Coastal Sand Scrub provides only sub-optimal habitat for: Wallum Froglet as it lacks acid swamp; Dusky Woodswallow as there is only limited foraging habitat and the habitat which is highly impacted by exotic invasion; Little Lorikeet, Powerful Owl and Masked Owl as it lacks hollow bearing trees for nesting habitat; Spotted-tailed Quoll as it lacks suitable den sites and there are limited records; Yellow-bellied Sheathtail-Bat, Little Bentwing-Bat, Eastern Bentwing Bat and Eastern Freetail Bat as it lacks roost sites and is not well timbered; Koala as it lacks preferred feed trees; Grey-headed Flying-fox as it is not a roost site. The soil landscape is sub-optimal for *Diuris praecox* and *Diuris arenaria* as it lacks dense grassy understory. Thus, the *Subject Site* is not considered important habitat for any of the threatened species with potential habitat on the *Subject Site*.

Critical Habitat

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

N/A

Consistency with a Recovery or TAP

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan (TAP)

Recovery plans have been prepared for the following relevant species:

1. Koala
2. Large Forest Owls

1. Recovery Plan for the Koala (Phascolarctos cinereus)

The specific objectives of this plan include:

Objective 1: To conserve koalas in their existing habitat.

The proposed works do not require the removal of core koala habitat as defined under SEPP 44.

Objective 2: To rehabilitate and restore koala habitat and populations.

The Subject Site was not previously koala habitat. Port Stephens Council have not included koala feed trees in the list of species to be planted on the Subject Site as part of the

Landscape Management Plan.

Objective 3: To develop a better understanding of the conservation biology of koalas.

This is outside the scope of the current proposal.

Objective 4: To ensure that the community has access to factual information about the distribution, conservation and management of koalas at a national, state and local scale.

This is outside the scope of the current proposal.

Objective 5: To manage captive, sick or injured koalas and orphaned wild koalas to ensure consistent and high standards of care.

This is outside the scope of the current proposal.

Objective 6: To manage overbrowsing to prevent both koala starvation and ecosystem damage in discrete patches of habitat.

This is outside the scope of the current proposal.

Objective 7: To coordinate, promote the implementation, and monitor the effectiveness of the NSW Koala Recovery Plan across NSW.

This is outside the scope of the current proposal.

2. Recovery Plan for the Large Forest Owls

The specific recovery objectives of this plan include:

Objective 1: Assess the distribution and amount of high quality habitat for each owl species across public and private lands to get an estimate of the number and proportion of occupied territories of each species that are, and are not, protected.

This is outside the scope of the current proposal.

Objective 2: To monitor trends in population parameters (numbers, distribution, territory fidelity and breeding success) across the range of the three species and across different land tenures and disturbance histories.

This is outside the scope of the current proposal.

Objective 3: To assess the implementation and effectiveness of forest management prescriptions designed to mitigate the impact of timber-harvesting operations on the three owl species and, (if necessary), to use this information to refine the prescriptions so that forestry activities on state forests are not resulting in adverse changes in species abundance and breeding success.

This is outside the scope of the current proposal.

Objective 4: Ensure the impacts on large forest owls and their habitats are adequately assessed during planning and environmental assessment processes.

No potential forest owl habitat trees will be removed as part of the current proposal.

Objective 5: Minimise further loss and fragmentation of habitat by protection and more informed management of significant owl habitat (including protection of individual nest sites).

No potential forest owl habitat trees will be removed as part of the current proposal.

Objective 6: To improve the recovery and management of the three large forest owls based on an improved understanding of key areas of their biology and ecology.

This is outside the scope of the current proposal.

Objective 7: To raise awareness of the conservation requirements of the three large forest owls amongst the broader community, to involve the community in owl conservation efforts and in so doing increase the information base about owl habitats and biology.

This is outside the scope of the current proposal.

Objective 8: To coordinate the implementation of the recovery plan and continually seek to integrate actions in this plan with actions in other recovery plans or conservation initiatives

This is outside the scope of the current proposal.

In summary, the proposed works are consistent with the objectives/actions of relevant recovery plan/threat abatement plans (TAP).

Constitutes a Key Threatening Process

(g) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process

The proposal does contribute to the Key Threatening Process *Clearing of Native Vegetation*. The vegetation that will be cleared as part of the proposed works is highly disturbed, with a high percentage cover of exotic species. A recommendation of this report is the use of local endemic natives in landscaping and around the perimeter of the *Subject Site* following completion of works.

Concluding Comments and Recommendations

Fifteen threatened species (1 amphibian, 5 birds, 7 mammals and 2 plants) previously recorded in the Study Area were considered to have potential habitat on the *Subject Site*. The proposed works require the removal of 0.28 ha of Disturbed Coastal Sand Scrub. This is considered unlikely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction. The proposed clearing will not result in further modification of the vegetation as it is already highly modified through weed invasion, nor will it result in fragmentation or isolation of habitat as the *Subject Site* is already partially isolated. The habitat to be removed is not considered important to the long-term survival of the species as it provides only sub-optimal habitat for Wallum Froglet as it lacks acid swamp, there is only limited foraging habitat for Dusky Woodswallow, there is no suitable habitat for hollow dependent species such as the Little Lorikeet, Powerful Owl, Masked Owl, there are no suitable den sites for Spotted-tailed Quoll and there are limited records, there are nil to limited suitable roost sites for Forest Bats, there are no preferred feed trees for Koalas and it is not a known roost site for Grey-headed Flying-fox. The *Subject Site* is sub-optimal for *Diuris praecox* and *Diuris arenaria* as it lacks dense grassy understory however there have been nearby records of *D. praecox*. This species flowers during winter and was not recorded on the *Subject Site* during surveys conducted in in *Area of Impact* in June. Thus, the *Subject Site* is not considered important habitat for any of the threatened species considered to have potential habitat on the *Subject Site*.

11. APPENDIX C: ASSESSMENT OF SIGNIFICANCE: EPBC ACT

A Protected Matters search was undertaken on 05/06/2018 within a 10x10 km area centred on the *Subject Site* to determine the likely occurrence of Matters of National Environmental Significance.

A summary of matters of National Environmental Significance is provided in Table A3 (Appendix 1), results of the Protected Matters Search Tool Results for Threatened Species listed under the EPBC Act with 10 km of the *Study Area* are provided in Table A4 (Appendix 1) and results of the Protected Matters Search Tool Results for Migratory Species listed under the EPBC Act with 10 km of the *Study Area* are provided in Table A5 (Appendix A).

The *Study Area* does not contain any World Heritage Properties, National Heritage Places, Great Barrier Reef Marine Park or Commonwealth Marine Areas. It does contain two Wetland of International Importance (Hunter Estuary Wetlands; Myall Lakes), seven listed threatened ecological communities, 80 listed threatened species and 74 listed migratory species.

Following a site inspection and habitat assessment:

The *Subject Site* does not form part of the Hunter Estuary Wetland or Myall Lakes and the proposal is unlikely to impact these wetlands.

The *Subject Site* does not contain the threatened ecological communities:

- Central Hunter Valley eucalypt forest and woodland (CE)
- Coastal Swamp Oak (*Casuarina glauca*) Forest of New South Wales and South East Queensland ecological community (E)
- Littoral Rainforest and Coastal Vine Thickets of Eastern Australia (CE)
- Lowland Rainforest of Subtropical Australia (CE)
- Posidonia australis seagrass meadows of the Manning-Hawkesbury ecoregion (E)
- Subtropical and Temperate Coastal Saltmarsh (V)
- White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (CE)

The *Subject Site* has potential habitat for:

• *Dasyurus maculatus*	Spotted-tailed Quoll	E
• *Phascolarctos cinereus*	Koala	V
• *Pseudomys novaehollandiae*	New Holland Mouse	V
• *Pteropus poliocephalus*	Grey-headed Flying-fox	V
• *Diuris praecox*	Rough Doubletail	V

CE – Critically Endangered, E=Endangered, V – Vulnerable under the EPBC Act

Significant Impact Guidelines (DEHWA, 2009) have been prepared in order to decide whether an action is likely to have a significant impact. In determining the nature and magnitude of an action's impact, it is important to consider matters such as:

- all on-site and off-site impacts,
- all direct and indirect impacts,
- the frequency and duration of the action,
- the total impact which can be attributed to that action over the entire geographic

area affected, and over time,

- the sensitivity of the receiving environment, and
- the degree of confidence with which the impacts of the action are known and understood.

11.1 ENDANGERED THREATENED SPECIES

The following threatened species have potential habitat within the *Study Area*:

1. *Dasyurus maculatus* Spotted-tailed Quoll E

11.1.1 Spotted-tailed Quoll

Four species of quolls are found in Australia. Most parts of the country were once inhabited by at least one quoll species and they were among the first native animals to be described by European scientists. All quoll species have declined in numbers since European settlement.

The spot-tailed quoll is the largest marsupial carnivore surviving on mainland Australia. They are more than 50 per cent larger than other quolls (eastern, western and northern) and, unlike other species, have white spots that extend along their tail. They have bright eyes, a moist pink nose and sharp teeth. They have a pointed snout and a long tail. Their fur has a coarse texture and is red-brown to dark brown with white spots of varying size.

Spot-tailed quolls are found in a range of forest environments, from rainforest to open woodland. They require forest with suitable den sites such as rock crevices, caves, hollow logs, burrows and tree hollows. They have a large home range and can cover more than six kilometres overnight. The spot-tailed quoll was once common throughout southeastern Australia, including Tasmania. However, since European settlement it has become rare across most of its range.

Spot-tailed quolls hunt mostly at night being largely nocturnal and solitary. Their diet appears to consist primarily of medium-sized mammals including gliders, possums, rabbits, and even small wallabies. They like carrion (dead animals), birds and eggs as well.

Small mammals, reptiles and invertebrates are also a significant part of the diet, particularly for juvenile quolls.

Spot-tailed quolls are sexually mature at two years of age. Adult males begin searching for females around May, and mating takes place in mid- June. The young are born in early July, and by mid-August are no longer attached to their mothers, although they feed from her and spend much time in the den. By early November at only 18 weeks of age, young are completely independent and they live for approximately five years.

Adult spot-tailed quolls have a territory of up to 500ha. There are few areas where such territories can exist without quolls encountering the effects of humans.

One of the main threats to the spot-tailed quoll is the loss and fragmentation of habitat, especially areas of suitable forest with sufficient numbers of den sites and prey.

The introduction of foxes and cats has had a major effect on many of Australia's unique species, including quolls. Not only are young quolls at risk of predation by foxes and cats

but these introduced species also compete for food. Poisoning by cane toads has led to the death of many quolls who try to eat them.

1080 poson is used to control fox and wild dog numbers. Unfortunately, female and juvenile spot-tailed quolls can also be susceptible to the poison. It is vital that when 1080 baits are used, best practice management guidelines are employed in order to keep impacts to native species to a minimum.

Since spot-tailed quolls favour habitats with abundant prey and refuges from predation, wildfire and controlled burns which reduce these are also a threat to the species.

In some areas quolls are killed in response to raids on poultry runs, having a devastating impact on local populations.

Other threats to the spot-tailed quoll include road mortality in some areas, due to scavenging of road-killed carcasses, as well as the impacts of climate change on fragmented habitat areas.

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

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

Spot-tailed quolls are found in a range of forest environments, from rainforest to open woodland. They require forest with suitable den sites such as rock crevices, caves, hollow logs, burrows and tree hollows. The *Subject Site* lacks forest with suitable den sites and therefore provides poor quality foraging and roosting habitat. The Spotted tailed Quoll is unlikely to rely on the *Subject Site* for breeding/nesting and as such, the proposed action will not result in a reduction in size of the population of this species as the

b) reduce the area of occupancy of the species

The proposed works require the clearing of approximately 0.27 ha of native vegetation however the *Subject Site* is considered sub-optimal habitat and this species is not known to have occurred in the *Subject Site*. The *Subject Site* does not occur at the limit of distribution or area of occupancy for this species.

c) fragment an existing population into two or more populations

The *Subject Site* provides only limited habitat and as it adjoins residential areas, it will not result in further fragmentation of a population if present.

d) adversely affect habitat critical to the survival of a species

The *Subject Site* does not represent critical habitat to the Spotted-tailed Quoll.

e) disrupt the breeding cycle of a population

Spot-tailed quolls are sexually mature at two years of age. Adult males begin searching for females around May, and mating takes place in mid- June. The young are born in early July, and by mid-August are no longer attached to their mothers, although they feed from her and spend much time in the den. By early November at only 18 weeks of age, young are completely independent and they live for approximately five years.

As discussed in section a) above, The *Subject Site* does not provide suitable dens sites or nesting habitat for this species. and as such, the proposal will not disrupt its breeding cycle.

f) modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

As the *Subject Site* provides sub-optimal habitat for this species, the proposal will not alter the habitat to the extent that this species is likely to decline.

g) result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat

The *Subject Site* is already impacted by Bitou Bush however the proposed clearing of the site is unlikely to result in the establishment of any new invasive species.

h) introduce disease that may cause the species to decline, or

The proposed works will not result in an introduction of a disease that may cause this species to decline.

i) interfere with the recovery of the species.

The proposal will not affect the recovery of these species.

11.2 VULNERABLE THREATENED SPECIES

Vulnerable species within the *Study Area*:

1.	*Phascolarctos cinereus*	Koala	V
2.	*Pseudomys novaehollandiae*	New Holland Mouse	V
3.	*Pteropus poliocephalus*	Grey-headed Flying-fox	V
4.	*Diuris praecox*	Rough Doubletail	V

11.2.1 Koala

The Koala is an arboreal marsupial with fur ranging from grey to brown above, and is white below. It has large furry ears, a prominent black nose and no tail. It spends most of its time in trees and has long, sharp claws, adapted for climbing. Adult males weigh 6 - 12 kg and adult females weigh 5 - 8 kg. During breeding, males advertise with loud snarling coughs and bellows.

The Koala has a fragmented distribution throughout eastern Australia from north-east Queensland to the Eyre Peninsula in South Australia. In NSW it mainly occurs on the central and north coasts with some populations in the west of the Great Dividing Range. It was briefly historically abundant in the 1890s in the Bega District on the south coast of NSW, although not elsewhere, but it now occurs in sparse and possibly disjunct populations. Koalas are also known from several sites on the southern tablelands.

They inhabit eucalypt woodlands and forests and feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species. They are inactive for most of the day, feeding and moving mostly at night and spend most of their time in trees, but will descend and traverse open ground to move between trees. Their home range size varies with quality of habitat, ranging from less than two ha to several hundred hectares in size. Koalas are generally solitary, but have complex social hierarchies based on a dominant male with a territory overlapping several females

and sub-ordinate males on the periphery. Females breed at two years of age and produce one young per year.

The Subject Site does not contain any of the preferred feed trees for this species and as such, it is unlikely to support an important population of Koalas.

11.2.2 New Holland Mouse

The New Holland Mouse is a small native rodent similar in size and appearance to the introduced House Mouse. It can be distinguished from the House Mouse by its dusky-brown tail which is longer than the rest of the body and darker on the dorsal surface, the absence of a notch on the upper incisors, and the absence of a distinctive 'mousy' odour.

The New Holland Mouse has a fragmented distribution across Tasmania, Victoria, New South Wales and Queensland. Genetic evidence indicates that the New Holland Mouse once formed a single continuous population on mainland Australia and the distribution of recent subfossils further suggest that the species has undergone a large range contraction since European settlement. Total population size of mature individuals is now estimated to be less than 10,000 individuals although, given the number of sites from which the species is known to have disappeared between 1999 and 2009, it is likely that the species' distribution is actually smaller than current estimates.

It is known to inhabit open heathlands, woodlands and forests with a heathland understorey and vegetated sand dunes. It is a social animal, living predominantly in burrows shared with other individuals. Their distribution is patchy in time and space, with peaks in abundance during early to mid stages of vegetation succession typically induced by fire.

11.2.3 Grey-headed Flying-fox

The Grey-headed Flying-fox is the largest Australian bat, with a head and body length of 23 - 29 cm. It has dark grey fur on the body, lighter grey fur on the head and a russet collar encircling the neck. The wing membranes are black and the wingspan can be up to 1 m. It can be distinguished from other flying-foxes by the leg fur, which extends to the ankle.

Grey-headed Flying-foxes are generally found within 200 km of the eastern coast of Australia, from Rockhampton in Queensland to Adelaide in South Australia. In times of natural resource shortages, they may be found in unusual locations.

They occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy. Individual camps may have tens of thousands of animals and are used for mating, and for giving birth and rearing young. Annual mating commences in January and conception occurs in April or May; a single young is born in October or November. Site fidelity to camps is high; some camps have been used for over a century. They can travel up to 50 km from the camp to forage; commuting distances are more often <20 km and they feed on the nectar and pollen of native trees, in particular *Eucalyptus, Melaleuca* and *Banksia*, and fruits of rainforest trees and vines. They also forage in cultivated gardens and fruit crops.

The Subject Site

11.2.4 Rough Doubletail

A terrestrial herb with two or three linear leaves, 15 - 35 cm long, 3 - 5 mm wide, folded flat together lengthwise. Raceme 20 - 40 cm high, 6 - 10-flowered. Flowers nodding, yellow with a few dark brown markings at the base of the dorsal sepal and labellum, ca 2.5 cm across. Dorsal sepal narrow-ovate, 9 - 11 mm long, 4.5 - 6 mm wide, obliquely erect. Lateral sepals linear to lanceolate, 12 - 15 mm long, 1.5 - 2 mm wide, bent sharply downward,

parallel. Petals obliquely erect, widely divergent, curved backwards; lamina narrow-elliptic to ovate, 8 - 12 mm long, 5 - 6 mm wide; claw 4 - 6 mm long, blackish. Labellum (median petal) 9 - 12 mm long; lateral lobes linear to more or less obovate, 3 - 4 mm long, 0.8 - 1.4 mm wide.

This species is known from between Bateau Bay and Smiths Lake where it grows on hills and slopes of near-coastal districts in open forests which have a grassy to fairly dense understorey. It exists as subterranean tubers most of the year. It produces leaves and flowering stems in winter.

The Subject Site is relatively flat sand dunes with patches of bitou Bush. It does not contain hills and slopes of open forest with grassy to dense understory. As such, the Subject Site is considered unlikely to provide habitat for this species despite nearby records.

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

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

Under the meaning of the Act, an "important" population is one that is necessary for a species' long-term survival and recovery, and may include key source populations for breeding and dispersal, populations necessary for maintaining genetic diversity and populations near the limit of the species range.

The *Subject Site* does not support an important population of Koalas as it lacks potential koala habitat (as defined under SEPP 44) and it provides only marginal foraging habitat for the Grey-headed Flying-fox. The majority of records for New Holland Mouse are over 20 years old with the exception of one record from 2015 near Salamander Bay. Distribution of New Holland Mouse is patchy in time and space, with peaks in abundance during early to mid stages of vegetation succession typically induced by fire. The *Subject Site* is not in the early to mid stages of vegetation succession and there is no evidence of recent fire. The Subject Site is largely dominated by Bitou Bush and sand and does not appear to have been subjected to fire recently. The Subject Site is not defined as open heathland, woodland or forest and as such, is considered unlikely to support an important population of New Holland Mouse. *Diuris praecox* has been recorded in habitat nearby to the *Subject Site* however the *Subject Site* does lack a dense grassy understory which is considered important habitat for this species. Surveys were conducted on 7 June 2018 which is within the flowering period of this species (i.e. when it is detectable) however no individual *D. praecox* were recorded. As such, it is considered unlikely that the *Subject Site* supports an important population of this species.

b) reduce the area of occupancy of an important population

As discussed, the *Subject Site* is considered unlikely to support an important population of Koala, Grey-headed Flying-fox, *D. praecox* or New Holland Mouse so the removal of 0.27 ha of vegetation is unlikely to reduce the area of occupancy of an important population.

c) fragment an existing important population into two or more populations

The *Subject Site* adjoins residential areas thus further clearing will not contribute to fragmentation of habitat or an important population.

d) adversely affect habitat critical to the survival of a species

The *Subject Site* provides potential, but sub-optimal habitat for these species. As such, the proposal will not effect habitat critical to their survival.

e) disrupt the breeding cycle of an important population

The *Subject Site* does not provide breeding habitat for Grey-headed Flying-fox and does not

support an important population of any of the three vulnerable species.

f) modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

The habitat on the *Subject Site* is not considered important to the survival of these species and as such, the removal of 0.27ha of native vegetation is unlikely to lead to a species decline.

g) result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat

The proposed works will not result in an introduction of an invasive species that may cause these species to decline.

h) introduce disease that may cause the species to decline, or

The proposed works will not result in an introduction of a disease that may cause these species to decline.

i) interfere substantially with the recovery of the species.

The proposed works will not interfere with the recovery of this species.

11.3 CONCLUSION

The proposed works (clearing of 0.27 ha of vegetation) will not substantially impact upon the endangered Spotted tailed Quoll or the vulnerable Koala, Grey-headed Flying-fox, New Holland Mouse or *D. praecox* with potential habitat in the broader *Study Area* as the *Subject Site* does not provide important habitat features for these species. The *Subject Site* lacks primary feed trees for Koalas, does not contain roost sites for the Grey-headed Flying-fox, lacks den sites for the Spotted-tailed Quoll and the stage of vegetation succession is not preferred by the New Holland Mouse. *Diuris praecox* prefers a dense grassy understory which is lacking on the *Subject Site*. Subsequently, it is considered that the *Subject Site* does not support an important population of these species.

Based on the above assessment it is considered that a referral to Department of the Environment and Energy is not required.

12. APPENDIX D. VEGETATION DATA SHEETS

BAM Site – Field Survey Form

Site Sheet no: 1 6

		Survey Name	Zone ID	Recorders			
Date	7 6 18	BRUBI		Kristy McQueen			
Zone 56	Datum AMG	Plot ID	1	Plot dimensions	20×20 20×50	Photo #	1-3
Easting 413890	Northing 6372956	IBRA region NNC	Karuah-Manning Subregion	Midline bearing from 0 m	SSW		
Vegetation Class		Bangalay / Cheese Tree / ~~Rough~~ Smooth barked Apple				Confidence H M L	
Plant Community Type	1645	Old Man Banksia–Rough-barked Apple–Bangalay shrubby open forest on Coastal Sands of the Central Coast			EEC:	Confidence H M L	

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	4
	Shrubs	2
	Grasses etc.	0
	Forbs	1
	Ferns	0
	Other	1
Sum of Cover of native vascular plants by growth form group	Trees	16
	Shrubs	3
	Grasses etc.	0
	Forbs	0.5
	Ferns	0
	Other	0.1
High Threat Weed cover		31.6

BAM Attribute (1000 m² plot)		
DBH	# Tree Stems Count	# Stems with Hollows
80 + cm		
50 – 79 cm	1	
30 – 49 cm	~~||||~~ ~~||||~~	
20 – 29 cm	~~||||~~ 11	
10 – 19 cm	~~||||~~ 111	
5 – 9 cm		
< 5 cm		n/a
Length of logs (m) (≥10 cm diameter, >50 cm in length)	10m	

3 exotic included

Counts apply when the number of tree stems within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30 … 100, 200, 300 …). For a multi-stemmed tree, only the largest living stem is included in the count/estimate. Tree stems must be living.

For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each)	97	45	37	75	30	3	5	2	0	0	0	0	1	0	0	0	0	0	0	0
Average of the 5 subplots	56.8					2					0.2					0				

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing (inc. logging)	3	NR	Clearing for track
Cultivation (inc. pasture)	3	R	Planting exotics & garden varieties
Soil erosion	–		
Firewood / CWD removal	–		
Grazing (identify native/stock)	–		
Fire damage	–		
Storm damage	–		
Weediness	3	NR	As above
Other			

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe. Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

400 m² plot: Sheet 2 of 6	Survey Name	Plot Identifier	Recorders
Date 7 6 18	BVRVB1	1	KRISTY M^CQUEEN

GF Code	Top 3 native species in each growth form group: Full species name mandatory. All other native and exotic species: Full species name where practicable	N, E or HTE	Cover	Abund	stratum	voucher
–	Tradescantia fluminensis - Wandering Jew	HTE	15	1,000	L	
–	Petroselinum crispum - Parsley	E	<0.1	3	L	
S	Breynia oblongifolia	N	1	2	L	
P	Doryanthes excelsa	N	0.1	1	L	
–	Asarum - Wild Ginger	HTE	0.4	18	L	
–	Mentha sp - Mint	E	0.1	5	L	
–	~~Rubus~~ Tradescantia spathacea - Rhoeo	E	0.4	22	L	
–	Yucca aloifolia L	E	0.1	1	L	
–	Cruzmania sp - Bromeliad	E	0.1	1	L	
–	- Succulent	E	0.1	1	L	
–	Dracaena sp - Dracena	E	0.2	2	L	
–	Stellaria media - chickweed	E	0.6	300	L	
–	Pennisetum clandestinum - Kikuyu	E	30	1000	L	
–	Ehrharta erecta - African Veldt Grass	HTE	0.1	20	L	
–	Panicum maximum - Guinea Grass	E	0.1	20	L	
–	Poa annua - Winter Grass	E	0.1	20	L	
–	Cenchrus echinatus Spiny-burr Grass	HTE	0.1	20	L	
F	Dichondra repens	N	0.5	2,500	L	
–	Liquidambar styraciflua	E	15	1	U	
T	Glochidion ferdinandi	N	10	10	U	
–	Erythrina x sykesii - Coral Tree	HTE	10	2	U	
T	Angophora floribunda	N	5	2	U	
T	Eucalyptus botryoides	N	5	1	U	
T	Angophora costata	N	8	3	U	
S	Pittosporum undulatum	N	3	1	M	
–	Lantana camara	HTE	5	100	M	
–	Camphor laurel - Cinnamomum camphora	HTE	1	1	U	
	Outside Quadrat					
	Ficus sp					
	Araucaria heterophylla NFI Pine					
	Nephrolepis cordifolia Fishbone Fern					
	Livistonea australis Cabbage Tree Palm					
	Bryophyllum sp Mother of Millions					
	Asparagus virgatus Asparagus Fern					

GF Code: see Growth Form definitions in Appendix 1 **N:** native, **E:** exotic, **HTE:** high threat exotic **GF – circle code** if top 3.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover). ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ..., 100, 200, ..., 1000, ...

BAM Site – Field Survey Form

Site Sheet no: 3 of 6

		Survey Name	Zone ID	Recorders			
Date	7/6/18	BIRUBI		KRISTY MCQUEEN			
Zone: 56	Datum: MGA	Plot ID	2	Plot dimensions	20×20 20×50	Photo #	✓
Easting: 413913	Northing: 6373018	IBRA region: NNS	Karuah - Manning sub-region	Midline bearing from 0 m	SW		
Vegetation Class		Coastal Sand Apple-Blackbutt Forest				Confidence: H M L	
Plant Community Type		Disturbed Vegetation		EEC:		Confidence: H M L	

Record easting and northing at 0 m on midline. Orientation (Bearing) of 0-04 m take-off.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	0
	Shrubs	3
	Grasses etc.	0
	Forbs	1
	Ferns	0
	Other	0
Sum of Cover of native vascular plants by growth form group	Trees	0
	Shrubs	22.7
	Grasses etc.	0
	Forbs	0.1
	Ferns	0
	Other	0
High Threat Weed cover		6.7

BAM Attribute (1000 m² plot)		
DBH	# Tree Stems Count	# Stems with Hollows
80 + cm		
50 – 79 cm		
30 – 49 cm	III	0
20 – 29 cm	I	0
10 – 19 cm	III	0
5 – 9 cm	III	0
< 5 cm	II	n/a
Length of logs (m) (≥10 cm diameter, >50 cm in length)	5m	

Counts apply when the number of tree stems within a size class is ≤ 10. Estimates can be used when > 10 (eg. 15, 20, 30, ... 100, 200, 300, ...). For a multi-stemmed tree, only the largest living stem is included in the count/estimate. Tree stems must be living.

For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each)	0	28	25	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
Average of the 5 subplots	10.6					0.4					0					0				

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred on 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes wood, seeds, twigs, branchlets and material less than 10 cm in diameter. Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site drainage		Outcrop or exposed rock and type	

Plot Disturbance	Severity code	Age code	Observations evidence
Clearing (inc. logging)	3	NR	clearing + weed invasion
Cultivation (inc. pasture)			
Soil erosion			
Firewood / CWD removal			
Grazing (pest, native/feral)			
Fire damage			
Storm damage			
Weeds/exotics	3	NR	High weed invasion E + HTE
Other			

Severity: 0=no evidence, 1=slight, 2=moderate, 3=severe

Age: R=recent (<5yrs), I=intermediate (5-20yrs), O=old (>20yrs), NR=not recorded

400 m² plot: Sheet 1 of 1	Survey Name	Plot Identifier	Recorders
Date 7/6/18	Birdsi	2	KRISTY McQUEEN

GF Code	Top 3 native species in each growth form group: Full species name mandatory. All other native and exotic species: Full species name where practicable	N, E or HTE	Cover	Abund	stratum	voucher
S	Leptospermum laevigatum	N	10	10	M	
–	Ricinus communis	HTE	0.6	2	L	
S	Acacia terminalis	N	12.5	22	M/L	
–	Lantana camara	HTE	5	1	M	
–	Ehrharta erecta	HTE	0.5	100	L	
–	Panicum maximum	E	5	1000	L	
–	Setaria gracilis	E	0.1	80	L	
–	Paspalum dilatatum	HTE	0.2	100	L	
–	Festuca elatior	E	3	400	L	
–	Conchrus echinatus	HTE	0.1	50	L	
–	Anthemis cotula ?	E	6	700	L	
–	Verbena bonariensis	E	0.1	6	L	
–	Chrysanthemoides monilifera Bitou Bush	HTE	0.1	3	L	
–	Bidens pilosa	HTE	0.1	10	L	
S	Acacia longifolia subsp sophorae	N	0.2	5	M	
–	Alanthus altissima	E	1	3	M	
–	Oenothera drummondii Beach Evening Primrose	E	0.1	8	L	
–	Rumex sagitata Turkey Rhubarb	E	0.1	12	L	
–	Plantago lanceolata Lambs Tongue	E	0.1	50	L	
–	Hypochaeris radicata	E	0.1	30	L	
–	Tecoma capensis	E	3	20	M	
–	Tagetes minuta -Stinking Roger	E	0.1	5	L	
–	Stellaria media	E	0.1	50	L	
–	Alternanthera pungens	HTE	0.1	2	L	
F	Wahlenbergia communis	N	0.1	5	L	

GF Code: see Growth Form definitions in Appendix 1 **N:** native, **E:** exotic, **HTE:** high threat exotic **GF – circle code** if top 3.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ... 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

BAM Site – Field Survey Form

Site Sheet no: 5 6

		Survey Name	Zone ID	Recorders			
Date	7/6/18	Birubi		Kristy McQueen			
Zone: 56	Datum: MGA	Plot ID	3	Plot dimensions	20×20 / 20×50	Photo #	✓
Easting: 413844	Northing: 6372942	IBRA region: NNC	Karuah-Manning Sub-region	Midline bearing from 0 m	SW		
Vegetation Class		Coastal Sand Scrub				Confidence: H M L	
Plant Community Type				EEC:		Confidence: H M L	

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	0
	Shrubs	2
	Grasses etc.	0
	Forbs	0
	Ferns	0
	Other	0
Sum of Cover of native vascular plants by growth form group	Trees	0
	Shrubs	2.3
	Grasses etc.	0
	Forbs	0
	Ferns	0
	Other	0
High Threat Weed cover		9

BAM Attribute (1000 m² plot)		
DBH	# Tree Stems Count	# Stems with Hollows
80 + cm		
50 – 79 cm		
30 – 49 cm		
20 – 29 cm		
10 – 19 cm	11	0
5 – 9 cm		
< 5 cm		n/a
Length of logs (m) (≥10 cm diameter, >50 cm in length)	0	

[illegible]

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each)	0	0	0	0	0	100	100	100	100	5	0	0	0	0	0	0	0	0	0	0
Average of the 5 subplots	0					80.1					0					0				

[illegible]

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture	Sand	Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing (inc. logging)			
Cultivation (inc. pasture)			
Soil erosion	2		Beach erosion
Firewood / CWD removal			
Grazing [illegible]			
Fire damage			
Storm damage			
Weediness	3		Bitou bush invasion
Other			

Severity: [illegible]   Age: [illegible]

400 m² plot: Sheet 6 of 6	Survey Name	Plot Identifier	Recorders
Date 7 6 18	BIRUBI	3	KRISTY M°QUEEN

GF Code	Top 3 native species in each growth form group. Full species name mandatory. All other native and exotic species: Full species name where practicable	N, E or HTE	Cover	Abund	stratum	voucher
–	Chrysanthemoides monilifera	HTE	8	60		
S	Acacia longifolia subsp sophorae	N	0.3	1		
S	Leptospermum laevigatum	N	2	2		
–	Erythrina x sykesii	HTE	1	1		
–	Oenothera drummondii	E	0.1	5		
–	Cakile edentula American Searocket	E	0.1	1		
–	Hydrocotyle bonariensis	E	0.1	1		
–	Euphorbia paralias	E	0.1	1		

Outside Quadrat
Carpobrotus glaucescens Pigface
Ficinia (Isolepis) nodosa
Banksia integrifolia

GF Code: see Growth Form definitions in Appendix 1 **N:** native, **E:** exotic, **HTE:** high threat exotic **GF – circle code** if 'top 3'.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover). ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across. 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ..., 100, 200, ..., 1000, ...

Environmental Assessments
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Ref: KM/180525/190523

23 May 2019

Royal HaskoningDHV

Level 14 56 Berry St

North Sydney NSW 2060

Attention: Nick Lewis

Dear Nick,

RE: Birubi Transport Interchange Addendum, incorporation of Lot 32 DP 1146884 Gan Gan Road, Anna Bay into existing DA 16-2018-434-1

Introduction

A development application was submitted in June 2018 for the Birubi Transport Interchange (DA 16-2018-434-1) on Lot 312 DP 753204 Gan Gan Road, Anna Bay. The Client, Port Stephens Council, propose to amend the original design of the Birubi Transport Interchange following acquisition of an adjoining lot of land to the west (Lot 32 DP 1146884 Gan Gan Road, Anna Bay; Figure 1) to allow for an alternative access route through the newly acquired land.

Method/Results

A site inspection of Lot 32 was undertaken on 23 May 2019 by Coast Ecology. Flora species recorded (Table 1) on Lot 32 were consistent with those previously reported in the Biodiversity Assessment (BA) by Coast Ecology (October 2018). Lot 32 was mapped as containing approximately 1,299m^2 *Disturbed Coastal Sand Scrub* and 8,176m^2 *Sand Dunes with Bitou Bush* (Figure 1). Both vegetation communities were mapped previously on Lot 312 and are described in the BA. No threatened flora, fauna or endangered ecological communities were recorded on Lot 32.

Assessment

The area of impact within Lot 32 is estimated at 1,600m^2, consisting mainly of *Sand Dunes with Bitou Bush*. Lot 32 does not contain any additional habitat features such as hollow bearing

trees, wet areas or vegetation types not already considered in the BA. As such, the inclusion of Lot 32 into the Birubi Transport Interchange does not alter the original assessment of significance of impact prepared in accordance with state and federal legislation (*Threatened Species Conservation Act* and *Environment Protection and Biodiversity Conservation Act*, respectively) and presented in the BA. Therefore, no further assessment is required.

Mitigation Measures

To mitigate the loss of additional vegetation clearing, it is recommended that the remainder of Lot 32 and Lot 312 DP 753204 that will not directly be impacted by works, be included in the restoration of the site. Restoration should include revegetation using flora species listed in section 7 of the BA and gradual weed removal. Density of planting should aim to cover 80% surface area after 5 years. This would limit the spread of Bitou Bush which is a priority weed in Port Stephens Council LGA.

If you have any queries in relation to this addendum, please do not hesitate to contact me.

Regards,

Kristy McQueen

Table 1. Flora Species Recorded on Lot 32 on 23/05/2019

Scientific Name	Common Name
Acacia longifolia var. *sophorae*	Coastal Wattle
Acacia terminalis	Sunshine Wattle
*Ailanthus altissima**	Tree of Heaven
*Alternanthera pungens**	Khaki Weed
Angophora costata	Smooth-barked Apple
Angophora floribunda	Rough-barked Apple
Anthemis cotula	Stinking chamomile
*Araucaria heterophylla**	Norfolk Island Pine
*Asparagus aethiopicus**	Asparagus Fern
Banksia integrifolia subsp. *integrifolia*	Coast Banksia
*Cakile edentula**	American Sea Rocket
Carpobrotus glaucescens	Pigface
Cenchrus echinatus	Spiny Burr Grass
Chrysanthemoides monilifera subsp. *monilifera**	Bitou Bush
*Conyza bonariensis**	Flax-leaf Fleabane
Cucumis melo L.	Paddy Melon
Cynodon dactylon	Common Couch
*Cyperus eragrostis**	Umbrella Sedge
*Erythrina x sykesii**	Coral Tree
Gloriosa superba	Glory Lily
*Hydrocotyle bonariensis**	Pennywort
*Hypochaeris radicata**	Flatweed
*Lantana camara**	Lantana
Leptospermum laevigatum	Coast Tea-tree
Oenothera drummondii	Beach Evening Primrose
*Panicium maximus**	Guinea Grass
*Plantago lanceolata**	Ribwort
*Ricinus communis**	Castor Oil Plant
*Sida rhombifolia**	Paddy's Lucerne

COAST ECOLOGY
ENVIRONMENTAL ASSESSMENTS

Figure 1. Vegetation Mapping: Coast Ecology
Addendum to Biodiversity Assessment
Birubi Information Centre Date: 23/05/2019

Birubi Information Centre
Transport and Engineering Advice

Prepared for McGregor Coxall by Haskoning Australia Pty Ltd (a company of Royal HaskoningDHV)

Draft

Project No. PA1845

27 June 2018

Royal HaskoningDHV
Enhancing Society Together

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Document title	Birubi Information Centre Transport and Engineering Advice
Status	**Final**
Date	27 June 2018
Reference	PA1845
Client	McGregor Coxall

Issue History

Issue	Streetatus	Drafted by	Checked by	Approved by	Date
Rev A	Draft	Alex van Gent	Miriam Knollys		19/06/2018
	Final	Alex van Gent	Miriam Knollys	René Zijlstra	27/06/2018

CONTENTS

1 INTRODUCTION

1.1 Preamble

This **Birubi Point Information Centre – Transport and Engineering Advice** has been prepared by Royal HaskoningDHV (RHDHV) for McGregor Coxall (MCGC).

Preliminary advice was provided during a workshop (1 May 2018).

Information presented in this report is deliberately selective and project specific.

The document is structured as follows:

- **Section 2** – Traffic Impact Assessment;
- **Section 3** – Lay-Out of the Information Centre, including assessment of the Accessibility of the Project Site and Design Advice.

1.2 Project Background

Port Stephens Council is planning to develop a new Information Centre at Anna Bay NSW to cater for the growing demand for international and domestic tourism activities on the Worimi Conservation Lands (WCL) and Birubi Point Aboriginal Place. The demand for sand dune adventure tourism and cultural heritage experiences has grown to such a point that urgent planning for a new Information Centre is being co-funded by the NSW Government's Tourism Demand Driver Infrastructure Fund and Port Stephens Council.

The design for the site will include the following:

- a cultural interpretive centre;
- suitable undercover drop off areas for large coaches;
- kiosks and shop fronts for the booking of tours and for tour operators to receive customers from the coaches;
- a central kiosk/information point;
- toilets;
- parking for buses, coaches, cars and bicycles; and,
- landscaping and signage that is in keeping with the concept theme.

McGregor Coxall is working on behalf of Port Stephen's Council to design and develop the Information Centre outside of the Aboriginal Place to provide a new gateway for visitors to the WCL. The aim of the Information Centre is to reduce traffic and parking congestion on the headland which currently puts pressure on the archaeological and cultural values. It is also an opportunity to carefully design an integrated gateway to the WCL and Birubi Point to retain the scenic value and sense of arrival that attracts visitors.

The proposed transport hub would be accessed from the existing Beach Access Road off, Gan Gan Road and would provide facilities for bus/coach and car parking and bicycle parking.

2 TRAFFIC IMPACT ASSESSMENT

2.1 Existing environment and accessibility Birubi Beach Tourist Site

The proposed development area comprises of the following existing elements:

Road network
The Project site is located on the south-east corner of the intersection Gan Gan Road and the existing Beach Access Road.

- Gan Gan Road is the main road in the project area and a regional road.
    - Speed limit of 50 km/h, though designed for 80 km/h.
    - Intersects with James Paterson Street and Crown Street.
    - Bus stop east of intersection of Gan Gan Road and the Beach Access Road.
    - At this bus stop, council placed a speed hump and road narrows to reduce speed of motorised traffic. There is a sign indicating a recommended speed of 25 km/h.
    - Shared path, for cyclists and pedestrians, along south side of Gan Gan Road.
- James Paterson Street (50 km/h) is a local street and provides access to the current Tourist Site at Birubi Beach, the SLSC and properties and beach resorts along James Paterson Street.
    - Traffic calming measures (speed humps).
    - Shared path, for cyclists and pedestrians, along east side James Paterson Street.
- Crown Road is an unsealed road, providing beach access from Gan Gan Road.

Figure 1: Project area (Source: Nearmap, 2015).

Active Transport access

- Pedestrian accessibility around the proposed development site is generally good with a shared path along Gan Gan Road, leading to the properties and holiday parks along James Paterson Street. and retail shops and bus stops in the township of Anna Bay.

- There is no dedicated cycleway provided within the proposed development area. There is some existing cycling infrastructure in the form of the shared paths along Gan Gan Road and James Paterson Street.

- There are currently no bicycle racks or areas for parking of bicycles within the proposed development area.

Public Transport Access

- There is a bus stop at Gan Gan Road, east of the intersection with Crown Road. Bus lines 130, 134 and 135, connect Birubi Point to Anna Bay, Nelson Bay and Fingal Bay in the north east and Newcastle to the west.

Figure 2: Bus network Anna Bay

Tourists – Day trips from Sydney

- A large proportion of the tourists heading for the Tourist Site at Birubi Beach arrive by coach on a day trip from Sydney to Port Stephens.

Parking

In the current situation, parking is allowed at the following locations:

- On the current Birubi Tourist Location at the beach
- James Paterson Street:
    - In a designated parking area at the Surf Life Savers Club (SLSC) near the headland (known as the Upper Carpark).
    - Along the west side of James Paterson Street.
- In a designated parking area off Fitzroy Street.
- In designated coach parking areas along James Paterson Street and on the Tourist Site at Birubi Beach, adjacent to the SLSC (known as the Lower Carpark).

Figure 3: Current Tourist Site at Birubi Beach adjacent to the SLSC (Source: Nearmap, 2015).

Current traffic and parking issues

The main traffic related issues are likely to be caused by the current parking situation on James Paterson Street on days when the beach attracts many tourists and locals. This is primarily during the weekends and on public holidays with problems rarely experienced on weekdays.

The current parking issues that lead to traffic congestion on James Paterson Street include:

- Parked vehicles on the road side leading to reduced road width, and, in extreme situations, leading to parked vehicles back to 400m north of the SLSC.
- Reduced capacity due to vehicle drivers making parking manoeuvres.
- Vehicle drivers looking for a free parking spaces or waiting for spaces to become available.

The aim of the Information Centre is to reduce traffic and parking congestion on the headland which is currently putting increasing pressure on the archaeological and cultural values of the area.

Figure 4: Birubi Beach headland, with parked vehicles on the background (Source: website crestbirubibeach.com.au)

Figure 5: Traffic calming measures at Gan Gan Road (Source: Google Maps, 2008).

Figure 6: Shared path along east side James Paterson Street. (Source: Google Maps, 2008).

Figure 7: Current Tourist Site at Birubi Beach adjacent to the SLSC (Source: Port Stephens Examiner, Ellie-Marie Watts).

Figure 8: Current Tourist Site at Birubi Beach adjacent to the SLSC (Source: Port Stephens Examiner).

Figure 9: Current Tourist Site at Birubi Beach adjacent to the SLSC (Source: Port Stephens Examiner, Ellie-Marie Watts).

2.2 Analysis of Traffic Volumes

This section presents an analysis of the traffic counts available on James Paterson Street and the existing Beach Access Road.

James Paterson Street

Traffic counts for this area are available from September and October 2016. These were conducted on James Paterson Street during a school holiday which included a public holiday. These counts give insight to the current traffic pattern in a relatively busy period.

Traffic count September 2016

- On an average weekday: Between 600-800 motorised vehicles enter James Paterson Street
- On an average weekend day: Around 1,200 motorised vehicles enter James Paterson Street
- Around 95% of these vehicles are passenger cars. On busier days the increase in traffic is primarily due to additional passenger cars.
- All days: Between 30-40 mini busses (small service trucks) and up to 4 coaches per day
- During weekdays: hourly peak between 12am-1pm with around 80 vehicles per hour
- During weekends: hourly peak later, around 1pm, with up to 120 vehicles per hour
- On a very busy Sunday (school holiday / long weekend): Around 1,700 motorised vehicles enter James Paterson Street, leading to vehicles parking along the road over 400m north of the SLSC.
- On a very busy Sunday: hourly peak of up to 220 vehicles per hour.
- Most people visit between 8am-3pm.

Despite the congestion issues during busy days, the traffic volumes presented are well below the capacity of James Paterson Street. It is likely that the congestion issues are related to the parking situation.

The following destinations can be accessed from James Paterson Street:

- SLSC (http://birubipointslsc.org.au/)
- Restaurant Crest Birubi Beach (https://crestbirubibeach.com.au/)
- Birubi Beach Holiday Park (http://glhp.com.au/parks/birubi-beach)
- Birubi Beach
- Current Tourist location at the Beach

Figure 10: Destinations along James Paterson Street. (Source: Google Maps, 2018).


Figure 11: Restaurant Crest Birubi Beach (Source: website restaurant).

There is no information available on the sites/facilities that people arriving in the vehicles are using (e.g. the beach, the SLSC, the restaurant or tourists visiting activities at Birubi Beach) or how long the vehicles are staying in the area. It can be assumed that the majority of the mini busses (small service trucks) and coaches are heading for the Birubi Tourist activities. These vehicles will be redirected to the proposed location of the new Information Centre.

Existing Beach Access Track

There are two traffic counts available for the existing Beach Access Road. These counts were undertaken in 2012 and 2014. The information from the traffic counts is summarised and presented below:

- During weekdays around 200 per day drive on the existing Beach Access Road (total of both directions).
- During weekends the daily amount of vehicles is around 400 per day.
- During Autumn and Winter months (April – June) these numbers decrease to around 10 on weekdays and 50 on weekend days.

- In the last week of December 2011 there were higher traffic densities, with over 1,500 vehicles on the busiest day and densities up to 1,000 vehicles for the days prior to this. It is possible that this may have been due to a specific event at the beach.
- The vehicles counted on the existing Beach Access Road are probably 4WD vehicles, as the road is unpaved and leads to the beach.

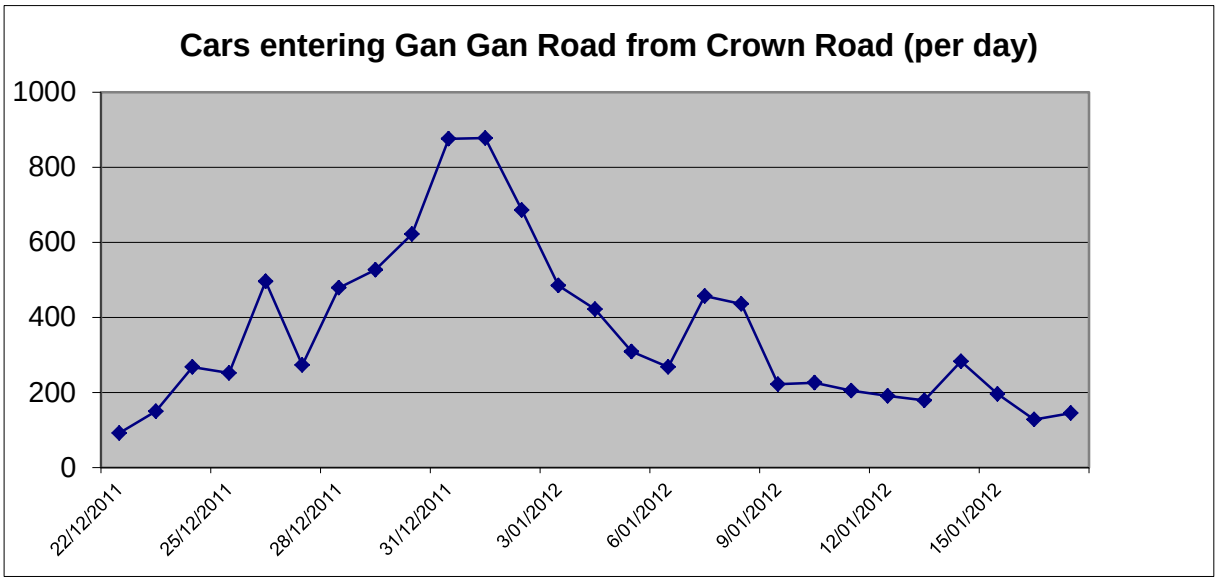

Figure 12: Traffic density at the existing Beach Access Road in December 2011 – January 2012 (direction towards Gan Gan Road)

2.3 Potential impacts

2.3.1 Operational phase

2.3.1.1 Road Network, Traffic and Parking

The project aims to redirected Birubi Tourist Traffic from James Paterson Street to the Information Centre along Gan Gan Road. The coaches currently heading to the parking facilities at the SLSC will be redirected to the new Information Centre. This will reduce the number of vehicles currently using James Paterson Street.

Passenger vehicles belonging to residents or heading for amenities along James Paterson Street, for example, Birubi Point SLSC, the restaurant, the holiday park or the beach (surfers), are likely to continue to use parking facilities accessed along, or from, James Patterson Street.

When assuming that a third of the passenger cars are heading to the tourist activities at the beach1, this will mean that on a weekend during a peak hour (between 12am-2pm) around 40 vehicles per hour will enter the Information Centre (based on the traffic count in September 2016: a third of 120 vehicles per hour). This is less than one vehicle per minute. This density of vehicles should not lead to traffic congestion at the Information Centre. On extremely busy days this hourly density can increase up to twice this amount. This would lead to a vehicle entering the interchange every 40 seconds (approximately 80 vehicles per hour). It will depend on the average parking duration whether this amount would exceed the capacity (50 parking spaces).

[1] Estimated distribution destination traffic on James Paterson Street: a third to the tourist activities at the beach and two third to the SLSC and restaurant.

James Paterson Street
The development of the Information Centre will have a beneficial effect on James Paterson Street by reducing the number of cars and coaches accessing and parking on this street. This in turn should lead to a decrease in parking related congestion on James Paterson Street.

Existing Beach Access Road
The development of the Information Centre will increase vehicle traffic on the existing Beach Access Road as well as increasing movements of 4WD vehicles between the Information Centre, the dunes and the beach. These amounts, however, are well below the capacity of the existing Beach Access Road, and unlikely to lead to congestion.

Gan Gan Road
The development of the Information Centre is likely to have a minimal impact on traffic flow at Gan Gan Road. The current road capacity of Gan Gan Road is sufficient to handle the redirected traffic. In addition to this, the largest share of this traffic is currently already driving via Gan Gan Road and will turn into the existing Beach Access Road instead of James Paterson Road.

In extreme situations, when all parking places at the new Information Centre are occupied, there is a chance that traffic congestion at the parking area of the interchange will lead to a queue along the Beach Access Road back to Gan Gan Road.

2.3.1.2 Pedestrians and Cyclists

The development of the Information Centre is likely to have a positive effect on access for pedestrians and cyclists (Active Transport), as James Paterson Street is their main access to the beach and will be less congested. This should lead to a more pleasant environment in which to walk and cycle. The Information Centre will be designed taking into account the needs of pedestrians and cyclists with existing shared pedestrian/cycling paths extended to access the site.

2.3.1.3 Public Transport

The development of the Information Centre is likely to have a positive effect on public transport access, as the centre will be located closer to existing bus stops.

2.3.2 Construction phase

As the new site for the proposed Information Centre is at a location set back from the main roads, the construction phase is unlikely to affect the traffic and parking situation at James Paterson Street. Upgrading the intersection between Gan Gan Road and the existing Beach Access Road and upgrading the surface of the existing Beach Access Road (from a track to a paved road) will also be undertaken as part of the proposed development.

Construction traffic will have the following potential impacts:

- localised changes to traffic conditions to support construction of the entrance way to the Information Centre on the existing Beach Access Road,
- temporary road closures and diversions due to paving the existing Beach Access Road, and upgrading the intersection with Gan Gan Road. This will include the addition of a right turning lane from Gan Gan Road into the existing Beach Access Road. The road closures and traffic diversions would be coordinated with Roads $ Maritime Services (RMS) and the Transport

Management Centre and undertaken at appropriate times which will minimise the impact to road users and existing bus services.

- minor increases in traffic along Gan Gan Road, including heavy vehicles, due to construction traffic and workers.

The upgrade of the intersection of Gan Gan Road with the existing Beach Access Road should improve traffic flow capacity at Gan Gan Road as vehicles turning right into the Beach Access Road will be separated from the through traffic. This will benefit road safety, as it reduces the risk of collisions.

A right hand turning lane on Gan Gan Road for traffic coming from the north-west direction is recommended as it improves both traffic flow and road safety at Gan Gan Road. A left hand turning lane on Gan Gan Road for traffic coming from a south-east direction is not recommended, as this could increase the risk of so called 'blocked-view accidents'. Left turning traffic from Gan Gan Road into the Beach Access Road driving on this left turning lane could obstruct the view of vehicles from the Beach Access Road that intend to enter Gan Gan Road on vehicles that drive on Gan Gan Road behind the left turning vehicle.

During the road works on the intersection, the contractor could provide for an alternative route via Old Main Road.

Figure 13: Intersection Gan Gan Road with the Existing Beach Access Road

A detailed construction methodology and associated management plans could be developed during the detailed design phase of the proposal to manage these potential impacts.

Throughout the construction phase deliveries and movements of construction vehicles would be planned to minimise potential impacts. All construction vehicles would access and egress the construction site via the existing Beach Access Road.

Construction parking can be organised on the project site and along the existing Beach Access Road.

2.4 Mitigation measures

Potential mitigation measures include:

- Traffic regulators on extremely busy days to prevent traffic from Gan Gan Road entering the existing Beach Access Road, when the carpark at the Information Centre is full. If possible they could redirect traffic to an alternative location, that is in accordance with the parking policy of Port Stephens Council.
- Dynamic road signage at Gan Gan Road when the carpark at the interchange is full.

BIRUBI POINT
WATER MANAGEMENT PLAN

DA Report

June 2018

Project client: Port Stephens Council

Project name: Birubi Point Stage 2

Project number: 0672SYD

Date: June 2018

Studio: Sydney

Report contact: Alexa McAuley

Revision	Status	Date	By	Checked
A	DA submission	27.06.2018	AMcA	AMcA

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CONTENTS

1 INTRODUCTION

This water management plan has been developed to support the design development for the proposed Birubi Point Information Centre

On behalf of Port Stephens Council an Information Centre is proposed for the subject site, Lot 312 DP753024. This site has been identified through a process of masterplanning and community engagement. It is located on Crown Land in a RU2 zone, adjacent to E2 and RE1 lands and the Birubi Point Aboriginal Place. The site is a disturbed area of dune landscape that is framed by vegetation along Gan Gan Road and James Paterson Road. The proposed information centre has been designed as a functional asset that resolves current parking and congestion issues around visitor activity at Birubi Point. The asset consists of 1325m2 of sheltered space and provides space for dune operators and amenities, including public toilets and a kiosk. The site has 50 car parking spaces, including 3 disabled spaces, 10 coach parking spaces with a drop-off zone that can accommodate 2 coaches, and provisions for pedestrians and cyclists. The proposal includes site specific Architecture and Landscape design that is integrated with sustainable water solutions. Heritage considerations, traffic management and an ecological assessment have also been incorporated into the proposed outcome.

The concept design for the proposed development is shown in Figure 1.

This report has been prepared to consider water management on the site, specifically:

- Existing conditions relating to both surface and groundwater
- Potential impacts of the proposed development
- Approval requirements
- Recommended measures to manage water and mitigate impacts

The water management plan covers surface water and groundwater, including both water quality and water balance. However its main focus is water sensitive urban design (WSUD), while a separate stormwater drainage plan covers drainage and on-site detention.

The plan has been developed to meet the requirements of Port Stephens Council's DCP, particularly the water quality requirements in Part B4.C. It also addresses riparian corridors (Part B4.D). Refer to the separate stormwater drainage plan for Parts B4.A and B4.B.

Figure 1: Concept design for proposed development

2 EXISTING CONDITIONS

The Information Centre site is located in a sensitive coastal environment, with a complex topography created my mobile sand dunes

Currently, the site is undeveloped. Rainfall either infiltrates into the sandy soil or runs off via ephemeral drainage lines. There are no drainage structures on site.

2.1 RAINFALL

Average monthly rainfall is shown in Figure 2. The mean annual rainfall is 1346 mm/year. This is based on the rain gauge at Nelson Bay (Nelson Head), which has been operating for more than 100 years. It is located approximately 11 km away.

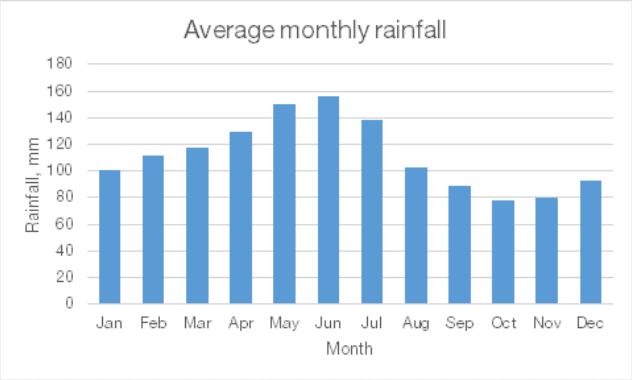


Figure 2: Average monthly rainfall

2.2 SURFACE WATER

Existing site catchments are shown in Figure 3. The catchment properties are summarised in Table 1.

Table 1: Existing catchment properties

Catchment	Area, ha	Drains to
A	11.87	Gan Gan Road to the north of the site
B	4.69	Private property to the south-west of the site
C	1.12	Stockton Beach to the south of the site

Catchment A, which represents two thirds of the site, drains to the north where stormwater pits on Gan Gan Road and James Paterson Street accept surface flows.

Catchment B drains to the south-west and into private properties along James Paterson Street. Nos 4, 6, and 8 James Paterson Street are located immediately adjacent to the site.

Soils on site are sandy and it is likely that infiltration capacity is relatively high, and runoff is low. Port Stephens Council Hydrologic Mapping indicates that the soil group on site is Group A— "soils having high infiltration rates, even when thoroughly wetted and consisting chiefly of deep, well to excessively-drained sands or gravels. These soils have a high rate of water transmission."

2.3 WATERCOURSES

There are no rivers, lakes or estuaries within 40 m of the site. There are only indistinct ephemeral watercourses on site, as shown in Figure 3.

2.4 GROUNDWATER

Immediately adjacent to the site is an area defined as a "Special Area" by Hunter Water. This Stockton Sandbeds Special Area protects an unconfined sand aquifer which extends from Fullerton Cove to Anna Bay. Hunter Water does not currently extract groundwater from this aquifer, but would do so in the event of a water shortage. Therefore there are measures in place to protect it from water quality impacts.

The subject site is outside the area identified as the Stockton Sand Beds Special Area. However:

- Soils on the site are sandy and therefore groundwater recharge is likely to occur on the site
- There is potentially some connection between groundwater on the site and the Stockton Sandbeds system

Figure 3: Existing surface water catchments

Figure 4: Groundwater Special Area

3 PROPOSED WORKS

From a water management perspective, the key features of the proposed works are an increase in impervious area and the introduction of facilities with water demands and wastewater flows

3.1 POST-DEVELOPMENT LAND USE AND POLLUTANT LOADS

The proposed site areas are shown in Table 2.

Table 2: Proposed site areas

Surface type	Area, sqm
Roads	1,800
Parking areas	2,750
Paths	550
Roof	1,500
Landscaped areas	2,950
Undeveloped areas	8,160
Total	**17,710**

MUSIC has been used to estimate post-development pollutant loads and size water quality treatment systems. MUSIC-Link was used to set up the MUSIC model with parameters appropriate to the Anna Bay and Nelson Bay area. The default catchment in sandy soil parameters have been adopted.

In the MUSIC model, roads and parking areas have been modelled with pollutant parameters typical of urban roads, boardwalks and landscaped areas have been modelled with pollutant parameters typical of mixed urban areas, roofs have been modelled with pollutant parameters typical of urban roofs, and undeveloped areas have been modelled with pollutant parameters typical of natural catchments.

Post-development pollutant loads estimated for the total site are estimated as shown in Note that road and paved parking areas could be constructed using semi-permeable materials, however for the purposes of water quality modelling these were assumed to function as impervious areas, as runoff from these areas should be pre-treated before it is allowed to infiltrate. This is discussed further in Section 5.

Table 3.

Note that road and paved parking areas could be constructed using semi-permeable materials, however for the purposes of water quality modelling these were assumed to function as impervious areas, as runoff from these areas should be pre-treated before it is allowed to infiltrate. This is discussed further in Section 5.

Table 3: Post-development pollutant loads (baseline)

Pollutant	Mean annual loads		
	Developed portion of site	Undeveloped portion of site	Total
Flow (ML/yr)	6.89	1.76	8.65
Total Suspended Solids (kg/yr)	1,575	65	1,640
Total Phosphorus (kg/yr)	2.9	0.1	3.0
Total Nitrogen (kg/yr)	15.1	1.4	16.5
Gross Pollutants (kg/yr)	157	0	157

3.2 NON-POTABLE WATER DEMANDS

Water used for toilet flushing and irrigation can be supplied from non-potable sources such as rainwater.

Irrigation demands are expected to be low – the design intent is to plant with locally native species suited to the dune environment, which can tolerate the natural conditions.

A significant proportion of the water used on site will be for toilet flushing. Toilet flushing demands have been estimated for the site based on the following assumptions:

– The site will accommodate 50 visitor cars, ten

coaches and fourteen 4WD operators

- Average occupancy in the cars is three people, and in the coaches is 50 people
- Visitors spend an average of half the day on site, and uses the toilet an average of two times
- 4WD operators will have an average of 2 staff, who spend all day on site and use the toilet an average of four times
- Toilet water demands will be an average of 4.5 L per flush
- A peak day's toilet flushing demand will therefore by 12 kL/day
- A peak month's toilet flushing demand will be 378 kL/month
- Peak months will be November to February
- The distribution of non-potable water demands through the remainder of the year will follow a similar pattern to the existing surf club, where approximately 48% of the water use falls within November to February

The expected toilet flushing demands on the site are shown in Figure 5.

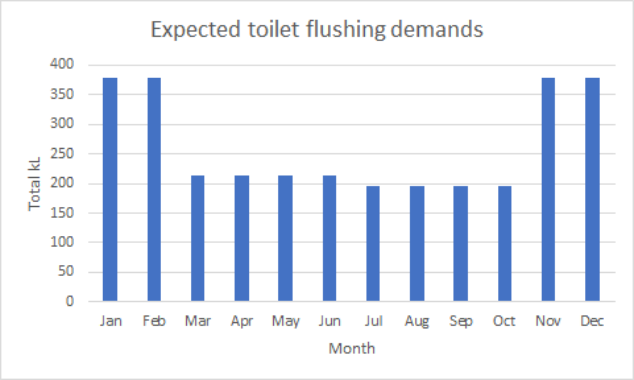


Figure 5: Expected toilet flushing demands at the site

The expected mean annual toilet flushing demands add up to approximately 3,150 kL/year. This is similar to the current total annual demand at the surf club (based on March 2017 to February 2018 usage in common and public areas, surf club facilities, café areas, and caretaker residence, which totalled 3,640 kL). Therefore the demand estimate is consistent with an increase in total visitor numbers with the Information Centre in place.

Note that the rainwater tank modelling has tested demands ranging from 1,000 to 5,000 kL per year, due to the uncertainty in future demands.

4 DEVELOPMENT CONTROLS

Port Stephens Council DCP 2014 includes controls for drainage and water quality, which are summarised here

Port Stephens Council's DCP 2014 Chapter B4 covers drainage and water quality. This chapter applies to the proposed development, as it increases impervious surfaces and drains to the public drainage system.

Chapter B4 calls for the following items to be addressed:

- A stormwater drainage plan
- On-site detention/infiltration
- Water quality (WSUD) measures
- Protection of riparian corridors

Each of these items is summarised in Table 4.

Table 4: DCP controls for drainage and water quality, as they apply to the site

Topic	Applicability to this site	DCP requirements
Legal and physical point of discharge	Required based on the facts that: - The development increases impervious surfaces; and - The development drains to the public drainage system	To ensure the stormwater drainage plan details a legal and physical point of discharge to minimise impacts on water balance, surface water and groundwater flow and volume regimes and flooding
On-site detention/on-site infiltration	Required based on the facts that: - The post-development flow rate or volume exceeds the pre-development flow rate or volume; and - Impervious surfaces exceed the total percentage of site area listed under Figure BD (p. B-29)	Sized so that the post-development flow rate and volume equals the predevelopment flow rate and volume for all storm events up to and including the 1% Annual Exceedance Probability (AEP) storm event
Water quality	Based on Figure BF in the DCP: - The site area is >2,500 m^2 - The proposed development is outside a drinking water catchment	Before water is released into public drainage it must achieve Council's water quality stripping targets: a. Total nitrogen retention post-development load: 45% b. Total phosphorus retention post-development load: 60% c. Total suspended solids post-development load: 90% d. Gross pollutants post-development load: 90% Use water quality modelling, such as MUSIC modelling, to demonstrate compliance.
Riparian corridors	The development does not involve any controlled activity within waterfront land	NA

5 WATER MANAGEMENT STRATEGY

The proposed water management strategy includes rainwater harvesting and wetlands to meet water quality treatment targets

5.1 RAINWATER HARVESTING

It is proposed to connect a rainwater tank to the roof of the main building on site, to supply toilet flushing demands inside.

The following rainwater tank scenarios have been tested:

- Connected roof area of 50%, 75% or 100% of the proposed 1,500 sqm roof
- Rainwater demands ranging from 1,000 to 5,000 kL/year, with the seasonal profile as shown in Figure 5.
- Tank volumes ranging from 10 to 200 kL

Results are shown in Figure 6. These show that:

- A tank volume of at least 50 kL is recommended, and 100 kL is encouraged
- For any of the demands tested, it is worth trying to maximise the connected roof area, as the roof area is a limiting factor in the ability to supply requested demands

5.2 WATER QUALITY TREATMENT

The post-development water quality model configuration is shown in Figure 7 and has been set up based on the following:

- The same MUSIC-Link parameters as described above (Anna Bay and Nelson Bay area, default catchment in sandy soil)
- Undeveloped parts of the site have been excluded from the treatment train. As shown in Table 3, these areas contribute very low pollutant loads compared to the developed parts of the site.
- A 50 kL rainwater tank has been included, connected to the whole roof and an annual demand of 3,150 kL/year
- A range of wetland areas were tested, to establish the wetland area required to meet Council's water quality targets for the site as a whole
- All impervious areas and stormflow from landscaped pervious areas have been directed to the wetland. Pervious baseflows bypass
- An infiltration rate of zero was assumed in the model. While infiltration zones may be included in the design, pre-treatment is recommended upstream of infiltration zones, and the intent of this assumption in the model is to show how water quality treatment targets can be achieved before water is lost to infiltration.

Note that some proposed elements of the treatment train have not been included in this model (e.g. swales within the car park). As the design develops the modelling can be refined to account for these, however at this stage the intent is to ensure that a sufficient area has been defined for the water quality treatment wetland/s.

Model results are shown in Figure 8. This shows that a wetland with a 500 sqm macrophyte zone can meet Council's water quality targets. It achieves:

- 90% removal of total suspended solids
- 79% removal of total phosphorus
- 55% removal of total nitrogen

It would also achieve 100% removal of gross pollutants.

The wetland with a 500 sqm macrophyte zone has been modelled with a 100 m^3 inlet pond, 0.5 m extended detention and a permanent pool volume of 100 m^3. The outlet condition has been set to achieve an extended detention time of 72 hours.

Allowing for the inlet pond, macrophyte zone and batter zones, it is recommended that an area of approximately 850 sqm should be allowed for the wetland.

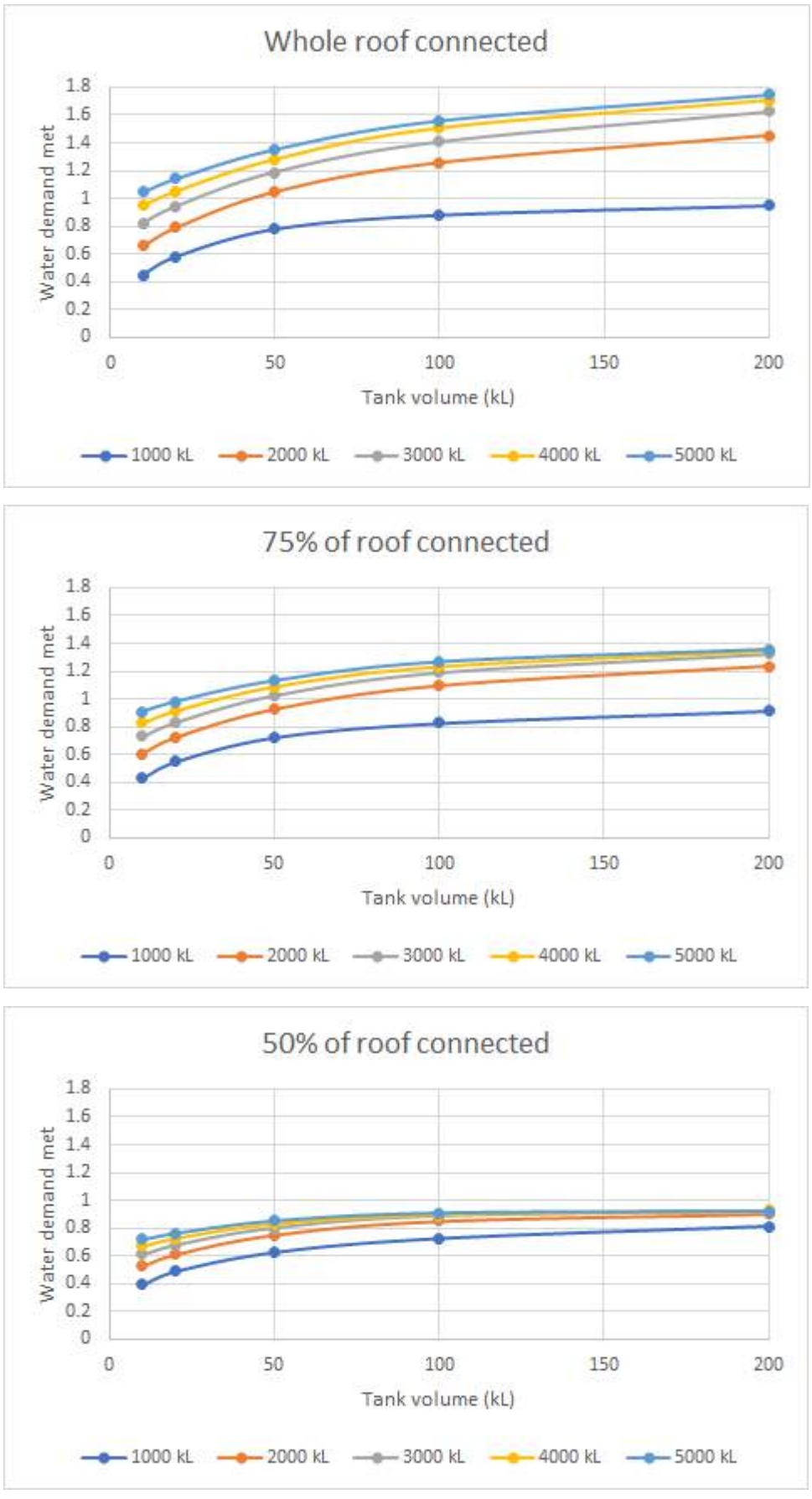


Figure 6: Rainwater tank modelling results

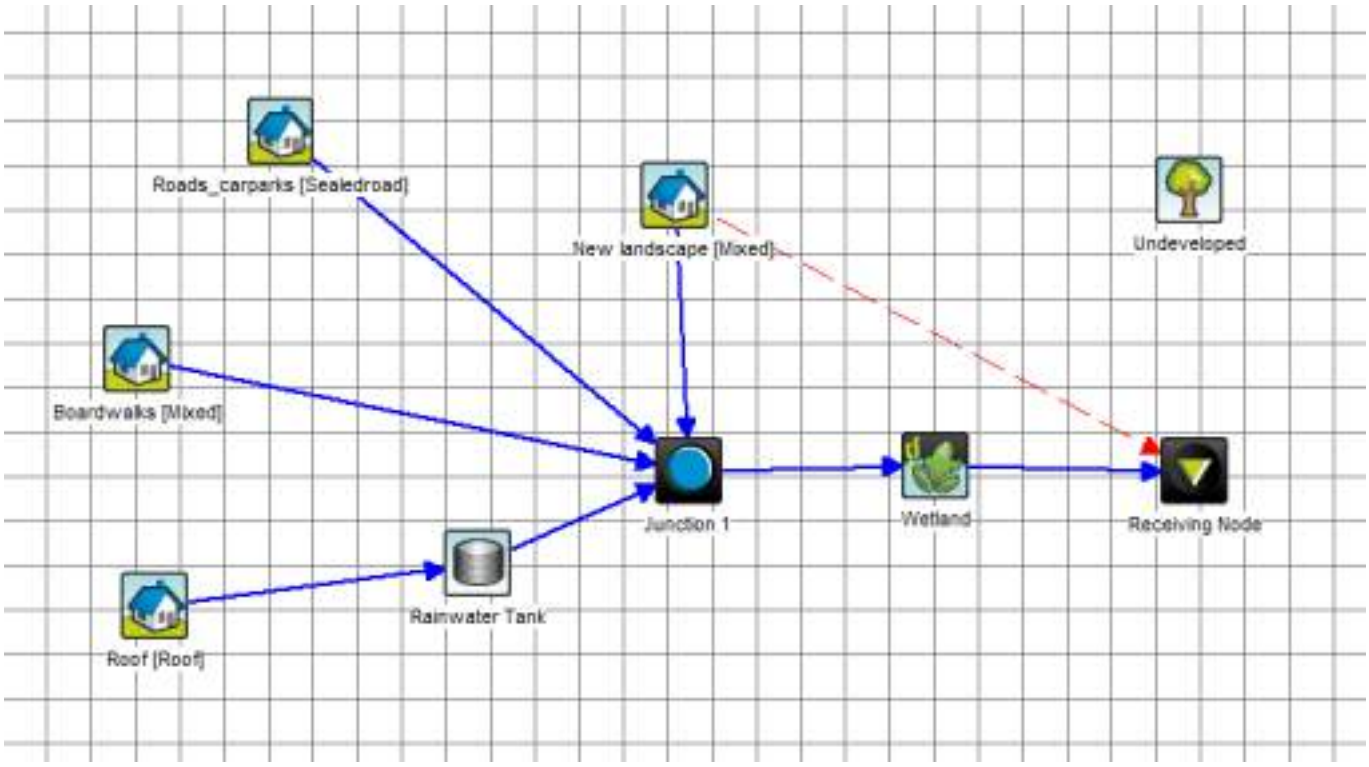


Figure 7: MUSIC model configuration

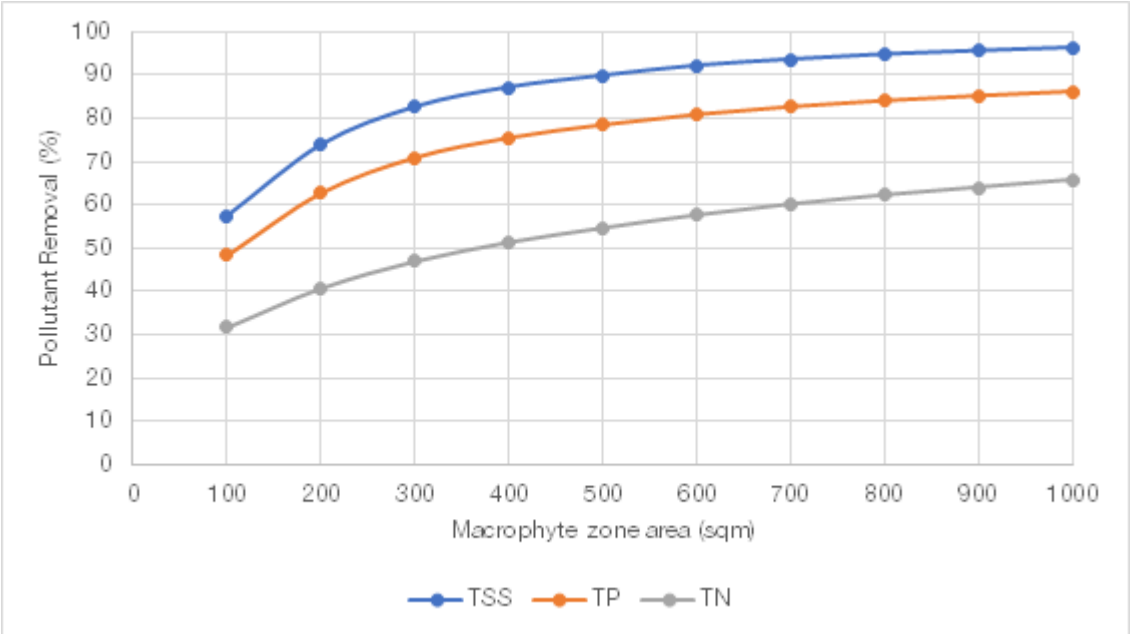


Figure 8: Water quality treatment train results for different wetland areas

Note that a wetland with a 300 sqm macrophyte zone would meet the targets for TN (45%) and TP (60%). A larger wetland is required to meet the TSS target (90%). It may be possible to refine the stormwater treatment train design to provide improved pre-treatment for suspended solids (e.g. in swales) and reduce the size of the wetland.

6 CONCLUSIONS AND RECOMMENDATIONS

This water management plan recommends a rainwater tank and wetland to meet Port Stephens Council's water quality targets

This water management strategy recommends the following elements to be included in the design of the Birubi Point Information Centre, in order to meet Port Stephens Council's water quality targets:

- **Rainwater tank**: minimum 50 kL tank collecting roof runoff from the proposed building and supplying toilet flushing demands in the proposed facility
- **Wetland**: including a 100 m^3 inlet pond and 500 sqm macrophyte zone

This treatment train is expected to achieve the following pollutant load reductions (in terms of mean annual loads):

- 90% of TSS
- 79% of TP
- 55% of TN
- 100% of gross pollutants

This plan also makes the following recommendations about how water management should be implemented on site:

- While infiltration can be encouraged in the sandy soils, stormwater runoff should be pre-treated prior to infiltration, to protect groundwater quality
- Where possible, car park runoff should be pre-treated in swales before it reaches the wetland. This could improve the performance of the wetland and reduce the wetland area required to meet the water quality targets.

Note that on-site detention will also be required and this is described in a separate stormwater drainage report.

1 ADDENDUM TO BIRUBI POINT WATER MANAGEMENT PLAN

This addendum has been developed to support the S55a development application for the proposed Birubi Point Information Centre

1.1 INTRODUCTION

Subject to Port Stephens Councils acquisition of Lot 32 DP1146884, this addendum has been developed to account for the additional site area and associated implications on the proposed water management strategy for the proposed Birubi Point Information Centre. The additional site area is highlighted in Figure 1 below.

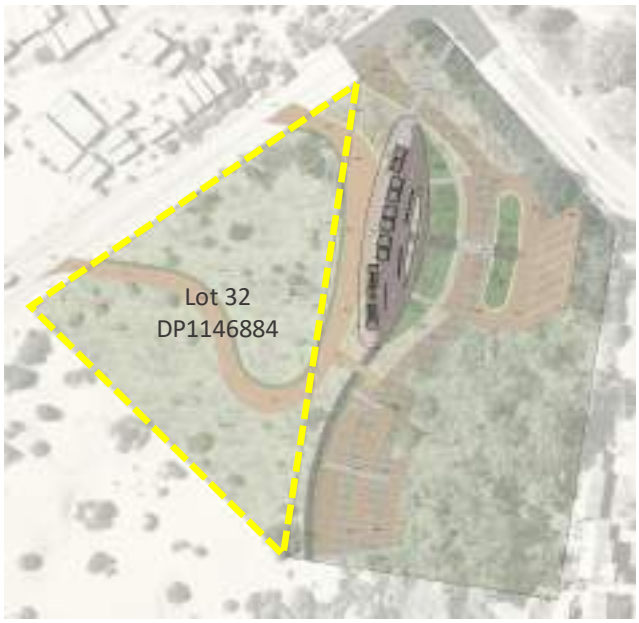


Figure 1: Concept design for proposed development

1.2 POST-DEVELOPMENT LAND USE AND POLLUTANT LOADS

The additional area consists of some 880m^2 of hardscape and 8,570m^2 of undeveloped sand dunes. Updated proposed site areas are shown in Table 1.

Table 1: Proposed site areas

Surface type	Area (m^2)
Roads	2,680
Parking areas	2,750
Paths	550
Roof	1,500
Landscaped areas	2,950
Undeveloped areas	16,730
Total	**27,160**

1.3 WATER QUALITY TREATMENT

The design approach, modelling configuration and assumptions of the original water management strategy have been maintained for the addendum. Wetland areas were modelled in MUSIC with increased hardscape and undeveloped area as per Table 1.

Post-development pollutant loads for the updated total site are shown in Table 2.

Table 2: Post-development pollutant loads (baseline)

Pollutant	Mean annual loads		
	Developed portion of site	Undeveloped portion of site	Total
Flow (ML/yr)	7.7	3.6	11.3
Total Suspended Solids (kg/yr)	1,861	139	2,000
Total Phosphorus (kg/yr)	3.3	0.2	3.5
Total Nitrogen (kg/yr)	16.9	3.1	20
Gross Pollutants (kg/yr)	178	0	178

Model treatment train pollutant removal results of the updated site area are shown in Figure 2. This shows that a wetland with a 600m^2 macrophyte zone can meet Council's water quality targets. It achieves:

- 91% removal of total suspended solids
- 80% removal of total phosphorus
- 55% removal of total nitrogen

It would also achieve 100% removal of gross pollutants.

The wetland with a 600m^2 macrophyte zone has been modelled with a 120m^3 inlet pond, 0.5m extended detention and a permanent pool volume of 120m^3. The outlet condition has been set to achieve an extended detention time of 72 hours.

Allowing for the inlet pond, macrophyte zone and batter zones, it is recommended that an area of approximately 1,020m^2 should be allowed for the wetland. This area is provided for in the design.

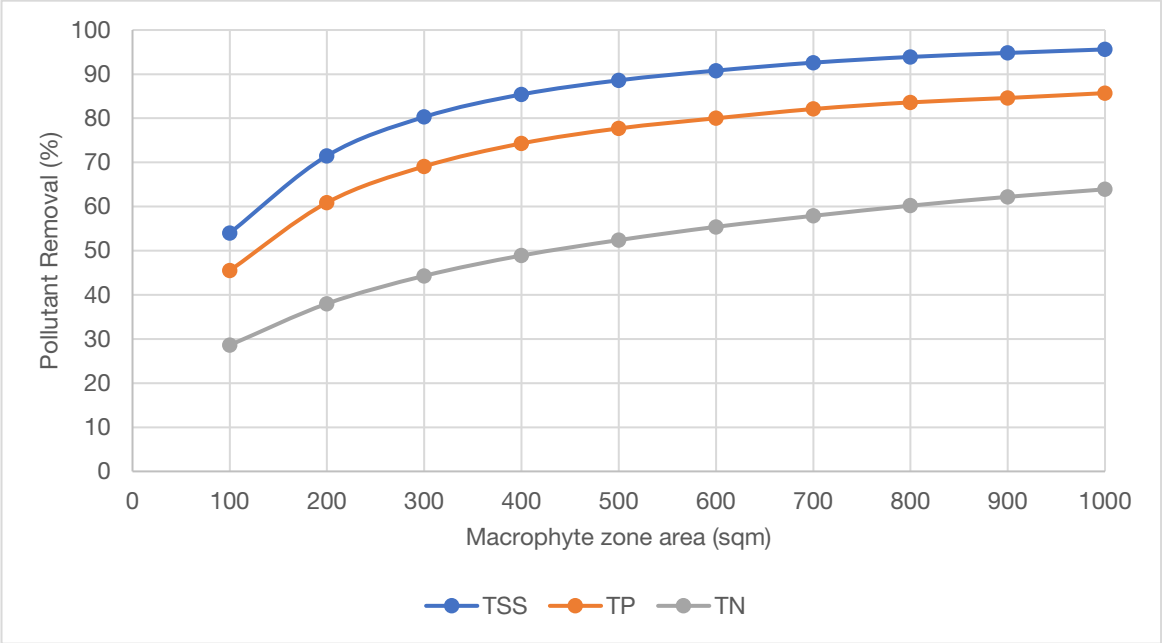


Figure 2: Water quality treatment train results for different wetland areas

Note that a wetland with a 300m^2 macrophyte zone would meet the targets for TN (45%) and TP (60%). A larger wetland is required to meet the TSS target (90%). It may be possible to refine the stormwater treatment train design to provide improved pre-treatment for suspended solids (e.g. in swales) and reduce the size of the wetland.

1.4 CONCLUSION AND RECOMMENDATIONS

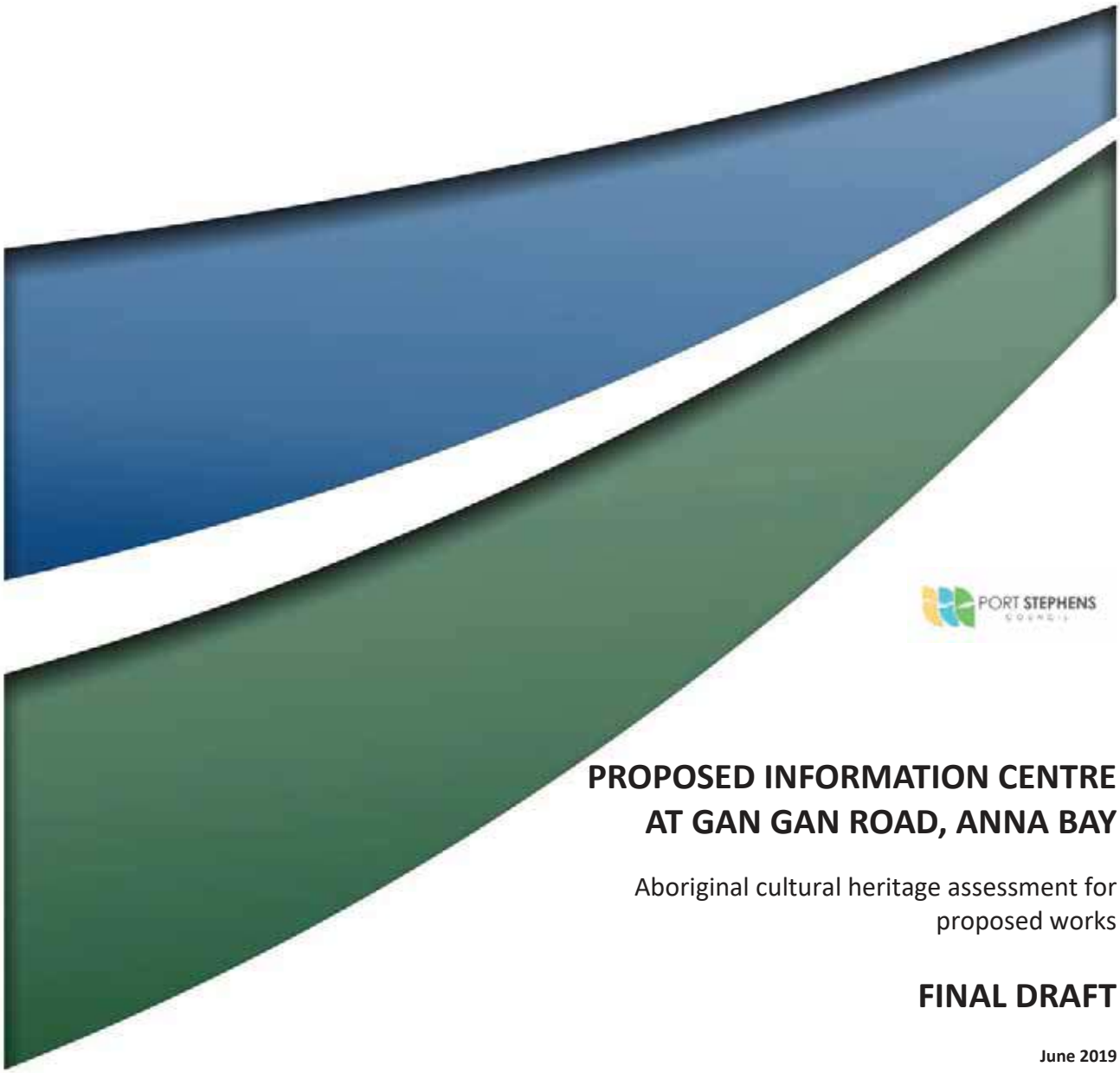
This addendum recommends a slightly larger wetland area to be included in the updated design of the Birubi Point Information Centre to meet Port Stephens Council's water quality targets. The wetland should include a 120m^3 inlet pond and 600m^2 macrophyte zone. The other recommendations in the original water management strategy remain the same.

The updated treatment train is expected to achieve the following pollutant load reductions (in terms of mean annual loads):

- 91% of TSS
- 80% of TP
- 55% of TN
- 100% of gross pollutants

Note that a conveyance swale is proposed along the new hardscape area and this is described in a separate stormwater drainage report.

umwelt
Environmental & Social Consultants



PORT STEPHENS COUNCIL

PROPOSED INFORMATION CENTRE AT GAN GAN ROAD, ANNA BAY

Aboriginal cultural heritage assessment for proposed works

FINAL DRAFT

June 2019

PROPOSED INFORMATION CENTRE AT GAN GAN ROAD, ANNA BAY

Aboriginal cultural heritage assessment for proposed works

FINAL DRAFT

Prepared by
Umwelt (Australia) Pty Limited
on behalf of
Port Stephens Council

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Report No.	4961/R01/V4
Date:	June 2019

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Document Status

Rev No.	Reviewer		Approved for Issue	
	Name	Date	Name	Date
V0_1	Nicola Roche	8 January 2019	Pam Dean-Jones	9 January 2019
V1	Pam Dean-Jones	14 January 2019	Naomi Buchhorn	14 January 2019
V2	Nicola Roche	13 February 2019	Pam Dean-Jones	13 February 2019
V3	Nicola Roche	31 May 2019	Pam Dean-Jones	31 May 2019
V4	Nicola Roche	3 June 2019	Pam Dean-Jones	3 June 2019

Acknowledgement

Umwelt (Australia) Pty Ltd and Port Stephens Council would like to acknowledge the Worimi people who are the traditional custodians of the Port Stephens area and pay respect to their cultural heritage, beliefs and continuing relationship with the land.

We pay our respect to the Elders – past, present and future – for they hold the knowledge, traditions, culture and hopes of the Aboriginal people of the area.

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Figures

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Appendices

1.0 Introduction

Port Stephens Council is proposing the construction of a new tourist information centre located at Lot 312 DP753024 and Lot 32 DP1146884 on the corner of Gan Gan Road and James Paterson Road in Anna Bay (refer to **Figure 1.1**). Port Stephens Council is the proponent for the project and the development application will be determined by the Joint Regional Planning Panel.

The information centre is located on land currently zoned RU2 (rural landscape) under the Port Stephens Local Environmental Plan. Lot 312 is Crown land that was gazetted for the purposes of control of sand drift and recreational use.

Birubi Point Aboriginal Place and the Worimi Conservation Lands on Stockton Bight adjoin the proposed information centre site. The entire area is recognised as having high cultural and archaeological significance for Worimi people and multiple Aboriginal sites have been previously identified in the vicinity.

Port Stephens Council have engaged Umwelt to prepare an Aboriginal cultural heritage assessment for the proposed information centre.

This Aboriginal Cultural Heritage Assessment Report (ACHAR) provides an assessment of Aboriginal cultural heritage impacts associated with the development of the proposed information centre.

The focus of the report is the:

- potential for the proposed works to impact on archaeological materials associated with the use of the land by Worimi people and protected by the *National Parks and Wildlife Act 1974* (NPW Act)

- potential impact on the Worimi cultural heritage values of the proposed information centre area, particularly with relevance to the values associated with the adjacent Worimi Conservation Lands and the Birubi Point Aboriginal Place.

This ACHAR has been prepared in accordance with the *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW* (OEH, 2011) and has been prepared in consultation with registered Aboriginal parties in accordance with the requirements of the relevant legislation and codes of practice, including the *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (DECCW, 2010a). The ACHAR incorporates required archaeological technical information in accordance with the *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW, 2010b) (the Code of Practice).

FIGURE 1.1

Locality Plan

Image Source: Nearmap (Sept 2018) Data source: Umwelt (2018); Port Stephens Council (2018); NSW OEH AHIMS (2018)

1.1 Project description

1.1.1 Project background

The Master Plan and Management Plan for Birubi Point Aboriginal Place (Umwelt 2018) identified the need to upgrade parking facilities to reduce parking and traffic congestion which currently affect the visitors' experience and place pressure on archaeological, cultural and ecological values. The Master Plan and Management Plan also identified the current site as a potential location for developing a new information centre as part of a package of actions to showcase the natural, cultural and scenic values of the area and to bring visitors into the main areas of interest via a new and less compromised route.

1.1.2 Project purpose

The proposed construction of the information centre in Anna Bay is important new infrastructure to support tourism in Port Stephens. It will provide facilities to accommodate the thousands of visitors attracted to the beach, headland and activities on the sand dunes in the Worimi Conservation Lands (WCL). The current infrastructure is not sufficient to cope with the growing demand and currently has a negative impact on the environmental, cultural and social values of the area as well as on visitor experience.

The purpose is to help to accommodate the growing demand for both international and domestic tourism activities within the Worimi Conservation Lands (WCL) and Birubi Point. The new facility will also become the northern gateway to the WCL. The new facility will:

- help to relieve traffic and parking congestion on Birubi Headland and the 'lower carpark' area, by reducing the number of buses (and other vehicles) that travel on the narrow headland road to drop off visitors
- reduce pressure on the cultural and ecological values of the Aboriginal Place, for instance due to illegal parking
- improve pedestrian safety in the carpark areas on the headland
- improve amenity for local residents who have been impacted by the growing popularity of the area for visitors
- improve visitor experience within the Aboriginal Place by returning visitor focus to the landscape and its cultural values
- provide information to introduce visitors to the cultural values and the opportunities available in the Conservation Lands and at Birubi Point
- streamline the transfer of passengers from buses and private vehicles to four wheel drive buses suitable for sand dune tours
- provide a more direct route for sand dune tour operators onto the high dunes and the beach (via Anna Bay entrance to Conservation Lands)

By organising tourist transport at the information centre, operators will be able to be take visitors directly to the high mobile dunes and avoid the lower carpark and headland carparks.

1.1.3 Project components

The immediate context and concept plan for the proposed information centre on the corner of Gan Gan Road and Paterson Road in Anna Bay is shown in **Figure 1.2**.

The proposed tourist information centre will provide parking for cars and buses, public toilets, kiosk, footpaths and a landscaped area including signage acknowledging the entrance to the WCL (refer to **Figure 1.2**).

The potential disturbance footprint for the proposed development is shown in **Figure 1.3**. The proposed works for the development of the information centre include:

- site levelling, which will include removal of sand which will be moved and stored off site
- installation of sediment fence along the lot boundary immediately adjacent to the visitor centre. This area will also be planted with native species. In combination the fence and vegetation will provide a buffer from strong westerly winds and sand drift for the new facility and will create an area of native landscaped vegetation
- paving of high use areas using a permeable paving
- access from Gan Gan Road along the existing beach access track, with three access points included, as shown in **Figure 1.2**
- 1500 m^2 of buildings
- 54 car spaces, which include three disabled spaces
- 8 coach spaces and space for a 2 coach drop off zone
- facilities for pedestrians and cyclists
- landscaping using native species
- educational signage
- construction of amenities (toilets)
- construction of a kiosk
- upgrading drainage facilities through the use of swales and buried pipes
- installation of services including electricity, water and supporting infrastructure
- sand dune stabilisation works along the western boundary of the project area (bordering the existing 4WD beach access).

Construction is proposed to take place over 16 to 18 weeks. Features of the design and construction of the facility include:

- prior to construction, a geotechnical assessment will be prepared. This will involve a drill rig and potentially excavation of shallow pits (see **Section 8** for discussion of permit requirements for geotechnical testing, noting that an application for an AHIP for geotechnical testing has been lodged with OEH)

- planted wetland areas (native macrophyte species) will be created along existing lines of natural drainage

- the sediment fence will be woven geotextile material, attached to wooden posts; native species will be planted downwind of the fence

- roadways and parking bays will be formed of permeable paving with a plastic capping layer for the main trafficable areas. Areas for coach parking, private vehicle parking and 4WD operators will be compacted road base

- buildings for tour operators will be set on hardwood decking supported by pre cast concrete. Buildings will be clad with hardwood timber battens on RC sheeting. The roof of the information centre will be polycarbonate sheets

- the first stage of construction includes bringing sheds and fencing onto the site, installation of sediment and erosion controls and removal of a number of trees and vegetation (including bitou)

- the site will be excavated to achieve the required floor level. The design of this work is intended to minimise the amount of excavation and reshaping required. Excavated material generally will be stockpiled on site for future reuse (with appropriate wind erosion controls), but some excess material, not suitable for reuse, may be removed by truck

- after site preparation, the drainage structures, car-parking, roads and buildings will be constructed.

1.2 Objectives of this assessment

The objective of this assessment is to ensure that the Aboriginal archaeological and cultural heritage values of the site of the proposed information centre are appropriately assessed with reference to the approach specified in the *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW*, the consultation requirements and with the *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales*.

Aboriginal people are the primary determinants of the cultural significance of their heritage. This ACHAR is prepared to ensure that the information provided by registered Aboriginal parties is documented and presented in a manner that informs decision making on the management of Aboriginal cultural heritage within the proposed information centre area, while ensuring that the required archaeological information is also appropriately documented.

Within this process and compliance framework, the objective of the assessment is to provide information to Port Stephens Council which will assist them to locate, design, develop and operate the proposed information centre within an archaeologically important and culturally significant landscape, in collaboration with the Worimi people, on whose country the site is located.

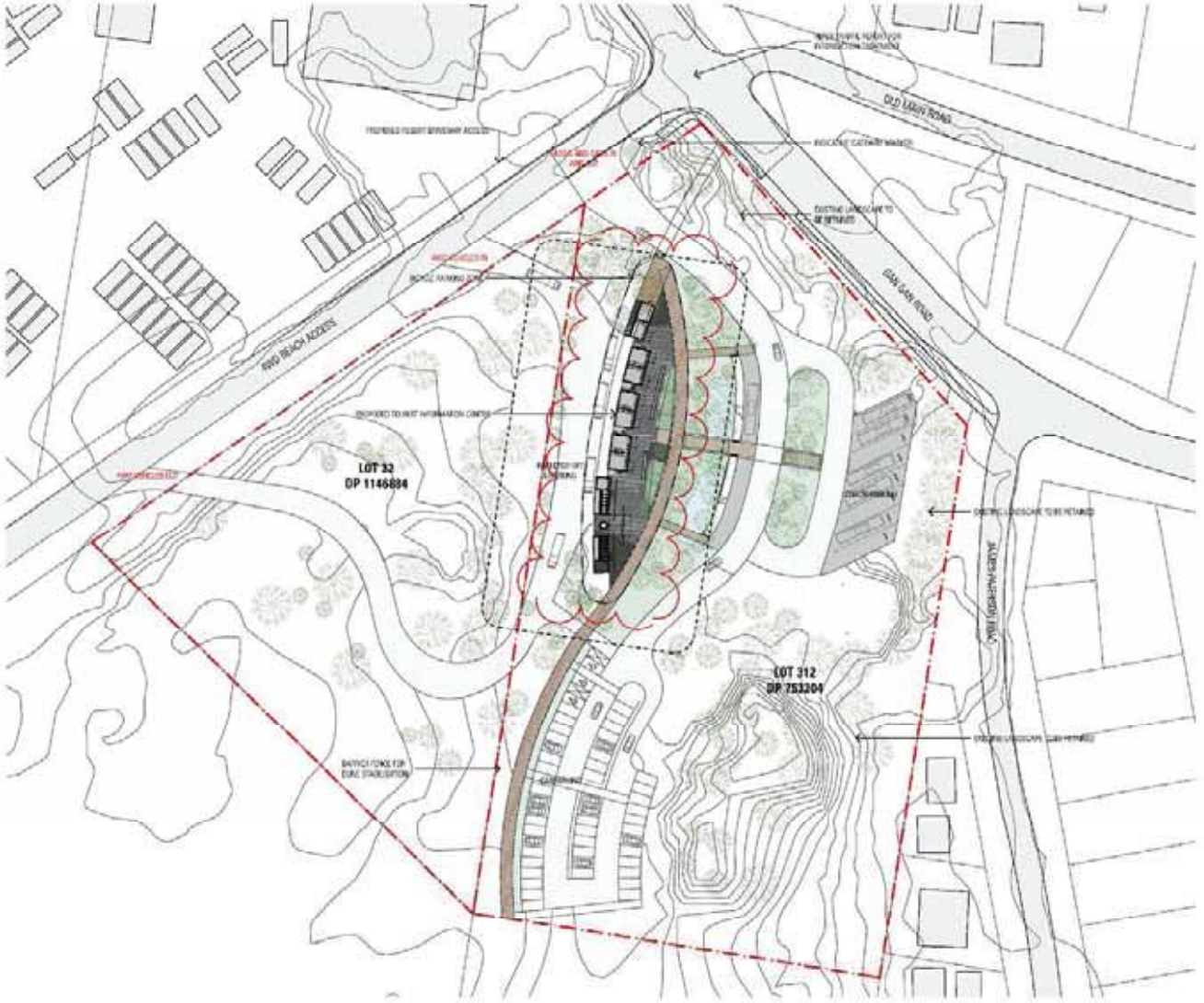

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FIGURE 1.2

Proposed Information Centre
Layout and Design

Image Source: Royal Haskoning DHB (2018, Birubi Information Centre Statement of Environmental Effects)

Legend

- Proposed Information Centre Site
- Potential Disturbance Area

FIGURE 1.3

Subject Site and Potential Areas of Impact

Image Source: Nearmap (Sept2018) Data source: NSW LPI DCDB

1.3 Project team and report authors

All Aboriginal cultural input for this report has been provided by the registered Aboriginal parties and their representatives, through the consultation process outlined in **Section 2**. This input builds on consultation about the cultural values of Birubi Point Aboriginal Place (which is adjacent to the proposed information centre area) which has been ongoing for more than a decade.

Pam Dean-Jones (Principal, Communities and Landscapes) compiled this ACHAR. Nicola Roche (Manager, Cultural Heritage) reviewed the report, with a focus on the archaeological content. Nicola and Pam were assisted by Amanda Crick (Umwelt Archaeologist). Drafting input was provided by Umwelt's drafting team.

Steve Bernasconi (Community Services Section Manager) was Port Stephens Council's project manager and provided information about the design and scope of the project.

1.4 Statutory context

The Office of Environment and Heritage (OEH) is responsible for regulating the management of Aboriginal cultural heritage in New South Wales under the NPW Act. The NPW Act is accompanied by the:

- National Parks and Wildlife Regulation 2009 (the Regulation)
- *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW* (Office of Environment and Heritage 2011)
- *Aboriginal cultural heritage consultation requirements for proponents* (Department of Environment, (DECCW 2010a) (ACHCRs)
- *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW 2010b)
- *Declared Aboriginal Places – Guidelines for developing Management Plans* (Office of Environment and Heritage 2017)
- other industry-specific codes and guides.

1.4.1 Aboriginal Place

The proposed development is situated immediately adjacent to Birubi Point Aboriginal Place and shares a boundary with it (**Figure 1.1**). This is important context for assessing the archaeological and cultural values of the site of the information centre.

Birubi Point Aboriginal Place, an area of approximately 56 hectares (ha) of coastal land at Anna Bay, was gazetted under Section 84 of the NPW Act by the Minister for the Environment in 2007. Section 86(4) of the NPW Act states that a person must not harm or desecrate an Aboriginal Place.

An Aboriginal Place is declared by the Minister as a place that, in the opinion of the Minister, is or was of special significance with respect to Aboriginal culture. Documentation of the Aboriginal cultural heritage values of the Birubi Point area, as known at the time of the nomination of Birubi Point as an Aboriginal Place, was prepared by Umwelt (2007) in consultation with Worimi traditional owners.

Port Stephens Council prepared and adopted a management plan for the Aboriginal Place in 2016-2018, in close consultation with Worimi people. The proposed works for the information centre were outlined in the management plan (Umwelt 2018).

1.4.2 Protection of objects

The NPW Act defines an Aboriginal object as:

> ..any deposit, object or material evidence (not being a handicraft made for sale) relating to the Aboriginal habitation of the area that comprises New South Wales.

In accordance with Section 86(1) of the NPW Act, it is an offence to harm or desecrate a known Aboriginal object, whilst it is also an offence to harm an Aboriginal object under Section 86(2). Harm to an object or place is defined as any act or omission that:

a) destroys, defaces or damages an object or place, or

b) in relation to an object – moves the object from the land on which it had been situated, or

c) is specified by the regulations, or

d) causes or permits the object or place to be harmed in a manner referred to in paragraph (a), (b) or (c),

but does not include any act or omission that:

e) desecrates the object or place (noting that desecration constitutes an offence separate to harm), or

f) is trivial or negligible, or

g) is excluded from this definition by the regulations

Section 87(1) of the NPW Act specifies that it is a defence to prosecution under Section 86(1) and Section 86(2) if the harm or desecration of an Aboriginal object was authorised by an Aboriginal Heritage Impact Permit (AHIP) and the activities were carried out in accordance with that AHIP.

The Regulation identifies that compliance with the Code of Practice for the Archaeological Investigation of Aboriginal Objects in New South Wales (DECCW 2010b) is excluded from the definition of harm. This includes provision for the completion of test excavations without the requirement to obtain an AHIP. However, the Code of Practice specifies that test excavations are not excluded from the definition of harm if undertaken at locations within 50 metres of a declared Aboriginal Place or in or within 50 metres of a shell midden. An Aboriginal Heritage Impact Permit (AHIP) is required prior to any archaeological testing or excavation for the purpose of works in these situations.

1.5 Key cultural heritage issues and risks addressed in this assessment

The site of the proposed information centre lies within an area known:

- to have provided diverse resources for Aboriginal people
- to contain abundant and diverse evidence of the lives and resource use of Worimi people
- to have been affected by significant landscape change, particularly the effects of aeolian processes which have created highly mobile coastal dune topography, with deflation and depositional areas
- to have been disturbed by a variety of former land-uses including agriculture, vehicle access and defence activities.

Details about the landscape processes and characteristics of the information centre site are provided in **Section 3** and information about the evidence of Aboriginal use of the land is provided in **Section 4**.

Within this context, the key cultural heritage issues for the project include:

- understanding the distribution of Aboriginal cultural objects (i.e. stone artefacts and shell) and the potential for burials within the proposed site of the information centre, in an area where the current ground surface is rapidly changing and is not the surface occupied by Aboriginal people. Only small sections of the natural pre European ground surface are exposed within the proposed information centre area, which is mantled by mobile sand. It is necessary to understand both the lateral extent of any occupation evidence and the depth of cover over the former ground surface.

- understanding the archaeological significance of remnants of formerly more extensive and more intact archaeological deposits

- making sure that the design of the information centre reflects the cultural significance of the place to Worimi people and is consistent with the objectives and priorities of the Birubi Point Aboriginal Place Management Plan (given the proximity of the Aboriginal Place and the management links between the two tenures)

- protecting the cultural values of the place for Worimi people

- making sure that people who visit the proposed information centre have access to information about why it is important to Worimi people

- ensuring that Worimi and other Aboriginal people have a say in the design and assessment of the proposed information centre.

- ensuring that the design and construction process is at all times consistent with the requirements of the NPW Act, Code and Guidelines.

1.6 Report Structure

This report addresses the issues outlined above.

Table 1.1 summarises the required components of an ACHAR and refers to the section of this document in which they are addressed.

Table 1.1 Required components of the assessment

Required Information (Aboriginal archaeological and cultural heritage assessment)	Relevant Section
Introduction	1.0
Statutory requirements	1.4
Report authors	1.3
Description of the project	1.1
Consultation process	2.0
Environmental context	3.0
Previous archaeological work and regional character	4.0
Predicted archaeological sensitivity	4.3
Sampling strategy and field methods	5.0
Results and discussion	6.0
Scientific values and significance assessment	7.0
Cultural heritage values and statement of significance	7.1
Impact assessment – risk of harm	8.0
Measures to avoid and/or mitigate harm	9.0
References	10.0

2.0 Aboriginal party consultation

Port Stephens Council has conducted Aboriginal Party Consultation for this assessment in accordance with the OEH guidelines for preparation of Aboriginal cultural heritage assessments.

Prior to commencing this project, Port Stephens Council engaged with members of the Worimi community about protection of cultural values, a strategic approach to managing visitor demand, and the opportunities for Worimi people in future management and business at Birubi Point (**Section 2.1**).

2.1 Birubi Point Cultural Heritage Advisory Panel

The Birubi Point Cultural Heritage Advisory Panel was formed to advise Port Stephens Council on the management plan for the Birubi Point Aboriginal Place.

Panel members include representatives of:

- Worimi Local Aboriginal Land Council
- Worimi conservation Lands Board of Management
- Registered Aboriginal Traditional Owners of Worimi Conservation Lands
- Port Stephens Council (councillors and staff)
- NSW National Parks and Wildlife Service
- NSW Department of Industry – Land and Water (formerly Crown Lands)
- Birubi Point Surf Life Saving Club
- Anna Bay community.

The Panel met several times during the preparation of the Management Plan for the Birubi Point Aboriginal Place and the final Management Plan has their approval. All members of the Panel contributed their knowledge to the preparation of the Aboriginal Place Management Plan, and provided invaluable advice and awareness of the cultural heritage and archaeological values of the Place, the management history, current use and management issues and options to protect the cultural heritage of the Place while facilitating respectful recreational and tourism uses.

The Aboriginal Place Management Plan guides the protection, stewardship, use and development of Birubi Point Aboriginal Place, in accordance with its value to the Worimi people and the requirements of the *National Parks and Wildlife Act 1979*.

The Worimi traditional owners welcome people to visit the Birubi Point Aboriginal Place and to join with them in looking after Worimi country.

During the process of the development of the Master Plan and Management Plan for Birubi Point Aboriginal Place, information relevant to the assessment of the Aboriginal cultural heritage values within the proposed information centre area was provided by all representatives of the registered Aboriginal parties who have subsequently participated in this assessment.

2.2 Consultation in accordance with ACHCRs

The consultation process is shown in **Figure 2.1** and documented in **Table 2.1** and **Appendix 1**, with reference to the four consultation stages specified in the *Aboriginal cultural heritage consultation requirements for proponents* (DECCW 2010).

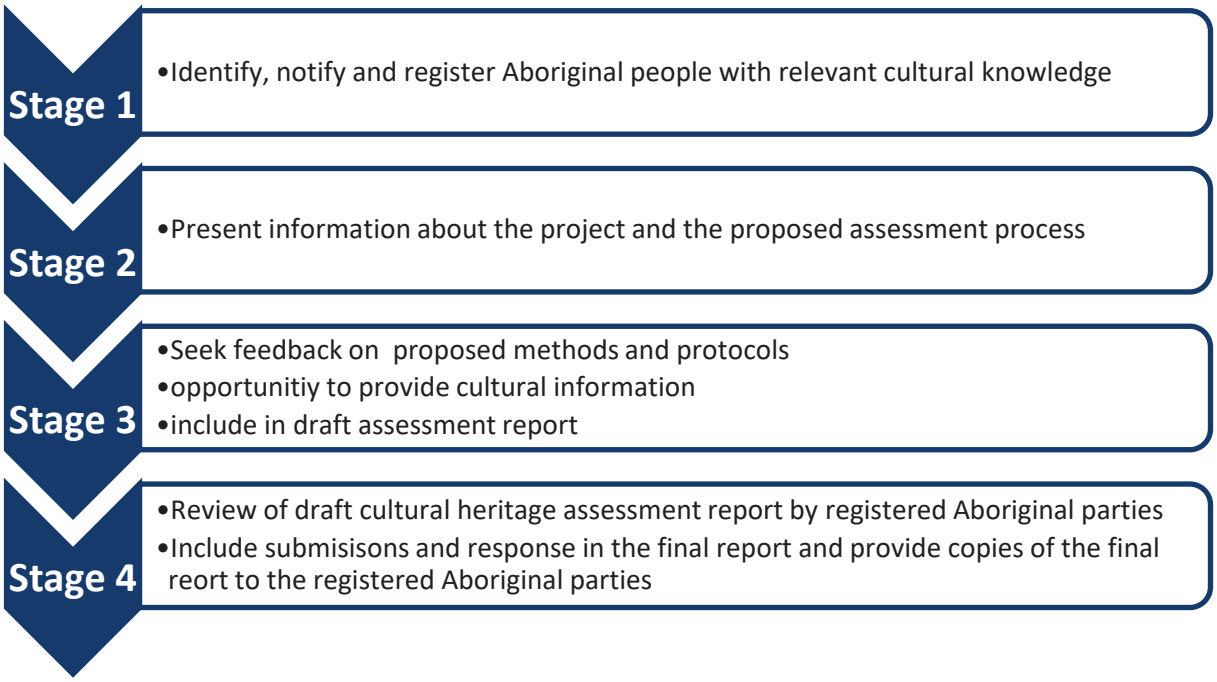


Figure 2.1 Stages in the consultation process

Details about the implementation of each of these stages are provided in the following sections.

2.2.1 Stage 1 – Notification and registration

Port Stephens Council wrote to the following organisations seeking advice on the names of Aboriginal people who may have an interest in the proposed information centre area:

- OEH
- Worimi Local Aboriginal Land Council
- Karuah Local Aboriginal Land Council
- The Registrar, *Aboriginal Land Rights Act*
- The National Native Title Tribunal
- Native Title Services Corporation (NTS Corp)
- Local Land Services

Copies of this correspondence are included in **Appendix 1**.

Port Stephens Council also placed a notification in the Port Stephens Examiner newspaper about the proposed project and an invitation to Aboriginal people who hold knowledge about the proposed information centre area, relevant to determining the cultural significance of objects, to register their interest in consultation about the project. A copy of the advertisement is included in **Appendix 1**.

It is noted that the proposed information centre area is adjacent to the Birubi Point Aboriginal Place and there has been ongoing consultation about management (as discussed in **Section 2.1**).

Table 2.1 provides a summary of the dates when Stage 1 consultation activities were conducted. Copies of all relevant correspondence are included in **Appendix 1**.

As a result of the project notification and registration process, thirteen parties registered an interest in ongoing consultation regarding the project during the specified timeframe. These parties are listed below and further information about the relevant contact people for each group is in **Table 2.1** and **Table 2.2**.

Registered Aboriginal parties

- Carol Ridgeway-Bissett
- Didge Ngunawal Clan
- Divine Diggers Aboriginal Cultural Consultants
- Karuah Indigenous Corporation
- Lower Hunter Wonnarua Cultural Services
- Murra Bidgee Mullangari Aboriginal Corporation
- Mur-Roo-Ma Inc
- Nur-Run-Gee Pty Ltd
- Steve Talbott
- Widescope Indigenous Group
- Worimi Local Aboriginal Land Council
- Worimi Traditional Owners Indigenous Corporation
- National Parks and Wildlife Services/Worimi Conservation Land Board of Management.

Council also consulted with OEH to confirm that it would be appropriate for the same registered Aboriginal parties to be consulted about proposed works in Robinson Reserve, which is within the Birubi Point Aboriginal Place. The proposals have similar time frames. OEH confirmed in writing that the same group of registered Aboriginal parties would be appropriate and the two assessments have been prepared concurrently.

Port Stephens Council advised that both projects would also be overseen by the Birubi Point Cultural Heritage Advisory Panel which includes majority Aboriginal membership from Registered Traditional Owners of WCL, WCL Board of Management, Worimi LALC and Worimi Elders.

Table 2.1 Summary of Stage 1 consultation activities

Date	Purpose	Contacted	Method
13 June 2018	Notification to organisations, seeking names and contact information for Aboriginal persons with an interest in the proposed information centre area	• Worimi Aboriginal Land Council • Karuah Local Aboriginal Land Council • Officer of the Registrar – Aboriginal Land Rights • National Native Title Tribunal • Native Title Services Corporation • Hunter Local Land Services • OEH	Email
14 June 2018	Public notification and request/invitation to Aboriginal people to register interest	General public	Newspaper advertisement in Port Stephens Examiner
14 June 2018	Notification to Aboriginal persons/organisations to register interest	• AGA Services • Cacatua Culture Consultants • Divine Diggers Aboriginal Cultural Consultants • Hunters & Collectors • Karuah Indigenous Corporation • Kawul Pty Ltd • Lakkari NTCG • Lower Hunter Aboriginal Incorporated • Lower Hunter Wonarua Cultural Services • Murra Bidgee Mullangari Aboriginal Corporation • Mur-Roo-Ma Inc • Nur-Run-Gee Pty Ltd • Wattaka Wonnarua CC Service • Widescope Indigenous Group • Worimi Traditional Owners Indigenous Corporation (Debbie Dates) • Steve Talbott • Didge Ngunawal Clan	By registered post and email (contact information provided by OEH)

Date	Purpose	Contacted	Method
22 June 2018	Notification to Aboriginal persons to register interest	• Birubi Point Aboriginal Place Cultural Heritage Advisory Panel	Email
29 June 2018	Seeking permission to forward contact information to OEH and WLALC	• Nur-Run-Gee Pty Ltd (Leonard Anderson, Chris Collison or Caitlin Moran) • Worimi Traditional Owners Indigenous Corporation (Debbie Dates) • Didge Ngunawal Clan (Paul Boyd and Lilly Carroll) • Worimi Local Aboriginal Land Council (Jamie Merrick) • Widescope Indigenous Group (Steven Hickey) • Murra Bidgee Mullangari Aboriginal Corporation (Ryan Johnson) • Lower Hunter Wonnarua Cultural Services (Tom Miller) • Mur-Roo-Ma Inc (Bec Young, Anthony Anderson, Candice O'Loughlin) • Steven Talbott • National Parks & Wildlife Services and Worimi Conservation lands Board of Management (Graeme Russell, Jamie Tarrant, Nadine Russell) • Karuah Indigenous Corporation (David Feeney or David Kirk) • Deidre Perkins	Email
2 July 2018	Confirming contact information and seeking interest in participating.	Carol Ridgeway-Bissett	Phone. Confirmed interest and approved forwarding information to OEH and WLALC. Future correspondence to occur through post.
2 July 2018	Confirming contact information and seeking interest in participating.	Roger Matthews Consultancy	Phone. Not interested in participating.
6 July 2018	Registering interest.	Mr Graeme Russell (NPWS)	Contacted via phone to register interest on behalf of the Board of Management.

Date	Purpose	Contacted	Method
10 July 2018	Notify OEH and WLALC of registered Aboriginal persons' details.	OEH Worimi LALC	Via email.
16 July 2018	Updated consultation register sent to OEH and WLALC to include David Feeney	OEH Worimi LALC	Via email.

2.2.2 Stages 2 and 3 – presenting information and gathering information about cultural significance

Council wrote to all registered Aboriginal parties on the project, providing information about the proposed project and seeking to gather information about cultural significance.

This correspondence included a proposed methodology for the cultural heritage assessment process. Council requested input from the Aboriginal parties in relation to the cultural values of the assessment areas and the way in which the assessment should document these values and provide a framework for their management.

A summary of the dates of correspondence in this stage is provided in **Table 2.2** and copies of correspondence are in **Appendix 1**.

Three registered Aboriginal parties confirmed receipt of the information provided. No comments were received about the proposed method of the assessment.

Table 2.2 Consultation communication, Stage 2

Date	Action	Recipient	Method
20 July 2018	Project information forwarded to registered stakeholders.	• Nur-Run-Gee Pty Ltd (Leonard Anderson, Chris Collison or Caitlin Moran) • Worimi Traditional Owners Indigenous Corporation (Debbie Dates) • Didge Ngunawal Clan (Paul Boyd and Lilly Carroll) • Worimi Local Aboriginal Land Council (Jamie Merrick) • Widescope Indigenous Group (Steven Hickey) • Murra Bidgee Mullangari Aboriginal Corporation (Ryan Johnson) • Lower Hunter Wonnarua Cultural Services (Tom Miller) • Mur-Roo-Ma Inc (Bec Young, Anthony Anderson, Candice O'Loughlin) • Carol Ridgeway-Bissett	Via email. Via registered post (Carol Ridgeway-Bissett).

Date	Action	Recipient	Method
		• Steven Talbott • National Parks & Wildlife Services and Worimi Conservation lands Board of Management (Graeme Russell, Jamie Tarrant, Nadine Russell) • Karuah Indigenous Corporation (David Feeney)	
26 July 2018	Confirmed receipt of information	Mur-Roo-Ma Inc	Via email.
26 July 2018	Confirmation of involvement in proposed site discussions.	Nur-Run-Gee Pty Ltd	Via email.
9 August 2018	Confirmed receipt of information	Murra Bidgee Mullangari	Via email.

2.2.3 Stages 2 and 3 – survey

An invitation to submit an Expression of Interest for commercial engagement to undertake a survey of the proposed information centre area to assist in identifying any areas of cultural value was provided to all of the registered Aboriginal parties on 2 October 2018. Completed Expressions of Interest were submitted by five registered Aboriginal parties, plus NPWS/Worimi Conservation Lands Board of Management. A total of six parties therefore participated in the survey of the assessment area on 1 November 2018.

Survey participants, identified through the Expressions of Interest process, are listed below in **Table 2.3.**

Table 2.3 Aboriginal party representatives who participated in survey

Date	Organisation	Name
1/11/18	Worimi LALC	Brendan Lilley Jamie Merrick
	Worimi Conservation Lands Board of Management/OEH/NPWS	Jamie Tarrant Graeme Russell
	Karuah Indigenous Corporation	David Feeney
	Nur-Run-Gee	Raymond Feeney
	Mur-Roo-Ma	Candice O'Loughlin
	Worimi TOIC	Luke Night

The field inspection was also attended by Port Stephens Council project manager and drainage engineer, an OEH archaeologist and two archaeologists from Umwelt.

Details about observations and discussion during the site inspection are provided in **Section 6** and **Section 7** of this report.

2.2.4 Stage 4 – review of draft cultural heritage assessment report

The recommendations included in this draft report were discussed with Aboriginal party representatives during the surveys. At the time of the survey, the Aboriginal party participants reinforced the cultural values of the area, as discussed in the Birubi Point Aboriginal Place Management Plan. Information and comments provided during the field survey is in **Section 6** and **7**.

The draft report was provided to the Registered Aboriginal Parties on 14 January 2019 with an invitation to review and comment. A reminder email, inviting comments on the draft ACHAA was sent to all registered Aboriginal parties on Thursday 7 February 2019.

All comments received are documented in full in **Appendix 1** and summarised below.

Comments on the draft ACHAA and the consultation process to date were received from five registered Aboriginal parties:

- Mur-Roo-ma (Anthony Anderson and Bec Young)
- Karuah Indigenous Corporation (David Feeney)
- Divine Diggers Aboriginal Cultural Consultants (Deidre Perkins)
- Didge Ngunawal Clan (Paul Boyd and Lilly Carroll)
- Worimi Local Aboriginal Land Council (Andrew Smith and Jamie Merrick)

The registered Aboriginal parties have advised the following:

- They are satisfied with the consultation that has occurred so far for this project and that the record of cultural values in the draft report reflects what was discussed during the site inspection
- They intend to be in continued contact about the proposed works and to continue to provide input on the cultural values of Birubi Point
- They agree with the proposed actions and draft methodology for further investigation of the Aboriginal archaeology of the reserve area.

The registered Aboriginal parties raised no objections to the ACHAA and proposed process of further assessment.

During the process outlined above, it was noted that Port Stephens Council did not have ownership of Lot 32 DP1146884 but this area was included within the survey process due to the potential for its subsequent inclusion with the information centre area. Following the completion of the original ACHAR, Port Stephens Council acquired this lot and the ACHAR was revised to include Lot 32.

*The revised final draft ACHAR was provided to the Registered Aboriginal parties on 3rd June 2019 for review and comment, with all comments to be provided by 1 July 2019. All comments received will be documented in full in **Appendix 1** and will be summarised below in the finalised document.*

3.0 Environmental context

This section provides a summary of key environmental information for the site of the proposed information centre; and discusses the implications of this information for the archaeological evaluation of the proposed information centre area.

The environmental context of land use and archaeological evidence has an important influence on:

- the resources available (such as fresh water), which may attract people to visit (e.g. seasonality of occupation)
- the types of materials available to be used for implements (e.g. shell, different types of stone, bone, plant species, fish, birds
- how long discarded objects remain on the surface and how exposed they are to weathering or other destructive environmental processes; how quickly they are protected by natural burial processes
- the complexity and extent of disturbance linked to subsequent land uses.

3.1 The development of the coastal landscape at the eastern end of Stockton Bight

3.1.1 Late Pleistocene and Holocene coastal geomorphology

Birubi Headland lies at the interface of the mobile dune landscape of Stockton Bight and the rocky coastline of the Tomaree Peninsula. It is the interface between these two landscapes which has contributed to the diversity of landforms, resources and places for many generations of Aboriginal life in the area.

Stockton Bight is a very large coastal barrier and dune system, incorporating depositional landforms of late Pleistocene and Holocene age (Inner and Outer barriers). The Outer or Holocene barrier, deposited within the last 7000 years, dominates the view to the west from Birubi Headland. This view is one of the most important features attracting visitors to the area.

The Outer Barrier includes remnants of the early Holocene accreting/prograding beach ridge plain and evidence of multiple periods of dune mobilisation and reworking during the Holocene, interspersed with periods of stable, vegetated dune landforms.

Geomorphic research at Stockton Bight has provided estimates of the ages of periods of dune mobility and stability. Periods of dune mobility commenced prior to 4500 years Before Present (BP), and also occurred from around 2300 years BP to approximately 1300 years BP and since about 500 years BP (Thom, Shepherd, Ly, Bowman and Hesp 1992).

The processes leading to destabilisation and stabilisation of the dunes during the Holocene are likely to include a combination of intermittent major storms, potentially in conjunction with small mid to late Holocene fluctuations in sea level. Processes that significantly increase or decrease the sand supply in the coastal sediment compartment (e.g. intermittent closing off sediment transport from south of Nobbys headland) could also be important, as could other factors such as drought or wildfire.

3.1.2 Landforms

The landform features of the eastern end of Stockton Bight, including the Birubi Point Aboriginal Place and the proposed information centre area, can be considered in three main categories:

- Exposed rocky headlands, sand mantled rocky headlands and nearshore reefs. These occur in the Aboriginal Place.
    - Porphyry rock outcrops, including low coastal headlands and dissected rock ramps. There are no shore platforms, but rock reefs are exposed in the nearshore area.
    - Porphyry rock landforms mantled by wind-blown sand. Birubi Headland (away from the cliff margin) is an example of this type of landform. A similar sand mantle occurs on Morna Point Headland, to the north east of Birubi Point headland. The mantling of the rock coast by wind-blown sand has occurred through several periods of dune deflation and deposition over the last 6000 years. Exposures in dune sand at Birubi Headland indicate an earlier phase of sand deposition, with some podsol soil development, overlain by more recent sand which has very limited soil profile development. Both sand deposition units continue over the headland and drape over its eastern slopes.
- Holocene and contemporary deflation basins and transgressive dunes, of varying periods of stability are the main feature of the proposed information centre area. They include:
    - Active mobile dune ridges of different forms, with seasonal changes to morphology linked to wind strength and direction. These dominate Stockton Bight and form the view south west from Birubi Headland. They have limited expression within the Aboriginal Place or the proposed information centre area, but are a key attractant for visitors.
    - The deflation basin, excavated by aeolian processes to the water table level extends along Stockton Bight, landward of the frontal dune system. Stringers of dune sand may extend across the deflation basin. In wet weather the deflation basin along Stockton Bight has accumulated extensive ponds of fresh water; although the standing water may also be saline because of waves overtopping of the frontal dune. The low lying area to the west of Birubi Headland, including the current lower carpark site and the portions of the proposed information centre area illustrate the deflation basin landform.
    - Former active transgressive dunes, subsequently vegetated with dune woodland. The interaction of beach processes with the process of windblown erosion, redeposition, stabilisation and revegetation of sand created multiple, dynamic landform features of relevance to Aboriginal occupation. Wetlands may occur in the swales between dunes, for instance linked to groundwater or perched groundwater tables as podsol soil profiles develop
        - At Birubi Point, a north south oriented transgressive dune mantles the bedrock, beach ridge and back barrier terrain. It is aligned roughly parallel with James Paterson Street and extends landward to the current proposed information centre area. Two periods of dune development can be identified from the exposed soil profiles. The A horizon of a soil profile developed on a gently undulating dune landscape, possibly the remnant of the beach ridge plain, can be seen in multiple exposures north of Birubi Headland, towards Gan Gan Road. Past archaeological reports (Dyall 1977, 2004) describe podsol soil profile features such as a bleached A2 horizon and orange stained B horizon. Remnants of dune woodland vegetation (such as banksia and eucalypt stumps) can be seen in the soil profile. This terrain has been disrupted by an advancing deflation basin and transgressive sand. This sand has formed a steep and high dune which still has active slip off slopes on its eastern face.

- The relationships of different periods of dune mobility along Stockton Bight and the layers of dune sand within the Birubi Point Aboriginal Place and adjoining areas such as the proposed information centre area have not yet been researched in detail. Based on the visible exposures along Stockton Bight and the Aboriginal Place, sand deposited in the period (approximately) 2500 BP to 1300 BP and sand deposited within the last century (with very limited soil profile development) are likely to be present.

- Recent frontal dune and beach landforms. An intact frontal dune protects landforms behind it, but when the frontal dune lowers or is breached, sea water intermittently overtops the dune and inundates the land behind. The frontal dune to the west of Birubi Headland (seaward of the lower carpark area) has been degraded, lowered and breached over the last decade. Wave overtopping of the frontal dune has allowed saltwater to penetrate into the deflation basin, but it does not reach as far inland is the proposed information centre area. The landward parts of the deflation basin may be inundated by freshwater during extended periods of wet weather.

The most important coastal processes continuing to shape the landscape within the Birubi Point Aboriginal Place and the proposed information centre area are beach erosion (by waves and currents), coastal recession (in the short term associated with sediment budget deficits, but in the longer term, due to sea level rise) and wind-blown transport of sand.

3.1.3 Specific features and geomorphic change in the north western part of the Aboriginal Place and the proposed information centre area

At the eastern end of Stockton Bight, close to Birubi Point, active mobile dunes continue to move landward, over woodland, wetland and development.

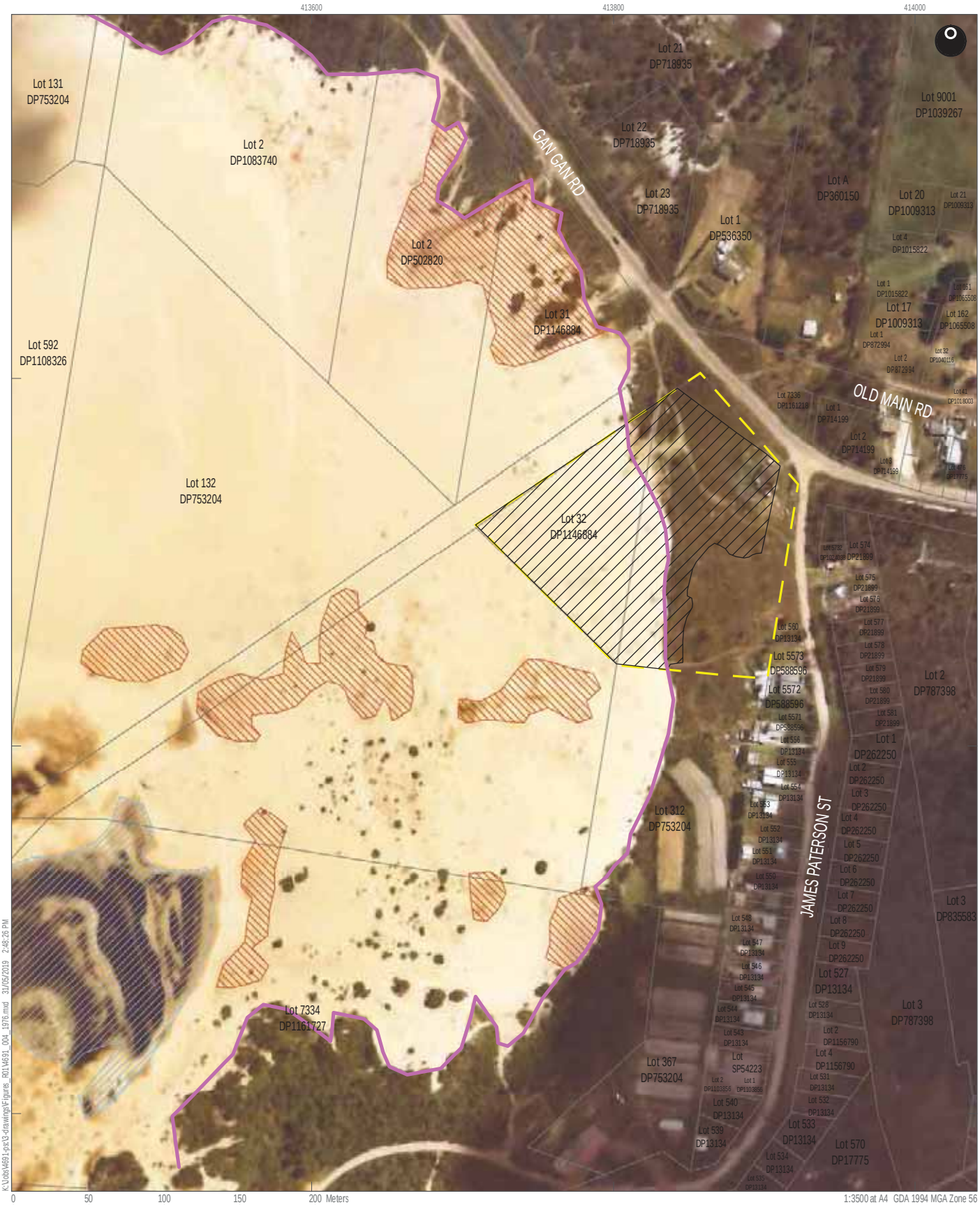
Within the Aboriginal Place, to the west of James Paterson St, these contemporary landforms are evident as:

- Heavily dissected frontal dune. At the south eastern end of Stockton Bight the frontal dune has become more fragmented and lower over the last two decades, as sand blows inland across the lower carpark area and the deflection basin. The low remnants of the frontal dune are overtopped by waves during storms and the carpark area is frequently buried by wind-blown sand.

- Partly stabilised and vegetated former mobile dunes, with high relief, noting that much of the vegetation is now invasive species rather than endemic dune woodland.

- Active mobile dunes with areas of loose sand, hummocky forms and exposures of former stable soil surfaces (with A1, A2 and sometimes B1 horizons exposed). The exposure of former ground surfaces (soil A1 horizon) indicate that prior to the current period of active dune transgression, the terrain in this area was gently undulating dune with woodland vegetation.

Figure 3.1 shows the extent of mobile sand surface west of James Paterson Street and south east of Gan Gan Road, in 1976. A large area of wet swale can be seen in the deflation basin, and areas of former soil profile A_1 and A_2 horizon can also be seen. The mobile dune at this time was actively moving across areas that had been cleared for farming. Houses associated with small rural holdings can be seen in the aerial photo.



Legend

Proposed Information Centre Site

Potential Disturbance Area

Name

1976 leading edge of transgressive sand mass

Name

1976 Wet Swale

1976 Old Soil Profile

FIGURE 3.1

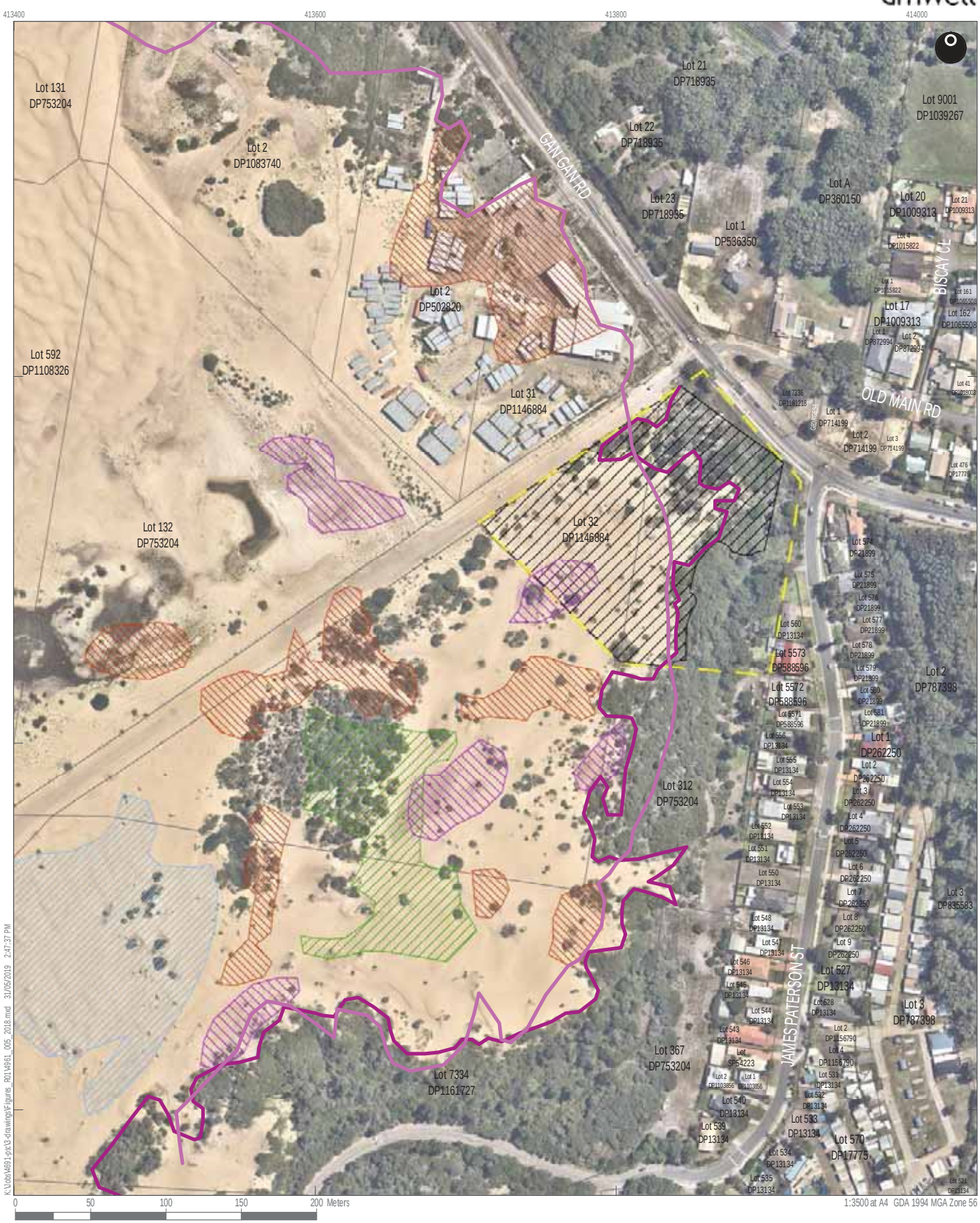
Site context and archaeological features from 1976

Image Source: OEH (1976) Data source: Umwelt (2018); Port Stephens Council (2018)

Figure 3.2 shows the area west of James Paterson Street in 2018. While the leading margin of mobile sand has moved a little further to the east, there has been significant revegetation since 1976, including growth of dune woodland and invasive species across former rural properties. Areas of shrubby vegetation (mostly bitou, with some coastal tea tree) have also colonised former bare sand. Areas where former soil profiles are exposed have changed, reflecting the dynamic nature of the sand surface.

Further evidence for the rate of change of the deflation basin and transgressive dunes at the Anna Bay/Birubi Point end of Stockton beach is presented in a research project using drone technology to collect digital terrain data over the period 2014 to 2017. This study (copy of the report is in **Appendix 2**) shows the ongoing movement of sand. In particular, the net loss of sand volume and ground surface elevation across much of the western part of the Aboriginal Place, including the frontal dune and deflation basin, is apparent. There is some net gain in sand volume close to the northern margin of the Aboriginal Place, adjacent to the boundary with the proposed information centre area.

The analysis presented in this research also shows the year on year variability in standing water in the deflation basin. In the past, this standing water has been fresh; however, with a low frontal dune which is overtopped by storm waves, the deflation basin may be inundated with salt water.



Legend

- Proposed Information Centre Site
- Potential Disturbance Area
- 2018 leading edge of transgressive sand mass
- 1976 leading edge of transgressive sand mass
- 1976 Wet Swale
- 1976 Old Soil Profile
- 2018 Old Soil Profile
- 2018 Dispersed Remnant Vegetation

FIGURE 3.2

Relationship of proposed works to archaeological features

Image Source: Data source:

3.2 Resource availability for Worimi people

The landscape around Birubi Point provided diverse and abundant resources for Worimi people. These are briefly described in the following sections.

3.2.1 Fresh water

Fresh water sources included:

- Fresh water ponding in the extensive deflation basin along Stockton Bight (extending west from the site of the proposed information centre) and potentially also behind Little Beach (located to the south of the proposed information centre area). This would have been an intermittent supply, dependent on rainfall.

- A wetland area (swale) landward of the main midden at Anna Bay. Freshwater in wetlands would have been relatively persistent.

- Small pools in the surface of bedrock headlands.

3.2.2 Terrestrial flora and fauna

Across the Worimi Conservation Lands generally, at least 190 plant species and nine vegetation communities have been mapped. Several of these would have been present on the dunes and headlands at Birubi Point, prior to clearing and development of the area.

The sand dune assemblages include grassland, heath, scrub, open forest, swamp forest and intermittent beach wetlands (freshwater wetlands). Although the vegetation communities, developed on relatively recent sand deposits, are not regarded as highly diverse (Bell and Driscoll 2010), they do include several endangered ecological communities and species listed as endangered at NSW and Commonwealth levels.

Prior to the most recent period of active dune transgression, Worimi people living at Birubi would have had access to foredune spinifex, banksia woodland, dune Blackbutt and Angophora forest, melaleuca/swamp mahogany and sedge forest, coastal tea tree and banksia scrub, beach wetlands and other freshwater wetlands. Each of these vegetation communities provides food species, medicines and materials (such as bark and twine), as well as providing habitat for animals that would also be food species.

The remaining vegetation of the proposed information centre area includes:

- Cheese tree/smooth barked apple/bangalay disturbed open forest. This community is heavily disturbed and is impacted by coral trees and bitou bush. This occurs in a narrow strip of land protected from strong westerly winds by the high dune at the end of Stockton Bight.

- Coastal sand scrub, occurring on the stabilised transgressive dune running north south from Birubi Headland to Gan Gan Road. Where old land surfaces are exposed across the information centre site and adjoining areas, stumps of former banksia woodland/sand scrub can be seen.

Both ecological communities are discontinuous and degraded; and the site also includes cleared areas, mobile dune sand and areas of invasive species such as bitou bush. Bitou often grows as clumps partially buried by mobile sand. Other parts of the site have been disturbed by previous agricultural and Defence uses, over the last century.

While these ecological communities are potential habitat for a number of important plant and animal species (including grey headed flying fox, koala, quoll, bats and several birds and frogs), the level of disturbance and the isolation of the site mean that their habitat value is currently limited. However, in pre European times, these ecological communities would have provide diverse resources for Aboriginal people, with separate and distinct assemblages in the banksia and sand scrub communities that dominate Stockton Bight and the smaller areas of cheese tree/smooth barked apple/bangalay.

Mammals recorded in the archaeological sites within and adjacent to Birubi Point Aboriginal Place included ringtail possum, wombat, grey kangaroo and dingo. These provide food, but also raw materials for cloaks, rugs and shelters. The most common bird bone reported from the sites was the migratory shearwater, which is present in the area from October to March.

3.2.3 Marine fauna

Dyall 2004 provides detailed information about shell fish and fish species represented in the midden sites at Birubi Point, Robinson Reserve and Morna Point, based on recording and excavation of these sites in the 1970s. Dyall also reported bone from a variety of bird and animal species in the middens.

Marine species observed in the middens within and adjacent to the Aboriginal Place (and adjacent to the proposed information centre area included:

- Beach, rocky reef and nearshore shellfish such as pipi (very common), bonnet shell, cartrut (common), chiton, kelpshell, limpet, nerita (common), triton, turban (common), oyster, Sydney cockle, flame cockle, mud whelk, abalone, mussel, elephant snail

- Fish species such as snapper (very common), groper, wrasse (common), tarwhine (common), mullet, leatherjacket, kelpfish (common), black bream (common), black drummer, red rock cod (common), wirrah cod (common), trevally, whiting.

- Crayfish, sea urchin.

Fish were caught with hook and line, nets and fish traps.

Whales pass close to Birubi Point and Morna Point on their migration. There are historical reports of Aboriginal people at Port Stephens eating beached whale (e.g. in Gunson 1974), but no evidence of whale bone has been observed in the midden sites at or around Birubi Point.

3.2.4 Other resources

People living at the north eastern end of Stockton Bight also had access to a variety of stone raw materials suitable for flaked and ground implements, including:

- Nobbys tuff, most likely obtained from Newcastle cliffs or from cobbles deposited from wave action and long-shore drift on Stockton Bight

- Silcrete, obtained from various sites around the Hunter estuary and lower Hunter

- Porphyry rock from the local area (outcropping on all local headlands), suitable for use as hammer stones, and for grinding

- Other materials obtained from elsewhere in the lower Hunter and mid north coast (including other mudstones, tuffs, basalt and cobbles from the Hunter River).

Fine vesicular pumice is also recorded in the midden sites at Birubi Point. This material can be moved by waves, but may also have been moved by Aboriginal people.

The ready availability of robust shell species provided raw materials for manufacture of shell fish hooks, which are abundant in the Birubi midden sites.

An important landscape asset at Birubi Point is the value of the former gently undulating stable dune surfaces, providing a sand substrate for camping and also for burials. A major advantage of the former low dune within the proposed information centre area is that it provided sheltered camping sites – protected from strong southerly winds by the high dune that runs roughly north- south inland from Birubi Headland.

3.3 Land use history

3.3.1 Development

The landscape context of Birubi Point Aboriginal Place and the proposed information centre area includes the Anna Bay and Fishermans Bay residential areas, tourist accommodation, access roads, carparks, current visitor transfer facilities and the surf club and cafe.

Early European settlement

Although European occupation at Anna Bay commenced in the nineteenth century, most of the development occurred in the twentieth century. The landforms and vegetation within the Birubi Point Aboriginal Place and the proposed information centre area have been much disturbed by the growing use of the area.

Early land use of the area includes market gardens along what is now the residential interface on the Stockton Bight side James Paterson Street. This activity introduced a variety of noxious weeds to the area. There are currently noxious weed treatment obligations for landowners in this area under the *Noxious Weeds Act 1993* and the *Noxious Weeds (Weed Control) Order 2014*. DILW has been working with other landholders to implement effective management of the weed species, but control remains a challenge.

The dunes in the north eastern part of Stockton Bight were used by the RAAF as a testing range in the mid twentieth century. The area was also part of the coastal defence infrastructure in the World War 2, and access tracks through the dune, tank trap structures and other fencing date to this time.

Expanding development in the 1970s

In the 1970s, the Anna Bay/Morna Point area was beginning to transform from a rural/agricultural and fishing village to a seaside suburb. Houses were present along the north western side of James Paterson St in 1976. Multiple closely spaced sheds were behind the houses – between them and the leading dune face. At that time, the south east side of James Paterson St was wetland.

Importantly, reports from the 1970s include comments that local people 'collected artefacts 'by the sugar bag full'. The impacts of residential development on the archaeological and cultural values of the area were therefore more than direct disturbance by construction. It included these collections that removed visually interesting artefacts and also disturbance of open space areas by informal recreational access ways.

Birubi Surf Club

A surf club was established at Birubi Headland in 1993. The current surf club building (built with an investment of $4.7 million) was opened in 2013. The surf club is an important community meeting place and also an important economic asset. A café operating in the surf club building attracts large numbers of visitors for beach side meals. The surf club site is also a popular viewing platform for the dunes, the beach and seasonally for passing whales.

The surf club hosts major carnival events, which bring large numbers of visitors to the site.

Worimi Conservation Lands

The northern gateway to the Worimi Conservation Lands for off road vehicles is off Gan Gan Road at Anna Bay, bordering the proposed information centre area. The Anna Bay access track to Worimi Conservation Lands is a popular route, providing relatively easy access to the beach.

Other activities

Land management activities in the Aboriginal Place have included some mechanical shaping of mobile dunes by the Soil Conservation Service (along the eastern margin of Stockton Bight, where sand was formerly advancing onto private land); efforts to revegetate the dunes restoring habitat and biodiversity as well as stabilising the sand surface; and noxious weed management actions in former market gardening and grazing lands behind James Paterson Street.

There has been historical intermittent sand extraction in the areas where mobile dunes encroach close to development. This currently includes removal of sand moving across the lower carpark.

Vacant land such as the proposed information centre area has been used by the general public for rubbish dumping, dog walking and motor bike riding, as well as being occasionally used for cultural purposes.

Over the last 10 to 15 years, two new projects have affected the margins of the proposed information centre site. These are the construction of the northern (Anna Bay) access to the Worimi Conservation Lands and the partial construction of a coastal resort on the north western side of this access track (refer to **Figure 1.1** and **Figure 1.2**). The construction of the coastal resort failed, in part due to failure to control mobile sand, and the site is now largely derelict.

3.3.2 Conservation and protection

The proposed information centre area is situated between Tomaree National Park and the Worimi Conservation Lands.

Tomaree National Park was originally reserved in 1984 and protects a coastal landscape of regional and state significance. The National Park includes part of the Aboriginal Place. A draft Plan of Management for the Park was exhibited in 1995, but was not finalised and adopted at that time. A new draft Plan of Management was prepared and exhibited in 2004 - 2005 and was adopted in 2006. This Plan of Management is still current.

The Worimi Conservation Lands lie to the south west of Birubi Point Aboriginal Place, sharing a boundary with the Place. The Conservation Lands were gazetted in 2007 and in 2015 the Worimi Conservation Lands Board of Management released their ten year Plan of Management, adopted by the Minister for the Environment.

3.4 Summary

Key points from this review include:

- The proposed information centre area is located in a dynamic coastal landscape
- Former land surfaces and associated archaeological materials are exposed from time to time, depending on the patterns of wind-blown sand
- The former (pre approximately 500 years) land surface within proposed information centre area was gently undulating terrain, with banksia woodland vegetation.
- Archaeological sites may be present on old land surfaces, buried beneath varying depths of recent wind-blown sand
- Worimi people living in this coastal landscape throughout the Holocene period had access to diverse terrestrial and marine resources. This diversity has supported frequent, potentially year round, use of the area by Worimi people and the resource value of the area continues for Worimi people today.
- The proposed information centre area has been extensively disturbed by land uses over the last 100 years, but particularly since the 1940s.

4.0 Cultural context

4.1 Worimi people

During the preparation of the Management Plan for the Birubi Point Aboriginal Place (Umwelt 2018), Worimi traditional owners and the Board of Management of the Worimi Conservation Lands provided information about the value of Birubi Point area to Worimi people. The description of values provided by Worimi people at that time is the basis of the information below.

Birubi Point Aboriginal Place is in the heart of Worimi country and Worimi people have been part of this land for tens of thousands of years. They are the Traditional Custodians of the land. Birubi means 'Southern Cross' and one of the special characteristics of Birubi Point is the expansive view it offers of the sea and sky, including the Southern Cross.

Worimi people travelled along the beaches and over headlands and dunes to wetlands and creeks when moving through the coastal parts of their country. The sites and lifestyle at Birubi Headland and adjacent areas are connected to other significant sites and landscape features across Worimi country, including the southern shores of Port Stephens and along Tilligerry Creek and the beaches and dunes of Stockton Bight.

The Worimi still use the area today and their history and connection to the land is demonstrated by both the abundance of significant resource materials that are available in the area and the archaeological evidence. Today the extensive archaeological material of Birubi Point Aboriginal Place makes it a site for teaching current and future generations about Worimi ancestors and local Aboriginal culture.

Throughout the beach, dune and headland landscape within the Birubi Point Aboriginal Place there is abundant material evidence of Worimi people living on their lands, including evidence of fishing, shellfish gathering (with shell middens being the most conspicuous form of evidence in the landscape), campsites, fire and hearthstones, flaked stone implements and burials.

Some members of the community refer to a men's ceremonial site in the area and a story involving an old warrior. They also talked about the contemporary spiritual importance because a young Aboriginal person died in the surf here.

4.1.1 Native title

Based on information provided by the National Native Title Tribunal on 27 November 2018 and a review of the Native Title Vision website on 27 November 2018, a number of Native Title Claims have been determined in relation to the Worimi people in in the general vicinity of the Aboriginal Place. There are no current or determined Native Title claims applying to the Aboriginal Place.

In relation to Worimi Local Aboriginal Land Council No. 1 and No. 2 (Stockton Bight), No. 3 (Taylors Beach), No. 4 (Boat Harbour), No. 5 (Tilligerry Creek) and No. 6 (Taylors Beach) the Federal Court found that Native Title does not exist in November 2005, September 2009, December 2008 and February 2012 respectively.

None of these land parcels is within the Birubi Point Aboriginal Place.

An application for determination of Native Title was made by Gateway Lifestyle Investments Holdings on 15 October 2018. This non-claimant application (Tribunal No. NN2018/008) covers parcels of land to the east of James Paterson Street, just outside the Birubi Point Aboriginal Place.

No Indigenous Land-Use Agreements (ILUAs) have been registered or notified by the National Native Title Tribunal as being in place over the Aboriginal Place or any adjacent area.

4.2 Archaeological context

There are a number of registers that contain information relevant to Aboriginal cultural heritage, including:

- The OEH Aboriginal Heritage Information Management System (AHIMS)
- The Australian Heritage Database
- The State Heritage Register
- The State Heritage Inventory
- The Port Stephens Local Environmental Plan.

The Australian Heritage Database lists the Newcastle Bight coastal area as an Indicative Place on the basis that indigenous and non-indigenous cultural values of National Estate significance may be associated with the area, but it does not specifically include the proposed information centre area.

4.2.1 Register searches

The OEH AHIMS is a database of Aboriginal sites for which site cards have been submitted. The AHIMS database was searched on 20 September 2018 for sites located within the search area:

Latitude, Longitude from: -32.7947, 152.0627 - Latitude, Longitude to: -32.7631, 152.1128.

A total of 50 sites were identified within this search area. The distribution of different site types is shown in **Figure 4.1** and a summary of site types is listed in **Table 4.1**. The site types include isolated finds, shell middens (including some with stone artefacts and hearths), open campsites, burials, resource and gathering sites, habitation structures, and potential archaeological deposits. Four of these sites, including three middens in close proximity to the surf club site, are registered as being partially destroyed.

In total in this search area there were 17 sites described as stone artefact scatters or open campsites, some with shell noted as a secondary component. Eight sites were recorded as 'Aboriginal resource gathering'. The location of these sites, predominantly within the mobile dune field, may reflect evidence of Aboriginal food plants, or shell. Eleven sites were recorded with shell/midden as the principal component; some are associated with artefacts or hearths. Two sites are recorded as 'habitation structure', but it is not clear what this means, in the context of a mobile dune field. Certainly, historic records suggest that there were numerous hearths and sometimes large rocks for grinding, recorded across this area, where former stable soil surfaces were exposed. There was one burial site recorded. This site is within the current residential area.

Legend

- Proposed Information Centre Site
- Potential Disturbance Area
- Lot 312 DP753204
- Birubi Point Aboriginal Place
- Robinson Reserve Excavation Impact Area

AHIMS Search Results

- # Aboriginal Resource and Gathering
- 0 Arteface (Stone, Bone, Shell, Glass, Ceramic, Metal)
- G Burial
- @ Ceremonial Ring (Stone or Earth) : 1
- © Habitation Structure
- ¢ Potential Archaeological Deposit (PAD)
- H Midden & Associated Artefact/s
- S Shell

FIGURE 4.1

AHIMS Search Results

Image Source: Nearmap (Sept 2018) Data source: Umwelt (2018); Port Stephens Council (2018); NSW OEH AHIMS (2018)

Table 4.1 Sites within and in the vicinity of proposed information centre

Site number	Site features
Within (on the boundary of) the proposed information centre area	
38-5-0272	Artefact site (this site is mapped as just west of the proposed information centre area in association with the 4WD access road)
38-5-0270	Stone artefacts (mapped immediately to the south of the proposed information centre area)
Within the Birubi Point Aboriginal Place adjacent to the site of the land on which the proposed information centre will be developed	
38-5-0316	Shell (partially destroyed)
38-5-0295	Aboriginal resource gathering
38-5-0196	Stone artefacts
38-5-0211	Shell, with artefacts, hearth
38-5-0269	Aboriginal resource gathering
38-5-0284	Aboriginal resource gathering
38-5-0286	Aboriginal resource gathering
38-5-0268	Habitation structure
38-5-0294	Aboriginal resource gathering
38-5-0293	Aboriginal resource gathering
38-5-0317	Shell
38-5-0012	Midden and associated artefacts
38-5-0013	Midden and associated artefacts
38-5-0014	Midden and associated artefacts
38-5-0015	Midden and associated artefacts
38-5-0016	Midden and associated artefacts
38-5-0240	Stone artefacts, with shell
38-5-0241	Stone artefacts, with shell
38-5-0239	Stone artefacts, with shell
38-5-0227	Shell, with artefacts, hearth

Site number	Site features
38-5-0150	Isolated find
38-5-0035	Open campsite
Outside the Aboriginal Place and proposed information centre area, in the remainder of the search area	
Back barrier and inter-barrier depression area (Nelson Bay Road)	
38-5-0327	Stone artefacts
38-5-0319	Shell
38-5-0312	Stone artefacts
38-5-0223	Stone artefacts
38-5-0311	Potential archaeological deposit
38-5-0318	Shell
Eastern margin of transgressive dunes and on sand sheet overlying rock towards Morna Point	
38-5-0210	Stone artefacts
38-5-0281	Aboriginal resource gathering
38-5-0268	Habitation structure
38-5-0280	Aboriginal resource gathering
38-5-0331	Stone artefacts
38-5-0198	Stone artefacts
38-5-0034	Burial
38-5-0309	Stone artefacts
38-5-0153	Isolated find
38-5-0248	Stone artefacts

4.2.2 Archaeological investigations at Stockton Bight and Anna Bay

Scientific interest in Aboriginal occupation of the coastal landscape from Newcastle to Port Stephens commenced in the early 20th century, with important publications from the Australian Museum dating to the 1920s. The intensity of survey increased with the introduction of the NPW Act 1974 and the EP&A Act 1979, as well as with the development of new residential areas such as at Fern Bay, Anna Bay, Medowie and along the southern shore of Port Stephens; and related power and water infrastructure through the dunes of both the Pleistocene and the Holocene barrier systems.

Stockton Bight provides sand resources for construction and previously also provided mineral sand resources. Extensive surveys, subsurface investigations and post consent monitoring have been completed over the last 40 years for these developments.

Examples of previous archaeological reports that contribute to the broad archaeological context of the proposed information centre area and the Birubi Point Aboriginal Place are reviewed in Dean-Jones (1990), ERM (2006) and Umwelt (2003) (assessment for declaration of an Aboriginal Place) and further archaeological understanding has been developed in a range of other more recent archaeological assessments (e.g. Umwelt 2016, 2017). These studies and reports are not reviewed in detail here but the key outcomes are summarised below. More detailed information from studies conducted within the Birubi Point Aboriginal Place is in **Section 4.2.2.1**.

The review of archaeological studies and reports highlights several important contextual characteristics for the site complex that extends from Morna Point and Birubi Point landward to Gan Gan Road. These include:

- There are multiple large site complexes within the Stockton Bight (Newcastle Bight) area. These sites demonstrate the diversity and reliability of resources for Aboriginal people, particularly in locations with access to estuarine, marine, wetland and terrestrial (dune) habitats.

- Worimi people occupied the sites on the Outer Barrier throughout the Holocene, but the best evidence of utilisation of shellfish comes from the last 1000 to 1500 years, whether in vegetated terrestrial dune contexts or exposed frontal dune contexts. This may be the result of:

    - Removal or poor preservation of older deposits at some sites due to transgressive dune activity or periods of severe beach erosion, potentially associated with a period of elevated sea level. For instance, there has long been a view (based on relatively limited dating) that the Holocene dunes were actively mobile in the period 2500 to 1300 years BP (Thom et al 1998). Dated sequences elsewhere on the NSW coast suggest elevated sea level in the period 2000-2500BP (Switzer A, Sloss C, Jones B and Bristow C (2010)). Sloss, Jones and Murray Wallace (2018) also propose a mid to late Holocene still-stand continuing until approximately 2000 BP (potentially with some slight oscillations), with a gradual fall to the present.

    - weathering of shell, reducing shell concentrations in the lower stratigraphic units of sites

    - a change in accessibility of other resources from environmental conditions or from the availability of more effective technology, perhaps accompanied by a significant increase in population

    - other differential stratigraphic processes, post deposition, leading to stone moving deeper into the profile than shell.

4.2.2.1 Archaeological investigations in the Birubi Point Aboriginal Place

The rich and spatially diverse archaeological record from the Birubi Point Aboriginal Place provides an indication of the scope and scale of occupation evidence that could be located within the proposed information centre area. A summary of the detailed early records and later assessments is provided below.

Although multiple individual sites have been recorded within the Birubi Point Aboriginal Place, within the proposed site of the information centre and in adjacent parts of the eastern end of Stockton Bight, historical descriptions of the former extent and connectivity of these ‘sites’ suggest that the area comprised an extensive site complex, with multiple foci of activity. These different activities across the site, which may be linked to distance to specific resources, or to seasonal patterns of use, or to patterns of use linked to men’s and women’s activities and cultural practices. The total area of the site complex is approximately

one kilometre by 1.5 kilometres. The distance from the Morna Point/Birubi Point/Little Beach component to the undulating dunes within the proposed information centre area is approximately one kilometre, with archaeological materials known to have been present on former stable land surfaces across the intervening landscape.

The most studied part of the site complex and the area retaining the best preserved examples of the midden (at Fitzroy Street) extend from Morna Point, across the dunes behind Little Beach and onto Birubi Headland. The information below provides background about this part of the site complex, as it provides the immediate archaeological context for the information centres area.

Umwelt (2003) reviewed archaeological and cultural information for Birubi Point for the nomination of the area as an Aboriginal Place.

The archaeological value of the Birubi Point Aboriginal Place was first formally documented in the 1920s (Thorpe 1926, Hall 1928) when Worimi burials were excavated and a large number of artefacts were described from a complex of occupation areas across the Place. In the 1970s (Dyall 1979, 2004) mapped several large and complex middens in what is now the Aboriginal Place and the area has been the subject of multiple archaeological studies over the last 40 years.

Hall (1928) describes Little Beach (between Morna Point and Birubi Point) as a secluded area which has been, in the past, a favourite camping ground for Aboriginal people. Along the sand are middens and conical shell heaps, reduced by erosion of southerly storms, but still large enough to indicate how much more extensive they must have been in earlier days.'

Photographs provided in Hall (1928) clearly show midden shell at the back of the beach, exposed in front of the deflating and dissected foredune. Dense shell deposits extend into the low and hummocky dunes landward of the beach. From Hall's photographs it is evident that dense midden shell continued at least 200 metres inland from the beach. The area is sheltered from west, north-west and south west winds by the Birubi Headland and high dune at the end of Stockton Beach. Hall (1928) also reported campsites (including ovens) on the lower north western flanks of this high dune (towards the area proposed for the information centre).

Hall (1928) mostly collected and described numerous stone artefacts (flakes and Worimi cleavers) from the extensive midden behind Little Beach (i.e. including the current Fitzroy St midden). Flakes were Nobbys tuff (Hall thought this was obtained by trading with the Awabakal); Worimi cleavers described as being of basalt (also reported by Thorpe 1926 and McCarthy 1947).

Dyall 1979 and 2004 reports that when he first visited Birubi in 1963, the shell middens behind Little Beach covered (estimated) 4 to 5 hectares. Dyall refers to this area as 'the mainland midden'. The extent of midden had been reduced between the 1960s and late 1970s by residential development, parking areas (in what is now Robinson Reserve), and the construction of the caravan park. Multiple chert and silcrete artefacts were also destroyed by this development.

Dyall 1979 and 2004 describes the archaeological materials as follows: 'In 1963, the most extensive shell heaps stretched across the top of low sand hills about 150m back from the water line at Little Beach. The shell layer, which was generally 10 to 30cm thick, had long been subjected to the undercutting action of southerly storms, so that shell, flaked stone and lumps of porphyry were strewn down from the seaward face of the ridge line. A continuous layer of undisturbed shell extended for about 150m parallel to the beach. The Fitzroy Street site was dominated by pipi shell, with estuarine species such as mud whelk, oyster and *Anadara*, and rock platform species comprising only 6 per cent of the specimens (including heavy turban shells). The site also contained flaked stone, generally Nobbys tuff (no geometrics or backed blades).

Based on the materials he could collect and describe, Dyall reported that 'Bondaian' tools were extremely rare on the main midden area behind Little Beach (but edge ground tools were present.

Windblown sand covered the top of the shell layer which possibly extended back inland 30m from the exposed face. The sand ridges terminated in swampy ground (black soil covered with tea tree scrub).'

Dyall reports that the deflated midden (with low conical sand heaps and disrupted thin shell capping), on the area extending towards the beach from the more intact shell layers, was 20 to 40m wide and occupied a gentle slope that terminated at the edge of a shallow swale immediately behind the low sand ridge at the back of the beach. In wet weather this swale held fresh water.

Dyall reports major collecting activities by locals in the Little Beach area, probably from the 1950s onwards. Locals referred to artefacts being collected 'by the sugar bag full' 'after each blow'. It is possible that thousands of flaked, retouched and edge ground implements were removed by local collectors. Given the land use history of the area of the proposed information centre, it is possible that flaked stone artefacts were also collected there by locals, wherever they were exposed (e.g. by tracks or by farming activities).

Foreshore middens at Little Beach contained large amounts of fish bone, capped by pipi shell and rock platform species of shellfish (Dyall 2004). The foreshore and rock platform middens contained very little flaked stone (and no 'Bondaian' implements, here or on Morna Point Headland)), but did include lenses of ash, wind-blown sand and shell. Numerous hearths were present as were fish hooks made from *Ninella torquata.* A carbon date of 1340+/-80BP was obtained for pipi the lowest occupation level of a foreshore midden) and a carbon date of 1445+/-75 years for the midden site at Fitzroy Street Dyall (2004).

4.2.2.2 Archaeological materials on the eastern slopes of Birubi Headland

Dyall 1977 and 2004 reports scattered shell and flaked stone exposed amongst the rocks at Birubi headland. This area was mostly covered in drift sand and lantana in the 1960s, so its extent was not realised until the area was cleared for road access to a beach side carpark.

A trench excavated in midden deposit high on the headland was described as black sand with shell (including heavy turban shell). The midden contained fish hook blanks, but not fish hooks. Rock platform, open beach and estuarine shellfish species were present.

RPS 2010 conducted an assessment at the Birubi Point Surf Club site, on Birubi Headland. This report reviewed several previous studies in the vicinity and relocated a number of midden sites previously recorded on the headland (pipi shell, other shell species and occasional stone artefacts). Salvage excavations were subsequently conducted, in consultation with registered Aboriginal parties for that project.

4.2.2.3 Archaeological materials on the slopes of high dunes to the northwest of Birubi Headland

Dyall 1979 and 2004 reports that most of the exposed face is made up of iron cemented layers (i.e. podsol soil profile B horizons), plus the presence of 'peaty layers' (these could be podsol A1 horizon, from the description). Tree stumps indicate it was stable and vegetated, probably within European times. Dyall describes the peaty layers a forming 'sills' about 6m above the level of the freshwater ponds in the swale behind the beach dune (likely referring to the deflation basin). Flaked stone was reported as being common in this area (including Bondaian artefacts) and Hall (1928) refers to ovens made up of rings of stones in this area. None of these features have been observed in recent years.

4.2.2.4 James Paterson Street

The alignment of James Paterson St was used by four wheel drive vehicles to gain beach access in the 1960s. This access could have provided access from Gan Gan Road along the dune face to Little Beach (where licensed beach haul fishers can still access the beach) or to Birubi Headland. Dyall reports that along the old sand track, small flaked stone artefacts were common, but there was little shell (where shell occurred, it was generally broken pipi). He reports that from his observations and collections between 1965 and 1977, numerous microliths (bondi points and geometrics) were collected along the alignment of James Paterson St and in the soil units of the high dunes to the north west of Birubi Headland.

4.3 Archaeological implications for the proposed information centre area

The proposed development area is located adjacent to the Worimi Conservation Lands (WCL) on Stockton Bight and the Birubi Point Aboriginal Place. Archaeological studies have been conducted in these areas for nearly a century. The proposed information centre area occupies an area of former transgressive dune and swale terrain which is part of the same landscape as these areas which are in conservation management.

The entire Birubi Point Aboriginal Place and adjoining land in the Worimi Conservation Lands has high cultural heritage sensitivity from an archaeological, cultural or spiritual perspective.

The former extent and continuity of midden deposits, open campsites, hearths, burials and other features suggest that although the area has multiple site numbers/site cards, it should be regarded as a single large and complex site, protecting evidence of the life of a Worimi community over thousands of years. Different parts of the complex provide evidence of different focal activities (e.g. shell fishing focus, terrestrial hunting focus, areas best used in summer or in winter, areas set aside for men's and women's special activities).

Although the main dune field of Stockton Bight was already destabilised/mobilised before significant European settlement, it is apparent from soil formation and dated occupation evidence that the landscape around Birubi Point was relatively stable from about 1500 years ago to perhaps 500 years ago. More dated materials would provide better resolution of the timeframe. The entire landscape around Birubi Point has been much disturbed over the last century.

Despite the level of disturbance, areas of archaeological evidence remain. It is possible that Aboriginal archaeological materials, including midden, stone artefacts, hearths and potentially burials, remain associated with former land surfaces, now buried within the mobile and stabilised dunes at the far eastern margin of Stockton Bight and across the transitional landscape where wind-blown sand overlies bedrock headlands. Thousands of flaked and edge ground artefacts are reported to have been removed from the area of the Birubi Point site assemblage in the past (Dyall 1979 and 2004).

In summary, the cultural heritage records and environmental evidence for the area indicate that:

- Aboriginal archaeological materials will be present within the proposed information centre area, although none have previously been recorded on the surface of this area (e.g. see **Figure 4.1**)

- Materials will most likely be flaked stone artefacts, with shell (beach and rock platform species) and grinding equipment also possible. Hearths may also be present. Shell is expected to be less common in this area than parts of the site complex that are immediately adjacent to the beach and rock platforms.

- Archaeological material will predominantly be associated with exposures of the former stable land surface, which is intermittently exposed beneath active mobile sand dune and is expected to continue

intermittently beneath the contemporary surface. Some archaeological materials may exist in an entirely disturbed context (e.g. as reworked lag deposits)

- The depth of cover of recent wind-blown sand (mostly deposited within the last century) over the former occupation surface will vary. This is partly because of the undulating nature of the older ground surface and partly because of the locations of multiple ongoing episodes of deflation and deposition

- Specific task-oriented areas are likely to be present, but may be difficult to detect because of the extent of disturbance and weathering of the archaeological material

- Flaked stone artefacts will utilise the fine grained Nobbys tuff, but other materials (notably silcrete) are likely to be present.

- Artefacts will include blades and geometric microliths. Fish hooks may be present, but are more common in the parts of the site complex directly adjacent to the sea.

- Any flaked stone that has been exposed on the surface will be impacted by abrasion by wind-blown sand.

- Disturbance within the proposed information centre area is likely to be greatest in the portion of the area that formerly contained houses and associated outbuildings (as discussed in **Section 3**).

These predictions form the basis of the site inspection described in **Section 5**.

5.0 Site inspection

5.1 Survey strategy and effective coverage

A site inspection was conducted by Umwelt archaeologists and selected registered Aboriginal parties on 1 November 2018. Port Stephens Council project managers also participated in the site inspection, to brief the registered Aboriginal parties on the proposed development.

It was agreed with the registered Aboriginal parties that the field survey would be conducted as a walking inspection of the proposed information centre area and its local context.

The aim was, as far as practical, to record sufficient information to satisfy Requirement 7 of the Code of Practice and to provide the registered Aboriginal parties participating in the survey with an opportunity to discuss the archaeological and Aboriginal cultural significance of any site that was observed. These discussions extended to the sites that may remain below the surface of the proposed development area.

The registered Aboriginal parties are all individuals who have a long standing association with the Birubi Point Aboriginal Place and adjoining areas and most had participated in previous walk over site inspections of the proposed information centre area.

The archaeologists and registered Aboriginal parties were therefore familiar with:

- the dynamic nature of the ground surface in the mobile sand dune terrain
- the highly variable nature of exposures of former ground surfaces as mobile sand moves across open space or scours and builds up around obstacles such as vegetation remnants or bitou bush.
- the nature of Aboriginal archaeological sites that have previously been observed and recorded at Stockton Bight, Birubi Point and across the Birubi Pont Aboriginal Place
- the landscape features with which Aboriginal archaeological sites are associated. In particular, Aboriginal archaeological sites are associated with topsoil (dark A_1 soil horizon and bleached A_2 soil horizon) materials developed during former periods of stable land surface. The organic content and structure of the A_1 horizon means that it stands out from shifting recent sand and can be identified from a distance.

With this background, the walking survey focused on identifying the locations of exposures of former stable land surface materials. Archaeological materials were predicted to be associated with all such exposures.

Participants visited all accessible parts of the proposed information centre area. At the time of survey, Lot 32 DP1146884 was not owned by Port Stephens Council however this area was included in the survey on the basis that it was likely to form a part of the proposed information centre area. This area has extensive ground surface visibility, including exposures of the former stable ground surface. It is indicative of the nature of the likely surface and subsurface character of the more vegetated areas of the proposed information centre. Areas of extremely dense vegetation were not inspected.

It is important to note that although ground cover is very low across much of the proposed information centre area and therefore ground surface visibility is very high (greater than 90 per cent), the effective visibility of a ground surface that could have archaeological potential is very low due to the presence of windblown sand mantling the former land surface. The exposures of the former stable ground surface are discrete, discontinuous and occupy less than 5 per cent of the visible ground surface.

5.1.1 Survey units included

The design of the survey covered the following terrain:

- Contemporary deflation basin
- Low discontinuous dunes and hummocks (often formed around clumpy vegetation)
- Undulating to gentle gradient terrain, often the morphology of the former stable land surface, overlain by a relatively thin mantle of wind-blown sand
- Steep dune terrain.

5.2 Information recorded during survey

During the walkover inspection, notes were made, as relevant, about the character of the proposed development area, including:

- Vegetation
- Soil features (where suitable areas of exposure/visibility are present)
- Identified Aboriginal resources (food and medicine plants, prey animals, stone and water)
- Levels of average ground surface visibility within the survey unit (in accordance with the Requirement 9 of the Code of Practice)
- Extent and type of exposures within the survey unit (with reference to the factors leading to the exposure such as erosion, earth-moving activities, track establishment etc.). As noted above, in the proposed information centre area , the extent of ground surface visibility is almost entirely due to the movement of wind-blown sand; with only intermittent exposures of former stable ground surface materials likely to be associated with occupation evidence.
- Any information provided by the registered Aboriginal parties in relation to cultural values, noting that such information will be recorded in accordance with the wishes of the party providing the information and
- Any site, area of Potential Archaeological Deposit (PAD) or landscape feature of Aboriginal cultural value present within the survey area. The details of this recording of known sites and any new sites are provided in **Section 6**.

Photographs were taken to illustrate landforms, vegetation, ground surface condition and existing development or disturbance across the proposed development area.

At each location where the former ground surface was exposed, participants marked (flagged) visible artefacts and likely midden shell fragments. The locations of these archaeological materials were mapped using GIS and the nature of each object was recorded.

Examples of the character of the landscape, the exposures of former stable ground surface and the types of archaeological materials that were recorded are shown in **Photos 5.1** to **5.11**, in **Table 5.1.** The photos also illustrate the impact of exposure to active wind-blown sand movement.

Table 5.1 Photos showing the nature of the terrain and ground surface visibility across the proposed development area

Description	Photo
Photo 5.1 Start – entry to the proposed development site, off the Anna Bay 4WD access road	
Photo 5.2 Wind-blown sand dominates the ground surface; with hummocky features formed around invasive vegetation (bitou bush clumps)	

Description	Photo
Photo 5.3 Tuff core. The material is most likely sourced from south of the Hunter River entrance. The core shows the effects of sand blasting by mobile dune sand, when exposed on the surface	
Photo 5.4 Flagged artefacts; blue flags show the locations of archaeological materials identified by registered Aboriginal parties who participated in the survey	

Description	Photo
Photo 5.5 The dark 'shadow' is an exposure of a former stable ground surface. The ground surface is identified from the dark, slightly organic and more robust A_1 horizon, generally overlying pale grey to white bleached A_2 horizon remnant of soil. Archaeological materials have previously been recorded in the A_1 and A_2 horizons of the dune podsol soil, but rarely in the B horizon.	
Photo 5.6 Tuff flake, showing strong weathering impacts of exposure to mobile sand.	

Description	Photo
Photo 5.7 Flagged artefacts, associated with an exposure of the former stable ground surface. The exposure is generated by wind swirling around a clump of bitou bush. Remnant stumps from the former banksia woodland can also be seen exposed on the current ground surface, suggesting that the soil materials from the former ground surface are more extensive at a shallow depth.	
Photo 5.8 Geometric microlith – a further example of the type of material (Nobbys tuff) and the impact of wind-blown mobile sand.	

Description	Photo
Photo 5.9 Along north eastern boundary – heavy vegetation cover, dominated by bitou and tea tree coastal scrub. There is no ground surface visibility in this part of the proposed information centre area and access is difficult. The vegetation cover is relatively recent – likely within the last 20 years.	
Photo 5.10 Towards four wheel drive access road, lower elevation, more vegetated – mobile sand forms the surface between clumps of recent vegetation (bitou bush and coastal tea tree scrub)	

Description	Photo
Photo 5.11 Possible old house block in the north eastern corner of the proposed development site. There is no ground surface visibility in this area and a dense cover of introduced and native vegetation species.	

6.0 Results

This section focuses on the archaeological materials observed during the surface survey. These include scatters of shell fragments and artefacts, some previously recorded and some likely to be new exposures. Although there are multiple discrete exposures, it is appropriate to include all these exposures as features within a single archaeological site complex.

This is consistent with the descriptions of the very large and complex array of archaeological material that was reported to be present at Birubi Point, Morna Point and the dunes and swales of the north eastern end of Stockton Bight, in reports dating to the 1920s. While there were clearly different loci of activity across the site complex, overall it represented aspects of the daily and seasonal lives of Worimi people over the late Holocene and up until the arrival of European settlers.

The level of disturbance of the vegetation cover of the proposed information centre area is such that very little habitat remains to illustrate the terrestrial resources for Worimi people in these dunes and swales.

The current location of freshwater ponding in the deflation basin after extended rain is indicative of a resource likely to have been available to Worimi people, but not of the specific locations, depths and duration of inundation.

6.1 Description of Survey Units

As discussed in **Section 5.1.1** and illustrated in photos in **Table 5.1**, the surface survey covered all areas of bare sand across the proposed development area. Much of this surface is recently deposited wind-blown sand. The overall terrain character of the site is discontinuous deflation hollows and accretion mounds, at the margin of the transgressive dune field. All terrain units were inspected, on foot. While visibility was high in approximately half of the proposed information centre area, the presence of windblown sand meant that levels of effective coverage were low.

6.2 Previously recorded archaeological sites

The locations of previously recorded sites or loci of activity (shown in **Figure 4.1**) were inspected. As noted above, the mobility of the ground surface means that there is no continuity of surface expression of the previous ground surface or archaeological materials. All exposures of soils associated with the former stable ground surface were inspected.

Artefacts recorded in the vicinity of previously recorded site s (38-5-0272 and 38-5-0270 are noted in **Table 6.1**. The locations of these artefacts are shown in **Figure 6.1**. As shown in this figure, the visible surface artefacts extend outside the proposed information centre area.

The artefacts recorded during this inspection are best understood as part of the two previously recorded sites, demonstrating that in fact the entire area comprises discrete exposures of a single site.

Table 6.1 Artefacts observed on the surface during the site inspection

Site Name	Artefact number	Raw material	Artefact class	X	Y
Birubi Point	1	Metal	Remnant material indicative of site disturbance (not a Worimi cultural object)	413775	637997
Birubi Point	2	Glass	Fragment		
Birubi Point	3	Tuff	Flake		
Birubi Point	4	Tuff	Flake	413773	6372995
Birubi Point	5	Tuff	Core	413773	6372996
Birubi Point	6	Tuff	Flake	413771	6372998
Birubi Point	7	Tuff	Flake	413770	6372995
Birubi Point	8	Bone	Fragments	413803	6372983
Birubi Point	9	Tuff	Flake	413751	6372965
Birubi Point	10	Tuff	Flake	413746	6372963
Birubi Point	11	Tuff	Flake	413740	6372958
Birubi Point	12	Tuff	Flake	413791	6372959
Birubi Point	13	Tuff	Flake	413770	6372951
Birubi Point	14	Tuff	Fragment	413764	6372953
Birubi Point	15	Tuff	Fragment		
Birubi Point	16	Tuff	Fragment		
Birubi Point	17	Tuff	Fragment	413763	6372953
Birubi Point	18	Tuff	Fragment		
Birubi Point	19	Tuff	Fragment	413761	6372952
Birubi Point	20	Tuff	Fragment		
Birubi Point	21	Tuff	Flake	413756	6372948
Birubi Point	22	Tuff	Flake	413753	6372944
Birubi Point	23	Tuff	Broken Flake	413749	6372942
Birubi Point	24	Tuff	Broken Flake		
Birubi Point	25	Tuff	Flake		

Site Name	Artefact number	Raw material	Artefact class	X	Y
Birubi Point	26	Tuff	Retouched Flake		
Birubi Point	27	Tuff	Flake		
Birubi Point	28	Tuff	Broken Flake	413741	6372942
Birubi Point	29	Tuff	Flake		
Birubi Point	30	Tuff	Flake	413739	6372941
Birubi Point	31	Tuff	Flake	413739	6372939
Birubi Point	32	Tuff	Flake		
Birubi Point	33	Tuff	Flake	413736	6372938
Birubi Point	34	Tuff	Core		
Birubi Point	35	Tuff	Flake	413737	6372953
Birubi Point	36	Tuff	Geometric Microlith	413732	6372959
Birubi Point	37	Tuff	Flake		
Birubi Point	38	Tuff	Flake	413786	6372908
Birubi Point	39	Tuff	Flake		
Birubi Point	40	Tuff	Flake		

Consistent with the historical descriptions of the diversity of the midden and open campsite complex in this area (e.g. see **Section 4.2.2**), the materials observed in this most landward part of the complex are predominantly flaked stone, rather than beach or rock platform shell.

These materials were heavily weathered and abraded.

No hearths were observed.

Legend

- Proposed Information Centre Site
- Potential Disturbance Area

Umwelt Survey (November 2018)

- Artefact Location

AHIMS Search Results

- Aboriginal Resource and Gathering site
- Artefact site

FIGURE 6.1

Survey Results

Image Source: Nearmap (2018) Data source: Umwelt (2018)

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6.3 Other materials

Also observed on the surface were scatters of broken glass, bitumen fragments, rock and other recent waste. This material adds to the clear evidence that the proposed information centre area has been extensively disturbed by a range of twentieth century land uses, including farming, defence, vehicle movement, general waste disposal. The area has also been affected by fire.

6.4 Areas of sub-surface archaeological potential

As discussed in **Section 3**, **Section 4**, and summarised in **Section 4.3**, there is a high probability that subsurface archaeological materials exist within the proposed information centre area, particularly where intact soil profiles may be present.

Archaeological evidence is associated with soils developed on a former stable land surface, which appears to have a gently undulating form. Currently small exposures of the A_1 and A_2 horizons of this soil can be seen scattered across the site. **Figure 3.1** and **Figure 3.2** show the distribution of these soil profile exposures in the 1970s and in 2017 and surface remnants are also illustrated in the photos in **Table 5.1**.

The history of landscape evolution in this locality means that it is unlikely that the old soil surface is continuous. The soil profile has been disrupted by the most recent period of dune destabilisation and migration, commencing some-time within the last 500 years and continuing today. The former land surface has also been disturbed by historic land use (farming and defence activities) in the area.

The results of the surface survey confirm that subsurface archaeological materials are likely to be present. It is not possible from the current surface expression of the podsol soil profile to determine the current extent of remnants of the old ground surface or the depth of cover of unconsolidated recent sand over the former stable ground surface. It is clear that the depth of cover is highly variable, depending on the development of the pattern of scour and deposition at any specific location.

The subsurface archaeological materials could be:

- In situ, within an intact soil profile associated with a former stable land surface. This soil profile may be buried by a thin mantle of recent sand of several metres, depending on the specific location. Generally, the greatest depth of cover with recent sand is along the eastern boundary of the proposed information centre area (roughly parallel with James Patterson Street), where the active sand accumulation zone was located prior to works by the Soil Conservation Service.

- A lag deposit when a soil profile has been disrupted/eroded, but with flaked stone artefacts relatively undamaged by mobile sand – i.e. exposed for relatively short periods of time, before being re-covered by accumulating sand deposits

- A reworked lag deposit, exposed on multiple occasions to aeolian processes. While these artefacts are unlikely to have been displaced a significant distance laterally, their vertical context is entirely lost.

Of these three subsurface contexts, only the first one has real archaeological potential from a scientific perspective. Subsurface testing is necessary to determine which of the artefact contexts occur in different parts of the site.

6.5 Discussion

The results of the surface survey confirm the following:

- Aboriginal objects that form part of a very large and complex archaeological site, which is important to Worimi people, remain visible on the surface in the western portion of the proposed information centre area and the adjoining lands, where there are exposures of a former stable soil surface. Elements of this site complex have the potential to continue into the remaining section of the proposed information centre area in a subsurface context.

- The materials at this inland part of the site complex are predominantly stone, not shell. It is possible that shell previously was included in this part of the site and has been weathered, but more likely this part of the site complex reflects a focus on terrestrial and wetland resources, rather than marine resources. This is consistent with earlier observations, when the site complex was relatively intact.

- The stone materials are almost exclusively Nobbys tuff and silcrete, both known to be available at the southern end of Stockton Bight, north and south of the Hunter River. The assemblage includes cores and flakes, including backed flakes. This is similar to the other sites that are present along Stockton Bight, in the deflation basin, or associated with old soil profiles within the transgressive dunes, or on the back barrier unit landward of the high transgressive dunes.

- The archaeological evidence in the proposed information centre area has been extensively disturbed

- Only archaeological materials associated with intact former soils are sufficiently in-situ to have scientific value. Other archaeological materials have cultural value.

- It is not possible to predict the distribution of relatively intact subsurface soil profile material (beyond that currently exposed), or the depth of cover from the surface survey alone.

7.0 Significance assessment

The assessment of significance is critical in establishing mitigation and management strategies for cultural heritage (refer to Pearson and Sullivan 1995:21). Cultural significance is defined by the Burra Charter in terms of aesthetic, scientific, historic and social values. In NSW, Aboriginal cultural heritage is typically assessed according to its social and scientific significance (in accordance with the *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW*, 2011).

7.1 Social or cultural value

Over the course of previous assessments and during consultation for the current project, the registered Aboriginal parties have confirmed that the site complex within Birubi Point Aboriginal Place is of very high cultural significance due to the nature and extent of the archaeological material it contains and its association with areas of cultural and ceremonial importance. This site complex is visible within the western portion of the proposed information centre area and has the potential to extend in a sub-surface context across the remainder of the area.

The extent and complexity of the former midden site landward of Little Beach, on the local headlands and extending landward to the Anna Bay 4WD access road and beyond, is a source of cultural pride for Worimi people. The existence of this large and complex site is evidence of the capacity of Worimi people to live well and look after their sea country and lands.

The whole of the Aboriginal Place, the Worimi Conservation Lands and the parcels of land in between have a strong, special and continuing association with the Worimi community, for social cultural, spiritual and economic reasons.

The Worimi still use the area today for fishing, shell fishing and recreation and their history and connection to the land is demonstrated by the abundance of significant resource materials that have been collected from within and adjoining the area over thousands of years.

Today the extensive archaeological material of Birubi Point Aboriginal Place and the Worimi Conservation Lands is a site for teaching current and future generations about Worimi ancestors and local Aboriginal culture. The proposed information centre will provide an opportunity for Worimi people to also share their knowledge, their stewardship of their country and their successes with more visitors.

Registered Aboriginal parties participating in the survey provided information about their knowledge and experience of the resources available in this locality and their archaeological expression.

Additional comments received during this assessment from the registered Aboriginal parties (Mur-Roo-Ma Inc) reinforce the Aboriginal cultural significance of the proposed information centre area (**Appendix 1**).

7.2 Scientific values and archaeological significance

Archaeological significance is part of the scientific heritage significance of the place. The Birubi Point Aboriginal Place as a whole has been assessed as having high archaeological significance; this was a key part of the decision to gazette the Place.

The proposed information centre area is adjacent to the Birubi Point Aboriginal Place and shares many of its archaeological values and significance.

The specific archaeological significance of the proposed information centre area relates to the potential of the surviving physical fabric of the archaeological materials that are present within the site to:

- Yield new or further substantial scientific/archaeological information
- Be a benchmark or reference site
- Provide evidence about past Worimi cultural activity that is not available elsewhere.
- Illustrate activities (or a complex of activities) that are uncommon or rare, or are poorly documented, and the activities are important to a community.

As discussed in **Sections 4**, **5** and **6** the current extent of the archaeological evidence in the proposed information centre area is much reduced from the extent, intactness and complexity that were observed in early reports of the archaeological materials (e.g. Hall 1928). The documentation of surveys and excavation across what is now Birubi Point Aboriginal Place, conducted by Len Dyall in the 1970s provides both a review of the historical and ethnographic records about the Place, but also an analysis of the types of materials present and the extent of damage that had occurred by that time.

There can be no doubt that the midden deposits recorded in the Robinson Reserve/Fitzroy Street area in the 1970s still had very high archaeological significance. The best preserved remaining midden is now within the protected Fitzroy St area, which is fenced, and protected by mulch and dense ground cover vegetation.

The occupation evidence previously recorded within and adjacent to the proposed information centre area over the last 30 years does not have the intensity of the sites to the east of Birubi headland. The current extent and structure of open campsite material that may remain is not known. However, it is likely that much of the remaining context for flaked stone material has low structural integrity due to a combination of severe and ongoing wind erosion impacts for more than 50 years; former agricultural and defence uses; works to reshape the ground surface and stabilise both high transgressive dunes and frontal dunes - in the 1980s through to 2000; and ongoing local and regional use of access routes onto the eastern end of Stockton Bight beach by vehicles.

As discussed in **Sections 4** and **6** of this report, it is appropriate to consider the artefacts that have been observed on the surface within the proposed information centre area as part of a continuous site, linked to the former stable land surface. The materials recorded during the current survey and assessment are located between the grid references provided for two previously recorded stone artefact sites: 38-5-0270 and 38-5-0272. These sites are also associated with exposures of the former stable dune surface and comprise stone artefacts of Nobbys tuff. All the exposed artefacts are affected to some extent by abrasion by wind-blown sand.

Stone artefact sites similar to these exposures are widespread through the dune landscapes of Stockton Bight, occurring in association with former stable dune surfaces, and evidence of former dune woodland vegetation. Artefact scatters have been recorded on sandy lower slopes/swale floors, gentle mid slopes and crests/ridges.

Table 7.1 provides an assessment of the scientific aspects of archaeological significance of materials recorded on the surface of the proposed site of the information centre and on adjoining land. This assessment considers rarity, representativeness, research potential, education potential and integrity (based on Australian ICOMOS 1988 and the *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW*, 2011). The assessment acknowledges that the artefacts exposed within the

proposed information centre area are part of a broader site complex. It therefore considers the significance of the surface artefacts at different spatial scales, namely:

- Only the area of the proposed information centre
- The area of the proposed information centre plus the immediately adjoining site records
- The area of the proposed information centre as an element of the Birubi Point site complex.

Table 7.1 Assessment of Archaeological Significance

Site	Rarity	Representativeness	Research Potential	Education Potential	Integrity	Overall
Surface artefacts within the proposed information centre area	Common: Early descriptions of the archaeological material within this landward part of the site complex refer to flaked stone artefacts (flakes, blades and cores), grind stones, edge ground implements and hearths. Of these site components, flakes, cores and occasional blades were observed on the surface during this assessment. These materials were heavily weathered and abraded. Low significance	Typical of the sites occurring in dune sites and associated with former stable dune ground surfaces along Stockton Bight (not the middens on the open coast). Similar sites exist within the Birubi Point Aboriginal Place (which also includes part of Tomaree National Park) and Worimi National Park. Low significance	Low, unless undisturbed subsurface deposits are identified. Disturbed context	Moderate significance. The artefacts are on the surface and there is good opportunity to discuss their natural context and the ways in which this landscape has changed. However, note that actual exposures of artefacts are highly variable, so no consistent evidence.	Poor – low significance. Although it is clear that these artefacts were discarded in the context of a former stable and vegetated soil and dune surface, they are only visible at this location because the soil have been exposed and deflated. Integrity may be good for any remaining unexposed and intact soil profile	Low archaeological significance (with potential for higher significance if intact subsurface deposits are present)
Surface artefacts across the proposed information centre area and two previously recorded artefact sites in the immediate vicinity	Common: The extended area increases the number of artefacts, but not necessarily the diversity of materials or flaking technology/flake styles Low significance	As above	As above	As above	As above	Low archaeological significance

Site	Rarity	Representativeness	Research Potential	Education Potential	Integrity	Overall
Surface artefacts within the proposed information centre area, in association with the other components of the site complex at Birubi Point	The scale and complexity of the overall site is rare. The diversity of evidence of lifestyle across the site reflects the different micro environments, access to specific resources and shelter from strong winds. The overall site complex has high significance. However, even within the site, the area of artefacts in the proposed development area is not particularly rare. Other examples of this type of evidence – artefacts and context, occur within the Aboriginal Place.	The overall site complex provides evidence of multiple aspects of Worimi lifestyle over many generations. The evidence provided by the stone artefact sites is replicated elsewhere in the complex and on the adjoining private land. **Moderate significance** for the proposed information centre area, in this context	The research potential of the Birubi site complex has already been demonstrated, with several large excavation programs occurring in the past. The site complex has been disturbed and partly destroyed since that work was completed. However, the site complex as a whole retains valuable archaeological research potential, partly revisiting the data collected in previous studies, partly around evidence retained under recent wind-blown sand deposits. **Moderate significance**	The overall site complex has high teaching potential. The artefacts in the proposed information centre area are part of the story of Worimi people's association with the sea, dunes and wetlands in this area. **Moderate significance**	Much of the site complex has been disturbed or destroyed by late 20th century development, continuing aeolian sand movement and shoreline change. Some areas with higher integrity remain and should be the focus for careful conservation management. On the currently available evidence, the proposed information centre area does not have high integrity and is not a priority	**Moderate significance**

7.3 Other values contributing to significance

This section considers historic value and aesthetic value.

The archaeological context and to some extent the current archaeological condition of the Birubi site complex, including the proposed information centre site, has been strongly influenced by historical interest in the archaeology of what was a very large and complex site. The historical records from the 1920s (from the Australian Museum) are important to understanding the size and functions of the archaeological site. They are also important to understanding the long term interactions between archaeologists, Aboriginal owners and other local communities. This is critical information for interpretation.

Aesthetic significance is generally used to refer to creative or technical achievement and 'landmark' qualities of architecture, but it does also take scenic qualities into account. Within the Birubi Point Aboriginal Place, the Birubi Point and Morna Point headlands can be considered to have aesthetic significance from a scenic perspective. This visual or scenic perspective also has cultural associations, as both of these elevated headlands offer extensive views of the beach, dunes and nearshore waters along Stockton Bight. This outlook would have been of great significance to Worimi people, because of the economic opportunities, and cultural contact information provided by the outlook.

Within the proposed information centre area, aesthetic aspects of archaeological and cultural significance can be identified. These include:

- Views from parts of the land extend across and along the high transgressive dunes which dominate the landscape of Stockton Bight. These dunes are an important part of the cultural landscape of generations of Worimi people.

- The visual character of the landscape, including the presence of lines of former stable topsoil materials is a key part of understanding its archaeological potential

In addition, 'Birubi' refers to the Southern Cross, which lights the night sky above Birubi Point. The expansive view of the sky from the headland is culturally significant and needs to be managed in the development of facilities.

8.0 Assessment of risk of harm - archaeological

Risk of harm relates to the likelihood that proposed works will disturb, damage or destroy Aboriginal archaeological materials. From an archaeological perspective, the consequences of the impact are linked to the significance of the archaeological materials that will be impacted. This may not be the case from an Aboriginal cultural perspective.

The proposed information centre area is part of a former extensive complex of Aboriginal archaeological materials. This part of the site complex has been heavily disturbed. The surface materials have low archaeological significance. However, it is possible that subsurface materials not subject to extensive disturbance and of higher archaeological significance may be present.

The distribution, depth of cover over midden materials and intactness of the remaining archaeological deposits is not known. This information can be obtained via further investigation, as discussed in **Section 9**.

Figure 1.3 shows the potential disturbance area for the proposed information centre. **Figure 5.1** and **Figure 6.1** show the known distribution of archaeological materials. As is apparent, the proposed disturbance footprint includes surface artefacts and an area of stabilised soil surface (with the potential to contain further artefacts). The proposed works will therefore result in direct harm to identified Aboriginal objects. In addition, areas of subsurface archaeological deposits, with greater integrity than the surface exposures are potentially located within the disturbance area. If further investigation confirms the presence of such deposits, they will be subject to harm as a result of the proposed activity, if it proceeds as currently designed.

8.1 Assessment of harm – cultural and social

The opportunity to provide input regarding the potential of harm to cultural and social values was provided to the Aboriginal parties. No specific information on potential harm was provided. The registered Aboriginal parties supported the proposed method for further investigation of the archaeological evidence.

9.0 Proposed management and mitigation strategies

The following management and mitigation strategies are based on a two stage approach.

9.1 AHIP applications

Works which have the potential to cause harm to Aboriginal objects and values are proposed to occur in two stages:

- Geotechnical testing and archaeological test excavation
- Construction of new facilities

The results of the first stage will inform the design and location of the works in the second stage.

To facilitate these works, two AHIP applications will be submitted to OEH.

- The first AHIP will relate to the geotechnical and archaeological investigation activities (**Section 9.1.1**). This AHIP application has been submitted to OEH.

Depending on the results of these investigations, Council will, after further consultation with the RAPs:

- advise OEH that the construction works are not expected to impact on any evidence of Aboriginal archaeological materials. In this case a second AHIP would not be required (based on the evidence from the context of the information centre area, this is considered to be an unlikely scenario) ; or
- Prepare a second AHIP application, with proposed salvage and monitoring requirements (**Section 9.1.2**). In this context:
    - the minimum salvage process would be that registered Aboriginal parties would monitor the ground disturbing works and collect any cultural materials that are exposed during the construction process
    - if intact soil material with occupation evidence are identified from the results of investigations under the first AHIP, a more detailed excavation and salvage program is likely to be required.

9.1.1 AHIP for geotechnical and archaeological testing

A geotechnical investigation of the proposed information centre area is required to provide more information about the complex stratigraphy of wind-blown sand which dominates the substrate of the site.

The land is also adjacent to land which has been mapped by the NSW Government (2011) as potentially being affected by acid sulphate soil (class 4 and 5). The proposed development site was not classified during the NSW government assessment. The geotechnical assessment will also confirm whether there is a risk of disturbing acid sulphate soil during the construction of the proposed information centre.

The results of the geotechnical investigation will be used to finalise the layout and detailed design of the new development, to minimise risks.

The auger will sample the materials underlying the site, to a depth of approximately 3 metres. This depth allows for the maximum depth of excavation to create a level space for the development and for foundations of the structures. The design of the information centre is intended to minimise the amount of sandy soil that will need to be excavated and/or removed from the site.

Auger holes will be drilled in a grid across the potential disturbance area (refer to **Figure 1.3**) at 20 metre centres, where practical and to a sufficient extent to adequately categorise the soil profile. Spacing may be extended if the terrain makes access difficult.

The geotechnical investigation will also provide information about the depth of cover of unconsolidated recent sand, over any remaining soils associated with the former stable land surface. The former dune podsol soils are distinguished from the recent sand by dark staining of the A_1 horizon, bleaching of the A_2 horizon and dark orange/brown staining of the upper B horizon.

The evidence available from previous archaeological survey and the current site inspection clearly indicates the potential for archaeological materials to be present below the surface. The proposed information centre area has not previously been mapped as an Aboriginal site or PAD, but it is clear that artefacts could be present. As discussed in **Sections 4.2**, **6** and **7** this area should be understood as part of a large site complex which previously extended over the majority of the Birubi Point Aboriginal Place and adjacent terrain. It connects the previously recorded artefact scatters 38-5-0272 and 38-5-0270.

It is proposed that an archaeologist and representatives of the registered Aboriginal parties would be present during the geotechnical drilling process, to monitor materials that are brought to the surface. They will be monitoring for the presence of soils associated with the former stable land surface, and any stone artefacts that may be present.

The locations of the auger holes will be mapped using GPS. The sand materials revealed in each auger hole will be recorded. Any archaeological materials will be recorded, together with information about the depth from which they were recovered and the soil context.

A report will be prepared, in consultation with the registered Aboriginal parties which describes the archaeological findings of the auger program, and maps any areas where the evidence indicates that relatively intact soil layers and cultural materials are present.

Based on these outcomes, Port Stephens Council will be able to advise OEH:

- that there is now good certainty that archaeological values will not be impacted by the proposal; or
- that soil and archaeological materials of low integrity and low archaeological value are present; or
- that soil and archaeological materials of good integrity and likely moderate archaeological significance are present.

It is noted that an application for an AHIP for geotechnical testing has been submitted to OEH.

9.1.2 AHIP for construction of new facilities

The scope of an AHIP for the construction of the new facility will depend on the results of the investigations conducted under the AHIP above.

Port Stephens Council will discuss AHIP requirements with OEH prior to preparing an application for the construction work. Based on the current information, options include:

- An AHIP is not required for the construction work because Port Stephens Council has modified the design of the proposed development to avoid impacting on the known extent of the Aboriginal archaeological site (as understood based on the results of the survey and geotechnical testing).
- An AHIP is required to permit the salvage of surface artefacts known to be present and subsurface artefacts that are known to be present, or may be present, in a disturbed context. This salvage would be completed by monitoring the initial earthworks to level the disturbance area. Monitoring would be conducted by registered Aboriginal parties and any observed artefacts would be collected. As the context will have been assessed as disturbed, there would be no need to make separate collections from different areas.
- An AHIP is required to permit salvage excavation of archaeological materials associated with a (relatively) intact soil profile developed when the dune ground surface was stable. In this case, Port Stephens Council will prepare an excavation plan and research design in consultation with registered Aboriginal parties, for review by OEH. As an example, the excavation plan could involve mechanical removal of recent sand cover and then hand excavation of trenches or wider open areas to document the soil stratigraphy and the distribution of artefacts within the soil profile. If this level of salvage is required, it will be conducted before other construction earthworks commence. All artefacts would be collected using standard archaeological techniques, to facilitate analysis.

9.2 Ongoing involvement of Worimi people

The information centre provides a new opportunity to introduce visitors to the natural and cultural heritage of the Worimi Conservation lands and Birubi Point Aboriginal Place.

Council proposes that new interpretative information and signage will be installed at the information centre. Signage and the text and images used in information will be developed in close consultation with the Board of the Worimi Conservation Lands and the Worimi Local Aboriginal Land Council.

Council also proposes that the detailed landscape design and planting for the information centre will incorporate locally indigenous and useful species, and to reflect the cultural values of the area and the importance of terrestrial as well as marine resources to the Worimi people.

Council will consult Worimi organisations, including rangers working on the conservation lands, about appropriate species and involve Worimi people in the planting of the site.

9.2.1 Other management controls

The car parking area of the information centre is designed to manage and control vehicle access beyond the boundaries of the site.

Council proposes, in accordance with the management plan for Birubi Point Aboriginal Place, to define a walking route through the dunes, from the proposed information centre to Birubi Surf Club. The intent is that this is designed to minimise impact on the natural and cultural values of the Aboriginal Place, but also to provide an opportunity to introduce visitors to the natural and cultural heritage of the area.

Signage at the beginning of the walk will encourage walkers to remain on the defined path, and not to pick or collect plants, stone or shell.

A detailed plan for the walking path has not yet been prepared. When Council has a firm proposal for the location and construction method for the walking path, a separate cultural heritage assessment will be required.

10.0 References

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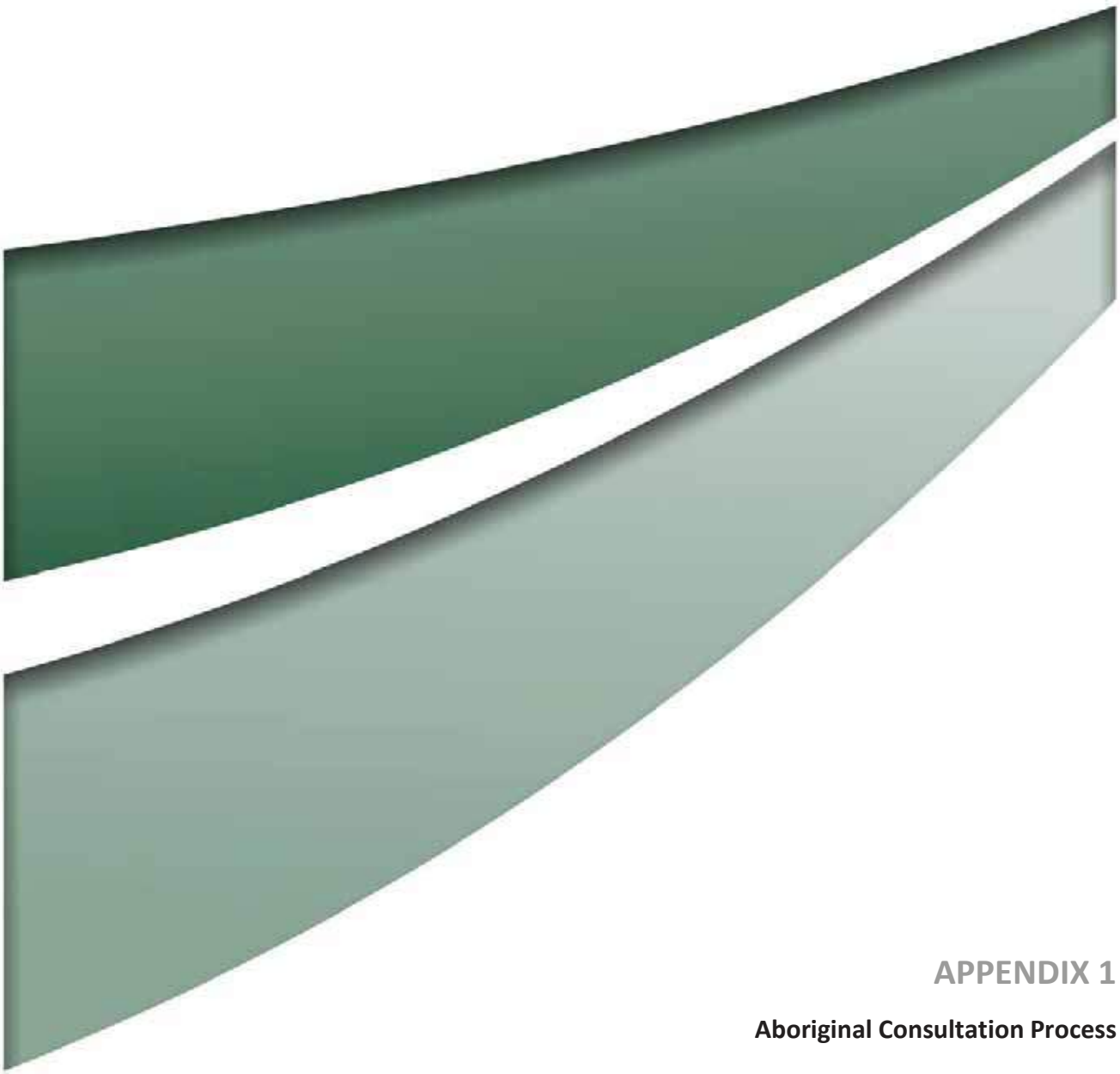

APPENDIX 1

Aboriginal Consultation Process

From:	Paul Burton
To:	Paul Burton (paul.burton@portstephens.nsw.gov.au)
Bcc:	"reception@worimi.org.au"; "admin@karuahaboriginal.com.au"; "adminofficer@oralra.nsw.gov.au"; "enquiries@nntt.gov.au"; "information@ntscorp.com.au"; "admin.hunter@lls.nsw.gov.au"
Subject:	Notification of Aboriginal Cultural Heritage Assessment and Invitation for Registrations of Interest – 73 James Paterson Street and 49B Ocean Avenue, Anna Bay (Port Stephens LGA)
Date:	Wednesday, 13 June 2018 5:28:00 PM
Attachments:	image001.png

Good Afternoon,

Port Stephens Council are undertaking Aboriginal community consultation for an Aboriginal Cultural Heritage Assessment Report for the proposed upgrade of recreation facilities at 73 James Paterson Street and 49B Ocean Avenue, Anna Bay.

Registrations are invited from Aboriginal individuals and organisations who hold cultural knowledge relevant to determining the significance of Aboriginal objects and/or places in the area and who wish to be involved in the consultation process.

The consultation may be used to prepare an Aboriginal Heritage Impact Permit application(s), if required, and to assist OEH in consideration and determination of the AHIP application(s).

Registrations of interest should be provided by no later than **28 June 2018** to Paul Burton at Port Stephens Council, by:

Email: paul.burton@portstephens.nsw.gov.au
Phone: (02) 4988 0535
Post: PO Box 42, Raymond Terrace, NSW, 2324

Please forward this email to potentially interested persons and organisations. Alternatively, you may respond to this email with their contact information and I will contact them directly.

PORT STEPHENS COUNCIL

Paul Burton
Senior Community and Recreation Planning Officer

p 02 4988 0535 | m 0407 664 357
w portstephens.nsw.gov.au

From:	Nicole Davis
To:	Nicola Roche
Cc:	Pam Dean-Jones; Steve Bernasconi
Subject:	RE: Confirmation of consultation approach - Birubi Point projects
Date:	Wednesday, 5 September 2018 11:55:07 AM
Attachments:	image001.png

Hi Nic,

Yes, I can confirm that OEH has no concerns with PSC utilising the one set of registered Aboriginal parties for both projects. Please just ensure that it is made clear to all involved that there are 2 separate but adjacent projects being proposed/undertaken.

Regards
Nicole

Nicole Davis
A/Senior Team Leader - Planning
Hunter Central Coast Branch
Conservation and Regional Delivery Division

26 Honeysuckle Drive, Newcastle 2300
Locked Bag 1002, Dangar 2309
T 02 4927 3156 **M** 0409 394 343

From: Nicola Roche <nroche@umwelt.com.au>
Sent: Wednesday, 5 September 2018 11:07 AM
To: Nicole Davis <Nicole.Davis@environment.nsw.gov.au>
Cc: Pam Dean-Jones <pdean-jones@umwelt.com.au>; Steve Bernasconi <Steve.Bernasconi@portstephens.nsw.gov.au>
Subject: Confirmation of consultation approach - Birubi Point projects

Hi Nicole,

Port Stephens Council is currently commencing the Aboriginal cultural heritage assessment process for 2 projects at Birubi Point. These relate to the redevelopment of Robinson Reserve (within the bounds of the Birubi Point Aboriginal Place) and the establishment of a transport interchange on James Patterson Drive (off Gan Gan Road and outside the Birubi Point AP). PSC has already commenced the notification and registration process for Aboriginal parties for the Robinson Reserve project. Given the concurrent timing and proximity of the two assessment areas, can OEH please confirm that the notification and registration process can be used for both projects ie. maintain the one set of registered Aboriginal parties for both projects.

Regards
Nic

Nicola Roche
Manager Cultural Heritage

Umwelt (Australia) Pty Limited
75 York Street
Teralba, NSW 2284

Phone: (02) 4950 5322
Mobile: 0427 125 685

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Planning and development

DEVELOPMENT APPROVALS

PROPERTY DESCRIPTION	LOT/DP	PROPOSAL	FILE NO.
ANNA BAY			
30 Ocean Avenue	LOT: 191 DP: 13134	S4.55 Modification to Two Storey Dwelling	474/2016
BRANDY HILL			
5 Warrigal Close	LOT: 504 DP: 805573	Carport	306/2018
FERN BAY			
7 Stringybark Drive	LOT: 44 DP: 280005	Swimming Pool	329/2018
MEDOWIE			
53A Lisadell Road	LOT: 1571 DP: 786936	S4.5 Modification to Alterations/ Additions to Existing Single Storey Dwelling, Detached Garage and Pool	24/2016
17 Harvest Road	LOT: 229 DP: 1224890	S4.55 1(A) Modification to Garage	232/2018
11A Kirrang Drive	LOT: 102 DP: 1227469	Earthworks (Landfill)	237/2018
21 Harvest Road	LOT: 231 DP: 1224890	Single Storey Dwelling, Swimming Pool and Farm Shed	246/2018
66 Sunningdale Circuit	LOT: 2 DP: 280074	Dwelling house 2+ storey and Retaining Wall	289/2018
6 Royal Avenue	LOT: 120 DP: 1234206	Single Storey Dwelling	313/2018
116 Sunningdale Circuit	LOT: 26 DP: 280074	Single Storey Dwelling	317/2018
NELSON BAY			
92 Wallawa Road	LOT: 1 DP: 1056302	S4.55 Modification to Two Storey Dwelling, Pool Retaining Wall & Deck	19/2015
30 Trafalgar Street	LOT: 9 DP: 24407	Dual occupancy and Torrens Title Subdivision	71/2018
31 Tallean Road	LOT: 1 DP: 506122	Deck	271/2018
RAYMOND TERRACE			
15 Kinross Street	LOT: 8 DP: 24067	S4.55 1(A) Modification to Dwelling	174/2018
24 Hastings Drive	LOT: 923 DP: 813726	Shed	283/2018
4 Irrawang Street	LOT: 11 DP: 1221364	S4.55 Modification - Changing from Torrens Title to Strata Title	731/2016
SEAHAM			
1449 Clarence Town Road	LOT: 5 DP: 708057	Shed	243/2018
SOLDIERS POINT			
38 Kent Gardens	LOT: 448 DP: 27844	Torrens Title subdivision - 1 lot into 2	849/2017
TANILBA BAY			
21 Broughton Circuit	LOT: 311 DP: 1071880	Dual Occupancy (Attached) and One into Two Torrens Title Subdivision	80/2018

The above consents are available for viewing through DA Tracker on the Port Stephens Council website. General Manager

Notice of designated and integrated development

Council has received the following Development Application (DA) for Designated and Integrated Development:

DA NO:	16-2018-315 1
DEVELOPMENT SITE:	LOT: 2 DP: 46729, LOT: 80 DP: 538678, LOT: 142 DP: 605461 35A Old Punt Road TOMAGO, 39 Old Punt Road TOMAGO, 44 Old Punt Road TOMAGO
PROPOSAL DESCRIPTION:	Alterations and additions to Industrial Building and First Use – General Industry (Concrete Product Manufacturing)
APPLICANT:	Civmec Holdings Pty Ltd
CONSENT AUTHORITY:	Port Stephens Council
NOTIFICATION PERIOD:	30 days

The proposal is Designated Development pursuant to Schedule 3 of the Environmental Planning and Assessment Regulation 2000. Designated development is generally a type of development that has potential significant environmental impacts. The DA has been submitted with an Environmental Impact Statement (EIS) which addresses these impacts. The development proposal is also Integrated Development as defined under Section 91 of the Environmental Planning and Assessment Act 1979 as the applicant has sought additional approvals, required under other legislation, as part of the current DA. The other approvals are as follows:

ADDITIONAL APPROVALS REQUIRED AS AN INTEGRATED DEVELOPMENT	
TYPE OF APPROVAL	APPROVAL AGENCY
Sections 43(a), 47 and 55 of the *Protection of the Environment Operations Act 1997*	Environment Protection Authority (EPA)
Section 91 of the *Water Management Act 2000*	Department of Primary Industries – Water

During the exhibition period you can view the DA including the details of the proposed development and EIS by visiting Council's DA Tracker on our website at http://datracker.portstephens.nsw.gov.au/. Please enter the 'Application Year' 2018, 'Application Number' 315, and 'Application Type' (Development Application) within the search fields. The DA may also be inspected during the exhibition period at the following locations during normal office hours: Port Stephens Council Administration Building, 116 Adelaide Street Raymond Terrace, NSW 2324; Tomaree Library and Community Centre, Town Centre Circuit Salamander Bay, NSW 2317; Department of Planning, Price Waterhouse Coopers Centre, Level 2, 26 Honeysuckle Drive, Newcastle NSW 2300. Any person can make a written submission in relation to the DA to Council/the consent authority via post to: PO Box 42 Raymond Terrace NSW 2324 or email at: council@portstephens.nsw.gov.au If you wish to advise Council of your views on the proposal, you must do so in writing no later than 30 June 2018. If the submission is an objection, then the grounds of the objection must be specified in the submission. All written submissions received during the exhibition period will be considered by Council during the assessment of the DA. Submissions are considered to be 'open access information' under Government Information (Public Access) Act 2009, (GIPA) and are made be publically available on Council's DA Tracker. Personal identifiable information is redacted from submissions uploaded to DA Tracker. As the development is Designated Development, we must advise you if a Commission of Inquiry is not held, any person who makes a submission by way of objection and who is dissatisfied with the determination of the consent authority in this matter may appeal to the Land and Environment Court in accordance with the provisions of Section 98 of the Environmental Planning and Assessment Act 1979. If a Commission of Inquiry is held, the Minister's determination of the application is final and not subject to appeal. If you have made a reportable political donation or gift donations (including donations of or more than $1,000) in the last two years your submission will need to be accompanied by a 'Political Donations and Gift Disclosure Declaration' form. For more details, including a disclosure form, go to www.portstephens.nsw.gov.au
Brett Gardiner will be assessing the DA and If you have any questions you can contact him directly on 4988 0213.

DEVELOPMENT APPICATIONS

PROPERTY DESCRIPTION	LOT/DP	PROPOSAL	FILE NO.
SALAMANDER BAY			
220 Soldiers Point Road	LOT: 151 DP: 27047	1 into 30 Lot Subdivision (23 Torrens Title lots and 7 Community Title)	306/2017*#

Please Note: The Government Information (Public Access) Act 2009, (GIPA) applies to Council. All submissions received are considered to be "open access information" under GIPA and therefore may be made available to members of the public, if requested. For More Information: Site and elevation plans may be viewed at Council's Customer Service Counter between 8:30am 5pm weekdays. General access to Planners and Building Surveyors is between the hours of 9am and 5pm. Alternatively an appointment at a mutually convenient time can be made with either the duty officer or assessing officer outside these access hours by phoning 4980 0115. Note: Development Applications that have a * next to the file number denotes that it is available on exhibition at the Tomaree Library & Community Centre (Town Centre Circuit) during operating hours. Development Applications that have a # next to the file number denotes that it is an integrated application. To Have Your Say: If you consider your interests would be detrimentally affected by the approval and construction of a building, you may put your case, in writing, addressed to the General Manager to reach Council prior to 5pm, 28/06/2018. Please note The Government Information (Public Access) Act 2009 applies to Council. Under this Act, information held by Council may be released upon application by members of the public. Council will not consider your submission confidential (unless otherwise stated), and may reproduce it in part or in whole.

Public Notice

NOTIFICATION OF ABORIGINAL CULTURAL HERITAGE ASSESSMENT & INVITATION FOR REGISTRATIONS OF INTEREST

Port Stephens Council are undertaking Aboriginal community consultation for an Aboriginal Cultural Heritage Assessment Report for the proposed upgrade of recreation facilities at **73 James Paterson Street and 49B Ocean Avenue, Anna Bay**.

Registrations are invited from Aboriginal individuals and organisations who hold cultural knowledge relevant to determining the significance of Aboriginal objects and/or places in the area and who wish to be involved in the consultation process.

The consultation may be used to prepare an Aboriginal Heritage Impact Permit application(s), if required, and to assist OEH in consideration and determination of the AHIP application(s).

Registrations of interest should be provided by no later than **28 June 2018** to Paul Burton, Senior Community and Recreation Planning Officer by email: paul.burton@portstephens.nsw.gov.au, phone: (02) 4988 0535, or post: PO Box 42, Raymond Terrace, NSW 2324.

Expression of Interest

MARATHON EXCHANGE - BELLINGHAM, USA

Council is seeking Expressions of Interest from Port Stephens residents who wish to represent our region in a Sister Cities marathon exchange with Bellingham in Washington, USA.
The Bellingham Bay Marathon is an annual event traversing northwest Washington, held on 30 September 2018. The trip will take place from **27 September to 2 October 2018**.
Up to three Port Stephens residents will be selected to participate. The successful representatives will be home hosted in Bellingham, with airport transfer, race entry fee and other tourist activities provided by the City of Bellingham.

Port Stephens Council in association with Port Stephens Sister Cities will provide $1,000 shared among successful participants. All other costs such as airfares, passport, meals, etc. will be at the cost of the successful representatives.

If you are interested in participating in this exchange, please forward your Expression of Interest to the Port Stephens Sister Cities Chairman, Mr Nigel Dique at **nigeldique@me.com**
Your Expression of Interest should detail your experience and achievements in this field to date. Applications close **Thursday 28 June 2018**. For inquiries, contact Nigel Dique on 0423 024 819 or the Mayor's office on 4988 0245.

Notice of intention to treat infestations of aquatic weeds

PERIOD UP UNTIL 14 DAYS FROM THIS ADVERTISEMENT

Council intends to treat infestations of aquatic weeds on or in drains, depressions and waterways throughout the area. Herbicides containing active ingredient 600g/kg Metsulfuron methyl and/or active ingredient 360g/l glyphosate will be used. Residents in the treatment area should not use, drink or swim in the water during the period. Small scale reapplications may occur within 30 days of the date of original treatment. For further enquiries contact Council on 4988 0255.

Proposed Council maintenance and construction works

FOR A LIST OF WORKS PLEASE VISIT OUR WEBSITE

portstephens.nsw.gov.au/roadmaintenance

FREE Energy Efficiency Workshop

VISIT OUR WEBSITE FOR MORE INFORMATION

Council, in partnership with the Office of Environment and Heritage is holding TWO x FREE workshops to introduce the Appliance Replacement Offer (ARO). The ARO provides discounts of up to 50% on new, energy efficient fridges and televisions to eligible applicants. The workshops will provide an introduction to the offer and assistance in completing the online application form.

For further information visit: **http://www.portstephens.nsw.gov.au/play/events/event-calendar**

Karuah Centre
9.30am – 11.30am
Thursday 28 June

Tomaree Library and Community Centre
6.30pm – 8.30pm
Wednesday 20 June

From: Paul Burton
To: "rog.hcc@environment.nsw.gov.au"; "reception@worimi.org.au"
Subject: Birubi Point Aboriginal Place Recreation Facility Upgrade - Registered Aboriginal Persons - Notification to OEH and Worimi LALC - updated Register
Date: Thursday, 12 July 2018 11:21:00 AM
Attachments: image001.png
Birubi Point Aboriginal Place Recreation Facility Upgrade - Registered A....pdf

Dear OEH and Worimi LALC,

Please find updated Register attached. The revised register includes the details of David Feeney.

14	David	Feeney	Karuah Indigenous Corporation	karuahindigenous@outlook.com 0421114853 1/7 Mustons Road, Karuah 2324

PORT STEPHENS COUNCIL

Paul Burton
Senior Community and Recreation Planning Officer

p 02 4988 0535 | m 0407 664 357
w portstephens.nsw.gov.au

From: Paul Burton
Sent: Tuesday, 10 July 2018 9:11 AM
To: 'rog.hcc@environment.nsw.gov.au' <rog.hcc@environment.nsw.gov.au>; 'reception@worimi.org.au' <reception@worimi.org.au>
Subject: Birubi Point Aboriginal Place Recreation Facility Upgrade - Registered Aboriginal Persons - Notification to OEH and Worimi LALC

Dear OEH and Worimi LALC,

In accordance with the *Aboriginal cultural heritage consultation requirements for proponents 2010*, please find attached registered Aboriginal persons who expressed interest to participate in consultation for the proposed recreation facility upgrades at Birubi Point, Anna Bay.

Please also find a copy of the Public Notice published in the Port Stephens Examiner on 14 June 2018 and notification letter posted on 14 June 2018.

Should you have any questions please do not hesitate to contact me via the details below.

PORT STEPHENS
COUNCIL

Paul Burton

Senior Community and Recreation Planning Officer

p 02 4988 0535 | **m** 0407 664 357
w portstephens.nsw.gov.au

Birubi Point Aboriginal Place Recreation Facility Upgrade

Registered Aboriginal Persons

Ref	First Name	Surname	Organisation	Contact Information
1	Leonard James	Anderson	Nur-Run-Gee Pty Ltd	lennie.anderson011@bigpond.com 0431334365 22 Popplewell Road, Fern Bay NSW 2295
2	Debbie	Dates	Worimi Traditional Owners Indigenous Corporation	worimitoc@hotmail.com 0412475362 36 Avon Street, Mayfield NSW 2304
3	Paul Lilly	Boyd Carroll	Didge Ngunawal Clan	didgengunawalclan@yahoo.com.au 0426823944 7 Siskin St, Quakers Hill NSW 2763
4	Jamie	Merrick	Worimi Local Aboriginal Land Council	sites@worimi.org.au 02 40338814 2163 Nelson Bay Road, Williamtown NSW 2318
5	Steven	Hickey	Widescope Indigenous Group	Widescope.group@live.com 0425230693 0425232056 73 Russell Street, Emu Plains NSW 2750
6	Deidre	Perkins	-	Dedemaree3@hotmail.com 0425654290 6 Ashleigh Street, Heddon Greta 2321
7	Ryan	Johnson	Murra Bidgee Mullangari Aboriginal Corporation	murrabidgeemullangari@yahoo.com.au 0497983332 PO Box 246 Seven Hills NSW 2147
8	Steven	Hickey	Widescope Indigenous Group	widescope.group@live.com 0425230693 0425232056 73 Russell Street, Emu Plains NSW 2750

Ref	First Name	Surname	Organisation	Contact Information
9	Tom	Miller	Lower Hunter Wonnarua Cultural Services	tn.miller@southernphone.com.au 0402636521 0249372694 51 Bowden Street, Heddon Greta NSW 2321
10	Bec Anthony	Young Anderson	Murrooma Inc	Murroomainc1@gmail.com 0402827482 0249281910 9 Vardon Road, Fern Bay NSW 2295
11	Carol	Ridgeway-Bissett	-	0249843113 33 Ullora Road, Nelson Bay 2315
12	Steven	Talbott	-	gomeroi.namoi@outlook.com 0476893944 73 Kiah Road, Gillieston Heights
13	Graeme	Russell	National Parks and Wildlife Services Worimi Conservation Land Board of Management	graeme.russell@environment.nsw.gov.au 0249848208 0409858811 C/- Graeme Russell Locked Bag 99 Nelson Bay NSW 2315

AGA Services
22 Ibis Parade
Woodberry NSW 2322

Dear AGA Services,

Re: Notification of Aboriginal Cultural Heritage Assessment and Invitation for Registrations of Interest – 73 James Paterson Street and 49B Ocean Avenue, Anna Bay (Port Stephens LGA)

Port Stephens Council is undertaking Aboriginal community consultation for an Aboriginal Cultural Heritage Assessment Report for the proposed upgrade of recreation facilities at 73 James Paterson Street and 49B Ocean Avenue, Anna Bay.

Registrations are invited from Aboriginal individuals and organisations who hold cultural knowledge relevant to determining the significance of Aboriginal objects and/or places in the area and who wish to be involved in the consultation process.

The consultation may be used to prepare an Aboriginal Heritage Impact Permit application(s), if required, and to assist OEH in consideration and determination of the AHIP application(s).

Registrations of interest should be provided by no later than **28 June 2018** to Paul Burton at Port Stephens Council, by:

Email: paul.burton@portstephens.nsw.gov.au
Phone: (02) 4988 0535
Post: PO Box 42, Raymond Terrace, NSW, 2324

Yours sincerely,

Paul Burton
Senior Community and Recreation Planning Officer

14 June 2018

2 October 2018

Dear Registered Aboriginal Party,

Re: Notification of Cultural Heritage Assessment Methodology and Site Inspections

We are writing to you as a Registered Aboriginal Party (RAP) who expressed interest in being consulted about the Aboriginal Cultural Heritage Assessment (ACHA) for a project to upgrade facilities in Robinson Reserve, which is part of the Birubi Point Aboriginal Place at Anna Bay.

Port Stephens Council (Council) also proposes the construction of a new information centre at the corner of Gan Gan Road and the existing Anna Bay four wheel drive vehicle access to the Worimi Conservation Lands. This site adjoins the boundary of the Birubi Point Aboriginal Place and is proposed as a gateway to the area that will reduce traffic congestion and unregulated vehicle access to the Birubi Point Aboriginal Place and Worimi Conservation Lands.

These projects were included in the Birubi Point Aboriginal Place Master Plan and Management Plan which were adopted by Council earlier this year. The location of the two project areas is shown in **Figure 1**.

Council sought advice from the Office of Environment and Heritage (OEH) about whether the same RAPs should be consulted for these two projects. OEH has confirmed that this is an appropriate approach and RAPs for the Robinson Reserve project are now also the RAPs for the information centre.

Council is now preparing detailed designs and assessments for the proposed works, including the preparation of a Review of Environmental Factors (REF) for the works in Robinson Reserve and studies to support a development application for the proposed information centre. Umwelt is preparing the Robinson Reserve REF on behalf of Council and is also preparing the cultural heritage assessment for the information centre.

Nicola Roche and Pam Dean-Jones from Umwelt will prepare the Aboriginal cultural heritage assessments for both projects, in consultation with the RAPs. **Please note that paid participation will be subject to a further expression of interest process.**

This letter:

- **Provides an overview of the scope of works proposed in Robinson Reserve and at the information centre site**
- **Invites you to participate in a site inspection on the 1 November, from 9.30am to 1.30pm. The site inspection will be a walk over of the Robinson Reserve area and the information centre site.**
    - **We will record the locations, context and characteristics of any cultural materials that are visible on the surface at the time of the inspection.**
    - **We will discuss further archaeological investigation requirements and the approval pathways for the projects**
- **Further details about the landscape and archaeological context of the two areas and about the site inspection are attached.**

Legend

- Birubi Point Aboriginal Place
- Proposed Information Centre
- Robinson Reserve Excavation Impact Area
- Property boundary

FIGURE 1

Locality plan

Image Source: DFSI (2018) Data source: Umwelt (2018); Port Stephens Council (2018)

3.0 Proposed works in Robinson Reserve

Robinson Reserve is located to the east of Birubi Headland, landward of Little Beach, Anna Bay.

The proposed works include:

- Improved stormwater drainage including new outlets onto the beach.
- Extending and upgrading the carpark.
- Relocating and upgrading the children's playground.
- Relocating and modernising the toilet block. The old toilet block will be removed.
- New picnic shelters.
- General landscaping.
- Reshaping of the dunes (seaward of the existing dune fence), as necessary to minimise wash over potential.
- Upgrading the beach access ways through the dunes.
- Rationalising some existing signage and preparing new interpretative signage with a consistent theme for the whole of the Aboriginal Place.
- The nature of these construction works requires geotechnical testing to confirm depth to bedrock across the reserve.
- An interpretative boardwalk and viewing platform on Birubi Headland is also proposed.

It is anticipated that the construction of these works will require excavation to a depth of up to 1.4 metres below existing ground level to provide stable foundations. Part of the reserve will be filled to a depth of up to 0.5 metres, to provide a flat surface suitable for recreation.

The existing vehicle access onto the beach for licensed beach haul commercial fishers and for emergency vehicles will be maintained. This access is via locked gate; approved users have keys to this gate.

3.1 Proposed information centre project

The Birubi Point Aboriginal Place Management Plan (2018) includes several projects, developed in consultation with the Birubi Point Cultural Advisory Panel, which are intended to protect cultural values, better manage traffic and access control; improve amenity and visitor experience and showcase the Worimi cultural values of Birubi Point Aboriginal Place.

One of these projects is the proposed information centre at the corner of James Paterson Drive and the Anna Bay 4WD access road onto the Worimi Conservation Lands and Stockton Bight. This project is

outside the Aboriginal Place, but its completion will reduce significant traffic and parking pressures within the Aboriginal Place.

The information centre will be a new gateway to the Worimi Conservation Lands and Birubi Point Aboriginal Place. It will provide a safe and sheltered location for transfer of visitors arriving by coach into smaller vehicles for the various recreational activities offered in the vicinity of the Aboriginal Place. It will provide additional parking for visitors who may choose to walk through the dunes to Birubi Headland. The interchange will also provide information for visitors.

The proposed works for the construction of the information centre will include

- Earthworks to establish a level surface suitable for construction;
- establishment of a vehicle parking area;
- establishment of pavements, walkways and gardens; and
- construction of buildings and signage.

These activities will require disturbance of the current natural ground surface to varying depths depending on the current topography of the area.

4.0 Proposed assessment methodology

We note that Section 3.2 of the consultation requirements specifies that the objective of consultation is to ensure 'that Aboriginal people have the opportunity to improve assessment outcomes'. Factors specified as assisting in meeting this objective include providing RAPs with the opportunity to:

- Provide information on cultural values (as invited in this draft methodology);
- influence methods regarding assessment of significance for Aboriginal objects/places (which can be undertaken in response to this draft methodology, during fieldwork and in commenting on the draft ACHA report); and
- comment on the draft ACHA report.

Our approach is designed to ensure compliance with this objective, including the potential for in-field consultation with Aboriginal party representatives during fieldwork. Umwelt archaeologists are trained to seek and document cultural feedback provided by Aboriginal party representatives during fieldwork. This is not limited to cultural values associated with archaeological sites but may encompass any values identified by Aboriginal people.

Umwelt acknowledges and understands that cultural values, by definition, relate to values outside those associated with specific archaeological sites/objects. They may be associated with a specific site or refer to a landscape feature or a broader value of a place. Throughout the assessment process, we invite comment from Aboriginal parties regarding any cultural values associated with the project areas and will ensure that any information provided regarding cultural values is documented and recorded in accordance with the wishes of the relevant Aboriginal party for inclusion in the ACHA report.

From an archaeological perspective, the challenge for the current assessment is to understand:

- whether the proposed works in Robinson Reserve and on Birubi Headland will intersect with buried midden deposits;
- whether the proposed development of the information centre will impact on Aboriginal archaeological sites
- whether any specific design changes are needed to avoid or minimise impacts on the cultural materials;
- if there are areas that should be avoided in the layout of the new facilities because of their cultural sensitivity; and
- how the stories of Worimi people at Birubi Point could be incorporated into the design of the new facilities and in interpretative signage. Council will consult with Worimi people about specific wording, graphics and images that could be used in the signage.

The first step for both projects is to meet on site and undertake a survey of the areas currently under consideration and to document cultural values.

4.1 Survey Methodology

Survey units will be defined and named with reference to Requirement 5c of the Code of Practice, including recording start and finish points and/or boundaries for all survey units using a hand-held GPS receiver (set to allow recording of data with datum MGA94) and topographic mapping (where relevant), with track logs to be recorded for all pedestrian transects. Start and finish points/boundaries for survey units will be defined based on landforms, study area boundaries, access or other arbitrary terminations (as specified in the Code of Practice). The spacing between individuals will also be recorded for each survey unit.

Photographs will be undertaken for landforms/survey units (where informative). Information recorded for each survey unit will include

- Vegetation.
- Geology and soils (where suitable areas of exposure/visibility are present).
- Identified Aboriginal resources (food and medicine plants, prey animals, stone and water).
- Levels of average ground surface visibility within the survey unit (in accordance with the Requirement 9 of the Code of Practice).
- Extent and type of exposures within the survey unit (with reference to the factors leading to the exposure such as erosion, earth-moving activities, track establishment etc.).
- Any information provided by the registered Aboriginal parties in relation to cultural values, noting that such information will be recorded in accordance with the wishes of the party providing the information.

- Any site, area of Potential Archaeological Deposit (PAD) or landscape feature of Aboriginal cultural value present within the survey unit (see below for further information on site/PAD recording).

Any Aboriginal archaeological sites identified during the survey will be assessed with reference to the site boundaries. Factors that will be taken into consideration in defining and mapping site boundaries may include the distribution of surface artefacts, landforms or physical boundaries and cultural information.

Sufficient information will be recorded for all sites to meet Requirement 7 of the Code of Practice. The archaeological and Aboriginal and cultural significance of any site will be discussed with the registered Aboriginal parties participating in the survey.

Based on our current understanding of the project areas, the key factors that we will also need to consider during the survey will include:

- The former and likely contemporary extent of the midden material in Robinson Reserve and the current depth of cover over it.
- How the depth of cover over midden material can be tested and confirmed.
- Where earthworks will be required for civil works and the necessary depth of excavation and disturbance.
- Other information needed to assess potential archaeological impacts and make decisions.
- How Worimi cultural values can be showcased at the interchange and along any pathways connecting the information centre to Birubi headland.

5.0 Subsequent Phases of Work

Based on our current knowledge of the project areas, we anticipate that it will be necessary to undertake further investigations within the project areas, potentially including geotechnical/soil testing and archaeological excavations. As the project areas are both located within recorded midden sites, testing under the Code of Practice may not be possible and an AHIP may be required. As part of the survey process, we will also be consulting with OEH to determine the most appropriate approvals pathways for both projects.

6.0 Timeframes for project milestones

Table 1 provides an overview of the project timeframes and when your input will be needed. These timeframes are subject to the time required for OEH processes and approvals. This information is provided for your review and comment, particularly in relation to the way in which you would like to provide cultural input and have it incorporated in relevant reports and other documents.

Table 1 Indicative timeframes for input by RAPs

Timeframe	Activity	RAP involvement
August 2018	Port Stephens Council seeks expression of interest from RAPs for this project and a list of RAPs is approved by OEH	RAPs have registered to be involved in the project
October 2018	Umwelt provides a draft methodology for the assessments and invites RAPs to participate in site survey and discussion. Port Stephens Council will ask RAPs for expressions of interest for paid participation in the field work and assessment process.	This letter and attachments is provided for review and comment over a 28 day period (closes **30 October 2018**). The site inspection is scheduled for the **1 November 2018.** Formal expression of interest for paid involvement in the project to be submitted by RAPs.
November 2018	On **1 November 2018**, conduct an on-site meeting and site inspection for both projects. This will include discussion of the investigation method for the remainder of the assessment.	RAPs are invited to participate in the meeting and site inspection, which are for information purposes. Payment arrangements are to be made with Port Stephens Council via an expression of interest process.
December 2018	If an AHIP is required for either project, a draft Aboriginal Cultural Heritage Assessment will be provided to RAPs for review and comment. If OEH indicates that excavations can be undertaken without an AHIP (under the Code of Practice), the excavation methodology will be provided to RAPs for review and comment.	For excavations under the Code of Practice or as part of the recommendations of an Aboriginal Cultural Heritage Assessment, the comment period will extend for a minimum of 28 days from provision of the draft document.

7.0 Summary

This letter provides details of the proposed methodology for Aboriginal Cultural Heritage Assessments associated with the projects. In accordance with the consultation requirements (DECCW 2010), we ask that your group provides comments on the draft methodology by no later than close of business **30 October 2018**. Comments regarding the draft methodology can be provided verbally or in writing to:

Pam Dean-Jones or Nicola Roche at Umwelt

Email: pdeanjones@umwelt.com.au or nroche@umwelt.com.au

Or by post, 75 York St Teralba 2284

If you would like more information or would like to discuss the project, please call Pam Dean-Jones on 49505322 or 0412278201.

Yours sincerely

Paul Burton
Senior Community and Recreation Planning Officer

Attachments

Attachment 1: Background - Landscape and archaeological context

Attachment 2: Site meeting and inspection arrangements

Attachment 1

Background information about Birubi Point Aboriginal Place and adjoining areas

1. Landforms

Across the Birubi Point Aboriginal Place, there is clear evidence of the character of the landscape in which Worimi people lived. The sandy coastal landforms generally have been deposited since sea level rose and the coastline returned to around its current position, more than 6000 years ago.

In and around Robinson Reserve are:

- Rocky headlands, with a mantle of wind-blown sand and nearshore rock outcrops, some of which were previously buried under beach sand.
- Low and gently undulating dunes with well-developed podsol soil profiles that indicate an extended period of landform stability.
- Freshwater wetland within dune swales or between dunes and bedrock landforms. After rain, freshwater also ponds in the deflation basin along Stockton Bight.
- A frontal dune. The current frontal dune at Robinson Reserve is recent and has only been in place since council conducted dune stabilisation and planting works in the last 10 to 15 years. Parts of this frontal dune are overtopped by waves in major storm events.
- Other mobile dune deposits, at the leading edge of dune transgression from Stockton Bight.

The current form of Robinson Reserve was created when Council formalised the parkland about 25 years ago. Prior to that time, the dominant characteristic of the reserve area was severe erosion of the former frontal dune and hind dune system by waves and wind.

The current landforms at the information centre site reflect the continuing movement of wind-blown sand across the area. The area has been much disturbed by previous land uses. The presence of old soil horizons and tree stumps indicates it was stable and vegetated probably within European times. Hummocky and trailing dune forms have developed around vegetation, including remnant banksia dune scrub and invasive bitou bush. Where sand has been deflated, patches of the older natural ground surface or soil profile are exposed. Some low lying deflated areas hold shallow fresh water after rain.

High mobile dunes are located to the north west of the site. Partially stabilised high steep dunes form the outer boundary of the dune field, to the south of the site towards Birubi Headland. Old podsol B horizon material is frequently exposed in the wind blown faces of the high dunes. Dyall (1977) describes peaty layers (or organic A horizons of soil profiles) a forming ‘sills’ about 6m above the level of the freshwater ponds in the swale behind the frontal dune at the back of the beach.

2. Aboriginal cultural heritage

The archaeological context of Birubi Point Aboriginal Place was reviewed and reported by Umwelt in 2010. Archaeological reports from the 1920s, 1970s and 1980s and around 2009 (for the new surf club) provide information about the complex evidence of Worimi people’s lives at Birubi Point, including within the Robinson Reserve and in the transgressive dunes at the eastern end of Stockton Bight.

Robinson Reserve

The Little Beach and Robinson Reserve area is part of a very large midden site which is known to have extended from the shoreline and landward across low dunes to a wetland area. The midden included shell, fish bone, animal and bird bone, hearths, flaked stone artefacts and edge ground stone artefacts. The concentrations of these components and species (e.g. rock platform and beach shell, and fish bone) vary across the site, reflecting different activity areas and use by different people.

Burials of Worimi people are known from several parts of the Aboriginal Place (including Birubi Headland), but have not been reported within the Robinson Reserve area.

The early archaeological reports describe extensive and stratified midden, built up over potentially thousands of years of coastal occupation.

Severe wind and wave erosion during the twentieth century exposed, dissected and eroded the extensive midden. The exposed stratified material can be seen in photos from the 1920s. Archaeological reports from the 1970s and 1980s describe the disturbance and loss of stratified deposits in the site. However, some midden shell and other cultural materials are likely to remain at variable depths and with variable concentration and integrity beneath the current ground surface.

Various past development and coastal management works in Robinson Reserve are likely to have impacted on the archaeological site. Much of the site was also impacted by residential subdivision and house construction in the 1950s to 1980s. The works in the reserve include earthworks for dune stabilisation, excavation for the car park and footings for the skate park; levelling of the open area and playground area, installation of water and sewer connections. The remaining extent of midden materials, outside the protected Fitzroy St area, is not known.

Information centre site

The early archaeological reports (such as Hall 1928 and Dyall 1977) describe the distribution of archaeological materials in the dunes to the north west of Birubi Headland. Although some shell is present, the sites in this area which is more than 800 metres from the beach or rocky headland, are generally stone artefacts scatters. Stone artefacts are common wherever the old A horizon of the stable land surface is exposed.

Dyall 1977 refers to numerous small flaked stone artefacts (including bondi points and geometrics) in the sand exposed along a track where James Paterson St is now aligned.

In addition to flaked stone, Hall (1928) refers to ‘ovens’ made up of rings of stones in the dunes to the north west of Birubi Headland.

3. Previous and required AHIPs

Two AHIPs have previously been issued for the Birubi Point Aboriginal Place:

- A general AHIP was first issued in 2010 and extended in 2013. It covers multiple routine maintenance activities, including in Robinson Reserve. The AHIP foreshadowed that separate AHIPs would be required for major works involving ground disturbance. The general AHIP did not permit geotechnical testing. This general AHIP has now expired.

- A specific AHIP was issued in 2013 for the surf club site on Birubi Headland.

Attachment 2

Arrangements for site inspection

Please confirm your attendance no later than **Thursday 25 October**, by contacting Paul Burton at Port Stephens Council.

Paul Burton
Senior Community and Recreation Planning Officer

Ph: 02 4988 0535

E: paul.burton@portstephens.nsw.gov.au

If your involvement is as a paid cultural knowledge holder, please make sure that you have provided your expression of interest and relevant information to council before **Friday 26 October**. An expression of interest form will be forwarded under separate cover.

Please come in comfortable clothes, enclosed footwear and bring a hat. The day is likely to be warm and it will be glary on the sand.

Program

We will meet at the information centre site at **9:30am on Thursday 1 November**, parking in Gan Gan Road. We propose to spend approximately 2 hours at the interchange site. This will involve a walkover inspection and preliminary recording of any archaeological materials that are identified.

We will then travel to the Birubi Beach Surf Club for a short break for morning tea.

We will then commence a walk over of Birubi Headland and Robinson Reserve. We propose to spend approximately 90 minutes at Robinson Reserve.

From:	Paul Burton
To:	Paul Burton
Cc:	Clare Naylor; Pam Dean-Jones; Nicola Roche; Steve Bernasconi
Subject:	Birubi Point Aboriginal Place Recreation Facility Upgrade and Information Centre - Notification of Methodology and Site Visit
Date:	Tuesday, 2 October 2018 4:02:40 PM
Attachments:	image001.png image010.jpg image011.jpg image012.jpg image013.jpg image014.jpg Methodology and Site Inspection - 2 October 2018.pdf

Dear Registered Aboriginal Party,

Please find attached letter outlining the proposed methodology and details of the site inspection to inform an Aboriginal Cultural Heritage Assessment for the proposed recreation facility upgrades at Robinson Reserve and the new information centre, Anna Bay.

Please note the following key dates:

- Registration for site visit closes on **Thursday 25 October 2018**.
- Expression of Interest for paid participation closes on **Friday 26 October 2018** (form to be forwarded under separate cover).
- Site visit commencing at 9:30am on **Thursday 1 November 2018** (please ensure you register prior to 25 October).

Please do not hesitate to contact me should you have any questions or require additional information.

Regards

Port Stephens Council

Paul Burton
Senior Community and Recreation Planning Officer

p 02 4988 0535 | m 0407 664 357
w portstephens.nsw.gov.au

Expression of Interest

Robinson Reserve and Birubi Point Information Centre Archaeological Investigations

Name of Registered Aboriginal Party: Murrooma Incorporated

Address: 9 Vardon Road Fern Bay 2295

ABN: 97 807 719 484

Clarify your cultural connection to the area and the site with reference to the criteria in Section 1.1;

All Murrooma representatives hold specific cultural knowledge and education, relevant to determining the significance of Aboriginal objects and places in the Worimi Area. We would like the opportunity to be involved in any cultural decisions made within the Anna Bay region as we have continued to maintain cultural contact and be custodians of this land for thousands of years. We have knowledge of this area (including the Aboriginal Place and surrounding sites) in regards to cultural significance, we have been a part of previous works completed in this area and protection of cultural heritage is our role within this community.

Bec Young and Candice O'Loughlin are representatives of Murrooma and hold over 15 years' experience within this industry as well as hold oral history that has been passed down from community elders. We are both Traditional Owners and Custodians of this Worimi area and are in a position within our community to speak for country.

Name of Nominated Representatives: Bec Young or Candice O'Loughlin

Nominated Representative's Contact Details: (phone and/or email):

Bec- 0421078695

Candice- 0432039260

Prior Excavation Experience: Both Representatives of Murrooma have had previous excavation experience and are able to complete all field work responsibilities as required.

We agree to provide our representative with all the required PPE and understand that he/she will not be able to participate without the appropriate PPE or proof of insurance cover. Yes

Quoted Payment Rates: As attached

Information provided by: Bec Young

Position in Registered Aboriginal Party: Operations Manager

Expression of Interest

Robinson Reserve and Birubi Point Information Centre Archaeological Investigations

Name of Registered Aboriginal Party:	Karuah Indigenous Corporation
Address	P.O. Box 24, Karuah 2324
ABN	
Clarify your cultural connection to the area and the site with reference to the criteria in Section 1.1	I and MR Kirk are Traditional owners within the Worimi Nation.
Name of Nominated Representatives:	Dave Feeney or David Kirk
Nominated Representative's Contact Details: (phone and/or email)	Dave Feeney 0421114853 Karuahindigenous@outlook.com
Prior Excavation Experience:	I have over 25 years of Aboriginal Surveying & Excavation. Experience. and Mr Kirk have at up to 5 years
We agree to provide our representative with all the required PPE and understand that he/she will not be able to participate without the appropriate PPE or proof of insurance cover.	
Quoted Payment Rates:	Hourly – 110 per Hr Base on RTA Rates. Daily - 8HRS. 880 per day. Rates.
Information provided by: (please insert name)	Dave Feeney.
Position in Registered Aboriginal Party:	Snr Cultural Officer.
Signature:	

Please provide details of your insurance cover below and attach copies of all appropriate insurances.

From: Paul Burton
To: Nicola Roche; Pam Dean-Jones
Subject: FW: Birubi Point Aboriginal Place Recreation Facility Upgrade and Information Centre - Notification of Methodology and Site Visit
Date: Wednesday, 10 October 2018 4:51:05 PM
Attachments: image001.png
image002.jpg
image003.jpg
image004.jpg
image005.jpg
image006.jpg

Hi Pam/Nicola,

I have received a request to be involved in the project from Nadine Russell (NPWS employee). I am planning on permitting her to be included and will state that she accepts that if she has feedback on the methodology she will meet the existing deadlines to avoid delaying the project.

Do you see any issue with this approach?

Port Stephens Council

Paul Burton
Senior Community and Recreation Planning Officer

p 02 4988 0535 | m 0407 664 357
w portstephens.nsw.gov.au

Port Stephens Annual Awards 2018

From: Nadine Russell [mailto:nadine.84@hotmail.com]
Sent: Wednesday, 10 October 2018 1:35 PM
To: Paul Burton
Subject: Re: Birubi Point Aboriginal Place Recreation Facility Upgrade and Information Centre - Notification of Methodology and Site Visit

Hey Paul

I am on the advisory panel for the Aboriginal place and interchange but have just gone through and checked emails and can not find this on that date perhaps Steve was sending information to the panel also, I'm not sure but I have not seen this.

Yes please add me to list of interested parties for this as I am on the advisory committee, I am a registered TO and board member for Worimi LALC.

Can you please send further correspondence to this email and not my work email.

Thanks

Sent from my iPhone

On 10 Oct 2018, at 1:28 pm, Paul Burton <Paul.Burton@portstephens.nsw.gov.au> wrote:

> Good afternoon Nadine,
>
> The previous email was sent to those persons who expressed interest to be involved as a Registered Aboriginal Party. An invitation to register was sent to members of the Birubi Point Aboriginal Place Advisory Panel on 22 June 2018 by Steve Bernasconi.
>
> Please advise if you would like to participate. I will however, need to seek advice of how I can register you now that the process has commenced.
>
> Regards,

Paul Burton
Senior Community and Recreation Planning Officer

p 02 4988 0535 | **m** 0407 664 357
w portstephens.nsw.gov.au

From: Nadine Russell [mailto:nadine.84@hotmail.com]
Sent: Monday, 8 October 2018 8:18 AM
To: Paul Burton
Subject: Fwd: Birubi Point Aboriginal Place Recreation Facility Upgrade and Information Centre - Notification of Methodology and Site Visit

Hey Paul

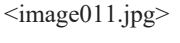
I am an interested Aboriginal party for the Birubi AP and sit on the advisory panel and was wondering why I never received the below email?

Thanks

Sent from my iPhone

Begin forwarded message:

> **From:** Nadine Russell <Nadine.Russell@environment.nsw.gov.au>
> **Date:** 8 October 2018 at 7:56:40 am AEDT
> **To:** '"nadine.84@hotmail.com"' <nadine.84@hotmail.com>
> **Subject: FW: Birubi Point Aboriginal Place Recreation Facility Upgrade and Information Centre - Notification of Methodology and Site Visit**



Nadine Russell
Visitor Service Assistant
Mon - Wed & Friday
Worimi Conservation Lands
Hunter Central Coast Branch
NSW National Parks & Wildlife Service

Locked Bag 99, Nelson Bay 2315
T 02 49848221
M 0484 643 337
F 02 49815913
W worimiconservationlands.com.au
W nationalparks.nsw.gov.au

I acknowledge the Worimi people, the traditional custodians of the land where I live and work.

From: Graeme Russell
Sent: Monday, 8 October 2018 7:53 AM
To: Nadine Russell <Nadine.Russell@environment.nsw.gov.au>; Jamie Tarrant <Jamie.Tarrant@environment.nsw.gov.au>
Subject: FW: Birubi Point Aboriginal Place Recreation Facility Upgrade and Information Centre - Notification of Methodology and Site Visit

FYI

Graeme Russell
Joint Management Coordinator
Hunter Central Coast Branch
Park Operations
NSW National Parks and Wildlife Service
Office of Environment & Heritage
12B Teramby Road, Nelson Bay NSW 2315
Locked Bag 99, Nelson Bay NSW 2315
T 02 4984 8208 **F** 02 4981 5918 **M** 0409 858 811 **E** Graeme.Russell@environment.nsw.gov.au

---

From: Paul Burton <Paul.Burton@portstephens.nsw.gov.au>
Sent: Tuesday, 2 October 2018 4:02 PM
To: Paul Burton <Paul.Burton@portstephens.nsw.gov.au>

Cc: Clare Naylor <cnaylor@umwelt.com.au>; Pam Dean-Jones <pdean-jones@umwelt.com.au>; Nicola Roche <nroche@umwelt.com.au>; Steve Bernasconi <Steve.Bernasconi@portstephens.nsw.gov.au>
Subject: Birubi Point Aboriginal Place Recreation Facility Upgrade and Information Centre - Notification of Methodology and Site Visit

Dear Registered Aboriginal Party,

Please find attached letter outlining the proposed methodology and details of the site inspection to inform an Aboriginal Cultural Heritage Assessment for the proposed recreation facility upgrades at Robinson Reserve and the new information centre, Anna Bay.

Please note the following key dates:

- Registration for site visit closes on **Thursday 25 October 2018**.
- Expression of Interest for paid participation closes on **Friday 26 October 2018** (form to be forwarded under separate cover).
- Site visit commencing at 9:30am on **Thursday 1 November 2018** (please ensure you register prior to 25 October).

Please do not hesitate to contact me should you have any questions or require additional information.

Regards

<image001.png>

Paul Burton
Senior Community and Recreation Planning Officer

p 02 4988 0535 | m 0407 664 357
w portstephens.nsw.gov.au

<image012.jpg>

<image013.jpg>

<image014.jpg>

<image015.jpg>

<image010.jpg>

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PLEASE CONSIDER THE ENVIRONMENT BEFORE PRINTING THIS EMAIL

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Expression of Interest

Robinson Reserve and Birubi Point Information Centre Archaeological Investigations

Name of Registered Aboriginal Party:	NUR-RUN-GEE. PTY LTD
Address	22 POPPLEWELL RD FERN BAY NSW 2295
ABN	37096307701
Clarify your cultural connection to the area and the site with reference to the criteria in Section 1.1	I WAS THE ORIGINAL CLAIMANT OF STOCKTON BIGHT ON BEHALF OF THE WORIMI PEOPLE ALSO A MEMBER OF THE WCL AND BIRUBI POINT MANAGEMENT COMMITTEES
Name of Nominated Representatives:	LENNIE ANDERSON, CHRIS COLLISON, CAITLIN MORAN
Nominated Representative's Contact Details: (phone and/or email)	LENNIE : 0431-334-365 CHRIS : 0421-921-533. CAITLIN : 0421-892 026
Prior Excavation Experience:	INDIGENOUS ARCHAEOLOGIST WORKED NATIONALLY / INTERNATIONALLY OVER 30 YEARS EXPERIENCE IN FIELD TEAM LEADER FOR SKELETAL REMAINS RECOVERY & REPAT REGIONAL AHO FOR OEH (PREVIOUS) REPRESENTING WORIMI TAEOG
We agree to provide our representative with all the required PPE and understand that he/she will not be able to participate without the appropriate PPE or proof of insurance cover.	
Quoted Payment Rates:	Hourly – SEE ATTACHED Daily -
Information provided by: (please insert name)	LENNIE ANDERSON OAM, ASM, AIM
Position in Registered Aboriginal Party:	DIRECTOR
Signature:	

Please provide details of your insurance cover below and attach copies of all appropriate insurances.

Lennie Anderson
22 Popplewell Road
Fern Bay
2295 NSW

Insurance Details

Insurance Type	Insurance Company	Policy Number	Extent of Cover	Valid to
Public Liability	SEE ATTACHED			
Workers Compensation	SEE ATTACHED			

Lennie Anderson
22 Popplewell Road
Fern Bay
2295 NSW

icare
workers
insurance

certificate of currency nsw

issue date
01/05/2018

print date
03/05/2018

Leonard Anderson
NUR-RUN-GEE PTY LTD
22 Popplewell Road
FERN BAY NSW 2295

Dear Sir/Madam

statement of coverage

The following policy of insurance covers the full amount of the employer's liability under the *Workers Compensation Act 1987(NSW)*.

valid until

30/04/2019

policy number
100686101

legal name
NUR-RUN-GEE PTY LTD

trading name

abn
37 096 307 701

acn
096 307 701

industry classification number (WIC)
782920 Technical Services nec

number of workers*
3

wages/units*
$64,049.31

* Number of workers includes contractors/deemed workers
+ Total wages/units estimated for the current period

important information

Principals relying on this certificate should ensure it is accompanied by a statement under section 175B of the *Workers Compensation Act 1987 (NSW)*. Principals should also check and satisfy themselves that the information is correct and ensure that the proper workers compensation insurance is in place, ie. compare the number of employees on site to the average number of employees estimated; ensure that the wages are reasonable to cover the labour component of the work being performed; and confirm that the description of the industry/industries noted is appropriate. A principal contractor may become liable for any outstanding premium of the sub-contractor if the principal has failed to obtain a statement or has accepted a statement where there was reason to believe it was false.

Yours faithfully,

Jason McLaughlin
General Manager, Loss Prevention and Pricing
icare workers insurance

Quattro Risk Services Pty. Limited
ABN 81 001 766 776 AFSL: 225022
Formerly Garaty Murnane Insurance Brokers
Level 3, 50 Hunter Street, Newcastle NSW 2300
PO Box 509 Newcastle NSW 2300
Phone: 02 4969 8100 Fax: 02 4969 8118
Web: www.quattrorisk.com.au Enq: qrsnewcastle@qrs.com.au

As per your request, we have renewed the following insurance cover effective from the 5/10/2018. To ensure your protection, we must receive your remittance within 14 days of you receiving this account.

TAX INVOICE

This document will be a tax invoice for GST when you make payment

Invoice Date: 6/09/2018
Invoice No: 115624
Our Reference: ANDER02

Should you have any queries in relation to this account, please contact your Account Manager
Grant - Newcastle

Nur-Run-Gee Pty Ltd
Len Anderson
22 Popplewell Street
FERN BAY NSW 2295

Class of Policy: Business Insurance
Insurer: Allianz Australia Insurance Ltd
GPO Box 4049 Sydney NSW 2001
ABN: 15 000 122 850
The Insured: NUR-RUN-GEE PTY LTD

RENEWAL
Policy No: 122A002328COM
Period of Cover:
From **5/10/2018**
to **15/10/2019** at 4:00 pm

Details: See attached schedule for a description of the risk(s) insured

22 Popplewell Street FERN BAY

Your Premium:

Premium	UW Levy	Fire Levy	GST	Stamp Duty	Admin Fee	Broker Fee
$906.14	$0.00	$176.70	$117.64	$66.11	$0.00	$93.41

TOTAL **$1,360.00**

(A processing fee applies for Credit Card payments)

YOUR DUTY OF DISCLOSURE
PLEASE READ IMPORTANT NOTICE BELOW

NON DISCLOSURE
If you fail to comply with your duty of disclosure, the Insurer may be entitled to reduce the liability under the Contract in respect of a claim or may cancel the Contract. If your non-disclosure is fraudulent, the Insurer may also have the option of avoiding the Contract from its beginning. Clients who are not fully satisfied with our services should contact our customer relations/complaints officer.
Quattro Risk Services Pty. Limited subscribe to the Financial Ombudsman Service (FOS), a free customer service, &follow the principles of the Insurance Brokers Code of Practice. Further information is available from this office, or contact the FOS on 1800 367 287

DEFT PAYMENT SYSTEMS

Refer to the attached for payment methods & instructions

BPAY
Biller Code: 20362
Ref: 40331181931162010

To pay on-line with your Visa, Mastercard, Amex or Diners visit www.deft.com.au
Client Ref: 0319984X **Invoice Ref: 115624**
Call 1300 78 11 45. A surcharge may apply.
DEFT Reference Number: 40331181931162010

POST billpay

*498 403311 81931162010

Quattro Risk Services Pty. Limited
Our Reference: ANDER02
Invoice No: 115624
Due Date: 5/10/2018

Premium	**$906.14**
U'writer Levy	**$0.00**
Fire Levy	**$176.70**
GST	**$117.64**
Stamp Duty	**$66.11**
Broker Fee	**$93.41**
Admin Fee	**$0.00**
AMOUNT DUE	**$1,360.00**

+403311 81931162010< 000136000<2+

Schedule of Insurance

Class of Policy:	Business Insurance	**Policy No:**	122A002328COM
The Insured:	NUR-RUN-GEE PTY LTD	**Invoice No:**	115624
		Our Ref:	ANDER02

This policy is underwritten by:
Allianz Australia Insurance Limited
AFS Licence No. 234708
ABN 15 000 122 850

Insured Name	NUR-RUN-GEE PTY LTD
ABN	37096307701
Registered for GST	YES
Tax Credit %	100.00%
Tax Status	Taxable
Period of Insurance:	
Effective Date	05/10/2018
Expiry Date	4.00pm on 15/10/2019
Situation	22 POPPLEWELL STREET FERN BAY NSW 2295
Business	ABORIGINAL SURVEYING & DOMESTIC CONSTRUCTION

*** Situation 1 ***

Property Damage

Property Insured		Sum Insured
Contents	$	13390
Optional Benefit		
Flood		Covered
Excess(es)	$	250
Theft		Not Insured
Money		Not Insured
Glass		Not Insured
Machinery		Not Insured
Electronic		Not Insured

*** End of Situation 1 ***

*** Policy Level risks***

Liability

Description		Limit of Indemnity
General Liability any one Occurrence	$	10000000
Products Liability any one Occurrence and in the aggregate any one Period of Insurance	$	10000000
Property in Your physical and legal control any one Occurrence	$	250000
Excess(es)		
Property Damage	$	500
Personal Injury	$	0

Class of Policy:	Business Insurance	**Policy No:**	122A002328COM
The Insured:	NUR-RUN-GEE PTY LTD	**Invoice No:**	115624
		Our Ref:	ANDER02

Business Interruption		Not Insured
General Property		
General Property		Sum Insured
Unspecified tools of trade and general items	$	8000
Unspecified Stock		Not insured
Excess(es)	$	250
Management Liability		Not Insured
Transit		Not Insured

End of Policy Level risks

MINIMUM PREMIUM MAY APPLY
Minimum premiums may apply. Any discounts/entitlements only apply to the extent any minimum premium is not reached. If you are eligible for more than one, we also apply each of them in a predetermined order to the premium (excluding taxes and government charges) as reduced by any prior applied discounts/entitlements.

Additional Conditions and Endorsements applying to this policy

The following additional condition(s) and/or endorsement(s) apply to this policy. Where applicable, they will replace any terms, conditions or exclusions contained in the Policy Document.

Terrorism Insurance Act

The condition Terrorism Insurance Act is deleted and replaced by:

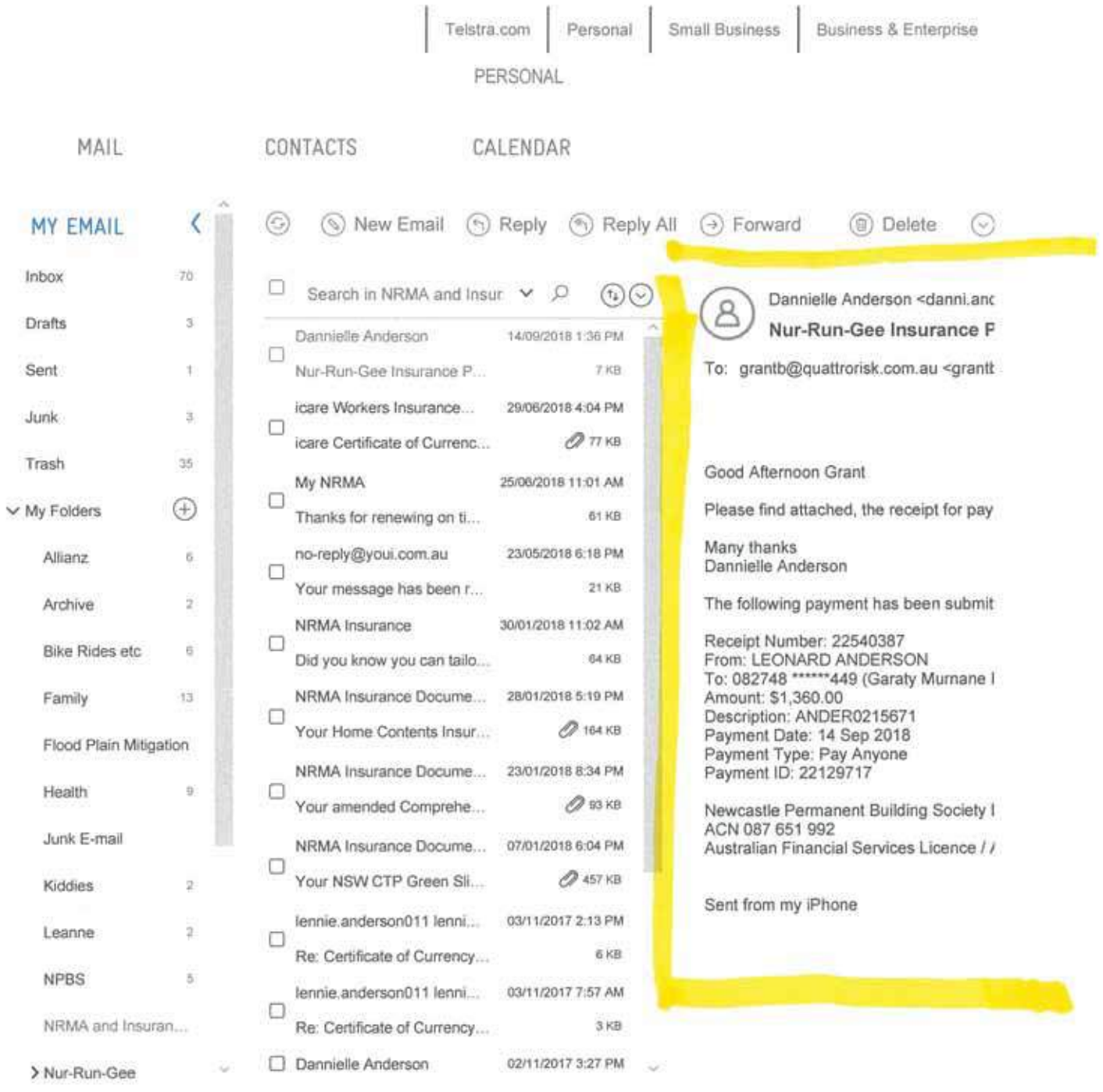
We have determined that this Policy (or part of it) is a policy to which the Terrorism Insurance Act 2003 applies. We may elect to reinsure part or all of Our liability under the Act with the Commonwealth Government reinsurer, the Australian Reinsurance Pool Corporation (ARPC).

As a consequence, We may be required to pay a premium to ARPC and that amount (together with the cost of that part of the cover provided by Us and administrative costs associated with the legislation) is reflected in the premium charged to You. As with any other part of Our premium, it is subject to government taxes and charges such as GST, Stamp Duty and where applicable, Fire Service Levy.

For further information contact Allianz or Your Intermediary.

Financial Claims Scheme

In the unlikely event Allianz Australia Insurance Limited were to become insolvent and could not meet its obligations under this Policy, a person entitled to claim may be entitled to payment under the Financial Claims Scheme. Access to the Scheme


Telstra.com
Personal
Small Business
Business & Enterprise
PERSONAL
MAIL
CONTACTS
CALENDAR
MY EMAIL
Inbox 70
Drafts 3
Sent 1
Junk 3
Trash 35
My Folders
Allianz 6
Archive 2
Bike Rides etc 6
Family 13
Flood Plain Mitigation
Health 9
Junk E-mail
Kiddies 2
Leanne 2
NPBS 5
NRMA and Insuran...
Nur-Run-Gee
New Email
Reply
Reply All
Forward
Delete
Search in NRMA and Insur
Dannielle Anderson 14/09/2018 1:36 PM
Nur-Run-Gee Insurance P... 7 KB
icare Workers Insurance... 29/06/2018 4:04 PM
icare Certificate of Currenc... 77 KB
My NRMA 25/06/2018 11:01 AM
Thanks for renewing on ti... 61 KB
no-reply@youi.com.au 23/05/2018 6:18 PM
Your message has been r... 21 KB
NRMA Insurance 30/01/2018 11:02 AM
Did you know you can tailo... 64 KB
NRMA Insurance Docume... 28/01/2018 5:19 PM
Your Home Contents Insur... 164 KB
NRMA Insurance Docume... 23/01/2018 8:34 PM
Your amended Comprehe... 93 KB
NRMA Insurance Docume... 07/01/2018 6:04 PM
Your NSW CTP Green Sli... 457 KB
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Re: Certificate of Currency... 6 KB
lennie.anderson011 lenni... 03/11/2017 7:57 AM
Re: Certificate of Currency... 3 KB
Dannielle Anderson 02/11/2017 3:27 PM
Dannielle Anderson <danni.anc
Nur-Run-Gee Insurance P
To: grantb@quattrorisk.com.au <grantt
Good Afternoon Grant
Please find attached, the receipt for pay
Many thanks
Dannielle Anderson
The following payment has been submit
Receipt Number: 22540387
From: LEONARD ANDERSON
To: 082748 ******449 (Garaty Murnane I
Amount: $1,360.00
Description: ANDER0215671
Payment Date: 14 Sep 2018
Payment Type: Pay Anyone
Payment ID: 22129717
Newcastle Permanent Building Society I
ACN 087 651 992
Australian Financial Services Licence / /
Sent from my iPhone

Nur-Run-Gee Pty Ltd
ABN 37 096 307 701

Nur-Run-Gee Fees and Charges For Aboriginal Sites Officer

Effective from 16 August 2018

Aboriginal Sites Officer

Daily Rate - 8 hours	$770.00
Half Day Rate - 4 hours	$385.00
Call Out Fee plus a minimum of 2 hours charged at hourly rate	$150.00
Hourly Rate (after 8 hours)	$100.00

Administration

Car Hire per Day – If required	$77.00

All rates are GST inclusive.

Payment will be required within 30 days of invoice date.

In the event of inclement weather a Nur-Run-Gee employee will arrive at the appointed time. An assessment will be made in conjunction with the proponents' representative. If the decision is made to postpone the days work a minimum charge of 4 hours will apply.

We look forward to your business.

Lennie Anderson OAM
Director
Nur-Run-Gee Pty Ltd

CULTURAL AND HERITAGE CONSULTANT
LICENCED BUILDER

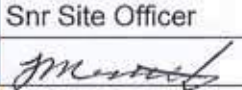
22 Popplewell Road
Fern Bay 2295

Phone: 02 49 201578

Mobile: Lennie 0431 334 365
Email:
lennie.anderson011@bigpond.com

Expression of Interest

Robinson Reserve and Birubi Point Information Centre Archaeological Investigations

Name of Registered Aboriginal Party:	Worimi Local Aboriginal Land Council
Address	2163 Nelson Bay Road, Williamtown 2318
ABN	51 352 201 603
Clarify your cultural connection to the area and the site with reference to the criteria in Section 1.1	Preserve, protect and foster Aboriginal Culture in the Worimi Community
Name of Nominated Representatives:	Jamie Merrick, Brendan Lilley
Nominated Representative's Contact Details: **(phone and/or email)**	Jamie Merrick - 0429 994 292 sites@worimi.org.au Brendan Lilley - 0467 378 825 sites@worimi.org.au
Prior Excavation Experience:	Both have extensive experience in excatations Jamie 20yrs, Brendan 10yrs
We agree to provide our representative with all the required PPE and understand that he/she will not be able to participate without the appropriate PPE or proof of insurance cover.	
Quoted Payment Rates:	Hourly – $75.00 Daily - $600.00
Information provided by: **(please insert name)**	Jamie Merrick
Position in Registered Aboriginal Party:	Snr Site Officer
Signature:	

Please provide details of your insurance cover below and attach copies of all appropriate insurances.

Insurance Details

Insurance Type	Insurance Company	Policy Number	Extent of Cover	Valid to
Public Liability	QBE	20A133484PLB	$20m	23/05/2019
Workers Compensation	ICare Insurance	125201401	$2.1m	31/01/2019

From:	Kathy Down
To:	Nicola Roche; Pam Dean-Jones; Naomi Buchhorn
Bcc:	lennie.anderson011@bigpond.com; worimitoc@hotmail.com; didgengunawalclan@yahoo.com.au; sites@worimi.org.au; Widescope.group@live.com; Dedemaree3@hotmail.com; murrabidgeemullangari@yahoo.com.au; widescope.group@live.com; tn.miller@southernphone.com.au; Murroomainc1@gmail.com; Murroomainc1@gmail.com; gomeroi.namoi@outlook.com; graeme.russell@environment.nsw.gov.au; karuahindigenous@outlook.com
Subject:	4691 - draft Aboriginal Cultural Heritage Assessment Report, Gan Gan Road Anna Bay
Date:	Wednesday, 16 January 2019 3:23:00 PM
Attachments:	4691_RAPs_draft ACHAR_20190116a_ltr.pdf

Dear Registered Aboriginal Party representative

We are writing to you as a registered Aboriginal party who expressed an interest in being consulted about the Aboriginal Cultural Heritage Assessment (ACHA) for a project to construct a new information centre and transport interchange at the corner of Gan Gan Road and the four wheel drive beach access track at Anna Bay. Please find enclosed/attached a copy of the draft ACHA report for your review and feedback.

Could you please contact Pam or Nicola at Umwelt with your comments by 12 February 2019.

Your comments may be provided in writing (preferred) or by phone or email.

Please send letters to Umwelt, 75 York Street Teralba 2284 (attention Pam Dean-Jones or Nicola Roche). If you are responding by phone or email, please call Pam Dean-Jones on 49505322 (Umwelt office) or 0412278201 (mobile), or email pdeanjones@umwelt.com.au

Regards

Kathy

Kathy Down
Senior Project Administrator

Umwelt (Australia) Pty Limited
75 York Street
Teralba, NSW 2284

Phone: (02) 4950 5322

www.umwelt.com.au

Inspired People | Dedicated Team | Quality Outcomes

Newcastle ph. 02 4950 5322 | **Perth** ph. 08 6260 0700 | **Canberra** ph. 02 6262 9484 | **Sydney** ph. 1300 793 267 | **Brisbane** ph. 1300 793 267

Our Ref: 4691/R01/RAPs/16012019

16 January 2019

Registered Aboriginal Parties

Dear Registered Aboriginal Party Representative

Re: Consultation about the draft Aboriginal Cultural Heritage Assessment Report for a proposed information centre at Gan Gan Road Anna Bay, adjacent to Birubi Point Aboriginal Place

We are writing to you as a registered Aboriginal party who expressed an interest in being consulted about the Aboriginal Cultural Heritage Assessment (ACHA) for a project to construct a new information centre and transport interchange at the corner of Gan Gan Road and the four wheel drive beach access track at Anna Bay.

Pam Dean-Jones and Nicola Roche from Umwelt have prepared the draft assessment report, following a site inspection on 1 November 2018.

Please find enclosed/attached a copy of the draft ACHA report for your review and feedback.

Based on a review of the previous reports for the area, including the Management Plan for Birubi Point Aboriginal Place; and the results of the site inspection, the draft report proposes that council should apply to the Office of Environment and Heritage (OEH) for two AHIPs for the project. These would relate to:

- Initial geotechnical investigations to understand the distribution of old soil surfaces across the proposed site of the information centre. These investigations will also provide information about the potential presence of shell and stone artefacts beneath the mobile dune sand that forms the current ground surface.

- A second AHIP will be required for the earthworks and construction of the information centre. The scope of the AHIP will depend on the results of the geotechnical studies.

We are keen to receive your comments on the information in the draft ACHA report. Most importantly, your comments on the cultural value and significance of the land and the potential impacts of the proposed information centre on cultural values are essential to completing the ACHA report.

We will include the full text of your comments in an appendix to the final draft report and a summary in tables within the report.

Inspired People
Dedicated Team
Quality Outcomes

Newcastle
75 York Street
Teralba NSW 2284

Perth
Level 1
12 Prowse Street
West Perth WA 6005
PO Box 783
West Perth WA 6872

Canberra
2/99 Northbourne Avenue
Turner ACT 2612
PO Box 6135
O'Connor ACT 2602

Sydney
Level 3
50 York Street
Sydney, NSW, 2000

Brisbane
Level 13
500 Queen Street
Brisbane QLD 4000

Orange
Office 1
3 Hampden Avenue
Orange NSW 2800

T| 1300 793 267
E| info@umwelt.com.au
www.umwelt.com.au

Umwelt (Australia) Pty Limited
ABN: 18 059 519 041

Could you please contact Pam or Nicola at Umwelt with your comments by 12 February 2019.

Your comments may be provided in writing (preferred) or by phone or email.

Please send letters to Umwelt, 75 York Street Teralba 2284 (attention Pam Dean-Jones or Nicola Roche). If you are responding by phone or email, please call Pam Dean-Jones on 49505322 (Umwelt office) or 0412278201 (mobile), or email pdeanjones@umwelt.com.au .

We will contact you at the beginning of February to check if you need any further information or have other questions about the draft ACHA report.

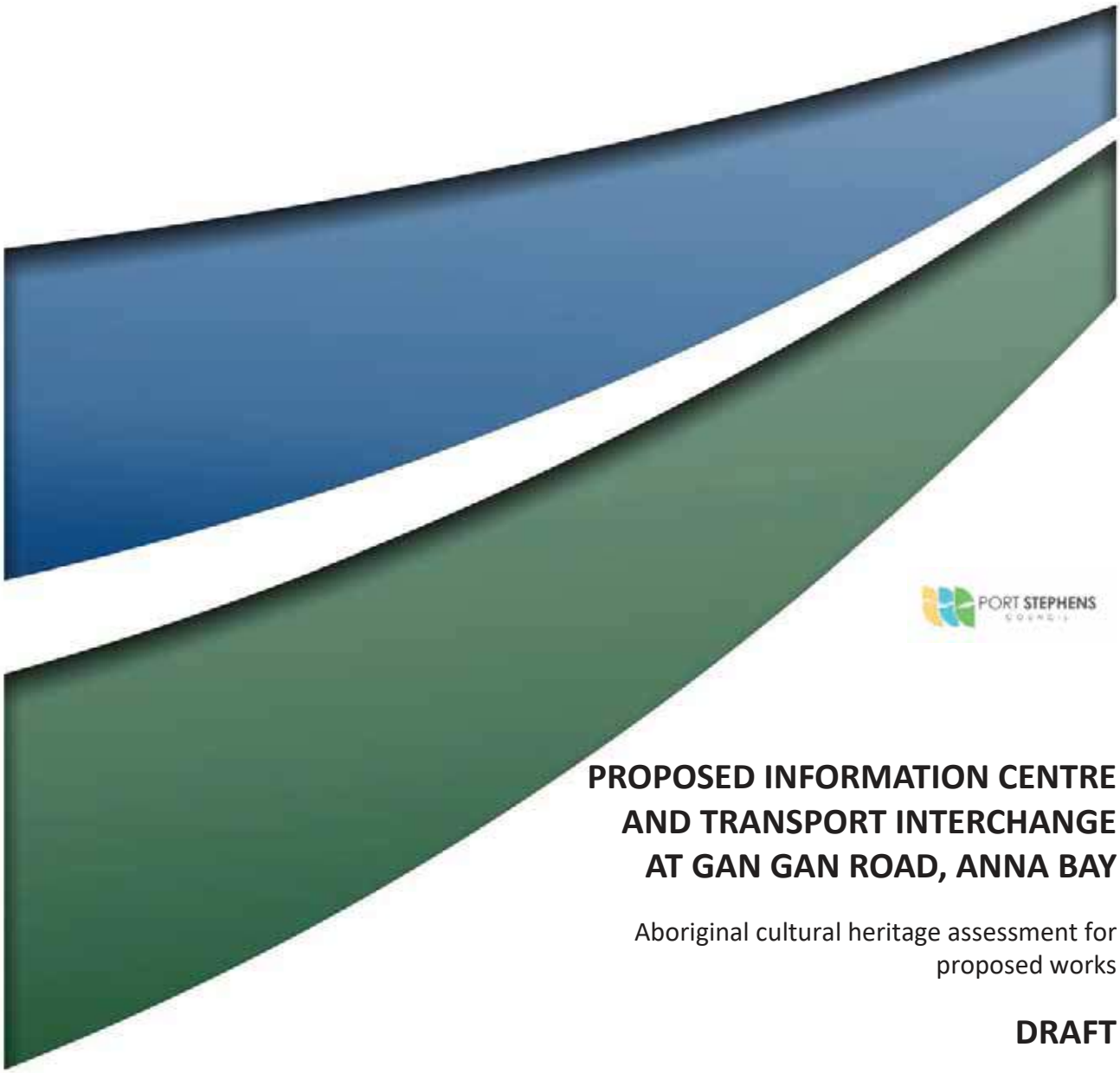
Thank you very much for your interest in this project to date.

Yours sincerely

Pam Dean-Jones
Principal, Communities and Landscapes

Attached: *Proposed Information Centre and Transport Interchange at Gan Gan Road, Anna Bay, Aboriginal Cultural Heritage Assessment Report for proposed works; January 2019*

umwelt
Environmental & Social Consultants



PORT STEPHENS COUNCIL

PROPOSED INFORMATION CENTRE AND TRANSPORT INTERCHANGE AT GAN GAN ROAD, ANNA BAY

Aboriginal cultural heritage assessment for proposed works

DRAFT

January 2019

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Prepared by
Umwelt (Australia) Pty Limited
on behalf of
Port Stephens Council

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Report No.	4961/R01/V1
Date:	January 2019

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Document Status

Rev No.	Reviewer		Approved for Issue	
	Name	Date	Name	Date
V0_1	Nicola Roche	8 January 2019	Pam Dean-Jones	9 January 2019
V1	Pam Dean-Jones	14 January 2019	Naomi Buchhorn	14 January 2019

Acknowledgement

Umwelt (Australia) Pty Ltd and Port Stephens Council would like to acknowledge the Worimi people who are the traditional custodians of the Port Stephens area and pay respect to their cultural heritage, beliefs and continuing relationship with the land.

We pay our respect to the Elders – past, present and future – for they hold the knowledge, traditions, culture and hopes of the Aboriginal people of the area.

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1.0 Introduction

Port Stephens Council is proposing the construction of a new tourist information centre and transport interchange (hereafter referred to as the information centre) located at Lot 312 DP753024 on the corner of Gan Gan Road and James Paterson Road in Anna Bay (refer to **Figure 1.1**). Port Stephens Council is the proponent for the project and the development application will be determined by the Joint Regional Planning Panel.

The information centre is located on Crown land currently zoned RU2 (rural landscape) under Port Stephens Local Environmental Plan. The Crown land was gazetted for the purposes of control of sand drift and recreational use.

Birubi Point Aboriginal Place and the Worimi Conservation Lands on Stockton Bight adjoin the proposed information centre site. A small parcel on unused and vacant private land separates the proposed information centre site from the Worimi Conservation Lands. The entire area is recognised as having high cultural and archaeological significance for Worimi people and multiple Aboriginal sites have been previously identified in the vicinity.

Port Stephens Council have engaged Umwelt to prepare an Aboriginal cultural heritage assessment for the proposed information centre.

This Aboriginal Cultural Heritage Assessment Report (ACHAR) provides an assessment of Aboriginal cultural heritage impacts associated with the development of the proposed information centre.

The focus of the report is the:

- potential for the proposed works to impact on archaeological materials associated with the use of the land by Worimi people and protected by the *National Parks and Wildlife Act* 1974 (NPW Act)

- potential impact on the Worimi cultural heritage values of the proposed information centre area, particular with relevance to the values associated with the adjacent Worimi Conservation Lands and the Birubi Point Aboriginal Place.

This ACHAR has been prepared in accordance with the *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW* (OEH, 2011) and has been prepared in consultation with registered Aboriginal parties in accordance with the requirements of the relevant legislation and codes of practice, including the *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (DECCW, 2010a). The ACHAR incorporates required archaeological technical information in accordance with the *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW, 2010b) (the Code of Practice).

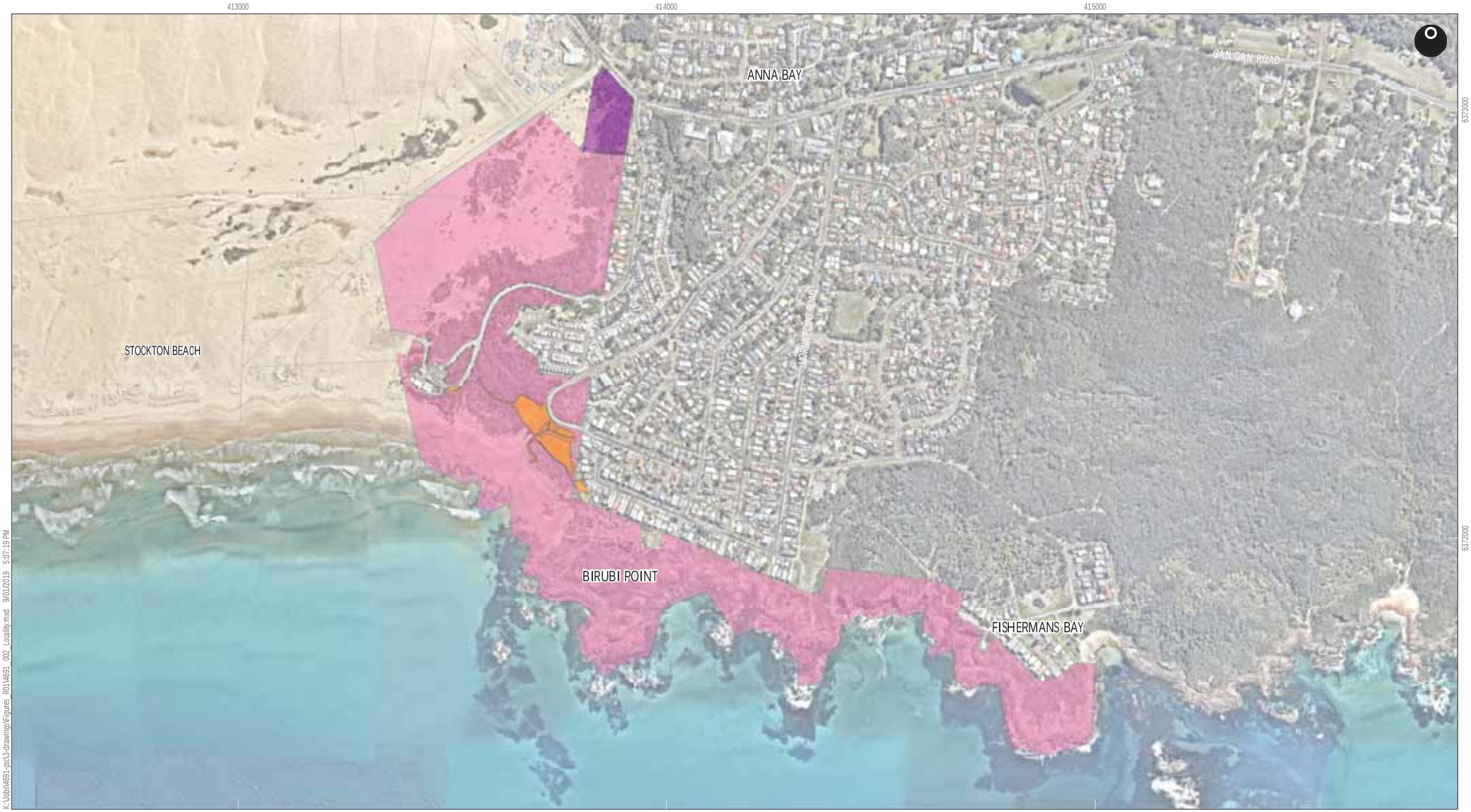

FIGURE 1.1

Locality Plan

Image Source: Nearmap (Sept 2018) Data source: Umwelt (2018); Port Stephens Council (2018); NSW OEH AHIMS (2018)

1.1 Project Description

1.1.1 Project background

The Master Plan and Management Plan for Birubi Point Aboriginal Place (Umwelt 2018) identified the need to upgrade parking facilities to reduce parking and traffic congestion which currently affect the visitors' experience and place pressure on archaeological, cultural and ecological values. The Master Plan and Management Plan also identified the current site as a potential location for developing a new information centre and transport interchange for tourists, as part of a package of actions to showcase the natural, cultural and scenic values of the area and to bring visitors into the main areas of interest via a new and less compromised route.

1.1.2 Project purpose

The proposed construction of the information centre and transport interchange in Anna Bay is important new infrastructure to support tourism in Port Stephens. It will provide facilities to accommodate the thousands of visitors attracted to the beach, headland and activities on the sand dunes in the Worimi Conservation Lands (WCL). The current infrastructure is not sufficient to cope with the growing demand and currently has a negative impact on the environmental, cultural and social values of the area as well as on visitor experience.

The purpose is to help to accommodate the growing demand for both international and domestic tourism activities within the Worimi Conservation Lands (WCL) and Birubi Point. The new facility will also become the northern gateway to the WCL. The new facility will:

- help to relieve traffic and parking congestion on Birubi Headland and the 'lower carpark' area, by reducing the number of buses (and other vehicles) that travel on the narrow headland road to drop off visitors
- reduce pressure on the cultural and ecological values of the Aboriginal Place, for instance due to illegal parking
- improve pedestrian safety in the carpark areas on the headland
- improve amenity for local residents who have been impacted by the growing popularity of the area for visitors
- improve visitor experience within the Aboriginal Place by returning visitor focus to the landscape and its cultural values
- provide information to introduce visitors to the cultural values and the opportunities available in the Conservation Lands and at Birubi Point
- streamline the transfer of passengers from buses and private vehicles to four wheel drive buses suitable for sand dune tours
- provide a more direct route for sand dune tour operators onto the high dunes and the beach (via Anna Bay entrance to Conservation Lands)

By organising tourist transport at the information centre and interchange, operators will be able to be take visitors directly to the high mobile dunes and avoid the lower carpark and headland carparks.

1.1.3 Project components

The immediate context and concept plan for the proposed information centre and transport interchange on the corner of Gan Gan Road and Paterson Road in Anna Bay is shown in **Figure 1.2**.

The proposed tourist information centre and transport interchange will provide parking for cars and buses, public toilets, kiosk, footpaths and a landscaped area including signage acknowledging the entrance to the WCL (refer to **Figure 1.2**).

The disturbance footprint for the proposed development is approximately 1500 square metres (m^2) and affects only the north western part of the development site (refer to **Figure 1.3**). The proposed works for the development of the information centre include:

- site levelling, which will include removal of sand which will be moved and stored off site
- installation of sediment fence along the western boundary of the site. This area will also be planted with native species. In combination the fence and vegetation will provide a buffer from strong westerly winds and sand drift for the new facility and will create an area of native landscaped vegetation
- paving of high use areas using a permeable paving
- access from Gan Gan Road along the existing beach access track
- 1500 m^2 of buildings
- 54 car spaces, which include three disabled spaces
- 8 coach spaces and space for a 2 coach drop off zone
- facilities for pedestrians and cyclists
- landscaping using native species
- educational signage
- construction of amenities (toilets)
- construction of a kiosk
- upgrading drainage facilities through the use of swales and buried pipes
- installation of services including electricity, water and supporting infrastructure.

Construction is proposed to take place over 16 to 18 weeks. Features of the design and construction of the facility include:

- prior to construction, a geotechnical assessment will be prepared. This will involve a drill rig and potentially excavation of shallow pits (see **Section 8** for discussion of permit requirements for geotechnical testing).
- planted wetland areas (native macrophyte species) will be created along existing lines of natural drainage
- the sediment fence will be woven geotextile material, attached to wooden posts; native species will be planted downwind of the fence

- roadways and parking bays will be formed of permeable paving with a plastic capping layer for the main trafficable areas. Areas for coach parking, private vehicle parking and 4WD operators will be compacted road base.

- buildings for tour operators will be set on hardwood decking supported by pre cast concrete. Buildings will be clad with hardwood timber battens on RC sheeting. The roof of the information centre will be polycarbonate sheets.

- the first stage of construction includes bringing sheds and fencing onto the site, installation of sediment and erosion controls and removal of a number of trees and vegetation (including bitou)

- the site will be excavated to achieve the required floor level. The design of this work is intended to minimise the amount of excavation and reshaping required. Excavated material generally will be stockpiled on site for future reuse (with appropriate wind erosion controls), but some excess material, not suitable for reuse, may be removed by truck

- after site preparation, the drainage structures, car-parking, roads and buildings will be constructed.

It is possible that at some future time, a second stage of the information centre will be developed, should council and the owner of the adjoining property form a suitable arrangement for the development of that land. This second stage would involve sand dune stabilisation, extension of the parking space for dune tour operators and a new exit from the information centre to the four wheel drive access track. This second stage of the development is not assessed in this report.

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FIGURE 1.2

Proposed Information Centre
Layout and Design

Image Source: Royal HaskoningDHB (2018, Birubi Information Centre Statement of Environmental Effects)

Legend

- Proposed Disturbance Area
- Proposed Information Centre Site
- Lot 312 DP753204

FIGURE 1.3

Subject Site and Potential Areas of Impact

Image Source: Nearmap (Sept2018) Data source: NSW LPI DCDB

1.2 Objectives of this assessment

The objective of this assessment is to ensure that the Aboriginal archaeological and cultural heritage values of the site of the proposed information centre are appropriately assessed with reference to the approach specified in the *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW*, the consultation requirements and with the *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales*.

Aboriginal people are the primary determinants of the cultural significance of their heritage. This ACHAR is prepared to ensure that the information provided by registered Aboriginal parties is documented and presented in a manner that informs decision making on the management of Aboriginal cultural heritage within the proposed information centre area, while ensuring that the required archaeological information is also appropriately documented.

Within this process and compliance framework, the objective of the assessment is to provide information to Port Stephens Council which will assist them to locate, design, develop and operate the proposed information centre within an archaeologically important and culturally significant landscape, in collaboration with the Worimi people, on whose country the site is located.

1.3 Project team and report authors

All Aboriginal cultural input for this report has been provided by the registered Aboriginal parties and their representatives, through the consultation process outlined in **Section 2**. This input builds on consultation about the cultural values of Birubi Point Aboriginal Place (which is adjacent to the proposed information centre area) which has been ongoing for more than a decade.

Pam Dean-Jones (Principal, Communities and Landscapes) compiled this ACHAR. Nicola Roche (Manager, Cultural Heritage) reviewed the report, with a focus on the archaeological content. Nicola and Pam were assisted by Amanda Crick (Umwelt Archaeologist). Drafting input was provided by Umwelt's drafting team.

Steve Bernasconi (Community Services Section Manager) was Port Stephens Council's project manager and provided information about the design and scope of the project.

1.4 Statutory context

The Office of Environment and Heritage (OEH) is responsible for regulating the management of Aboriginal cultural heritage in New South Wales under the NPW Act. The NPW Act is accompanied by the:

- National Parks and Wildlife Regulation 2009 (the Regulation)
- *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW* (Office of Environment and Heritage 2011)
- *Aboriginal cultural heritage consultation requirements for proponents* (Department of Environment, (DECCW 2010a) (ACHCRs)
- *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW 2010b)
- *Declared Aboriginal Places – Guidelines for developing Management Plans* (Office of Environment and Heritage 2017)
- other industry-specific codes and guides.

1.4.1 Aboriginal Place

The proposed development is situated immediately adjacent to Birubi Point Aboriginal Place and shares a boundary with it (**Figure 1.1**). This is important context for assessing the archaeological and cultural values of the site of the information centre.

Birubi Point Aboriginal Place, an area of approximately 56 hectares (ha) of coastal land at Anna Bay, was gazetted under Section 84 of the NPW Act by the Minister for the Environment in 2007. Section 86(4) of the NPW Act states that a person must not harm or desecrate an Aboriginal Place.

An Aboriginal Place is declared by the Minister as a place that, in the opinion of the Minister, is or was of special significance with respect to Aboriginal culture. Documentation of the Aboriginal cultural heritage values of the Birubi Point area, as known at the time of the nomination of Birubi Point as an Aboriginal Place, was prepared by Umwelt (2007) in consultation with Worimi traditional owners.

Port Stephens Council prepared and adopted a management plan for the Aboriginal Place in 2016-2018, in close consultation with Worimi people. The proposed works for the information centre were outlined in the management plan (Umwelt 2018).

1.4.2 Protection of objects

The NPW Act defines an Aboriginal object as:

> ..any deposit, object or material evidence (not being a handicraft made for sale) relating to the Aboriginal habitation of the area that comprises New South Wales.

In accordance with Section 86(1) of the NPW Act, it is an offence to harm or desecrate a known Aboriginal object, whilst it is also an offence to harm an Aboriginal object under Section 86(2). Harm to an object or place is defined as any act or omission that:

a) destroys, defaces or damages an object or place, or

b) in relation to an object – moves the object from the land on which it had been situated, or

c) is specified by the regulations, or

d) causes or permits the object or place to be harmed in a manner referred to in paragraph (a), (b) or (c),

but does not include any act or omission that:

e) desecrates the object or place (noting that desecration constitutes an offence separate to harm), or

f) is trivial or negligible, or

g) is excluded from this definition by the regulations

Section 87(1) of the NPW Act specifies that it is a defence to prosecution under Section 86(1) and Section 86(2) if the harm or desecration of an Aboriginal object was authorised by an Aboriginal Heritage Impact Permit (AHIP) and the activities were carried out in accordance with that AHIP.

The Regulation identifies that compliance with the Code of Practice for the Archaeological Investigation of Aboriginal Objects in New South Wales (DECCW 2010b) is excluded from the definition of harm. This includes provision for the completion of test excavations without the requirement to obtain an AHIP.

However, the Code of Practice specifies that test excavations are not excluded from the definition of harm if undertaken at locations within 50 metres of a declared Aboriginal Place or in or within 50 metres of a shell midden. An Aboriginal Heritage Impact Permit (AHIP) is required prior to any archaeological testing or excavation for the purpose of works in these situations.

1.5 Key cultural heritage issues and risks addressed in this assessment

The site of the proposed information centre lies within an area known:

- to have provided diverse resources for Aboriginal people
- to contain abundant and diverse evidence of the lives and resource use of Worimi people
- to have been affected by significant landscape change, particularly the effects of aeolian processes which have created highly mobile coastal dune topography, with deflation and depositional areas
- to have been disturbed by a variety of former land-uses including agriculture, vehicle access and defence activities.

Details about the landscape processes and characteristics of the information centre site are in **Section 3** and information about the evidence of Aboriginal use of the land is in **Section 4**.

Within this context, the key cultural heritage issues for the project include:

- understanding the distribution of Aboriginal cultural objects (i.e. stone artefacts and shell) and the potential for burials within the proposed site of the information centre, in an area where the current ground surface is rapidly changing and is not the surface occupied by Aboriginal people. Only small sections of the natural pre European ground surface are exposed within the proposed information centre area, which is mantled by mobile sand. It is necessary to understand both the lateral extent of any occupation evidence and the depth of cover over the former ground surface.
- understanding the archaeological significance of remnants of formerly more extensive and more intact archaeological deposits
- making sure that the design of the information centre reflects the cultural significance of the place to Worimi people and is consistent with the objectives and priorities of the Birubi Point Aboriginal Place Management Plan (given the proximity of the Aboriginal Place and the management links between the two tenures)
- protecting the cultural values of the place for Worimi people
- making sure that people who visit the proposed information centre have access to information about why it is important to Worimi people
- ensuring that Worimi and other Aboriginal people have a say in the design and assessment of the proposed information centre.
- ensuring that the design and construction process is at all times consistent with the requirements of the NPW Act, Code and Guidelines.

1.6 Report Structure

This report addresses the issues outlined above.

Table 1.1 summarises the required components of an ACHAR and refers to the section of this document in which they are addressed.

Table 1.1 Required components of the assessment

Required Information (Aboriginal archaeological and cultural heritage assessment)	Relevant Section
Introduction	1.0
Statutory requirements	1.4
Report authors	1.3
Description of the project	1.1
Consultation process	2.0
Environmental context	3.0
Previous archaeological work and regional character	4.0
Predicted archaeological sensitivity	4.3
Sampling strategy and field methods	5.0
Results and discussion	6.0
Scientific values and significance assessment	7.0
Cultural heritage values and statement of significance	7.1
Impact assessment – risk of harm	8.0
Measures to avoid and/or mitigate harm	9.0
References	10.0

2.0 Aboriginal Party Consultation

Port Stephens Council has conducted Aboriginal Party Consultation for this assessment in accordance with the OEH guidelines for preparation of Aboriginal cultural heritage assessments.

Prior to commencing this project, Port Stephens Council engaged with members of the Worimi community about protection of cultural values, a strategic approach to managing visitor demand, and the opportunities for Worimi people in future management and business at Birubi Point (**Section 2.1**).

2.1 Birubi Point Cultural Heritage Advisory Panel

The Birubi Point Cultural Heritage Advisory Panel was formed to advise Port Stephens Council on the management plan for the Birubi Point Aboriginal Place.

Panel members include representatives of:

- Worimi Local Aboriginal Land Council
- Worimi conservation Lands Board of Management
- Registered Aboriginal Traditional Owners of Worimi Conservation Lands
- Port Stephens Council (councillors and staff)
- NSW National Parks and Wildlife Service
- NSW Department of Industry – Land and Water (formerly Crown Lands)
- Birubi Point Surf Life Saving Club
- Anna Bay community

The Panel met several times during the preparation of the Management Plan for the Birubi Point Aboriginal Place and the final Management Plan has their approval. All members of the Panel contributed their knowledge to the preparation of the Aboriginal Place Management Plan, and provided invaluable advice and awareness of the cultural heritage and archaeological values of the Place, the management history, current use and management issues and options to protect the cultural heritage of the Place while facilitating respectful recreational and tourism uses.

The Aboriginal Place Management Plan guides the protection, stewardship, use and development of Birubi Point Aboriginal Place, in accordance with its value to the Worimi people and the requirements of the *National Parks and Wildlife Act 1979*.

The Worimi traditional owners welcome people to visit the Birubi Point Aboriginal Place and to join with them in looking after Worimi country.

During the process of the development of the Master Plan and Management Plan for Birubi Point Aboriginal Place, information relevant to the assessment of the Aboriginal cultural heritage values within the proposed information centre area was provided by all representatives of the registered Aboriginal parties who have subsequently participated in this assessment.

2.2 Consultation in accordance with ACHCRs

The consultation process is shown in **Figure 2.1** and documented in **Table 2.1** and **Appendix 1**, with reference to the four consultation stages specified in the *Aboriginal cultural heritage consultation requirements for proponents* (DECCW 2010).

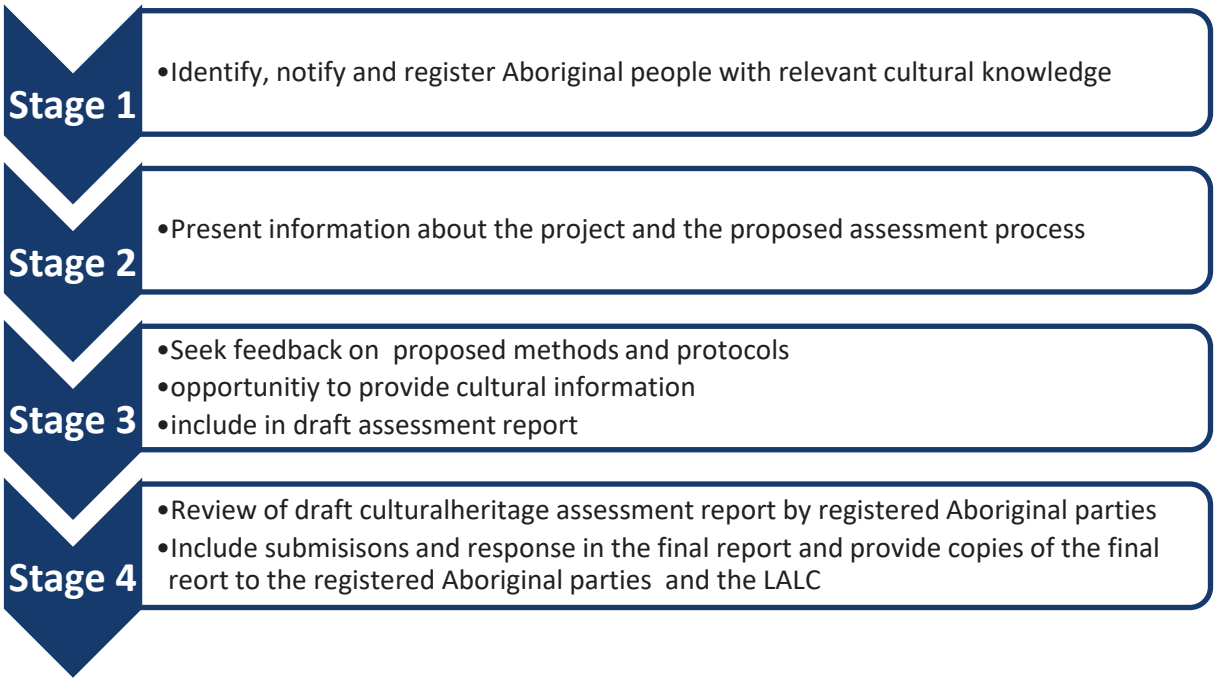


Figure 2.1 Stages in the consultation process

Details about the implementation of each of these stages are provided in the following sections.

2.2.1 Stage 1 – Notification and registration

Port Stephens Council wrote to the following organisations seeking advice on the names of Aboriginal people who may have an interest in the proposed information centre area:

- OEH
- Worimi Local Aboriginal Land Council
- Karuah Local Aboriginal Land Council
- The Registrar, *Aboriginal Land Rights Act*
- The National Native Title Tribunal
- Native Title Services Corporation (NTS Corp)
- Local Land Services

Copies of this correspondence are included in **Appendix 1**.

Port Stephens Council also placed a notification in the Port Stephens Examiner newspaper about the proposed project and an invitation to Aboriginal people who hold knowledge about the proposed information centre area, relevant to determining the cultural significance of objects, to register their interest in consultation about the project. A copy of the advertisement is included in **Appendix 1**.

It is noted that the proposed information centre area is adjacent to the Birubi Point Aboriginal Place and there has been ongoing consultation about management (as discussed in **Section 2.1**).

Table 2.1 provides a summary of the dates when Stage 1 consultation activities were conducted. Copies of all relevant correspondence are included in **Appendix 1**.

As a result of the project notification and registration process, thirteen parties registered an interest in ongoing consultation regarding the project during the specified timeframe. These parties are listed below and further information about the relevant contact people for each group is in **Table 2.1** and **Table 2.2**.

Registered Aboriginal parties

- Carol Ridgeway-Bissett
- Didge Ngunawal Clan
- Divine Diggers Aboriginal Cultural Consultants
- Karuah Indigenous Corporation
- Lower Hunter Wonnarua Cultural Services
- Murra Bidgee Mullangari Aboriginal Corporation
- Mur-Roo-Ma Inc
- Nur-Run-Gee Pty Ltd
- Steve Talbott
- Widescope Indigenous Group
- Worimi Local Aboriginal Land Council
- Worimi Traditional Owners Indigenous Corporation
- National Parks and Wildlife Services/Worimi Conservation Land Board of Management.

Council also consulted with OEH to confirm that it would be appropriate for the same registered Aboriginal parties to be consulted about proposed works in Robinson Reserve, which is within the Birubi Point Aboriginal Place. The proposals have similar time frames. OEH confirmed in writing that the same group of registered Aboriginal parties would be appropriate and the two assessments have been prepared concurrently.

Table 2.1 Summary of Stage 1 consultation activities

Date	Purpose	Contacted	Method
13 June 2018	Notification to organisations, seeking names and contact information for Aboriginal persons with an interest in the proposed information centre area	• Worimi Aboriginal Land Council • Karuah Local Aboriginal Land Council • Officer of the Registrar – Aboriginal Land Rights • National Native Title Tribunal • Native Title Services Corporation • Hunter Local Land Services • OEH	Email
14 June 2018	Public notification and request/invitation to Aboriginal people to register interest	General public	Newspaper advertisement in Port Stephens Examiner
14 June 2018	Notification to Aboriginal persons/organisations to register interest	• AGA Services • Cacatua Culture Consultants • Divine Diggers Aboriginal Cultural Consultants • Hunters & Collectors • Karuah Indigenous Corporation • Kawul Pty Ltd • Lakkari NTCG • Lower Hunter Aboriginal Incorporated • Lower Hunter Wonarua Cultural Services • Murra Bidgee Mullangari Aboriginal Corporation • Mur-Roo-Ma Inc • Nur-Run-Gee Pty Ltd • Wattaka Wonnarua CC Service • Widescope Indigenous Group • Worimi Traditional Owners Indigenous Corporation (Debbie Dates) • Steve Talbott • Didge Ngunawal Clan	By registered post and email (contact information provided by OEH)
22 June 2018	Notification to Aboriginal persons to register interest	• Birubi Point Aboriginal Place Cultural Heritage Advisory Panel	Email

29 June 2018	Seeking permission to forward contact information to OEH and WLALC	• Nur-Run-Gee Pty Ltd (Leonard Anderson, Chris Collison or Caitlin Moran) • Worimi Traditional Owners Indigenous Corporation (Debbie Dates) • Didge Ngunawal Clan (Paul Boyd and Lilly Carroll) • Worimi Local Aboriginal Land Council (Jamie Merrick) • Widescope Indigenous Group (Steven Hickey) • Murra Bidgee Mullangari Aboriginal Corporation (Ryan Johnson) • Lower Hunter Wonnarua Cultural Services (Tom Miller) • Mur-Roo-Ma Inc (Bec Young, Anthony Anderson, Candice O'Loughlin) • Steven Talbott • National Parks & Wildlife Services and Worimi Conservation lands Board of Management (Graeme Russell, Jamie Tarrant, Nadine Russell) • Karuah Indigenous Corporation (David Feeney or David Kirk) • Deidre Perkins	Email
2 July 2018	Confirming contact information and seeking interest in participating.	Carol Ridgeway-Bissett	Phone. Confirmed interest and approved forwarding information to OEH and WLALC. Future correspondence to occur through post.
2 July 2018	Confirming contact information and seeking interest in participating.	Roger Matthews Consultancy	Phone. Not interested in participating.
6 July 2018	Registering interest.	Mr Graeme Russell (NPWS)	Contacted via phone to register interest on behalf of the Board of Management.
10 July 2018	Notify OEH and WLALC of registered Aboriginal persons' details.	OEH Worimi LALC	Via email.
16 July 2018	Updated consultation register sent to OEH and WLALC to include David Feeney	OEH Worimi LALC	Via email.

2.2.2 Stages 2 and 3 – presenting information and gathering information about cultural significance

Council wrote to all registered Aboriginal parties on the project, providing information about the proposed project and seeking to gather information about cultural significance.

This correspondence included a proposed methodology for the cultural heritage assessment process. Council requested input from the Aboriginal parties in relation to the cultural values of the assessment areas and the way in which the assessment should document these values and provide a framework for their management.

A summary of the dates of correspondence in this stage is provided in **Table 2.2** and copies of correspondence are in **Appendix 1**.

Three registered Aboriginal parties confirmed receipt of the information provided. No comments were received about the proposed method of the assessment.

Table 2.2 Consultation communication, Stage 2

Date	Action	Recipient	Method
20 July 2018	Project information forwarded to registered stakeholders.	• Nur-Run-Gee Pty Ltd (Leonard Anderson, Chris Collison or Caitlin Moran) • Worimi Traditional Owners Indigenous Corporation (Debbie Dates) • Didge Ngunawal Clan (Paul Boyd and Lilly Carroll) • Worimi Local Aboriginal Land Council (Jamie Merrick) • Widescope Indigenous Group (Steven Hickey) • Murra Bidgee Mullangari Aboriginal Corporation (Ryan Johnson) • Lower Hunter Wonnarua Cultural Services (Tom Miller) • Mur-Roo-Ma Inc (Bec Young, Anthony Anderson, Candice O'Loughlin) • Carol Ridgeway-Bissett • Steven Talbott • National Parks & Wildlife Services and Worimi Conservation lands Board of Management (Graeme Russell, Jamie Tarrant, Nadine Russell) • Karuah Indigenous Corporation (David Feeney)	Via email. Via registered post (Carol Ridgeway-Bissett).

Date	Action	Recipient	Method
26 July 2018	Confirmed receipt of information	Mur-Roo-Ma Inc	Via email.
26 July 2018	Confirmation of involvement in proposed site discussions.	Nur-Run-Gee Pty Ltd	Via email.
9 August 2018	Confirmed receipt of information	Murra Bidgee Mullangari	Via email.

2.2.3 Stages 2 and 3 – survey

An invitation to submit an Expression of Interest for commercial engagement to undertake a survey of the proposed information centre area to assist in identifying any areas of cultural value was provided to all of the registered Aboriginal parties on 2 October 2018. Completed Expressions of Interest were submitted by five registered Aboriginal parties, plus NPWS/Worimi Conservation Lands Board of Management. A total of six parties therefore participated in the survey of the assessment area on 1 November 2018.

Survey participants, identified through the Expressions of Interest process, are listed below in **Table 2.3.**

Table 2.3 Aboriginal party representatives who participated in survey

Date	Organisation	Name
1/11/18	Worimi LALC	Brendan Lilley Jamie Merrick
	Worimi Conservation Lands Board of Management/OEH/NPWS	Jamie Tarrant Graeme Russell
	Karuah Indigenous Corporation	David Feeney
	Nur-Run-Gee	Raymond Feeney
	Mur-Roo-Ma	Candice O'Loughlin
	Worimi TOIC	Luke Night

The field inspection was also attended by Port Stephens Council project manager and drainage engineer, an OEH archaeologist and two archaeologists from Umwelt.

Details about observations and discussion during the site inspection are provided in **Section 6** and **Section 7** of this report.

2.2.4 Stage 4 – review of draft cultural heritage assessment report

The recommendations included in this draft report were discussed with Aboriginal party representatives during the surveys. At the time of the survey, the Aboriginal party participants reinforced the cultural values of the area, as discussed in the Birubi Point Aboriginal Place Management Plan. Information and comments provided during the field survey is in **Section 6** and **7**.

*The draft report was provided to the Registered Aboriginal Parties for their review and comments, on 14 January 2019 with an invitation to review and comment. All comments received will be documented in full in **Appendix 1** and summarised in **Table 2.4**.*

To be added after review of the draft by the registered Aboriginal parties

Table 2.4 Comments on the draft report from registered Aboriginal parties

Registered Aboriginal party (organisation and person)	Information, comments and advice received

3.0 Environmental Context

This section provides a summary of key environmental information for the site of the proposed information centre and transport interchange; and discusses the implications of this information for the archaeological evaluation of the proposed information centre area.

The environmental context of land use and archaeological evidence has an important influence on:

- the resources available (such as fresh water), which may attract people to visit (e.g. seasonality of occupation)
- the types of materials available to be used for implements (e.g. shell, different types of stone, bone, plant species, fish, birds
- how long discarded objects remain on the surface and how exposed they are to weathering or other destructive environmental processes; how quickly they are protected by natural burial processes
- the complexity and extent of disturbance linked to subsequent land uses.

3.1 The development of the coastal landscape at the eastern end of Stockton Bight

3.1.1 Late Pleistocene and Holocene coastal geomorphology

Birubi Headland lies at the interface of the mobile dune landscape of Stockton Bight and the rocky coastline of the Tomaree Peninsula. It is the interface between these two landscapes which has contributed to the diversity of landforms, resources and places for many generations of Aboriginal life in the area.

Stockton Bight is a very large coastal barrier and dune system, incorporating depositional landforms of late Pleistocene and Holocene age (Inner and Outer barriers). The Outer or Holocene barrier, deposited within the last 7000 years, dominates the view to the west from Birubi Headland. This view is one of the most important features attracting visitors to the area.

The Outer Barrier includes remnants of the early Holocene accreting/prograding beach ridge plain and evidence of multiple periods of dune mobilisation and reworking during the Holocene, interspersed with periods of stable, vegetated dune landforms.

Geomorphic research at Stockton Bight has provided estimates of the ages of periods of dune mobility and stability. Periods of dune mobility commenced prior to 4500 years Before Present (BP), and also occurred from around 2300 years BP to approximately 1300 years BP and since about 500 years BP (Thom, Shepherd, Ly, Bowman and Hesp 1992).

The processes leading to destabilisation and stabilisation of the dunes during the Holocene are likely to include a combination of intermittent major storms, potentially in conjunction with small mid to late Holocene fluctuations in sea level. Processes that significantly increase or decrease the sand supply in the coastal sediment compartment (e.g. intermittent closing off sediment transport from south of Nobbys headland) could also be important, as could other factors such as drought or wildfire.

3.1.2 Landforms

The landform features of the eastern end of Stockton Bight, including the Birubi Point Aboriginal Place and the proposed information centre area, can be considered in three main categories:

- Exposed rocky headlands, sand mantled rocky headlands and nearshore reefs. These occur in the Aboriginal Place.
    - Porphyry rock outcrops, including low coastal headlands and dissected rock ramps. There are no shore platforms, but rock reefs are exposed in the nearshore area.
    - Porphyry rock landforms mantled by wind-blown sand. Birubi Headland (away from the cliff margin) is an example of this type of landform. A similar sand mantle occurs on Morna Point Headland, to the north east of Birubi Point headland. The mantling of the rock coast by wind-blown sand has occurred through several periods of dune deflation and deposition over the last 6000 years. Exposures in dune sand at Birubi Headland indicate an earlier phase of sand deposition, with some podsol soil development, overlain by more recent sand which has very limited soil profile development. Both sand deposition units continue over the headland and drape over its eastern slopes.
- Holocene and contemporary deflation basins and transgressive dunes, of varying periods of stability are the main feature of the proposed information centre area. They include:
    - Active mobile dune ridges of different forms, with seasonal changes to morphology linked to wind strength and direction. These dominate Stockton Bight and form the view south west from Birubi Headland. They have limited expression within the Aboriginal Place or the proposed information centre area, but are a key attractant for visitors.
    - The deflation basin, excavated by aeolian processes to the water table level extends along Stockton Bight, landward of the frontal dune system. Stringers of dune sand may extend across the deflation basin. In wet weather the deflation basin along Stockton Bight has accumulated extensive ponds of fresh water; although the standing water may also be saline because of waves overtopping of the frontal dune. The low lying area to the west of Birubi Headland, including the current lower carpark site and the portions of the proposed information centre area illustrate the deflation basin landform.
    - Former active transgressive dunes, subsequently vegetated with dune woodland. The interaction of beach processes with the process of windblown erosion, redeposition, stabilisation and revegetation of sand created multiple, dynamic landform features of relevance to Aboriginal occupation. Wetlands may occur in the swales between dunes, for instance linked to groundwater or perched groundwater tables as podsol soil profiles develop
        - At Birubi Point, a north south oriented transgressive dune mantles the bedrock, beach ridge and back barrier terrain. It is aligned roughly parallel with James Paterson Street and extends landward to the current proposed information centre area. Two periods of dune development can be identified from the exposed soil profiles. The A horizon of a soil profile developed on a gently undulating dune landscape, possibly the remnant of the beach ridge plain, can be seen in multiple exposures north of Birubi Headland, towards Gan Gan Road. Past archaeological reports (Dyall 1977, 2004) describe podsol soil profile features such as a bleached A2 horizon and orange stained B horizon. Remnants of dune woodland vegetation (such as banksia and eucalypt stumps) can be seen in the soil profile. This terrain has been disrupted by an advancing deflation basin and transgressive sand. This sand has formed a steep and high dune which still has active slip off slopes on its eastern face.

- The relationships of different periods of dune mobility along Stockton Bight and the layers of dune sand within the Birubi Point Aboriginal Place and adjoining areas such as the proposed information centre area have not yet been researched in detail. Based on the visible exposures along Stockton Bight and the Aboriginal Place, sand deposited in the period (approximately) 2500 BP to 1300 BP and sand deposited within the last century (with very limited soil profile development) are likely to be present.

- Recent frontal dune and beach landforms. An intact frontal dune protects landforms behind it, but when the frontal dune lowers or is breached, sea water intermittently overtops the dune and inundates the land behind. The frontal dune to the west of Birubi Headland (seaward of the lower carpark area) has been degraded, lowered and breached over the last decade. Wave overtopping of the frontal dune has allowed saltwater to penetrate into the deflation basin, but it does not reach as far inland is the proposed information centre area. The landward parts of the deflation basin may be inundated by freshwater during extended periods of wet weather.

The most important coastal processes continuing to shape the landscape within the Birubi Point Aboriginal Place and the proposed information centre area are beach erosion (by waves and currents), coastal recession (in the short term associated with sediment budget deficits, but in the longer term, due to sea level rise) and wind-blown transport of sand.

3.1.3 Specific features and geomorphic change in the north western part of the Aboriginal Place and the proposed information centre area

At the eastern end of Stockton Bight, close to Birubi Point, active mobile dunes continue to move landward, over woodland, wetland and development.

Within the Aboriginal Place, to the west of James Paterson St, these contemporary landforms are evident as:

- Heavily dissected frontal dune. At the south eastern end of Stockton Bight the frontal dune has become more fragmented and lower over the last two decades, as sand blows inland across the lower carpark area and the deflection basin. The low remnants of the frontal dune are overtopped by waves during storms and the carpark area is frequently buried by wind-blown sand.

- Partly stabilised and vegetated former mobile dunes, with high relief, noting that much of the vegetation is now invasive species rather than endemic dune woodland.

- Active mobile dunes with areas of loose sand, hummocky forms and exposures of former stable soil surfaces (with A1, A2 and sometimes B1 horizons exposed). The exposure of former ground surfaces (soil A1 horizon) indicate that prior to the current period of active dune transgression, the terrain in this area was gently undulating dune with woodland vegetation.

Figure 3.1 shows the extent of mobile sand surface west of James Paterson Street and south east of Gan Gan Road, in 1976. A large area of wet swale can be seen in the deflation basin, and areas of former soil profile A1 and A2 horizon can also be seen. The mobile dune at this time was actively moving across areas that had been cleared for farming. Houses associated with small rural holdings can be seen in the aerial photo.

Legend

- Proposed Disturbance Area
- Proposed Information Centre Site
- Lot 312 DP753204

Name

- 1976 leading edge of transgressive sand mass

Name

- 1976 Wet Swale
- 1976 Old Soil Profile

FIGURE 3.1

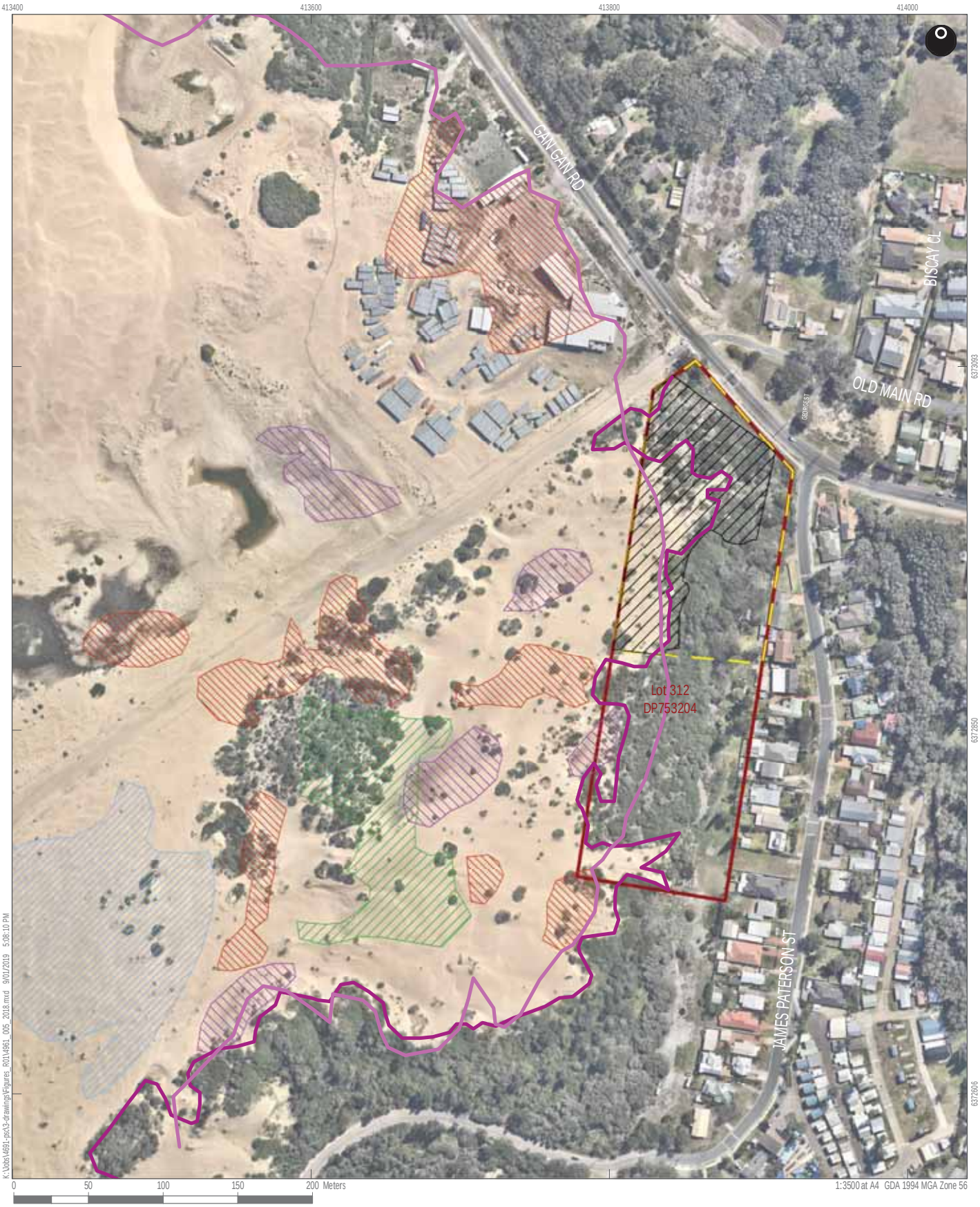
Site context and archaeological features from 1976

Image Source: OEH (1976) Data source: Umwelt (2018); Port Stephens Council (2018)

Figure 3.2 shows the area west of James Paterson Street in 2018. While the leading margin of mobile sand has moved a little further to the east, there has been significant revegetation since 1976, including growth of dune woodland and invasive species across former rural properties. Areas of shrubby vegetation (mostly bitou, with some coastal tea tree) have also colonised former bare sand. Areas where former soil profiles are exposed have changed, reflecting the dynamic nature of the sand surface.

Further evidence for the rate of change of the deflation basin and transgressive dunes at the Anna Bay/Birubi Point end of Stockton beach is presented in a research project using drone technology to collect digital terrain data over the period 2014 to 2017. This study (copy of the report is in **Appendix 2**) shows the ongoing movement of sand. In particular, the net loss of sand volume and ground surface elevation across much of the western part of the Aboriginal Place, including the frontal dune and deflation basin, is apparent. There is some net gain in sand volume close to the northern margin of the Aboriginal Place, adjacent to the boundary with the proposed information centre area.

The analysis presented in this research also shows the year on year variability in standing water in the deflation basin. In the past, this standing water has been fresh; however, with a low frontal dune which is overtopped by storm waves, the deflation basin may be inundated with salt water.



Legend

- Proposed Disturbance Area
- Proposed Information Centre Site
- Lot 312 DP753204
- 2018 leading edge of transgressive sand mass
- 1976 leading edge of transgressive sand mass
- 1976 Wet Swale
- 1976 Old Soil Profile
- 2018 Old Soil Profile
- 2018 Dispersed Remnant Vegetation

FIGURE 3.2

Relationship of proposed works to archaeological features

Image Source: Data source:

3.2 Resource availability for Worimi people

The landscape around Birubi Point provided diverse and abundant resources for Worimi people. These are briefly described in the following sections.

3.2.1 Fresh water

Fresh water sources included:

- Fresh water ponding in the extensive deflation basin along Stockton Bight (extending west from the site of the proposed information centre) and potentially also behind Little Beach (located to the south of the proposed information centre area). This would have been an intermittent supply, dependent on rainfall.

- A wetland area (swale) landward of the main midden at Anna Bay. Freshwater in wetlands would have been relatively persistent.

- Small pools in the surface of bedrock headlands.

3.2.2 Terrestrial flora and fauna

Across the Worimi Conservation Lands generally, at least 190 plant species and nine vegetation communities have been mapped. Several of these would have been present on the dunes and headlands at Birubi Point, prior to clearing and development of the area.

The sand dune assemblages include grassland, heath, scrub, open forest, swamp forest and intermittent beach wetlands (freshwater wetlands). Although the vegetation communities, developed on relatively recent sand deposits, are not regarded as highly diverse (Bell and Driscoll 2010), they do include several endangered ecological communities and species listed as endangered at NSW and Commonwealth levels.

Prior to the most recent period of active dune transgression, Worimi people living at Birubi would have had access to foredune spinifex, banksia woodland, dune Blackbutt and Angophora forest, melaleuca/swamp mahogany and sedge forest, coastal tea tree and banksia scrub, beach wetlands and other freshwater wetlands. Each of these vegetation communities provides food species, medicines and materials (such as bark and twine), as well as providing habitat for animals that would also be food species.

The remaining vegetation of the proposed information centre area includes:

- Cheese tree/smooth barked apple/bangalay disturbed open forest. This community is heavily disturbed and is impacted by coral trees and bitou bush. This occurs in a narrow strip of land protected from strong westerly winds by the high dune at the end of Stockton Bight.

- Coastal sand scrub, occurring on the stabilised transgressive dune running north south from Birubi Headland to Gan Gan Road. Where old land surfaces are exposed across the information centre site and adjoining areas, stumps of former banksia woodland/sand scrub can be seen.

Both ecological communities are discontinuous and degraded; and the site also includes cleared areas, mobile dune sand and areas of invasive species such as bitou bush. Bitou often grows as clumps partially buried by mobile sand. Other parts of the site have been disturbed by previous agricultural and Defence uses, over the last century.

While these ecological communities are potential habitat for a number of important plant and animal species (including grey headed flying fox, koala, quoll, bats and several birds and frogs), the level of disturbance and the isolation of the site mean that their habitat value is currently limited. However, in pre European times, these ecological communities would have provide diverse resources for Aboriginal people, with separate and distinct assemblages in the banksia and sand scrub communities that dominate Stockton Bight and the smaller areas of cheese tree/smooth barked apple/bangalay.

Mammals recorded in the archaeological sites within and adjacent to Birubi Point Aboriginal Place included ringtail possum, wombat, grey kangaroo and dingo. These provide food, but also raw materials for cloaks, rugs and shelters. The most common bird bone reported from the sites was the migratory shearwater, which is present in the area from October to March.

3.2.3 Marine fauna

Dyall 2004 provides detailed information about shell fish and fish species represented in the midden sites at Birubi Point, Robinson Reserve and Morna Point, based on recording and excavation of these sites in the 1970s. Dyall also reported bone from a variety of bird and animal species in the middens.

Marine species observed in the middens within and adjacent to the Aboriginal Place (and adjacent to the proposed information centre area included:

- Beach, rocky reef and nearshore shellfish such as pipi (very common), bonnet shell, cartrut (common), chiton, kelpshell, limpet, nerita (common), triton, turban (common), oyster, Sydney cockle, flame cockle, mud whelk, abalone, mussel, elephant snail

- Fish species such as snapper (very common), groper, wrasse (common), tarwhine (common), mullet, leatherjacket, kelpfish (common), black bream (common), black drummer, red rock cod (common), wirrah cod (common), trevally, whiting.

- Crayfish, sea urchin.

Fish were caught with hook and line, nets and fish traps.

Whales pass close to Birubi Point and Morna Point on their migration. There are historical reports of Aboriginal people at Port Stephens eating beached whale (e.g. in Gunson 1974), but no evidence of whale bone has been observed in the midden sites at or around Birubi Point.

3.2.4 Other resources

People living at the north eastern end of Stockton Bight also had access to a variety of stone raw materials suitable for flaked and ground implements, including:

- Nobbys tuff, most likely obtained from Newcastle cliffs or from cobbles deposited from wave action and long-shore drift on Stockton Bight

- Silcrete, obtained from various sites around the Hunter estuary and lower Hunter

- Porphyry rock from the local area (outcropping on all local headlands), suitable for use as hammer stones, and for grinding

- Other materials obtained from elsewhere in the lower Hunter and mid north coast (including other mudstones, tuffs, basalt and cobbles from the Hunter River)

Fine vesicular pumice is also recorded in the midden sites at Birubi Point. This material can be moved by waves, but may also have been moved by Aboriginal people.

The ready availability of robust shell species provided raw materials for manufacture of shell fish hooks, which are abundant in the Birubi midden sites.

An important landscape asset at Birubi Point is the value of the former gently undulating stable dune surfaces, providing a sand substrate for camping and also for burials. A major advantage of the former low dune within the proposed information centre area is that it provided sheltered camping sites – protected from strong southerly winds by the high dune that runs roughly north- south inland from Birubi Headland.

3.3 Land Use History

3.3.1 Development

The landscape context of Birubi Point Aboriginal Place and the proposed information centre area includes the Anna Bay and Fishermans Bay residential areas, tourist accommodation, access roads, carparks, current visitor transfer facilities and the surf club and cafe.

Early European settlement

Although European occupation at Anna Bay commenced in the nineteenth century, most of the development occurred in the twentieth century. The landforms and vegetation within the Birubi Point Aboriginal Place and the proposed information centre area have been much disturbed by the growing use of the area.

Early land use of the area includes market gardens along what is now the residential interface on the Stockton Bight side James Paterson Street. This activity introduced a variety of noxious weeds to the area. There are currently noxious weed treatment obligations for landowners in this area under the *Noxious Weeds Act 1993* and the *Noxious Weeds (Weed Control) Order 2014*. DILW has been working with other landholders to implement effective management of the weed species, but control remains a challenge.

The dunes in the north eastern part of Stockton Bight were used by the RAAF as a testing range in the mid twentieth century. The area was also part of the coastal defence infrastructure in the World War 2, and access tracks through the dune, tank trap structures and other fencing date to this time.

Expanding development in the 1970s

In the 1970s, the Anna Bay/Morna Point area was beginning to transform from a rural/agricultural and fishing village to a seaside suburb. Houses were present along the north western side of James Paterson St in 1976. Multiple closely spaced sheds were behind the houses – between them and the leading dune face. At that time, the south east side of James Paterson St was wetland.

Importantly, reports from the 1970s include comments that local people 'collected artefacts 'by the sugar bag full'. The impacts of residential development on the archaeological and cultural values of the area were therefore more than direct disturbance by construction. It included these collections that removed visually interesting artefacts and also disturbance of open space areas by informal recreational access ways.

Birubi Surf Club

A surf club was established at Birubi Headland in 1993. The current surf club building (built with an investment of $4.7 million) was opened in 2013. The surf club is an important community meeting place and also an important economic asset. A café operating in the surf club building attracts large numbers of visitors for beach side meals. The surf club site is also a popular viewing platform for the dunes, the beach and seasonally for passing whales.

The surf club hosts major carnival events, which bring large numbers of visitors to the site.

Worimi Conservation Lands

The northern gateway to the Worimi Conservation Lands for off road vehicles is off Gan Gan Road at Anna Bay, adjacent to the proposed information centre area. The Anna Bay access track to Worimi Conservation Lands is a popular route, providing relatively easy access to the beach.

Other activities

Land management activities in the Aboriginal Place have included some mechanical shaping of mobile dunes by the Soil Conservation Service (along the eastern margin of Stockton Bight, where sand was formerly advancing onto private land); efforts to revegetate the dunes restoring habitat and biodiversity as well as stabilising the sand surface; and noxious weed management actions in former market gardening and grazing lands behind James Paterson St.

There has been historical intermittent sand extraction in the areas where mobile dunes encroach close to development. This currently includes removal of sand moving across the lower carpark.

Vacant land such as the proposed information centre area has been used by the general public for rubbish dumping, dog walking and motor bike riding, as well as being occasionally used for cultural purposes.

Over the last 10 to 15 years, two new projects have affected the margins of the proposed information centre site. These are the construction of the northern (Anna Bay) access to the Worimi Conservation Lands and the partial construction of a coastal resort on the north western side of this access track (refer to **Figure 1.1** and **Figure 1.2**). The construction of the coastal resort failed, in part due to failure to control mobile sand, and the site is now largely derelict.

3.3.2 Conservation and protection

The proposed information centre area is situated between Tomaree National Park and the Worimi Conservation Lands.

Tomaree National Park was originally reserved in 1984 and protects a coastal landscape of regional and state significance. The National Park includes part of the Aboriginal Place. A draft Plan of Management for the Park was exhibited in 1995, but was not finalised and adopted at that time. A new draft Plan of Management was prepared and exhibited in 2004 - 2005 and was adopted in 2006. This Plan of Management is still current.

The Worimi Conservation Lands lie to the south west of Birubi Point Aboriginal Place, sharing a boundary with the Place. The Conservation Lands were gazetted in 2007 and in 2015 the Worimi Conservation Lands Board of Management released their ten year Plan of Management, adopted by the Minister for the Environment.

3.4 Summary

Key points from this review include:

- The proposed information centre area is located in a dynamic coastal landscape
- Former land surfaces and associated archaeological materials are exposed from time to time, depending on the patterns of wind-blown sand
- The former (pre approximately 500 years) land surface within proposed information centre area was gently undulating terrain, with banksia woodland vegetation.
- Archaeological sites may be present on old land surfaces, buried beneath varying depths of recent wind-blown sand
- Worimi people living in this coastal landscape throughout the Holocene period had access to diverse terrestrial and marine resources. This diversity has supported frequent, potentially year round, use of the area by Worimi people and the resource value of the area continues for Worimi people today.
- The proposed information centre area has been extensively disturbed by land uses over the last 100 years, but particularly since the 1940s.

4.0 Cultural Context

4.1 Worimi people

During the preparation of the Management Plan for the Birubi Point Aboriginal Place (Umwelt 2018), Worimi traditional owners and the Board of Management of the Worimi Conservation Lands provided information about the value of Birubi Point area to Worimi people. The description of values provided by Worimi people at that time is the basis of the information below.

Birubi Point Aboriginal Place is in the heart of Worimi country and Worimi people have been part of this land for tens of thousands of years. They are the Traditional Custodians of the land. Birubi means 'Southern Cross' and one of the special characteristics of Birubi Point is the expansive view it offers of the sea and sky, including the Southern Cross.

Worimi people travelled along the beaches and over headlands and dunes to wetlands and creeks when moving through the coastal parts of their country. The sites and lifestyle at Birubi Headland and adjacent areas are connected to other significant sites and landscape features across Worimi country, including the southern shores of Port Stephens and along Tilligerry Creek and the beaches and dunes of Stockton Bight.

The Worimi still use the area today and their history and connection to the land is demonstrated by both the abundance of significant resource materials that are available in the area and the archaeological evidence. Today the extensive archaeological material of Birubi Point Aboriginal Place makes it a site for teaching current and future generations about Worimi ancestors and local Aboriginal culture.

Throughout the beach, dune and headland landscape within the Birubi Point Aboriginal Place there is abundant material evidence of Worimi people living on their lands, including evidence of fishing, shellfish gathering (with shell middens being the most conspicuous form of evidence in the landscape), campsites, fire and hearthstones, flaked stone implements and burials.

Some members of the community refer to a men's ceremonial site in the area and a story involving an old warrior. They also talked about the contemporary spiritual importance because a young Aboriginal person died in the surf here.

4.1.1 Native title

Based on information provided by the National Native Title Tribunal on 27 November 2018 and a review of the Native Title Vision website on 27 November 2018, a number of Native Title Claims have been determined in relation to the Worimi people in in the general vicinity of the Aboriginal Place. There are no current or determined Native Title claims applying to the Aboriginal Place.

In relation to Worimi Local Aboriginal Land Council No. 1 and No. 2 (Stockton Bight), No. 3 (Taylors Beach), No. 4 (Boat Harbour), No. 5 (Tilligerry Creek) and No. 6 (Taylors Beach) the Federal Court found that Native Title does not exist in November 2005, September 2009, December 2008 and February 2012 respectively.

None of these land parcels is within the Birubi Point Aboriginal Place.

An application for determination of Native Title was made by Gateway Lifestyle Investments Holdings on 15 October 2018. This non-claimant application (Tribunal No. NN2018/008) covers parcels of land to the east of James Paterson Street, just outside the Birubi Point Aboriginal Place.

No Indigenous Land-Use Agreements (ILUAs) have been registered or notified by the National Native Title Tribunal as being in place over the Aboriginal Place or any adjacent area.

4.2 Archaeological Context

There are a number of registers that contain information relevant to Aboriginal cultural heritage, including:

- The OEH Aboriginal Heritage Information Management System (AHIMS)
- The Australian Heritage Database
- The State Heritage Register
- The State Heritage Inventory
- The Port Stephens Local Environmental Plan.

The Australian Heritage Database lists the Newcastle Bight coastal area as an Indicative Place on the basis that indigenous and non-indigenous cultural values of National Estate significance may be associated with the area, but it does not specifically include the proposed information centre area.

4.2.1 Register searches

The OEH AHIMS is a database of Aboriginal sites for which site cards have been submitted. The AHIMS database was searched on 20 September 2018 for sites located within the search area:

Latitude, Longitude from: -32.7947, 152.0627 - Latitude, Longitude to: -32.7631, 152.1128.

A total of 50 sites were identified within this search area. The distribution of different site types is shown in **Figure 4.1** and a summary of site types is listed in **Table 4.1**. The site types include isolated finds, shell middens (including some with stone artefacts and hearths), open campsites, burials, resource and gathering sites, habitation structures, and potential archaeological deposits. Four of these sites, including three middens in close proximity to the surf club site, are registered as being partially destroyed.

In total in this search area there were 17 sites described as stone artefact scatters or open campsites, some with shell noted as a secondary component. Eight sites were recorded as 'Aboriginal resource gathering'. The location of these sites, predominantly within the mobile dune field, may reflect evidence of Aboriginal food plants, or shell. Eleven sites were recorded with shell/midden as the principal component; some are associated with artefacts or hearths. Two sites are recorded as 'habitation structure', but it is not clear what this means, in the context of a mobile dune field. Certainly, historic records suggest that there were numerous hearths and sometimes large rocks for grinding, recorded across this area, where former stable soil surfaces were exposed. There was one burial site recorded. This site is within the current residential area.

Legend

- Proposed Disturbance Area
- Proposed Information Centre Site
- Lot 312 DP753204
- Birubi Point Aboriginal Place
- Robinson Reserve Excavation Impact Area

AHIMS Search Results

- # Aboriginal Resource and Gathering
- 0 Arteface (Stone, Bone, Shell, Glass, Ceramic, Metal)
- G Burial
- @ Ceremonial Ring (Stone or Earth) : 1
- © Habitation Structure
- Potential Archaeological Deposit (PAD)
- H Midden & Associated Artefact/s
- S Shell

FIGURE 4.1

AHIMS Search Results

Image Source: Nearmap (Sept 2018) Data source: Umwelt (2018); Port Stephens Council (2018); NSW OEH AHIMS (2018)

Table 4.1 Sites within and in the vicinity of proposed information centre and transport interchange

Site number	Site features
Within (on the boundary of) the proposed information centre area	
38-5-0272	Artefact site (this site is mapped as just west of the current proposed development area, on private land)
38-5-0270	Stone artefacts (adjacent to 38-5-270)
Within the Birubi Point Aboriginal Place	
38-5-0316	Shell (partially destroyed)
38-5-0295	Aboriginal resource gathering
38-5-0196	Stone artefacts
38-5-0211	Shell, with artefacts, hearth
38-5-0269	Aboriginal resource gathering
38-5-0284	Aboriginal resource gathering
38-5-0286	Aboriginal resource gathering
38-5-0268	Habitation structure
38-5-0294	Aboriginal resource gathering
38-5-0293	Aboriginal resource gathering
38-5-0317	Shell
38-5-0012	Midden and associated artefacts
38-5-0013	Midden and associated artefacts
38-5-0014	Midden and associated artefacts
38-5-0015	Midden and associated artefacts
38-5-0016	Midden and associated artefacts
38-5-0240	Stone artefacts, with shell
38-5-0241	Stone artefacts, with shell
38-5-0239	Stone artefacts, with shell
38-5-0227	Shell, with artefacts, hearth
38-5-0150	Isolated find
38-5-0035	Open campsite

Site number	Site features
Outside the Aboriginal Place and proposed information centre area, in the remainder of the search area	
Back barrier and inter-barrier depression area (Nelson Bay Road)	
38-5-0327	Stone artefacts
38-5-0319	Shell
38-5-0312	Stone artefacts
38-5-0223	Stone artefacts
38-5-0311	Potential archaeological deposit
38-5-0318	Shell
Eastern margin of transgressive dunes and on sand sheet overlying rock towards Morna Point	
38-5-0210	Stone artefacts
38-5-0281	Aboriginal resource gathering
38-5-0268	Habitation structure
38-5-0280	Aboriginal resource gathering
38-5-0331	Stone artefacts
38-5-0198	Stone artefacts
38-5-0034	Burial
38-5-0309	Stone artefacts
38-5-0153	Isolated find
38-5-0248	Stone artefacts

4.2.2 Archaeological investigations at Stockton Bight and Anna Bay

Scientific interest in Aboriginal occupation of the coastal landscape from Newcastle to Port Stephens commenced in the early 20th century, with important publications from the Australian Museum dating to the 1920s. The intensity of survey increased with the introduction of the NPW Act 1974 and the EP&A Act 1979, as well as with the development of new residential areas such as at Fern Bay, Anna Bay, Medowie and along the southern shore of Port Stephens; and related power and water infrastructure through the dunes of both the Pleistocene and the Holocene barrier systems.

Stockton Bight provides sand resources for construction and previously also provided mineral sand resources. Extensive surveys, subsurface investigations and post consent monitoring have been completed over the last 40 years for these developments.

Examples of previous archaeological reports that contribute to the broad archaeological context of the proposed information centre area and the Birubi Point Aboriginal Place are reviewed in Dean-Jones (1990), ERM (2006) and Umwelt (2003) (assessment for declaration of an Aboriginal Place) and further archaeological understanding has been developed in a range of other more recent archaeological assessments (e.g. Umwelt 2016, 2017). These studies and reports are not reviewed in detail here but the key outcomes are summarised below. More detailed information from studies conducted within the Birubi Point Aboriginal Place is in **Section 4.2.2.1**.

The review of archaeological studies and reports highlights several important contextual characteristics for the site complex that extends from Morna Point and Birubi Point landward to Gan Gan Road. These include:

- There are multiple large site complexes within the Stockton Bight (Newcastle Bight) area. These sites demonstrate the diversity and reliability of resources for Aboriginal people, particularly in locations with access to estuarine, marine, wetland and terrestrial (dune) habitats.

- Worimi people occupied the sites on the Outer Barrier throughout the Holocene, but the best evidence of utilisation of shellfish comes from the last 1000 to 1500 years, whether in vegetated terrestrial dune contexts or exposed frontal dune contexts. This may be the result of:

    - Removal or poor preservation of older deposits at some sites due to transgressive dune activity or periods of severe beach erosion, potentially associated with a period of elevated sea level. For instance, there has long been a view (based on relatively limited dating) that the Holocene dunes were actively mobile in the period 2500 to 1300 years BP (Thom et al 1998). Dated sequences elsewhere on the NSW coast suggest elevated sea level in the period 2000-2500BP (Switzer A, Sloss C, Jones B and Bristow C (2010)). Sloss, Jones and Murray Wallace (2018) also propose a mid to late Holocene still-stand continuing until approximately 2000 BP (potentially with some slight oscillations), with a gradual fall to the present.

    - weathering of shell, reducing shell concentrations in the lower stratigraphic units of sites;

    - a change in accessibility of other resources from environmental conditions or from the availability of more effective technology, perhaps accompanied by a significant increase in population

    - other differential stratigraphic processes, post deposition, leading to stone moving deeper into the profile than shell.

4.2.2.1 Archaeological investigations in the Birubi Point Aboriginal Place

The rich and spatially diverse archaeological record from the Birubi Point Aboriginal Place provides an indication of the scope and scale of occupation evidence that could be located within the proposed information centre area. A summary of the detailed early records and later assessments is provided below.

Although multiple individual sites have been recorded within the Birubi Point Aboriginal Place, within the proposed site of the information centre and in adjacent parts of the eastern end of Stockton Bight, historical descriptions of the former extent and connectivity of these 'sites' suggest that the area comprised an extensive site complex, with multiple foci of activity. These different activities across the site, which may be linked to distance to specific resources, or to seasonal patterns of use, or to patterns of use linked to men's and women's activities and cultural practices. The total area of the site complex is approximately one kilometre by 1.5 kilometres. The distance from the Morna Point/Birubi Point/Little Beach component to the undulating dunes within the proposed information centre area is approximately one kilometre, with archaeological materials known to have been present on former stable land surfaces across the intervening landscape.

The most studied part of the site complex and the area retaining the best preserved examples of the midden (at Fitzroy Street) extend from Morna Point, across the dunes behind Little Beach and onto Birubi Headland. The information below provides background about this part of the site complex, as it provides the immediate archaeological context for the information centres area.

Umwelt (2003) reviewed archaeological and cultural information for Birubi Point for the nomination of the area as an Aboriginal Place.

The archaeological value of the Birubi Point Aboriginal Place was first formally documented in the 1920s (Thorpe 1926, Hall 1928) when Worimi burials were excavated and a large number of artefacts were described from a complex of occupation areas across the Place. In the 1970s (Dyall 1979, 2004) mapped several large and complex middens in what is now the Aboriginal Place and the area has been the subject of multiple archaeological studies over the last 40 years.

Hall (1928) describes Little Beach (between Morna Point and Birubi Point) as a secluded area which has been, in the past, a favourite camping ground for Aboriginal people. Along the sand are middens and conical shell heaps, reduced by erosion of southerly storms, but still large enough to indicate how much more extensive they must have been in earlier days.'

Photographs provided in Hall (1928) clearly show midden shell at the back of the beach, exposed in front of the deflating and dissected foredune. Dense shell deposits extend into the low and hummocky dunes landward of the beach. From Hall's photographs it is evident that dense midden shell continued at least 200 metres inland from the beach. The area is sheltered from west, north-west and south west winds by the Birubi Headland and high dune at the end of Stockton Beach. Hall (1928) also reported campsites (including ovens) on the lower north western flanks of this high dune (towards the area proposed for the information centre).

Hall (1928) mostly collected and described numerous stone artefacts (flakes and Worimi cleavers) from the extensive midden behind Little Beach (i.e. including the current Fitzroy St midden). Flakes were Nobbys tuff (Hall thought this was obtained by trading with the Awabakal); Worimi cleavers described as being of basalt (also reported by Thorpe 1926 and McCarthy 1947).

Dyall 1979 and 2004 reports that when he first visited Birubi in 1963, the shell middens behind Little Beach covered (estimated) 4 to 5 hectares. Dyall refers to this area as 'the mainland midden'. The extent of midden had been reduced between the 1960s and late 1970s by residential development, parking areas (in what is now Robinson Reserve), and the construction of the caravan park. Multiple chert and silcrete artefacts were also destroyed by this development.

Dyall 1979 and 2004 describes the archaeological materials as follows: 'In 1963, the most extensive shell heaps stretched across the top of low sand hills about 150m back from the water line at Little Beach. The shell layer, which was generally 10 to 30cm thick, had long been subjected to the undercutting action of southerly storms, so that shell, flaked stone and lumps of porphyry were strewn down from the seaward face of the ridge line. A continuous layer of undisturbed shell extended for about 150m parallel to the beach. The Fitzroy Street site was dominated by pipi shell, with estuarine species such as mud whelk, oyster and *Anadara*, and rock platform species comprising only 6% of the specimens (including heavy turban shells). The site also contained flaked stone, generally Nobbys tuff (no geometrics or backed blades).

Based on the materials he could collect and describe, Dyall reported that 'Bondaian' tools were extremely rare on the main midden area behind Little Beach (but edge ground tools were present.

Windblown sand covered the top of the shell layer which possibly extended back inland 30m from the exposed face. The sand ridges terminated in swampy ground (black soil covered with tea tree scrub).'

Dyall reports that the deflated midden (with low conical sand heaps and disrupted thin shell capping), on the area extending towards the beach from the more intact shell layers, was 20 to 40m wide and occupied a gentle slope that terminated at the edge of a shallow swale immediately behind the low sand ridge at the back of the beach. In wet weather this swale held fresh water.

Dyall reports major collecting activities by locals in the Little Beach area, probably from the 1950s onwards. Locals referred to artefacts being collected 'by the sugar bag full' 'after each blow'. It is possible that thousands of flaked, retouched and edge ground implements were removed by local collectors. Given the land use history of the area of the proposed information centre, it is possible that flaked stone artefacts were also collected there by locals, wherever they were exposed (e.g. by tracks or by farming activities).

Foreshore middens at Little Beach contained large amounts of fish bone, capped by pipi shell and rock platform species of shellfish (Dyall 2004). The foreshore and rock platform middens contained very little flaked stone (and no 'Bondaian' implements, here or on Morna Point Headland)), but did include lenses of ash, wind-blown sand and shell. Numerous hearths were present as were fish hooks made from *Ninella torquata.* A carbon date of 1340+/-80BP was obtained for pipi the lowest occupation level of a foreshore midden) and a carbon date of 1445+/-75 years for the midden site at Fitzroy Street Dyall (2004).

4.2.2.2 Archaeological materials on the eastern slopes of Birubi Headland

Dyall 1977 and 2004 reports scattered shell and flaked stone exposed amongst the rocks at Birubi headland. This area was mostly covered in drift sand and lantana in the 1960s, so its extent was not realised until the area was cleared for road access to a beach side carpark.

A trench excavated in midden deposit high on the headland was described as black sand with shell (including heavy turban shell). The midden contained fish hook blanks, but not fish hooks. Rock platform, open beach and estuarine shellfish species were present.

RPS 2010 conducted an assessment at the Birubi Point Surf Club site, on Birubi Headland. This report reviewed several previous studies in the vicinity and relocated a number of midden sites previously recorded on the headland (pipi shell, other shell species and occasional stone artefacts). Salvage excavations were subsequently conducted, in consultation with registered Aboriginal parties for that project.

4.2.2.3 Archaeological materials on the slopes of high dunes to the northwest of Birubi Headland

Dyall 1979 and 2004 reports that most of the exposed face is made up of iron cemented layers (i.e. podsol soil profile B horizons), plus the presence of 'peaty layers' (these could be podsol A1 horizon, from the description). Tree stumps indicate it was stable and vegetated, probably within European times. Dyall describes the peaty layers a forming 'sills' about 6m above the level of the freshwater ponds in the swale behind the beach dune (likely referring to the deflation basin). Flaked stone was reported as being common in this area (including Bondaian artefacts) and Hall (1928) refers to ovens made up of rings of stones in this area. None of these features have been observed in recent years.

4.2.2.4 James Paterson Street

The alignment of James Paterson St was used by four wheel drive vehicles to gain beach access in the 1960s. This access could have provided access from Gan Gan Road along the dune face to Little Beach (where licensed beach haul fishers can still access the beach) or to Birubi Headland. Dyall reports that along the old sand track, small flaked stone artefacts were common, but there was little shell (where shell occurred, it was generally broken pipi). He reports that from his observations and collections between 1965 and 1977, numerous microliths (bondi points and geometrics) were collected along the alignment of James Paterson St and in the soil units of the high dunes to the north west of Birubi Headland.

4.3 Archaeological implications for the proposed information centre area

The proposed development area is located adjacent to the Worimi Conservation Lands (WCL) on Stockton Bight and the Birubi Point Aboriginal Place. Archaeological studies have been conducted in these areas for nearly a century. The proposed information centre area occupies an area of former transgressive dune and swale terrain which is part of the same landscape as these areas which are in conservation management.

The entire Birubi Point Aboriginal Place and adjoining land in the Worimi Conservation Lands has high cultural heritage sensitivity from an archaeological, cultural or spiritual perspective.

The former extent and continuity of midden deposits, open campsites, hearths, burials and other features suggest that although the area has multiple site numbers/site cards, it should be regarded as a single large and complex site, protecting evidence of the life of a Worimi community over thousands of years. Different parts of the complex provide evidence of different focal activities (e.g. shell fishing focus, terrestrial hunting focus, areas best used in summer or in winter, areas set aside for men's and women's special activities).

Although the main dune field of Stockton Bight was already destabilised/mobilised before significant European settlement, it is apparent from soil formation and dated occupation evidence that the landscape around Birubi Point was relatively stable from about 1500 years ago to perhaps 500 years ago. More dated materials would provide better resolution of the timeframe. The entire landscape around Birubi Point has been much disturbed over the last century.

Despite the level of disturbance, areas of archaeological evidence remain. It is possible that Aboriginal archaeological materials, including midden, stone artefacts, hearths and potentially burials, remain associated with former land surfaces, now buried within the mobile and stabilised dunes at the far eastern margin of Stockton Bight and across the transitional landscape where wind-blown sand overlies bedrock headlands. Thousands of flaked and edge ground artefacts are reported to have been removed from the area of the Birubi Point site assemblage in the past (Dyall 1979 and 2004).

In summary, the cultural heritage records and environmental evidence for the area indicate that:

- Aboriginal archaeological materials will be present within the proposed information centre area, although none have previously been recorded on the surface of this area (e.g. see **Figure 4.1**)

- Materials will most likely be flaked stone artefacts, with shell (beach and rock platform species) and grinding equipment also possible. Hearths may also be present. Shell is expected to be less common in this area than parts of the site complex that are immediately adjacent to the beach and rock platforms.

- Archaeological material will predominantly be associated with exposures of the former stable land surface, which is intermittently exposed beneath active mobile sand dune and is expected to continue

intermittently beneath the contemporary surface. Some archaeological materials may exist in an entirely disturbed context (e.g. as reworked lag deposits)

- The depth of cover of recent wind-blown sand (mostly deposited within the last century) over the former occupation surface will vary. This is partly because of the undulating nature of the older ground surface and partly because of the locations of multiple ongoing episodes of deflation and deposition

- Specific task-oriented areas are likely to be present, but may be difficult to detect because of the extent of disturbance and weathering of the archaeological material

- Flaked stone artefacts will utilise the fine grained Nobbys tuff, but other materials (notably silcrete) are likely to be present.

- Artefacts will include blades and geometric microliths. Fish hooks may be present, but are more common in the parts of the site complex directly adjacent to the sea.

- Any flaked stone that has been exposed on the surface will be impacted by abrasion by wind-blown sand.

- Disturbance within the proposed information centre area is likely to be greatest in the portion of the area that formerly contained houses and associated outbuildings (as discussed in **Section 3**).

These predictions form the basis of the site inspection described in **Section 5**.

5.0 Site Inspection

5.1 Survey strategy and effective coverage

A site inspection was conducted by Umwelt archaeologists and selected registered Aboriginal parties on 1 November 2018. Port Stephens Council project managers also participated in the site inspection, to brief the registered Aboriginal parties on the proposed development.

It was agreed with the registered Aboriginal parties that the field survey would be conducted as a walking inspection of the proposed information centre area and its local context.

The aim was, as far as practical, to record sufficient information to satisfy Requirement 7 of the Code of Practice and to provide the registered Aboriginal parties participating in the survey with an opportunity to discuss the archaeological and Aboriginal cultural significance of any site that was observed. These discussions extended to the sites that may remain below the surface of the proposed development area.

The registered Aboriginal parties are all individuals who have a long standing association with the Birubi Point Aboriginal Place and adjoining areas and most had participated in previous walk over site inspections of the proposed information centre area.

The archaeologists and registered Aboriginal parties were therefore familiar with:

- the dynamic nature of the ground surface in the mobile sand dune terrain
- the highly variable nature of exposures of former ground surfaces as mobile sand moves across open space or scours and builds up around obstacles such as vegetation remnants or bitou bush.
- the nature of Aboriginal archaeological sites that have previously been observed and recorded at Stockton Bight, Birubi Point and across the Birubi Pont Aboriginal Place
- the landscape features with which Aboriginal archaeological sites are associated. In particular, Aboriginal archaeological sites are associated with topsoil (dark A1 soil horizon and bleached A2 soil horizon) materials developed during former periods of stable land surface. The organic content and structure of the A1 horizon means that it stands out from shifting recent sand and can be identified from a distance.

With this background, the walking survey focused on identifying the locations of exposures of former stable land surface materials. Archaeological materials were predicted to be associated with all such exposures.

Participants visited all accessible parts of the proposed information centre area. Areas of extremely dense vegetation were not inspected. Participants also inspected the area just outside (to the south west) the proposed information centre area. This area has extensive ground surface visibility, including exposures of the former stable ground surface. It is indicative of the nature of the likely surface and subsurface character of the more vegetated areas of the proposed information centre.

It is important to note that although ground cover is very low across parts of the site and adjacent land to the south west and therefore ground surface visibility is very high (greater than 90%), the effective visibility of a ground surface that could have archaeological potential is very low due to the presence of windblown sand mantling the former land surface. The exposures of the former stable ground surface are discrete, discontinuous and occupy less than 5% of the visible ground surface.

5.1.1 Survey units included

The design of the survey covered the following terrain:

- Contemporary deflation basin
- Low discontinuous dunes and hummocks (often formed around clumpy vegetation)
- Undulating to gentle gradient terrain, often the morphology of the former stable land surface, overlain by a relatively thin mantle of wind-blown sand
- Steep dune terrain.

5.2 Information recorded during survey

During the walkover inspection, notes were made, as relevant, about the character of the proposed development area, including:

- Vegetation
- Soil features (where suitable areas of exposure/visibility are present)
- Identified Aboriginal resources (food and medicine plants, prey animals, stone and water)
- Levels of average ground surface visibility within the survey unit (in accordance with the Requirement 9 of the Code of Practice)
- Extent and type of exposures within the survey unit (with reference to the factors leading to the exposure such as erosion, earth-moving activities, track establishment etc.). As noted above, in the proposed information centre area , the extent of ground surface visibility is almost entirely due to the movement of wind-blown sand; with only intermittent exposures of former stable ground surface materials likely to be associated with occupation evidence.
- Any information provided by the registered Aboriginal parties in relation to cultural values, noting that such information will be recorded in accordance with the wishes of the party providing the information and
- Any site, area of Potential Archaeological Deposit (PAD) or landscape feature of Aboriginal cultural value present within the survey area. The details of this recording of known sites and any new sites are provided in **Section 6**.

Photographs were taken to illustrate landforms, vegetation, ground surface condition and existing development or disturbance across the proposed development area.

At each location where the former ground surface was exposed, participants marked (flagged) visible artefacts and likely midden shell fragments. The locations of these archaeological materials were mapped using GIS and the nature of each object was recorded.

Examples of the character of the landscape, the exposures of former stable ground surface and the types of archaeological materials that were recorded are shown in **Photos 5.1** to **5.11**, in **Table 5.1.** The photos also illustrate the impact of exposure to active wind-blown sand movement.

Table 5.1 Photos showing the nature of the terrain and ground surface visibility across the proposed development area

Description	Photo
Photo 5.1 Start – entry to the proposed development site, off the Anna Bay 4WD access road	
Photo 5.2 Wind-blown sand dominates the ground surface; with hummocky features formed around invasive vegetation (bitou bush clumps)	

Description	Photo
Photo 5.3 Tuff Core. The material is most likely sourced from south of the Hunter River entrance. The core shows the effects of sand blasting by mobile dune sand, when exposed on the surface	
Photo 5.4 Flagged artefacts; blue flags show the locations of archaeological materials identified by registered Aboriginal parties who participated in the survey	

Description	Photo
Photo 5.5 The dark 'shadow' is an exposure of a former stable ground surface. The ground surface is identified from the dark, slightly organic and more robust A1 horizon, generally overlying pale grey to white bleached A2 horizon remnant of soil. Archaeological materials have previously been recorded in the A1 and A2 horizons of the dune podsol soil, but rarely in the B horizon.	
Photo 5.6 Tuff Flake, showing strong weathering impacts of exposure to mobile sand.	

Description	Photo
Photo 5.7 Flagged artefacts, associated with an exposure of the former stable ground surface. The exposure is generated by wind swirling around a clump of bitou bush. Remnant stumps from the former banksia woodland can also be seen exposed on the current ground surface, suggesting that the soil materials from the former ground surface are more extensive at a shallow depth.	
Photo 5.8 Geometric microlith – a further example of the type of material (Nobbys tuff) and the impact of wind-blown mobile sand.	

Description	Photo
Photo 5.9 Along north eastern boundary – heavy vegetation cover, dominated by bitou and tea tree coastal scrub. There is no ground surface visibility in this part of the proposed information centre area and access is difficult. The vegetation cover is relatively recent – likely within the last 20 years.	
Photo 5.10 Towards four wheel drive access road, lower elevation, more vegetated – mobile sand forms the surface between clumps of recent vegetation (bitou bush and coastal tea tree scrub)	

Description	Photo
Photo 5.11 Possible old house block in the north eastern corner of the proposed development site. There is no ground surface visibility in this area and a dense cover of introduced and native vegetation species.	

6.0 Results

This section focuses on the archaeological materials observed during the surface survey. These include scatters of shell fragments and artefacts, some previously recorded and some likely to be new exposures. Although there are multiple discrete exposures, it is appropriate to include all these exposures as features within a single archaeological site complex.

This is consistent with the descriptions of the very large and complex array of archaeological material that was reported to be present at Birubi Point, Morna Point and the dunes and swales of the north eastern end of Stockton Bight, in reports dating to the 1920s. While there were clearly different loci of activity across the site complex, overall it represented aspects of the daily and seasonal lives of Worimi people over the late Holocene and up until the arrival of European settlers.

The level of disturbance of the vegetation cover of the proposed information centre area is such that very little habitat remains to illustrate the terrestrial resources for Worimi people in these dunes and swales.

The current location of freshwater ponding in the deflation basin after extended rain is indicative of a resource likely to have been available to Worimi people, but not of the specific locations, depths and duration of inundation.

6.1 Description of Survey Units

As discussed in **Section 5.1.1** and illustrated in photos in **Table 5.1**, the surface survey covered all areas of bare sand across the proposed development area and the adjacent land. Much of this surface is recently deposited wind-blown sand. The overall terrain character of the site is discontinuous deflation hollows and accretion mounds, at the margin of the transgressive dune field. All terrain units were inspected, on foot. While visibility was high in approximately half of the proposed information centre area, the presence of windblown sand meant that levels of effective coverage were low.

6.2 Previously recorded archaeological sites

The locations of previously recorded sites or loci of activity (shown in **Figure 4.1**) were inspected. As noted above, the mobility of the ground surface means that there is no continuity of surface expression of the previous ground surface or archaeological materials. All exposures of soils associated with the former stable ground surface were inspected.

Artefacts recorded in the vicinity of previously recorded site s (38-5-0272 and 38-5-0270 are noted in **Table 6.1**. The locations of these artefacts are shown in **Figure 6.1**.

The artefacts recorded during this inspection are best understood as part of the two previously recorded sites, demonstrating that in fact the entire area comprises discrete exposures of a single site. It is proposed to amend the site Card for the two previously recorded sites to this effect, and to submit descriptions of the additional artefacts to OEH for their records.

Table 6.1 Artefacts observed on the surface during the site inspection

Site Name	Artefact number	Raw material	Artefact class	X	Y
Birubi Point	1	Metal	Remnant material indicative of site disturbance (not a Worimi cultural object)	413775	637997
Birubi Point	2	Glass	Fragment		
Birubi Point	3	Tuff	Flake		
Birubi Point	4	Tuff	Flake	413773	6372995
Birubi Point	5	Tuff	Core	413773	6372996
Birubi Point	6	Tuff	Flake	413771	6372998
Birubi Point	7	Tuff	Flake	413770	6372995
Birubi Point	8	Bone	Fragments	413803	6372983
Birubi Point	9	Tuff	Flake	413751	6372965
Birubi Point	10	Tuff	Flake	413746	6372963
Birubi Point	11	Tuff	Flake	413740	6372958
Birubi Point	12	Tuff	Flake	413791	6372959
Birubi Point	13	Tuff	Flake	413770	6372951
Birubi Point	14	Tuff	Fragment	413764	6372953
Birubi Point	15	Tuff	Fragment		
Birubi Point	16	Tuff	Fragment		
Birubi Point	17	Tuff	Fragment	413763	6372953
Birubi Point	18	Tuff	Fragment		
Birubi Point	19	Tuff	Fragment	413761	6372952
Birubi Point	20	Tuff	Fragment		
Birubi Point	21	Tuff	Flake	413756	6372948
Birubi Point	22	Tuff	Flake	413753	6372944
Birubi Point	23	Tuff	Broken Flake	413749	6372942
Birubi Point	24	Tuff	Broken Flake		
Birubi Point	25	Tuff	Flake		
Birubi Point	26	Tuff	Retouched Flake		
Birubi Point	27	Tuff	Flake		
Birubi Point	28	Tuff	Broken Flake	413741	6372942
Birubi Point	29	Tuff	Flake		
Birubi Point	30	Tuff	Flake	413739	6372941
Birubi Point	31	Tuff	Flake	413739	6372939
Birubi Point	32	Tuff	Flake		
Birubi Point	33	Tuff	Flake	413736	6372938
Birubi Point	34	Tuff	Core		
Birubi Point	35	Tuff	Flake	413737	6372953
Birubi Point	36	Tuff	Geometric Microlith	413732	6372959

Site Name	Artefact number	Raw material	Artefact class	X	Y
Birubi Point	37	Tuff	Flake		
Birubi Point	38	Tuff	Flake	413786	6372908
Birubi Point	39	Tuff	Flake		
Birubi Point	40	Tuff	Flake		

Consistent with the historical descriptions of the diversity of the midden and open campsite complex in this area (e.g. see **Section 4.2.2**), the materials observed in this most landward part of the complex are predominantly flaked stone, rather than beach or rock platform shell.

These materials were heavily weathered and abraded.

No hearths were observed.

Legend

- Proposed Disturbance Area
- Proposed Information Centre Site
- Lot 312 DP753204

Umwelt Survey (November 2018)

- Artefact Location

AHIMS Search Results

- Aboriginal Resource and Gathering site
- Artefact site

Image Source: Nearmap (2018) Data source: Umwelt (2018)

FIGURE 6.1

Survey Results

6.3 Other materials

Also observed on the surface were scatters of broken glass, bitumen fragments, rock and other recent waste. This material adds to the clear evidence that the proposed information centre area has been extensively disturbed by a range of twentieth century land uses, including farming, defence, vehicle movement, general waste disposal. The area has also been affected by fire.

6.4 Areas of sub-surface archaeological potential

As discussed in **Section 3**, **Section 4**, and summarised in **Section 4.3**, there is a high probability that subsurface archaeological materials exist within the proposed information centre area, particularly where intact soil profiles may be present.

Archaeological evidence is associated with soils developed on a former stable land surface, which appears to have a gently undulating form. Currently small exposures of the A1 and A2 horizons of this soil can be seen scattered across the site. **Figure 3.1** and **Figure 3.2** show the distribution of these soil profile exposures in the 1970s and in 2017 and surface remnants are also illustrated in the Photos in **Table 5.1**.

The history of landscape evolution in this locality means that it is unlikely that the old soil surface is continuous. The soil profile has been disrupted by the most recent period of dune destabilisation and migration, commencing some-time within the last 500 years and continuing today. The former land surface has also been disturbed by historic land use (farming and defence activities) in the area.

The results of the surface survey confirm that subsurface archaeological materials are likely to be present. It is not possible from the current surface expression of the podsol soil profile to determine the current extent of remnants of the old ground surface or the depth of cover of unconsolidated recent sand over the former stable ground surface. It is clear that the depth of cover is highly variable, depending on the development of the pattern of scour and deposition at any specific location.

The subsurface archaeological materials could be:

- In situ, within an intact soil profile associated with a former stable land surface. This soil profile may be buried by a thin mantle of recent sand of several metres, depending on the specific location. Generally, the greatest depth of cover with recent sand is along the eastern boundary of the proposed information centre area (roughly parallel with James Patterson Street), where the active sand accumulation zone was located prior to works by the Soil Conservation Service.

- A lag deposit when a soil profile has been disrupted/eroded, but with flaked stone artefacts relatively undamaged by mobile sand – i.e. exposed for relatively short periods of time, before being re-covered by accumulating sand deposits

- A reworked lag deposit, exposed on multiple occasions to aeolian processes. While these artefacts are unlikely to have been displaced a significant distance laterally, their vertical context is entirely lost.

Of these three subsurface contexts, only the first one has real archaeological potential from a scientific perspective. Subsurface testing is necessary to determine which of the artefact contexts occur in different parts of the site.

6.5 Discussion

The results of the surface survey confirm the following:

- No Aboriginal archaeological materials have previously been recorded, or were observed during this assessment, within the proposed site of the information centre
- Parts of a very large and complex archaeological site, which is important to Worimi people, remain visible on the surface adjacent to (just west of) the proposed information centre area, where there are exposures of a former stable soil surface. Elements of the site complex have the potential to continue into the proposed area of the information centre in a subsurface context.
- The materials at this inland part of the site complex are predominantly stone, not shell. It is possible that shell previously was included in this part of the site and has been weathered, but more likely this part of the site complex reflects a focus on terrestrial and wetland resources, rather than marine resources. This is consistent with earlier observations, when the site complex was relatively intact.
- The stone materials are almost exclusively Nobbys tuff and silcrete, both known to be available at the southern end of Stockton Bight, north and south of the Hunter River. The assemblage includes cores and flakes, including backed flakes. This is similar to the other sites that are present along Stockton Bight, in the deflation basin, or associated with old soil profiles within the transgressive dunes, or on the back barrier unit landward of the high transgressive dunes.
- The archaeological evidence in the proposed information centre area has been extensively disturbed
- Only archaeological materials associated with intact former soils are sufficiently in-situ to have scientific value. Other archaeological materials have cultural value.
- It is not possible to predict the distribution of relatively intact subsurface soil profile material, or the depth of cover from the surface survey alone.

7.0 Significance Assessment

The assessment of significance is critical in establishing mitigation and management strategies for cultural heritage (refer to Pearson and Sullivan 1995:21). Cultural significance is defined by the Burra Charter in terms of aesthetic, scientific, historic and social values. In NSW, Aboriginal cultural heritage is typically assessed according to its social and scientific significance (in accordance with the *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW*, 2011).

7.1 Social or Cultural Value

Over the course of previous assessments and during consultation for the current project, the registered Aboriginal parties have confirmed that the site complex within Birubi Point Aboriginal Place is of very high cultural significance due to the nature and extent of the archaeological material it contains and its association with areas of cultural and ceremonial importance. This site complex extends to the proposed site of the information centre.

The extent and complexity of the former midden site landward of Little Beach, on the local headlands and extending landward to the Anna Bay 4WD access road and beyond, is a source of cultural pride for Worimi people. The existence of this large and complex site is evidence of the capacity of Worimi people to live well and look after their sea country and lands.

The whole of the Aboriginal Place, the Worimi Conservation Lands and the parcels of land in between have a strong, special and continuing association with the Worimi community, for social cultural, spiritual and economic reasons.

The Worimi still use the area today for fishing, shell fishing and recreation and their history and connection to the land is demonstrated by the abundance of significant resource materials that have been collected from within and adjoining the area over thousands of years.

Today the extensive archaeological material of Birubi Point Aboriginal Place and the Worimi Conservation Lands is a site for teaching current and future generations about Worimi ancestors and local Aboriginal culture. The proposed information centre will provide an opportunity for Worimi people to also share their knowledge, their stewardship of their country and their successes with more visitors.

Registered Aboriginal parties participating in the survey provided information about their knowledge and experience of the resources available in this locality and their archaeological expression.

Additional comments received during this assessment from the registered Aboriginal parties regarding the Aboriginal cultural significance of the proposed information centre area will be summarised in ***Table 2.4*** *and included in full in* ***Appendix 1****.*

7.2 Scientific values and archaeological significance

Archaeological significance is part of the scientific heritage significance of the place. The Birubi Point Aboriginal Place as a whole has been assessed as having high archaeological significance; this was a key part of the decision to gazette the Place.

The proposed site of the information centre and transport interchange is adjacent to the Birubi Point Aboriginal Place and shares many of its archaeological values and significance.

The specific archaeological significance of the proposed development area relates to the potential of the surviving physical fabric of the archaeological materials that are present within the site to:

- Yield new or further substantial scientific/archaeological information
- Be a benchmark or reference site
- Provide evidence about past Worimi cultural activity that is not available elsewhere.
- Illustrate activities (or a complex of activities) that are uncommon or rare, or are poorly documented, and the activities are important to a community.

As discussed in **Sections 4**, **5** and **6** the current extent of the archaeological evidence in the proposed information centre area is much reduced from the extent, intactness and complexity that were observed in early reports of the archaeological materials (e.g. Hall 1928). The documentation of surveys and excavation across what is now Birubi Point Aboriginal Place, conducted by Len Dyall in the 1970s provides both a review of the historical and ethnographic records about the Place, but also an analysis of the types of materials present and the extent of damage that had occurred by that time.

There can be no doubt that the midden deposits recorded in the Robinson Reserve/Fitzroy Street area in the 1970s still had very high archaeological significance. The best preserved remaining midden is now within the protected Fitzroy St area, which is fenced, and protected by mulch and dense ground cover vegetation.

The occupation evidence previously recorded within and adjacent to the proposed information centre area over the last 30 years does not have the intensity of the sites to the east of Birubi headland. The current extent and structure of open campsite material that may remain is not known. However, it is likely that much of the remaining context for flaked stone material has low structural integrity due to a combination of severe and ongoing wind erosion impacts for more than 50 years; former agricultural and defence uses; works to reshape the ground surface and stabilise both high transgressive dunes and frontal dunes - in the 1980s through to 2000; and ongoing local and regional use of access routes onto the eastern end of Stockton Bight beach by vehicles.

As discussed in **Sections 4** and **6** of this report, it is appropriate to consider the artefacts that have been observed on the surface within the proposed information centre area as part of a continuous site, linked to the former stable land surface. The materials recorded during the current survey and assessment are located between the grid references provided for two previously recorded stone artefact sites: 38-5-0270 and 38-5-0272. These sites are also associated with exposures of the former stable dune surface and comprise stone artefacts of Nobbys tuff. All the exposed artefacts are affected to some extent by abrasion by wind-blown sand.

Stone artefact sites similar to these exposures are widespread through the dune landscapes of Stockton Bight, occurring in association with former stable dune surfaces, and evidence of former dune woodland vegetation. Artefact scatters have been recorded on sandy lower slopes/swale floors, gentle mid slopes and crests/ridges.

Table 7.1 provides an assessment of the scientific aspects of archaeological significance of materials recorded on the surface of the proposed site of the information centre and on adjoining land. This assessment considers rarity, representativeness, research potential, education potential and integrity (based on Australian ICOMOS 1988 and the *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW*, 2011). The assessment acknowledges that the artefacts exposed within the

proposed information centre area are part of a broader site complex. It therefore considers the significance of the surface artefacts at different spatial scales, including:

- Only the area of the proposed information centre
- The area of the proposed information centre plus the area exposed on the adjoining land
- The area of the proposed information centre as an element of the Birubi Point site complex.

Table 7.1 Assessment of Archaeological Significance

Site	Rarity	Representativeness	Research Potential	Education Potential	Integrity	Overall
Surface artefacts within the proposed information centre area	Common: Early descriptions of the archaeological material within this landward part of the site complex refer to flaked stone artefacts (flakes, blades and cores), grind stones, edge ground implements and hearths. Of these site components, flakes, cores and occasional blades were observed on the surface during this assessment. These materials were heavily weathered and abraded. Low significance	Typical of the sites occurring in dune sites and associated with former stable dune ground surfaces along Stockton Bight (not the middens on the open coast). Similar sites exist within the Birubi Point Aboriginal Place (which also includes part of Tomaree National Park) and Worimi National Park. Low significance	Low, unless undisturbed subsurface deposits are identified. Disturbed context	Moderate significance. The artefacts are on the surface and there is good opportunity to discuss their natural context and the ways in which this landscape has changed. However, note that actual exposures of artefacts are highly variable, so no consistent evidence.	Poor – low significance. Although it is clear that these artefacts were discarded in the context of a former stable and vegetated soil and dune surface, they are only visible at this location because the soil have been exposed and deflated. Integrity may be good for any remaining unexposed and intact soil profile	Low archaeological significance (with potential for higher significance if intact subsurface deposits are present)
Surface artefacts across the proposed information centre area and two previously recorded artefact sites in the immediate vicinity	Common: The extended area increases the number of artefacts, but not necessarily the diversity of materials or flaking technology/flake styles Low significance	As above	As above	As above	As above	Low archaeological significance

Site	Rarity	Representativeness	Research Potential	Education Potential	Integrity	Overall
Surface artefacts within the proposed information centre area, in association with the other components of the site complex at Birubi Point	The scale and complexity of the overall site is rare. The diversity of evidence of lifestyle across the site reflects the different micro environments, access to specific resources and shelter from strong winds. The overall site complex has high significance. However, even within the site, the area of artefacts in the proposed development area is not particularly rare. Other examples of this type of evidence – artefacts and context, occur within the Aboriginal Place.	The overall site complex provides evidence of multiple aspects of Worimi lifestyle over many generations. The evidence provided by the stone artefact sites is replicated elsewhere in the complex and on the adjoining private land. **Moderate significance** for the proposed information centre area, in this context	The research potential of the Birubi site complex has already been demonstrated, with several large excavation programs occurring in the past. The site complex has been disturbed and partly destroyed since that work was completed. However, the site complex as a whole retains valuable archaeological research potential, partly revisiting the data collected in previous studies, partly around evidence retained under recent wind-blown sand deposits. **Moderate significance**	The overall site complex has high teaching potential. The artefacts in the proposed information centre area are part of the story of Worimi people's association with the sea, dunes and wetlands in this area. **Moderate significance**	Much of the site complex has been disturbed or destroyed by late 20th century development, continuing aeolian sand movement and shoreline change. Some areas with higher integrity remain and should be the focus for careful conservation management. On the currently available evidence, the proposed information centre area does not have high integrity and is not a priority	**Moderate significance**

7.3 Other values contributing to significance

This section considers historic value and aesthetic value.

The archaeological context and to some extent the current archaeological condition of the Birubi site complex, including the proposed information centre site, has been strongly influenced by historical interest in the archaeology of what was a very large and complex site. The historical records from the 1920s (from the Australian Museum) are important to understanding the size and functions of the archaeological site. They are also important to understanding the long term interactions between archaeologists, Aboriginal owners and other local communities. This is critical information for interpretation.

Aesthetic significance is generally used to refer to creative or technical achievement and 'landmark' qualities of architecture, but it does also take scenic qualities into account. Within the Birubi Point Aboriginal Place, the Birubi Point and Morna Point headlands can be considered to have aesthetic significance from a scenic perspective. This visual or scenic perspective also has cultural associations, as both of these elevated headlands offer extensive views of the beach, dunes and nearshore waters along Stockton Bight. This outlook would have been of great significance to Worimi people, because of the economic opportunities, and cultural contact information provided by the outlook.

Within the proposed site of the information centre and transport interchange, aesthetic aspects of archaeological and cultural significance can be identified. These include:

- Views from parts of the land extend across and along the high transgressive dunes which dominate the landscape of Stockton Bight. These dunes are an important part of the cultural landscape of generations of Worimi people.

- The visual character of the landscape, including the presence of lines of former stable topsoil materials is a key part of understanding its archaeological potential

In addition, 'Birubi' refers to the Southern Cross, which lights the night sky above Birubi Point. The expansive view of the sky from the headland is culturally significant and needs to be managed in the development of facilities.

8.0 Assessment of risk of harm - archaeological

Risk of harm relates to the likelihood that proposed works will disturb, damage or destroy Aboriginal archaeological materials. From an archaeological perspective, the consequences of the impact are linked to the significance of the archaeological materials that will be impacted. This may not be the case from an Aboriginal cultural perspective.

The proposed information centre is part of a former extensive complex of Aboriginal archaeological materials. This part of the site complex has been heavily disturbed. The surface materials have low archaeological significance. However, it is possible that subsurface materials not subject to extensive disturbance and of higher archaeological significance may be present.

The distribution, depth of cover over midden materials and intactness of the remaining archaeological deposits is not known. This information can be obtained via further investigation, as discussed in **Section 9**.

Figure 1.3 shows the proposed disturbance area for the proposed information centre. **Figure 5.1** and **Figure 6.1** show the known distribution of archaeological materials. For this disturbance footprint, the impact on known surface artefacts is low. The artefacts that are visible on the surface are all located to the south west of the disturbance area, with one isolated flake being identified close to the boundary.

Based on this evidence, the risk of harm to known Aboriginal objects is low. However, two additional factors require further consideration:

- Council may acquire the area to the south west of the development footprint, or negotiate with the owner about the management of this area as a buffer for improved dune stabilisation and to provide additional tour operator parking and a new exit to the four wheel drive track. These works would form Stage 2 of the development (as noted in **Section 1.1.3**). The presence of artefacts on the surface of this land will then be an issue, with clear likelihood that artefacts of low archaeological significance would be damaged, disturbed or destroyed. An AHIP would be required for any activity in this area.

- Areas of subsurface archaeological deposits, with greater integrity than the surface exposures are potentially located within the disturbance area. If further investigation confirms the presence of such deposits, they will be subject to harm as a result of the proposed activity, if it proceeds as currently designed.

8.1 Assessment of harm – cultural and social

This assessment is made by the registered Aboriginal parties.

To be added after further input from the registered Aboriginal parties

9.0 Proposed management and mitigation strategies

Amended site cards for the previously recorded sites 38-05-0272 and 38-5-0270 will be prepared for OEH, to record the additional stone artefacts visible on the surface between the previous locations and demonstrating continuity. The total area encompassed by the known artefacts is approximately 150 m by 150 m of open bare sand, with discrete exposures of the soil associated with the former stable land surface.

9.1 AHIP applications

Works which have the potential to cause harm to Aboriginal objects and values are proposed to occur in two stages:

- Geotechnical testing and archaeological test excavation
- Construction of new facilities

The results of the first stage will inform the design and location of the works in the second stage.

To facilitate these works, two AHIP applications will be submitted to OEH.

- The first AHIP will relate to the geotechnical and archaeological investigation activities (**Section 9.1.1**)

Depending on the results of these investigations, Council will, after further consultation with the RAPs:

- advise OEH that the construction works are not expected to impact on any evidence of Aboriginal archaeological materials. In this case a second AHIP would not be required (based on the evidence from the context of the information centre area, this is considered to be an unlikely scenario) ; or
- Prepare a second AHIP application, with proposed salvage and monitoring requirements (**Section 9.1.2**). In this context:
    - the minimum salvage process would be that registered Aboriginal parties would monitor the ground disturbing works and collect any cultural materials that are exposed during the construction process
    - if intact soil material with occupation evidence are identified from the results of investigations under the first AHIP, a more detailed excavation and salvage program is likely to be required.

9.1.1 AHIP for geotechnical and archaeological testing

A geotechnical investigation of the proposed information centre area is required to provide more information about the complex stratigraphy of wind-blown sand which dominates the substrate of the site.

The land is also adjacent to land which has been mapped by the NSW Government (2011) as potentially being affected by acid sulphate soil (class 4 and 5). The proposed development site was not classified during the NSW government assessment. The geotechnical assessment will also confirm whether there is a risk of disturbing acid sulphate soil during the construction of the proposed information centre.

The results of the geotechnical investigation will be used to finalise the layout and detailed design of the new development, to minimise risks.

The auger will sample the materials underlying the site, to a depth of approximately 3 metres. This depth allows for the maximum depth of excavation to create a level space for the development and for foundations of the structures. The design of the information centre is intended to minimise the amount of sandy soil that will need to be excavated and/or removed from the site.

Auger holes will be drilled in a grid across the proposed disturbance area (refer to **Figure 1.3**) at 20 metre centres, where practical. Spacing may be extended if the terrain makes access difficult.

The geotechnical investigation will also provide information about the depth of cover of unconsolidated recent sand, over any remaining soils associated with the former stable land surface. The former dune podsol soils are distinguished from the recent sand by dark staining of the A1 horizon, bleaching of the A2 horizon and dark orange/brown staining of the upper B horizon.

The evidence available from previous archaeological survey and the current site inspection clearly indicates the potential for archaeological materials to be present below the surface. The proposed information centre area has not previously been mapped as an Aboriginal site or PAD, but it is clear that artefacts could be present. As discussed in **Sections 4.2**, **6** and **7** this area should be understood as part of a large site complex which previously extended over the majority of the Birubi Point Aboriginal Place and adjacent terrain. It connects the previously recorded artefact scatters 38-5-0272 and 38-5-0270.

It is proposed that an archaeologist and representatives of the registered Aboriginal parties would be present during the geotechnical drilling process, to monitor materials that are brought to the surface. They will be monitoring for the presence of soils associated with the former stable land surface, and any stone artefacts that may be present.

The locations of the auger holes will be mapped using GPS. The sand materials revealed in each auger hole will be recorded. Any archaeological materials will be recorded, together with information about the depth from which they were recovered and the soil context.

A report will be prepared, in consultation with the registered Aboriginal parties which describes the archaeological findings of the auger program, and maps any areas where the evidence indicates that relatively intact soil layers and cultural materials are present.

Based on these outcomes, Port Stephens Council will be able to advise OEH:

- that there is now good certainty that archaeological values will not be impacted by the proposal; or
- that soil and archaeological materials of low integrity and low archaeological value are present; or
- that soil and archaeological materials of good integrity and likely moderate archaeological significance are present.

9.1.2 AHIP for construction of new facilities

The scope of an AHIP for the construction of the new facility will depend on the results of the investigations conducted under the AHIP above.

Port Stephens Council will discuss AHIP requirements with OEH prior to preparing an application for the construction work. Based on the current information, options include:

- An AHIP is not required for the construction work because there is no surface or subsurface archaeological evidence present within the proposed development area. Alternatively, an AHIP is not required because Port Stephens Council has modified the design of the proposed development to avoid impacting on any known extent of the Aboriginal archaeological site.

- An AHIP is required to permit the salvage of artefacts (subsurface) which are known to be present, or may be present, in a disturbed context. This salvage would be completed by monitoring the initial earthworks to level the disturbance area. Monitoring would be conducted by registered Aboriginal parties and any observed artefacts would be collected. As the context will have been assessed as disturbed, there would be no need to make separate collections from different areas.

- An AHIP is required to permit salvage excavation of archaeological materials associated with a (relatively) intact soil profile developed when the dune ground surface was stable. In this case, Port Stephens Council will prepare an excavation plan and research design in consultation with registered Aboriginal parties, for review by OEH. As an example, the excavation plan could involve mechanical removal of recent sand cover and then hand excavation of trenches or wider open areas to document the soil stratigraphy and the distribution of artefacts within the soil profile. If this level of salvage is required, it will be conducted before other construction earthworks commence. All artefacts would be collected using standard archaeological techniques, to facilitate analysis.

9.1.3 Potential AHIP for Stage 2 development

As noted in **Section 1.1.3** and **Section 8**, a second stage of the development of the information centre may take place in the future, subject to appropriate arrangements with the owner of the adjoining land parcel. The second stage of the information centre is not within the scope of this assessment report. However, the review of archaeological records and the field inspection conducted for the current assessment demonstrate that archaeological materials are present on the land where the potential stage 2 works would take place. Council will need to consult with the registered Aboriginal parties and apply for a new AHIP before implementing the stage 2 works.

9.2 Ongoing involvement of Worimi people

The information centre and transport interchange provides a new opportunity to introduce visitors to the natural and cultural heritage of the Worimi Conservation lands and Birubi Point Aboriginal Place.

Council proposes that new interpretative information and signage will be installed at the information centre. Signage and the text and images used in information will be developed in close consultation with the Board of the Worimi Conservation Lands and the Worimi Local Aboriginal Land Council.

Council also proposes that the detailed landscape design and planting for the information centre and transport interchange will incorporate locally indigenous and useful species, and to reflect the cultural values of the area and the importance of terrestrial as well as marine resources to the Worimi people.

Council will consult Worimi organisations, including rangers working on the conservation lands, about appropriate species and involve Worimi people in the planting of the site.

9.2.1 Other management controls

The car parking area of the information centre and transport interchange is designed to manage and control vehicle access beyond the boundaries of the site.

Council proposes, in accordance with the management plan for Birubi Point Aboriginal Place, to define a walking route through the dunes, from the proposed information centre and transport interchange to Birubi Surf Club. The intent is that this is designed to minimise impact on the natural and cultural values of the Aboriginal Place, but also to provide an opportunity to introduce visitors to the natural and cultural heritage of the area.

Signage at the beginning of the walk will encourage walkers to remain on the defined path, and not to pick or collect plants, stone or shell.

A detailed plan for the walking path has not yet been prepared. When Council has a firm proposal for the location and construction method for the walking path, a separate cultural heritage assessment will be required.

10.0 References

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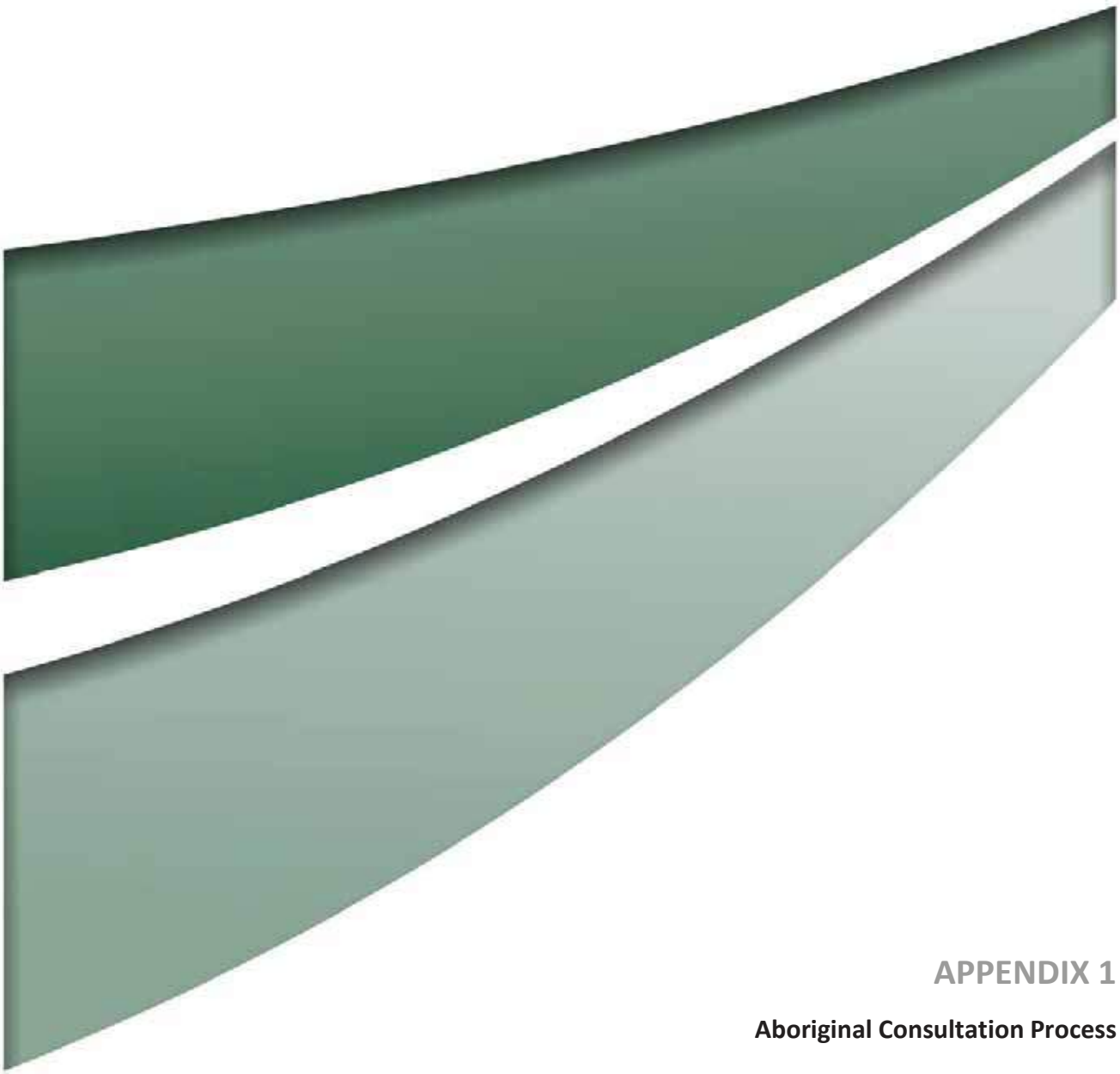
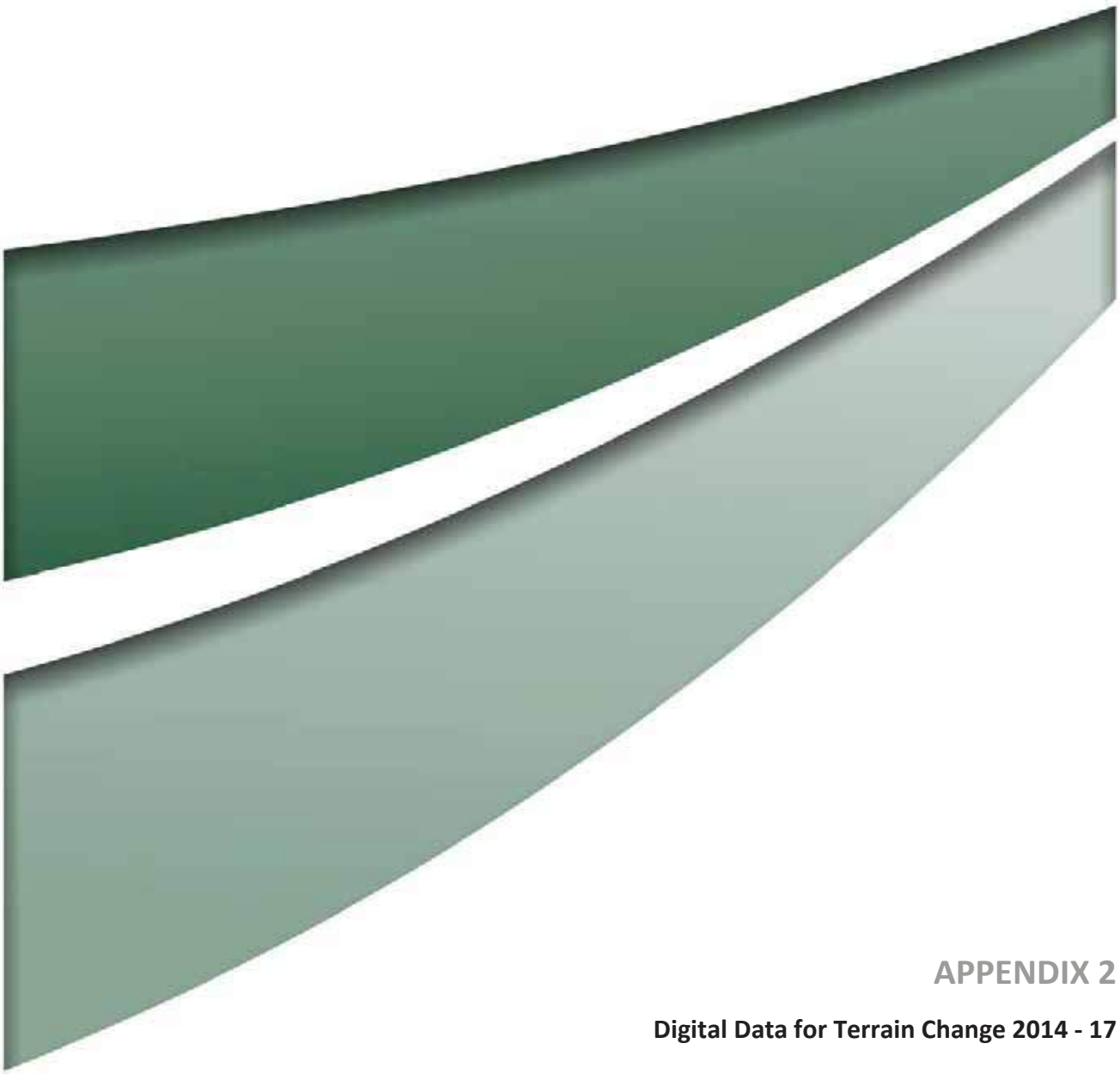


APPENDIX 1

Aboriginal Consultation Process

Copies of all consultation documents will be included in this appendix



APPENDIX 2

Digital Data for Terrain Change 2014 - 17

This appendix is a research report which provides evidence of the recent rate of surface change in and adjacent to the proposed site of the information centre

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From:	Nicole Davis
To:	Nicola Roche
Cc:	Pam Dean-Jones; Steve Bernasconi
Subject:	RE: Confirmation of consultation approach - Birubi Point projects
Date:	Wednesday, 5 September 2018 11:55:07 AM
Attachments:	image001.png

Hi Nic,

Yes, I can confirm that OEH has no concerns with PSC utilising the one set of registered Aboriginal parties for both projects. Please just ensure that it is made clear to all involved that there are 2 separate but adjacent projects being proposed/undertaken.

Regards
Nicole

Nicole Davis
A/Senior Team Leader - Planning
Hunter Central Coast Branch
Conservation and Regional Delivery Division

26 Honeysuckle Drive, Newcastle 2300
Locked Bag 1002, Dangar 2309
T 02 4927 3156 **M** 0409 394 343

From: Nicola Roche <nroche@umwelt.com.au>
Sent: Wednesday, 5 September 2018 11:07 AM
To: Nicole Davis <Nicole.Davis@environment.nsw.gov.au>
Cc: Pam Dean-Jones <pdean-jones@umwelt.com.au>; Steve Bernasconi <Steve.Bernasconi@portstephens.nsw.gov.au>
Subject: Confirmation of consultation approach - Birubi Point projects

Hi Nicole,

Port Stephens Council is currently commencing the Aboriginal cultural heritage assessment process for 2 projects at Birubi Point. These relate to the redevelopment of Robinson Reserve (within the bounds of the Birubi Point Aboriginal Place) and the establishment of a transport interchange on James Patterson Drive (off Gan Gan Road and outside the Birubi Point AP). PSC has already commenced the notification and registration process for Aboriginal parties for the Robinson Reserve project. Given the concurrent timing and proximity of the two assessment areas, can OEH please confirm that the notification and registration process can be used for both projects ie. maintain the one set of registered Aboriginal parties for both projects.

Regards
Nic

Nicola Roche
Manager Cultural Heritage

Umwelt (Australia) Pty Limited
75 York Street
Teralba, NSW 2284

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Newcastle ph. 02 4950 5322 | **Perth** ph. 08 6260 0700 | **Canberra** ph. 02 6262 9484 | **Sydney** ph. 1300 793 267 | **Brisbane** ph. 1300 793 267

From: Kathy Down
To: Irene Boundy
Cc: Naomi Buchhorn; Nicola Roche; Pam Dean-Jones
Subject: 4691 - one hard copy to go to Carol Ridgeway-Bissett please
Date: Wednesday, 16 January 2019 3:25:00 PM

Hi Irene
The report for 4691 that you are printing out for me needs to go by mail to the following person please:

Carol	Ridgeway-Bissett	-	33 Ullora Road Nelson Bay NSW 2315		0249843113

Thanks heaps!
Kath

Kathy Down
Senior Project Administrator

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From: Lilly Carroll
To: Kathy Down
Subject: Re: 4691 - draft Aboriginal Cultural Heritage Assessment Report, Gan Gan Road Anna Bay
Date: Friday, 18 January 2019 1:27:16 PM

Hi Kathy

DNC agrees to all proposals of the draft report

Kind regards DNC
Paul Boyd
0426823944

Sent from myMail for iOS

Wednesday, 16 January 2019, 3:23 pm +1100 from Kdown@umwelt.com.au <Kdown@umwelt.com.au>:

> Dear Registered Aboriginal Party representative
>
> We are writing to you as a registered Aboriginal party who expressed an interest in being consulted about the Aboriginal Cultural Heritage Assessment (ACHA) for a project to construct a new information centre and transport interchange at the corner of Gan Gan Road and the four wheel drive beach access track at Anna Bay. Please find enclosed/attached a copy of the draft ACHA report for your review and feedback.
>
> Could you please contact Pam or Nicola at Umwelt with your comments by 12 February 2019.
>
> Your comments may be provided in writing (preferred) or by phone or email.
>
> **Please send letters to Umwelt, 75 York Street Teralba 2284 (attention Pam Dean-Jones or Nicola Roche). If you are responding by phone or email, please call Pam Dean-Jones on 49505322 (Umwelt office) or 0412278201 (mobile), or email pdeanjones@umwelt.com.au**
>
> Regards
>
> Kathy
>
> **Kathy Down**
> Senior Project Administrator
>
> **Umwelt (Australia) Pty Limited**
> 75 York Street
> Teralba, NSW 2284
>
> Phone: (02) 4950 5322
>
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From: David Feeney
To: Pam Dean-Jones
Subject: cULTURAL wORKS
Date: Tuesday, 29 January 2019 5:03:36 PM

Could you please contact Pam or Nicola at Umwelt with your comments by 12 February 2019.

i AM RIGHT FOR THE STAR OF THE PROJECT

Dave Feeney
Karuah Indigenous Corporation
0421114853

From:	Kathy Down
To:	Pam Dean-Jones; Nicola Roche; Clare Naylor
Bcc:	"lennie.anderson011@bigpond.com"; "worimitoc@hotmail.com"; "didgengunawalclan@yahoo.com.au"; "sites@worimi.org.au"; "Widescope.group@live.com"; "Dedemaree3@hotmail.com"; "murrabidgeemullangari@yahoo.com.au"; "widescope.group@live.com"; "tn.miller@southernphone.com.au"; "Murroomainc1@gmail.com"; "Murroomainc1@gmail.com"; "gomeroi.namoi@outlook.com"; "graeme.russell@environment.nsw.gov.au"; "karuahindigenous@outlook.com"
Subject:	REMINDER - Opportunity to respond to draft ACHARs for two projects
Date:	Thursday, 7 February 2019 1:50:08 PM

Dear Registered Aboriginal Party Representatives

This email is just a friendly reminder on the opportunity to respond to draft Aboriginal Cultural Heritage Assessment (ACHA) reports for two separate projects which were recently emailed to your organisation.
The projects are listed below:

- **Umwelt project number 4401** - Consultation about the draft Aboriginal Cultural Heritage Assessment Report for the upgrade of facilities in Robinson Reserve, Birubi Point Aboriginal Place
  This was sent to your organisation by email on 18 January 2019. Responses for this project are due back to Umwelt by 15 February 2019.

- **Umwelt project number 4691** - Consultation about the draft Aboriginal Cultural Heritage Assessment Report for a proposed information centre at Gan Gan Road Anna Bay, adjacent to Birubi Point Aboriginal Place
  This was sent to your organisation by email on 16 January 2019. Responses for this project are due back to Umwelt by 12 February 2019.

When responding please be sure to let us know which project your response refers to. You can do this by quoting the project name as shown on the draft ACHAR and / or by quoting the Umwelt project number (shown above in bold text).
This will help us ensure that your response is recorded against the relevant project.

Details for how to respond are shown below:

- Letters can be sent to Umwelt, 75 York Street Teralba 2284 (attention Pam Dean-Jones or Nicola Roche).
- Phone responses can be made by calling Pam Dean-Jones on 49505322 (Umwelt office) or 0412278201 (mobile)
- Email responses can be made to pdeanjones@umwelt.com.au

If you have already responded we thank you for your time and response. If you have not responded, but would like to, then please take this opportunity to submit your organisations response.

Thank you.

Regards
Kathy

Kathy Down
Senior Project Administrator

Umwelt (Australia) Pty Limited
75 York Street
Teralba, NSW 2284

Phone: (02) 4950 5322

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From: Deidre Perkins
To: Kathy Down
Subject: Re: REMINDER - Opportunity to respond to draft ACHARs for two projects
Date: Tuesday, 12 February 2019 10:06:13 AM

Hello Kathy, I am responding to both projects.
All good with me .
Deidre

Get Outlook for Android

From: Kathy Down <Kdown@umwelt.com.au>
Sent: Thursday, February 7, 2019 1:50:06 PM
To: Pam Dean-Jones; Nicola Roche; Clare Naylor
Subject: REMINDER - Opportunity to respond to draft ACHARs for two projects

Dear Registered Aboriginal Party Representatives

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- Email responses can be made to pdeanjones@umwelt.com.au

If you have already responded we thank you for your time and response. If you have not

responded, but would like to, then please take this opportunity to submit your organisations response.

Thank you.

Regards
Kathy

Kathy Down
Senior Project Administrator

Umwelt (Australia) Pty Limited
75 York Street
Teralba, NSW 2284

Phone: (02) 4950 5322

www.umwelt.com.au

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Newcastle ph. 02 4950 5322 | **Perth** ph. 08 6260 0700 | **Canberra** ph. 02 6262 9484 | **Sydney** ph. 1300 793 267 | **Brisbane** ph. 1300 793 267

From: David Feeney
To: Kathy Down; Pam Dean-Jones
Subject: Re: REMINDER - Opportunity to respond to draft ACHARs for two projects
Date: Friday, 8 February 2019 10:21:12 AM

Hi Pam;

Re: Lot 4401, Consultation about the draft Aboriginal Cultural Heritage Assessment Report for the upgrade of facilities in Robinson Reserve, Birubi Point Aboriginal Place

And

Re: Lot 4691, Consultation about the draft Aboriginal Cultural Heritage Assessment Report for a proposed informationcentre at Gan Gan Road Anna Bay, adjacent to Birubi Point Aboriginal Place

I have read the reports and Karuah Indigenous Corporation will support the reports to date

Thank you

Dave Feeney
Snr Aboriginal Cultural Officer
0421114853

From: Kathy Down <Kdown@umwelt.com.au>
Sent: Thursday, February 7, 2019 3:50 AM
To: Pam Dean-Jones; Nicola Roche; Clare Naylor
Subject: REMINDER - Opportunity to respond to draft ACHARs for two projects

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From:	Anthony Anderson
To:	Nicola Roche; Pam Dean-Jones
Subject:	Response to draft ACHARs for two projects
Date:	Monday, 11 February 2019 3:29:07 PM

Monday 11th February 2019
Umwelt
ATT: Nicola Roche/Pam Dean Jones

Re: **Umwelt project number 4401 and 4691**

Murrooma has received your reports and we have fully read, understand and agree with all points, including proposed works and draft assessment methodology.

We are happy with the consultation process up to this point and we will be in continued contact regarding the proposed works for Birubi Point and provide information regarding the cultural values associated with the project area and relevant management/mitigation activities.

This area of Birubi Point as stated is a very highly significant area for our Worimi People. As a Traditional Owner and Knowledge Holder company it is part of Murrooma's responsibility to ensure protection or best practice to preserve our Aboriginal Sites.

In regards ACHAR's for both - Murrooma agree with this as outlined in report and our representative for the initial survey, Candice O'Loughlin has advised this to be a true reflection of what was discussed.

Yours Truly
Bec Young- Operations Manager
Anthony Anderson- CEO

On Thursday, February 7, 2019, Kathy Down <Kdown@umwelt.com.au> wrote:

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>
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Kathy Down

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--
Anthony Anderson
CEO Mur-roo-ma Incorporated
Justice of The Peace

From: Lilly Carroll
To: Kathy Down
Subject: Re: 4691 - draft Aboriginal Cultural Heritage Assessment Report, Gan Gan Road Anna Bay
Date: Friday, 18 January 2019 1:27:16 PM

Hi Kathy

DNC agrees to all proposals of the draft report

Kind regards DNC
Paul Boyd
0426823944

Sent from myMail for iOS

Wednesday, 16 January 2019, 3:23 pm +1100 from Kdown@umwelt.com.au <Kdown@umwelt.com.au>:

> Dear Registered Aboriginal Party representative
>
> We are writing to you as a registered Aboriginal party who expressed an interest in being consulted about the Aboriginal Cultural Heritage Assessment (ACHA) for a project to construct a new information centre and transport interchange at the corner of Gan Gan Road and the four wheel drive beach access track at Anna Bay. Please find enclosed/attached a copy of the draft ACHA report for your review and feedback.
>
> Could you please contact Pam or Nicola at Umwelt with your comments by 12 February 2019.
>
> Your comments may be provided in writing (preferred) or by phone or email.
>
> **Please send letters to Umwelt, 75 York Street Teralba 2284 (attention Pam Dean-Jones or Nicola Roche). If you are responding by phone or email, please call Pam Dean-Jones on 49505322 (Umwelt office) or 0412278201 (mobile), or email pdeanjones@umwelt.com.au**
>
> Regards
>
> Kathy
>
> **Kathy Down**
> Senior Project Administrator
>
> **Umwelt (Australia) Pty Limited**
> 75 York Street
> Teralba, NSW 2284
>
> Phone: (02) 4950 5322
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From: Deidre Perkins
To: Kathy Down
Subject: Re: REMINDER - Opportunity to respond to draft ACHARs for two projects
Date: Tuesday, 12 February 2019 10:06:13 AM

Hello Kathy, I am responding to both projects.
All good with me .
Deidre

Get Outlook for Android

From: Kathy Down <Kdown@umwelt.com.au>
Sent: Thursday, February 7, 2019 1:50:06 PM
To: Pam Dean-Jones; Nicola Roche; Clare Naylor
Subject: REMINDER - Opportunity to respond to draft ACHARs for two projects

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From:	Andrew Smith
To:	Pam Dean-Jones; Kathy Down
Cc:	Sites
Subject:	Umwelt Projects 4401 & 4691
Date:	Wednesday, 13 February 2019 4:58:34 PM

Dear Pam,

I write in response to following Umwelt projects being:

- **Umwelt Project 4401** – Upgrade of facilities at Robinson Reserve; &
- **Umwelt Project 4691** – Proposed information centre at Gan Gan Road, Anna Bay.

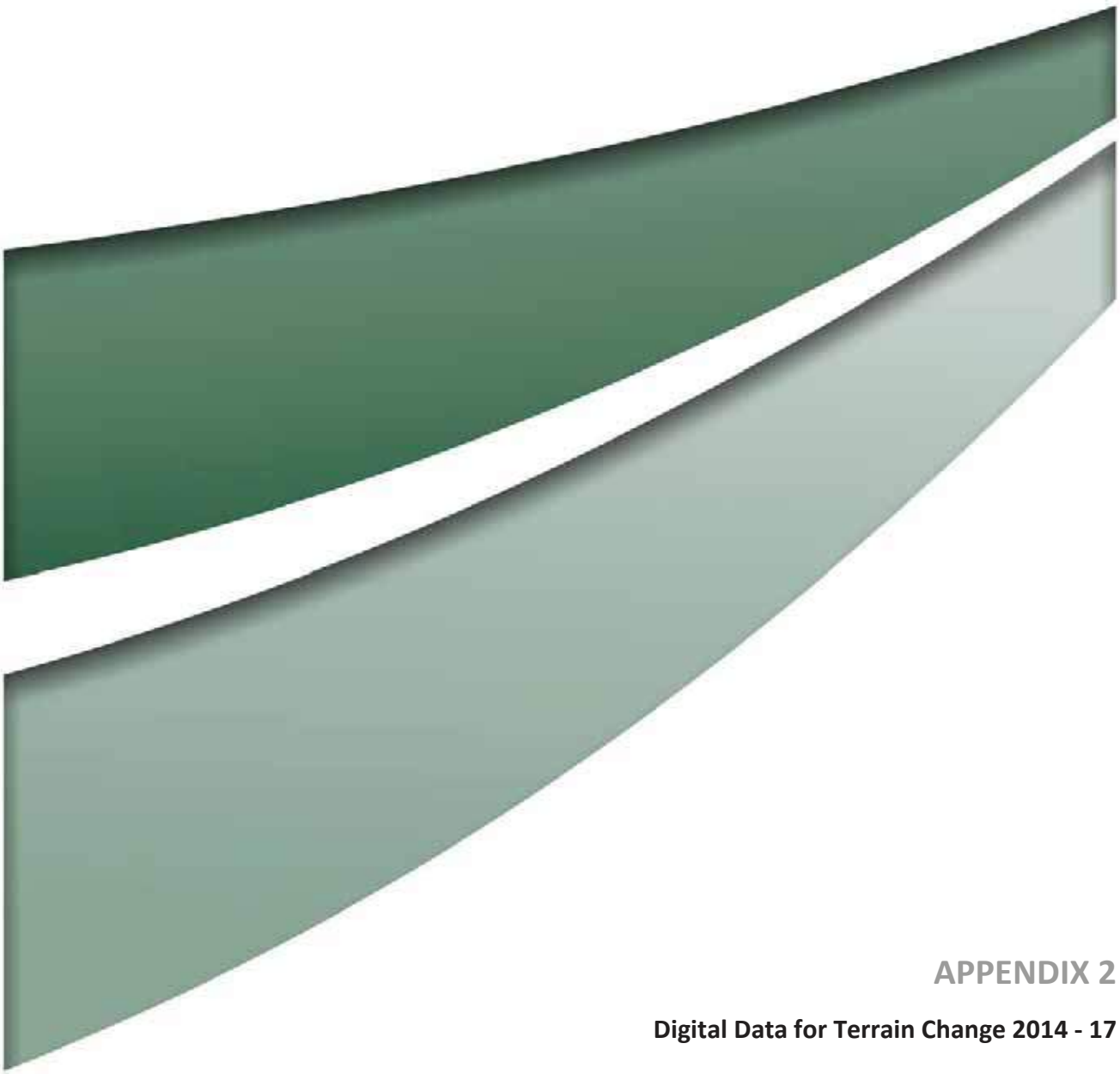
There is no question that the areas (collectively forming part of the same landscape), house and abundance of Worimi Cultural Heritage (both tangible and non-tangible) and it is crucial that all attempts to protect and preserve this heritage is critical.

Mr Jamie Merrick (Worimi LALC Cultural Sites Officer) and myself have read through the reports and believe them to be comprehensive and all-inclusive of concerns; relating to the protection of Aboriginal Culture and Heritage. It is our opinion that the proposed action of seeking AHIPS for the staged (proposed) works; for both areas is sufficient and we acknowledge the request of a Cultural Site officers being present, during earthwork activities.

We look forward to hearing back from you on the projects soon.

Warm Regards

Andrew Smith | Chief Executive Officer
Worimi Local Aboriginal Land Council
"SHARING TOGETHER / WORKING TOGETHER / SUCCEEDING TOGETHER"



APPENDIX 2

Digital Data for Terrain Change 2014 - 17

This appendix is a research report which provides evidence of the recent rate of surface change in and adjacent to the proposed site of the information centre

UAV MONITORING OF DUNE DYNAMICS - ANNA BAY ENTRANCE, STOCKTON BIGHT

Nicolas Pucino[1a], Sandro Condurso[2]

[1]University of Wollongong, NSW
[2]NSW-National Park and Wildlife Service - OEH, Nelson Bay
[a]Corresponding author: nicolas.pucino@hotmail.com

Introduction

"*When the causes and trends of coastal dune movement are well understood, tailored management strategies can be applied in order to maximize tourist attraction while maintaining a healthy and naturally dynamic geomorphic behaviour*" (Mitasova et al., 2005)

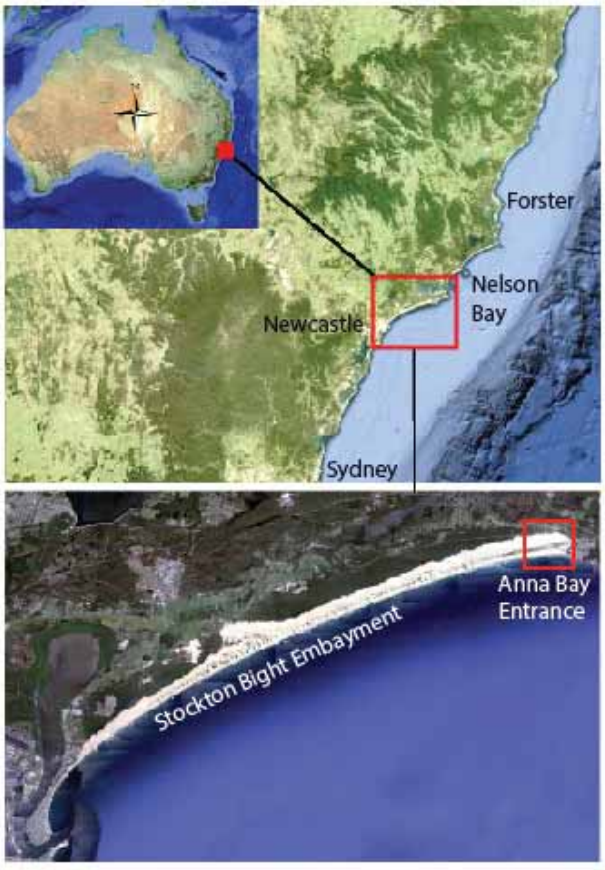


Figure 1 Location map of Stockton Bight

This site-specific (Anna Bay entrance) Unmanned Aerial Vehicle (UAV) survey and analysis is part of a broader environmental study conducted at the whole Stockton Bight (NSW) embayment scale. The full-study aims to understand Stockton Bight dune dynamics and migration trends, adding local knowledge to both managers, aboriginal community and visitors. Stockton Bight's management is challenged by its naturally dynamic geomorphic state, richness in aboriginal sites and artefacts, sand mining activities, high visitation and touristic impact. Its extent is a major issue to deal with. The study site, which is included in the Worimi National Park, features the southern hemisphere's largest mobile coastal sand mass (NPWS). With its 32 km, Stockton Bight is also the longest beach in NSW. Some of its transgressive dunes reach heights of 40m of elevation above sea level and its beach-backdune-transgressive dune system covers an area of 2700 ha, which means approximately 3800 football fields.

Given the aforementioned conditions, it is evident that the study of such a dynamic and geographically extended area implies trade-offs in spatial scales and analytical techniques.

Accordingly, this research features geospatial analysis of both LiDAR (whole-embayment analysis) and UAV (site-specific) digital terrain models. Upon deriving and mapping sand movement trends, the project will also explore sand mitigation measures for targeted locations to best achieve efficient and cost effective sand stabilisation outcomes.

The UAV solution at Anna Bay entrance

This conference paper describes methods and analysis of a topographical coastal surveys using UAV, Structure From Motion (SfM) and GIS, in Anna Bay entrance, the northern end of Stockton Bight (NSW, Australia) embayment. Here is the area where the most human pressure occurs as it is used as main northern entrance to the national park by tourists, locals, rangers, 4wd vehicles and every kind of recreational or touristic operator activities, including horse and camel riding, 4wd buses and trucks, sand boarding, dogs, etc. As the expected outcome in this area will be an effective and calibrated sand stabilisation strategy, beach morphodynamics and sand movements must be acknowledged and monitored. Thanks to the availability of an UAV system (SenseFly Ebee) and a fully certified, licensed and experienced surveyor (Condurso Sandro), very high spatial resolution (10cm) Digital Surface Models (DSM) and ultra-high (3cm) repetitive orthophotos have been generated and both volumetric change (cut and fill operation) and height differences (DSMs subtraction) analysed over time. These digital products are unevaluable to coastal monitoring projects, especially when the low time-step between acquisition dates allows seasonal variations to be observed. In fact, one of the major limitation of eolian geomorphology has been the relatively short temporal baseline of dune activity observations (Hugenholtz et al., 2012). To fully understand the changing morphology of a dune system, monthly or quaternarly surveys must be conducted in order to correlate data with storm events or weather patterns (Woolard and Colby, 2002; Andrews et al., 2002). Nowadays, UAV systems represent an extremely useful resource with endless potentials in topographic surveys of the coasts, capable of extending the analysis baseline at very short time-periods. This paper presents the details of the most recent UAV survey and the results of the geospatial analysis of all the available datasets (figure 2).

name	month	day	year	season	dsm	ortho	comment
20120903	9	3	2012	summer	y	y	no GCP
20140703	7	3	2014	winter	y	y	pilot_volume
20140905	9	5	2014	spring	n	y	foredune
20150515	5	15	2015	autumn	n	y	dsm corrupt
20150527	5	27	2015	autumn	y	y	pilot_volume
20151015	10	15	2015	spring	n	y	foredune
20151029	10	29	2015	spring	n	y	foredune
20151106	11	6	2015	spring	y	n	pilot_volume
20160317	3	17	2016	autumn	y	y	pilot_volume

Figure 2 Table of the available datasets. Only the datasets labelled as pilot_volume have been used for the geospatial analysis.

Structure from Motion

Thanks to the recent development of the so called “computer-vision approach”, the fundamental principles that underpin a classic photogrammetric method are combined with robust and well documented image processing algorithms to create DSM models with sub decimetre accuracy, in a (semi) automated and user-friendly way. Classic aerial photogrammetry needs highly specialized personnel, expensive softwares and manned aircraft, perfectly calibrated and virtually distortion-free metric cameras, restrictive image collection requirements and long planning times. Structure from Motion (SfM) approaches allow non-specialized users to align and mosaic aerial photographs acquired

by consumer-grade medium resolution camera (though any camera can be potentially used) mounted on many different moving platforms ranging from balloons, UAVs and kites. In this research, aerial photography acquired with a surveyor grade UAV system has been processed with the classic SfM pipeline (figure 3). This consists in placing all the images acquired by the UAV aerial survey into a virtual terrain, aligning and stitching them together, correcting for distortions and georeferencing the mosaic (using Ground Control Points (GCPs) surveyed on the ground), identifying and extracting common features occurring in overlapping images, tying them together and finally computing the elevation of every pixel of the images.

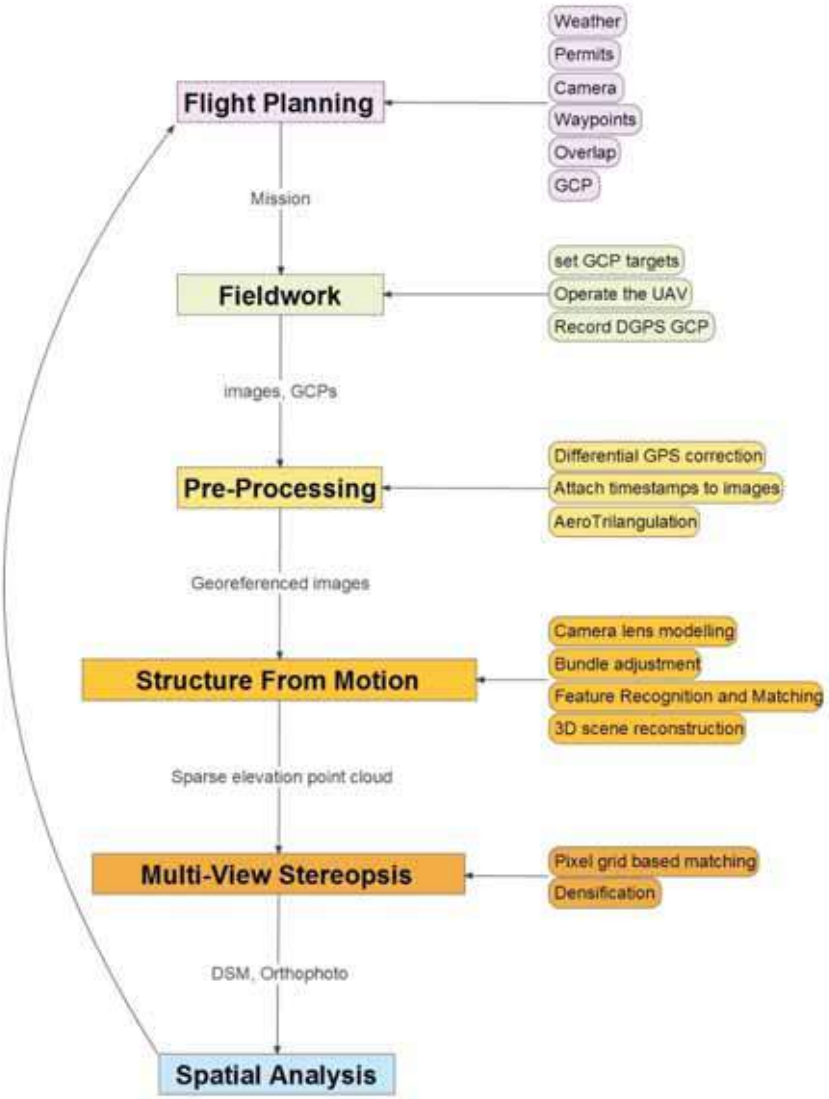


Figure 3 Scheme displaying the key steps used in most of the UAV SfM-related studies.

Drift Potentials

Monitoring dune activity means identifying, quantifying and interpreting dune surface changes related to the eolian sand transport potentials (Hugenholtz et al., 2012). In fact, dune activity is usually regarded as an index of eolian sand transport potential (Fryberger and Dean, 1979; Ash and Wasson, 1983; Lancaster, 1988). Amongst the different indices that exist in eolian geomorphology literature, the Fryberger method (Fryberger and Dean, 1979) for calculating sand Drift Potentials (DPs) and relate them to the wind energetic environment has been used in this study. Fryberger's method has been validated by many global sand sea (Fryberger and Dean, 1979; Wasson and Hyde, 1983; Bullard et al., 1996) and coastal studies (Miot da Silva and Hesp, 2010; Tsoar, 2005; Levin et al, 2014). The sand Drift Potential (DP) is a parameter that describes the maximum potential amount of sand that could be eroded and transported by wind coming from a determined direction over a period of time (Fryberger and Dean, 1979) and it is widely used all over the world and in Australia (Levin et al, 2014). DPs must be calculated in each of the wind direction component (12 or more Directional Classes; DCs). The assumptions are that the surface is composed by loose quartz grains (0.25-0.30 mm average diameter), no bedforms bigger than ripples are present, it is dry and clear of vegetation cover (Fryberger and Dean, 1979). It is calculated as

$$DP = \sum \frac{U^2(U - U_t)}{100} \times t$$

where U is the wind velocity (m/s, at 10m height from ground level) Ut is the threshold wind velocity (= 5 m/s) and t is the percentage of time that wind exceed Ut. Following the Belly method and valid for the aforementioned assumptions, a threshold velocity (Ut) of 5.97 m/s (11.6 knots) was adopted by Fryberg's global sand seas analysis. In Stockton Bight transverse dune environment, according to expert local geomorphologist (Thom et al. 1992) and in lack of in situ sand sample, the local threshold has been chosen at 5 m/s (9.72 knots). DPs from all the DCs can be resolved into the Resultant Drift Potential (RDP) and its direction as the Resultant Drift Direction (RDD) via a vector analysis. Following the original Fryberger's (1979) method sand roses can eventually be produced. Moreover, the RDP/DP is a measure of wind variability, used by Fryberger for classification depositional environments. The wind data utilised for the Fryberger's indexes have been collected by the Newcastle Nobby's Signal Station AWS, managed by the Bureau of the Meteorology (BoM). The station is situated at the southern end of Stockton Bight embayment, directly on the headland and facing the ocean. The station is at 33 m above mean sea level and 10m above ground, which is with the 10m assumption of Fryberger's method. The BoM wind measurements are designed to satisfy weather and climate monitoring needs. Its uncertainty tolerances are 10% of the wind speed when wind speeds are greater than 10 m/s and 1 m/s for wind speeds at or below 10 m/s.

Area of study

Stockton Bight transgressive sand barrier system (originally “Newcastle Bight”, figure 1) is located on the coast of central New South Wales, Australia, between Port Stephens drowned river valley (north) and the mouth of the Hunter River at Newcastle. Stockton Bight embraces most of the features that characterise coastal NSW, namely, rocky headlands which compartmentalize an embayed and wave-dominated sandy beach or barrier, a steep and relatively narrow inner continental shelf and a limited supply of river sediment to the coast (Thom et al., 1992; Wright, 1996; Davies, 1974; Thom et al, 1981). The climate is temperate, providing minor seasonal variation around a mean warm and humid conditions. This climate highly increases the wave climate variability and sets a moderate to high-energy south-easterly swell (occasionally southerly). The tidal range is less than 2m (micro-tidal system). During the day, sea breezes dominate. Trade winds, swell and regional climate combined, result in the dynamisms that characterised the NSW beaches (Short, 1993). Anna Bay entrance geomorphology is dominated by (inland to seaside):

1) long-walled active ridge
2) mobile sand sheet of migrating transverse and barchanoid dunes (referred as “high dunes”)
3) deflation plain
4) foredune
5) beach

Unfortunately, the UAV surveys do not cover the whole shore-normal transect from the long-walled ridge to the beach but only from the upper end of the deflation basin in contact with the transverse sand sheet to the swash zone. The deflation basin is shaped by the inland motion of the transgressive dunes. They migrate leaving behind an extensive and relatively deep basin, which lays parallel to the rear of the beach. The deflation basin is barely above the water table (which in Southeast Australia is very shallow) and is characterised by hummocky surfaces with low active dunes and vegetated patches. Transverse “high dunes” become more barchanoidal close to the deflation basin where the sand supply is limited. The seaward limit of the deflation basin is represented by the (currently) heavily dissected foredune system. The foredune is discontinued due to the occurrence of multiple blowouts. Blowouts are a specific eolian “dune-like” landform generated by holes along foredunes, wind erosion, sand deposition and trailing arms fixation by vegetation. These dunes are derived from the dissection of foredune by marine erosion, vegetation removal or human trampling. These blowouts channelize beach sediments through their arm, funnelling onshore winds that exacerbate erosion deepening its deflation basin and scouring its trailing arms. This process is known to be responsible of deposition of wind-borne sand behind the foredune, lowering the foredune and filling the deflation plain. The beach morphodynamics states that occur more often at Stockton Bight are those of the high-energy wave energy. Anna Bay is more exposed to SW swell and higher energy waves, resulting in dissipative, longshore bar and through and rhythmic bar and beach morphodynamic states. In general, this area experiences a wide spectrum of wave energy, the persistence of a longshore bar at the northern end of the embayment. In the SW end, the very coarse grainsize and the steeper beach face are more characteristic of reflective conditions, but purely reflective states are rare (Thom et al 1992).

Methods

In this section, the methods for the UAV survey, the DSM production (and accuracy) and the volumetric analysis are outlined.

The UAV survey and products accuracy

Here are reported the details of the last UAV survey, while the other UAV datasets had already been captured by Sandro Condurso, Park Systems Officer at the National Parks and Wildlife Service office in Nelson Bay (NSW).
This UAV survey took place the 17 March 2016 along the northern tip of Stockton Bight, covering the Anna Bay entrance in the Worimi National Park. It started early morning

Figure 4 Left: Differential GPS survey of GCPs. Right: eBee Sensefly with operator controller.

(7.00 AM), when weak coastal breezes and low sun elevation allowed stable flight and enhanced textural heterogeneity. The survey was divided in three distinct flights which have been subsequently merged in one single dataset. All the datasets were derived by a foam fixed-wing off-the-shelf SenseFly eBee, (figure 4) having an approximate weight of 0,69 kg, wingspan of 96 cm and an incorporated camera WX (6,170 X 4,627 mm sensor dimensions) of 18,2 MP.
According to the manufacturer, this aerial platform can fly for a maximum of 50 minutes with one standard 11,1 V (2150mAh) battery. However, this is only an indicative maximum value, as wind gusts require the UAV stabilisation manoeuvres depleting the battery at faster pace than in calm wind conditions. This UAV is able to withstand winds up to 12 m/s. Waypoints (see figure 5), speed, altitude (120 m above a.m.s.l, Australian maximum allowed) and lifting/landing areas were all calibrated and combined together (with eMotion software) for assuring a forward and side overlap of at least 80% between successive imageries along the flight path. The average Ground Sampling Distance (GSD) was 3,49 cm, the area covered in three missions was 222,76 ha (2,23 km2). The time spent for the fieldwork (UAV survey and Ground Control Points (GCP) differential GPS (dGPS) survey) was around 4h. Average flight times were 15 minutes, the greater part of the fieldwork being the dGPS survey. A total of 22 1X1, 5 m rectangular mats displaying an identification number and a cross (figure 4) were used as GCPs and regularly distributed across each of the three surveys area.

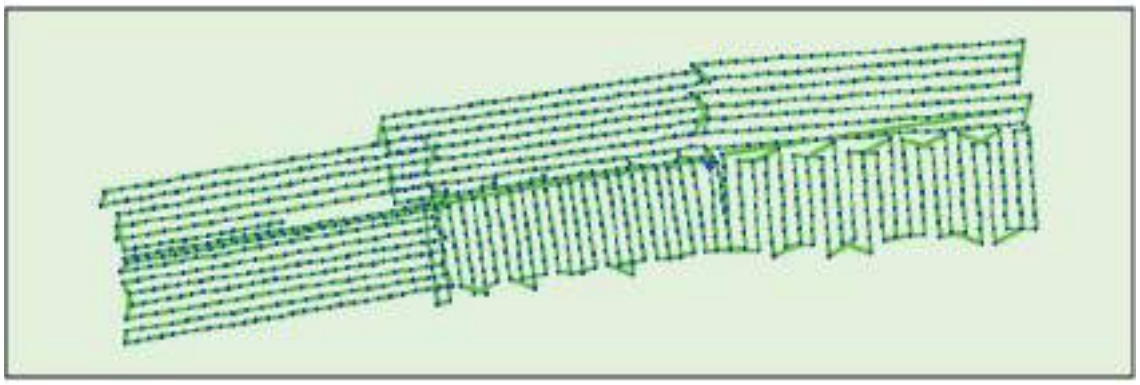


Figure 5 Waypoints and flight paths of the three flights merged together.

This GCP network is essential for Aero Triangulation (AT) and bundle block adjustments. Single frequency GNSS Trimble GeoXH receiver was used to collect GCPs's locations. For each GCP points, 3 minutes of static dGPS data was collected (1 point/s) and post-processed using Trimble® GPS Pathfinder® Office software. Correction data has been downloaded from CORSnet New South Wales's server for the two base stations the closest to the survey locations, which are Anna Bay and Newcastle East base stations.

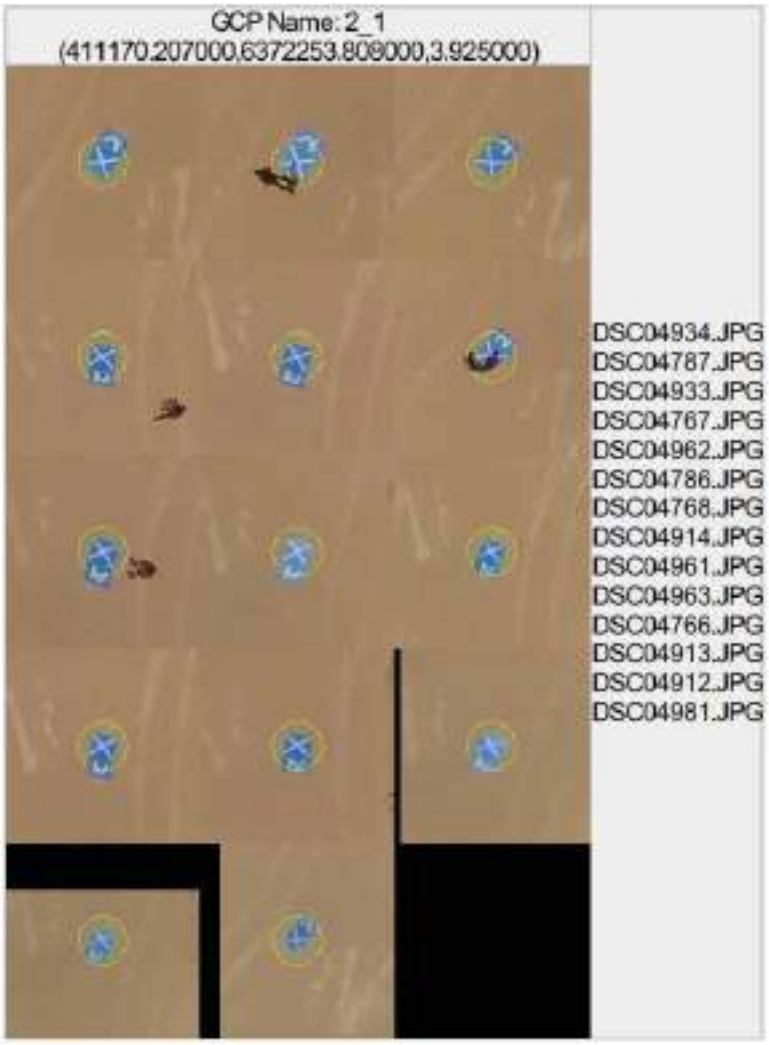


Figure 6 Example of procedure of Aero Trinagulation performed by the operator within PostFLight Terra 3d. The same target on the ground is seen by different orientation and angles and the operator has to adjust the suggested points (by the software, using coarse on-board GPS coordinates) and place them in the centre of the X displayed by the targets. This will allows PostFlight Terra 3d to model the camera distortion parameters and perform SfM-MVS routine to extract DSM and orthophoto.

CORSnet-NSW is a network of permanent Global Navigation Satellite System (GNSS) tracking stations, which improve the accuracy of satellite positioning for users in NSW. According to the correction service provider (Trimble®VRS Now®) the horizontal accuracy achievable in optimal conditions with this type of differential correction is less than 2 cm. After code and carrier differential correction, the estimated accuracies for the GCPs locations improved from 3-5 m to 5-15 cm. However, based on past observations and local expertise of the surveyor, accuracies are believed to be in the order of 5 cm.
After correction of the GCP points, an ASCII file is generated and opened into Postflight Terra 3d for AT (figure 6). The eMotion software is also used to attach the timestamps to each picture. In figure 6 is possible to see how the AT process is user-friendly and performed by visualising each target (in this case named 2_1), adjusting the suggested GCP XYZ coordinates (411170.207, 6372253.808, 3.925) by dragging the point to the centre of the “X” target. This will allow Structure from Motion and Multi-View Stereopsis to perform AT, bundle block adjustment, feature recognition and matching algorithms and more, in order to finally output the DSM and orthophoto. After AT, the post-processing phase can start. An Intel® Xeon ® CPU E5-2603 0 @ 1.80 GHz with 12 GB of RAM and NVIDIA Quadro 2000D (GPU) was used to process all the 1108 images

collected during the three surveys and merged together in a single dataset. The whole processing time (from AT to dense point cloud and mesh generation) was 23h. The median feature matches per calibrated image were 5324,07 (figure 7) and the georeferencing Root Mean Squared (RMS) errors were 0.019 m, 0.017 m and 0.006 m for the X,Y,Z coordinates respectively. The total positional RMS value is then 1.14 cm.

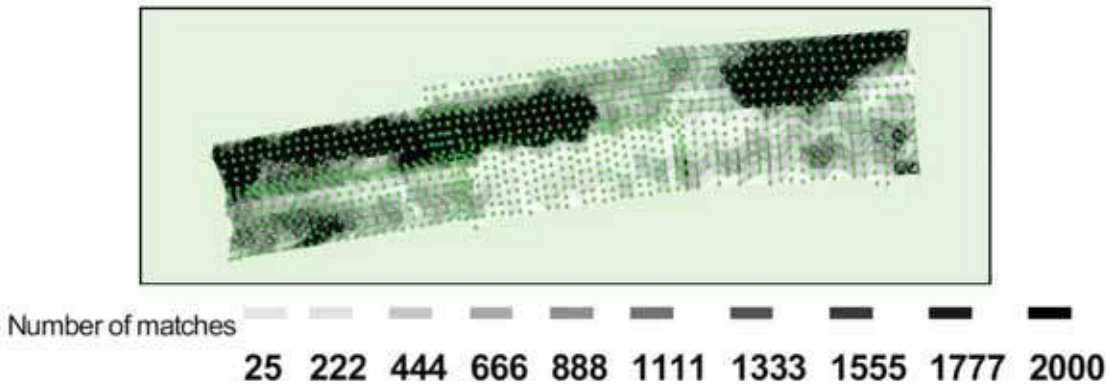


Figure 7 Number of matches and images focal points (green signs). Note how the lighter areas (less matchings) are located above the thin dune sheet of bare and deflated sand immediately behind the foredune, indicating high texture homogeneity, complicating the feature extraction and matching process.

The average elevation points spacing within the dense point cloud was 3.49 cm, varying according to the texture qualities of the location being sensed. Therefore, the final DSM was produced interpolating and re-gridding elevation points from the dense point cloud, yielding a final spatial resolution of 10 cm. The orthophoto pixel resolution however (figure 8) is of 3,5 cm.

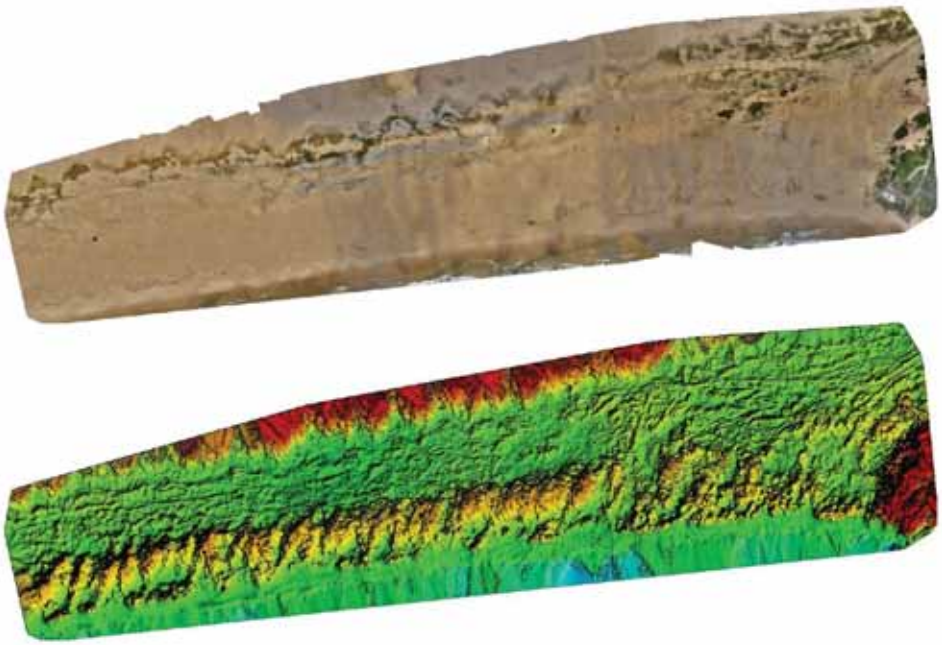


Figure 8 Orthophoto and sparse Digital Surface Model (DSM) before densification (MVS) of the surveyed area, as provided by the automatically generated accuracy report of PostFlight Terra 3d software.

All these digital products were generated using the GDA94/MGA zone 56 coordinate system, based on the Geocentric Datum of Australia 1994 (GDA94) and the Map Grid of

Australia 1994 (MGA94) and exported in common GIS file formats in order to be compatible with and further analysed by GIS platforms (ArcGIS 10.2, in this case).

The delineation of three discrete depositional environments was meant to offer a finer separation of volumes and differences during the analysis periods, providing insights on sediment dynamics in a cross-shore direction. Obviously, this is a simplification of the real sediment dynamics of this area, as longshore drift and lateral contributions to the shore-normal beach-foredune-deflation basin system are not taken into account. Moreover, UAV DSMs lack of the most important geomorphic feature of this system, which is the transverse dune system above the entrance. The high transverse dune sheet and especially the transgressive long walled ridge are supposed to be the sink of the whole Stockton Bight sediment compartment (Gordon and Roy, 1977). Thus, only general observations can be drawn from fine-scale volumetric changes in each of the sub-systems analysed. The delineation of the three sedimentary compartments has been based on visual interpretation of orthophoto (where available) and three shore-normal elevation profiles traced from the landward limit of the study area to the seaward one, in each dataset. In figures 9, 10, 11 and 12 it is possible to see how this process works, resulting in the final sub-compartmentalisation (figure 13).

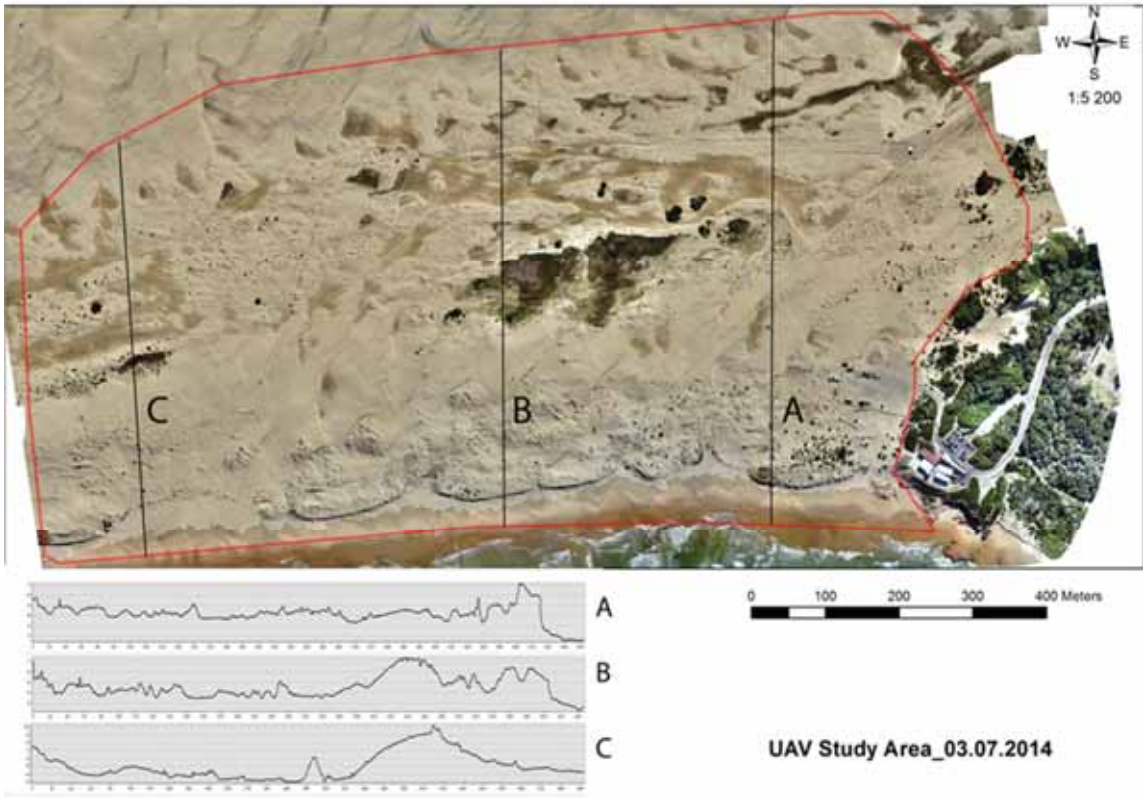


Figure 9 Orthophoto and elevation profiles used to separate the study area in the three sub-systems (beach-foredune-deflation basin). Date of data acquisition: 03.07.2014.

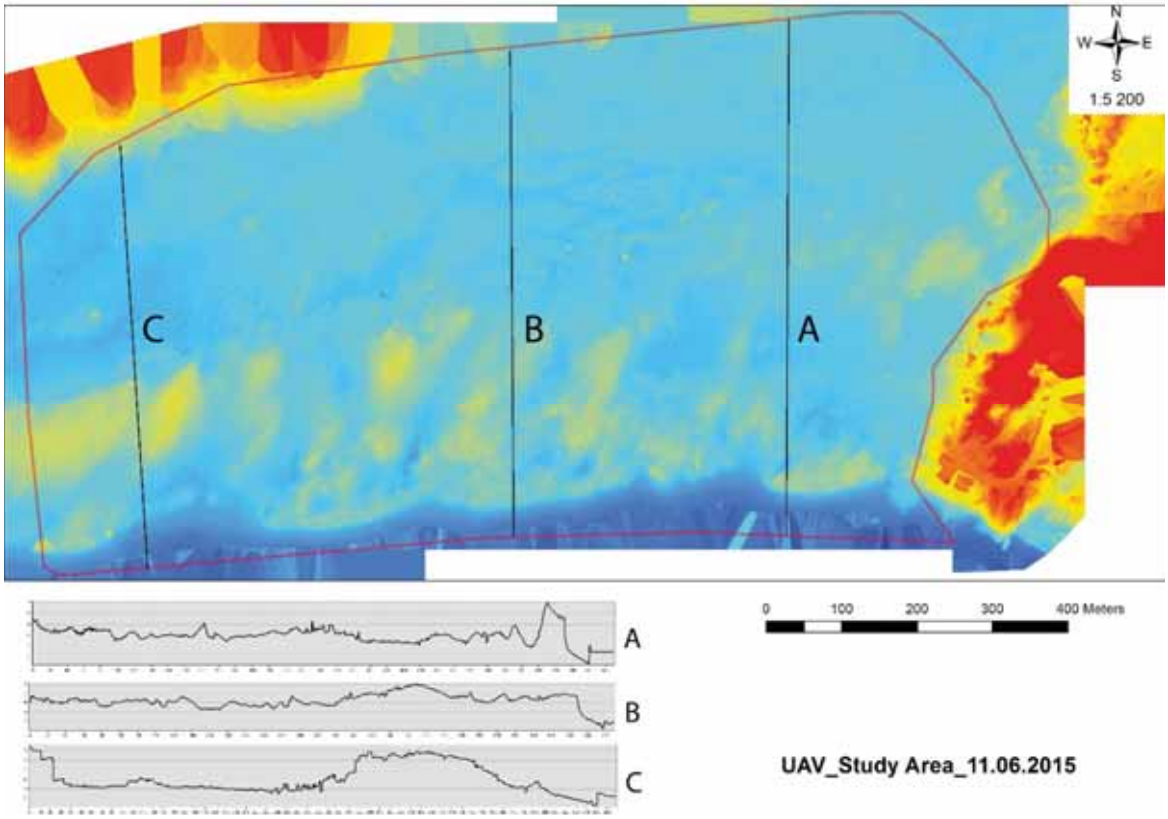


Figure 10 In this case, the DSM was available while the orthophoto was not. Only the elevation profiles were used for interpretation. Date of data acquisition: 11.06.2015.

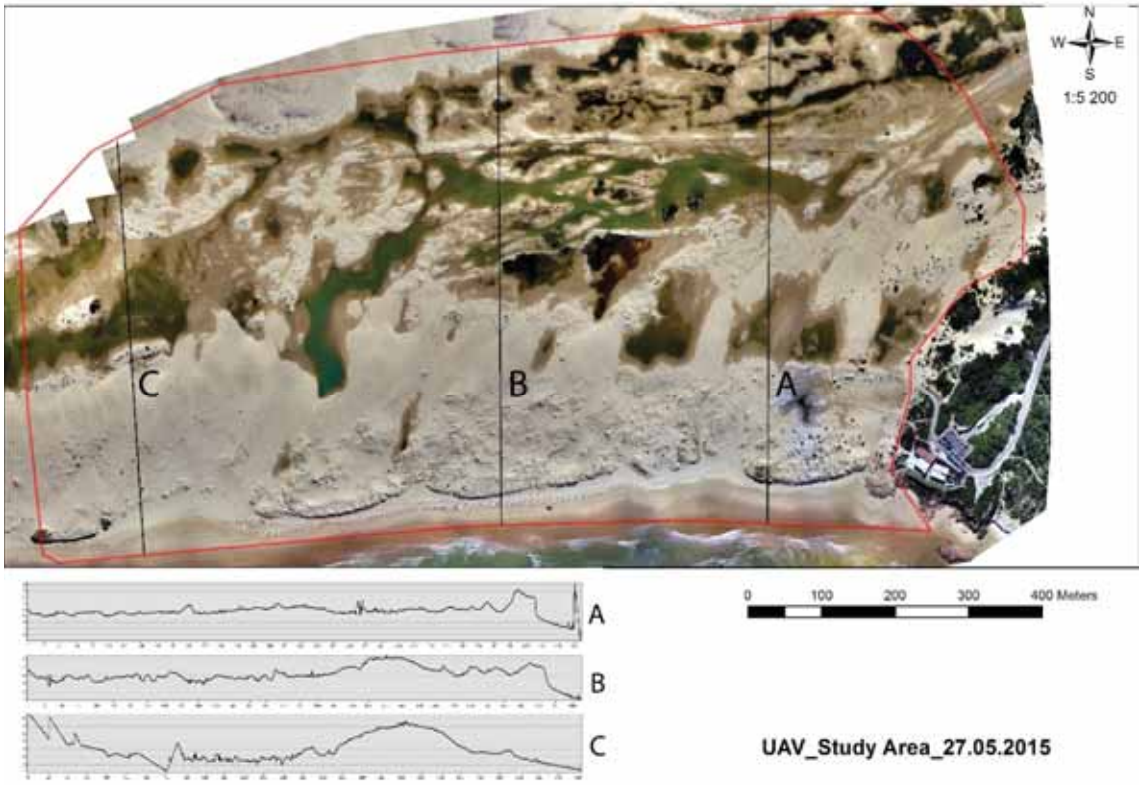


Figure 11 Orthophoto and elevation profiles used to separate the study area in the three sub-systems (beach-foredune-deflation basin). Date of data acquisition: 27.05.2015.

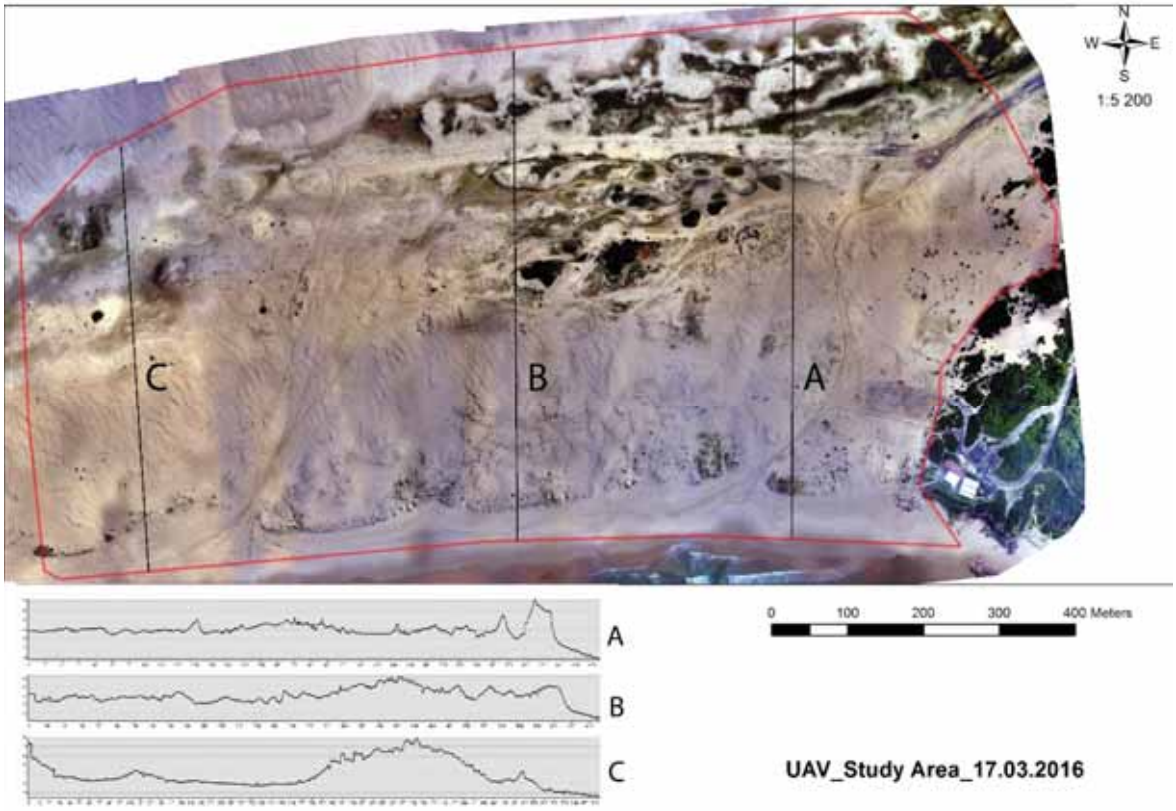


Figure 12 Orthophoto and elevation profiles used to separate the study area in the three sub-systems (beach-foredune-deflation basin). Date of data acquisition: 17.03.2016.

Please note that the foredune looks abnormally protruded landward because of the inclusion of the thin and bare sand sheet formed by deflated sediment eroded from and transported over the foredune-beach system. Once the sub-systems have been identified, volume and height differences can be calculated by running the Cut and Fill algorithm (volume) or simply by subtracting the most recent DSM from the earlier one

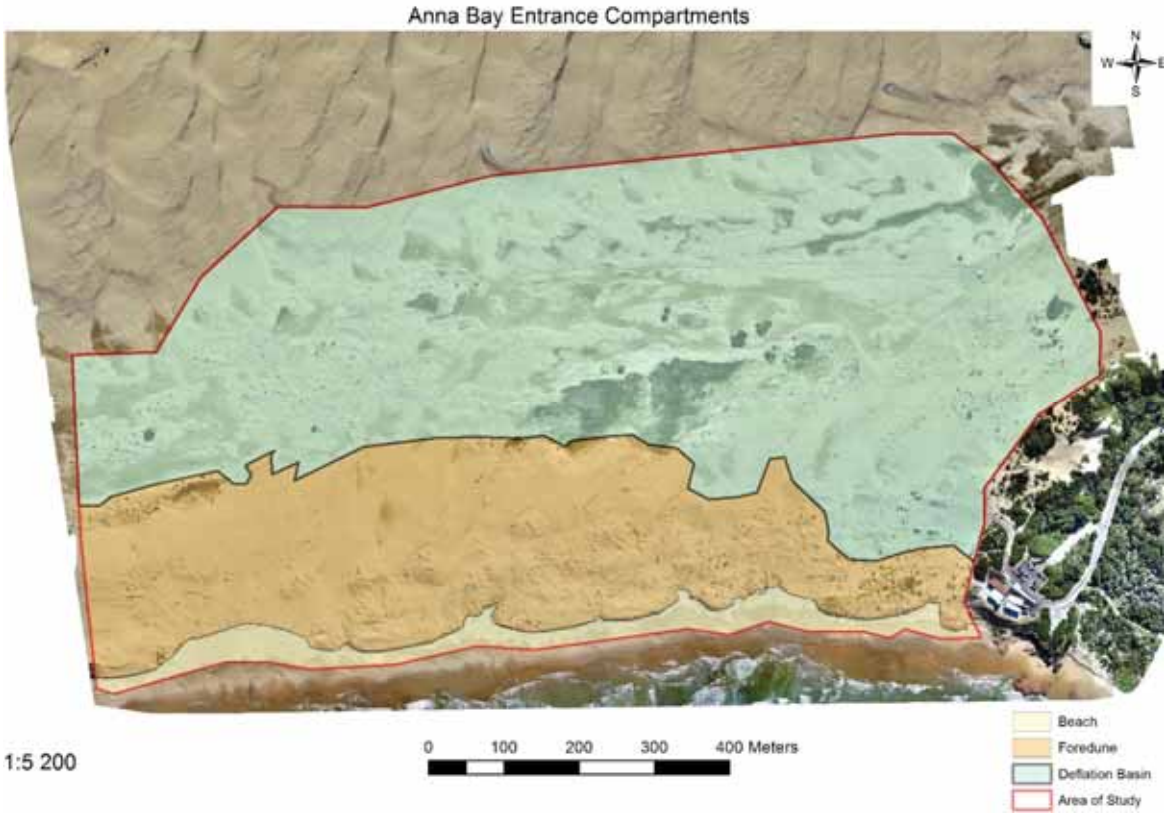


Figure 13 The discrimination of the study area (red boundary) in three distinct but inter-connected sub-systems, namely the beach, the foredune and the deflation basin.

(height). By using the Cut and Fill tool in ArcMap 10.2, an output raster is returned with cell values having as attribute the volumetric difference from raster 1 to raster 2. Therefore, positive volume cells (displayed in blue) are where sediment was cut (erosion), and negative ones (displayed in red) indicate where sediment was filled (accretion). Those accretion and erosion cells have been grouped based on the sub-systems they occur and then summed up to calculate volume change.

Results and Discussion

The following pages provide images (figures 14-17) of the results of the volumetric/height analysis for every time period. The relative data tables and discussion are provided at the end of the following pages.

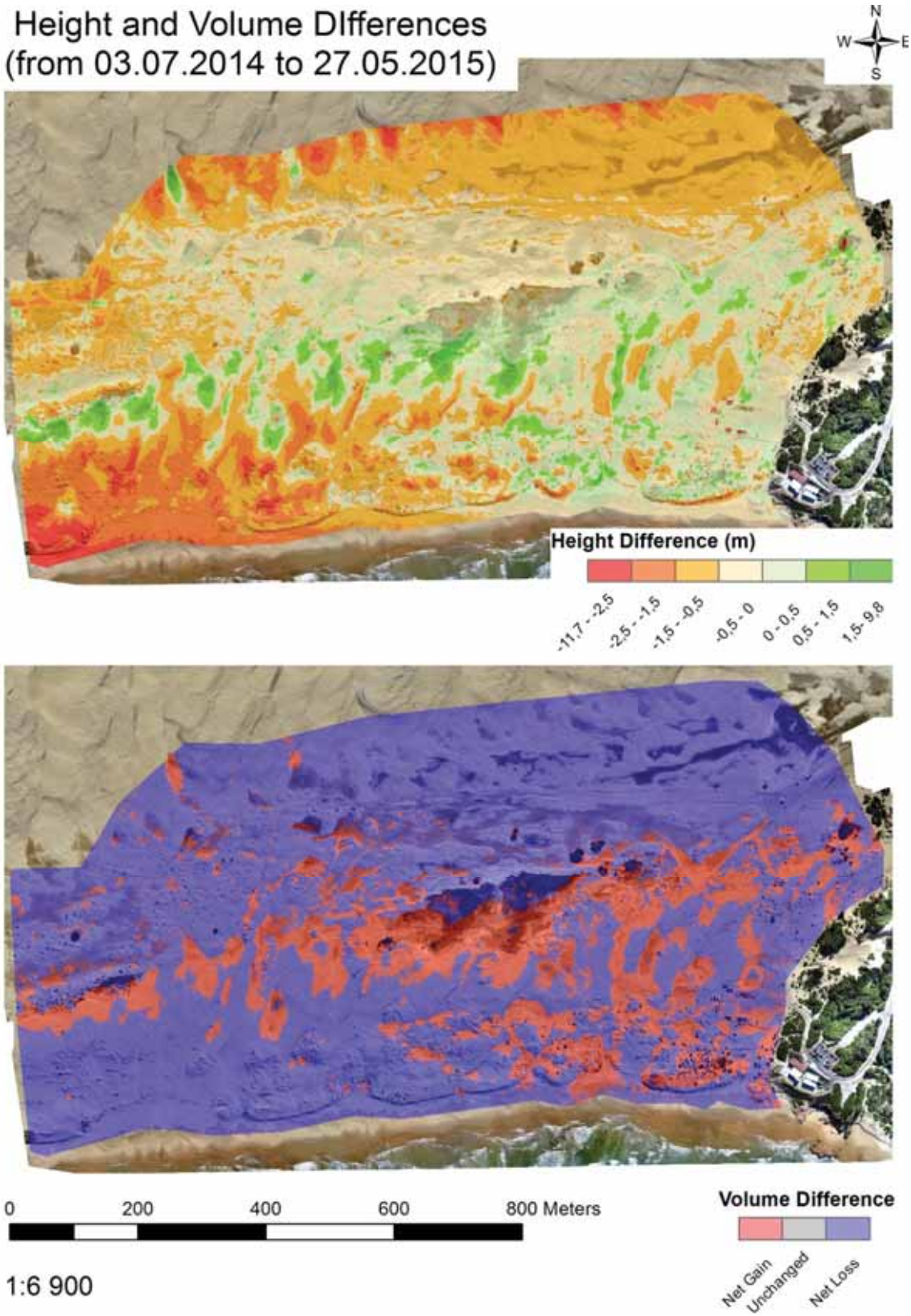


Figure 14 Height and volume difference maps of voldiff_1 period.

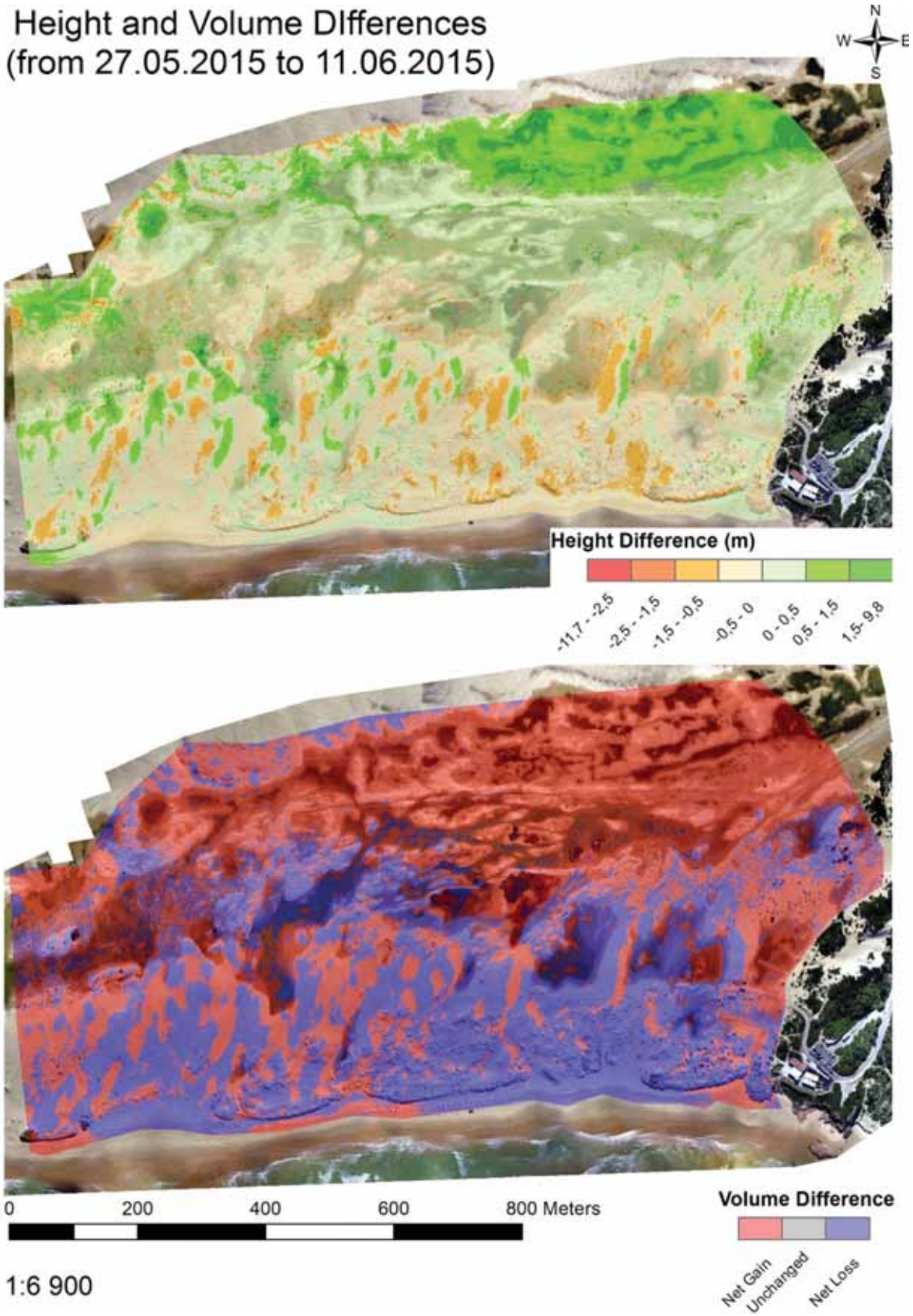


Figure 15 Height and volume difference maps of voldiff_2 period.

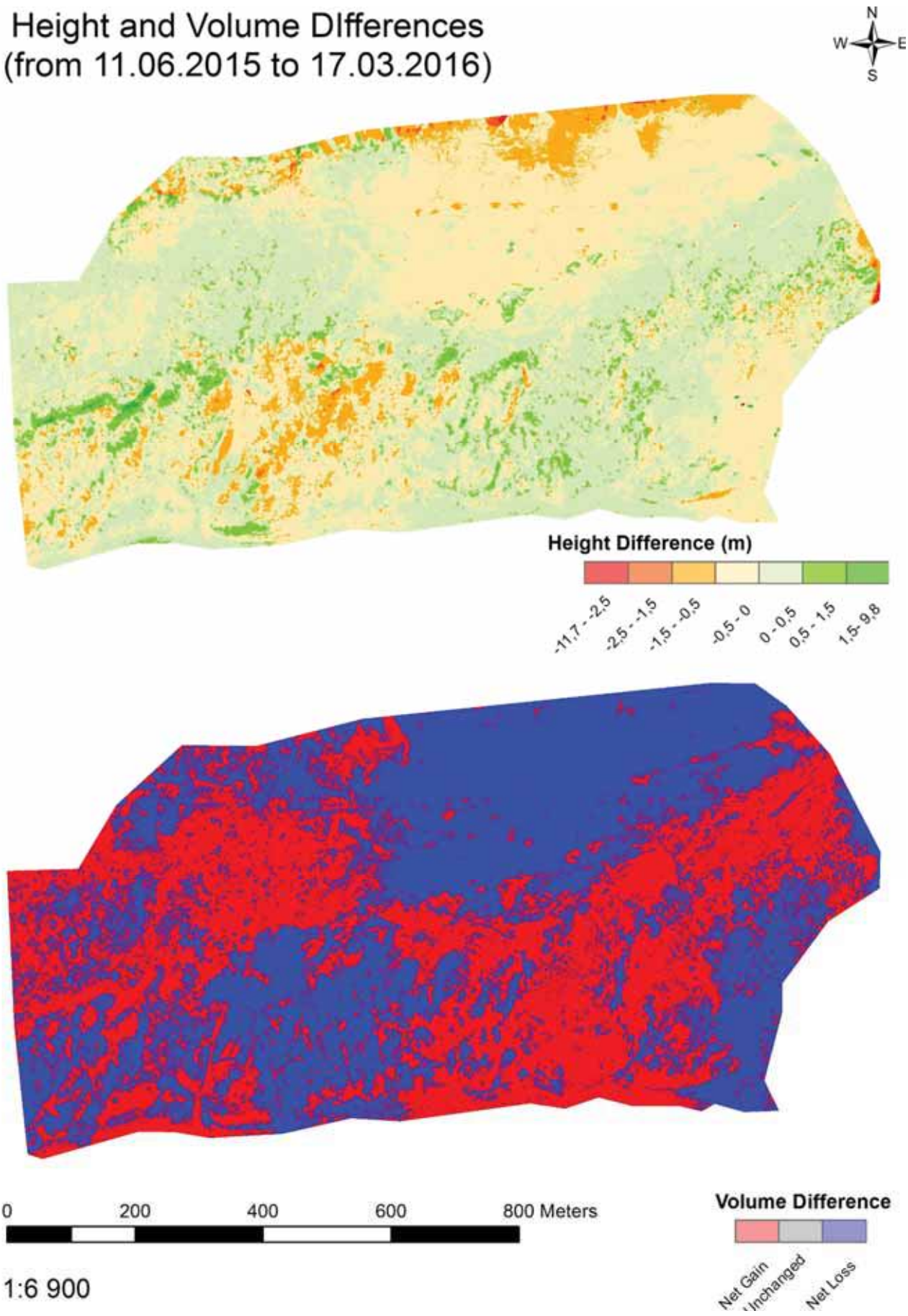


Figure 16 Height and volume difference maps of voldiff_3 period.

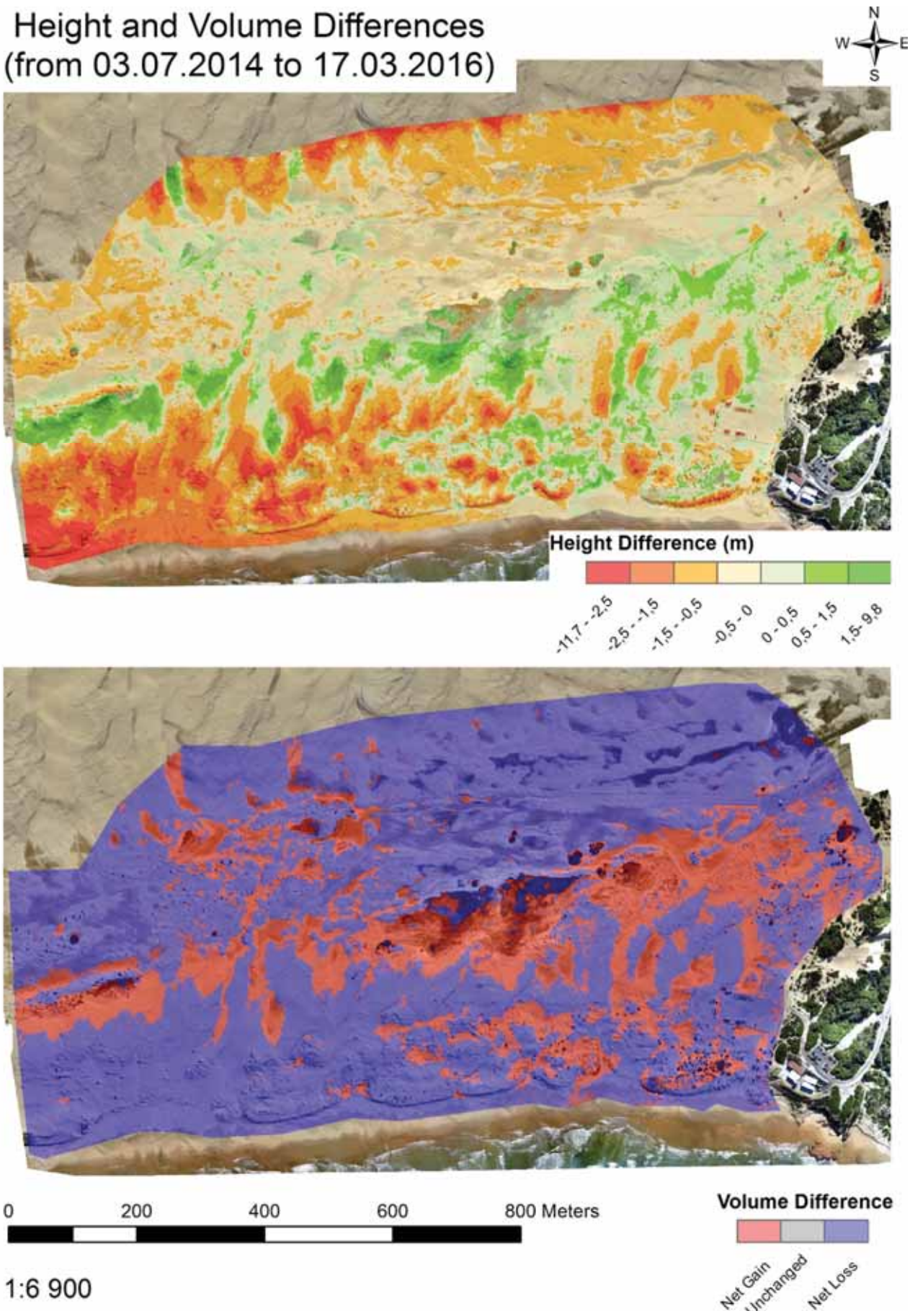


Figure 17 Height and volume difference maps of voldiff_long period.

voldiff1	accretion	erosion	net
beach	868,61964	40890,897	-40022,3
foredune	34964,931	190046,34	-155081
deflation basin	29633,456	252492,66	-222859
tot	65467,007	483429,9	-417963

The first period (voldiff_1) represents almost one year (328 days) of time interval and it is characterised by the highest net loss of all the periods (- 417'963 m3). The deflation basin has been the sub-system with the largest net sediment loss (- 222'859 m3) followed by the foredune (- 155'081 m3) and the beach (-40'022 m3). By looking at detailed sub-systems erosion/accretion values, it is interesting to note how there is a moderately high accordance with a dominance in the shore-normal sediment transportation. The loss of the beach (- 40'891 m3) is close to the foredune sediment accretion (+ 34'965 m3), with only 5'926 m3 of difference which could be the lateral contribution from outside the system. However, the foredune sub-system loss (- 190'046 m3) is much higher than the deflation basin accretion (+ 29'633 m3), suggesting that 160'413 m3 of foredune sediment has not contributed to the deflation basin infilling and it has exited the system or partially contributed to beach accretion.

Figure 14 clearly shows the general sediment loss of the beach and evidences how the only accretion areas are located above the rocky headland that tops up the embayment or at the foredune dissections (blowouts) used as entrances by 4WD, touristic operators and all kind of beach users. The foredune sub-system accreted only at its northern end, where vegetation increases surface roughness, reducing the surface wind and facilitating sedimentation. Interestingly, the border between foredune sub-system and deflation plain is where the majority of the accretion occurred, showing how the upper part of the deflation basin and the partial transverse dunes have lost sediment in favour of that area. From the height map, it is possible to note how the areas of most height loss or gain can track the barchanoid ridges and individual barchans migration paths. Please remember that the background orthophoto is always the initial state (in this case captured on 3 July 2014). By observing contiguous reddish (height loss) and greenish (height gain) area is possible to infer that these dunes migrated predominantly toward the NNE-NE and these observations are validated by the sand drift potential analysis. In fact, this period was characterised by a high wind energy (872 VU) coupled with an unusual high wind variability index (0, 67), which means that a less complex effective wind regime occurred. This resulted in a very high resultant sand drift potential (RDP) of 584 VU toward the NNE (RDD = 35°).

voldiff2	accretion	erosion	net
beach	2082,3582	5968,643	-3886,28
foredune	33247,733	46807,876	-13560,1
deflation basin	140250,46	34172,47	106078
tot	175580,55	86948,989	88631,56

The second period (voldiff_2) represents a 5 months interval (163 days) and shows a net accretion of + 88'869 m3 in the system due to the impressive net infilling of the deflation basin of + 106'078 m3. A positive gradient in accretion amounts is observed, increasing from the beach (+ 2'082 m3), the foredune (+ 33'248 m3) up to the deflation basin (+ 140'250 m3). This time, the shore-normal sediment transportation is less dominant than the previous period. The foredune accretion volume was well above (27'279 m3 of difference) the beach erosion one (- 5'969 m3). There is also a large difference of 93'442 m3 of sediment between the foredune sediment loss (- 46'808 m3) and the deflation basin accretion. Hence, this period could be dominated by a strong lateral contribution or a "reversed" trend with respect to the precedent one, with sand

being transported from the deflation plain (perhaps the high transverse dune sheet?) toward the beach. When the spatial distribution of loss/gain areas displayed in figure 15 are taken into account, it is evident how the majority of the sediment gain areas are located in the upper part of the deflation basin, which is in contact with the high dunes. The "reversed" hypothesis could be retained only if sediments are entering the deflation plain sub-system from the high transverse dunes. The foredune system shows a pattern of elongated accumulation/erosion areas, which suggests that sand has moved in a NE-E direction. The height map better evidences how is especially the barchanoid sand sheet that migrates NE-E, while the seaward margin of the foredune sub-system features a general loss except localised accretions at the southern blowouts and at the northern rocky headland. According to the wind data of this period, the resultant sand drift was low (RDP = 51 VU) toward NNE (RDD = 25°) due to the overall effective wind energy was intermediate (DP= 216 VU) further attenuated by a fairly complex wind regime (RDP/DP = 0, 25).

voldiff3	accretion	erosion	net
beach	4776,6796	1748,9882	3027,691
foredune	33146,635	39491,419	-6344,78
deflation basin	49214,387	70839,216	-21624,8
tot	87137,702	112079,62	-24941,9

The third period (voldiff_3) includes 132 days and shows a net loss of - 24'942 m3 of sediment from the system. Interestingly, a net beach accretion (+ 3'028 m3) has been observed in spite of the general erosional trend, especially marked within the deflation basin sub-system (- 70'839 m3). The shore-normal sediment transportation is fairly poor, once again, probably due to the lateral contribution, which comes from outside the system. There is a significantly large difference of 31'398 m3 of sediment between beach erosion (- 1'749 m3) and foredune accretion (+ 33'147 m3). This shows how a significant amount of sediment has entered the foredune sub-system from outside the system or the deflation basin. The difference between foredune erosion (- 39'491 m3) and deflation basin infilling (+ 49'214 m3) of 9'723 m3 is relatively lower and shows how the deflation basin lateral (or high transverse dune sheet) contribution are relatively less important. Regarding the spatial distribution of gain/loss areas within specific sub-systems, no orthophoto was available to compare the prior-change environmental situation with the mapped volumetric and height changes. Spatial patterns by visual inspection of figure 16 are not as evident as previous periods. However, it can be observed that the beach accretion occurred all over the sweep area except in some isolated locations. Interestingly, this is the only time that no accumulation has been recorded at the rocky northern end of the study area. The foredune, immediately behind the beach, appears to be eroded at its top and accreted just few meters landward. This "flattening" is particularly appreciable in the height map, where orange areas showing height decrease are mainly found on the top of the foredune and are often flacked by a landward green area, showing height increase. The upper foredune subsystem (barchanoid sand sheet) concentrates its volumetric loss in its western part. The central part is characterized by accumulation while the far east (next to the headland) displays net sediment loss. From this configuration seems that sediments have entered the foredune sub-system by the west. The deflation basin loss is focused on its northern and north-eastern part. It is difficult to infer sand movement directions from figure 16 and can only be modelled by using sand drift potential analysis. During this time period, a low (RDP= 93 VU) northern (RDD= 6°) sand drift has to be expected. The overall wind energy was intermediate (DP = 252 VU) with a simple wind regime (RDP/DP = 0, 37).

voldifflong	accretion	erosion	net
beach	721,8645	41603,446	-40881,6
foredune	49886,681	224872,93	-174986
deflation basin	48165,791	186560,79	-138395
tot	98774,336	453037,17	-354263

When the period from the earliest UAV survey to the latest (voldiff_long, 623 days) is taken into account, the very short-term variability observed might not be so evident, but it is important to remember that these types of surveys are only temporal snapshots of the environmental conditions that were present at the time of every UAV survey. This means that the longer period might reflect an apparently stable situation because of tremendous variability in inter-compartment sediment exchanges that have occurred from the first to the last UAV survey. Thus, volumetric changes calculated in this longer period hide the oscillations that are so important to depict for effective sand stabilisation solutions. Thus, the more surveys are operated in short time intervals the more precise the volumetric changes can be captured and reliable solutions can be proposed. Keeping in mind the aforementioned considerations, voldiff_long displays a behaviour similar to voldiff_1. A relatively very high net loss occurred (-354'263 m3) in the system. Interestingly, the foredune sub-system is the most eroded one (174'986 m3) followed by the deflation basin (138'395 m3) and the beach lost the same amount (-40'881 m3) of sediment as during voldiff_1 (-40'022 m3). While there are only 8'284 m3 of difference between beach erosion and foredune accretion (49'887 m3), the difference between foredune erosion and deflation basin accretion (48'166 m3) is remarkably high, showing that 176'707 m3 of sediment has been lost from the foredune and not stored within the boundaries of the deflation basin. By looking at the maps (figure 17), a very similar situation to voldiff_1 is observed, showing how in the longer term landward cross-shore sediment transportation dominates Anna Bay entrance.

Conclusion

UAV surveys and fine-scale site-specific analysis revealed useful to identify these sand movement trends and volumetric interchanges between sub-systems. The results highlight how shorter periods evidence western influx of sediment while yearly and bi-yearly periods suggest that landward cross-shore sediment transport is dominant, which comes from the beach (across blowouts) and from the erosion of the foredune. Generally, the stabilization works imply sand fencing traps, avoidance of littoral erosion during storms, provision of sand source for seasonal changes in beach slopes and plantation of native vegetation communities (Navarro et al., 2011).
Hence, two different type of interventions are needed in order to mitigate both short and long-term sand drift. The first intervention is the mechanical stabilisation of the deflated sand sheet behind the eroded foredune. Mulch, which is locally available, can be used for covering this area uniformly, preventing saltation and decreasing surface wind velocity. After the mechanical stabilization, planting trees and perennial vegetation will permanently stabilise the deflated sand sheet. During this phase, a soil and local vegetation expert must be contacted in order to determine:

1) The best planting period and specimens
2) The optimal density of planting
3) How the ground should be preparation for hosting the rooting system and facilitates the water retention
4) The optimal planting strategy

The second intervention aims to stop short-term pulses of migrating sand coming from the west, as observed from UAV sand movement analysis. This can be achieved by

stimulating the creation of an *ad-hoc* dune, which will be oriented normal to the prevailing RDD.
Interestingly, these two major interventions could be simultaneously accomplished by applying the so-called "*aerodynamic method*". This method uses the wind's speed to convoy unwanted sand toward a different direction than the prevailing effective wind direction. This is possible by placing fences at an angle of 120° to 140° to the RDD. In this way, obstacles in the path of the transporting wind deviates and accelerates the air flow, eroding the unwanted sand and building it up in another location. It is important not to generate any turbulence. Thus, the preliminary idea is to protect the road in its southern trait when it crosses the barchanoid sand sheet by creating a shield dune, which in turn convoys sediment toward the hummocky foredune previously mechanically stabilised increasing its accretion rate.

To sum up, to contrast the local sand drift, the following actions should be considered:

1) Accretion and stabilisation of dunes (referred as "shield dunes") located at the western side of the thin barchanoid sand sheet to contrast the short term western sand drift
2) Foredune backdune stabilisation and blowouts recovery to contrast the shore-normal sand transport
3) Foredune and shield dunes have to be fenced to prevent human trampling and possible re-activation

However, this is only a hypothetic solution that needs to be carefully assessed before any decision can be taken. Effectiveness in the long term of sand fencing still has to be evaluated by continuous monitoring. Another issue that might arise is related to the foredune vegetalisation process. In fact, if the sediment flux supplied by the aerodynamic divergence of the shield dune is excessively high, then vegetation development might be challenged. In addition, blowouts need to be sealed in order to avoid onshore winds to funnel thru them and activating freshly sand deposits provided by this mechanism.

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REPORT

Birubi Information Centre

Statement of Environmental Effects

Client: McGregor Coxall

Reference: M&ANAR001D0.1

Revision: 0.1/Draft

Date: 27 June 2018

Royal HaskoningDHV

Enhancing Society Together

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1 Introduction

1.1 Overview

Haskoning Australia Pty Ltd, a company of Royal HaskoningDHV (RHDHV), was commissioned by McGregor Coxall Pty Ltd to provide transport and civil engineering services for the development of an information centre at Birubi Point, NSW. This site is immediately adjacent to the Stockton Bight sand dunes (Worimi Conservation Lands (WCL)) a popular destination for domestic and international visitors (**Figure 1.1**).

As a component of these services RHDHV has prepared a Statement of Environmental Effects (SoEE) for the Development Application (DA) for the proposed works.

This report herein details the environmental assessment for the development of the information centre. This SoEE considers the impact of the proposed works on both the natural and built environments, and the proposed methods of mitigating any adverse effects.

1.2 Background

The information centre will be developed by Port Stephen's Council and will cater for the growing demand in international and domestic tourism activities at the WCL and Birubi Point. The demand for sand dune adventure tourism and cultural heritage experiences has grown to such a point that urgent planning for an information centre is being co-funded by the NSW Governments Tourism Demand Driver Infrastructure Fund and Port Stephens Council.

The WCL (Stockton Bight Sand Dunes) cover 4,200 ha along the NSW coast and include 32km of the longest moving sand dunes in the southern hemisphere. The dunes can reach heights of over 40m with slopes up to 60 degrees and are shaped by continuous processes of coastal erosion, coastal recession and wind-blown transport of sand. Birubi Point lies at the interface of the mobile sand dunes and the rocky coastline of Tomaree it is also the interface between the natural landscape and built environment and a key gateway to the WCL.

The WCL is internationally recognised for its landscape and is a popular destination for outdoor recreation and tourism. Activities include; 4x4 driving, recreational fishing, surfing, horse/camel riding and family based recreation. Accessing Stockton Beach is a key experience for most visitors to the area with the majority of visitors relying on 4x4 vehicles for access.

The WCL and Birubi Point are important for Aboriginal culture and heritage. Birubi Point is a designated Aboriginal Place under the National Parks and Wildlife (NPW) Act 1974 and the WCL is known to contain a large number of Aboriginal Sites. Both Birubi Point and the WCL are part of a large area of land considered Worimi Country and under traditional custodian of the Worimi People.

The increasing numbers of visitors accessing the area at Birubi Point is leading to traffic congestion and unregulated visitor access along Birubi Point. This is putting increasing pressure on the Aboriginal archaeological heritage and cultural values of the area as well as leading to ecological damage and affecting the overall experience of visitors to the site.

McGregor Coxall is working on behalf of Port Stephen's Council to design and develop an information centre to provide a new gateway for visitors to the WCL. The aim of the information centre is to reduce traffic and parking congestion on the headland. It is also an opportunity to carefully design an integrated gateway to the WCL and Birubi Point to retain the scenic value and sense of arrival that attracts visitors to the area.

The proposed information centre would be accessed from the existing beach access off Gan Gan Road and would provide 1,325m^2 of sheltered space, space for dune operators and amenities, including public toilets and a kiosk. The site will have 50 car parking spaces, including 3 disabled spaces, 10 coach parking spaces with a drop-off zone that can accommodate 2 coaches, and provisions for pedestrians and cyclists (**Figure 1.2**).

Figure 1.1 Site Location (Google Earth 2018)

Figure 1.2 Proposed Information Centre Layout and Design

2 Planning Context and Other Approvals

2.1 Land Ownership and Zoning

The proposed transport intersection would be located on land classified as Rural Landscape under the Port Stephens Local Environmental Plan (LEP) (Port Stephens Council, 2013). The works are immediately adjacent to land classified for Environmental Conservation to the south and west of the site and low density residential to the east. The land is Crown land under the management of Port Stephens Council.

The objectives of each of these classifications is listed in **Table 2.1** below.

Table 2.1 Land Zoning

Land Zone	Objectives of Zone
RU2 – Rural Landscape	• To encourage sustainable primary industry production by maintaining and enhancing the natural resource base. • To maintain the rural landscape character of the land. • To provide for a range of compatible land uses, including extensive agriculture.
E2 – Environmental Conservation	• To protect, manage and restore areas of high ecological, scientific, cultural or aesthetic values. • To prevent development that could destroy, damage or otherwise have an adverse effect on those values.
RE1 – Low Density Residential	• To provide for the housing needs of the community within a low density residential environment. • To enable other land uses that provide facilities or services to meet the day to day needs of residents. • To protect and enhance the existing residential amenity and character of the area. • To ensure that development is carried out in a way that is compatible with the flood risk of the area.

2.2 NSW Planning and Approvals Process

The statutory basis for planning and environmental assessment in NSW is set out in the Environmental Planning and Assessment Act (EP&A Act) and the Environmental Planning and Assessment Regulation 2000 (EP&A Regulation).

2.2.1 Environmental Planning and Assessment Act (1979)

Part 4 of the EP&A Act sets out the development assessment requirements for those developments that require consent. Part 5 of the EP&A Act specifies the environmental impact assessment requirements for activities undertaken by or on behalf of public authorities that are permissible without development consent.

Part 4 generally requires the preparation of a Statement of Environmental Effects (SEE) or an Environmental Impact Statement (EIS), depending on the nature, location and capital investment value of the proposed development.

Development consent will be sought by Port Stephens Council under Part 4 of the EP&A Act.

The proposed development does not fall under the criteria of Schedule 4.2 of the EP&A Act. An Environmental Impact Statement is therefore not required.

2.2.2 State Environmental Planning Policy (State and Regional Development) 2011

State Environmental Planning Policy (State and Regional Development) 2011 (SEPP SRD) identifies development that is state significant development (SSD), state significant infrastructure (SSI) and critical SSI and confers functions on joint regional planning panels to determine development applications for such development and development considered regionally significant.

The proposed information centre does not fit the definition of SSD, as listed under Schedule 1 and 2, or SSI, as listed under Schedule 3 and 4 or critical SSI, as listed under Schedule 5, of the policy.

2.2.3 Regional Environmental Plans

2.2.3.1 Port Stephens Council Local Environment Plan

The Port Stephens Council Local Environment Plan (PSLEP) (2018) provides the statutory framework for planning within the Port Stephens local government area. It provides planning and environmental control over the use and development of land, in order to uphold and promote the objectives of the EP&A Act 1979.

2.2.3.2 Port Stephens Development Control Plan

The Port Stephens Council Development Control Plan (DCP) (2014) aims to facilitate development in accordance with the PSLEP. The plan applies to all development requiring development consent under the PSLEP.

In determining a development application Council is to provide consideration to this Plan under Section 79C of the EP&A Act.

This Plan does not apply to development that is:

- Identified as permissible without consent under Land Use Table of the PSLEP 2013.
- Carried out under Part 5 Environmental assessment of the EP&A Act.
- Assessed under the provisions of another Environmental Planning Instrument (EPI) that excludes the provisions of the PSLEP 2013.

The proposed Information centre will be designed to ensure that the objectives of the Port Stephens DCP have been considered.

2.3 Other Legislative Requirements

2.3.1 State Legislation

Relevant additional State Legislation that applies to the activity includes the following:

- *NSW Biodiversity Conservation Act 2016 (BC Act)* - The BC Act lists the threatened species, populations or ecological communities to be considered when deciding if a significant impact on threatened biota, or their habitats, is likely as the result of an activity.

  Activities that fall under Part 4 of the EP&A Act must enter into the Biodiversity Offset Scheme (BOS) if the proposal triggers certain BOS development thresholds or if an Assessment of Significance (5 part test) is significant. This is described further in **Section 5.3.1**.

  The proposed development would not impact on threatened species, populations and communities or their habitat and the assessment process can proceed without entering the BOS.

- *NSW National Parks and Wildlife Act 1974 (NPW Act)* - The NPW Act aims to conserve nature, objects, places or features (including biological diversity) of cultural value within the landscape. If an impact to an Aboriginal heritage object or site is likely from a proposal, a permit must be sought under Section 90.

  The proposed development will require a permit under Section 90.

- *NSW Roads Act 1993* – under Section 75, a public authority may not carry out road work on a classified road, being work that involves:

  (a) the deviation or alteration of the road, or

  (b) the construction of a bridge, tunnel or level crossing in the road,

  Unless the plans and specifications for the proposed work have been approved by RMS.

  Under Section 138 of the Act, a person must not:

  (a) erect a structure or carry out a work in, on or over a public road, or

  (b) dig up or disturb the surface of a public road, or

  (c) remove or interfere with a structure, work or tree on a public road, or

  (d) pump water into a public road from any land adjoining the road, or

  (e) connect a road (whether public or private) to a classified road,

  Otherwise than with the consent of the appropriate roads authority. If the applicant is a public authority, the roads authority and, in the case of a classified road, RMS must consult with the applicant before deciding whether or not to grant consent or concurrence.

  The proposed works involve the creation of a new intersection on Gan Gan Road therefore approval/consent will need to be sought from the RMS for these works.

- *Coastal Management Act 2016* - The Coastal Management Act aims to manage the coastal environment of New South Wales in a manner consistent with the principles of ecologically sustainable development for the social, cultural and economic well-being of the people of the State.

Section 5 of the Coastal Management Act defines the coastal zone as comprising of the following coastal management areas:

(a) The coastal wetland and littoral rainforests area

(b) The coastal vulnerability area

(c) The coastal environment area

(d) The coastal use area

Under Section 23 of the Act, public authorities are required to have regard to coastal management programs to the extent that those programs are relevant to the exercise of their functions.

- *Biosecurity Act 2015* – the Biosecurity Act provides for modern, flexible tools and powers that allow effective, risk-based management of biosecurity in NSW. It provides a streamlined statutory framework to protect the NSW economy, environment and community from the negative impact of pests, diseases and weeds.

  In NSW, all plants are regulated with a general biosecurity duty to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable.

  The Hunter Regional Weeds Committee has developed a five-year Regional Strategic Weed Management Plan to focus on managing weed biosecurity in the area. A key part of developing the plan was the review and prioritisation of weeds in the region. This resulted in the Priority Weed List (Appendix 1 of the plans) and other regional weed lists (Appendix 2 of the plans), using a risk-based approach.

  Bitou Bush is found on the proposed development site and is listed as a priority weed in Appendix 1 of the Hunter Regional Strategic Weed Management Plan, 2017-22, with a State Priority objective of eradication. The removal of Bitou Bush and scheme of planting with native species is discussed in **Section 5.3**.

2.3.2 Commonwealth Legislation

The Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) requires that proposals for development or “actions” that have, will have, or are likely to have a significant impact on any matter of national environmental significance are to be referred to the Commonwealth Environment Minister for consideration and approval.

The EPBC Act identifies the following matters of national environmental significance:

- world heritage;
- national heritage;
- wetlands of international importance;
- listed threatened species and communities;
- listed migratory species;
- protection of the environment from nuclear actions; and
- marine environment.

The proposed Information centre works will not have a significant impact on any of the above. This is detailed in the relevant sections of this report (**Section 5.3** Ecology and **Section 5.4** Aboriginal Heritage), Referral to the Minister for approval is, therefore, not required.

2.4 Summary of Legislative Consideration and Approvals

- Council will submit a Development Application (DA) under Part 4 of the EP&A Act;
- The proposed development does not fall under the criteria of Schedule 4.2 of the EP&A Act. An Environmental Impact Statement is therefore not required. Council will prepare an SEE for the proposed development;
- The proposed development is not considered to be regionally significant development under SEPP SRD;
- The proposed development will require consent under Section 90 of the NPW Act for potential impacts to heritage items;
- Approval will need to be sought from the RMS under the Roads Act for road works associated with the proposal;
- The proposal meets the definition of integrated development as per Section 4.4.6 of the EP&A Act.

3 Consultation

Consultation with local stakeholders regarding the proposed information centre has been ongoing since 2015. A number of stakeholder and public meetings as well as exhibitions have been held locally to discuss the proposals and gather feedback from stakeholders. Key events have been listed below.

3.1 Stakeholder and Community Consultation

Birubi Point Cultural Heritage Panel – since 2015 regular meetings have been held between Port Stephens Council and the Birubi Point Cultural Heritage Panel (BPCHP). The aim of these meetings has been to advise Port Stephen's Council on the management plan required to protect the Worimi cultural and spiritual heritage and enhance the environment of the Birubi Point Crown Reserve and Birubi Point Aboriginal Place.

Site Meeting (2015) – meeting for residents to view the concept plan for the tourism transport facility, provide feedback, and discuss concerns for consideration in the planning process.

Birubi Point Aboriginal Place Master Plan – community consultation on the concept and vision of the Birubi Point Aboriginal Place Master Plan, including the location of the proposed information centre.

Design and Planning Stakeholder Workshops (2018) – three dedicated workshops have been held with local stakeholders to gain an understanding of the vision for the information centre and the challenges of conducting quality cultural and adventure tourism at Birubi Point. The aim of these workshops was to provide the consultants with local insight that could help develop concepts for further consideration.

Community Consultation with Residents (2018) – flyer drops to residences along James Paterson Street have been undertaken to seek feedback from residents and provide information regarding traffic management of James Paterson Street during peak periods and to inform residents of plans for a tourism information centre.

Birubi Point Aboriginal Place Management Plan (2018) – consultation to gather community comment and feedback on the draft management plan including the location of the proposed information centre.

4 Project Proposal

4.1 General

On behalf of Port Stephens Council an Information Centre is proposed for the subject site, Lot 312 DP753024. This site has been identified through a process of masterplanning and community engagement. It is located on Crown Land in a RU2 zone, adjacent to E2 and RE1 lands and the Birubi Point Aboriginal Place. The site is a disturbed area of dune landscape that is framed by vegetation along Gan Gan Road and James Paterson Road.

The proposed information centre has been designed as a functional asset that resolves current parking and congestion issues around visitor activity at Birubi Point. The asset consists of 1500m^2 of sheltered area and provides space for dune operators and amenities, including public toilets and a kiosk. The site will have 54 car parking spaces, including 3 disabled spaces, 8 coach parking spaces with a drop-off zone that can accommodate 2 coaches, and provisions for pedestrians and cyclists. Signs and landscape markers will identify the land as the entrance to the Worimi Conservation lands.

The proposal includes site specific Architecture and Landscape design that is integrated with sustainable water solutions. Heritage considerations, traffic management and an ecological assessment have also been incorporated into the proposed outcome. The site will be managed by Port Stephens Council in collaboration with the Birubi Point Cultural Heritage Advisory Panel.

4.2 Justification of Proposed Works

Tourism plays a large part in the economy within Port Stephens Council Local Government Area with the Wormini Conservation Lands (WCL) at the centre of this industry. The sand dunes within the Birubi Point Aboriginal Place and the WCL attract thousands of visitors to the area each year; however at present the infrastructure in the area is not sufficient to cope with the high numbers of visitors which is causing increasing negative impacts on the experience and ecology of the area.

The transport intersection is designed to address some of the key issues in the area including; traffic congestion, lack of parking space, provision of amenities and signage. This will help to alleviate the pressures on the surrounding area and reduce some of the negative environmental and social impacts associated with high visitor numbers.

4.3 Proposed Works

The proposed works will comprise sand removal and levelling of ground at Site A. Excavated material will be removed and stored off site. A sediment fence will be installed along the western boundary of the site with planting of native species on either side to stabilise the fence and provide screening. Once established with vegetation, the fencing would create a buffer for the information centre from the prevailing winds and sand drift.

The road base will be compacted and paved in high use areas using a permeable paving. Site won material will be used to form pavements and walkways alongside the road. The site will have 54 car parking spaces, including 3 disabled spaces, 8 coach parking spaces with a drop-off zone that can accommodate 2 coaches, and provisions for pedestrians and cyclists.

Buildings and signage will be constructed following completion of civil engineering works. In total the constructed buildings will create a covered area of 1500m^2. Signs and landscape markers will identify the land as the entrance to the Worimi Conservation lands.

Landscaping will be undertaken across the site using native species. Planting will include the creation of a wetland area for naturally managing site drainage.

Architectural drawings for the proposed development are set out in **Appendix A**

4.4 Alternatives Considered

4.4.1 Do Nothing Option

Leaving the parking and access through the SLSC car park would not address the issues of traffic congestion, impacts on Aboriginal heritage or environmental damage from vehicle parking and unofficial access to Birubi Point and the WCL.

4.4.2 Anna Bay Skate Park

An alternative area considered for the information centre was at the Anna Bay skate park to the east of the Birubi Point SLSC. Construction in this area would have impacted on the existing recreational use of the skate park. It is also within the Birubi Point Aboriginal Place where construction impacts on heritage were likely to be greater than the selected location off the existing beach access at Gan Gan Road.

4.5 Materials

4.5.1 Roadways and Parking Bays

Roadways and parking bays will be formed of a permeable paving with plastic capping layer for main traffic able areas and compacted road base for the 4WD operator/ Coach/ Private vehicle parking areas, with plastic capping layer under.

4.5.2 Pavements and Pedestrian Access

Pavements will be raised using site won material and edged with sandstone blocks on a geotextile layer. The pavement will be capped with asphalt on a primer seal.

4.5.3 Buildings

Buildings for tour operators will be set on a hardwood decking platform supported by pre-cast concrete. Buildings will be clad with hardwood timber batten cladding on RC sheeting. Roof construction for the information centre will be polycarbonate roofing with perforated soffit lining.

4.5.4 Drainage and Stormwater

Planted wetland areas will be created along existing lines of natural drainage. These will be planted with native macrophyte species. Drainage will be directed via swales and buried concrete pipes.

4.5.5 Sediment Fence and Planting

The sediment fence will be constructed from a woven geotextile attached to wooden posts. Planting along the boundary of the fence will be undertaken using native species in keeping with the local area.

4.6 Construction Activities and Methodology

4.7 Plant and Equipment

The proposed development comprises the following construction activities:

1. Site Establishment (Mobilisation and Setup)

- Site establishment (fencing, sheds, etc).
- Mobilisation of plant including excavator for earth works.
- Construction planning, preconstruction dilapidation survey and set-out survey.

2. Installation of Environmental Protection

- Installation of sediment and erosion controls, flow management and exclusion fencing around the full extent of the works and maintained for the duration of the contract.

3. Demolition, Excavation and Tree Removal

- Removal of a number of trees and vegetation.
- Excavation of material to achieve the finished floor levels - any excavated material would be stockpiled on site for re-use or removal and disposal by truck.

4. Installation of Drainage, Car Park and Building Infrastructure

- The car park will be constructed concurrently to the associated stormwater infrastructure.
- The buildings would be completed following completion of the car park.

5. Reinstatement and Landscaping

- Following completion of the car park and building infrastructure, any adjacent earth excavated and stockpiled for reuse would be reinstated.
- All landscaping and planting would be undertaken.

6. Removal of Temporary Environmental Protection

- Removal of temporary environmental protection controls such as fencing, signage and sediment and erosion controls.

7. Site Disestablishment (Clean Up and Demobilisation)

- Final as built survey.
- Final clean-up of the site to its preconstruction state and demobilisation of all plant and equipment for handover of site to Council.

Plant and equipment associated with the construction would include excavators, trucks and other light vehicles. This plant is likely to be on site for the majority of the works. The works may also require the occasional visit from crane, piling rig or geotechnical rig, where required.

4.8 Work Schedule/Duration

The ground preparations and construction works would likely be undertaken over a 16 - 18 week period.

The works are scheduled to commence in the second part of 2018.

4.9 Working Hours

The following working hours are proposed as specified in the in the Interim Construction Noise Guideline (DECC, 2009) for normal construction activities:

- Monday – Friday – 7am – 6.00pm;
- Saturday – 8am – 4.00pm; and
- Sundays and public holidays – no work.

Should the contractor need to carry out work outside the above hours, it would be necessary for the Contractor to make application to Council for approval to extend the hours, and for due consideration to be given to issues such as noise generation and traffic impacts.

5 Environmental Assessment and Mitigation Measures

5.1 Geology and Soils

5.1.1 Existing Environment

The proposed development site is located on the edge of the shifting dune system of the Worimbi Conservation Lands (WCL) which extends for approximately 32km along the NSW coast.

Coastal dunes are accumulations of wind-blown (aeolian) sand located behind the beach. Near their seaward margins aeolian deposits are intermixed with wave deposited beach sands but as distance from the shore increases, wind action becomes the dominant force. The nature and extent of dune development at any location is governed by a number of factors including:

- The amount and size of sand currently being supplied to the beach itself;
- Patterns of wind strength and direction,
- Embayment topography and orientation; and
- The type of beach.

Other factors being equal, dissipative beaches with finer sands and gentler beach gradients are more conducive to wind-blown sand transport and growth of dunes. **Figure 5.1** shows the typical features of a dynamic beach system with dune formation (NSW Department of Land and Water Conservation, 2001).

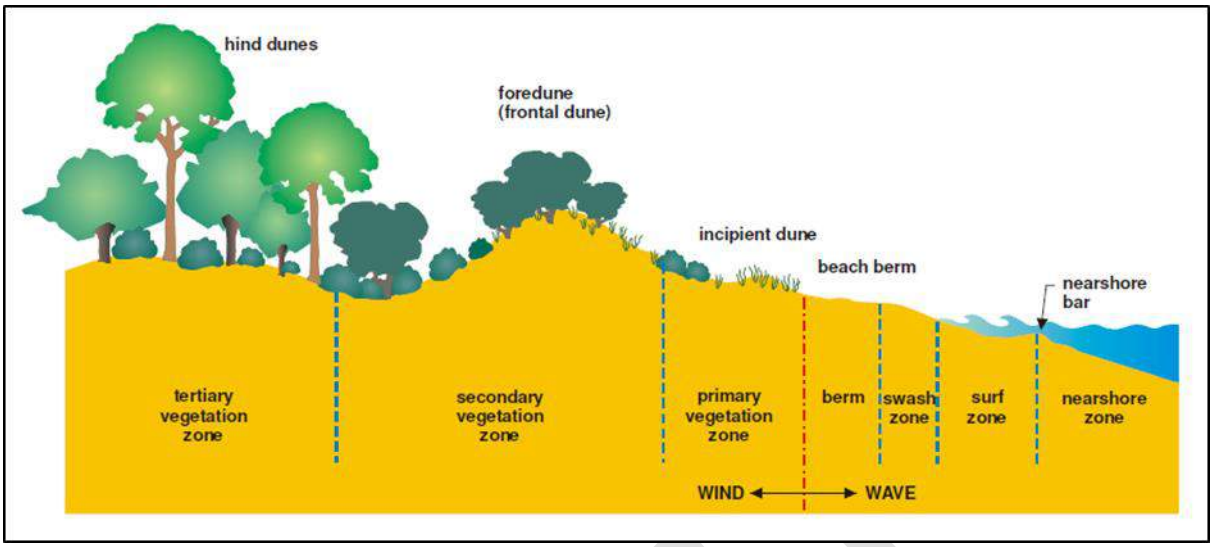


Figure 5.1 Typical features of a dynamic beach system

The dune system is part of the Newcastle or Stockton Bight barrier system comprising of three main landform units:

- Inner barrier – associated with the formation of the Grahamstown and Moffats swamps.
- Outer barrier – beach and sand dune system which forms the WCL.
- Inter barrier depression – low lying area of swamp and marsh land between the inner and outer barrier.

The dune system is thought to have formed nearly 6000 years ago when windblown sands formed a mobile dune system which moved inland. Between the formation of the dune system and the present day there have been two key periods when the dunes have vegetated and stabilised. These periods of change have led to the formation of three distinct, near parallel ridges across the dune system. The current landform of the dune system within the WCL is shown in **Figure 5.2** below.

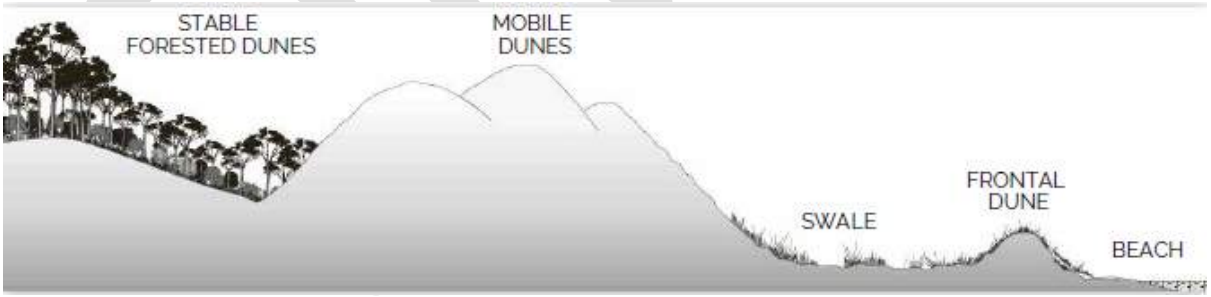


Figure 5.2Current landform of the dune system in the WCL ((NSW Office of Environment and Heritage, 2015)

The stable vegetated and forested dunes reach up to 40m above sea level and occur through the northern and central areas of the WCL. The soils in these locations comprise of a mix of well drained weakly to poorly developed podzol soils on the slopes and more poorly drained humus podzols along the flatter areas of the dunes (NSW Office of Environment and Heritage, 2015).

The mobile dunes are migrating inland and gradually covering the stable vegetated part of the dune system. As the sands move inland the remnant soils from the previous period of stability are gradually

exposed. This process can expose Aboriginal cultural material as well as stumps and remnants of old vegetation.

The sandy landscape of the WCL and Birubi Point is highly mobile which results in a complex stratigraphy which is difficult to date. Mobile sands from the WCL dune system have added to the soil layers at Birubi Point and less densely vegetated areas continue to be mobile and reworked through coastal processes.

A geotechnical investigation of the proposed development site has not yet been undertaken. The land is adjacent to land classified as low probability of acid sulphate soils (ASS) occurrence (NSW Government, 2011). The development site has not been classified but the land surrounding the Birubi Point surf club site to the south is known as being affected by ASS (class 4 and 5) and there is a possibility that the development site may also be a risk.

5.1.2 Potential Impacts

5.1.2.1 Construction Phase

Material across the site will be highly disturbed during the works including land levelling and removal of material from the site. Further minor disturbances will be caused by compaction of the roadways and parking areas and ground preparations for the construction of buildings and signage.

These works have the potential to:

- Disturb or release any contaminated materials on the site;
- Disturb any ASS material; and,
- Mobilise sediments leading to increased erosion at the site.

5.1.2.2 Operational Phase

Removal of vegetation to allow for the proposed development has the potential to lead to increased erosion of soils in the area.

5.1.3 Recommended Control Measures

- Site specific ground investigation to be undertaken, including geotechnical investigation to inform detailed design.
- Waste classification testing and testing for ASS should be undertaken prior to any development at the site to determine any risks associated with contaminated sediment or exposure of ASS. Detailed management plans for waste and ASS may be required depending on the findings of the site investigations.
- Where possible the transport intersection will be designed to minimise the amount of excavation and removal of material from site.
- Appropriate management of any stockpiled material should be undertaken (e.g. damping down or covering) to prevent mobilisation and drift of material.
- Working areas should be stabilised as soon as possible after construction to prevent erosion.
- A scheme of planting using native species to be undertaken to stabilise and trap wind-blown sediments.

5.2 Flood Risk and Coastal Processes

5.2.1 Existing Environment

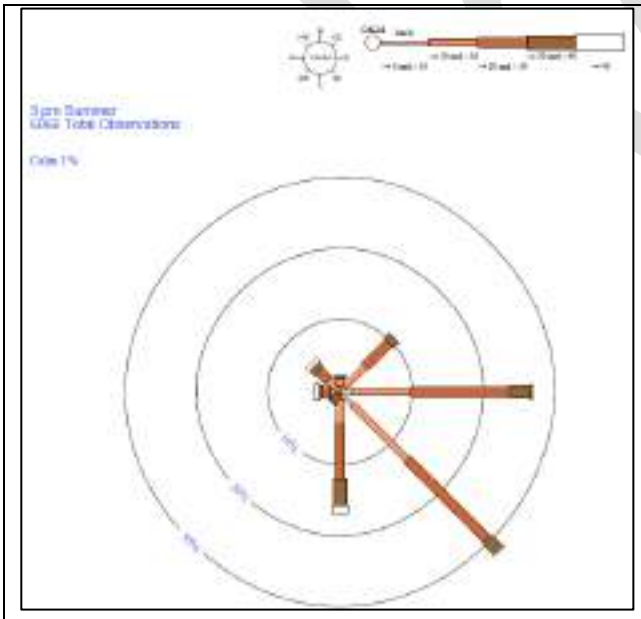
A flood study for Anna Bay and Tilligery Creek was undertaken by Jacobs, on behalf of Port Stephens Council, in 2017 (Jacobs, 2017). There is no flood risk associated with the proposed development site, however, the area of Gan Gan Road which provides access to the beach road and development site is identified as having a low provisional flood hazard (peak flood depth up to 0.1m at 20% AEP).

Wind directly influences waves, currents, water levels and sand transport and thereby moulds many coastal features into shapes that reflect wind strength, direction and duration. The proposed development site is not directly affected by tidal inundation or tidally influenced coastal processes but is affected by processes associated with onshore winds. Coastal dunes are a specific expression of local winds. Local wind patterns also play a critical role in dune rehabilitation through their effect on plant establishment and survival.

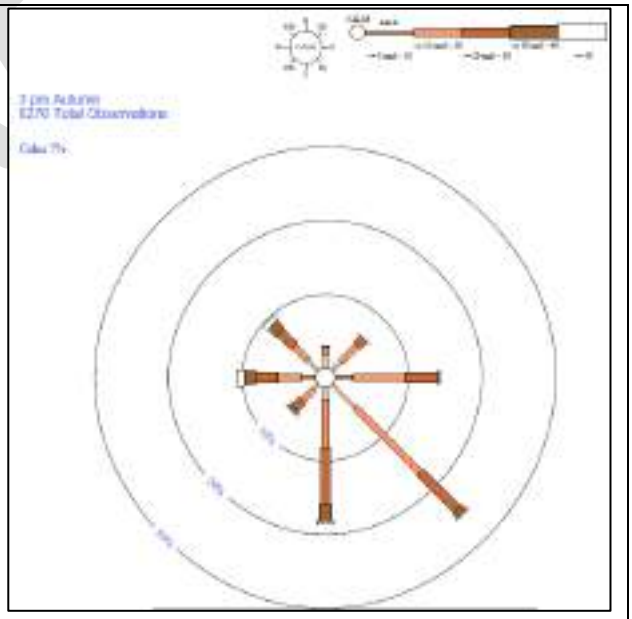
The NSW coastline experiences an annual wind regime that features several distinct components. These result from the persistent west to east passage of High and Low pressure cells across Australia and the seasonal variations in their tracking latitude. The latter facilitate the ingress of warm, moist tropical air masses during summer and incursions of cold Southern Ocean air during winter.

Winds are generally weaker during the morning and commonly blow offshore. Wind strengths increase during the day, typically to a late afternoon peak.

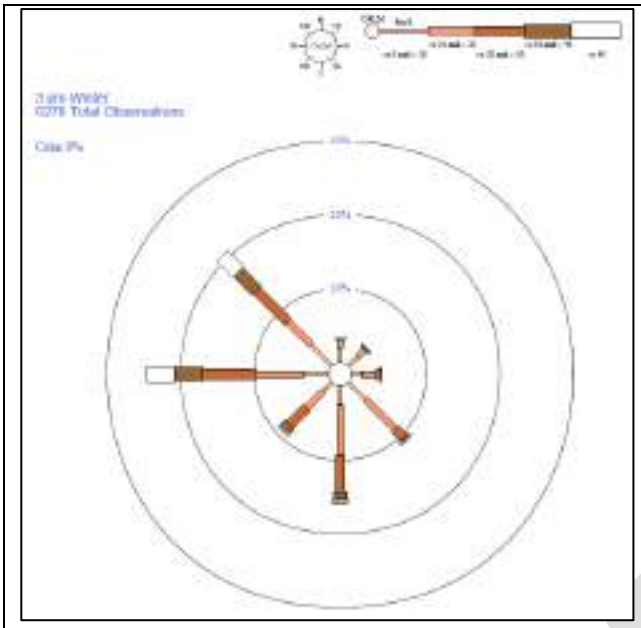
Winds with a westerly component are generally more common during winter and spring when the anticyclones are following their northernmost tracks (**Figure 5.3**). They can be a seasonally important mobilising force on larger sand masses, such as the WCL dune system.



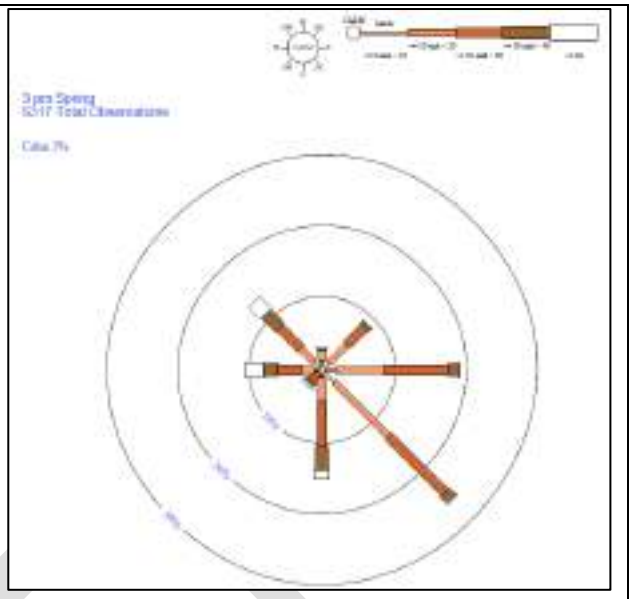
Summer



Autumn



Winter



Spring

Figure 5.3 Seasonal wind roses at Williamstown Airfield (Source: Bureau of Meteorology).

The most important coastal processes continuing to shape the landscape at Birubi Point are coastal erosion, coastal recession and wind-blown transport of sand. The location of the proposed information centre is set back from the beach and protected from processes of coastal erosion and recession caused by wave action. The site is, however, influenced by wind and transport of sand across the site.

5.2.2 Potential Impacts

5.2.2.1 Construction Phase

Removal of vegetation at the construction site may lead to an increase in erosion and potential for release, or more rapid transport, of wind-blown sediments from and across the development site.

5.2.2.2 Operational Phase

Construction of new buildings and hardstanding may present a barrier to movement of wind-blown sediments. This may lead to accumulation of sediments against these structures and routine clearance may be required to maintain operational activity of the information centre development.

5.2.3 Recommended Control Measures

- Installation of a sediment fence and planting of native vegetation along the western boundary of the proposed development site to prevent encroachment of wind-blown sediments into the site.
- Retention of the existing vegetation on site as far as possible to prevent any increase in erosion and release of sediments from the site.

5.3 Ecology and Biodiversity

This section sets out the potential impacts of the proposed development in relation to ecology and biodiversity. A full Biodiversity Assessment Report for the proposed Information Centre is presented in **Appendix B**.

5.3.1 Existing Environment

The subject site for the ecology and biodiversity assessment covers the proposed development area and land immediately adjacent to it. The subject site is at the northern end of extensive sand dunes that stretch between Stockton Beach and Anna Bay in the Port Stephens Local Government Area (LGA). The dunes have been subjected to extensive erosion from natural and anthropogenic forces along with alterations to the species composition of the vegetation through weed invasion. The subject site, proposed area of works and area of potential disturbance are shown in **Figure 5.4**.

Biodiversity Legislation
Under the Biodiversity Conservation Act 2016 activities that fall under Part 4 of the EP&A Act must enter into the Biodiversity Offset Scheme (BOS if the proposal triggers the BOS development thresholds described below or if an Assessment of Significance (5 part test) is significant.

The Biodiversity Conservation Regulation 2017 (BC Regulation) provides details on:

- Clearing thresholds and Biodiversity Values Map for application of the BOS;
- Principles for consideration of serious and irreversible impacts (SII);
- Rules for meeting biodiversity offset obligation;
- Biodiversity Certification criteria; and,
- Compliance provisions.

The BOS development thresholds are used to determine when the BOS applies to local developments and are based on:

- Area Criteria; or,
- Biodiversity Values Map.

For proposals that do not trigger the threshold, a 'test of significance' is required. If this indicates a likely significant impact, the Biodiversity Assessment Methodology Order 2017 (BAM) applies. The Area Criteria are set out in Table 1 below.

Table 5.1 Biodiversity Offset Scheme Thresholds

Minimum lot size associated with the property	Threshold for clearing, above which the BAM and offsets scheme apply
Less than 1 ha	0.25 ha or more
1 ha and less than 40 ha	0.5 ha or more
40 ha and less than 1000 ha	1 ha or more
1000 ha or greater	2 ha or more

Part 7 of the BC Regulation (section 7.4) refers to
(1) Proposed development exceeds the biodiversity offsets scheme threshold for the purposes of Part 7 of the Act if it is or involves:

(a) the clearing of native vegetation of an area declared by clause 7.2 as exceeding the threshold, or

(b) the clearing of native vegetation, or other action prescribed by clause 6.1, on land included on the Biodiversity Values Map published under clause 7.3

The minimum lot size associated with the property (i.e. size of the Subject Site being Lot 312 DP 753204) is approximately 3.2 ha. The Area of Impact (**Figure 5.4**) for the proposed development is approximately 1 ha and within this Area of Impact, there is 0.28 ha of native vegetation. The area of native vegetation to be cleared is, therefore, below the clearing threshold (0.5 ha) for entry into the BOS.

Other legislation relevant to ecology and biodiversity includes the provisions of SEPP 44 Koala Habitat Protection which applies to all lands within Newcastle Local Government Area. This Policy aims to encourage the proper conservation and management of areas of natural vegetation that provide habitat for koalas to ensure a permanent free-living population over their present range and reverse the current trend of koala population decline. An assessment a site survey of the subject site concluded that the site does not contain potential koala habitat and the site does not constitute core koala habitat. Given this, no further koala assessment is required.

Figure 5.4 Subject Site and Potential Area of Impact

Ecological Survey

Field surveys were undertaken on 7 June 2018 within the area of impact on the subject site. Three vegetation quadrats were established to assess vegetation integrity and condition. Opportunistic fauna sightings were also undertaken. The complete Biodiversity Assessment Report which details the findings of the surveys are presented in **Appendix B.**

The vegetation across the subject site had a high level of weed invasion. In the north eastern corner of the site, the vegetation was mapped as 'disturbed' due to the high percentage cover of exotic species. The area behind existing residences along James Paterson Street has been cleared for lawn and an access track and was subsequently mapped as 'cleared areas'. In addition, the sand dunes which had isolated clumps of bitou bush were not mapped as vegetated.

The mapped habitat distribution across the site is shown in **Figure 5.5**. Vegetation communities include:

- Cheese Tree/ Smooth-Barked Apple/ Bangalay Disturbed Open Forest
- Coastal Sand Scrub

Also mapped are areas of:

- Disturbed Vegetation
- Cleared Areas
- Sand Dunes

There were no Endangered Ecological Communities (EECs) found to be present on the proposed development site and no threatened ecological communities as listed under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).

Figure 5.5 Vegetation Mapping at the Proposed Development Site

The Cheese Tree/ Smooth-Barked Apple/ Bangalay Disturbed Open Forest community has been highly disturbed through encroaching gardens/lawn, a vehicle access track and invasive exotic species. Coastal Sand Scrub community has been impacted considerably by Bitou Bush (*C. monilifera*) and Coral Trees (*Erythrina x sykesii*) as well as dune erosion. Areas of disturbed vegetation could not be assigned a native vegetation community description due to the high percentage of weeds present. Rough Doubletail *Diuris praecox* has been recorded in habitat nearby to the subject site however the subject site lacks a dense grassy understory which is considered important habitat for this species.

Fauna surveys were limited to opportunistic sightings, however, the proposed development site provides potential habitat for a range of species including; common bird species, native and exotic ground dwelling mammals and foraging forest bats. The drainage lines along the perimeter of the roads adjacent to the proposed site also provide potential habitat for amphibians. The forested areas lack hollow bearing trees and, therefore, does not provide roosting or nesting habitat for hollow dependant species, including; forest bats, parrots, owls or arboreal mammals.

The site was found to have some potential to support the following threatened species listed under the Biodiversity Conservation Act and EPBC Act:

- Wallum Froglet *Crinia tinnula* (BC Act)
- Dusky Woodswallow *Artamus cyanopterus cyanopterus* (BC Act)
- Little Lorikeet *Glossopsitta pusilla* (BC Act)
- Little Bentwing-bat *Miniopterus australis* (BC Act)
- Yellow-bellied Sheathtail-bat *Saccolaimus flaviventris* (BC Act)
- Rough Doubletail *Diuris praecox* (BC Act)
- Sand Doubletail *Diuris arenaria* (BC Act)
- Spotted-tailed Quoll *Dasyurus maculatus* (BC Act and EPBC Act)
- Koala *Phascolarctos cinereus* (BC Act and EPBC Act)
- New Holland Mouse *Pseudomys novaehollandiae* (BC Act and EPBC Act)
- Grey-headed Flying-fox *Pteropus poliocephalus* (BC Act and EPBC Act)

An assessment of significance of impact (Appendix B) under the Biodiversity Conservation Act concluded that the removal of approximately 0.28 ha of Disturbed Coastal Sand Scrub during construction is unlikely to have an adverse effect on the life cycle of these species such that a viable local population of the species is likely to be placed at risk of extinction. The proposed clearing will not result in further modification of the vegetation as it is already highly modified through weed invasion, nor will it result in fragmentation or isolation of habitat as the Subject Site is already partially isolated. The habitat to be removed is not considered important to the long-term survival of the species as it provides only sub-optimal habitat for Wallum Froglet as it lacks acid swamp, there is only limited foraging habitat for Dusky Woodswallow, the Little Lorikeet does not have nesting habitat, there are no suitable den sites for Spotted-tailed Quoll and there are limited records, there are no roost sites for Little Bentwing-bat or Yellow-bellied Sheathtail-bat, there are no preferred feed trees for Koalas and it is not a known roost site for Grey-headed Flying-fox.

An assessment of significance of impact under the EPBC Act concluded that the proposed works (clearing of 0.28 ha of vegetation) will not substantially impact upon the threatened species listed as the proposed development site does not provide important habitat features for these species. The site lacks primary feed trees for Koalas, does not contain roost sites for the Grey-headed Flying-fox, lacks den sites for the

Spotted-tailed Quoll and the stage of vegetation succession is not preferred by the New Holland Mouse. Subsequently, the Subject Site does not support an important population of these species.

5.3.2 Potential Impacts

Construction
The development will have a direct impact on a number of the habitat types recorded on the site. A proportion of native vegetation will be lost from site clearance for car parking facilities and development of the information centre.

Clearance of the site will have a direct beneficial impact on biodiversity through the removal of invasive weeds and exotic species including Bitou Bush.

Operation
Ongoing use of the site has the potential to prevent, or lead to the damage of, threatened species which may move into the development area. For example vehicle collisions with fauna or grounds maintenance preventing colonisation of protected flora.

5.3.3 Recommended Control Measures

- Any native trees within the *Area of Impact* are to be retained where possible, with barrier fencing installed around the base (to the circumference of the crown) to protect the root system during works.
- Appropriate erosion and sediment control measures are to be put in place prior to commencement of any works.
- Targeted surveys for *Diuris praecox* and *Diuris arenaria* should be undertaken in late July/August during the flowering period for these two species and prior to the commencement of works. In the unlikely event that these species are detected, mitigation measures can be formulated to protect any plants identified.
- Landscaping within the subject site and around its perimeter should use only local, native species that naturally occur in the Coastal Sand Scrub community (as defined by LHCCREMS, 2000). Species should be selected from each stratum (upper, mid, low) of the vegetation canopy to reflect the natural community. Swamp Mahogany *E. robusta*, should also be included in landscaping to supplement habitat for the local koala population.

5.4 Aboriginal Heritage

5.4.1 Existing Environment

The proposed transport intersection sits immediately adjacent to the Worimi Conservation Lands (WCL) and Birubi Point Aboriginal Place. These sites are part of a large area of land considered Worimi Country and under traditional custodian of the Worimi People. Worimi Country is generally bounded by the four rivers: the Hunter River to the south, Manning River to the north, and the Allyn and Paterson rivers to the west, and includes the adjoining ocean and waterways. The WCL and Birubi Point Aboriginal Place fall within the area of the Maiangal ngurra (clan group) who traditionally would have used the beaches to travel between the northern and southern parts of the WCL with the land and waters used for thousands of years for gathering of foods and continuation of cultural activities (NSW Office of Environment and Heritage, 2015).

The WCL contains a large number of sites of significance to Worimi People. These Aboriginal Sites are protected under the National Parks and Wildlife Act (NPW Act 1974) and include evidence of fishing, shellfish gathering (with shell middens being the most conspicuous form of evidence in the landscape),

campsites, fire and hearthstones, flaked stone implements and burials across the WCL. Shell deposits from middens are readily exposed and recovered due to movement of the dunes as shown in **Figure 5.5** below. This process of dune movement makes these sites difficult to identify and protect and they become prone to damage, primarily from vehicles accessing the dunes in the WCL (NSW Office of Environment and Heritage, 2015).

Figure 5.6Dunes within the WCL with visible shell middens (NSW Office of Environment and Heritage, 2015)

The area of land known as the WCL was returned to Worimi ownership on 1st February 2007. The Local Aboriginal Land Council (LALC) holds the title to the WCL on behalf of the registered Worimi owners. The management of the WCL is vested in a Board of Management appointed under Part 4A of the NPW Act by the Minister responsible for administering the NPW Act and the Minister for Aboriginal Affairs, following a nomination process. A Plan of Management for the WCL was published in 2015 with an updated plan expected in 2018 (NSW Office of Environment and Heritage, 2015).

Birubi Point Aboriginal Place was designated under Section 84 of the NPW Act in 2007 for its values as an important ceremonial site and burial ground and presence of extensive archaeological material (NSW Office of Environment and Heritage, 2015). The Aboriginal Place is 54ha of coastal land comprising rocky outcrop overlain by wind-blown sand at the eastern end of the WCL mobile dunes. The area is of great cultural importance to the local Aboriginal community because of its spiritual values as well as the extensive material evidence of traditional Aboriginal people. There is evidence of extensive remains of campsites, implements and food resources used by Aboriginal people as well as burial sites within the area (Umwelt, 2003). Some members of the community refer to a men's ceremonial site in the area and a story involving an old warrior. There is also contemporary significance with the community using the area for fishing, gathering pipis and recreational activities such as surfing. The community has also talked about the contemporary spiritual importance because a young Aboriginal person died in the surf here (Umwelt, 2003).

Cultural Value

Birubi Point Aboriginal Place is culturally linked to the WCL and other significant sites and landscape features across Worimi Country. The archaeological material that is across the entire Aboriginal Place (which includes burials) is important because it is evidence of how Worimi ancestors lived in the area and how they interacted with the land and the sea in their traditional lifestyles.

Archaeological and ethnohistorical investigations suggest that there was consistent extensive occupation across the Birubi Point area since the mid Holocence period. Midden material has been found across all of the headlands as well as dunes behind the headlands and bays (Umwelt, 2003).

Plant species in the area indicate the natural resources used by Worimi people and there is a need to restore natural resources that are part of the cultural value of the Aboriginal Place. As an example, the invasive non-native species Bitou Bush (*Chrysanthemoides monilifera rotundata*) is actively growing and spreading in the area, smothering local native vegetation, blocking important views and covering cultural attributes. Other invasive weed species are also present, competing strongly with native vegetation.

Important characteristics of the land, influencing its cultural value, include:

- An actively transforming landscape – mobile dunes, changing vegetation, and waves of post European settlement ;
- A complex of archaeological sites, including extensive middens and burials, extending across almost all the Birubi Point Aboriginal Place and WCL; and,
- Evidence of long term and continuing use of and attachment to country, by innovative and adaptable people.

The values of the Stockton Bight Aboriginal Place highlighted at Gazettal were:

- The landscape context of the Aboriginal Place, with extensive outlook over land, sea and sky;
- Burials, a ceremonial site;
- An area rich in natural resources, and
- Extensive archaeological material important for teaching current and future generations about Aboriginal culture.

The construction of housing, infrastructure and recreational facilities over the last 50 years has led to the destruction of a large amount of the Aboriginal cultural heritage material that was present in the area (Umwelt, 2003). The increasing visitor numbers and lack of suitable infrastructure to support them is adding to this pressure at Birubi point and leading to continued pressure on the Aboriginal Place and cultural values.

There is presently limited information available to communicate the values of the WCL and Birubi Point Aboriginal Place to those visiting the area. This is leading to a general lack of awareness about the Aboriginal heritage and values of the area, increasing the risk of impacts from visitors.

At this stage a site specific heritage assessment has not been undertaken, however, given the proximity of the proposed development area to the WCL and Birubi Point, and findings from archaeological research in the area, there is a high likelihood of Aboriginal cultural material being present. A lot specific search for the proposed development site using the Aboriginal Heritage Information Management System (AHIMS) indicates that Aboriginal Sites are recorded in or close to this location (NSW Government, 2018).

5.4.2 Potential Impacts

Aboriginal sites are protected under Section 90 of the NPW Act and cannot be knowingly destroyed, defaced or damaged without the consent of the Director-General of the NPWS. The proposed works has the potential to impact on Aboriginal Sites in both the construction and operational phases.

5.4.2.1 Construction Phase

Direct impact of the intersection development on Aboriginal cultural material – the proposed development site is within an area likely to contain heritage items. There is a risk that the development activities could

uncover and damage or disturb Aboriginal cultural material through the movement and clearance of sand, compaction of new access and roadways and construction of buildings.

5.4.2.2 Operational Phase

Beneficial impact on Aborginal heritage and cultural value at Birubi Aboriginal Place and the WCL through the management of access to the site – the information centre will help to manage access and parking in the area reducing the existing pressures of unregulated parking and access on Aborginal heritage and Beneficial impact on Aboriginal heritage and cultural values at Birubi Point and the WCL through the installation of dedicated signage and visitor information regarding Aboriginal heritage in the area – increasing the information available to visitors about the important Aboriginal heritage in the area will help inform visitors about the potential impacts of their activities in the area and reduce damaging activities.

Indirect impact of increased capacity for vehicles and visitor numbers on the Birubi Point Aboriginal Place and WCL cultural values – the proposed development will improve access for vehicles transporting visitors to the WCL and Birubi Point Aboriginal Place as well as supporting the relocation of the existing hub for 4x4 driving tours across the dunes, currently located to the south at the Birubi Point surf club. There is potential that the new intersection will lead to an increase in the number of visitors to the area subsequently increasing the number of vehicles accessing the WCL. An increase in vehicle movements across the WCL could lead to additional damage to cultural material present, for example vehicles driving across middens or accessing protected areas.

5.4.3 Recommended Control Measures

- A visual inspection of the site should be undertaken by a qualified archaeologist to determine the potential of the site to contain Aboriginal cultural material. If heritage sites are identified that cannot be avoided or it is deemed that heritage sites are likely to occur, an Aboriginal Heritage Impact Permit (AHIP) will be required and a new level of assessment necessary, including comprehensive Aboriginal consultation.

- Development of improved signage, interpretation and information on Aboriginal heritage and cultural values of Birubi Point Aboriginal Place and the WCL to be installed and developed at the proposed transport intersection. Improving the information to visitors on the Aboriginal heritage and cultural values of the site will reduce the potential negative impacts of vehicles and visitors accessing the area.

5.5 Traffic and Transport

This section provides an assessment on traffic and transport. A full Transport Assessment has been completed for the project. This assessment is provided in **Appendix C**.

5.5.1 Existing Environment

The Project site is located on the south-east corner of the intersection of Gan Gan Road and the existing beach access road. Gan Gan Road is the main road in the project area and a regional road which intersects with James Paterson Street and the existing beach access road. The road has a speed limit of 50 km/h though it has been designed for 80km/h. There is a shared path for cyclists and pedestrians along south side of Gan Gan Road. There is a bus stop east of intersection of Gan Gan Rd and the Beach Access Road. At this bus stop, council placed a speed hump and the road narrows to reduce speed of motorised traffic. There is a sign indicating a recommended speed of 25 km/h in this location.

James Paterson Street has a 50km/h speed limit and provides access to the residential properties along this street as well as Birubi Point Surf Life Saving Club (SLSC) and the existing tour drop-off/pick-up point

at Birubi Beach. The street has speed bump traffic calming measures and a shared path for cyclists and pedestrians.

Pedestrian Access
Pedestrian accessibility around the proposed development site is generally good with a shared path along Gan Gan Rd, leading to properties and holiday parks along James Paterson St. and retail shops and bus stops in the town.

Cycling infrastructure is provided via the shared paths along Gan Gan Rd and James Paterson St. There are no existing bicycle racks within the proposed development area.

Public and Private Transport
There are bus lines (130, 134 and 135,) connecting Birubi Point to Anna Bay, Nelson Bay and Fingal Bay in the north east and Newcastle to the west.

A large number of tourists visiting the area arrive by coach, on a day trip from Sydney to Port Stephens. These coaches drop off passengers near the Birubi Point SLSC to access the tour drop-off/pick-up point at Birubi beach.

Presently parking is allowed at the following locations:

- On the current Birubi Tourist Location at the beach;
- James Paterson St:
  - In a designated parking area at the Surf Life Saving Club (SLSC) near the headland (known as the Upper Carpark);
  - Along the west side of James Paterson St.
- In a designated parking area of Fitzroy St; and,
- In designated parking for coaches along James Paterson Road and on the Tourist Site at Birubi Beach adjacent to the SLSC (known as the Lower Carpark).

The high numbers of visitors travelling to the area is currently causing a number of traffic related issues. James Paterson Street experiences high volumes of traffic on weekends and public holidays, when the area attracts many tourist and locals. This is currently causing issues with parking and congestion along this road from issues including:

- Reduced capacity due to parking manoeuvres.
- Parked vehicles on the road side leading to reduced road width (in extreme situations leading to parking back to 400 m north of the SLSC).
- Vehicles driving around looking for a free parking space and waiting for a free parking space.

Figure 5.6 shows the existing parking facilities at and around the Birubi Point SLSC and James Paterson Street. It also shows the existing drop off/pick up location for beach/dune tours located to the north east of the SLSC.

Figure 5.7 Existing Parking and Access near Birubi Point Surf LIife Saving Club (source: Nearmap 2015)

5.5.1.1 Traffic Volume Analysis

Traffic count information is available for James Paterson Street and the existing beach access road.

James Paterson Street
Traffic counts were conducted on James Paterson Street during a school holiday, including a long weekend. These counts indicate the current traffic pattern in a relatively busy period.

Traffic count September 2016:

- On an average week day: Between 600-800 motorised vehicles enter James Paterson St
- On an average weekend day: Around 1,200 motorised vehicles enter James Paterson St
- Around 95% of these are passenger cars. On busy days, mainly the amount of cars increase.
- All days: Between 30-40 mini busses (small service trucks) and up to 4 coaches per day
- During weekdays: hourly peak between 12am-1pm with around 80 vehicles per hour
- During weekends: hourly peak later, around 1pm, with up to 120 vehicles per hour
- On a very busy Sunday (school holiday / long weekend): Around 1,700 motorised vehicles enter James Paterson St, leading to parking back to 400 m north of Surf club (and maybe even exceeding).
- On a very busy Sunday: Hourly peak of up to 220 vehicles per hour.
- Most people visit between 8am-3pm.

The traffic volumes indicated in these counts are below the current capacity of James Paterson Street.

The destinations accessible from James Paterson Street are shown in **Figure 5.7** below.

Figure 5.8 Destinations along James Paterson St. (Source: Google Maps, 2018).

It is not known which part of the vehicles counted on James Paterson Street belong to residents, visitors to the beach, the SLSC, the restaurant, the holiday park or tourists visiting activities at Birubi Beach. It can be assumed that the majority of the mini busses (small service trucks) and coaches recorded are heading to Birubi Point for tours. These vehicles will be redirected to the proposed location of the new information centre.

Existing Beach Access Road

There are two traffic counts available for the existing beach access road. These were undertaken in 2012 and 2014 and the results displayed in **Figure 5.8**.

The traffic counts indicate that:

- During weekdays around 200 per day drive on the beach access road (total of both directions)
- During weekends the daily amount of vehicles is around 400 per day
- During Autumn and Winter months (April – June) these numbers decrease to around 10 on weekdays and 50 in weekends.
- In the last week of December 2011 there were higher traffic densities, with over 1,500 vehicles on the peak day and densities up to 1,000 vehicles the days before. There might have been an event at the beach.
- The vehicles counted on the beach access road are probably 4WD vehicles, as the road is unpaved and leads to the beach.

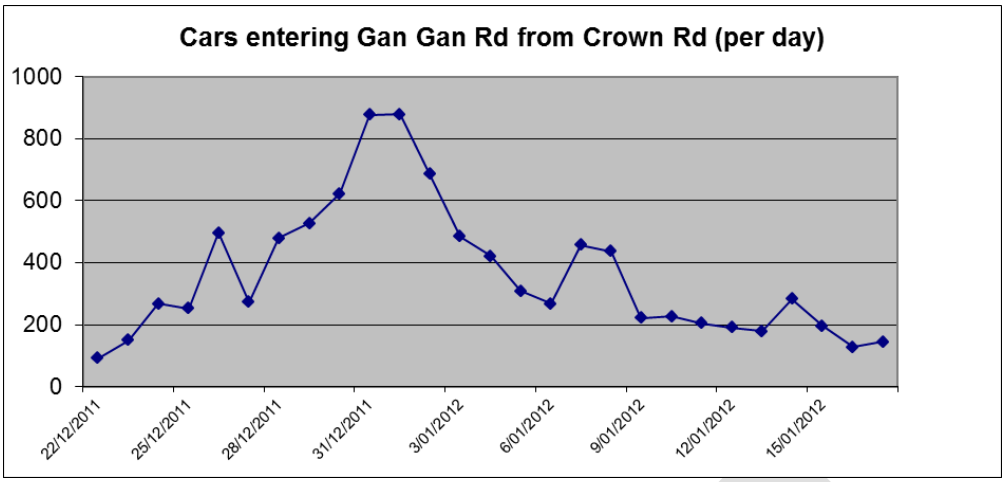


Figure 5.9 Traffic density at the beach access road in December 2011 – January 2012 (direction towards Gan Gan Rd)

5.5.2 Potential Impacts

5.5.2.1 Construction Phase

As the new site for the proposed information centre is at a location set back from the main roads, the construction phase is unlikely to affect the traffic and parking situation at James Paterson Street. Upgrading the intersection between Gan Gan Road and the existing beach access road and upgrading the surface of the existing beach access road (from a track to a paved road) will also be undertaken as part of the proposed development.

Construction traffic will have the following potential effects:

- Localised changes to traffic conditions to support construction of the entry to the information centre on the beach access road, and road works on the beach access road.
- Minor increase in traffic, including heavy vehicles due to construction traffic and workers.
- Temporary road closures and diversions due to paving the existing beach access road, and upgrading the intersection with Gan Gan Road. This will include the addition of a right turning lane from Gan Gan Road into the existing beach access road. The road closures and traffic diversions would be coordinated with RMS and the Transport Management Centre and undertaken at appropriate times which will minimise the impact to road users and existing bus services.
- Minor increases in traffic along Gan Gan Road, including heavy vehicles, due to construction traffic and workers.

A detailed construction methodology and associated management plans could be developed during the detailed design phase of the proposal to manage impacts.

5.5.2.2 Operational Phase

The project aims to redirect Birubi tourist traffic from James Paterson Street to the information centre along Gan Gan Road. The coaches currently heading to the parking facilities at the SLSC will be redirected to the new information centre. This will reduce the number of vehicles currently using James Paterson Street.

Passenger vehicles belonging to residents or heading for amenities along James Paterson Street, for example, Birubi Point SLSC, the restaurant, the holiday park or the beach (surfers), are likely to continue to use parking facilities accessed along, or from, James Patterson Street.

When assuming that 50% of the passenger cars are heading to the tourist activities at the beach , this will mean that on a weekend during a peak hour (between 12am-2pm) around 60 vehicles per hour will enter the information centre (based on the traffic count in September 2016: 50% of 120 vehicles per hour). This is around one vehicle per minute. On extremely busy days this hourly density can increase up to twice this amount. This would lead to a vehicle entering the interchange every 30 seconds (120 vehicles per hour). This density of vehicles should not lead to traffic congestion at the information centre.

The creation of the information centre should have a positive effect on James Paterson Street by reducing the number of parked cars and coaches on the road side and reducing the traffic driving down this street. This in turn, will lead to a decrease of parking related congestion on James Paterson Street.

The development of the information centre will have a beneficial effect on James Paterson Street by reducing the number of cars and coaches accessing and parking on this street. This in turn should lead to a decrease in parking related congestion on James Paterson Street.

The development of the information centre will increase vehicle traffic on the existing beach access road as well as increasing movements of 4WD vehicles between the information centre, the dunes and the beach. This increased volume of traffic is, however, below the capacity of the existing beach access road and unlikely to lead to congestion.

The development of the information centre is likely to have a minimal impact on traffic flow at Gan Gan Road. The current road capacity of Gan Gan Road is sufficient to handle the redirected traffic. In addition to this, the largest share of this traffic is currently already driving via Gan Gan Road and will turn into the existing beach access road instead of James Paterson Road.

In extreme situations, when all parking places at the new information centre are occupied, there is a chance that traffic congestion at the parking area of the interchange will lead to a queue along the beach access road back to Gan Gan Road.

The development of the information centre is likely to have a positive effect on access for pedestrians and cyclists (Active Transport), as James Paterson Street is their main access to the beach and will be less congested. This should lead to a more pleasant environment in which to walk and cycle. The information centre will be designed taking into account the needs of pedestrians and cyclists with existing shared pedestrian/cycling paths extended to access the site.

The development of the information centre is likely to have a positive effect on public transport access as the centre will be located closer to existing bus stops.

5.5.3 Recommended Control Measures

- Dynamic road signage at Gan Gan Road when the carpark at the interchange is full. This would be to prevent traffic from Gan Gan Road to enter the existing beach access road, which could lead to congestion at the interchange.
- Traffic regulators on extremely busy days to prevent traffic from Gan Gan Road entering the existing beach access road when the carpark at the interchange is full. If possible they would redirect traffic to an alternative location.

- Throughout construction, deliveries and movements of construction vehicles would be planned to minimise impacts. All construction vehicles would access and egress the construction site via the beach access road. Construction parking can be organised on the project site and along Crown Rd.
- During the road works on the intersection, the contractor could provide for an alternative route via Old Main Road.

5.6 Water Quality and Stormwater

This section of the SoEE addresses the impact of the proposed development on water quality, hydrology and stormwater quantity. In addition, the conformance with the Port Stephens Development Consent Plan (DCP) is also assessed.

A Water Management Plan has been prepared which considers surface water and groundwater, including both water quality and water balance. However its main focus is water sensitive urban design (WSUD), while a separate stormwater drainage plan covers drainage and on-site detention.

The Water Management Plan and conceptual drainage plan are presented in **Appendix D**. The drainage plan has been informed from the stormwater assessment presented below.

5.6.1 Existing Environment

The proposed information centre is located in a sensitive coastal environment with a complex topography created by mobile sand dunes. The site is currently undeveloped with rainfall either infiltrating into the sandy soil or as runoff via ephemeral drainage lines. There are no constructed drainage structures on the site. The mean average rainfall taken from the Nelson Bay rain gauge (11km from the site) is 1,346mm/year.

The existing site catchments are shown in **Figure 5.9** with the catchment properties summarised in Table 5.1.

Table 5.2 Existing Catchment Properties

Catchment	Area, ha	Drains to
A	11.87	Gan Gan Road to the north of the site
B	4.69	Private property to the south-west of the site
C	1.12	Stockton Beach to the south of the site

Catchment A, which represents two thirds of the site, drains to the north where stormwater pits on Gan Gan Road and James Paterson Street accept surface flows.

Catchment B drains to the south-east and into private properties along James Paterson Street. Nos 4, 6, and 8 James Paterson Street are located immediately adjacent to the site.

Catchment C drains to the south-west and onto Stockton Beach.

The geology and soil characteristics exhibit high infiltration rates, resulting in a relatively low rainfall runoff (as described further later). Hydrologic Soil Mapping data for Port Stephens was reviewed. The mapping demonstrates that the soils at the site have been classified as 'Group A' — soils having high infiltration

rates, even when thoroughly wetted and consisting chiefly of deep, well to excessively-drained sands or gravels. These soils have a high rate of water transmission. For design purposes, it is assumed that the Antecedent Moisture Condition is "Rather wet" (refer to Australian Rainfall and Runoff (ARR) 2016, 'Table 5.3.11') and the Horton Maximum (Initial) Infiltration Rate is 83.6 mm/hr, the Minimum (Final) Infiltration Rate is 25 mm/hr and the Shape Factor/Decay Rate k is 2mm /hour (refer ARR 2016, 'Table 5.3.12').

Rainfall runoff analysis is described below and includes estimated peak runoff rates under the existing conditions.

Requirements of the DCP

Relevant extracts of the DCP referring to drainage are presented below:

B4.1	***Development*** that applies to this Part is to provide a ***stormwater drainage plan*** and a written description of the proposed drainage system within the ***SEE*** **Note:** C1.H also provides drainage requirements for ***development*** relating to ***subdivision*** **Note:** Hydrological/hydraulic calculations and designs shall be prepared in accordance with the approaches outlined in the current ***Australian Rainfall and Runoff*** Guidelines using the current Hydrologic Soil Mapping data for Port Stephens available from Council. Other current Australian published design guides may also be applied to particular design situations.
B4.2	***On-site detention*** / ***on-site infiltration*** is required where: • the post-development flow rate or volume exceeds the pre-development flow rate or volume; or • ***impervious surfaces*** exceed the total percentage of ***site area*** listed under Figure BD (p. B-29); or • it is identified under Section D Specific Areas of the ***PSDCP 2014***; or • the stormwater catchment is identified to have stormwater issues.
B4.3	***On-site detention*** / ***on-site infiltration*** is to be: • sized so that the post-development flow rate and volume equals the predevelopment flow rate and volume for all storm events up to and including the ***1% Annual Exceedance Probability (AEP)*** storm event • provided by either underground chambers, surface storage or a combination of the two and are generally positioned: - under grassed areas for any ***cellular system*** (which can be easily maintained) - under hardstand areas such as ***driveways*** for any concrete tank structures **Note:** A ***Neutral or Beneficial Effect (NorBE)*** on water quality must be designed for all storm events.
B4.4	Details of the ***on-site detention*** / ***on-site infiltration*** concept design must be provided in the ***stormwater drainage plan*** and the written description and must include information on: • the location and type of detention / infiltration system • demonstrated flow rate / volume for all design storm events up to the ***1% AEP*** • pipes, pits, ***overland flow*** and discharge point • surface grates and maintenance access points • orifice type, location and screening facility • slope/gradient of the land • post-development flow rate and volume for the site equal to pre-development flow rate and volume for the site

There are no rivers, lakes or estuaries within 40m of the proposed development site. There are a number of indistinct ephemeral watercourses which are indicated by the blue arrows on **Figure 5.9**.

Figure 5.10 Existing Surface Water Catchments and Ephemeral Watercourses

Immediately adjacent to the east of the site is the Stockton Sandbeds Special Area which has been defined by Hunter Water and protects an unconfined sand aquifer extending from Fullerton Cove to Anna Bay (see **Figure 5.10**). Water is not currently extracted from this aquifer but it would be used by Hunter Water in the event of a water shortage. The proposed development site is outside of this area, however, there is potentially some connection between groundwater on the site and the Stockton Sandbeds system.

Figure 5.11 Stockton Sandbeds Special Area

Currently the site has no water service, however there are existing water mains in the immediate vicinity of the site (detailed below and shown in **Figure 5.11**):

- Immediately adjacent to the site boundary in James Paterson Street (100 mm AC)
- Opposite the proposed site entrance in Old Main Road south of Gan Gan Road (150 mm PVC).
- There is also a 300 mm PVC water main along the western part of Gan Gan Road and Old Main Road.

Figure 5.12 Water Services in Vicinity of the SIte

There are also existing sewer mains in the immediate vicinity of the site: there is a 150 mm main running along Gan Gan Road, as shown in **Figure 5.12**.

Figure 5.13 Sewer Services in Vicinity of the Site.

Hydrological Assessment

A hydrological/hydraulic assessment (and resulting conceptual drainage design) has been prepared in accordance with the approaches outlined in Australian Rainfall and Runoff Guidelines using the current Hydrologic Soil Mapping data for Port Stephens (mentioned above).

The site is 17,392 m^2 (1.73ha) and solely pervious with nearly 100% infiltration capacity. The proposed development would increase the impervious area from zero to 9,350m^2 (0.935ha) impervious, approximately 50% of the total site area. Part of the proposed development site would remain undisturbed (hence pervious). This undisturbed area has been discounted from the impact assessment. Hydrological assessment was undertaken using the XP-RAFTS hydrological model. The to-be disturbed catchment area was modelled for the existing conditions and proposed conditions. Once the increase in peak runoff was determined, on-site detention (OSD) was sized to ensure post development peak runoff does not exceed pre development runoff.

Key parameters used in the hydrological modelling are presented below:

	IL	CL
Pervious surfaces	35 IL*	25mm/hr CL
Impervious	1 mm / hr	0mm / hr

***maximum value recommended by ARR 1987, as per the Anna Bay Flood Study**

IFD values and coefficients were adopted from the BoM IFD charts. The model was run for the 100 year ARI. A range of storm durations were run to determine the critical duration, noting that the critical duration may be different for the pre, post and post with OSD scenarios.

For the purposes of assessment, the area proposed to be disturbed was changed from a pervious surface to impervious surface. Resulting peak runoff for pre and post development scenarios are presented in **Figures 5.13** and **5.14** below.

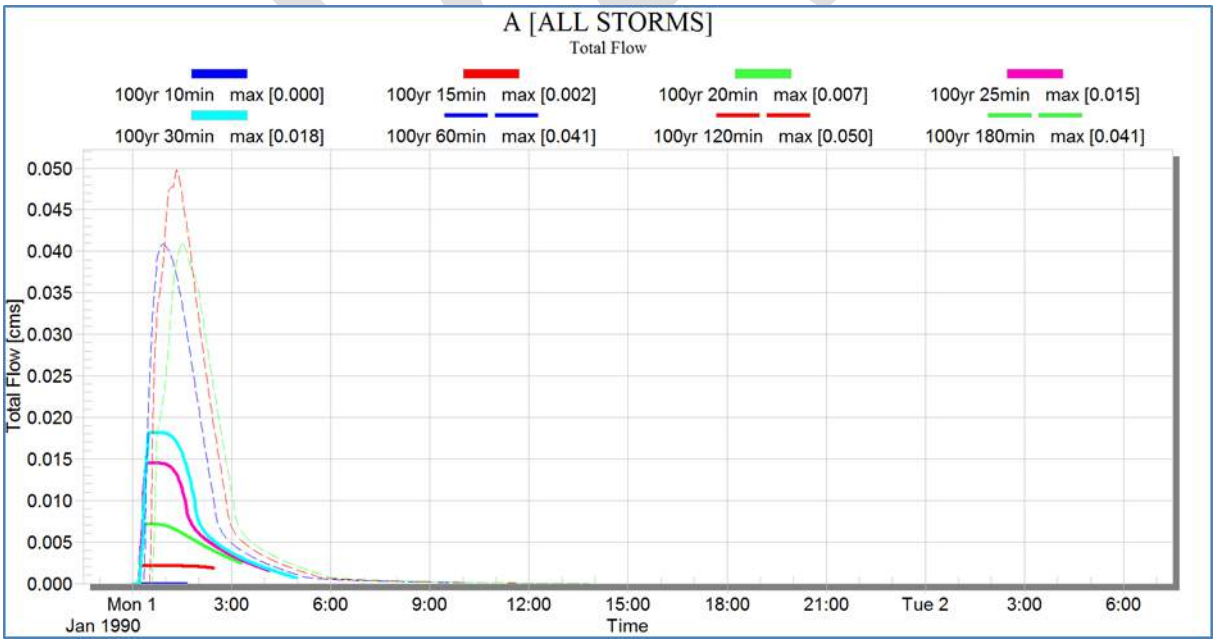


Figure 5.14 Pre Development Peak Runoff

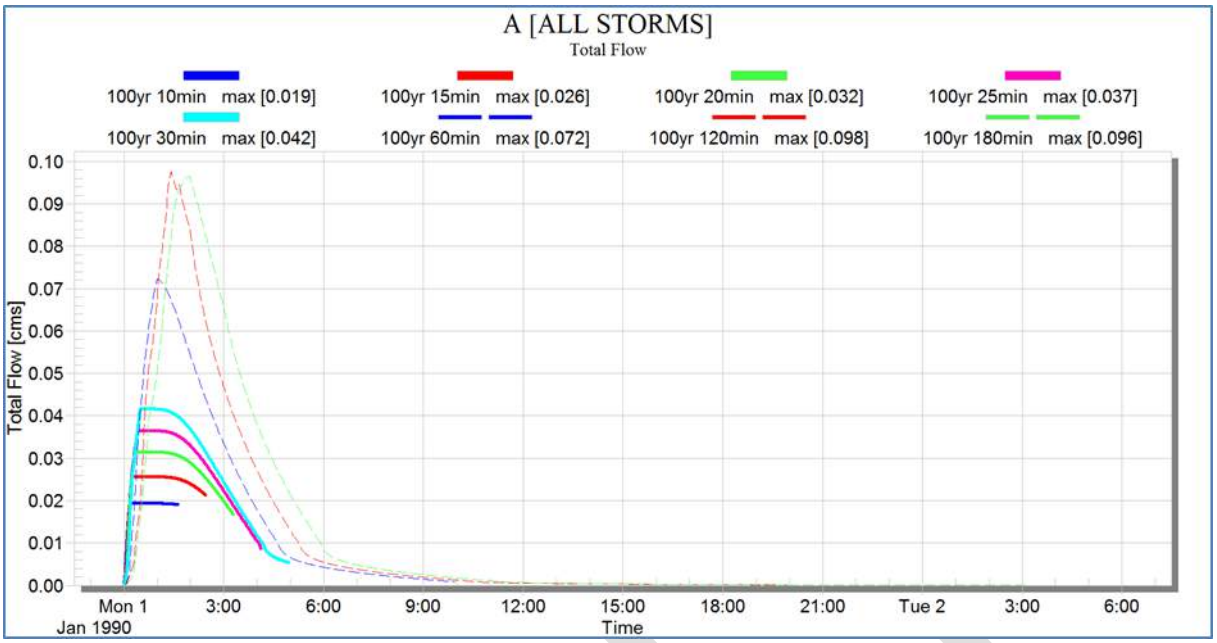


Figure 5.15 Post Development Peak Runoff

As is demonstrated by the above results, the peak runoff from the site in the 100 year ARI is estimated to increase from 0.05m^3/s to 0.1m^3/s.

The required OSD was determined using the hydrological model, using an open retarding basin. Key features of the proposed retarding basin, as simulated in the hydrological model include a peak storage volume of 800m^3 above any standing water level, a 125mm diameter low-flow outlet pipe, and spillway 1.0m above the low flow invert. Results with the retarding basin incorporated are presented in **Figure 5.15** below.

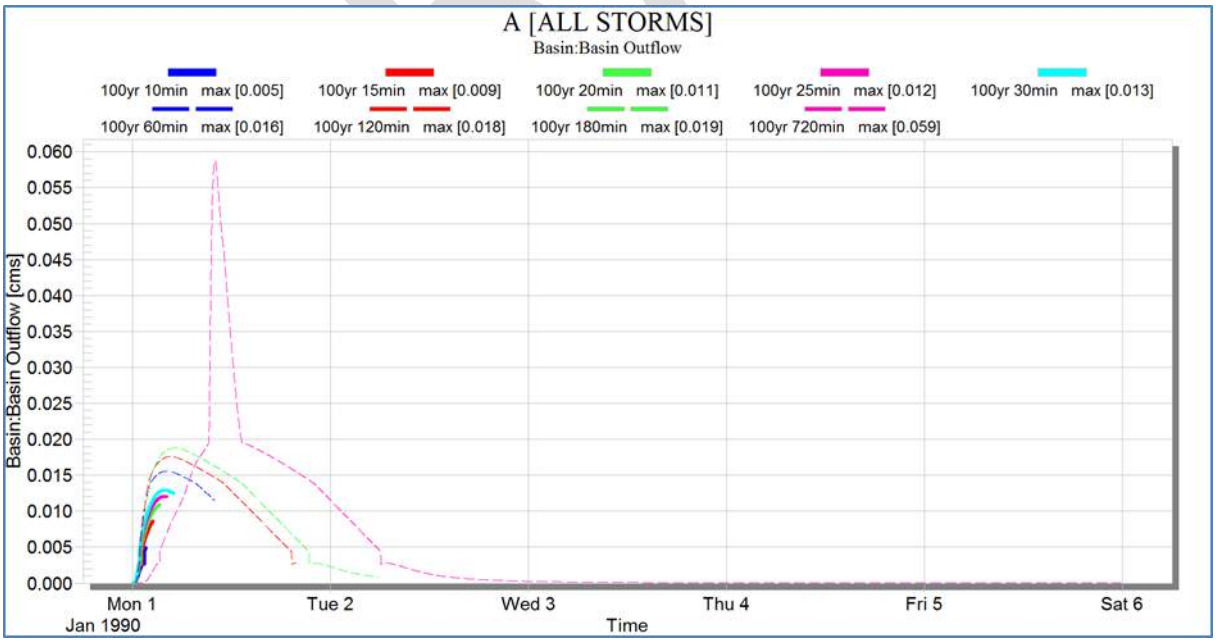


Figure 5.16 Post Development Peak Runoff with Retarding Basin Incorporated in the Design

5.6.2 Potential Impacts

Compaction of material for roadways and parking and the construction of hardstanding for buildings and facilities has the potential to reduce the rate of rainwater infiltration into the sand and increase surface runoff. As is demonstrated from the hydrological assessment documented above, rainfall runoff is estimated to increase from a peak of 0.50m^3/s to 0.10m^3/s.

There is potential for minor fuel spills and leaks from vehicles using the site to affect the water quality of groundwater in the area. Fuel or oil could seep into the ground and be washed into ground or surface water following rainfall. There is a risk that this could affect the protected Stockton Sands aquifer.

Newly constructed facilities and buildings will require a mains water source and suitable disposal of wastewater. Port Stephens Council's Development Control Plan (DCP) 2014 Chapter B4 covers drainage and water quality. This chapter applies to the proposed transport intersection as it will increase impervious surfaces and drains to the public drainage system. Before water is released into public drainage it must achieve Council's water quality stripping targets:

- Total nitrogen retention post-development load: 45%
- Total phosphorus retention post-development load: 60%
- Total suspended solids post-development load: 90%
- Gross pollutants post-development load: 90%ange development, as it increases impervious surfaces and drains to the public drainage system.

5.6.3 Recommended Control Measures

The following elements to be included in the design of the Birubi Point Information Centre, in order to meet Port Stephens Council's water quality targets:

- Rainwater tank: minimum 50 kL tank collecting roof runoff from the proposed building and supplying toilet flushing demands in the proposed facility.
- Wetland: including a 100 m3 inlet pond and 500 sqm macrophyte zone. Where possible, car park runoff should be pre-treated in swales before it reaches the wetland. This could improve the performance of the wetland and reduce the wetland area required to meet the water quality targets.
- The negative impacts of increased runoff are proposed to be mitigated using OSD in the form of a retarding basin. The retarding basin has been sized appropriately to ensure that the peak runoff in the 100 year ARI does not exceed pre-development values. In all storms other than the 9hr storm, peak runoff is reduced when compared to the existing situation.
- On site detention/infiltration should be sized so that post development flow rate and volume equals the pre-development flow rate and volume for all storm events up to and including the 1% Annual Exceedance Probability (AEP) storm event. While infiltration can be encouraged in the sandy soils, stormwater runoff should be pre-treated prior to infiltration, to protect groundwater quality.
- Water quality modelling (e.g. MUSIC modelling) to be undertaken to demonstrate compliance with Council's water quality targets.

5.7 Noise and Vibration

5.7.1 Existing Environment

The closest sensitive receptors for noise are the residential areas immediately adjacent to the proposed development site along James Paterson Street and Gan Gan Road. The residences on the western side of James Paterson Street have gardens that directly back onto the proposed site at a distance of 10m at the closest point. The existing acoustic environment surrounding the site is influenced by road traffic, recreational users, and ocean waves.

5.7.2 Potential Impacts

5.7.2.1 Construction Phase

Works will be undertaken during the standard construction hours where practicable (i.e. 7.00 am to 5.00 pm Monday to Friday and 7.00 am to 1.00 pm Saturdays, with no work to be undertaken on Sundays and Public Holidays). However on occasion works may be required outside of the standard hours to meet the tide conditions and to allow for the works to be delivered before the peak summer period. Where works are required outside of the standard hours, notification will be undertaken in accordance with a Communications Plan to be prepared by Council.

The proposed land clearance works will involve use of plant and machinery to clear sand and level the ground for the Transport Intersection. Given the proximity of the residences with the proposed works there is likely to be an impact of construction noise on a number of the residences along James Paterson Street. There is a tourist development to the north west of the proposed site. This is currently under construction however depending on construction timeframes there is potential for noise impacts on those staying in/visiting this property. There is also a potential impact of construction noise on recreational users of the beach in this area.

5.7.2.2 Operational Phase

During the operational phase the transport hub will receive cars and busses. There will be a certain level of noise from moving vehicles and visitors using the transport intersection. This is likely to impact on the residences along James Paterson Street that immediately adjoin the site. There is also the potential for impact on the tourist development to the north of the site and recreational users of the beach in this area.

5.7.3 Recommended Control Measures

- Construction times to be limited to standard construction hours (7.00 am to 5.00 pm Monday to Friday and 7.00 am to 1.00 pm Saturdays, with no work to be undertaken on Sundays and Public Holidays);
- A construction noise management plan should be included within a Construction Environmental Management Plan (CEMP);
- Surrounding residences, beach users and businesses should be notified of the proposed works and hours of operation;
- A Council contact should be provided for the works in the event of any complaints; and
- Instructions should be issued to the Contractor that appropriate silencers are to be fitted on all plant and equipment where possible.

5.8 Visual Impacts

5.8.1 Existing Environment

The proposed development site is characterised by low lying wind-blown sand deposits with scattered colonisation of shrub vegetation throughout the middle of the site and denser areas of vegetation to the east of the site. The site is immediately adjacent to Gan Gan Road and borders a number of residential properties to the East and a commercial development site to the North West.

The proposed site is currently well screened from the beach and roadways by these areas of fairly dense vegetation which form a boundary between James Paterson Street and the sand dunes of the WCL. There are 4 residential properties which directly back onto the proposed development site. The gardens of these properties are screened from the site by this band of vegetation.

There is minimal vegetation to the North West boundary of the site along the existing beach access road. This gives open sight lines to the commercial development site on the opposite side of the beach access road.

Figure 5.16 shows recent aerial imagery of the proposed development site and provides an indication of the existing setting, landscape and aspect of the proposed development site.

Figure 5.17 Existing environment and Surrounds of Proposed Development Area

5.8.2 Potential Impacts

5.8.2.1 Construction Phase

The construction works are expected to cause minimal and temporary impact on the visual amenity of the site and adjacent areas and would be in keeping with the current visual amenity of the under construction development to the north east of the site. Impacts would be in the form of earthworks, the presence of vehicles, plant, equipment and temporary stockpiling of materials.

There is potential for increased amounts of sand and sediment to mobilise during the construction phase. As vegetation is removed there is potential for sediment to become less stable and mobilise/drift in the wind impacting gardens, residences or roadways.

5.8.2.2 Operational Phase

The new transport intersection will lead to the removal of some areas of existing vegetation at the site. Established areas of vegetation will be retained wherever possible and replanting will be undertaken with native species to improve visual amenity and provide additional screening (see drawings in **Appendix A**).

New buildings for the information centre and operator kiosks will be low level and designed to be sympathetic to the existing landscape. The concept design for the Information Centre is shown below in **Figure 5.18**.

Figure 5.18 Example of similar low level building sympathetic to existing landscape

5.8.3 Recommended Control Measures

- Existing dense areas of vegetation along the Eastern boundary of the site should be retained as far as possible to maintain screening from the residential areas along James Paterson Street and Gan Gan Road.
- Construction works to be completed in the shortest possible timeframe to minimise construction impacts.
- All plant and equipment to be kept to a minimal area and to be retained within the site compound outside of construction hours.
- The site would be kept tidy at all times. Any floating or windblown debris would be collected as soon as practicable.
- Any temporary stockpiles of material would be damped down with water or covered as appropriate to prevent re-mobilisation of material.

- Additional planting of native vegetation will be undertaken to provide screening of the constructed development and minimise drift of sand and sediment in the prevailing wind.

5.9 Public Access and Safety

The proposed development site lies to the South east of the beach access road from Gan Gan road into the Worimi Conservation Lands (WCL) dunes. The Birubi Point SLSC is to the south of the site and used for access to the beach for recreational users including 4x4 driving/tours, surfing and other recreational beach activities.

There is currently no barrier to accessing the proposed development site from the beach access road or north from the SLSC. There are a number of unofficial beach access routes extending through the proposed development site from the residential gardens along James Paterson St.

The proposed development site is on land which is classified as bushfire prone. Approximately 50% of the site is classified as Vegetation Category 1 and 50% as Vegetation Buffer.

5.9.1 Construction Phase

The construction site is on land currently accessible to the public from the beach, road and private residences. There is a risk of construction works temporarily impacting on the public and recreational users accessing this area.

5.9.2 Operational Phase

The proposed information centre, once completed, will provide new public access to the WCL dunes. This will redirect many users of the existing public access at the Birubi Point SLSC to the new information centre where there will be improved parking and public facilities.

The pick up location for 4x4 tours will be relocated to the new information centre again reducing the number of people accessing the WCL dunes from the SLSC car park.

The informal residential access to the beach and dunes may be impacted by the operation of the proposed information centre.

It is likely that the improvements in parking and facilities will lead to an increase in public access to the area over time. This will lead to an increase in traffic using the junction with the existing beach access road.

Much of the vegetation on the site will be retained following development and the site will remain bushfire prone. Planning law in NSW requires new development on bush fire prone land to comply with the provisions of Planning for Bush Fire Protection 2006 and must be designed to improve the survivability of the development and the occupants that are exposed to a bush fire hazard.

5.9.3 Recommended Control Measures

- Landowners and recreational users to be notified in advance of the proposed works.
- The perimeter of the construction site to be fenced and secured with site safety fencing to prevent public access during the works.
- Improvements to be made to the junction of the existing beach access road from Gan Gan road to allow for increase in vehicle use (see Section 5.4 Traffic and Transport).

- New signage to be put in place on roads and access to direct and inform users of the intersection and new access.
- A bushfire assessment report will be prepared to prevent and mitigate for the impact of bushfire on the proposed development by ensuring bushfire protection measures are integrated into the design and siting. The assessment report determines the suitability of a proposal with regards to bushfire through consideration of the requirements contained within the Planning for Bush Fire Protection 2006 document prepared by the Rural Fire Service.

5.10 Waste Management

5.10.1 Existing Environment

The proposed development site is currently undeveloped and there are no existing waste management facilities on the site. The site is accessible from the existing beach access road.

5.10.2 Potential Impacts

Construction
In general, waste will only be generated by demolition and excavation material that is deemed unsuitable for reuse. The proposed works may generate the following waste during construction:

- Excavated fill material unsuitable for reuse;
- Green waste including grasses and small trees or shrubs; and
- General construction waste.

Operation
Waste will be generated from the Information Centre, kiosks and visitors using the site once it is operational.

5.10.3 Recommended Control Measures

- A waste management plan is required for development involving on-site construction works that details the following:
  - Volume and type of waste
  - Storage and treatment of waste
  - Disposal of residual material
- Waste should be managed in accordance with the philosophy of the waste minimisation hierarchy as follows:
  - Avoidance, where possible;
  - Treated, as required and reused onsite;
  - Recycled, either within the site or offsite; and
  - Where other alternatives are not possible, wastes should be disposed of at appropriately licensed waste management facilities.
- Maximise reuse and recycling of all general construction waste.
- Appropriate training on the management of waste should be provided to all workers onsite.
- During operation it is recommended to use 12 x 240 litre wheelie bins for recycling and waste which can be locked in a well ventilated room/lock up cage overnight. Operators will wheel the bins out each day for use by site users and visitors.

- A bay should be provided for 2 x 3 cubic metre skips, one for waste and one for recycling, near the car park area. This should be well screened in the landscaping plan. Skips should be lockable to prevent access afterhours and illegal dumping of waste.

6 Environmental Management and Control Measures

A site-specific construction environmental management plan (CEMP) should be prepared by the Contractor and approved by Council prior to commencement of construction. The Contractor would implement the CEMP during the construction works for the Information Centre and would be responsible for selecting appropriate control measures for the potential impacts identified in this SEE. The CEMP would ensure that:

- Appropriate control measures for the potential impacts are implemented on the site;
- Activities are carried out with due diligence; and
- All activities comply with relevant environmental legislation including conditions of approval, Acts and Regulations, and Standards and Best Management Practices.

A contamination management plan and acid sulfate soil management plan should form part of the CEMP.

With the implementation of the CEMP environmental controls there would not be expected to be significant environmental impacts during construction.

7 Conclusions

Port Stephen's Council is seeking to develop a new Information centre on Lot 312 DP753024 at Anna Bay, NSW.

The proposed works are to be undertaken under Part 4 of the EP&A Act. This SEE has been prepared to support the development application for these works.

In general, the proposed development is expected to have an environmental benefit on the surrounding area by improving the management of transport and visitors and reducing current pressure on the important heritage and ecological values of the area. Where potential environmental impacts have been identified, either during construction works or operation of the Information Centre, control measures are recommended to avoid or minimise these impacts.

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Appendix A - Architectural Drawings

Appendix B - Biodiversity Assessment Report

Appendix C - Transport Report

Appendix D - Birubi Water Strategy and Conceptual Stormwater Drainage Plan

REPORT

Birubi Point Transport Interchange

Statement of Environmental Effects

Client: McGregor Coxall

Reference: M&ANAR001D0.1

Revision: 0.1/Final

Date: 05/10/2018

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Enhancing Society Together

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Author(s):	Miriam Knollys, Alex van Gent
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Appendices

1 Introduction

1.1 Overview

Haskoning Australia Pty Ltd, a company of Royal HaskoningDHV (RHDHV), was commissioned by McGregor Coxall Pty Ltd to provide transport and civil engineering services for the development of an Information Centre at Birubi Point, New South Wales (NSW). This site is immediately adjacent to the Stockton Bight sand dunes (Worimi Conservation Lands (WCL)) a popular destination for domestic and international visitors (**Figure 1.1**).

As a component of these services, RHDHV has prepared a Statement of Environmental Effects (SoEE) for the Development Application (DA) for the proposed works.

This report herein details the environmental assessment for the development of the Information Centre. This SoEE considers the impact of the proposed works on both the natural and built environments, and the proposed methods of mitigating any adverse effects.

1.2 Background

The WCL (Stockton Bight Sand Dunes) cover 4,200 ha along the NSW coast and include 32km of the longest moving sand dunes in the southern hemisphere. The dunes can reach heights of over 40m with slopes up to 60 degrees and are shaped by continuous processes of coastal erosion, coastal recession and wind-blown transport of sand. Birubi Point lies at the interface of the mobile sand dunes and the rocky coastline of Tomaree it is also the interface between the natural landscape and built environment and a key gateway to the WCL.

The WCL and Birubi Point are important for Aboriginal culture and heritage. Birubi Point is a designated Aboriginal Place under the National Parks and Wildlife (NPW) Act 1974 and the WCL is known to contain a large number of Aboriginal Sites. Both Birubi Point and the WCL are part of a large area of land considered Worimi Country and under traditional custodian of the Worimi People.

Birubi Point is internationally recognised for its landscape and is a popular destination for outdoor recreation and tourism as well as cultural heritage experiences. Activities include; 4x4 driving, recreational fishing, surfing, horse/camel riding and family based recreation. Accessing Stockton Beach is a key experience for most visitors to the area with the majority of visitors relying on 4x4 vehicles for access.

The majority of visitors currently access Stockton Beach at the Birubi Point Surf Life Saving Club (SLSC) at the southern end of James Patterson Street. There is a car park (known locally as the top car park), restaurant and direct beach access at the SLSC. Local tour operates have their stalls at the access to the beach and there is additional parking for vehicles at this location (known locally as the bottom car park) which is used as a meeting point and starting location for tours, including; 4x4, horse and camel riding (**Figure 1.2**).

The demand for sand dune adventure tourism is increasing and more and more visitors are coming into the area each year. This increase in visitor numbers is leading to traffic congestion and unregulated vehicle/pedestrian access at Birubi Point and, in particular, along James Patterson Street. This is putting increasing pressure on the Aboriginal archaeological heritage and cultural values of the area, as well as leading to ecological damage and affecting the overall experience of visitors to the site.

McGregor Coxall is working on behalf of Port Stephen's Council to design an Information Centre which will provide a new gateway for visitors to the WCL. The aim of the Information Centre is to create a new

central hub for visitors coming into the area, relocating the existing meeting point for tour operators from the beach access at James Patterson Street and reducing traffic and parking congestion on the headland. It is also an opportunity to carefully design an integrated gateway to the WCL and Birubi Point to retain the scenic value and sense of arrival that attracts visitors to the area.

The proposed Information Centre would be accessed from the existing beach access road off Gan Gan Road and would provide 1,325m^2 of sheltered space, space for dune operators and amenities, including public toilets and a kiosk. The site will provide an additional 50 car parking spaces, including 3 disabled spaces, 10 coach parking spaces with a drop-off zone that can accommodate 2 coaches, and provisions for pedestrians and cyclists. A new junction will be developed at the intersection of Gan Gan Road and the existing beach access road to manage the flow of traffic into the Information Centre (**Figure 1.3**).

Figure 1.1 Site Location (Google Earth 2018)

Figure 1.2 Birubi Point Surf Life Saving Club and Beach Access with Existing Area of Use for Tour Operators

Figure 1.3 Proposed Information Centre Layout and Design

2 Project Proposal

2.1 General

On behalf of Port Stephens Council, an Information Centre is proposed for the subject site, Lot 312 DP753024. This site has been identified through a process of master planning and community engagement. It is located on Crown Land in a RU2 zone, adjacent to E2 and RE1 lands (see **Table 2.1**) and the Birubi Point Aboriginal Place. The site is a disturbed area of dune landscape that is framed by vegetation along Gan Gan Road and James Paterson Road. Works will also be required to the road immediately adjacent to this Lot to upgrade the road junction at Gan Gan Road and the existing beach access road which will provide access into the new Information Centre.

The existing tour operator location near the SLSC will be relocated to the Information Centre where additional facilities and parking would be provided. The beach car park (bottom car park) next to the SLSC would be retained but would no longer be used by the tour operators as a meeting point.

The proposed Information Centre has been designed as a functional asset that would resolve current parking and congestion issues around visitor activity at Birubi Point. The project site would comprise of 1500m^2 of sheltered area and would provide space for dune operators and amenities, including public toilets and a kiosk. A new road junction would be created at the turning off Gan Gan road to allow access to the site which would have 54 car parking spaces, including 3 disabled spaces, 8 coach parking spaces with a drop-off zone that would accommodate 2 coaches and provisions for pedestrians and cyclists. Signs and landscape markers would identify the land as the entrance to the WCL.

The proposal includes site specific Architecture and Landscape design that is integrated with sustainable water solutions. Heritage considerations, traffic management and an ecological assessment have also been incorporated into the proposed outcome. The site would be managed by Port Stephens Council in collaboration with the Birubi Point Cultural Heritage Advisory Panel (BPCHP).

2.2 Justification of Proposed Works

Tourism plays a large part in the economy within Port Stephens Council Local Government Area with the WCL at the centre of this industry. The sand dunes within the Birubi Point Aboriginal Place and the WCL attract thousands of visitors to the area each year. However, at present the existing infrastructure in the area is not sufficient to cope with the high numbers of visitors which is causing increasing negative impacts on the experience and ecology of the area.

The Information Centre is required to address some of the key issues in the area including; traffic congestion at Birubi Point headland and James Patterson Street, lack of parking spaces, provision of amenities for visitors and tourist information. The development of the new Information Centre would help to alleviate some of the pressures on the surrounding area by re-directing a proportion of the visitor traffic currently using James Patterson Street to the new Information Centre off Gan Gan Road. The Information Centre will provide a new central point for accessing local tours, provide a dedicated space for tour operators to work out of, include an Information Centre for tourists and provide appropriate facilities for visitors including parking, toilets and rubbish/recycling bins. The provision of this dedicated facility would help to reduce some of the negative environmental and social impacts associated with the increasingly high numbers of visitors coming to the area.

2.3 Proposed Works

The proposed works would comprise sand removal and levelling of the ground at the proposed development site. Excavated sand would be removed off site and recycled at an appropriate facility where possible and depending on ground investigation work to determine suitability for re-use. A sediment fence would be installed along the western boundary of the site with planting of native species on either side to stabilise the fence and provide screening. Once established with vegetation, the fencing would create a buffer for the Information Centre from the prevailing winds and sand drift.

The road base within the project site would be compacted and paved in high use areas using a permeable paving. Site won material would be used to form pavements and walkways alongside the road. The site would have 54 car parking spaces, including 3 disabled spaces, 8 coach parking spaces with a drop-off zone that can accommodate 2 coaches, and provisions for pedestrians and cyclists.

The access road from the Gan Gan Road junction to the project site would be constructed along the existing beach access track and paved with permeable paving in the same way as the project site. The shared cycle/pedestrian path would be continued from Gan Gan Road along this road and to the Information Centre.

Buildings and signage will be constructed following completion of civil engineering works. In total, the constructed buildings would create a covered area of 1500m^2. Signs and landscape markers would identify the land as the entrance to the WCL.

Landscaping would be undertaken across the site using native species. Planting will include the creation of a wetland area for naturally managing site drainage.

Architectural drawings for the proposed development are set out in **Appendix A.** Recommendations regarding transport design and engineering are detailed in **Appendix B**.

2.4 Alternatives Considered

2.4.1 Do Nothing Option

The Do Nothing Option was not considered to be a suitable option given the current and ongoing parking and congestion issues at Birubi Point. Continuing with the use of the existing meeting point for tour operators from the beach access at James Patterson Street would not address the issues of traffic congestion, or the impacts on Aboriginal heritage or environmental damage from inappropriate vehicle parking and unofficial access to Birubi Point and the WCL in this area.

2.4.2 Anna Bay Skate Park

An alternative area considered for the Information Centre was at the Anna Bay skate park to the east of the Birubi Point SLSC. Construction in this area would have impacted on the existing recreational use of the skate park. It is also within the Birubi Point Aboriginal Place where construction impacts on heritage were likely to be greater than the selected location off the existing beach access at Gan Gan Road. No other alternatives were identified in the local area as being feasible options.

2.5 Materials

2.5.1 Roadways and Parking Bays

Roadways and parking bays would be permeable with a plastic capping layer for main traffic able areas and compacted road base for the 4WD operator/ Coach/ Private vehicle parking areas, with plastic capping layer underneath.

2.5.2 Pavements and Pedestrian Access

Pavements would be raised using site won material and edged with sandstone blocks on a geotextile layer. The pavement would be capped with asphalt on a primer seal.

2.5.3 Buildings

Buildings for tour operators would be set on a hardwood decking platform supported by pre-cast concrete. Buildings would be clad with hardwood timber batten cladding on ridge cap sheeting. Roof construction for the Information Centre will be polycarbonate roofing with perforated soffit lining.

2.5.4 Drainage and Stormwater

Planted wetland areas would be created along existing lines of natural drainage. These would be planted with native macrophyte species. Drainage would be directed via swales and buried concrete pipes.

2.5.5 Sediment Fence and Planting

The sediment fence would be constructed from a woven geotextile attached to wooden posts. Planting along the boundary of the fence would be undertaken using native species in keeping with the local area.

2.6 Construction Activities and Methodology

2.6.1 Plant and Equipment

The proposed development would require the following construction activities:

1. Site Establishment (Mobilisation and Setup)

- Site establishment (fencing, sheds, etc).
- Mobilisation of plant including excavator for earth works.
- Construction planning, preconstruction dilapidation survey and set-out survey.

2. Installation of Environmental Protection

- Installation of sediment and erosion controls, flow management and exclusion fencing around the full extent of the works and maintained for the duration of the contract.

3. Demolition, Excavation and Tree Removal

- Removal of a number of trees and vegetation.
- Excavation of material to achieve the finished floor levels - excavated material would be taken off site by truck and dog trailers to a dedicated facility for recycling where possible.

4. Installation of Drainage, Car Park and Building Infrastructure

- The car park would be constructed concurrently to the associated storm water infrastructure.
- The buildings would be completed following completion of the car park.

5. Reinstatement and Landscaping

- Following completion of the car park and building infrastructure, any adjacent earth excavated and stockpiled for reuse would be reinstated.
- All landscaping and planting would be undertaken.

6. Removal of Temporary Environmental Protection

- Removal of temporary environmental protection controls such as fencing, signage and sediment and erosion controls.

7. Site Disestablishment (Clean Up and Demobilisation)

- Final as built survey.
- Final clean-up of the site to its preconstruction state and demobilisation of all plant and equipment for handover of site to Council.

Plant and equipment associated with the construction would include excavators, trucks and other light vehicles. This plant is likely to be on site for the majority of the works. The works may also require the occasional visit from crane, piling rig or geotechnical rig, where required.

2.6.2 Work Schedule/Duration

The ground preparations and construction works would likely be undertaken over a 16 - 18 week period.

The works would preferably commence in the second half of 2018.

2.6.3 Working Hours

The following working hours are proposed as specified in the in the Interim Construction Noise Guideline (Depar of Environment & Climate Change, 2009) for normal construction activities:

- Monday – Friday – 7am – 6.00pm;
- Saturday – 8am – 4.00pm; and
- Sundays and public holidays – no work.

Should the contractor need to carry out work outside the above hours, it would be necessary for the Contractor to make application to Council for approval to extend the hours, and for due consideration to be given to issues such as noise generation and traffic impacts.

3 Planning Context and Other Approvals

3.1 Land Ownership and Zoning

The proposed Information Centre would be located on land classified as Rural Landscape under the Port Stephens Local Environmental Plan (PSLEP) (Port Stephens Council, 2013). The works are immediately adjacent to land classified for Environmental Conservation to the south and west of the site and low density residential to the east. The land is Crown land under the management of Port Stephens Council.

The objectives of each of these classifications is listed in **Table 2.1** below.

Table 3.1 Land Zoning

Land Zone	Objectives of Zone
RU2 – Rural Landscape	• To encourage sustainable primary industry production by maintaining and enhancing the natural resource base. • To maintain the rural landscape character of the land. • To provide for a range of compatible land uses, including extensive agriculture.
E2 – Environmental Conservation	• To protect, manage and restore areas of high ecological, scientific, cultural or aesthetic values. • To prevent development that could destroy, damage or otherwise have an adverse effect on those values.
RE1 – Low Density Residential	• To provide for the housing needs of the community within a low density residential environment. • To enable other land uses that provide facilities or services to meet the day to day needs of residents. • To protect and enhance the existing residential amenity and character of the area. • To ensure that development is carried out in a way that is compatible with the flood risk of the area.

3.2 NSW Planning and Approvals Process

The statutory basis for planning and environmental assessment in NSW is set out in the Environmental Planning and Assessment Act (EP&A Act) and the Environmental Planning and Assessment Regulation 2000 (EP&A Regulation).

3.2.1 Environmental Planning and Assessment Act (1979)

Part 4 of the EP&A Act sets out the development assessment requirements for those developments that require consent. Part 5 of the EP&A Act specifies the environmental impact assessment requirements for activities undertaken by or on behalf of public authorities that are permissible without development consent.

Part 4 generally requires the preparation of a Statement of Environmental Effects (SEE) or an Environmental Impact Statement (EIS), depending on the nature, location and capital investment value of the proposed development.

Development consent will be sought by Port Stephens Council under Part 4 of the EP&A Act.

The proposed development does not fall under the criteria of Schedule 3 of the EP&A Regulation. An EIS is therefore not required.

3.2.2 State Environmental Planning Policy (State and Regional Development) 2011

State Environmental Planning Policy (State and Regional Development) 2011 (SEPP SRD) identifies development that is state significant development (SSD), state significant infrastructure (SSI) and critical SSI and confers functions on joint regional planning panels to determine development applications for such development and development considered regionally significant.

The proposed Information Centre does not fit the definition of SSD, as listed under Schedule 1 and 2, or SSI, as listed under Schedule 3 and 4 or critical SSI, as listed under Schedule 5, of the policy.

3.2.3 Local Environmental Plans

3.2.3.1 Port Stephens Council Local Environment Plan

The Port Stephens Council Local Environment Plan (PSLEP) (2018) provides the statutory framework for planning within the Port Stephens local government area. It provides planning and environmental control over the use and development of land, in order to uphold and promote the objectives of the EP&A Act 1979.

3.2.3.2 Port Stephens Development Control Plan

The Port Stephens Council Development Control Plan (DCP) (2014) aims to facilitate development in accordance with the PSLEP. The plan applies to all development requiring development consent under the PSLEP.

In determining a development application, Council is to provide consideration to this Plan under Section 79C of the EP&A Act.

This Plan does not apply to development that is:

- Identified as permissible without consent under Land Use Table of the PSLEP 2013.
- Carried out under Part 5 Environmental assessment of the EP&A Act.
- Assessed under the provisions of another Environmental Planning Instrument (EPI) that excludes the provisions of the PSLEP 2013.

The proposed Information Centre will be designed to ensure that the objectives of the Port Stephens DCP have been considered.

3.3 Other Legislative Requirements

3.3.1 State Legislation

Relevant additional State Legislation that applies to the activity includes the following:

- *NSW Biodiversity Conservation Act 2016 (BC Act)* - The BC Act lists the threatened species, populations or ecological communities to be considered when deciding if a significant impact on threatened biota, or their habitats, is likely as the result of an activity.

  Activities that fall under Part 4 of the EP&A Act must enter into the Biodiversity Offset Scheme (BOS) if the proposal triggers certain BOS development thresholds or if an Assessment of Significance (5 part test) is significant. This is described further in **Section 5.3.1**.

  The proposed development would not impact on threatened species, populations and communities or their habitat and the assessment process can proceed without entering the BOS.

- *NSW National Parks and Wildlife Act 1974 (NPW Act)* - The NPW Act aims to conserve nature, objects, places or features (including biological diversity) of cultural value within the landscape. If an impact to an Aboriginal heritage object or site is likely from a proposal, a permit must be sought under Section 90.

  The proposed development will require a permit under Section 90.

- *NSW Roads Act 1993* – under Section 75, a public authority may not carry out road work on a classified road, being work that involves:

  (a) The deviation or alteration of the road, or

  (b) The construction of a bridge, tunnel or level crossing in the road.

  Unless the plans and specifications for the proposed work have been approved by RMS.

  Under Section 138 of the Act, a person must not:

  (a) Erect a structure or carry out a work in, on or over a public road;

  (b) Dig up or disturb the surface of a public road;

  (c) Remove or interfere with a structure, work or tree on a public road;

  (d) Pump water into a public road from any land adjoining the road; or

  (e) Connect a road (whether public or private) to a classified road.

  otherwise than with the consent of the appropriate roads authority.

  If the applicant is a public authority, the roads authority and, in the case of a classified road, RMS must consult with the applicant before deciding whether or not to grant consent or concurrence.

  The proposed works involve the creation of a new intersection on Gan Gan Road therefore approval/consent will need to be sought from the RMS for these works. As additional approval is required for the DA the application will be considered as Integrated Development.

- *Coastal Management Act 2016* - The Coastal Management Act aims to manage the coastal environment of New South Wales in a manner consistent with the principles of ecologically sustainable development for the social, cultural and economic well-being of the people of the State.

  Section 5 of the Coastal Management Act defines the coastal zone as comprising of the following coastal management areas:

  (a) The coastal wetland and littoral rainforests area;

(b) The coastal vulnerability area;

(c) The coastal environment area; and

(d) The coastal use area.

Under Section 23 of the Act, public authorities are required to have regard to coastal management programs to the extent that those programs are relevant to the exercise of their functions.

- *Biosecurity Act 2015* – the Biosecurity Act provides for modern, flexible tools and powers that allow effective, risk-based management of biosecurity in NSW. It provides a streamlined statutory framework to protect the NSW economy, environment and community from the negative impact of pests, diseases and weeds.

  In NSW, all plants are regulated with a general biosecurity duty to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable.

  The Hunter Regional Weeds Committee has developed a five-year Regional Strategic Weed Management Plan to focus on managing weed biosecurity in the area. A key part of developing the plan was the review and prioritisation of weeds in the region. This resulted in the Priority Weed List (Appendix 1 of the plans) and other regional weed lists (Appendix 2 of the plans), using a risk-based approach.

  Bitou Bush is found on the proposed development site and is listed as a priority weed in Appendix 1 of the Hunter Regional Strategic Weed Management Plan, 2017-22, with a State Priority objective of eradication. The removal of Bitou Bush and scheme of planting with native species is discussed in **Section 5.3**.

3.3.2 Commonwealth Legislation

The Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) requires that proposals for development or “actions” that have, will have, or are likely to have a significant impact on any matter of national environmental significance are to be referred to the Commonwealth Environment Minister for consideration and approval.

The EPBC Act identifies the following matters of national environmental significance:

- World heritage;
- National heritage;
- Wetlands of international importance;
- Listed threatened species and communities;
- Listed migratory species;
- Protection of the environment from nuclear actions; and
- Marine environment.

The proposed Information Centre works will not have a significant impact on any of the above. This is detailed in the relevant sections of this report (**Section 5.3** Ecology and **Section 5.4** Aboriginal Heritage), Referral to the Minister for approval is, therefore, not required.

3.4 Summary of Legislative Consideration and Approvals

- Council will submit a DA under Part 4 of the EP&A Act;
- The proposed development does not fall under the criteria of Schedule 4.2 of the EP&A Act. An EIA is therefore not required. Council will prepare an SEE for the proposed development;
- The proposed development is not considered to be regionally significant development under SEPP SRD;
- The proposed development will require consent under Section 90 of the NPW Act for potential impacts to heritage items;
- Approval will need to be sought from the RMS under the Roads Act for road works associated with the proposal; and
- The proposal meets the definition of integrated development as per Section 4.4.6 of the EP&A Act.

4 Consultation

Consultation with local stakeholders regarding the proposed Information Centre has been ongoing since 2015. A number of stakeholder and public meetings as well as exhibitions have been held locally to discuss the proposals and gather feedback from stakeholders. Key meetings and events have been listed below.

4.1 Stakeholder and Community Consultation

Birubi Point Cultural Heritage Advisory Panel (BPCHP) – Since 2015 regular meetings have been held between Port Stephens Council and the BPCHP. The aim of these meetings has been to advise Port Stephen's Council on the management plan required to protect the Worimi cultural and spiritual heritage and enhance the environment of the Birubi Point Crown Reserve and Birubi Point Aboriginal Place.

Site Meeting (2015) – A meeting was held for residents to view the concept plan for the tourism transport facility, provide feedback, and discuss concerns for consideration in the planning process.

Birubi Point Aboriginal Place Master Plan – A master plan was produced to assist with community consultation on the concept and vision of the Birubi Point Aboriginal Place Master Plan, including the location of the proposed Information Centre.

Design and Planning Stakeholder Workshops (2018) – Three dedicated workshops were held with local stakeholders to gain an understanding of the vision for the Information Centre and the challenges of conducting quality cultural and adventure tourism at Birubi Point. The aim of these workshops was to provide the consultants with local insight that could help develop concepts for further consideration.

Community Consultation with Residents (2018) – Flyer drops to residences along James Paterson Street were undertaken to seek feedback from residents and to provide information regarding the proposed traffic management of James Paterson Street during peak periods and to inform residents of the proposed plans for a tourism Information Centre.

Birubi Point Aboriginal Place Management Plan (2018) – Consultation through a series of public exhibitions has been undertaken to gather community comment and feedback on the draft management plan including the location of the proposed Information Centre.

5 Environmental Assessment and Mitigation Measures

5.1 Introduction

An assessment of the proposed development on each environmental receptor is set out in the sections below. Each section looks at the existing environment, the potential effects of the proposed development on the existing environment (either positive or negative), and any recommended control measures which should be implemented to remove or reduce potential negative effects.

5.2 Geology and Soils

This section looks at the potential effects of the proposed development relating to the geology and soils in the area.

5.2.1 Existing Environment

The proposed development site is located on the edge of the shifting dune system of the WCL which extends for approximately 32km along the NSW coast.

Coastal dunes are accumulations of wind-blown (aeolian) sand located behind the beach. Near their seaward margins, aeolian deposits are intermixed with wave deposited beach sands but as distance from the shore increases, wind action becomes the dominant force. The nature and extent of dune development at any location is governed by a number of factors including:

- The amount and size of sand currently being supplied to the beach itself;
- Patterns of wind strength and direction;
- Embayment topography and orientation; and
- The type of beach.

Other factors being equal, dissipative beaches with finer sands and gentler beach gradients are more conducive to wind-blown sand transport and growth of dunes. **Figure 5.1** shows the typical features of a dynamic beach system with dune formation (NSW Department of Land and Water Conservation, 2001).

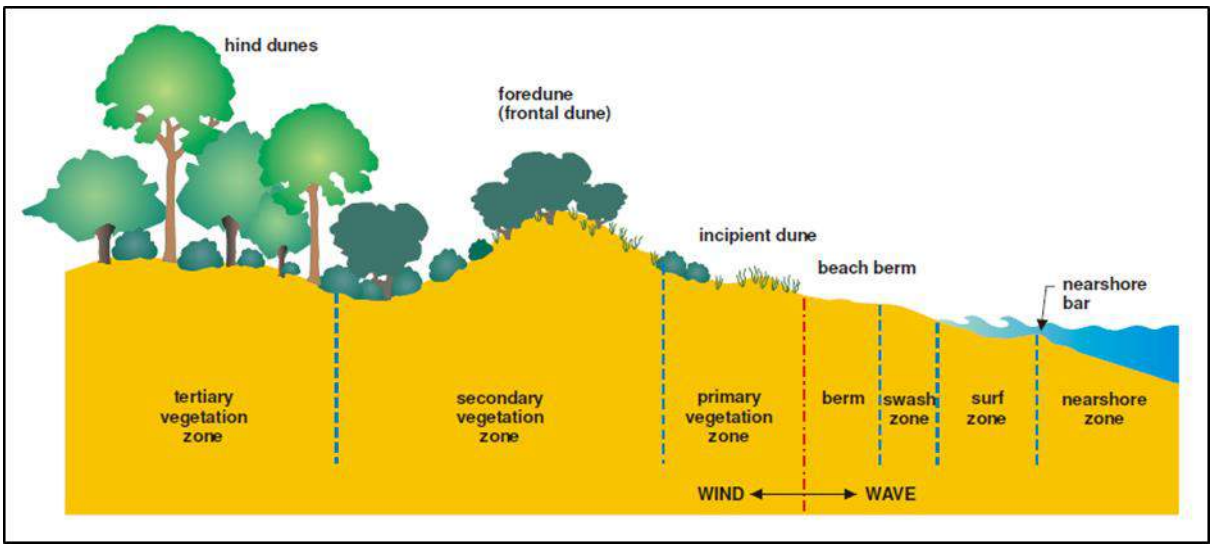


Figure 5.1 Typical features of a dynamic beach system

The dune system is part of the Newcastle or Stockton Bight barrier system comprising of three main landform units:

- Inner barrier – associated with the formation of the Grahamstown and Moffats swamps;
- Outer barrier – beach and sand dune system which forms the WCL; and
- Inter barrier depression – low lying area of swamp and marsh land between the inner and outer barrier.

The dune system is thought to have formed nearly 6000 years ago when windblown sands formed a mobile dune system which moved inland. Between the formation of the dune system and the present day there have been two key periods when the dunes have vegetated and stabilised. These periods of change have led to the formation of three distinct, near parallel ridges across the dune system. The current landform of the dune system within the WCL is shown in **Figure 5.2** below.

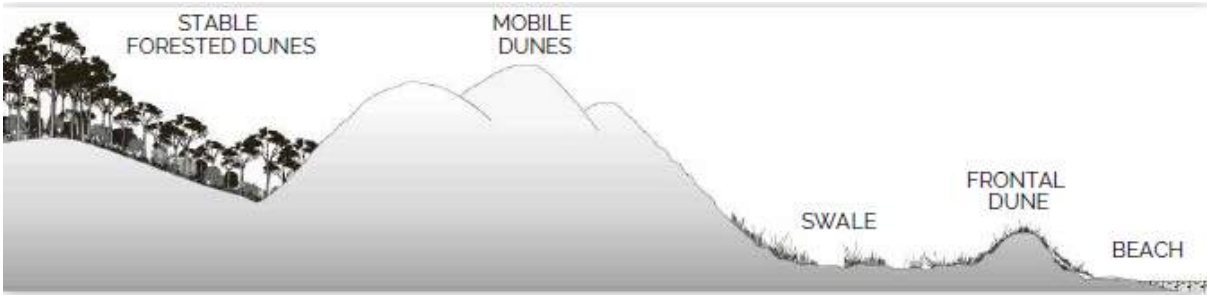


Figure 5.2 Current landform of the dune system in the WCL ((NSW Office of Environment and Heritage, 2015)

The stable vegetated and forested dunes reach up to 40m above sea level and occur through the northern and central areas of the WCL. The soils in these locations comprise of a mix of well drained weakly to poorly developed podzol soils on the slopes and more poorly drained humus podzols along the flatter areas of the dunes (NSW Office of Environment and Heritage, 2015).

The mobile dunes are migrating inland and gradually covering the stable vegetated part of the dune system. As the sands move inland the remnant soils from the previous period of stability are gradually exposed. This process can expose Aboriginal cultural material as well as stumps and remnants of old vegetation.

The sandy landscape of the WCL and Birubi Point is highly mobile which results in a complex stratigraphy which is difficult to date. Mobile sands from the WCL dune system have added to the soil layers at Birubi Point and less densely vegetated areas continue to be mobile and reworked through coastal processes.

A geotechnical investigation of the proposed development site has not yet been undertaken. The land is adjacent to land classified as low probability of acid sulphate soils (ASS) occurrence (NSW Government, 2011). The development site has not been classified but the land surrounding the Birubi Point surf club site to the south is known as being affected by ASS (class 4 and 5) and there is a possibility that the development site may also be a risk.

5.2.2 Potential Effects

5.2.2.1 Construction Phase

Material across the site would be highly disturbed during the works through land levelling and removal of material from the site. Further minor disturbances would be caused by the compaction of the roadways and parking areas, and ground preparations for the construction of buildings and signage.

These works have the potential to:

- Disturb or release any contaminated materials on the site;
- Disturb any ASS material; and,
- Mobilise sediments leading to increased erosion at the site.

A sediment and erosion control plan for the construction works has been prepared and is presented in **Appendix C.**

5.2.2.2 Operational Phase

Removal of vegetation to allow for the proposed development has the potential to lead to increased erosion of soils in the area.

The ongoing movement of sand within the dynamic environment may create a consideration during operation for the mobilisation and deposition of sand within the site. A Sand Management Plan is presented below:

- Overview;
  - Management of wind-blown sand across the subject site is based on the procedures developed for the lower carpark at Birubi Point. This process has been refined over a 10-year period.
  - The lessons learned from this level of experience are deemed appropriate and relevant to the subject site. The scenario for the lower carpark at Birubi point is considered a worst-case scenario; it is highly exposed to the South with no vegetation buffer or sand fences. The subject site for this DA is less exposed that the lower carpark.

- Sand Management Measures;
  - The subject site will be buffered by revegetation of the surrounding dunescape within the site and integrate sand trap fences.
  - The existing heavily vegetated and established planting buffer on the dunes between the site and the existing residencies will be maintained.
  - The vegetated wetlands will be maintained in the follow manner. If sand accumulates quickly and is required to be removed frequently, hand removal techniques will minimise vegetation damage. If accumulation is slower and it can be removed less often (e.g. at intervals of several years), is would be done with an excavator, accepting the vegetation damage at the time and then restoring vegetation afterward. To minimise the need for hand removal, an effective buffer on the windward edges/side of swales/wetlands is proposed to minimise the amount of sand that gets in. This includes incorporation of a densely planted vegetated buffer (e.g. Lomandra), permanent silt fence and built features like seating walls.
  - The removal of sand from the hard surfaces and buildings, which although more straight forward, would likely comprise the bulk of the material. As part of the increased hardscape any additional sand run off will be swept up as required and integrated into the weekly or monthly management tasks.
- Procedures;
  - Minor sand management tasks (manual handling and or small posi-track excavator) will be done weekly (manual tasks) and monthly (posi-track excavator).
  - All sand deemed the be VENM (Virgin Excavated Natural Material) or ENM (Excavated Natural Material) will be repositioned on site where possible (to fill voids or landscape

features) or taken off site to DA approved sites requiring fill (estimated to be 90% of all sand captured).
    - Sand that is not deemed to be VENM or ENM will be disposed to a licensed landfill site (estimated to be 10% of all sand captured).
- Costs;
    - Number of major sand removal maintenance actions per year: 4
    - Expected tonnes of sand removed per maintenance action: 100 (based on lower range of maintenance data from lower car park at Birubi headland)
    - Cost to undertake sand removal maintenance action: $2,000 per action
    - Estimated annual cost to undertaken sand management actions is $25,000 including disposal of 50 tonnes of waste sand to licensed landfill site.
    - Note: the costs associated with the sand management plan have been factored into the business case for the information centre.

5.2.3 Recommended Control Measures

- Site specific ground investigation to be undertaken, including geotechnical investigation to inform detailed design.
- Waste classification testing and testing for ASS should be undertaken prior to any development at the site to determine any risks associated with contaminated sediment or exposure of ASS. Detailed management plans for waste and ASS may be required depending on the findings of the site investigations.
- Where possible the Information Centre would be designed to minimise the amount of excavation and removal of material from site.
- Appropriate management of any stockpiled material during construction should be undertaken (e.g. damping down or covering) to prevent mobilisation and drift of material.
- Working areas should be stabilised as soon as possible after construction to prevent erosion.
- A scheme of planting using native species would be undertaken to stabilise and trap wind-blown sediments.
- The sand management plan, presented above, should be adopted and applied.

5.3 Flood Risk and Coastal Processes

This section looks at the potential effects of the proposed development relating to site flood risk and coastal processes.

5.3.1 Existing Environment

A flood study for Anna Bay and Tilligery Creek was undertaken by Jacobs, on behalf of Port Stephens Council, in 2017 (Jacobs, 2017). There is no flood risk associated with the proposed development site, however, the area of Gan Gan Road which provides access to the beach road and development site is identified as having a low provisional flood hazard (peak flood depth up to 0.1m at 20% Annual Exceedance Probability (AEP)).

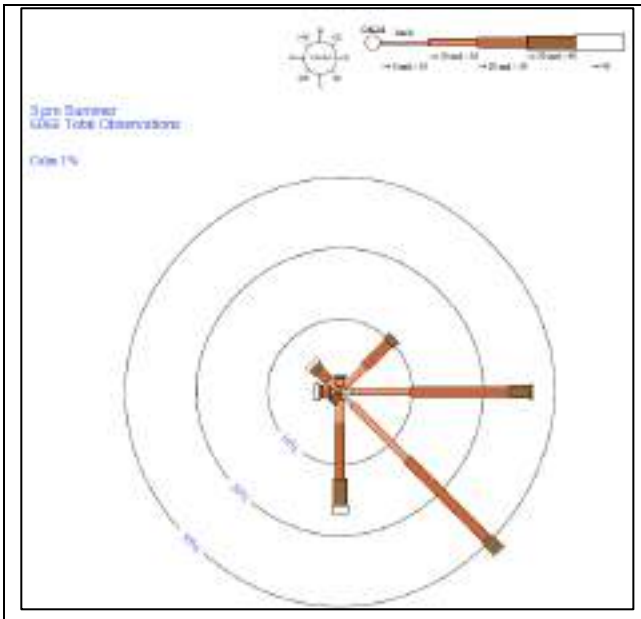
The project site is also much more heavily influenced by the wind than it is by coastal processes. Wind directly influences waves, currents, water levels and sand transport and thereby moulds many coastal features into shapes that reflect wind strength, direction and duration. The proposed development site is not directly affected by tidal inundation or tidally influenced coastal processes but is affected by processes

associated with onshore winds. Coastal dunes are a specific expression of local winds. Local wind patterns also play a critical role in dune rehabilitation through their effect on plant establishment and survival.

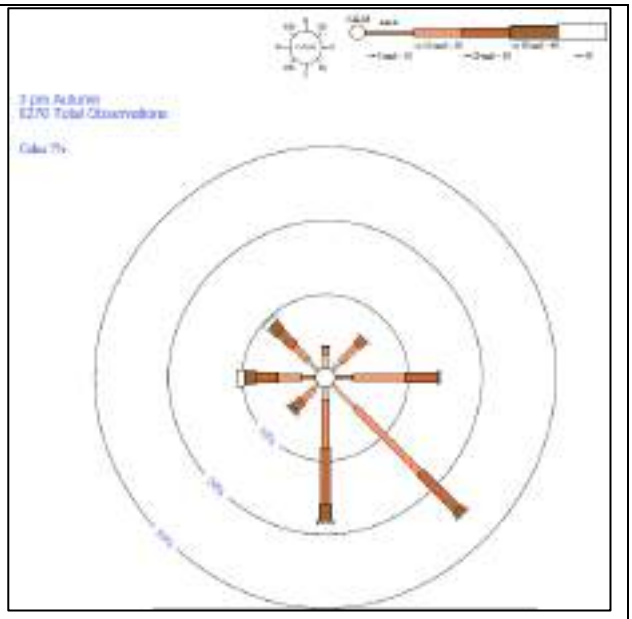
The NSW coastline experiences an annual wind regime that features several distinct components. These result from the persistent west to east passage of High and Low pressure cells across Australia and the seasonal variations in their tracking latitude. The latter facilitate the ingress of warm, moist tropical air masses during summer and incursions of cold Southern Ocean air during winter.

Winds are generally weaker during the morning and commonly blow offshore. Wind strengths increase during the day, typically to a late afternoon peak.

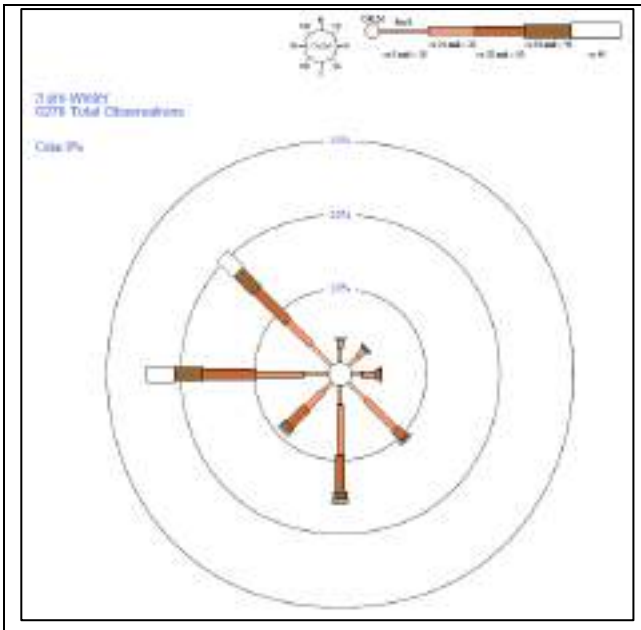
Winds with a westerly component are generally more common during winter and spring when the anticyclones are following their northernmost tracks (**Figure 5.3**). They can be a seasonally important mobilising force on larger sand masses, such as the WCL dune system.



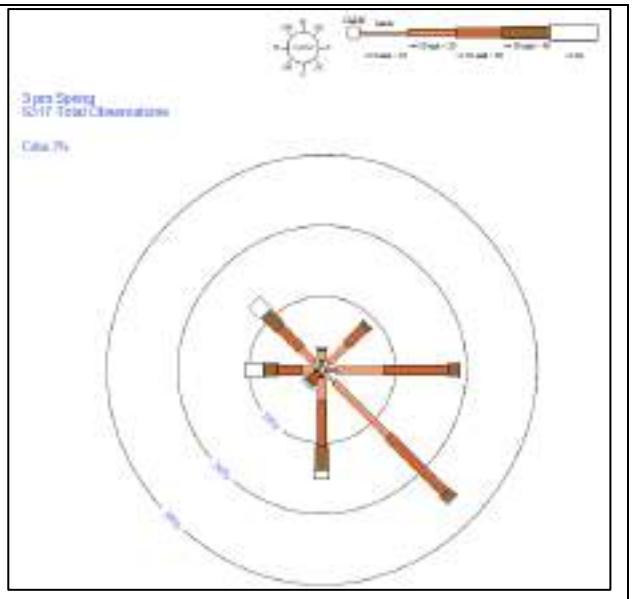
Summer



Autumn



Winter



Spring

Figure 5.3 Seasonal wind roses at Williamstown Airfield (Source: Bureau of Meteorology).

The most important coastal processes continuing to shape the landscape at Birubi Point are coastal erosion, coastal recession and wind-blown transport of sand. The location of the proposed Information Centre is set back from the beach and protected from processes of coastal erosion and recession caused by wave action. The site is, however, influenced by wind and transport of sand across the site.

5.3.2 Potential Effects

5.3.2.1 Construction Phase

Removal of vegetation at the construction site may lead to an increase in erosion and potential for release, or more rapid transport, of wind-blown sediments from and across the development site.

5.3.2.2 Operational Phase

Construction of new buildings and hardstanding may present a barrier to the movement of wind-blown sediments. This may lead to accumulation of sediments against these structures and routine clearance may be required to maintain operational activity of the Information Centre development.

5.3.3 Recommended Control Measures

- Installation of a sediment fence and planting of native vegetation along the western boundary of the proposed development site to prevent encroachment of wind-blown sediments into the site.
- Retention of the existing vegetation on site as far as possible to prevent any increase in erosion and release of sediments from the site.
- Development of a new site drainage plan (this is discussed in detail in **Section 5.7** Water Quality and Stormwater)

5.4 Ecology and Biodiversity

This section sets out the potential impacts of the proposed development in relation to ecology and biodiversity. A full Biodiversity Assessment Report for the proposed Information Centre is presented in **Appendix D**.

5.4.1 Existing Environment

The subject site for the ecology and biodiversity assessment covers the proposed development area and land immediately adjacent to it. The subject site is at the northern end of extensive sand dunes that stretch between Stockton Beach and Anna Bay in the Port Stephens Local Government Area (LGA). The dunes have been subjected to extensive erosion from natural and anthropogenic forces along with alterations to the species composition of the vegetation through weed invasion. The subject site, proposed area of works and area of potential disturbance are shown in **Figure 5.4**.

Biodiversity Legislation
Under the Biodiversity Conservation Act 2016, activities that fall under Part 4 of the EP&A Act must enter into the BOS if the proposal triggers the BOS development thresholds described below or if an Assessment of Significance (5 part test) is significant.

The Biodiversity Conservation Regulation 2017 (BC Regulation) provides details on:

- Clearing thresholds and Biodiversity Values Map for application of the BOS;
- Principles for consideration of serious and irreversible impacts (SII);
- Rules for meeting biodiversity offset obligation;
- Biodiversity Certification criteria; and
- Compliance provisions.

The BOS development thresholds are used to determine when the BOS applies to local developments and are based on:

- Area Criteria; or,
- Biodiversity Values Map.

For proposals that do not trigger the threshold, a 'test of significance' is required. If this indicates a likely significant impact, the Biodiversity Assessment Methodology Order 2017 (BAM) applies. The Area Criteria are set out in **Table 5.1** below.

Table 5.1 BOS Thresholds

Minimum lot size associated with the property	Threshold for clearing, above which the BAM and offsets scheme apply
Less than 1 ha	0.25 ha or more
1 ha and less than 40 ha	0.5 ha or more
40 ha and less than 1000 ha	1 ha or more
1000 ha or greater	2 ha or more

Part 7 of the BC Regulation (section 7.4) refers to:

- Proposed development exceeds the BOS threshold for the purposes of Part 7 of the Act if it is or involves:

(a) The clearing of native vegetation of an area declared by clause 7.2 as exceeding the threshold, or
(b) The clearing of native vegetation, or other action prescribed by clause 6.1, on land included on the Biodiversity Values Map published under clause 7.3

The minimum lot size associated with the property (i.e. size of the Subject Site being Lot 312 DP 753204) is approximately 3.2 ha. The Area of Impact (**Figure 5.4**) for the proposed development is approximately 1 ha and within this Area of Impact, there is 0.28 ha of native vegetation. The area of native vegetation to be cleared is, therefore, below the clearing threshold (0.5 ha) for entry into the BOS.

Other legislation relevant to ecology and biodiversity includes the provisions of SEPP 44 Koala Habitat Protection which applies to all lands within Newcastle Local Government Area. This Policy aims to encourage the proper conservation and management of areas of natural vegetation that provide habitat for koalas to ensure a permanent free-living population over their present range and reverse the current trend of koala population decline. A site survey of the subject site concluded that the site does not contain potential koala habitat and the site does not constitute core koala habitat. Given this, no further koala assessment is required.

Figure 5.4 Subject Site and Potential Area of Impact

Ecological Survey
Field surveys were undertaken on 7 June 2018 within the area of impact on the subject site. Three vegetation quadrats were established to assess vegetation integrity and condition. Opportunistic fauna sightings were also undertaken. The complete Biodiversity Assessment Report which details the findings of the surveys is presented in **Appendix D.**

The vegetation across the subject site had a high level of weed invasion. In the north eastern corner of the site, the vegetation was mapped as 'disturbed' due to the high percentage cover of exotic species. The area behind existing residences along James Paterson Street has been cleared for lawn and an access track and was subsequently mapped as 'cleared areas'. In addition, the sand dunes which had isolated clumps of bitou bush were not mapped as vegetated.

The mapped habitat distribution across the site is shown in **Figure 5.5**. Vegetation communities include:

- Cheese Tree/ Smooth-Barked Apple/ Bangalay Disturbed Open Forest; and
- Coastal Sand Scrub.

Also mapped are areas of:

- Disturbed Vegetation;
- Cleared Areas; and
- Sand Dunes.

There were no Endangered Ecological Communities (EECs) found to be present on the proposed development site and no threatened ecological communities as listed under the EPBC Act.

The Cheese Tree/ Smooth-Barked Apple/ Bangalay Disturbed Open Forest community has been highly disturbed through encroaching gardens/lawn, a vehicle access track and invasive exotic species. Coastal Sand Scrub community has been impacted considerably by Bitou Bush (*C. monilifera*) and Coral Trees (*Erythrina x sykesii*) as well as dune erosion. Areas of disturbed vegetation could not be assigned a native vegetation community description due to the high percentage of weeds present. Rough Doubletail *Diuris praecox* has been recorded in habitat nearby to the subject site, however, the subject site lacks a dense grassy understory which is considered important habitat for this species.

Fauna surveys were limited to opportunistic sightings, however, the proposed development site provides potential habitat for a range of species including; common bird species, native and exotic ground dwelling mammals and foraging forest bats. The drainage lines along the perimeter of the roads adjacent to the proposed site also provide potential habitat for amphibians. The forested areas lack hollow bearing trees and, therefore, does not provide roosting or nesting habitat for hollow dependant species, including; forest bats, parrots, owls or arboreal mammals.

Figure 5.5 Vegetation Mapping at the Proposed Development Site

The site was found to have some potential to support the following threatened species listed under the Biodiversity Conservation Act and EPBC Act:

- Wallum Froglet Crinia tinnula (BC Act).
- Dusky Woodswallow Artamus cyanopterus cyanopterus (BC Act).
- Little Lorikeet Glossopsitta pusilla (BC Act).
- Little Bentwing-bat Miniopterus australis (BC Act).
- Yellow-bellied Sheathtail-bat Saccolaimus flaviventris (BC Act).
- Rough Doubletail Diuris praecox (BC Act).
- Sand Doubletail Diuris arenaria (BC Act).
- Spotted-tailed Quoll Dasyurus maculatus (BC Act and EPBC Act).
- Koala Phascolarctos cinereus (BC Act and EPBC Act).
- New Holland Mouse Pseudomys novaehollandiae (BC Act and EPBC Act).
- Grey-headed Flying-fox Pteropus poliocephalus (BC Act and EPBC Act).

An assessment of significance of impact (**Appendix D**) under the Biodiversity Conservation Act concluded that the removal of approximately 0.28 ha of Disturbed Coastal Sand Scrub during construction is unlikely to have an adverse effect on the life cycle of these species such that a viable local population of the species is likely to be placed at risk of extinction. The proposed clearing would also not result in further modification of the vegetation as it is already highly modified through weed invasion, nor would it result in fragmentation or isolation of habitat as the Subject Site is already partially isolated.

The habitat to be removed is not considered important to the long-term survival of the species as it provides:

- Sub-optimal habitat for Wallum Froglet, as it lacks acid swamp
- Limited foraging habitat for Dusky Woodswallow
- No nesting habitat for the Little Lorikeet
- No suitable den sites for the Spotted-tailed Quoll;
- No preferred vegetation for the New Holland Mouse;
- No roost sites for Little Bentwing-bat or Yellow-bellied Sheathtail-bat;
- No preferred feed trees for Koalas; and
- Not a known roost site for Grey-headed Flying-fox.

An assessment of significance of impact under the EPBC Act concluded that the proposed works (clearing of 0.28 ha of vegetation) would not substantially impact upon the threatened species listed as the proposed development site does not provide important habitat features for these species. The site lacks primary feed trees for Koalas, does not contain roost sites for the Grey-headed Flying-fox, lacks den sites for the Spotted-tailed Quoll and the s. Subsequently, the Subject Site does not support an important population of these species.

5.4.2 Potential Effects

Construction

The development would have a direct effect on a number of the habitat types recorded on the site. A proportion of native vegetation would be lost from site clearance for car parking facilities and development of the Information Centre.

Clearance of the site would also have a direct beneficial impact on biodiversity through the removal of invasive weeds and exotic species including Bitou Bush.

Operation
Ongoing use of the site has the (very limited) potential to prevent, or lead to the damage of, threatened species which may move into the development area. For example vehicle collisions with fauna or grounds maintenance preventing colonisation of protected flora.

5.4.3 Recommended Control Measures

- Any native trees within the *Area of Impact* are to be retained where possible, with barrier fencing installed around the base (to the circumference of the crown) to protect the root system during works.
- Appropriate erosion and sediment control measures are to be put in place prior to commencement of any works.
- Targeted surveys for *Diuris praecox* and *Diuris arenaria* should be undertaken in late July/August during the flowering period for these two species and prior to the commencement of works. In the unlikely event that these species are detected, mitigation measures can be formulated to protect any plants identified.
- Landscaping within the subject site and around its perimeter should use only local, native species that naturally occur in the Coastal Sand Scrub community (as defined by the Lower Hunter Central Coast Regional Environmental Management Strategy (LHCCREMS, 2012). Species should be selected from each stratum (upper, mid, low) of the vegetation canopy to reflect the natural community. Swamp Mahogany *E. robusta*, should also be included in landscaping to supplement habitat for the local koala population.

5.5 Aboriginal Heritage

This section looks at the potential effects of the proposed development in relation to Aboriginal heritage in the area.

5.5.1 Existing Environment

The proposed Information Centre sits immediately adjacent to the WCL and the Birubi Point Aboriginal Place. These sites are part of a large area of land considered Worimi Country and under traditional custodian of the Worimi People. Worimi Country is generally bounded by the four rivers: the Hunter River to the south, Manning River to the north, and the Allyn and Paterson rivers to the west, and includes the adjoining ocean and waterways. The WCL and the Birubi Point Aboriginal Place fall within the area of the Maiangal ngurra (clan group) who traditionally would have used the beaches to travel between the northern and southern parts of the WCL with the land and waters used for thousands of years for gathering of foods and continuation of cultural activities (NSW Office of Environment and Heritage, 2015).

The WCL contains a large number of sites of significance to the Worimi People. These Aboriginal Sites are protected under the National Parks and Wildlife Act (NPW Act 1974) and include evidence of fishing, shellfish gathering (with shell middens being the most conspicuous form of evidence in the landscape), campsites, fire and hearthstones, flaked stone implements and burials across the WCL. Shell deposits from middens are readily exposed and recovered due to movement of the dunes as shown in **Figure 5.5** below. This process of dune movement makes these sites difficult to identify and protect and they become

prone to damage, primarily from vehicles accessing the dunes in the WCL (NSW Office of Environment and Heritage, 2015).

Figure 5.6 Dunes within the WCL with visible shell middens (NSW Office of Environment and Heritage, 2015)

The area of land known as the WCL was returned to Worimi ownership on 1st February 2007. The Local Aboriginal Land Council (LALC) holds the title to the WCL on behalf of the registered Worimi owners. The management of the WCL is vested in a Board of Management appointed under Part 4A of the NPW Act by the Minister responsible for administering the NPW Act and the Minister for Aboriginal Affairs, following a nomination process. A Plan of Management for the WCL was published in 2015 with an updated plan expected in 2018 (NSW Office of Environment and Heritage, 2015).

Birubi Point Aboriginal Place was designated under Section 84 of the NPW Act in 2007 for its values as an important ceremonial site and burial ground and presence of extensive archaeological material (NSW Office of Environment and Heritage, 2015). The Aboriginal Place is 54ha of coastal land comprising rocky outcrop overlain by wind-blown sand at the eastern end of the WCL mobile dunes. The area is of great cultural importance to the local Aboriginal community because of its spiritual values as well as the extensive material evidence of traditional Aboriginal people. There is evidence of extensive remains of campsites, implements and food resources used by Aboriginal people as well as burial sites within the area (Umwelt, 2003). Some members of the community refer to a men's ceremonial site in the area and a story involving an old warrior. There is also contemporary significance with the community using the area for fishing, gathering pipis and recreational activities such as surfing. The community has also talked about the contemporary spiritual importance because a young Aboriginal person died in the surf here (Umwelt, 2003).

Cultural Value

Birubi Point Aboriginal Place is culturally linked to the WCL and other significant sites and landscape features across Worimi Country. The archaeological material that is across the entire Aboriginal Place (which includes burials) is important because it is evidence of how Worimi ancestors lived in the area and how they interacted with the land and the sea in their traditional lifestyles.

Archaeological and ethnohistorical investigations suggest that there was consistent extensive occupation across the Birubi Point area since the mid Holocence period. Midden material has been found across all of the headlands as well as dunes behind the headlands and bays (Umwelt, 2003).

Plant species in the area indicate the natural resources used by Worimi people and there is a need to restore natural resources that are part of the cultural value of the Aboriginal Place. As an example, the invasive non-native species Bitou Bush (*Chrysanthemoides monilifera rotundata*) is actively growing and spreading in the area, smothering local native vegetation, blocking important views and covering cultural attributes. Other invasive weed species are also present, competing strongly with native vegetation.

Important characteristics of the land, influencing its cultural value, include:

- An actively transforming landscape – mobile dunes, changing vegetation, and waves of post European settlement ;
- A complex of archaeological sites, including extensive middens and burials, extending across almost all the Birubi Point Aboriginal Place and WCL; and,
- Evidence of long term and continuing use of and attachment to country, by innovative and adaptable people.

The values of the Stockton Bight Aboriginal Place highlighted at Gazettal were:

- The landscape context of the Aboriginal Place, with extensive outlook over land, sea and sky;
- Burials, a ceremonial site;
- An area rich in natural resources, and
- Extensive archaeological material important for teaching current and future generations about Aboriginal culture.

The construction of housing, infrastructure and recreational facilities over the last 50 years has led to the destruction of a large amount of the Aboriginal cultural heritage material that was present in the area (Umwelt, 2003). The increasing visitor numbers and lack of suitable infrastructure to support them is adding to this pressure at Birubi point and leading to continued pressure on the Aboriginal Place and cultural values.

There is presently limited information available to communicate the values of the WCL and Birubi Point Aboriginal Place to those visiting the area. This is leading to a general lack of awareness about the Aboriginal heritage and values of the area, increasing the risk of impacts from visitors.

At this stage a site specific heritage assessment has not been undertaken, however, given the proximity of the proposed development area to the WCL and Birubi Point, and findings from archaeological research in the area, there is a high likelihood of Aboriginal cultural material being present. A lot specific search for the proposed development site using the Aboriginal Heritage Information Management System (AHIMS) indicates that Aboriginal Sites are recorded in or close to this location (NSW Government, 2018).

5.5.2 Potential Effects

Aboriginal sites are protected under Section 90 of the NPW Act and cannot be knowingly destroyed, defaced or damaged without the consent of the Director-General of the NPWS. The proposed works have the potential to impact on Aboriginal Sites in both the construction and operational phases.

5.5.2.1 Construction Phase

There is likely to be a direct impact on Aboriginal cultural material asthe proposed development site is within an area likely to contain heritage items. There is a risk that the development activities could uncover and damage or disturb Aboriginal cultural material through the movement and clearance of sand, compaction of new access and roadways and construction of buildings.

5.5.2.2 Operational Phase

There is likely to be a beneficial impact on Aborginal heritage and cultural value at Birubi Aboriginal Place and the WCL through the management of access to the site. The Information Centre will help to manage access and parking in the area reducing the existing pressures of unregulated parking and access withihin the local area. There would also be benefits through the installation of dedicated signage and visitor information regarding Aboriginal heritage in the area, which would increase the heritage information available to visitors and also inform them about the potential impacts of their activities in the area.

There would likely be a beneficial impact of providing increased capacity for vehicles and visitor numbers to the Birubi Point Aboriginal Place and WCL, thus allowing more people to enjoy the site in a controlled and managed fashion. Furthermore, the existing 4X4 driving tours hub and the nearby 4WD car parking would be diverted from its current location to the south of the Birubi Point surf club, thus reducing erosion and damage.

There is potential that the proposed Information Centre would lead to an increase in the number of visitors to the area subsequently increasing the number of vehicles accessing the WCL. An increase in vehicle movements across the WCL could lead to additional damage to cultural material present, for example vehicles driving across middens or accessing protected areas.

5.5.3 Recommended Control Measures

- A visual inspection of the site should be undertaken by a qualified archaeologist to determine the potential of the site to contain Aboriginal cultural material. If heritage sites are identified that cannot be avoided or it is deemed that heritage sites are likely to occur, an AHIP would be required and a new level of assessment necessary, including comprehensive Aboriginal consultation.

- Development of improved signage, interpretation and information on Aboriginal heritage and cultural values of Birubi Point Aboriginal Place and the WCL would be installed and developed at the proposed Information Centre. This would improve the information to visitors on the Aboriginal heritage and cultural values of the site and will help to reduce the potential negative impacts of vehicles and visitors accessing the area.

- Given the potential to increase numbers of visitors and cars to site it is important to manage and control access beyond the Information Centre for walkers and cars. It is highly recommended that access is restricted or controlled to sensitive areas and minimised where possible in all other areas.

5.6 Traffic and Transport

This section provides an assessment of traffic and transport effects from the proposed development. A full Transport Assessment has been completed for the project and is provided in **Appendix E**.

5.6.1 Existing Environment

5.6.1.1 Road Network Access

The project site is located on the south-east corner of the intersection of Gan Gan Road and the existing beach access road. Gan Gan Road is the main road in the project area and a regional road which intersects with James Paterson Street and the existing beach access road.

James Paterson Street provides access to the residential properties along this street as well as the Birubi Point SLSC and the existing tour drop-off/pick-up point at the bottom car park on Birubi Beach. The street has speed bump traffic calming measures and a shared path for cyclists and pedestrians.

5.6.1.2 Active Transport Access

Active transport describes the non-vehicular access to the area (i.e. pedestrian/cycle).
There is a shared pedestrian and cycle path which runs along the south side of Gan Gan Road and James Paterson Street. This path provides access to the SLSC, and facilities in this area, and eventually leads to the retail shops and bus stops in Anna Bay.

There are no facilities for parking bicycles near the proposed development area.

5.6.1.3 Public Transport Access

There is bus stop east of intersection of Gan Gan Rd and the Beach Access Road. Bus lines130, 134 and 135 connect Birubi Point to Anna Bay, Nelson Bay and Fingal Bay in the north east and Newcastle to the west.

5.6.1.4 Organised Tours

A large number of tourists visiting the area arrive by coach as part of organised tours to the area. These coaches drop and collect passengers near the Birubi Point SLSC to access the tour drop-off/pick-up point on Birubi beach.

5.6.1.5 Parking

Parking is provided for vehicles at the following locations:

- The SLSC car park (known as upper car park);
- The current meeting point for tours next to the SLSC (known as bottom car park);
- The west side of James Paterson Street;
- Fitzroy Street parking area; and
- Coach parking area along James Paterson Street.

5.6.1.6 Current Traffic and Parking Issues

The main flow of traffic currently travels from Gan Gan Road along James Paterson Street to the SLSC and existing tour operator hub on Birubi Beach. James Patterson Street in particular can experience high volumes of traffic, particularly on weekends and public holidays when many visitors are coming to the area. This can lead to congestion along this road for a number of reasons including:

- Lack of parking space at the car parks can lead to vehicles parking along the roadside in James Paterson Street (on very busy days cars can be parked back to back up to 400 m north of the SLSC). This reduces the road width and increases congestion along the road particularly with larger vehicles such as buses and coaches;
- Vehicles stopping in the road to wait for parking spaces or to make manoeuvres into spaces along the roadside; and,
- Vehicles driving around looking for free parking spaces.

Figure 5.7 shows the existing parking facilities at and around the Birubi Point SLSC and James Paterson Street. It also shows the existing drop off/pick up location for beach/dune tours located to the north east of the SLSC.

Figure 5.7 Existing Parking and Access near Birubi Point Surf Llife Saving Club (source: Nearmap 2015)

5.6.2 Traffic Volume Analysis

Traffic counts have been undertaken for James Patterson Street and the existing beach access road. Full details of these counts are provided within the Transport Assessment Report in **Appendix E**.

5.6.2.1 James Paterson Street

Traffic counts were undertaken in September and October 2016. The dates for the counts included a school holiday and a long (public holiday) weekend. These counts indicate the current traffic pattern in a relatively busy period and are summarised below:

- On an average week day (24 hour period): Between 600-800 motorised vehicles travel in either direction along this street.
- On an average weekend (24 hour period): Up to 1,200 motorised vehicles travel in either direction along this street.
- Around 95% of the vehicles travelling along this street are cars.
- The increase in vehicle use during weekends is primarily from additional cars.
- On both weekdays and weekends between 30-40 mini busses and up to 4 coaches travel along this street.
- The weekday hourly peak is between 12am-1pm with up to 80 vehicles per hour travelling along the street.
- The weekend hourly peak is between 1pm – 2pm with up to 120 vehicles per hour travelling along the street.
- The busiest day of the traffic count was a Sunday during the school holidays and on a long (public holiday) weekend. On this day over 1,700 motorised vehicles travelled along James Paterson

Street. On this day vehicles were recorded parking along James Paterson Street from the SLSC to 400 m back along the roadside. A maximum hourly peak of 220 vehicles per hour was recorded on this day.

- The traffic counts showed that majority of vehicles were accessing the area between 8am-3pm.

The location of the traffic counts and destinations accessible from James Paterson Street are shown in **Figure 5.8** below.

Figure 5.8 Destinations accessible from James Paterson St. (Source: Google Maps, 2018).

The destinations of the vehicles using the street was not recorded or noted during the counts. It can be assumed that the majority of the mini busses and coaches recorded are heading to Birubi Point for tours.

Existing Beach Access Road

Traffic counts were undertaken in 2012 and 2014 for the beach access road. The 2012 traffic count was undertaken in December during a holiday period. The 2014 count was undertaken on a daily basis between December and June. The counts indicate traffic use in a relatively busy period during the holiday season as well as outside of this time and are summarised below:

- During weekdays in summer, an average of 200 vehicles per day use the beach access road (total of both directions).
- During weekends in summer the daily amount of vehicles increases to an average of 400 per day.
- During the Autumn and Winter months (April – June) these numbers decrease to an average of 10 on weekdays and 50 on weekends.
- In the last week of December 2011, there were higher traffic densities, with over 1,500 vehicles on the peak day and densities up to 1,000 vehicles in the preceding days (see **Figure 5.9**). It is possible that this high number reflects a specific event at the beach that day.

- The vehicles counted on the beach access road are probably 4WD vehicles, as the road is unpaved and leads to the beach which is only suitable for diving on using 4WD vehicles.

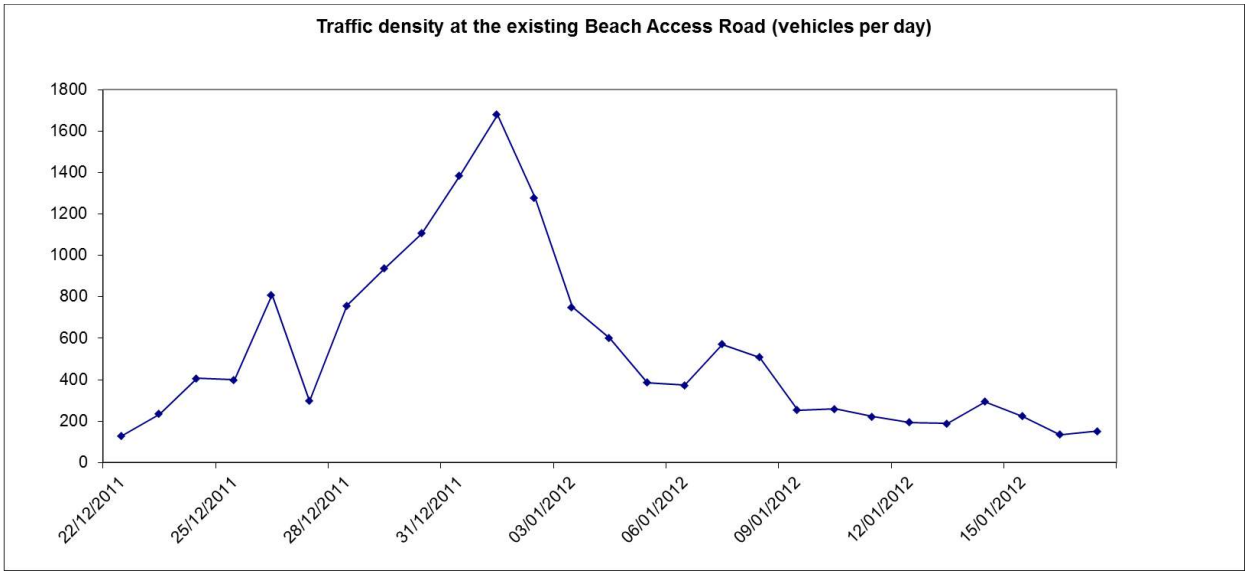


Figure 5.9 Traffic density at the existing beach access road

5.6.3 Potential Effects

5.6.3.1 Construction Phase

As the new site for the proposed Information Centre is at a location set back from the main roads, the construction phase is unlikely to affect the parking situation at James Paterson Street. Upgrading the intersection between Gan Gan Road and the existing beach access road and upgrading the surface of the existing beach access road (from a track to a paved road) would be undertaken as part of the proposed development and would have an effect on local traffic. Removal of sediment off site would involve additional vehicle movements during site clearance works to transport the sediment.

Construction traffic would have the following potential effects:

- Localised changes to traffic conditions to support construction of the entry to the Information Centre on the beach access road, and road works on the beach access road.
- Minor increase in traffic along Gan Gan Road, including heavy vehicles due to construction traffic and workers. This is likely to be higher during site clearance works when truck and dog trailers will be moving material off site as part of the levelling works.
- Temporary road closures and diversions due to paving the existing beach access road, and upgrading the intersection with Gan Gan Road. This would include the addition of a right turning lane from Gan Gan Road into the existing beach access road. The road closures and traffic diversions would be coordinated with RMS and the Transport Management Centre and undertaken at appropriate times to minimise the impact to road users and public transport.

A detailed construction methodology and associated management plans would need to be developed during the detailed design phase of the proposal to manage impacts.

5.6.3.2 Operational Phase

Road Network and Parking

The project aims to redirect a proportion of the tourist traffic currently using James Paterson Street to the proposed Information Centre. The coaches currently heading to the tour operators pick up/drop off point near the SLSC would be redirected to the new Information Centre. This would reduce the number of vehicles currently using James Paterson Street.

Passenger vehicles belonging to residents or heading for amenities along James Paterson Street, for example, Birubi Point SLSC, the restaurant, the holiday park or the beach (surfers), are likely to continue to use parking facilities accessed along, or from, James Patterson Street.

When assuming that a third of the passenger cars are heading to the tourist activities at the beach, this would mean that on a weekend during a peak hour (between 12am-2pm) around 40 vehicles per hour would enter the Information Centre (based on the traffic count in September 2016: a third of 120 vehicles per hour). This is less than one vehicle per minute. On extremely busy days this hourly density can increase up to twice this amount. This would lead to a vehicle entering the Information Centre every 40 seconds (approximately 80 vehicles per hour). It will depend on the average parking duration whether this amount would exceed capacity (50 parking spaces). It is unlikely that this frequency of vehicles would lead to congestion along the beach access road.

The creation of the Information Centre would have a positive effect on James Paterson Street by reducing the number of vehicles using it for access to the current tour operator's location on Birubi Beach. A proportion of the vehicles that would turn right into James Paterson Street from Gan Gan Road would turn off Gan Gan Road at the beach access road instead. This is likely to lead to a decrease in parking related congestion on James Paterson Street.

The development of the Information Centre is likely to have a minimal impact on traffic flow at Gan Gan Road. The current road capacity of Gan Gan Road is sufficient to handle the redirected traffic. A proportion of the vehicles that would currently turn right into James Paterson Street from Gan Gan Road would turn right into the beach access road instead.

The development of the Information Centre would have a beneficial effect on James Paterson Street by increasing the number of parking spaces available for vehicles visiting the area. This would reduce the current pressure on the car parks on James Paterson Street and potentially lead to a decrease in parking related congestion on James Paterson Street.

The development of the Information Centre would increase vehicle traffic on the existing beach access road as well as increasing movements of 4WD vehicles between the Information Centre, the dunes and the beach. This increased volume of traffic is, however, below the capacity of the existing beach access road and unlikely to lead to congestion.

In extreme situations, when all parking places at the proposed Information Centre are occupied, there is potential that this would lead to traffic congestion on the beach access road and at the new intersection with Gan Gan Road.

Active Transport

The development of the Information Centre is likely to have a positive effect on access for pedestrians and cyclists, as James Paterson Street is currently their main access to the beach and would be less congested. This would lead to a safer and more pleasant environment in which to walk and cycle. The

Information Centre would be designed to take into account the needs of pedestrians and cyclists with existing shared pedestrian/cycling paths extended to access the site.

The development of the Information Centre is likely to have a positive effect on public transport access as the centre will be located closer to existing bus stops.

5.6.4 Recommended Control Measures

- Dynamic road signage (and or traffic regulators) at Gan Gan Road to advise people of when the carpark at the Information Centre is full. This would reduce the risk of congestion at the Information Centre and traffic accumulating along the beach access road and intersection.
- Throughout construction, deliveries and movements of construction vehicles would be planned to minimise impacts. All construction vehicles would access and egress the construction site via the beach access road. Construction parking would be organised on the project site and along the beach access road.
- During the road works on the new Gan Gan Road intersection, the contractor would provide for an alternative route via Old Main Road, diverting traffic using approved measures.

5.7 Water Quality and Stormwater

This section of the SoEE addresses the effects of the proposed development on water quality, hydrology and stormwater quantity. In addition, the conformance with the Port Stephens Development Consent Plan (DCP) is also assessed.

A Water Management Plan (WMP) has been prepared which considers surface water and groundwater, including both water quality and water balance. The main focus of the WMP is on water sensitive urban design (WSUD).

The WMP is presented in **Appendix F**.

5.7.1 Existing Environment

The proposed Information Centre is located in a sensitive coastal environment within a complex topography created by mobile sand dunes. The immediate site is currently undeveloped with rainfall either infiltrating into the sandy soil or as runoff via ephemeral drainage lines. There are no constructed drainage structures on the site. The mean average rainfall taken from the Nelson Bay rain gauge (11km from the site) is 1,346mm/year.

The existing site catchments are shown in **Figure 5.10** with the catchment properties summarised in **Table 5.2**.

Table 5.2 Existing Catchment Properties

Catchment	Area, ha	Drains to
A	11.87	Gan Gan Road to the north of the site
B	4.69	Private property to the south-west of the site
C	1.12	Stockton Beach to the south of the site

Catchment A, which represents two thirds of the site, drains to the north where stormwater pits on Gan Gan Road and James Paterson Street accept surface flows.

Catchment B drains to the south-east and into private properties along James Paterson Street. Nos 4, 6, and 8 James Paterson Street are located immediately adjacent to the site.

Catchment C drains to the south-west and onto Stockton Beach.

The geology and soil characteristics exhibit high infiltration rates, resulting in a relatively low rainfall runoff (as described later). Hydrologic Soil Mapping data for Port Stephens was reviewed. The mapping demonstrates that the soils at the site have been classified as 'Group A' — soils having high infiltration rates, even when thoroughly wetted and consisting chiefly of deep, well to excessively-drained sands or gravels. These soils have a high rate of water transmission.

For design purposes, it is assumed that the Antecedent Moisture Condition is "Rather wet" (refer to Australian Rainfall and Runoff (ARR) 2016, 'Table 5.3.11') and the Horton Maximum (Initial) Infiltration Rate is 83.6 mm/hr, the Minimum (Final) Infiltration Rate is 25 mm/hr and the Shape Factor/Decay Rate k is 2mm /hour (refer ARR 2016, 'Table 5.3.12').

Rainfall runoff analysis is described below and includes estimated peak runoff rates under the existing conditions.

Requirements of the DCP

Relevant extracts of the DCP referring to drainage are presented below:

B4.1	***Development*** that applies to this Part is to provide a ***stormwater drainage plan*** and a written description of the proposed drainage system within the ***SEE*** **Note:** C1.H also provides drainage requirements for ***development*** relating to ***subdivision*** **Note:** Hydrological/hydraulic calculations and designs shall be prepared in accordance with the approaches outlined in the current ***Australian Rainfall and Runoff*** Guidelines using the current Hydrologic Soil Mapping data for Port Stephens available from Council. Other current Australian published design guides may also be applied to particular design situations.
B4.2	***On-site detention*** / ***on-site infiltration*** is required where: • The post-development flow rate or volume exceeds the pre-development flow rate or volume; or • ***Impervious surfaces*** exceed the total percentage of ***site area*** listed under Figure BD (p. B-29); • It is identified under Section D Specific Areas of the ***PSDCP 2014***; or • The stormwater catchment is identified to have stormwater issues.
B4.3	***On-site detention*** / ***on-site infiltration*** is to be: • Sized so that the post-development flow rate and volume equals the predevelopment flow rate and volume for all storm events up to and including the ***1% Annual Exceedance Probability (AEP)*** storm event. • Provided by either underground chambers, surface storage or a combination of the two and are generally positioned: - Under grassed areas for any ***cellular system*** (which can be easily maintained) - Under hardstand areas such as ***driveways*** for any concrete tank structures **Note:** A ***Neutral or Beneficial Effect (NorBE)*** on water quality must be designed for all storm events.
B4.4	Details of the ***on-site detention*** / ***on-site infiltration*** concept design must be provided in

	the ***stormwater drainage plan*** and the written description and must include information on: • The location and type of detention / infiltration system. • Demonstrated flow rate / volume for all design storm events up to the ***1% AEP.*** • Pipes, pits, ***overland flow*** and discharge point. • Surface grates and maintenance access points. • Orifice type, location and screening facility. • Slope/gradient of the land. • Post-development flow rate and volume for the site equal to pre-development flow rate and volume for the site.

There are no rivers, lakes or estuaries within 40m of the proposed development site. There are a number of indistinct ephemeral watercourses which are indicated by the blue arrows on **Figure 5.10**.

Figure 5.10 Existing Surface Water Catchments and Ephemeral Watercourses

Immediately adjacent to the east of the site is the Stockton Sandbeds Special Area which has been defined by Hunter Water and protects an unconfined sand aquifer extending from Fullerton Cove to Anna Bay (see **Figure 5.11**). Water is not currently extracted from this aquifer but it can be used by Hunter Water in the event of a water shortage. The proposed development site is outside of this area, however, there is potentially some connection between groundwater on the site and the Stockton Sandbeds system.

Figure 5.11 Stockton Sandbeds Special Area

Currently the site has no water service, however there are existing water mains in the immediate vicinity of the site (detailed below and shown in **Figure 5.12**):

- Immediately adjacent to the site boundary in James Paterson Street (100 mm AC).
- Opposite the proposed site entrance in Old Main Road south of Gan Gan Road (150 mm PVC).
- There is also a 300 mm PVC water main along the western part of Gan Gan Road and Old Main Road.

Figure 5.12 Water Services in Vicinity of the SIte

There are also existing sewer mains in the immediate vicinity of the site: there is a 150 mm main running along Gan Gan Road, as shown in **Figure 5.13**.

Figure 5.13 Sewer Services in Vicinity of the Site.

5.7.1.1 Hydrological Assessment

A hydrological/hydraulic assessment has been prepared in accordance with the approaches outlined in Australian Rainfall and Runoff Guidelines using the current Hydrologic Soil Mapping data for Port Stephens (mentioned above).

The site is 17,392 m^2 (1.73ha) and solely pervious with nearly 100% infiltration capacity. The proposed development would increase the impervious area from zero to 9,350m^2 (0.935ha), approximately 50% of the total site area. Part of the proposed development site would remain undisturbed (hence pervious). This undisturbed area has been discounted from the impact assessment.

Hydrological assessment was undertaken using the XP-RAFTS hydrological model. The to-be disturbed catchment area was modelled for the existing conditions and proposed conditions. Once the increase in peak runoff was determined, on-site detention (OSD) was sized to ensure post development peak runoff does not exceed pre development runoff.

Key parameters used in the hydrological modelling are presented below:

Table 5.3 Hydrological Modelling Parameters

	IL	CL
Pervious surfaces	35 IL*	25mm/hr CL
Impervious	1 mm / hr	0mm / hr

***maximum value recommended by ARR 1987, as per the Anna Bay Flood Study**

IFD values and coefficients were adopted from the BoM IFD charts. The model was run for the 100 year ARI. A range of storm durations were run to determine the critical duration, noting that the critical duration may be different for the pre, post and post with OSD scenarios.

For the purposes of assessment, the area proposed to be disturbed was changed from a pervious surface to impervious surface. Resulting peak runoff for pre and post development scenarios are presented in **Figures 5.14** and **5.15** below.

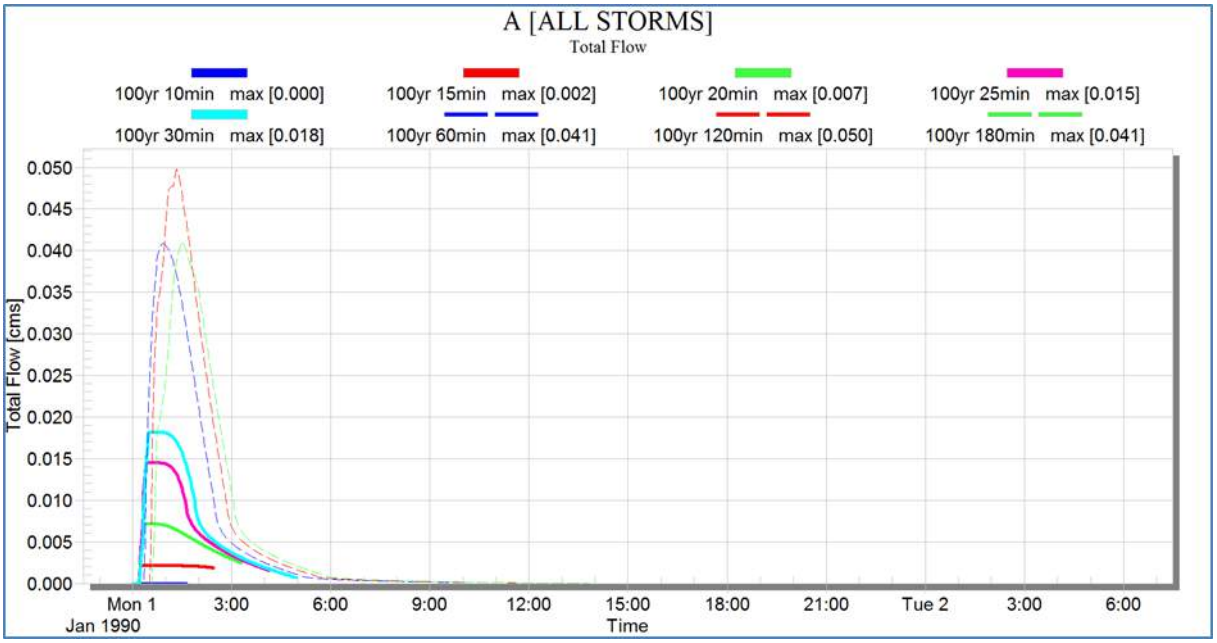


Figure 5.14 Pre Development Peak Runoff

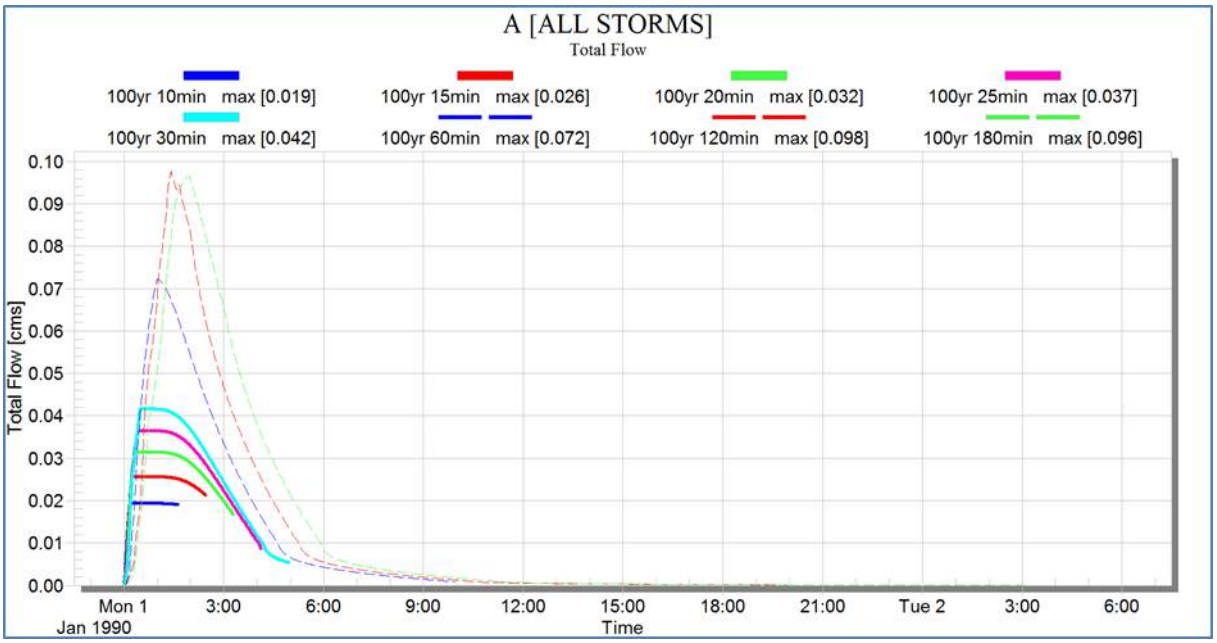


Figure 5.15 Post Development Peak Runoff

As is demonstrated by the above results, the peak runoff from the site in the 100 year ARI is estimated to increase from 0.05m^3/s to 0.1m^3/s.

The required OSD was determined using the hydrological model, using an open retarding basin. Key features of the proposed retarding basin, as simulated in the hydrological model include a peak storage volume of 800m^3 above any standing water level, a 125mm diameter low-flow outlet pipe, and spillway 1.0m above the low flow invert. Results with the retarding basin incorporated are presented in **Figure 5.16** below.

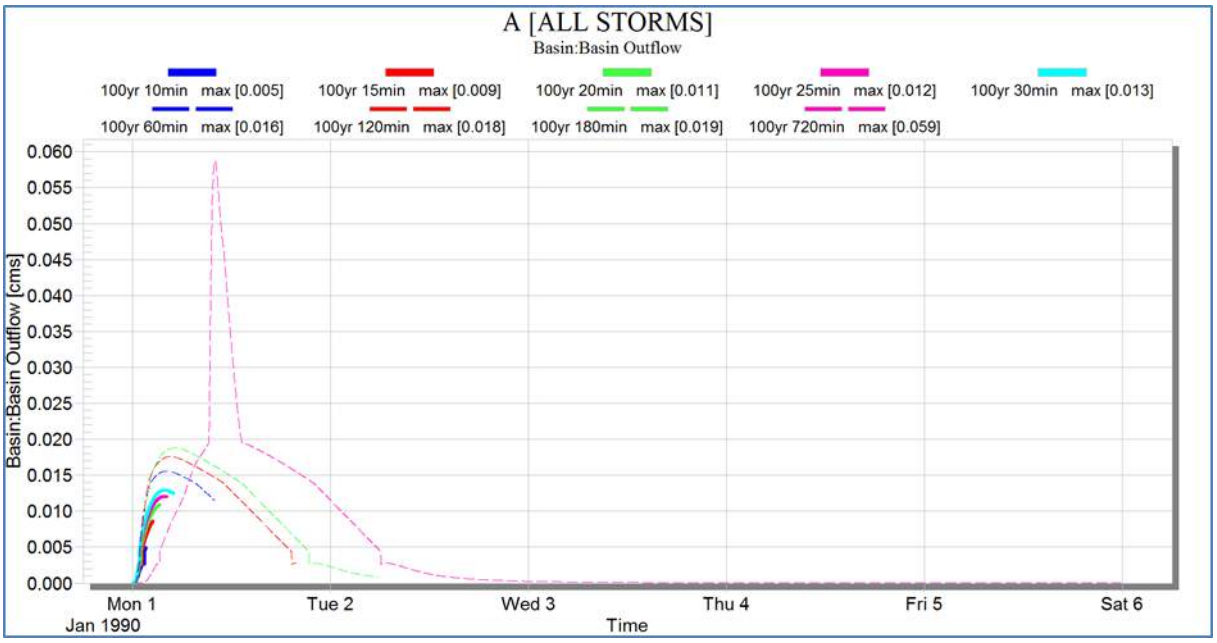


Figure 5.16 Post Development Peak Runoff with Retarding Basin Incorporated in the Design

5.7.2 Potential Effects

Compaction of material for roadways and parking and the construction of hardstanding for buildings and facilities has the potential to reduce the rate of rainwater infiltration into the sand and increase surface runoff. As is demonstrated from the hydrological assessment documented above, rainfall runoff is estimated to increase from a peak of 0.05m^3/s to 0.10m^3/s.

There is the potential for minor fuel spills and leaks from vehicles using the site to affect the water quality of groundwater in the area. Fuel or oil could seep into the ground and be washed into ground or surface water following rainfall.

Newly constructed facilities and buildings will require new water sources and suitable disposal of wastewater. Before water is released into the public drainage system it must achieve Council's water quality targets. Mains water would need to be provided to the site with water for toilet flushing and irrigation supplied from non-potable water sources such as rainwater.

5.7.3 Recommended Control Measures

The following elements are recommended to be included in the design of the Birubi Point Information Centre to meet Port Stephens Council's water quality targets:

- Rainwater tank: minimum 50 kL tank collecting roof runoff from the proposed building and supplying toilet flushing demands in the proposed facility.
- Wetland: including a 100 m^3 inlet pond and 500 sqm macrophyte zone. Where possible, car park runoff should be pre-treated in swales before it reaches the wetland. This could improve the performance of the wetland and reduce the wetland area required to meet the water quality targets.
- The negative impacts of increased runoff are proposed to be mitigated using OSD in the form of a retarding basin. The retarding basin has been sized appropriately to ensure that the peak runoff in the 100 year ARI does not exceed pre-development values. In all storms other than the 9hr storm, peak runoff is reduced when compared to the existing situation.
- On site detention/infiltration should be sized so that post development flow rate and volume equals the pre-development flow rate and volume for all storm events up to and including the 1% Annual Exceedance Probability (AEP) storm event. While infiltration can be encouraged in the sandy soils, stormwater runoff should be pre-treated prior to infiltration, to protect groundwater quality.
- Water quality modelling (e.g. MUSIC modelling) has been undertaken to demonstrate compliance with Council's water quality targets (see **Appendix F**).

5.8 Noise and Vibration

This section considers the potential effects of noise from the proposed Information Centre on the surrounding environment.

5.8.1 Existing Environment

The existing ambient noise environment around the site is likely to be influenced both day and night by road traffic noise from Gan Gan Road and James Paterson Street, recreational users of the area (primarily during the daytime) and ocean waves.

The closest sensitive receptors for noise are the residential areas immediately adjacent to the proposed development site along James Paterson Street and Gan Gan Road. The residences on the western side of James Paterson Street have gardens that directly back onto the proposed site at a distance of 10m at the closest point. There is a tourist facility under development to the north west of the proposed development site. This site, together with recreational users who visit the area, would also be a receptor for noise during construction and operation of the proposed Information Centre.

5.8.2 Potential Effects

5.8.2.1 Construction Phase

The proposed construction works will involve use of plant and machinery to clear sand and level the ground for the Information Centre as well as building of the new interchange with Gan Gan Road and the buildings and facilities at the site. Given the proximity of the residences with the proposed works there is likely to be an impact of construction noise on a number of the residences along James Paterson Street. There is a tourist development to the north west of the proposed site. This is currently under construction however depending on construction timeframes there is potential for noise impacts on those staying in/visiting this property. There is also a potential impact of construction noise on recreational users of the beach in this area.

Works will be undertaken during the standard construction hours where practicable (i.e. 7.00 am to 5.00 pm Monday to Friday and 7.00 am to 1.00 pm Saturdays, with no work to be undertaken on Sundays and Public Holidays). However on occasion works may be required outside of the standard hours to meet the tide conditions and to allow for the works to be delivered before the peak summer period. Where works are required outside of the standard hours, notification will be undertaken in accordance with a Communications Plan to be prepared by Council.

5.8.2.2 Operational Phase

During the operational phase the transport hub will receive cars and busses dropping off visitors to the Information Centre. Tour operators will be based at the Information Centre and vehicles and animals for taking people out on tours will be moving in and out of the area around the Information Centre. There will be a certain level of noise from moving vehicles, staff and visitors using the Information Centre. This is likely to increase ambient noise levels in the area and have an effect on the residences along James Paterson Street that immediately adjoin the site. There is also the potential for impact on the tourist development to the north west of the site and recreational users of the beach in this area.

5.8.3 Recommended Control Measures

- A construction noise management plan would be included within the Construction Environmental Management Plan (CEMP). This plan should detail information on noise reduction measures and promote the best practicable approach to control noise and minimise potential impacts on local residents;
- Construction times to be limited to standard construction hours (7.00 am to 5.00 pm Monday to Friday and 7.00 am to 1.00 pm Saturdays, with no work to be undertaken on Sundays and Public Holidays);

- Surrounding residences, beach users and businesses should be notified of the proposed works and hours of operation;
- A Council contact should be provided for the works in the event of any complaints; and
- Instructions should be issued to the Contractor that appropriate silencers are to be fitted on all plant and equipment where possible.
- Existing dense areas of vegetation along the Eastern boundary of the site should be retained as far as possible to maintain sound screening from the residential areas along James Paterson Street and Gan Gan Road;

5.9 Visual Impacts

This section considers the potential effects of the proposed development on the visual aspect of the area.

5.9.1 Existing Environment

The proposed development site is characterised by low lying wind-blown sand deposits with scattered colonisation of shrub vegetation throughout the middle of the site and denser areas of vegetation to the east of the site. The site is immediately adjacent to Gan Gan Road and borders a number of residential properties to the East and a commercial development site to the North West.

The proposed site is currently well screened from the beach and roadways by these areas of fairly dense vegetation which form a boundary between James Paterson Street and the sand dunes of the WCL. There are 4 residential properties which directly back onto the proposed development site. The gardens of these properties are screened from the site by this band of vegetation.

There is minimal vegetation to the North West boundary of the site along the existing beach access road. This gives open sight lines to the commercial development site on the opposite side of the beach access road.

Figure 5.17 shows recent aerial imagery of the proposed development site and provides an indication of the existing setting, landscape and aspect of the proposed development site.

Figure 5.17 Existing environment and Surrounds of Proposed Development Area

5.9.2 Potential Effects

5.9.2.1 Construction Phase

The construction works are expected to cause minimal and temporary impact on the visual amenity of the site and adjacent areas and would be in keeping with the current visual amenity of the under construction development to the north east of the site. Impacts would be in the form of earthworks, the presence of vehicles, plant, equipment and temporary stockpiling of materials.

As discussed in **Section 5.3,** there is potential for increased amounts of sand and sediment to mobilise during the construction phase. As vegetation is removed there is potential for sediment to become less stable and mobilise/drift in the wind impacting gardens, residences or roadways.

5.9.2.2 Operational Phase

The new Information Centre will lead to the removal of some areas of existing vegetation at the site. Established areas of vegetation will be retained wherever possible and replanting will be undertaken with native species to improve visual amenity and provide additional screening (see drawings in **Appendix A**).

New buildings for the Information Centre and operator kiosks will be low level and designed to be sympathetic to the existing landscape. The concept design for the Information Centre is shown below in **Figure 5.19**.

Figure 5.18 Example of similar low level building sympathetic to existing landscape

5.9.3 Recommended Control Measures

- Existing dense areas of vegetation along the Eastern boundary of the site should be retained as far as possible to maintain screening from the residential areas along James Paterson Street and Gan Gan Road.
- Construction works to be completed in the shortest possible timeframe to minimise construction visual impacts.
- All plant and equipment to be kept to a minimal area and to be retained within the site compound outside of construction hours.
- The site would be kept tidy at all times. Any floating or windblown debris would be collected as soon as practicable.
- Any temporary stockpiles of material would be damped down with water or covered as appropriate to prevent re-mobilisation of material.
- Additional planting of native vegetation to the north and west of the site will be undertaken to provide screening of the constructed development and minimise drift of sand and sediment in the prevailing wind.

5.10 Public Access and Safety

This section looks at the potential effects of the development in relation to public access to the site and safety of the public.

5.10.1 Existing Environment

The proposed development site lies to the South east of the beach access road from Gan Gan road into the WCL dunes. The Birubi Point SLSC is to the south of the site and used for access to the beach for recreational users including 4x4 driving/tours, surfing and other recreational beach activities.

There is currently no barrier to accessing the proposed development site from the beach access road or north from the SLSC. There are a number of unofficial beach access routes extending through the proposed development site from the residential gardens along James Paterson St.

The proposed development site is on land which is classified as bushfire prone. Approximately 50% of the site is classified as Vegetation Category 1 and 50% as Vegetation Buffer.

5.10.2 Potential Effects

5.10.2.1 Construction Phase

The construction site is on land currently accessible to the public from the beach, road and private residences. There is a risk of construction works temporarily impacting on the public and recreational users accessing this area.

5.10.2.2 Operational Phase

The proposed Information Centre, once completed, will provide new public access to the WCL dunes. This will redirect many users of the existing public access at the Birubi Point SLSC to the new Information Centre where there will be improved parking and public facilities.

The pick up location for 4x4 tours will be relocated to the new Information Centre again reducing the number of people accessing the WCL dunes from the SLSC car park.

The informal residential access to the beach and dunes may be impacted by the operation of the proposed Information Centre.

It is likely that the improvements in parking and facilities will lead to an increase in public access to the area over time. This will lead to an increase in traffic using the junction with the existing beach access road.

Much of the vegetation on the site will be retained following development and the site will remain bushfire prone. Planning law in NSW requires new development on bush fire prone land to comply with the provisions of Planning for Bush Fire Protection 2006 and must be designed to improve the survivability of the development and the occupants that are exposed to a bush fire hazard.

5.10.3 Recommended Control Measures

- Landowners and recreational users to be notified in advance of the proposed works.
- The perimeter of the construction site to be fenced and secured with site safety fencing to prevent public access during the works.
- Improvements to be made to the junction of the existing beach access road from Gan Gan road to allow for increase in vehicle use (see **Section 5.4** Traffic and Transport).
- New signage to be put in place on roads and access to direct and inform users of the intersection and new access.
- A bushfire assessment report will be prepared to prevent and mitigate for the impact of bushfire on the proposed development by ensuring bushfire protection measures are integrated into the design and siting. The assessment report determines the suitability of a proposal with regards to bushfire through consideration of the requirements contained within the Planning for Bush Fire Protection 2006 document prepared by the Rural Fire Service.

5.11 Waste Management

This section looks at the potential effects of the proposed development in relation to waste management. Waste management tales account of all waste materials or products which will need to be removed from the site.

5.11.1 Existing Environment

The proposed development site is currently undeveloped and there are no existing waste management facilities on the site. The site is accessible from the existing beach access road.

5.11.2 Potential Effects

Construction
In general, waste will only be generated by demolition and excavation material that is deemed unsuitable for reuse. The proposed works may generate the following waste during construction:

- Excavated fill material unsuitable for reuse;
- Green waste including grasses and small trees or shrubs; and
- General construction waste.

Operation
Waste will be generated from the Information Centre, kiosks and visitors using the site once it is operational.

5.11.3 Recommended Control Measures

- A waste management plan is required for development involving on-site construction works that details the following:
  - Volume and type of waste
  - Storage and treatment of waste
  - Disposal of residual material
- Waste should be managed in accordance with the philosophy of the waste minimisation hierarchy as follows:
  - Avoidance, where possible;
  - Treated, as required and reused onsite;
  - Recycled, either within the site or offsite; and
  - Where other alternatives are not possible, wastes should be disposed of at appropriately licensed waste management facilities.
- Maximise reuse and recycling of all general construction waste.
- Appropriate training on the management of waste should be provided to all workers onsite.
- During operation it is recommended to use 12 x 240 litre wheelie bins for recycling and waste which can be locked in a well ventilated room/lock up cage overnight. Operators will wheel the bins out each day for use by site users and visitors.
- A bay should be provided for 2 x 3 cubic metre skips, one for waste and one for recycling, near the car park area. This should be well screened in the landscaping plan. Skips should be lockable to prevent access afterhours and illegal dumping of waste.

6 Environmental Management and Control Measures

A site-specific construction environmental management plan (CEMP) should be prepared by the Contractor and approved by Council prior to commencement of construction. The Contractor would implement the CEMP during the construction works for the Information Centre and would be responsible for selecting appropriate control measures for the potential impacts identified in this SEE. The CEMP would ensure that:

- Appropriate control measures for the potential impacts are implemented on the site;
- Activities are carried out with due diligence; and

- All activities comply with relevant environmental legislation including conditions of approval, Acts and Regulations, and Standards and Best Management Practices.

A contamination management plan and acid sulfate soil management plan should form part of the CEMP.

With the implementation of the CEMP environmental controls there would not be expected to be significant environmental impacts during construction.

7 Conclusions

Port Stephen's Council is seeking to develop a new Information Centre on Lot 312 DP753024 at Anna Bay, NSW.

The proposed works are to be undertaken under Part 4 of the EP&A Act. This SEE has been prepared to support the development application for these works.

In general, the proposed development is expected to have an environmental benefit on the surrounding area by improving the management of transport and visitors to the local area and reducing current pressure on the important heritage and ecological values of the area. Where potential environmental impacts have been identified, either during construction works or operation of the Information Centre, control measures are recommended to avoid or minimise these impacts.

8 References and Bibliography

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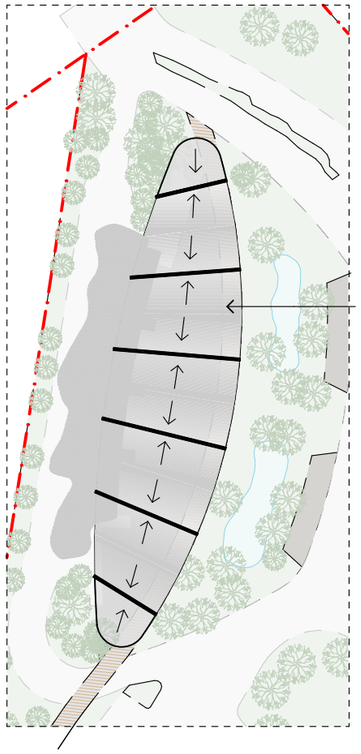
Appendix A - Architectural Drawings

1. SITE PLAN
1:1000



2. ROOF LEVEL
1:1000

3. AREAS - FOR COSTING
1:1000

NOT FOR CONSTRUCTION

ISSUE	DATE	DESCRIPTION

ISSUE	DATE	DESCRIPTION

ARCHITECT
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PROJECT
BIRUBI POINT TOURISM TRANSPORT INTERCHANGE

NORTH

SHEET TITLE
SITE PLAN

PROJECT NUMBER	PLOT DATE	DRAWN	CHECKED	SHEET SCALE	SHEET SIZE	SHEET NUMBER	ISSUE
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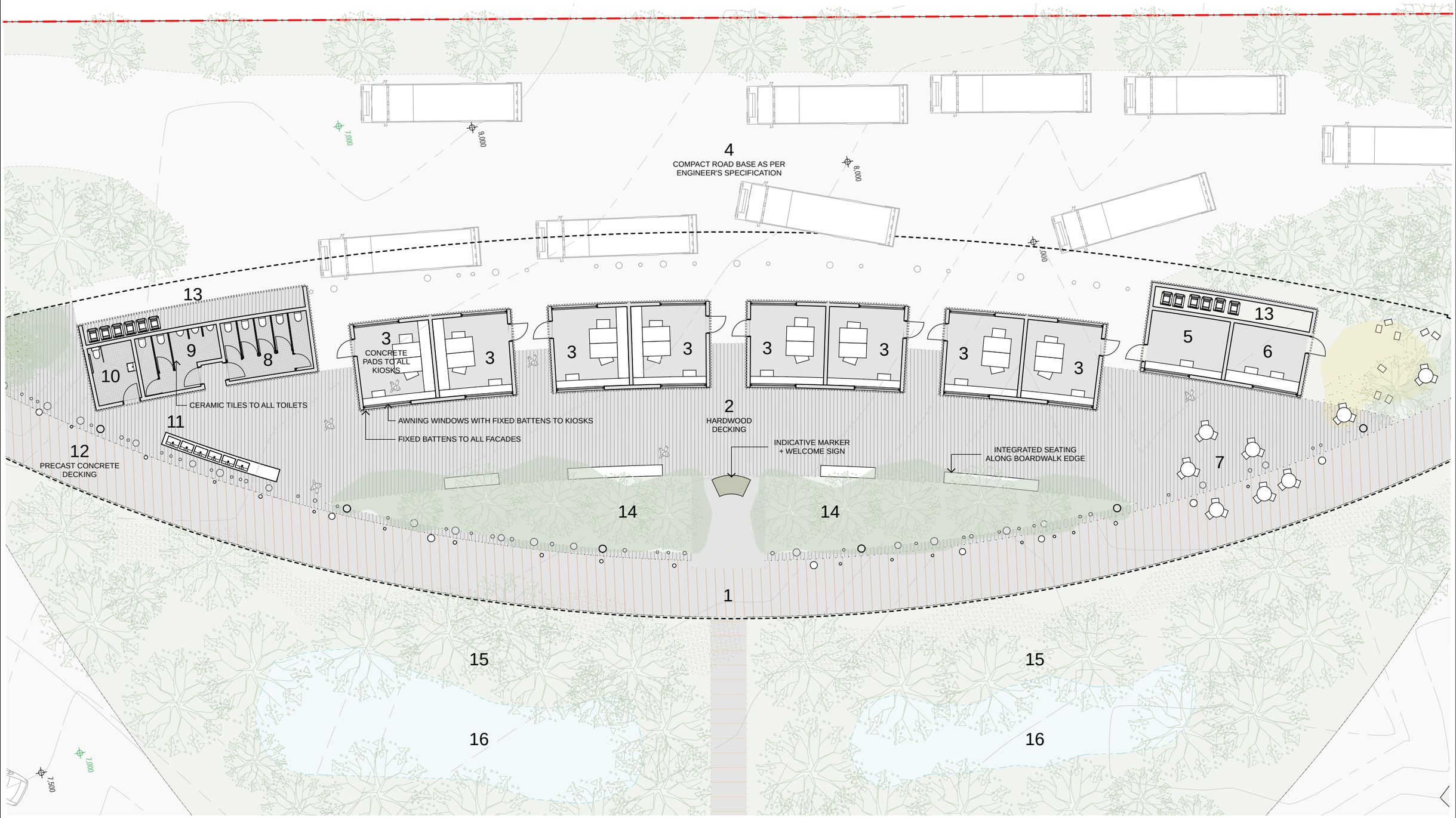

1	BOARDWALK - GATHERING POINT
2	WAITING ZONE FOR TOUR GROUPS
3	TOUR KIOSKS
4	TOUR DEPARTURE ZONE
5	FOOD KIOSK
6	SITE MANAGEMENT OFFICE
7	KIOSK SEATING
8	FEMALE WC
9	MALE WC
10	ACCESSIBLE WC
11	COMMUNAL HANDWASH ZONE
12	BOARDWALK CONNECTION TO ABORIGINAL PLACE
13	BIN STORE + SERVICES
14	LANDSCAPING - LIGHT
15	LANDSCAPING - DENSE
16	LANDSCAPING - WETLANDS AREA

PROPOSED RLS

EXISTING RLS

NOT FOR CONSTRUCTION

ISSUE	DATE	DESCRIPTION

ISSUE	DATE	DESCRIPTION

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PROJECT
BIRUBI POINT TOURISM TRANSPORT INTERCHANGE

NORTH

SHEET TITLE
GROUND FLOOR PLAN - DETAILED

PROJECT NUMBER	PLOT DATE	DRAWN	CHECKED	SHEET SCALE	SHEET SIZE	SHEET NUMBER	ISSUE
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1. SITE PLAN
- 1:1000

1. PSD STAGE 1
- 1:1000

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ISSUE	DATE	DESCRIPTION

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PROJECT
BIRUBI POINT TOURISM TRANSPORT INTERCHANGE

NORTH

SHEET TITLE
SITE PLAN -STAGE 1_COMPARISON

PROJECT NUMBER	PLOT DATE	DRAWN	CHECKED	SHEET SCALE	SHEET SIZE	SHEET NUMBER	ISSUE
1752	8/6/18	EJ	AL	1:1000	A3	SK.03	1

1.
-
PSD STAGE 1
1:1000

1.
-
PSD STAGE 2
1:1000

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ISSUE	DATE	DESCRIPTION

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PROJECT
BIRUBI POINT TOURISM TRANSPORT INTERCHANGE

NORTH

SHEET TITLE
SITE PLAN -STAGE 1 + 2

PROJECT NUMBER	PLOT DATE	DRAWN	CHECKED	SHEET SCALE	SHEET SIZE	SHEET NUMBER	ISSUE
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1. PSD STAGE 1
- 1:1000

1. AERIAL VIEW 1:1000
- 1:1000

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ISSUE	DATE	DESCRIPTION

ISSUE	DATE	DESCRIPTION

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PROJECT
BIRUBI POINT TOURISM TRANSPORT INTERCHANGE

NORTH

SHEET TITLE
SITE PLAN - OVERLAY

PROJECT NUMBER	PLOT DATE	DRAWN	CHECKED	SHEET SCALE	SHEET SIZE	SHEET NUMBER	ISSUE
1752	8/6/18	EJ	AL	1:1000	A3	SK.05	1

Appendix B - Transport Design and Engineering Advice

Birubi Information Centre
Transport and Engineering Advice

Prepared for McGregor Coxall by Haskoning Australia Pty Ltd (a company of Royal HaskoningDHV)

FINAL

Project No. PA1845

3 July 2018

Royal HaskoningDHV
Enhancing Society Together

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Document title	Birubi Information Centre Transport and Engineering Advice
Status	**Final**
Date	3 July 2018
Reference	PA1845
Client	McGregor Coxall

Issue History

Issue	Streetatus	Drafted by	Checked by	Approved by	Date
Rev A	Draft	Alex van Gent	Miriam Knollys		19/06/2018
	Final	Alex van Gent	Miriam Knollys	René Zijlstra	03/07/2018

CONTENTS

1 INTRODUCTION

1.1 Preamble

This **Birubi Point Information Centre – Transport and Engineering Advice** has been prepared by Royal HaskoningDHV (RHDHV) for McGregor Coxall (MCGC).

Preliminary advice was provided during a workshop (1 May 2018).

Information presented in this report is deliberately selective and project specific.

The document is structured as follows:

- **Section 1** – Introduction;
- **Section 2** – Transport and Engineering Advice.

1.2 Project Background

Port Stephens Council is planning to develop a new Information Centre at Anna Bay NSW to cater for the growing demand for international and domestic tourism activities on the Worimi Conservation Lands (WCL) and Birubi Point Aboriginal Place. The demand for sand dune adventure tourism and cultural heritage experiences has grown to such a point that urgent planning for a new Information Centre is being co-funded by the NSW Government's Tourism Demand Driver Infrastructure Fund and Port Stephens Council.

The design for the site will include the following:

- a cultural interpretive centre;
- suitable undercover drop off areas for large coaches;
- kiosks and shop fronts for the booking of tours and for tour operators to receive customers from the coaches;
- a central kiosk/information point;
- toilets;
- parking for buses, coaches, cars and bicycles; and,
- landscaping and signage that is in keeping with the concept theme.

McGregor Coxall is working on behalf of Port Stephen's Council to design and develop the Information Centre outside of the Aboriginal Place to provide a new gateway for visitors to the WCL. The aim of the Information Centre is to reduce traffic and parking congestion on the headland which currently puts pressure on the archaeological and cultural values. It is also an opportunity to carefully design an integrated gateway to the WCL and Birubi Point to retain the scenic value and sense of arrival that attracts visitors.

The proposed transport hub would be accessed from the existing Beach Access Road off, Gan Gan Road and would provide facilities for bus/coach and car parking and bicycle parking.

2 TRANSPORT AND ENGINEERING ADVICE

Preliminary advice concerning transport planning and engineering was provided as part of a project workshop. This advice, as well as information subsequently provided, is presented below.

2.1 General Design Principles

To ensure a functioning Information Centre, that is comfortable for the users (both tourists enjoying the area and road users) and safe, the following General Design Principles should be taken into account:

- Design the Information Centre using a low maximum speed (preferably 30 km/h), to encourage safe driving behaviour.
- Keep motorised traffic separated from pedestrians and cyclists as much as possible.
- Keep coaches separated from other traffic as much as possible.
- Manage pedestrian access on site, connecting the carpark to the new facilities.
- Provide for walking and cycling infrastructure at the project site, connecting to the existing shared path along Gan Gan Road.
- Provide parking facilities for bicycles.

2.2 Site Entrance

The following Design Principles should be taken into account for the site entrance:

- The grading of both the existing Beach Access Road as well as the site access should be designed according to the AustRoads guidelines.
- Inbound and outbound lanes at the entry/exit of the site will be clearly organised by signage, lineage and stop signs at the Beach Access Road and on-site, so that it will be clear which lanes are to be used by incoming and outbound traffic, both for passenger cars and coaches as 4WD traffic. ‘KEEP CLEAR’ or ‘DO NOT QUEUE ACROSS INTERSECTION’, pavement markings may be used on the intersection at the site entrance, to prevent traffic queues to obstruct other traffic wishing to cross that intersection.
- Maximise the distance between the Information Centre entrance and Gan Gan Road, to minimise the risk of queues along the Beach Access Road. Design should allow for a coach to be able to wait on the existing Beach Access Road without blocking Gan Gan Road, if there is another coach leaving the site.
- When a coach is entering or leaving the site all other vehicles should wait (cars, coaches and 4WD’s), as the entrance is quite narrow. We advise to add line markings on the existing Beach Access Road to organise where traffic should wait in case a coach is entering or leaving.
- The 4WD’s cross each other when leaving and entering the site, this is a major point of attention to the 4WD-drivers, as it is not common when turning left, to mind incoming traffic from the left side. This happens when 4WD’s leave the Information Centre heading to the beach and when they are returning from the beach.
- Provide access for pedestrians and cyclists which is separate from motorised traffic by extending the existing shared pedestrian/cycling path from Gan Gan Road all the way to the ‘tourist platform’ at the Information Centre.

2.3 Intersection Gan Gan Road with the Existing Beach Access Road

In order to increase road safety, we advise that the following adjustments are made to the intersection of Gan Gan Road with the existing Beach Access Road:

- Provide for a right turning lane[1] from Gan Gan Road toward the existing Beach Access Road.
- Provide for a shared pedestrian and cycle path connecting the project site to the shared path along Gan Gan Road (2 meters wide, just as wide as the shared path along Gan Gan Road).
- Adjust the first part of the Old Main Road so that it intersects Gan Gan Road with a 90 degree angle. This improves sight lines and therefore reduces the risk of crashes.
- Selective pruning of the existing trees may be required to ensure clear sight lines from Gan Gan Road into the Beach Access Road.

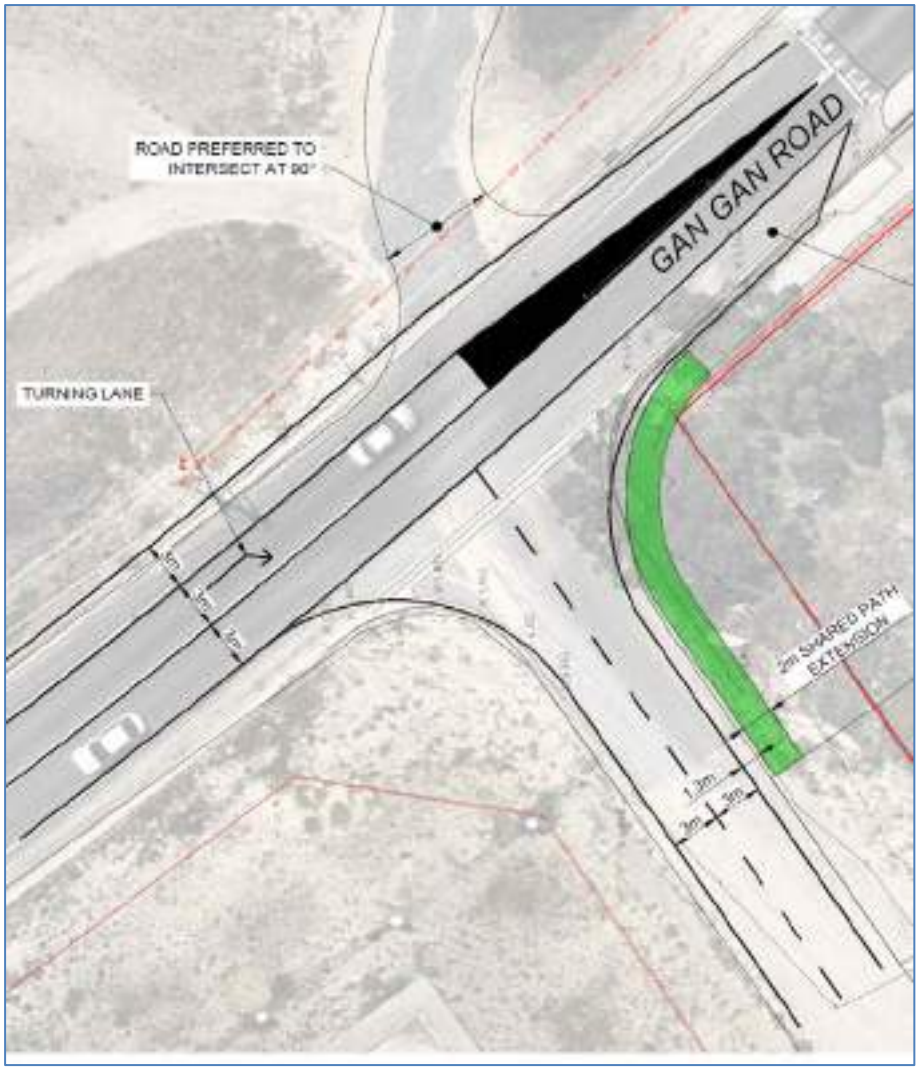

Figure 1: Suggested adjustments to the intersection Gan Gan Road with the existing Beach Access Road

[1] We would not recommend to provide for a left turning lane, due to increased risk of so called 'blocked-view accidents'.

2.4 Traffic circulation on-site

Remarks:

- Mixing outgoing dune bound traffic (4WD) with passenger cars and coaches could lead to delays for 4WD vehicles if there is vehicle congestion on busy days.
- Add pedestrian markings for people parking their car on the eastern side of the car park.
- Provide access for pedestrians and cyclists separated from motorised traffic, all the way from entrance to 'tourist platform'.

Allow for the following aisle widths:

- Between 7-8 meters for the area where the coaches park by reversing
- Between 7-8 meters for the area where there is:
    - Two way car traffic
    - Coaches parking inside the two parking bays
    - Outgoing 4WD's
- In addition to this we recommend to turn the 2 parking bays for coaches into one long parking bay so that it is easier and faster for coaches to manoeuvre.
- Around 6 meters for the private car park, with 90 degree car parking on both sides of the aisle.

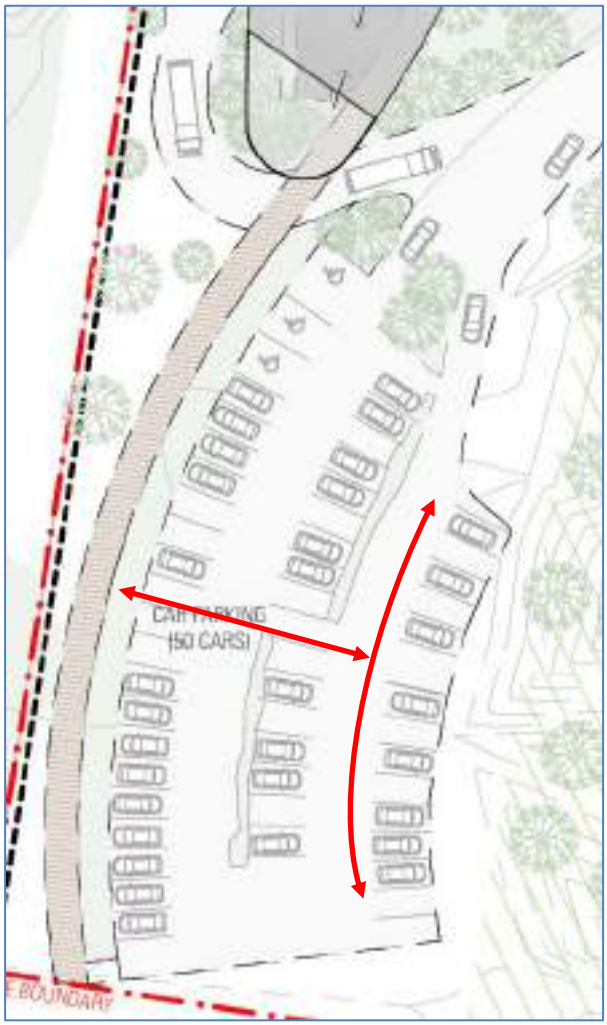

Figure 2: Lay-out of the passenger car parking bay

2.5 Swept Path Analysis

Swept Path Analyses have been performed for

- Street standard car (5.2 m, AustRoads 2006)
- Coach (Single unit truck-bus - 12.5m, AustRoads 2006)
- 4WD cars and trucks (service vehicle 8.8 m, AustRoads)

Figure 3: Typical 4WD vehicle operating at Birubi Beach.

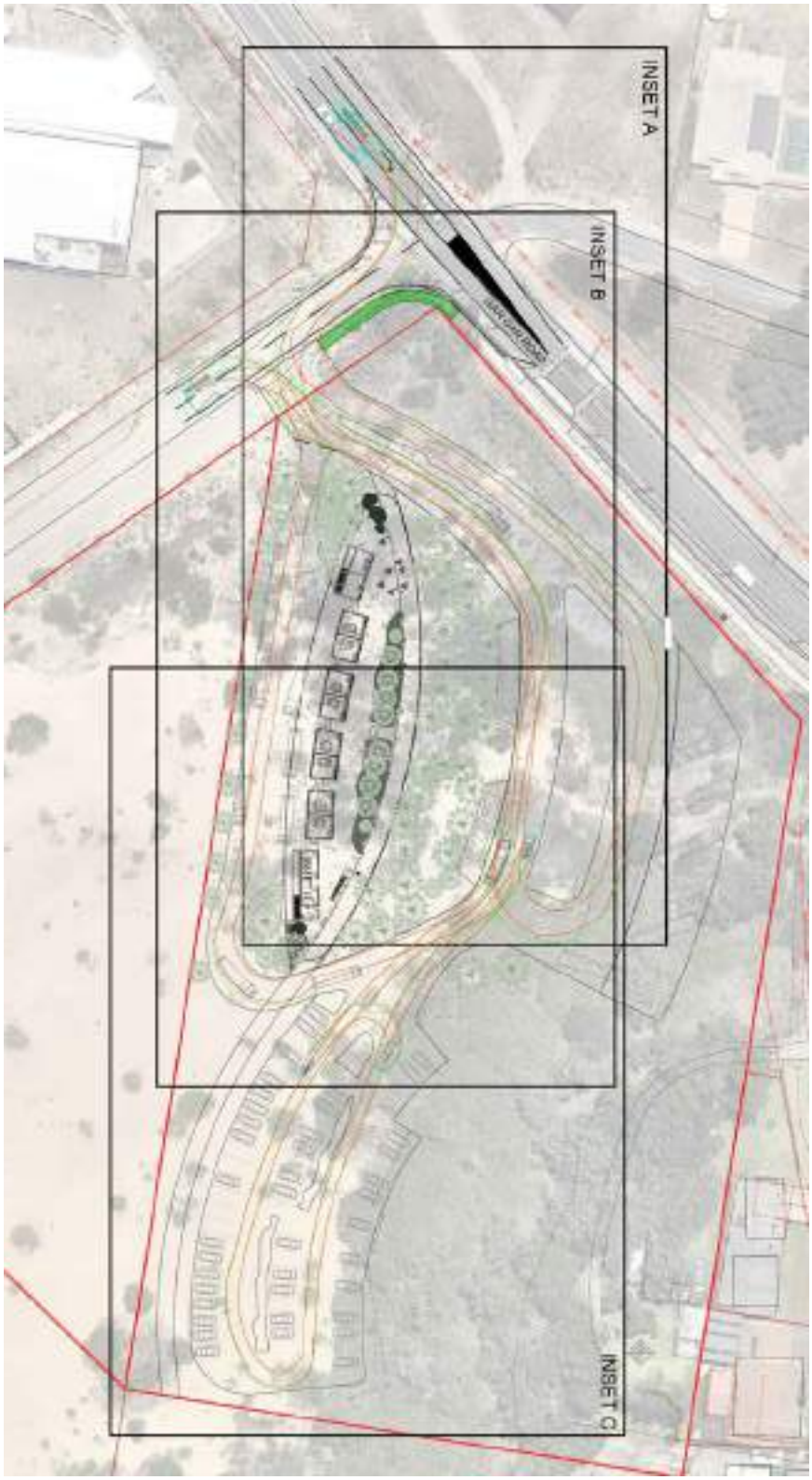

Figure 4: Swept Path Analysis (version 14-06-2018)

Figure 5: Swept Path Analysis private car park (version 14-06-2018)

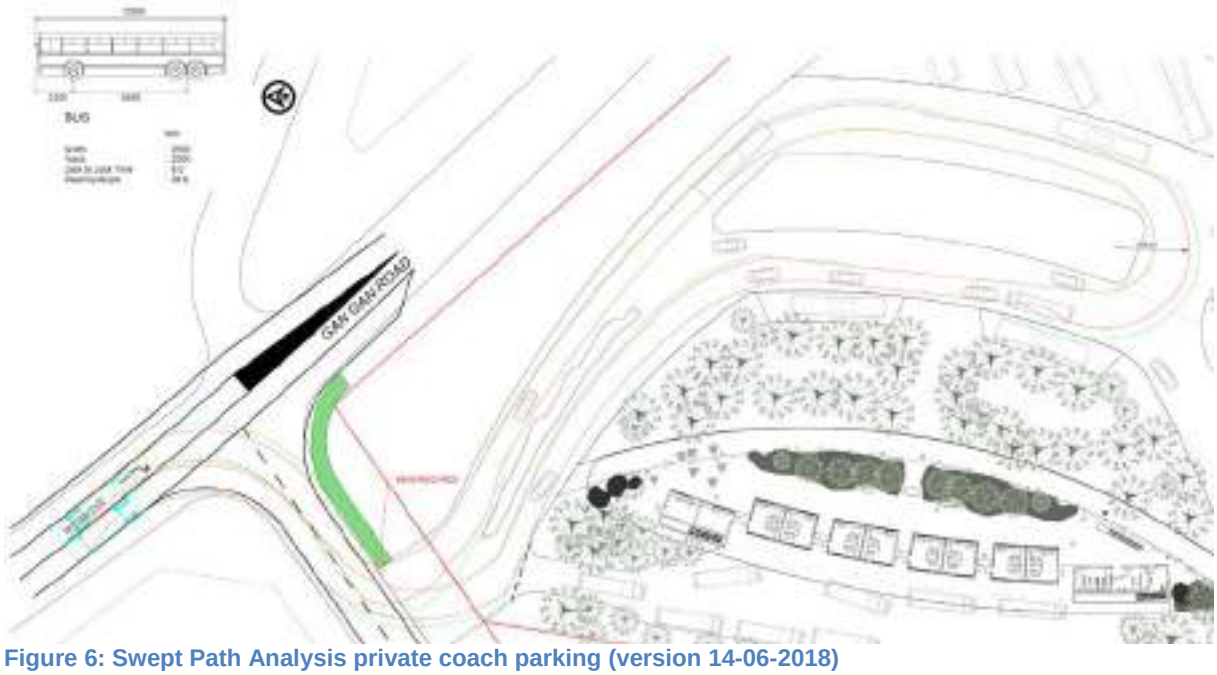

Figure 6: Swept Path Analysis private coach parking (version 14-06-2018)

Figure 7: Swept Path Analysis (design drawings version 16-05-2018)

Recommendations and remarks on draft design drawings version 16 May 2018

- The one way circuits on the Information Centre should be designed and signposted very clearly to prevent incoming traffic choosing the more direct route via the western side of the island in the middle of the 'coach area'. This can be made clear by signage and lineage and preferably also by elements in the streetscape.
- We do not expect problems for cars, though the mixing of cars and coaches in the northern part of the Information Centre is not ideal. In earlier versions of the design the parking for coaches and cars were separated

- The coaches can make turns in all directions however there may be some problems at the southern part of the coach area when the parking lot is full with coaches and the trees on the island in the middle are as large as they seem on the DWG. Increasing the circle on the outside, or decreasing the island in the middle should address this.
- The 4WD section is quite narrow, especially in the southern end.
- The main entrance is narrow, it will be difficult to have coaches arriving and leaving at the same time (though the positive side of this is that it will force traffic to reduce their speed). → widen the entrance
- Add facilities for pedestrians to get safely from the parked coaches and cars to the tourist Information Centre platform. In practice it will be hard to prevent coaches parking before dropping people off if it is busy.
- The coach parking seems quite narrow. Wasn't there an option possible with 45^0 angle parking?
- The entrance to the car parking seems narrow as well, especially in combination with the parking lots directly south of the entrance.
- Will you provide for a 'turning loop' at the south side of the car parking?

Appendix C - Sediment and Erosion Control Plan

1. Sediment and Erosion Control Plan

1.1. Introduction

Soil Erosion and Sediment Control Plan
This plan should be used as a guide. All erosion and sediment controls would be in accordance with:

- Council's erosion and sediment control policy
- The contractor's Environmental Management Plan (EMP)
- The 'Bluebook' Landcom 2004, 4th Edition

1.2. Site Specific Criteria

The following sets out criteria for the management of soil erosion and sediment control on site during the construction phase of the proposed Birubi Information Centre:

Sediment control and erosion devices which will be used on site:

- **Sediment Fence:** a sediment fence will be constructed along the western boundary of the site. These will be constructed from a wire and steel mesh frame with geotextile layer covering. The fence will be secured with wooden posts driven into the ground to a max depth of 0.6m and at a maximum spacing of 3m.
- **Sediment Stockpiles:** any stockpiling of sediment on the site will be surrounded by a bund and silt fence to prevent erosion. A diversion channel will be dug along the foot pf the bund to direct runoff. If sediment is to be stockpiled for more than 10 days it must be covered and secured with an appropriate protective covering.
- **Wheel Cleaning Facility:** a grid style tyre cleaning rumble strip will be installed at site exits to remove sediment and debris from construction vehicle wheels before entering the public road. This will be raised from the site access road with ramps to drive over. A shallow diversion channel and bund would be dug along the edges of the strip to contain sediment.
- **Drop Inlet Sediment Trap System:** an excavated sediment trap with drop inlet grates surrounded by a geotextile filter. These systems should be used to trap sediment onsite and minimise erosion from runoff.

The following measures will be implemented on site to manage sediment and erosion controls:

1. All sediment and erosion controls shall be checked weekly and immediately after rainfall. Sediment build up to be removed and controls repaired where necessary.
2. Soil and sediment control devices would be to the standard recommended by the New South Wales Department of Housing 'Blue Book' titled 'Managing Urban Stormwater and Construction – Volume 1', 4th Edition 2004.
3. The contractor shall regularly maintain all sediment and erosion control devices and remove accumulated sediment from such devices before 50% of the device capacity is used. All the accumulated sediment shall be re-spread or removed in accordance with the site superintendent's instructions. The devices shall be maintained by the contractor until such time as the disturbed areas have been rehabilitated to a condition satisfactory to the site superintendent.
4. The contractor shall maintain all re-vegetated areas including watering and fertilising until such a time as the vegetation has stabilised (minimum time is at least until the end of the construction works).
5. The contractor shall ensure temporary controls do not damage existing structures, kerbing, pavement or subgrades.

6. Vehicle access to site shall be controlled through the site entrance on the existing beach access road only. Vehicles not required for works shall be parked off site away from disturbed areas.
7. All erosion and sediment control measures to be installed prior to site disturbance to the extent that this can be practically achieved.
8. Rumble strips are to be used at the site exit to remove sediment and debris from construction vehicle wheels as they leave the site.
9. Any sediment or debris that transported to public roads resulting from construction activities will be swept with sweeping undertaken at a minimum of twice monthly.
10. The contractor shall take care not to disturb any portion of the site other than in the immediate area of works. Nominated undisturbed areas shall be barricaded prior to the commencement of construction.
11. Drainage inlet protection to be provided from the commencement of excavation works.
12. No disturbed area would remain denuded for a period longer than 20 days.
13. The contractor must ensure the stability and integrity of all works at the end of each day's work.
14. All reasonable and practicable measures must be taken to ensure stormwater runoff from access roads and stabilised entry/exit systems drains to an appropriate sediment control device.
15. No sediment should be deposited off site. If sediment is deposited offsite as a result of onsite activities it must be collected and the area cleaned/rehabilitated as soon as reasonable and practicable.
16. Concrete waste and chemical products, including petroleum and oil-based products, must be prevented from entering any internal or external waterbody, or any external drainage system, excluding those waterbodies on site specifically designed to contain and/or treat such material. Appropriate measures must be installed to trap these materials on site.
17. Stockpiles of erodible material must be provided with an appropriate protective cover (synthetic or organic) if the materials are likely to be stockpiled for more than 10 days.
18. Measures used must be appropriate for all working hours, out of hours, weekends, public holidays and during any other shutdown periods.
19. All materials removed from sediment and erosion control devices during maintenance or decommissioning, whether solid or liquid, must be disposed of in a manner that does not cause any ongoing erosion or pollution hazard.

Appendix D - Biodiversity Assessment Report

ROYAL HASKONING DHV

Birubi Information Centre

BIODIVERSITY ASSESSMENT

Job No: 180525

Date: 11 September 2018

COAST ECOLOGY
ENVIRONMENTAL ASSESSMENTS

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Birubi Information Centre, Biodiversity Assessment

Issue	Date	Description	Author	Reviewed By
A	20/06/2018	DRAFT	KM	NL
B	27/06/2018	FINAL	KM	PSC
C	03/07/2018	FINAL – incorporated response from LMBC Contact Service Centre regarding the BVMap	KM	NL
D	11/09/2018	FINAL – updated with Councils comments	KM	PSC

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EXECUTIVE SUMMARY

Royal Haskoning DHV engaged coast ecology to prepare a Biodiversity Assessment for the proposed Birubi Information Centre at Lot 312 DP 753204 on the corner of James Paterson Street and Gan Gan Road at Anna Bay (hereafter referred to as the *Subject Site*; Figure 1).

The proposed Information Centre and transport interchange will be developed by Port Stephen's Council and will cater for the growing demand in international and domestic tourism activities at Birubi Point. The proposed works will comprise sand removal and levelling the ground. Buildings and signage will be constructed following completion of civil engineering works and will comprise of retail units, amenities and toilet blocks.

The impact of the proposed works on threatened species, populations and communities (i.e. 7-part test) have been considered in accordance with the Threatened Species Conservation Act.

Vegetation communities on the *Subject Site* include:

- Cheese Tree/ Smooth-Barked Apple/ Bangalay Disturbed Open Forest
- Disturbed Coastal Sand Scrub

Also mapped are:

- Cleared Areas
- Sand Dunes

These communities are not consistent with the definitions of any listed endangered/threatened ecological communities under state or commonwealth legislation.

State Legislation

The BioNet search of threatened flora and fauna previously recorded in the broader *Study Area* returned a total of 2,291 records of 43 species. Of these, 15 species (2 flora, 13 fauna) were considered to have potential habitat on the *Subject Site*.

An assessment of significance of impact (Appendix B) under the Threatened Species Conservation Act concluded that the removal of approximately 0.28 ha of Disturbed Coastal Sand Scrub is unlikely to have an adverse effect on the life cycle of these species such that a viable local population of the species is likely to be placed at risk of extinction. The proposed clearing will not result in further modification of the vegetation as it is already highly modified through weed invasion, nor will it result in fragmentation or isolation of habitat as the *Subject Site* is already partially isolated. The habitat to be removed is not considered important to the long-term survival of the species as it provides only sub-optimal habitat for Wallum Froglet as it lacks acid swamp, there is only limited foraging habitat for Dusky Woodswallow, there is no suitable habitat for hollow dependent species such as the Little Lorikeet, Powerful Owl, Masked Owl, there are no suitable den sites for Spotted-tailed Quoll and there are limited records, there are nil to limited suitable roost sites for threatened Forest Bats, there are no preferred feed trees for Koalas and it is not a known roost site for Grey-headed Flying-fox. The *Subject Site* is sub-optimal for *Diuris praecox* and *Diuris arenaria* as it lacks dense grassy understory however there have been nearby records of *D. praecox*. This species flowers during winter and was not recorded on the *Subject Site* during surveys conducted in in *Area of Impact* in June 2018. Thus, the *Subject Site* is not considered important habitat for any of the threatened species considered to have potential habitat on the *Subject Site*.

With regards to Endangered Ecological Communities, LHCCREMS (2002) mapped the *Subject Site* as containing a small portion of Swamp Mahogany – Paperbark Forest which is consistent with *Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions*" Endangered Ecological Community (EEC). Following a site assessment however, the *Subject Site* did not contain Swamp Mahogany,

Melaleucas or Woolybutt which are characteristic species of this EEC. It did contain two isolated Bangalay however this species is typically only characteristic of the EEC south of Sydney. The *Subject Site* also contained Cheese Tree however this is a commonly occurring tree in many vegetation communities and is not a characteristic species of the Swamp Sclerophyll EEC. The substrate of the *Subject Site* is predominantly sand and is not characteristic of a waterlogged or periodically inundated alluvial floodplain. As such, it was considered that this EEC did not occur on the *Subject Site*.

Commonwealth Legislation

Under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), actions that have, or are likely to have, a significant impact on a matter of national environmental significance (MNES) require approval from the Australian Government Minister for the Environment (the Minister).

The *Study Area* does not contain any World Heritage Properties, National Heritage Places, Great Barrier Reef Marine Park or Commonwealth Marine Areas. It does contain two Wetland of International Importance (Hunter Estuary Wetlands; Myall Lakes), seven listed threatened ecological communities, 80 listed threatened species and 74 listed migratory species.

The *Subject Site* does not form part of the Hunter Estuary Wetland or Myall Lakes and the proposal is unlikely to impact these wetlands. Following a site inspection and habitat assessment, the *Subject Site* does not contain any threatened ecological communities.

The *Subject Site* has potential habitat for the following threatened species:

- *Dasyurus maculatus* Spotted-tailed Quoll E
- *Phascolarctos cinereus* Koala V
- *Pseudomys novaehollandiae* New Holland Mouse V
- *Pteropus poliocephalus* Grey-headed Flying-fox V

Following an assessment of significance of impact, it was concluded that the proposed works (clearing of 0.28 ha of vegetation) will not substantially impact upon the endangered Spotted tailed Quoll or the vulnerable Koala, Grey-headed Flying-fox, New Holland Mouse or *D. praecox* with potential habitat in the broader *Study Area* as the *Subject Site* does not provide important habitat features for these species. The *Subject Site* lacks primary feed trees for Koalas, does not contain roost sites for the Grey-headed Flying-fox, lacks den sites for the Spotted-tailed Quoll and the stage of vegetation succession is not preferred by the New Holland Mouse. *Diuris praecox* prefers a dense grassy understory which is lacking on the *Subject Site*. Subsequently, it is considered that the *Subject Site* does not support an important population of these species.

Based on the above assessment it is considered that a referral to SEWPaC is not required.

CONTENTS

1. INTRODUCTION

Royal Haskoning DHV engaged Coast Ecology to prepare a Biodiversity Assessment for the proposed Birubi Information Centre at Lot 312 DP 753204 on the corner of James Paterson Street and Gan Gan Road at Anna Bay (hereafter referred to as the *Subject Site*; Figure 1).

2. SUBJECT SITE/STUDY AREA

The *Subject Site* (Figure 2) is at the northern end of extensive sand dunes that stretch between Stockton Beach and Anna Bay in the Port Stephens Local Government Area (LGA). The dunes have been subjected to extensive erosion from natural and anthropogenic forces along with alterations to the species composition of the vegetation through weed invasion.

The Study Area (Figure 1) is defined as a 10 x 10 km area centred on *The Subject Site* and includes the broader local area which may be impacted upon, either directly or indirectly by the proposed works. Database searches are conducted within this *Study Area* limit.

3. PROPOSED WORKS

On behalf of Port Stephens Council, an Information Centre is proposed for the *Subject Site*, Lot 312 DP753024. This site has been identified through a process of master planning and community engagement. It is located on Crown Land in a RU2 zone, adjacent to E2 and RE1 lands and the Birubi Point Aboriginal Place. The site is a disturbed area of dune landscape that is framed by vegetation along Gan Gan Road and James Paterson Road. The proposed information centre has been designed as a functional asset that resolves current parking and congestion issues around visitor activity at Birubi Point.

The asset consists of 1,325m^2 of sheltered space and provides space for dune operators and amenities, including public toilets and a kiosk. The site has 50 car parking spaces, including 3 disabled spaces, 10 coach parking spaces with a drop-off zone that can accommodate 2 coaches, and provisions for pedestrians and cyclists. The proposal includes site specific Architecture and Landscape design that is integrated with sustainable water solutions. Heritage considerations, traffic management and an ecological assessment have also been incorporated into the proposed outcome.

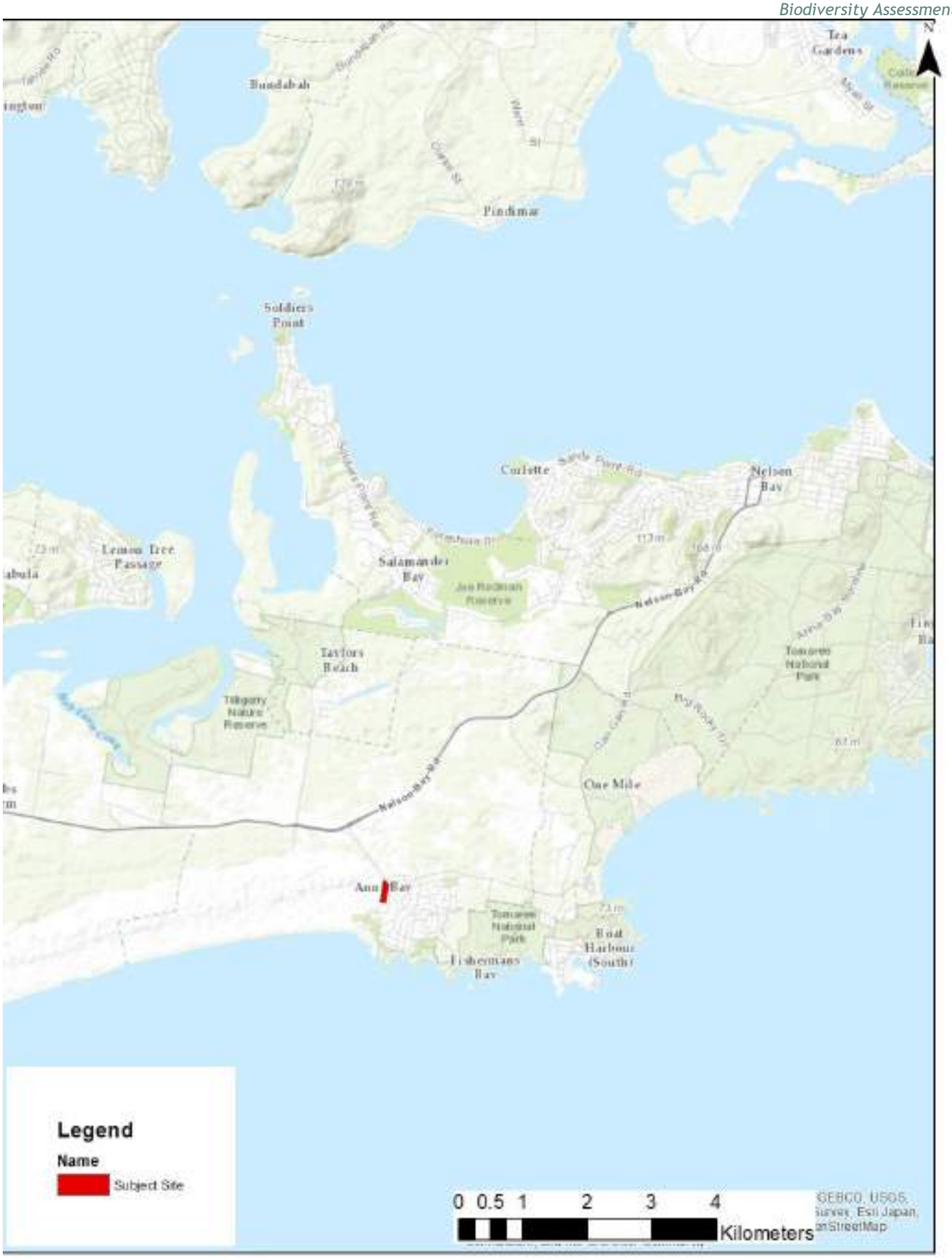
The demand for sand dune adventure tourism and cultural heritage experiences has grown to such a point that urgent planning for a transport interchange is being co-funded by the NSW Government's Tourism Demand Driver Infrastructure Fund and Port Stephens Council.

The proposed works will comprise sand removal and levelling of ground in the northern portion of the *Subject Site* closest to Gan Gan Road. The southern portion of the *Subject Site* is contained in the Aboriginal Place designation and excluded from development.

Excavated material will be removed and stored off site. A sediment fence will be installed along the western boundary of the site with planting of native species on either side to stabilise the fence and provide screening. Once established with vegetation, the fencing would create a buffer for the interchange from the prevailing winds and sand drift.

A compacted road base sealed with asphalt will be constructed for access routes and parking bays within the transport intersection. Site stormwater drainage and water quality management infrastructure will be incorporated. Buildings and signage will be constructed following completion of civil engineering works.

The *Area of Impact* includes the footprint for the works (Map 1; Figure 2).



COAST ECOLOGY
ENVIRONMENTAL ASSESSMENTS

Figure 1. Locality
Biodiversity Assessment
Birubi Information Centre

COAST ECOLOGY
ENVIRONMENTAL ASSESSMENTS

Figure 2. Subject Site & Area of Impact
Biodiversity Assessment
Birubi Information Centre

Map 1. Proposed Interchange in Stage A

4. DESKTOP STUDIES

4.1 RELEVANT LEGISLATION

In June 2014 the NSW Government began a review and subsequent reform of the Biodiversity Legislation. In November 2016 the Biodiversity Conservation Act (BC Act) and amendments to the Local Land Services Act (LLS Act) were passed by Parliament. The new legislation commenced on the 25th August 2017 however there were some exceptions to the commencement date. Port Stephens Council is a nominated Interim Designated Area under the Biodiversity Conservation Act 2016 (BC Act) until 25 November 2018. As such, the Threatened Species Conservation Act 1995 (TSC Act) still applies.

4.1.1 THREATENED SPECIES CONSERVATION ACT 1995

The objects of this Act are as follows:

a) to conserve biological diversity and promote ecologically sustainable development, and

b) to prevent the extinction and promote the recovery of threatened species, populations and ecological communities, and

c) to protect the critical habitat of those threatened species, populations and ecological communities that are endangered, and

d) to eliminate or manage certain processes that threaten the survival or evolutionary development of threatened species, populations and ecological communities, and

e) to ensure that the impact of any action affecting threatened species, populations and ecological communities is properly assessed, and

f) to encourage the conservation of threatened species, populations and ecological communities by the adoption of measures involving co-operative management.

A Threatened Species Assessment in accordance with Section 5A of the *EP&A Act* has been undertaken and is provided in Appendix B and summarised in Section 6 of this report. This assessment determined that the proposal is not likely to have a significant effect on threatened species, populations or ecological communities or their habitats and a Species Impact Statement is not required for the proposal.

4.1.2 SEPP 44 KOALA HABITAT PROTECTION

The provisions of SEPP 44 Koala Habitat Protection apply to all lands within Newcastle Local Government Area.

This Policy aims to encourage the proper conservation and management of areas of natural vegetation that provide habitat for koalas to ensure a permanent free-living population over their present range and reverse the current trend of koala population decline:

(a) by requiring the preparation of plans of management before development consent can be granted in relation to areas of core koala habitat, and

(b) by encouraging the identification of areas of core koala habitat, and

(c) by encouraging the inclusion of areas of core koala habitat in environment protection zones.

In this Policy:

core koala habitat means an area of land with a resident population of koalas, evidenced by attributes such as breeding females (that is, females with young) and recent sightings of and historical records of a population.

potential koala habitat means areas of native vegetation where the trees of the types listed in Schedule 2 constitute at least 15% of the total number of trees in the upper or lower strata of the tree component.

Land to which this Part applies

This Part applies to land:

(a) that is land to which this Policy applies, and

(b) that is land in relation to which a development application has been made, and

(c) that:

(i) has an area of more than 1 hectare, or

(ii) has, together with any adjoining land in the same ownership, an area of more than 1 hectare,

whether or not the development application applies to the whole, or only part, of the land.

The *Subject Site* is 3.2 hectares, thus SEPP 44 is triggered.

Step 1—Is the land potential koala habitat?

The *Subject Site* does not contain any schedule 2 Feed Tree under this SEPP nor does it contain *main koala food trees* listed under North Coast (Hunter-Central Rivers, Northern Rivers) by Office of Environment and Heritage (NSW OEH, undated). A small portion of the *Subject Site* is mapped as Swamp Mahogany-Paperbark Forest (LHCCREMS, 2000: Figure 5) however following a site inspection, the vegetation was not consistent with the mapping and no Swamp Mahogany were present. Two Bangalay *Eucalyptus botryoides* were however present and this species is similar in appearance to Swamp Mahogany.

Thus, preferred feed trees do not contribute more than 15% of the total number of trees present. As such, The *Subject Site* does contain potential koala habitat.

Step 2—Is the land core koala habitat?

Actives searches for koala scat were undertaken at the base of all native trees within the three vegetation quadrats. No scats, scratches or signs of koala utilisation were recorded. A resident population is considered unlikely on The *Subject Site* however it may be used by dispersing males on occasion, given the proximity of known core koala habitat in the Port Stephens region.

Thus, it is considered that the *Subject Site* does not constitute core koala habitat. Further assessment of potential impacts of the works on Koalas is provided in Section 6.0 of this report in accordance with the Port Stephens Council Comprehensive Koala Plan of Management (PSC CKPoM, 2002) and the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) referral guidelines.

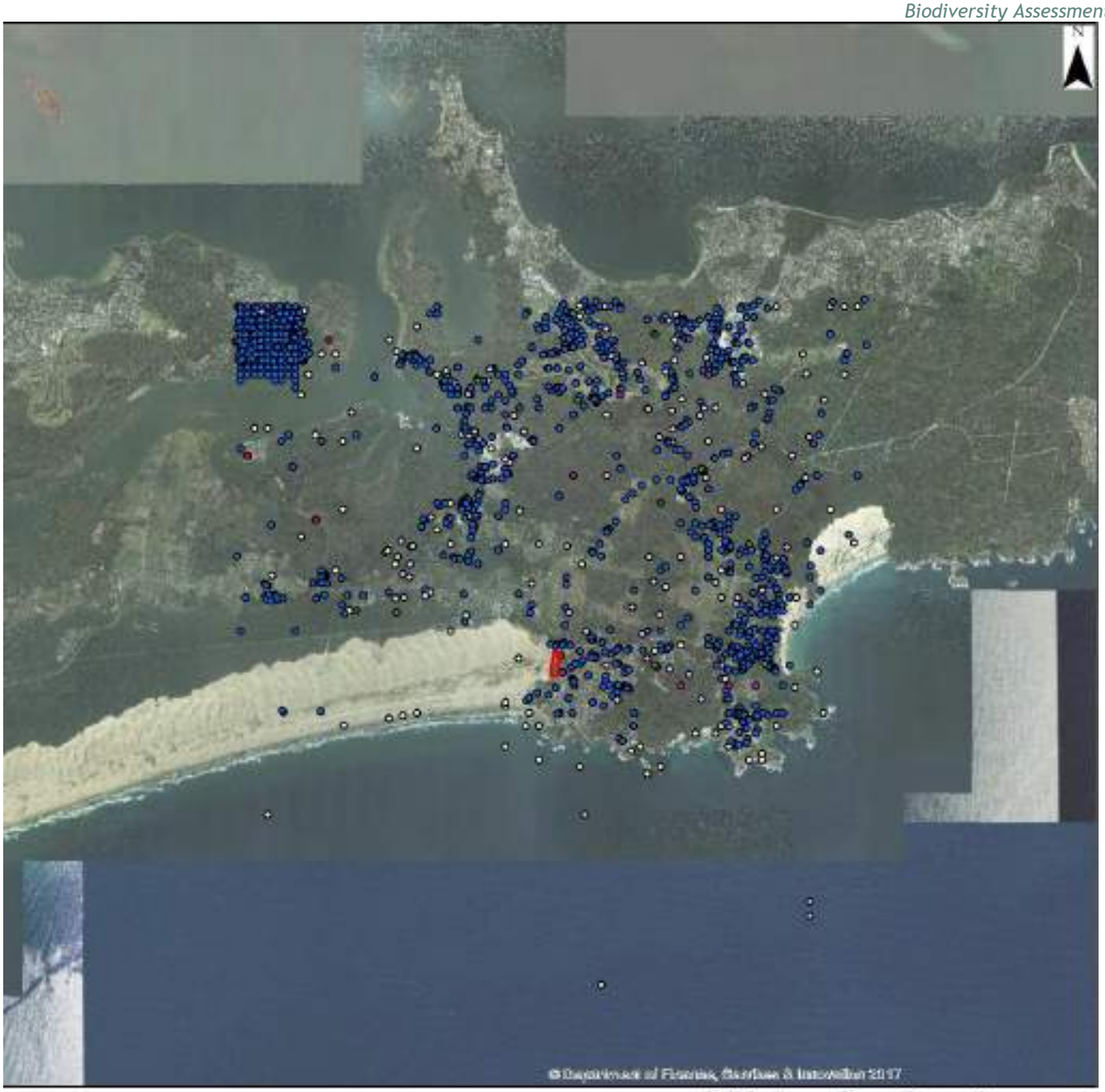
4.2 DATABASE SEARCHES

A database search was conducted within a 10 x 10 km area centred on the *Subject Site* from the following databases:

- BioNet website for the Atlas of NSW Wildlife. BioNet is a portal for accessing government held information about plants and animals in NSW. It is supported by several NSW government held agencies including Office of Environment and Heritage (OEH) (National Parks and Wildlife and Royal Botanic Gardens and Domain Trust), Department of Primary Industries (Forests NSW and Fisheries NSW) and the Australian Museum. BioNet contains records for threatened species and endangered ecological communities listed under the Threatened Species Conservation Act 1995 (TSC Act) and the Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act) which have been recorded within the locality. The search was conducted on 31/05/2018 using search coordinates: North: -32.73, West: 152.03, East: 152.13, South: -32.83. It returned a total of 2,291 records of 43 fauna species and 846 records of 4 flora species. Species listed as being part of the bilateral migratory bird agreements with China (CAMBA), Japan (JAMBA) and Republic of Korea (ROKAMBA) are also listed http://www.bionet.nsw.gov.au/
- Australian Government: Department of the Environment Protected Matters Search Tool

for Matters of National Environmental Significance (NES) listed under the Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act) that may occur in the *Study Area*. a region search was conducted on 05/06/2018 under Port Stephens Council LGA http://www.environment.gov.au/epbc/protected-matters-search-tool

A full list of threatened species (pursuant to the TSC Act) and Endangered Ecological Communities (EECs) recorded in the *Study Area* from database searches are provided in tables A1 and A2 (Appendix A) respectively. The locations of threatened fauna and flora previously recorded within a 10 km radius of the *Study Area* are shown in Figures 3 and 4 respectively. Results of the protected matters search tool are provided in Tables A3, A4 and A5 (Appendix A).



COAST ECOLOGY
ENVIRONMENTAL ASSESSMENTS

Figure 3. Threatened Fauna recorded within a 10x10km radius of the Subject Site: BioNet 04/06/2018, Biodiversity Assessment
Birubi Information Centre

COAST ECOLOGY
ENVIRONMENTAL ASSESSMENTS

Figure 4. Threatened Flora recorded within a 10x10km radius of the Subject Site: BioNet 04/06/2018, Biodiversity Assessment Birubi Information Centre

4.3 VEGETATION MAPPING

The Lower Hunter Central Coast Regional Environmental Management Strategy (LHCCREMS) Vegetation Survey, Classification and Mapping report (Report: April 2000, mapping 2002) identified four vegetation communities within the *Subject Site* (Figure 5). Table A6 (Appendix A) lists these vegetation communities and provides a brief description of each, including their legal status.

One of the communities mapped by LHCCREMS (Swamp Mahogany – Paperbark Swamp Forest) falls under the definition of a listed Endangered Ecological Community under the Threatened Species Conservation Act (TSC Act): *Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions*" Endangered Ecological Community (EEC).

Following a site inspection, the *Subject Site* was not mapped as having this EEC as the *Subject Site* does not have the characteristic species of this EEC such as Swamp Mahogany *E. robusta* and Paperbark *Melaleuca quinquenervia*. This is discussed further in Section 6.2.1.

In addition, the *Area of Impact* does not include the vegetation mapped by LHCCREMS as Swamp Mahogany – Paperbark Forest.

COAST ECOLOGY
ENVIRONMENTAL ASSESSMENTS

Figure 5. Vegetation Mapping: LHCCREMS 2000
Biodiversity Assessment
Birubi Information Centre

5. FIELD SURVEYS

Field surveys were undertaken on 7 June 2018 within the *Area of Impact* on the *Subject Site*. Three vegetation quadrats were established to assess vegetation integrity and condition. Opportunistic fauna sightings were also undertaken.

A copy of quadrat data sheets is provided in Appendix D and a full species list is provided in Table A7 (Appendix A).

5.1 VEGETATION MAPPING

The vegetation across the *Subject Site* had a high level of weed invasion, particularly in the north eastern corner of the *Subject Site*. The area behind existing residents along James Paterson Street has been cleared for lawn and an access track and was subsequently mapped as 'cleared areas'. In addition, the sand dunes which had isolated clumps of bitou bush were not mapped as vegetated. This is consistent with LHCCRES mapping which also did not map the sand dunes as vegetated.

Areas that are not native vegetation do not require further assessment or inclusion in BAM calculations (Section 5.1.1.5 BAM).

Vegetation communities on the *Subject Site* include (refer Figure 6):

- Cheese Tree/ Smooth-Barked Apple/ Bangalay Disturbed Open Forest
- Disturbed Coastal Sand Scrub

Also mapped are areas of:

- Cleared Areas
- Sand Dunes

5.1.1 CHEESE TREE/ SMOOTH-BARKED APPLE/ BANGALAY DISTURBED OPEN FOREST

This community has been highly disturbed through encroaching garden/lawns, a vehicle access track and invasive exotic species.

Upper Stratum: 8-25m height range

The upper canopy is dominated by Cheese Tree *Glochidion ferdinandii* and Smooth-barked Apple *Angophora costata*. There are also 2 large Bangalay *Eucalyptus botryoides* located over a kikuyu lawn adjoining a residential dwelling along with individual Rough-barked Apple *Angophora floribunda* and *Pittosporum undulatum*. Exotic canopy species were numerous and had a high percent cover and included Coral Tree *Erythrina x sykesii**, Liquid amber *Liquidambar styraciflua** and Camphor laurel *Cinnamomum camphora**.

Middle Stratum: 1-8m height range

The middle stratum was sparse and native species included Coffee Bush *Breynia oblongifolia* and Gymea Lily *Doryanthes excelsa*. Exotic species in the middle stratum included Lantana *Lantana camara**.

Lower Stratum: 0-1m height range

The lower stratum was dominated by Wandering Jew *Tradescantia fluminensis**. Other exotic herbs include chickweed *Stellaria media**. Exotic grasses were dominant such as Kikuyu *Pennisetum clandestinum**, African Veldt Grass *Ehrharta erecta**, Guinea Grass *Penicium maximum** and Winter Grass *Poa annua**. There were also planted garden exotics such as Bromeliad, succulents, dracaena and yuccas within the community.

Status/PCT:

It is difficult to assign this community to a Plant Community Type (PCT) under the BioNet Vegetation Classification as it has been highly modified through clearing and exotic invasion. The dominant native canopy species have similarities with the PCT's listed in Table 2.

Table 2. Plant Community Types with similarities to vegetation from the Cheese Tree/Smooth-barked Apple/Bangalay Open Forest

PCT ID	Common Name	Scientific Name	Comment
1645	Old Man Banksia - Rough-barked Apple - Bangalay shrubby open forest on coastal sands of the Central Coast	*Angophora floribunda , Eucalyptus botryoides / Banksia serrata , Glochidion ferdinandi , Allocasuarina littoralis , Macrozamia communis , Platysace lanceolata , Breynia oblongifolia , Monotoca elliptica , Acacia suaveolens , Hardenbergia violacea / Lomandra longifolia , Dianella caerulea , Pomax umbellata , Themeda australis , Pteridium esculentum*	This PCT is not known from the Port Stephens area and a number of canopy species are absent from the *Subject Site*.
1648	Smooth-barked Apple - Blackbutt heathy open forest of the Tomaree Peninsula	*Angophora costata , Corymbia gummifera , Eucalyptus pilularis / Banksia serrata , Acacia terminalis , Bossiaea rhombifolia , Dillwynia retorta , Eriostemon australasius , Acacia suaveolens , Ricinocarpos pinifolius , Acacia ulicifolia , Persoonia levis / Themeda australis , Leucopogon ericoides , Tetratheca ericifolia , Hypolaena fastigiata , Pteridium esculentum , Epacris pulchella.*	A number of characteristic species are absent from the *Subject Site*
1793	Smooth-barked Apple - Bangalay / Tuckeroo - Cheese Tree open forest on coastal sands of the Sydney basin	*Angophora costata, Eucalyptus botryoides , Banksia integrifolia / Elaeocarpus reticulatus , Banksia integrifolia , Cupaniopsis anacardioides , Glochidion ferdinandi / Lomandra longifolia , Pteridium esculentum , Dianella caerulea , Imperata cylindrica var. major*	This PCT is not known from the Port Stephens area however this PCT has the most consistencies with the species recorded in this community on the *Subject Site*.

5.1.2 DISTURBED COASTAL SAND SCRUB

The Coastal Sand Scrub community on the *Subject Site* has been highly impacted by Bitou Bush *C. monilifera** and Coral Trees *Erythrina x sykesii**. The north eastern corner (between Gan Gan Rd and James Paterson St) had a very high percent cover of weed species (Quadrat Centreline 2; Figure 6).

Upper Stratum: 2-20m height range

A number of Coral Trees *E. sykesii** occur in this community. Isolated *A. costata* Smooth-barked Apple were observed near Quadrat centreline 2 and isolated *Eucalyptus pilularis* Blackbutt occur along Gan Gan Road. No other upper canopy species were present in the quadrat and very few native canopy species occurred across the community.

Middle Stratum: 1-2m height range

This stratum is largely dominated by Bitou Bush *C. monilifera** however some natives still occur in this stratum including Coastal Wattle *A. longifolia subsp sophorae* and Coastal Tea tree *L. laevigatum*. Green Wattle *Acacia irrorata* also occurred near James Paterson St. Other exotics in the middle stratum consisted of high threat exotics such as Castor Oil Plant *Ricinus communis** and Lantana *L. camara**.

Lower Stratum: 0-1m height range

The lower stratum is sparse, consisting either of bare sand, or exotic species such as Beach Evening Primrose *Oenothera drummondii**, American Searocket *Cakile edentula**, Pennywort *Hydrocotyle bonariensis** *and* Sea Spurge *Euphorbia paralias**. In the north east of the *Subject Site*, the lower stratum consisted entirely of exotic species, including spiny Burr Grass *Cenchrus echinatus**, Panic Veldtgrass *Ehrharta erecta**, Paspalum *Paspalum dilatatum**, Cobblers Pegs *Bidens Pilosa** and Khaki weed *Alternanthera pungens**.

Status/PCT

It is difficult to assign this community to a Plant Community Type (PCT) under the BioNet Vegetation Classification as it has been highly modified through dune erosion and exotic invasion. The dominant native species have similarities with the PCT's listed in Table 3.

Table 3. Plant Community Types with similarities to vegetation from the Coastal Sand Scrub

PCT ID	Common Name	Scientific Name	Comment
772	Coast Banksia - Coast Wattle dune scrub of the Sydney Basin Bioregion and South East Corner Bioregion	*Banksia integrifolia subsp. integrifolia , Leptospermum laevigatum / Acacia longifolia subsp. sophorae , Leucopogon parviflorus , Rhagodia candolleana subsp. candolleana , Breynia oblongifolia / Actites megalocarpa , Carpobrotus glaucescens , Isolepis nodosa , Lomandra longifolia*	This PCT is not known from the Port Stephens area however the *Subject Site* contains many of the species listed in this PCT.
784	Coastal headland heaths of the NSW North Coast Bioregion	*Acacia longifolia subsp. sophorae , Banksia integrifolia subsp. integrifolia / Leucopogon parviflorus / Pimelea linifolia , Pultenaea maritima , Themeda australis , Imperata cylindrica var. major*	This PCT does occur in the Port Stephens LGA however a number of species are absent from the *Subject Site*
1821	Coastal Foredune Wattle Scrub	*Acacia longifolia , Leptospermum laevigatum , Banksia integrifolia , Monotoca elliptica , Leucopogon parviflorus , Breynia oblongifolia , Rhagodia candolleana / Spinifex sericeus , Carpobrotus glaucescens , Ficinia nodosa , Pelargonium australe , Dianella congesta , Dichondra repens , Scaevola calendulacea*	This PCT is not known from the Port Stephens area however the *Subject Site* contains many of the species listed in this PCT.

The area of native vegetation within the *Subject Site* and within the *Area of Impact* is calculated and summarised in Table 4 and shown in Figure 7.

Table 4. Area of Native Vegetation

Vegetation Community	m^2 in *Subject Site*	m^2 in *Area of Impact*
Cheese Tree/ Smooth-Barked Apple/ Bangalay Disturbed Open Forest	676	0
Coastal Sand Scrub	7,178	2,792
Cleared Areas	1,201	0
Sand Dunes	8,097	7,724
Total	17,152	10,516

COAST ECOLOGY
ENVIRONMENTAL ASSESSMENTS

Figure 6. Vegetation Mapping: Coast Ecology
Biodiversity Assessment
Birubi Information Centre

COAST ECOLOGY
ENVIRONMENTAL ASSESSMENTS

Figure 7. Native Vegetation within the Area of Impact
Biodiversity Assessment
Birubi Information Centre

5.2 HABITAT ASSESSMENT

The *Subject Site* provides habitat for a range of common bird species and drainage lines along the perimeter of the roads provided some habitat for amphibians

The *Subject Site* provides potential foraging habitat for forest bats however it lacks hollow bearing trees and as such does not provide roosting or nesting habitat for hollow dependant species including forest bats, parrots, owls or arboreal mammals.

The *Subject Site* provides habitat for native and exotic ground dwelling mammals.

5.3 FAUNA

Fauna surveys were limited to opportunistic sightings of diurnal bird species and common frog species. Large paw prints, likely belonging to unaccompanied domestic dogs, were observed in the sand dunes and sand scrub.

Common birds observed during vegetation plots are listed in Table 5.

Table 5. Opportunistic Fauna Sightings (07/06/2018)

Common Name	Scientific Name
BIRDS	
Eastern Spinebill	*Acanthorhynchus tenuirostris*
Little Wattlebird	*Anthochaera chrysoptera*
Australian Raven	*Corvus coronoides*
Eastern Yellow Robin	*Eopsaltria australis*
Bar-shouldered Dove	*Geopelia humeralis*
Australian Magpie	*Gymnorhina tibicen*
White-bellied Sea-Eagle	*Haliaeetus leucogaster*
Welcome Swallow	*Hirundo neoxena*
Superb Fairy-wren	*Malurus cyaneus*
Eastern Rosella	*Platycercus eximius*
AMPHIBIANS	
Common Eastern Froglet	*Crinia signifera*

6. ASSESSMENT

6.1 ASSESSMENT OF SIGNIFICANCE: TSC ACT

A habitat assessment of threatened flora and fauna reported on BioNet is provided in Table A8 (Appendix A). Species with potential habitat on the *Subject Site* were considered further in an Assessment of Significance (7-part test) in Appendix B. A summary of threatened species and endangered ecological communities with potential habitat on the *Subject Site* are listed in Table 6.

Table 6. Threatened Species and Endangered Ecological Communities with potential habitat on the Subject Site

Scientific Name	Common Name	Status TSC Act	Status EPBC Act	Records
Crinia tinnula	Wallum Froglet	V,P		69
Haliaeetus leucogaster	White-bellied Sea-Eagle	V,P	C	73
Glossopsitta pusilla	Little Lorikeet	V,P		5
Ninox strenua	Powerful Owl	V,P,3		11
Tyto novaehollandiae	Masked Owl	V,P,3		7
Artamus cyanopterus cyanopterus	Dusky Woodswallow	V,P		2
Dasyurus maculatus	Spotted-tailed Quoll	V,P	E	12
Phascolarctos cinereus	Koala	V,P	V	###
Pteropus poliocephalus	Grey-headed Flying-fox	V,P	V	18
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V,P		2
Mormopterus norfolkensis	Eastern Freetail-bat	V,P		3
Miniopterus australis	Little Bentwing-bat	V,P		16
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V,P		3
Pseudomys novaehollandiae	New Holland Mouse	P	V	7
Diuris praecox	Rough Doubletail	V,P	V	667
Diuris arenaria	Sand Doubletail	E1,P		175

6.1.1 THREATENED SPECIES

The BioNet search of threatened flora and fauna previously recorded in the broader *Study Area* returned a total of 2,291 records of 43 species. Of these, 15 species (2 flora, 13 fauna) were considered to have potential habitat on the *Subject Site*.

An assessment of significance of impact (Appendix B) under the Threatened Species Conservation Act concluded that the removal of approximately 0.28 ha of Disturbed Coastal Sand Scrub is unlikely to have an adverse effect on the life cycle of these species such that a viable local population of the species is likely to be placed at risk of extinction. The proposed clearing will not result in further modification of the vegetation as it is already highly modified through weed invasion, nor will it result in fragmentation or isolation of habitat as the *Subject Site* is already partially isolated. The habitat to be removed is not considered important to the long-term survival of the species as it provides only sub-optimal habitat for Wallum Froglet as it lacks acid swamp, there is only limited foraging habitat for Dusky Woodswallow, there is no suitable habitat for hollow dependent species such as the Little Lorikeet, Powerful Owl, Masked Owl, there are no suitable den sites for Spotted-tailed Quoll and there are limited records, there are nil to limited suitable roost sites for Forest Bats, there are no preferred feed trees for Koalas and it is not a known roost site for Grey-headed Flying-fox. The *Subject Site* is sub-optimal for *Diuris praecox* and *Diuris arenaria* as it lacks dense grassy understory however there have been nearby records of *D. praecox*. This species flowers during winter and was not recorded on the *Subject Site* during surveys conducted in in *Area of Impact* in June. Thus, the *Subject Site* is not considered important habitat for any of the threatened species considered to have potential habitat on the *Subject Site*.

6.1.2 ENDANGERED ECOLOGICAL COMMUNITIES

Table A2 lists Endangered Ecological Communities (EECs) with potential to occur in the *Study Area* as recorded on BioNet. None of these EECs were identified on the *Subject Site*.

6.1.2.1 Swamp Sclerophyll Forest EEC

Vegetation Mapping by LHCCREMS (2000) maps Swamp Mahogany – Paperbark Swamp Forest as occurring in a small portion in the north east of the *Subject Site*. This community falls under the definition of a listed Endangered Ecological Community under the Threatened Species Conservation Act (TSC Act): *Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions*" Endangered Ecological Community (EEC).

This EEC is associated with humic clay loams and sandy loams, on waterlogged or periodically inundated alluvial flats and drainage lines associated with coastal floodplains. It generally occurs below 20 m (though sometimes up to 50 m) elevation. The composition of the community is primarily determined by the frequency and duration of waterlogging and the texture, salinity nutrient and moisture content of the soil, and latitude. The composition and structure of the understorey is influenced by grazing and fire history, changes to hydrology and soil salinity and other disturbance, and may have a substantial component of exotic grasses, vines and forbs.

This swamp community has an open to dense tree layer of eucalypts and paperbarks although some remnants now only have scattered trees as a result of partial clearing. The trees may exceed 25 m in height but can be considerably shorter in regrowth stands or under conditions of lower site quality where the tree stratum is low and dense. For example, stands dominated by *Melaleuca ericifolia* typically do not exceed 8 m in height. The community also includes some areas of fernland and tall reedland or sedgeland, where trees are very sparse or absent.

The most widespread and abundant dominant trees include *Eucalyptus robusta* (swamp mahogany), *Melaleuca quinquenervia* (paperbark) and, south from Sydney, *Eucalyptus botryoides* (bangalay) and *Eucalyptus longifolia* (woollybutt). Other trees may be scattered throughout at low abundance or may be locally common at few sites, including *Callistemon salignus* (sweet willow bottlebrush), *Casuarina glauca* (swamp oak) and *Eucalyptus resinifera* subsp. *Hemilampra* (red mahogany), *Livistona australis* (cabbage palm) and *Lophostemon suaveolens* (swamp turpentine).

A layer of small trees may be present, including *Acacia irrorate* (green wattle), *Acmena smithii* (lilly pilly), *Elaeocarpus reticulatus* (blueberry ash), *Glochidion ferdinandi* (cheese tree), *Melaleuca linariifolia* and *M. styphelioides* (paperbarks).

Shrubs include *Acacia longifolia, Dodonaea triquetra, Ficus coronata, Leptospermum polygalifolium* subsp. *Polygalifolium* and *Melaleuca* spp. Occasional vines include *Parsonsia straminea, Morinda jasminoides* and *Stephania japonica* var. *discolor*.

The groundcover is composed of abundant sedges, ferns, forbs, and grasses including *Gahnia clarkei, Pteridium esculentum, Hypolepis muelleri, Calochlaena dubia, Dianella caerulea, Viola hederacea, Lomandra longifolia, Entolasia marginate* and *Imperata cylindrica*.

On sites downslope of lithic substrates or with soils of clay-loam texture, species such as *Allocasuarina littoralis, Banksia oblongifolia, B. spinulosa, Ptilothrix deusta* and *Themeda australis*, may also be present in the understorey.

Following a site assessment, the *Subject Site* did not contain Swamp Mahogany, Melaleucas or Woolybutt. It did contain two isolated Bangalay however this species is typically only characteristic of this community south of Sydney. The *Subject Site* also contained Cheese Tree however this is a commonly occurring tree in many vegetation communities and is not a characteristic species of the Swamp Sclerophyll EEC. The substrate of the Disturbed Coastal Sand Scrub is sand. The landform of the Cheese Tree/ Smooth-Barked Apple/ Bangalay Disturbed Open Forest is a slope and not characteristic of a waterlogged or periodically

inundated alluvial floodplain. As such, it was considered that this EEC did not occur on the *Subject Site*.

6.2 ASSESSMENT OF SIGNIFICANCE: EPBC ACT

Under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), actions that have, or are likely to have, a significant impact on a matter of national environmental significance (MNES) require approval from the Australian Government Minister for the Environment (the Minister).

The *Study Area* does not contain any World Heritage Properties, National Heritage Places, Great Barrier Reef Marine Park or Commonwealth Marine Areas. It does contain two Wetland of International Importance (Hunter Estuary Wetlands; Myall Lakes), seven listed threatened ecological communities, 80 listed threatened species and 74 listed migratory species.

The *Subject Site* does not form part of the Hunter Estuary Wetland or Myall Lakes and the proposal is unlikely to impact these wetlands. Following a site inspection and habitat assessment, the *Subject Site* does not contain any threatened ecological communities.

The *Subject Site* has potential habitat for the following threatened species:

1.	*Dasyurus maculatus*	Spotted-tailed Quoll	E
2.	*Phascolarctos cinereus*	Koala	V
3.	*Pseudomys novaehollandiae*	New Holland Mouse	V
4.	*Pteropus poliocephalus*	Grey-headed Flying-fox	V

Following an assessment of significance of impact, it was concluded that the proposed works (clearing of 0.28 ha of vegetation) will not substantially impact upon these species as the *Subject Site* does not provide important habitat features for these species. The *Subject Site* lacks primary feed trees for Koalas, does not contain roost sites for the Grey-headed Flying-fox, lacks den sites for the Spotted-tailed Quoll and the stage of vegetation succession is not preferred by the New Holland Mouse. Subsequently, the *Subject Site* does not support an important population of these species.

Based on the above assessment it is considered that a referral to SEWPaC is not required.

6.2.1 KOALA HABITAT ASSESSMENT

In accordance with the EPBC Act referral guidelines for the vulnerable koala (DoE, 2014), Table 7 provides a habitat assessment and score for the Subject Site. An impact area that scores five or more using the habitat assessment tool in the referral guidelines is highly likely to contain habitat critical to the survival of the koala.

Table 7. Koala Habitat Assessment in accordance with the EPBC Act

Attribute	Score	Habitat Appraisal	
Koala Occurrence	1	Desktop	• The EPBC PMST report identified the koala as 'known to occur' in the study area. • NSW BioNET map revealed 194 koala records in a 10 km radius of the site, the closest being 1 km from the impact area. • The Atlas of Living Australia did not have any koala records in the study area.
		On-ground	• Coast Ecology carried out a Spot Assessment Technique (SAT) along with searches for scratchings. Both were conducted on all native trees within the site, which were few. Equal effort was allocated within the impact area and outside the impact area along with active diurnal searches in each native tree on the Subject Site. • No Koalas were observed on the Subject Site during surveys.
Vegetation structure and composition	0	Desktop	The Subject Site was mapped by LHCCREMS as mostly Beach Sands, Coastal Sand Scrub, Heath followed by a small patch of Swamp Mahogany – Paperbark Forest and Coastal Sand Apple-Blackbutt Forest.
		On-ground	The vegetation on the Subject Site within the area of impact was defined by Coast Ecology as Coastal Sand Scrub. Habitat assessments undertaken during the on-ground surveys revealed no koala food tree species on the Subject Site. There were no signs of past or present koala utilising the Subject Site with no scats or scratches observed.
Habitat Connectivity	0	• The area of koala habitat proposed to be cleared is not part of a contiguous landscape. The adjoining Swamp Mahogany – Paperbark Forest mapped by LHCCREMS covers approximately 40 ha however it occurs within residential areas and as such contains barriers.	
Key existing threats	1	Desktop	• The Subject Site scored 0 for koala occurrence and is likely to have some degree of dog or vehicle threat present.
		On-ground	• No further investigation into the presence of threats was carried out. Threats may be present as the area is residential and there is likely to be vehicle traffic and dogs.
Recovery Value	0	The Interim recovery objectives include: • Protect and conserve large, connected areas of koala habitat, particularly large, connected areas that support koalas that are: o Of sufficient size to be genetically robust / operate as a viable sub-population OR o free of disease or have a very low incidence of disease OR – breeding. • Maintain corridors and connective habitat that allow movement of koalas between large areas of habitat. As the Subject Site is not a large connected area of koala habitat nor does it maintain corridors that allows movement, the habitat is unlikely to be important for achieving the interim recovery objectives.	
Total	**2**	**Decision: Habitat is not critical to the survival of the koala—assessment of significance not required.**	

The loss of <two hectares of marginal quality habitat critical to the survival (habitat score of < 5) is highly unlikely to have a significant impact on the koala for the purposes of the EPBC Act (DoE, 2014).

6.3 Comprehensive Koala Plan of Management (PSC)

Under the Port Stephens Council Comprehensive Koala Plan of Management 2001 and associated maps (PSC CKPoM), the majority of the Subject Site has been mapped as "mainly cleared" however a small portion in the north east of the Subject Site has been identified as "preferred koala habitat. The area mapped as "preferred Koala habitat" was likely based on vegetation mapping by LHCCREMS which mapped a small portion in the north east corner of the Subject Site as Swamp Mahogany-Paperbark Forest. However, following a site inspection, there were no Swamp Mahogany on the Subject Site and the vegetation was not consistent with this community (refer Section 6.1.2.1 for further discussion). Regardless, the *Area of Impact* excludes both the area mapped as "preferred koala habitat" and the area mapped as "50m Buffer over Cleared" on the Koala Habitat Planning Map (2001).

Table 8 considers the performance criteria for development applications in accordance with Appendix 4 of the PSC CKPoM.

Table 8. Performance Criteria for development applications in accordance with the PSC CKPoM

Performance Criteria	Complies?
a) Minimise the removal or degradation of native vegetation within Preferred Koala Habitat or Habitat Buffers;	Yes, The Area of Impact does not include areas mapped as Preferred Koala Habitat.
b) Maximise retention and minimise degradation of native vegetation within Supplementary Koala Habitat and Habitat Linking Areas;	Yes, The Area of Impact does not include areas mapped as either Supplementary Koala Habitat or Habitat Linking Areas.
c) Minimise the removal of any individuals of preferred koala food trees, where ever they occur on a development site. In the Port Stephens LGA these tree species are Swamp Mahogany (*Eucalyptus robusta*), Parramatta Red Gum (*Eucalyptus parramattensis*), and Forest Red Gum (*Eucalyptus tereticornis*), and hybrids of any of these species. An additional list of tree species that may be important to koalas based on anecdotal evidence is included in Appendix 8	Yes, No preferred koala food trees require removal under the proposal.
d) Make provision, where appropriate, for restoration or rehabilitation of areas identified as Koala Habitat including Habitat Buffers and Habitat Linking Areas over Mainly Cleared Land. In instances where Council approves the removal of koala habitat (in accordance with dot points 1-4 of the above waive clause), and where circumstances permit, this is to include measures which result in a "net gain" of koala habitat on the site and/or adjacent land;	Yes, This report has recommended that the landscape plan include planting of Swamp Mahogany *Eucalyptus robusta*.
e) Make provision for long term management and protection of koala habitat including both existing and restored habitat;	Yes, There is currently no existing koala habitat on the Subject Site. Any Swamp Mahogany planted on the Subject Site will be managed and maintained with like for like planting as part of the implementation of the Landscape Plan.

f) Not compromise the potential for safe movement of koalas across the site. This should include maximising tree retention generally and minimising the likelihood that the proposal would result in the creation of barriers to koala movement, such as would be imposed by certain types of fencing. The preferred option for minimising restrictions to safe koala movement is that there be no fencing (of a sort that would preclude koalas) associated with dog free developments within or adjacent to Preferred or Supplementary Koala Habitat, Habitat Buffers or Habitat Linking Areas. Suitable fencing for such areas could include: I. fences where the bottom of the fence is a minimum of 200 mm above ground level that would allow koalas to move underneath; II. fences that facilitate easy climbing by koalas; for example, sturdy chain mesh fences, or solid style fences with timber posts on both sides at regular intervals of approximately 20m; or III. open post and rail or post and wire (definitely not barbed wire on the bottom strand). However, where the keeping of domestic dogs has been permitted within or adjacent to Preferred or Supplementary Koala Habitat, Habitat Buffers or Habitat Linking Areas, fencing of a type that would be required to contain dogs (and which may also preclude koalas) should be restricted to the designated building envelope. Fences which are intended to preclude koalas should be located away from any trees which now or in the future could allow koalas to cross the fence.	N/A As the site is not considered to be Preferred Koala habitat, Supplementary Koala Habitat, Habitat Buffers or Habitat Linking Areas, fencing requirements do not apply.
g) Be restricted to identified envelopes which contain all buildings and infrastructure and fire fuel reduction zone. Generally there will be no clearing on the site outside these envelopes. In the case of applications for subdivision, such envelopes should be registered as a restriction on the title, pursuant to the Conveyancing Act 1919; and	Yes, This has been included in the recommendations of this report.
h) Include measures to effectively minimise the threat posed to koalas by dogs, motor vehicles and swimming pools by adopting the following minimum standards. I. The development must include measures that effectively abate the threat posed to koalas by dogs through prohibitions or restrictions on dog ownership. Restrictions on title may be appropriate. II. The development must include measures that effectively minimise the threat posed to koalas from traffic by restricting motor vehicle speeds, where appropriate, to 40 kph or less. III. The development must reduce the risk of koala mortality by drowning in backyard swimming pools. Appropriate measures could include: trailing a length of stout rope (minimum diameter of 50mm), which is secured to a stable poolside fixture, in the swimming pool at all times; designing the pool in such a way that koalas can readily escape; or enclosing the pool with a fence that precludes koalas. This last option should include locating the fence away from any trees which koalas could use to cross the fence.	Noted. Restrictions on dog ownership and/or backyard swimming pools have been included in the recommendations of this report. Restriction of motor vehicle speeds to <40km/hr has been included in the recommendations of this report.

7. RECOMMENDATIONS

- Any native trees within the *Area of Impact* are to be retained where possible, with barrier fencing installed around the base (to the circumference of the crown) to protect the root system during works.
- Appropriate erosion and sediment control measures are to be put in place prior to commencement of any works.
- Landscaping within the *Subject Site* and around its perimeter should use only local, native species that naturally occur in the Coastal Sand Scrub community (as defined by LHCCREMS, 2000). Species should be selected from each stratum (upper, mid, low) to reflect the natural community. Suitable species for planting include:

  Upper

  Angophora costata

  Eucalyptus robusta

  Mid

  Leptospermum laevigatum

  Banksia integrifolia subsp integrifolia

  Myoporum boninense subsp australe

  Acacia sophorae

  Banksia serrata

  Cupaniopsis anacardioides

  Banksia oblongifolia

  Banksia aemula

  Low (<1m) Strata

  Carpobrotus glaucescens

  Monotoca elliptica

  Lomandra longifolia

  Correa reflexa var reflexa

  Scaevola calendulacea

  Rhagodia candolleana subsp candolleana

- Swamp Mahogany *E. robusta*, should also be included in landscaping to supplement habitat for the local koala population. This recommendation is in accordance with Performance Criteria e), Appendix 4 of the CKPoM.
- No additional clearing is to be permitted outside of the *Area of Impact* marked in Figure 2&7 which is in accordance with Performance Criteria g), Appendix 4 of the CKPoM.
- Any pools are to be designed in such a way that koalas can readily escape; or enclosing the pool with a fence that precludes koalas.
- Restrictions on dog ownership in residential units include keeping of dogs indoors at night.
- Motor vehicles are to be restricted to 40km/hr to reduce the risk of Koala strikes in accordance with Performance Criteria h), Appendix 4 of the CKPoM.

8. REFERENCES

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9. APPENDIX A: DESKTOP RESULTS

Table A1. BioNet Search Results for threatened species listed under the TSC Act and EPBC Act with a 10 x 10 km Area.

Scientific Name	Common Name	NSW status	Comm. status	Records
FAUNA				
Crinia tinnula	Wallum Froglet	V,P		69
Caretta caretta	Loggerhead Turtle	E1,P	E	1
Chelonia mydas	Green Turtle	V,P	V	3
Eretmochelys imbricata	Hawksbill Turtle	P	V	2
Dromaius novaehollandiae	Emu population in the New South Wales North Coast Bioregion and Port Stephens local government area	E2,P		1
Hirundapus caudacutus	White-throated Needletail	P	C,J,K	4
Thalassarche cauta	Shy Albatross	V,P	V	1
Ardenna pacificus	Wedge-tailed Shearwater	P	J	1
Ardenna tenuirostris	Short-tailed Shearwater	P	J,K	2
Macronectes halli	Northern Giant-Petrel	V,P	V	1
Ephippiorhynchus asiaticus	Black-necked Stork	E1,P		3
Ardea ibis	Cattle Egret	P	C,J	1
Haliaeetus leucogaster	White-bellied Sea-Eagle	V,P	C	73
Burhinus grallarius	Bush Stone-curlew	E1,P		13
Haematopus fuliginosus	Sooty Oystercatcher	V,P		5
Haematopus longirostris	Pied Oystercatcher	E1,P		3
Numenius phaeopus	Whimbrel	P	C,J,K	1
^^*Calyptorhynchus lathami*	Glossy Black-Cockatoo	V,P,2		1
Glossopsitta pusilla	Little Lorikeet	V,P		5
Lathamus discolor	Swift Parrot	E1,P,3	CE	11
Ninox connivens	Barking Owl	V,P,3		1
Ninox strenua	Powerful Owl	V,P,3		11
Tyto longimembris	Eastern Grass Owl	V,P,3		1
Tyto novaehollandiae	Masked Owl	V,P,3		7
Daphoenositta chrysoptera	Varied Sittella	V,P		3
Artamus cyanopterus cyanopterus	Dusky Woodswallow	V,P		2
Dasyurus maculatus	Spotted-tailed Quoll	V,P	E	12
Phascogale tapoatafa	Brush-tailed Phascogale	V,P		10
Phascolarctos cinereus	Koala	V,P	V	###
Petaurus norfolcensis	Squirrel Glider	V,P		23
Pteropus poliocephalus	Grey-headed Flying-fox	V,P	V	18
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V,P		2
Mormopterus norfolkensis	Eastern Freetail-bat	V,P		3
Chalinolobus dwyeri	Large-eared Pied Bat	V,P	V	2
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V,P		4
Miniopterus australis	Little Bentwing-bat	V,P		16
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V,P		3
Myotis macropus	Southern Myotis	V,P		2
Scoteanax rueppellii	Greater Broad-nosed Bat	V,P		10
Vespadelus troughtoni	Eastern Cave Bat	V,P		2
Pseudomys novaehollandiae	New Holland Mouse	P	V	7
Megaptera novaeangliae	Humpback Whale	V,P	V	2

Scientific Name	Common Name	NSW status	Comm. status	Records
Petalura gigantea	Giant Dragonfly	E1		2
Crinia tinnula	Wallum Froglet	V,P		69
Caretta caretta	Loggerhead Turtle	E1,P	E	1
Chelonia mydas	Green Turtle	V,P	V	3
Eretmochelys imbricata	Hawksbill Turtle	P	V	2
Dromaius novaehollandiae	Emu population in the New South Wales North Coast Bioregion and Port Stephens local government area	E2,P		1
Hirundapus caudacutus	White-throated Needletail	P	C,J,K	4
Thalassarche cauta	Shy Albatross	V,P	V	1
Ardenna pacificus	Wedge-tailed Shearwater	P	J	1
Ardenna tenuirostris	Short-tailed Shearwater	P	J,K	2
Macronectes halli	Northern Giant-Petrel	V,P	V	1
Ephippiorhynchus asiaticus	Black-necked Stork	E1,P		3
Ardea ibis	Cattle Egret	P	C,J	1
Haliaeetus leucogaster	White-bellied Sea-Eagle	V,P	C	73
Burhinus grallarius	Bush Stone-curlew	E1,P		13
Haematopus fuliginosus	Sooty Oystercatcher	V,P		5
Haematopus longirostris	Pied Oystercatcher	E1,P		3
Numenius phaeopus	Whimbrel	P	C,J,K	1
^^*Calyptorhynchus lathami*	Glossy Black-Cockatoo	V,P,2		1
Glossopsitta pusilla	Little Lorikeet	V,P		5
Lathamus discolor	Swift Parrot	E1,P,3	CE	11
Ninox connivens	Barking Owl	V,P,3		1
Ninox strenua	Powerful Owl	V,P,3		11
Tyto longimembris	Eastern Grass Owl	V,P,3		1
Tyto novaehollandiae	Masked Owl	V,P,3		7
Daphoenositta chrysoptera	Varied Sittella	V,P		3
Artamus cyanopterus cyanopterus	Dusky Woodswallow	V,P		2
Dasyurus maculatus	Spotted-tailed Quoll	V,P	E	12
Phascogale tapoatafa	Brush-tailed Phascogale	V,P		10
Phascolarctos cinereus	Koala	V,P	V	###
Petaurus norfolcensis	Squirrel Glider	V,P		23
Pteropus poliocephalus	Grey-headed Flying-fox	V,P	V	18
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V,P		2
Mormopterus norfolkensis	Eastern Freetail-bat	V,P		3
Chalinolobus dwyeri	Large-eared Pied Bat	V,P	V	2
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V,P		4
Miniopterus australis	Little Bentwing-bat	V,P		16
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V,P		3
Myotis macropus	Southern Myotis	V,P		2
Scoteanax rueppellii	Greater Broad-nosed Bat	V,P		10
Vespadelus troughtoni	Eastern Cave Bat	V,P		2
Pseudomys novaehollandiae	New Holland Mouse	P	V	7
Megaptera novaeangliae	Humpback Whale	V,P	V	2
Petalura gigantea	Giant Dragonfly	E1		2
Crinia tinnula	Wallum Froglet	V,P		69
Caretta caretta	Loggerhead Turtle	E1,P	E	1
Chelonia mydas	Green Turtle	V,P	V	3
Eretmochelys imbricata	Hawksbill Turtle	P	V	2

Scientific Name	Common Name	NSW status	Comm. status	Records
Dromaius novaehollandiae	Emu population in the New South Wales North Coast Bioregion and Port Stephens local government area	E2,P		1
Hirundapus caudacutus	White-throated Needletail	P	C,J,K	4
Thalassarche cauta	Shy Albatross	V,P	V	1
Ardenna pacificus	Wedge-tailed Shearwater	P	J	1
Ardenna tenuirostris	Short-tailed Shearwater	P	J,K	2
Macronectes halli	Northern Giant-Petrel	V,P	V	1
Ephippiorhynchus asiaticus	Black-necked Stork	E1,P		3
Ardea ibis	Cattle Egret	P	C,J	1
Haliaeetus leucogaster	White-bellied Sea-Eagle	V,P	C	73
Burhinus grallarius	Bush Stone-curlew	E1,P		13
Haematopus fuliginosus	Sooty Oystercatcher	V,P		5
Haematopus longirostris	Pied Oystercatcher	E1,P		3
Numenius phaeopus	Whimbrel	P	C,J,K	1
^^*Calyptorhynchus lathami*	Glossy Black-Cockatoo	V,P,2		1
Glossopsitta pusilla	Little Lorikeet	V,P		5
Lathamus discolor	Swift Parrot	E1,P,3	CE	11
Ninox connivens	Barking Owl	V,P,3		1
Ninox strenua	Powerful Owl	V,P,3		11
Tyto longimembris	Eastern Grass Owl	V,P,3		1
Tyto novaehollandiae	Masked Owl	V,P,3		7
Daphoenositta chrysoptera	Varied Sittella	V,P		3
Artamus cyanopterus cyanopterus	Dusky Woodswallow	V,P		2
Dasyurus maculatus	Spotted-tailed Quoll	V,P	E	12
Phascogale tapoatafa	Brush-tailed Phascogale	V,P		10
Phascolarctos cinereus	Koala	V,P	V	###
Petaurus norfolcensis	Squirrel Glider	V,P		23
Pteropus poliocephalus	Grey-headed Flying-fox	V,P	V	18
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V,P		2
Mormopterus norfolkensis	Eastern Freetail-bat	V,P		3
Chalinolobus dwyeri	Large-eared Pied Bat	V,P	V	2
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V,P		4
Miniopterus australis	Little Bentwing-bat	V,P		16
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V,P		3
Myotis macropus	Southern Myotis	V,P		2
Scoteanax rueppellii	Greater Broad-nosed Bat	V,P		10
Vespadelus troughtoni	Eastern Cave Bat	V,P		2
Pseudomys novaehollandiae	New Holland Mouse	P	V	7
Megaptera novaeangliae	Humpback Whale	V,P	V	2
Petalura gigantea	Giant Dragonfly	E1		2
FLORA				
Callistemon linearifolius	Netted Bottle Brush	V,P,3		1
Eucalyptus parramattensis subsp. decadens		V,P	V	3
^^*Diuris arenaria*	Sand Doubletail	E1,P,2		175

Scientific Name	Common Name	NSW status	Comm. status	Records
^^*Diuris praecox*	Rough Doubletail	V,P,2	V	667
Callistemon linearifolius	Netted Bottle Brush	V,P,3		1

V=Vulnerable, E=Endangered, P=Protected, C=CAMBA, J-JAMBA, K= ROKAMBA

Table A2. Endangered Ecological Communities under the TSC Act and EPBC Act within the Study Area.

Common Name	NSW status	Comm. status
Coastal Saltmarsh in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E3	V
Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E3	
Hunter Lowland Redgum Forest in the Sydney Basin and New South Wales North Coast Bioregions	E3	
Littoral Rainforest in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E3	CE
Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions	E3	CE
River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E3	
Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E3	
Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E3	
Sydney Freshwater Wetlands in the Sydney Basin Bioregion	E3	
Themeda grassland on seacliffs and coastal headlands in the NSW North Coast, Sydney Basin and South East Corner Bioregions	E3	

E = Endangered, CE = Critically Endangered

Table A3. Protected Matters Search Tool Summary for Matters of National Environmental Significance under the EPBC Act within the Study Area.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Significance:	2
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Threatened Ecological Communities:	7
Threatened Species:	80
Migratory Species:	74

Table A4. Protected Matters Search Tool Results for Threatened Species listed under the EPBC Act within the Study Area.

Scientific Name	Common Name	Status
Birds		
Anthochaera Phrygia	Regent Honeyeater	E
Botaurus poiciloptilus	Australasian Bittern	E
Calidris canutus	Red Knot	E
Calidris ferruginea	Curlew Sandpiper	CE
Calidris tenuirostris	Great Knot	CE
Charadrius leschenaultia	Greater Sand Plover	V
Charadrius mongolus	Lesser Sand Plover	E

Dasyornis brachypterus	Eastern Bristlebird	E
Diomedea epomophora epomophora	Southern Royal Albatross	V
Diomedea epomophora sanfordi	Northern Royal Albatross	E
Diomedea exulans antipodensis	Antipodean Albatross	V
Diomedea exulans gibsoni	Gibson's Albatross	V
Diomedea exulans (sensu lato)	Wandering Albatross	V
Erythrotriorchis radiatus	Red Goshawk	V
Fregetta grallaria grallaria	White-bellied Storm-Petrel (Tasman Sea)	V
Grantiella picta	Painted Honeyeater	V
Lathamus discolor	Swift Parrot	E
Limosa lapponica baueri	Bar-tailed Godwit	V
Limosa lapponica menzbieri	Northern Siberian Bar-tailed Godwit	CE
Macronectes giganteus	Southern Giant-Petrel	E
Macronectes halli	Northern Giant-Petrel	V
Numenius madagascariensis	Eastern Curlew	CE
Pachyptila turtur subantarctica	Fairy Prion (southern)	V
Phoebetria fusca	Sooty Albatross	V
Pterodroma leucoptera leucoptera	Gould’s Petrel	E
Pterodroma neglecta neglecta	Kermadec Petrel	V
Rostratula australis	Australian Painted Snipe	E
Thalassarche bulleri	Buller's Albatross,	V
Thalassarche bulleri platei	Northern Bullller’s Albatross	V
Thalassarche cauta cauta	Shy Albatross,	V
Thalassarche cauta salvini	Salvin's Albatross	V
Thalassarche cauta steadi	White-capped Albatross	V
Thalassarche eremita	Chatham albatross	E
Thalassarche melanophris	Black-browed Albatross	V
Thalassarche melanophris impavida	Campbell Albatross	V
Thalassarche melanophris	Black-browed Albatross	V
Fish		
Epinephelus daemelii	Black Rockcod,	V
Amphibians		
Heleioporus australiacus	Giant Burrowing Frog	V
Litoria aurea	Green and Golden Bell Frog	V
Mixophyes balbus	Stuttering Frog	V
Mammals		
Chalinolobus dwyeri	Large-eared Pied Bat,	V
Dasyurus maculatus maculatus	Spotted-tail Quoll,	E
Petauroides volans	Greater Glider	V
Petrogale penicillate	Brush-tailed Rock-wallaby	V
Phascolarctos cinereus	Koala	V
Potorous tridactylus tridactylus	Long-nosed Potoroo	V
Pseudomys novaehollandiae	New Holland Mouse	V
Pteropus poliocephalus	Grey-headed Flying-fox	V
Plants		
Angophora inopina	Charmhaven Apple	V
Asperula asthenes	Trailing Woodruff	V
Asterolasia elegans		E
Caladenia tessellate	Thick-lipped Spider-orchid	V
Commersonia prostrata	Dwarf Kerrawang	E
Cryptostylis hunteriana	Leafless Tongue-orchid	V
Cynanchum elegans	White-flowered Wax Plant	E

Dichanthium setosum	Bluegrass	V
Diuris praecox	Newcastle Doubletail	V
Eucalyptus camfieldii	Camfield's Stringybark	V
Eucalyptus glaucina	Slaty Red Gum	V
Eucalyptus parramattensis subsp decadens	Earp's Gum	V
Euphrasia arguta		CE
Grevillea parviflora subsp. parviflora	Small-flower Grevillea	V
Melaleuca biconvexa	Biconvex	V
Persicaria elatior	Knotweed	V
Phaius australis	Lesser swamp-orchid	E
Prasophyllum sp. Wybong	a leek orchid	CE
Prostanthera densa	Vilous Mintbush	V
Syzygium paniculatum	Magenta Lilly Pilly	V
Tetratheca juncea	Black-eyed Susan	V
Thesium austral	Austral Toadflax	V
Reptiles		
Caretta caretta	Loggerhead Turtle	E
Chelonia mydas	Green Turtle	V
Dermochelys coriacea	Leatherback Turtle	E
Eretmochelys imbricata	Hawksbill Turtle	V
Natator depressus	Flatback Turtle	V

Table A5. Protected Matters Search Tool Results for Migratory Species listed under the EPBC Act with 10 km of the Study Area.

Scientific Name	Common Name	Status
Terrestrial Species		
Cuculus optatus	Oriental Cuckoo	M
Hirundapus caudacutus	White-throated Needletail	M
Monarcha melanopsis	Black-faced Monarch	M
Monarcha trivirgatus	Spectacled Monarch	M
Motacilla flava	Yellow Wagtail	M
Myiagra cyanoleuca	Satin Flycatcher	M
Rhipidura rufifrons	Rufous Fantail	M
Wetlands Species		
Actitis hypoleucos	Common Sandpiper	M
Arenaria interpres	Ruddy Turnstone	M
Calidris acuminata	Sharp-tailed Sandpiper	M
Calidris alba	Sanderling	M
Calidris canutus	Red Knot	M
Calidris ferruginea	Curlew Sandpiper	M, CE
Calidris melanotos	Pectoral Sandpiper	M
Calidris ruficollis	Red-necked Stint	M
Calidris tenuirostris	Great Knot	M
Charadrius bicinctus	Double-banded Plover	M
Charadrius leschenaultia	Greater Sand Plover	V
Charadrius mongolus	Lesser Sand Plover,	M
Gallinago hardwickii	Latham's Snipe,	M
Gallinago megala	Swinhoe's Snipe	M
Gallinago stenura	Pin-tailed Snipe	M
Limicola falcinellus	Broad-billed Sandpiper	
Heteroscelus brevipes	Grey-tailed Tattler	M
Limosa lapponica	Bar-tailed Godwit	M

Limosa limosa	Black-tailed Godwit	M
Numenius madagascariensis	Eastern Curlew	M, CE
Numenius minutus	Little Curlew	M
Numenius phaeopus	Whimbrel	M
Pandion haliaetus	Osprey	M
Philomachus pugnax	Ruff	M
Pluvialis fulva	Pacific Golden Plover	M
Pluvialis squatarola	Grey Plover	M
Tringa nebularia	Common Greenshank	M
Tringa brevipes	Grey-tailed Tattler	
Tringa stagnatilis	Marsh Sandpiper,	M
Xenus cinereus	Terek Sandpiper	M

Table A6. Vegetation Mapped within 1 km of the Study Area (LHCCREMS, 2002)

MU	Name	Description	Legal Status
	Beach Sands	Not described	
MU 33	Coastal Sand Apple-Blackbutt Forest	Coastal Sand Apple-Blackbutt Forest occurs principally on Holocene sands, where protection from direct coastal salt-laden winds is available. It occupies dunes of higher elevations with improved soil development. Typically it takes the form of an open forest with a moderately open, shrubby understorey. *Angophora costata* and *Eucalyptus pilularis* are the key canopy species, the presence and abundance of each in the canopy is variable, and it is not uncommon for one to almost completely dominate. It has been found in a study of sand communities of the Eurundree Sandmass that *Angophora costata* often dominates where the water table is close to the surface (Myerscough & Carolin, 1986). The shrub stratum is highly dependent on recent fire history however where present it is often composed of *Banksia serrata*, *Acacia ulicifolia*, and *Dillwynia retorta*. A combination of herbs, ferns and grasses inhabit the understorey. *Pteridium esculentum* is the most dominant however others such as *Gonocarpus teucrioides*, *Aotus ericoides* and *Themeda australis* are usually associated. This assemblage is widespread across the Tomago-Stockton Sandmass in the Port Stephens Shire. It extends along the narrow sand coastal strip south of Newcastle to the Central Coast wherever conditions are optimal. Map Unit 34 Wallum Heath Woodland is the most floristically similar assemblage within the region although structurally they are distinct. A number of canopy and shrub species are common to both assemblages including *Acacia ulicifolia, Dillwynnia retorta, Angophora Costata, Corymbia gummifera and E. signata*. Sandmining and urban development has cleared or altered some of the former extent of this community.	
MU34a	Coastal Sand Wallum Woodland - Heath Heath	This dry woodland - heath assemblage is marked by the dominance of Wallum Banksia (*Banksia aemula)*. It occurs largely on Pleistocene sands across the Tomago Coastal Plain, perched dunes of Bouddi Peninsula (Mc Rae, 1990) and coastal headlands east of Lake Macquarie. Structurally, this community varies from heathland in exposed areas of low relief and to low open forest in areas of increased shelter. As Heathland (mapped as MU34a where API delineates structural variation), a shrub layer of *Banksia aemula*, *Leptospermum*	

		trinervium, *Isopogon anemonifolius*, and *Ricinocarpus pinifolius* to a height of 2 metres dominates this community. Where it forms a woodland *Angophora costata* and *Corymbia gummifera* emerge above the heathland as low trees to a height of 10 metres. Where this community occurs as low open forest, the canopy can also include *Eucalyptus piperita*, and *Eucalyptus signata*. A large example of this form is found in Port Stephens across the Tomago Sandbeds. Where this occurs the understorey is somewhat less dense than the heathland variation, it still contains Wallum Banksia however includes shrubs such as *Leptospermum trinervium, Acacia ulicifolia* and *Lambertia formosa*. Where fire is frequent *Pteridium esculentum* can dominate the understorey. This community type is related to Map Unit 33: Coastal Sand Apple Blackbutt Forest which oocurs on higher dunes of deeper soils. Close similarity with Map Unit 49 Wallum Clay Heath is apparent. However it is distinguished by its marked abundance of *Melaleuca sieberi* and moisture tolerant sedges in the lowest stratum.	
MU37	Swamp Mahogany - Paperbark Swamp Forest	Swamp Mahogany - Paperbark Swamp Forest occurs in areas of impeded drainage near coastal swamps, lagoons and along drainage lines on alluvial flats of Quaternary sands and sediments. Structurally, this community ranges from open forest to forest with *Eucalyptus robusta* and *Melaleuca quinquenervia* forming the key diagnostic species either in combination or as monospecific stands. There are four main variations within this group that have been identified; • The first is typified by an open forest of *Eucalyptus robusta* and *Melaleuca quinquinervia* with high abundances of *Pteridium esculentum* and *Imperata cylindrica* in the understorey. This often occurs where fire has been recent or frequent near urban environments. • The second is a wet form where the canopy remains the same however the understorey is characterised by a high abundance of *Gahnia clarkei*. This is typical of the drier coastal plains at Wyong. • The third is a group localised around Gosford, it contains mesic elements such as *Glochidion ferdinandii*, *Livistona australis* and also can contain *Melaleuca biconvexa* in the canopy. This is generally on alluvial sediments of the Gosford Wyong area. • Finally the fourth is another wet form with mesic elements as the previous but with a high abundance of ferns in the lowest stratum such as *Blechnum indicum* and *Hypolepis muelleri*. This is common on the coastal sands at Belmont and at Tomago in the Port Stephens Shire. It is not uncommon for *Casuarina glauca* and *Livistona australis* to be included in the canopy especially in areas close to estuarine fringes. Other canopy species can merge where drainage is improved however are not diagnostic for this community. This community most closely relates to Map Unit 68: Swamp Oak – Sedge Forest through similar floristic composition and Map Unit 94: Redgum- Roughbarked Apple Foreshores Forest. Where mesic elements are well developed	EEC

		this assemblage will merge with Map Unit 5 Alluvial Tall Moist Forest. Similar Forest Ecosystems are not described by NPWS (1999(a)) although the assemblage is likely to be extensively though patchily distributed along the north coast of NSW.	
MU50	Coastal Sand Scrub	Coastal Sand Scrub occurs on deep Quaternary sands usually on foredunes. It is a relatively dense, low community subject to desiccating salt winds. Floristically it is quite simple with *Leptospermum laevigatum* occurring with a very high frequency to form the main canopy species alongside *Banksia integrifolia subsp integrifolia*, *Myoporum boninense subsp australe*, and *Acacia sophorae* amongst others. Where more nutrients and shelter are available *Angophora costata* (often Mallee from) can occur as a small tree. Fleshy ground covers such as *Carpobrotus glaucescens* and *Scaevola calenulace* are widespread and often occur with *Monotocca elliptica* and *Lomandra longifolia*. Coastal Sand Scrub occurs along the coast from Port Stephens to Gosford. It has been heavily cleared and modified by urban development and sandmining. In some instances eg. Munmorah SRA, some species of this assemblage have been used in regeneration. This community generally merges with Map Unit 33 and 34 where shelter and soil podzolisation is increased on the leeward side of the dunes (Myerscough & Carolin, 1986). Coastal Sand Scrub is a feature of most coastal environments along NSW.	

* EEC is an Endangered Ecological Community listed under the NSW Threatened Species Conservation Act

Table A7. Flora recorded within the Subject Site on 07/06/2018

Scientific Name	Common Name	% cover		
		Plot 1	Plot 2	Plot 3
Acacia longifolia var. *sophorae*	Coastal Wattle		0.2	0.3
Acacia irrorata	Green Wattle		12.5	
*Ailanthus altissima**	Tree of Heaven		1	
*Alternanthera pungens**	Khaki Weed		0.1	
Angophora costata	Smooth-barked Apple	8		
Angophora floribunda	Rough-barked Apple	5		
Anthemis cotula	Stinking chamomile		6	
*Araucaria heterophylla**	Norfolk Island Pine			
*Asparagus aethiopicus**	Asparagus Fern			
Banksia integrifolia subsp. *integrifolia*	Coast Banksia			
*Bidens pilosa**	Cobbler's Pegs		0.1	
Breynia oblongifolia	Coffee Bush	1.1		
*Bryophyllum delagoense**	Mother of Millions			
*Cakile edentula**	American Sea Rocket			0.1
Carpobrotus glaucescens	Pigface			
Cenchrus echinatus	Spiny Burr Grass	0.1	0.1	
Chrysanthemoides monilifera subsp. *monilifera**	Bitou Bush		0.1	8
*Cinnamomum camphora**	Camphor Laurel	1		

Dichondra repens	Kidney Weed	0.5		
Doryanthes excelsa	Gymea Lily	0.1		
*Ehrharta erecta**	Panic Veldtgrass	0.1	0.5	
Eriobotrya japonica	Loquat			
*Erythrina x sykesii**	Coral Tree	10		1
Eucalyptus botryoides	Bangalay	5		
Eucalyptus pilularis	Blackbutt			
*Euphorbia paralias**	Sea Spurge			0.1
*Festuca elatior**			3	
Ficinia (Isolepis) nodosa	-			
Ficus sp	Fig Tree			
Glochidion ferdinandii	Cheese Tree	10		
*Hydrocotyle bonariensis**	Pennywort			0.1
*Hypochaeris radicata**	Flatweed		0.1	
*Lantana camara**	Lantana	5	5	
Leptospermum laevigatum	Coast Tea-tree		10	2
*Liquidambar styraciflua**	Liquidambar	15		
Livistona australis	Cabbage Tree Palm			
Mentha sp.*	Mint	0.1		
*Nephrolepis cordifolia**	Fish-bone Fern			
Oenothera drummondii	Beach Evening Primrose		0.1	0.1
*Panicium maximus**	Guinea Grass	0.1	5	
*Paspalum dilatatum **	Paspalum		0.2	
*Pennisetum clandestinum **	Kikuyu	30		
Persea Americana	Avocado			
Pittosporum undulatum	Sweet Pittosporum	3		
*Plantago lanceolata**	Ribwort		0.1	
*Poa annua**	Winter Grass	0.1		
*Ricinus communis**	Castor Oil Plant		0.6	
Rumex sagitata	Turkey Rhubarb		0.1	
*Setaria gracilis**	Slender Pigeon Grass		0.1	
*Stellaria media**	Common Chickweed	0.6	0.1	
*Tagetes minuta**	Stinking Roger		0.1	
*Tecoma capensis**	Cape Honeysuckle		3	
*Tradescantia fluminensis**	Wandering Jew	15		
*Verbena bonariensis**	Purpletop		0.1	
Wahlenbergia communis	Tufted Bluebell		0.1	
*Yucca aloifolia**	Dagger Plant	0.1		

Table A8. Habitat Assessment of Threatened Species Recorded in the Study Area

Family	Scientific Name	Common Name	NSW status	Comm. status	Habitat Preference	Records	Likelihood of Occurrence
AMPHIBIANS							
Myobatrachidae	*Crinia tinnula*	Wallum Froglet	V,P		Wallum Froglets are found in a wide range of habitats, usually associated with acidic swamps on coastal sand plains. They typically occur in sedgelands and wet heathlands. They can also be found along drainage lines within other vegetation communities and disturbed areas, and occasionally in swamp sclerophyll forests. The species breeds in swamps with permanent water as well as shallow ephemeral pools and drainage ditches. Breeding is thought to peak in the colder months, but can occur throughout the year following rain. Eggs of 1.1-1.2mm are deposited in water with a pH of <6 and tadpoles take 2-6 months to develop into frogs. Wallum Froglets shelter under leaf litter, vegetation, other debris or in burrows of other species. Shelter sites are wet or very damp and often located near the water's edge. Males may call throughout the year and at any time of day, peaking following rain.	69	Moderate. Potential habitat in drainage lines outside of *Subject Site* boundary.
REPTILES							
Cheloniidae	*Caretta caretta*	Loggerhead Turtle	E1,P	E	Loggerhead Turtles are ocean-dwellers, foraging in deeper water for fish, jellyfish and bottom-dwelling animals. The female comes ashore to lay her eggs in a hole dug on the beach in tropical regions during the warmer months. Identifiable all year but lay eggs on beaches during summer. Nesting is around Great Barrier Reef and Ningaloo Reef	1	Low. Outside of nesting habitat range.
Cheloniidae	*Chelonia mydas*	Green Turtle	V,P	V	Ocean-dwelling species spending most of its life at sea. Carnivorous when young but as adults they feed only on marine plant material.	3	Low. Outside of nesting habitat range.

					Eggs laid in holes dug in beaches throughout their range. In Australia, there are seven regional populations of green turtles that nest in different areas; the southern Great Barrier Reef, the northern Great Barrier Reef, the Coral Sea, the Gulf of Carpentaria, Western Australia's north-west shelf, the Ashmore and Cartier Reefs and Scott Reef.		
AVES							
Apodidae	*Hirundapus caudacutus*	White-throated Needletail	P	C,J,K	In Australia, the White-throated Needletail is almost exclusively aerial, from heights of less than 1 m up to more than 1000 m above the ground. The White-throated Needletail is widespread in eastern and south-eastern Australia. After breeding in eastern Siberia, north-eastern China and Japan, the species leaves the breeding grounds between late August and October, flying singly or in scattered flocks and enter Australia via the Torres Strait, usually during September and October.	4	Low. Aerial species
Diomedeidae	*Thalassarche cauta*	Shy Albatross	V,P	V	This pelagic or ocean-going species inhabits subantarctic and subtropical marine waters, spending the majority of its time at sea. While at sea, it soars on strong winds and when calm, individuals may rest on the ocean, in groups during the breeding season or as individuals at other times. Occasionally the species occurs in continental shelf waters, in bays and harbours. The species feeds on fish, crustaceans, offal and squid and may forage in mixed-species flocks. Food may be caught by seizing prey from the water's surface while swimming, by landing on top of prey, diving for prey beneath the water and by scavenging behind fishing vessels. Known breeding locations include Albatross Island off Tasmania, Auckland Island, Bounty Island and The Snares, off New Zealand, where nesting colonies of 6-500 nests occur and may contain other species such as the Australian Gannet. Located on sheltered sides of islands, on cliffs and ledges, in crevices and slopes, nests are used annually and consist of a mound of mud, bones, plant matter and rocks. Parents are	1	Low. No nesting habitat on the *Subject Site*.

					territorial while nesting, having both defensive and mating displays. Breeding occurs September-December, when a single egg is laid and incubated for 72 days. Both parents feed and guard the young for approximately 5 months before they fledge and become independent.		
Procellariidae	*Ardenna pacificus*	Wedge-tailed Shearwater	P	J	The Wedge-tailed Shearwater is a pelagic, marine bird known from tropical and subtropical waters. The Wedge-tailed Shearwater breeds on the east and west coasts of Australia and on off-shore islands. The species is common in the Indian Ocean, the Coral Sea and the Tasman Sea.	1	Low. No nesting habitat on the *Subject Site*.
Procellariidae	*Ardenna tenuirostris*	Short-tailed Shearwater	P	J,K	Short-tailed Shearwater breeds on the east and west coasts of Australia and on off-shore islands. Breeds from October-April in a sparse of grass, leaves in burrows 0.5-2m long, usually under tussocks, typically in island colonys. Migrates from May-August to North Pacific (Pizzey, 2006).	2	Low. No nesting habitat on the *Subject Site*.
Procellariidae	*Macronectes halli*	Northern Giant-Petrel	V,P	V	Breeding in Australian territory is limited to Macquarie Island and occurs during spring and summer. Adults usually remain near the breeding colonies throughout the year (though some do travel widely) while immature birds make long and poorly known circumpolar and trans-oceanic movements. Hence most birds recorded in NSW coastal waters are immature birds. Northern Giant-Petrels seldom breed in colonies but rather as dispersed pairs, often amidst tussocks in dense vegetation and areas of broken terrain. A single chick is raised and although breeding occurs annually, approximately 30% of the potential breeding population do not nest. There are marked differences in diet between the sexes. Females obtain most of their prey live from the sea, while males also scavenge from the carcases of penguins and seals on land. At sea, both sexes are aggressive opportunists, feeding on fish, cephalopods, birds and crustaceans, including euphausiids or krill, and regularly scavenge on fishing vessels.	1	Low. No nesting habitat on the *Subject Site*.

					During the vulnerable early chick phase adult birds utilise land-based carrion resources (e.g. seals) extensively.		
Ciconiidae	*Ephippiorhynchus asiaticus*	Black-necked Stork	E1,P		Floodplain wetlands (swamps, billabongs, watercourses and dams) of the major coastal rivers are the key habitat in NSW for the Black-necked Stork. Secondary habitat includes minor floodplains, coastal sandplain wetlands and estuaries. Storks usually forage in water 5-30cm deep for vertebrate and invertebrate prey. Eels regularly contribute the greatest biomass to their diet, but they feed on a wide variety of animals, including other fish, frogs and invertebrates (such as beetles, grasshoppers, crickets and crayfish). Black-necked Storks build large nests high in tall trees close to water. Trees usually provide clear observation of the surroundings and are at low elevation (reflecting the floodplain habitat). In NSW, breeding activity occurs May - January; incubation May - October; nestlings July - January; fledging from September. Parents share nest duties and in one study about 1.3-1.7 birds were fledged per nest. The NSW breeding population has been estimated at about 75 pairs. Territories are large and variable in size. They have been estimated to average about 9,000ha, ranging from 3,000-6,000ha in high quality habitat and 10,000-15,000ha in areas where habitat is poor or dispersed.	3	Low. No suitable habitat on the *Subject Site* as it lacks water features.
Accipitridae	*Haliaeetus leucogaster*	White-bellied Sea-Eagle	P	C	The White-bellied Sea-Eagle is distributed along the coastline (including offshore islands) of mainland Australia and Tasmania. It also extends inland along some of the larger waterways, especially in eastern Australia. The White-bellied Sea-Eagle feeds opportunistically on a variety of fish, birds, reptiles, mammals and crustaceans, and on carrion and offal. Breeding habitat consists of mature tall open forest, open forest, tall woodland, and swamp sclerophyll forest close to foraging habitat. Nest trees are typically large emergent eucalypts and often have emergent dead branches or large dead trees nearby which are used as 'guard roosts'. Nests are large	73	Moderate. While this species may be observed overhead, there is no suitable roosting or breeding habitat or nesting trees on the *Subject Site*. Potential foraging habitat only.

					structures built from sticks and lined with leaves or grass.		
Burhinidae	*Burhinus grallarius*	Bush Stone-curlew	E1,P		Inhabits open forests and woodlands with a sparse grassy groundlayer and fallen timber. Largely nocturnal, being especially active on moonlit nights. Feed on insects and small vertebrates, such as frogs, lizards and snakes. Nest on the ground in a scrape or small bare patch. Two eggs are laid in spring and early summer.	13	Low. No suitable habitat on the *Subject Site* as it lacks open forest with a sparse grassy groundlayer.
Haematopodidae	*Haematopus fuliginosus*	Sooty Oystercatcher	V,P		Favours rocky headlands, rocky shelves, exposed reefs with rock pools, beaches and muddy estuaries. Forages on exposed rock or coral at low tide for foods such as limpets and mussels. 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.	5	Low. No suitable habitat on the *Subject Site*.
Haematopodidae	*Haematopus longirostris*	Pied Oystercatcher	E1,P		Favours intertidal flats of inlets and bays, open beaches and sandbanks. Forages on exposed sand, mud and rock at low tide, for molluscs, worms, crabs and small fish. The chisel-like bill is used to pry open or break into shells of oysters and other shellfish. Nests mostly on coastal or estuarine beaches although occasionally they use saltmarsh or grassy areas. Nests are shallow scrapes in sand above the high tide mark, often amongst seaweed, shells and small stones. Two to three eggs are laid between August and January. The female is the primary incubator and the young leave the nest within several days.	3	Low. No suitable habitat on the *Subject Site*.
Scolopacidae	*Numenius phaeopus*	Whimbrel	P	C,J,K	The Whimbrel is a regular migrant to Australia and New Zealand, with a primarily coastal distribution. There are also scattered inland records of Whimbrels in all regions. It is found in all states but is more common in the north. The Whimbrel breeds in north and west Alaska. The Whimbrel generally forages on intertidal mudflats, along the muddy banks of estuaries and in coastal	1	Low. No suitable habitat on the *Subject Site*.

				lagoons, either in open unvegetated areas or among mangroves. They sometimes forage on sandy beaches or among rocks. It has occasionally been sighted feeding on exposed coral or rocky reefs and rock platforms. It is known to probe holes and crevices among rubble and on reef flats, but not on reef crests.		
Cacatuidae	*Calyptorhynchus lathami*	Glossy Black-Cockatoo	V,P,2	Inhabits open forest and woodlands of the coast and the Great Dividing Range where stands of sheoak occur. Black Sheoak (Allocasuarina littoralis) and Forest Sheoak (A. torulosa) are important foods. Inland populations feed on a wide range of sheoaks, including Drooping Sheoak, Allocasuaraina diminuta, and A. gymnathera. Belah is also utilised and may be a critical food source for some populations. In the Riverina, birds are associated with hills and rocky rises supporting Drooping Sheoak, but also recorded in open woodlands dominated by Belah (Casuarina cristata). Feeds almost exclusively on the seeds of several species of she-oak (Casuarina and Allocasuarina species), shredding the cones with the massive bill. Dependent on large hollow-bearing eucalypts for nest sites. A single egg is laid between March and May.	1	Low. No suitable habitat (including lack of feed trees) on the *Subject Site*.
Psittacidae	*Glossopsitta pusilla*	Little Lorikeet	V,P	Forages primarily in the canopy of open Eucalyptus forest and woodland, yet also finds food in Angophora, Melaleuca and other tree species. Riparian habitats are particularly used, due to higher soil fertility and hence greater productivity. Isolated flowering trees in open country, e.g. paddocks, roadside remnants and urban trees also help sustain viable populations of the species. Feeds mostly on nectar and pollen, occasionally on native fruits such as mistletoe, and only rarely in orchards Gregarious, travelling and feeding in small flocks (<10), though often with other lorikeets. Flocks numbering hundreds are still occasionally observed and may have been the norm in past centuries. Roosts in treetops, often distant from feeding areas.	5	Moderate Potential foraging habitat only.

					Nests in proximity to feeding areas if possible, most typically selecting hollows in the limb or trunk of smooth-barked Eucalypts. Entrance is small (3 cm) and usually high above the ground (2–15 m). These nest sites are often used repeatedly for decades, suggesting that preferred sites are limited. Riparian trees often chosen, including species like Allocasuarina. Nesting season extends from May to September. In years when flowering is prolific, Little Lorikeet pairs can breed twice, producing 3-4 young per attempt. However, the survival rate of fledglings is unknown.		
Psittacidae	*Lathamus discolor*	Swift Parrot	E1,P,3	E	Migrates to the Australian south-east mainland between March and October. On the mainland they occur in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. Favoured feed trees include winter flowering species such as Swamp Mahogany *Eucalyptus robusta*, Spotted Gum *Corymbia maculata*, Red Bloodwood *C. gummifera*, Mugga Ironbark *E. sideroxylon*, and White Box *E. albens*. Commonly used lerp infested trees include Inland Grey Box E. microcarpa, Grey Box E. moluccana and Blackbutt E. pilularis. Return to some foraging sites on a cyclic basis depending on food availability. Following winter they return to Tasmania where they breed from September to January, nesting in old trees with hollows and feeding in forests dominated by Tasmanian Blue Gum Eucalyptus globulus. Identifiable from March to September.	11	Low. No suitable feed trees on the *subject site* and does not breed on the mainland.
Strigidae	*Ninox connivens*	Barking Owl	V,P,3		Inhabits woodland and open forest, including fragmented remnants and partly cleared farmland. It is flexible in its habitat use, and hunting can extend in to closed forest and more open areas. Sometimes able to successfully breed along timbered watercourses in heavily cleared habitats (e.g. western NSW) due to the higher density of prey on these fertile soils. Roost in shaded portions of tree canopies, including tall midstorey trees with dense foliage such as Acacia	1	Low. No suitable nesting or roosting habitat as the *Subject Site* does not have habitat trees or dense foliage

				and Casuarina species. During nesting season, the male perches in a nearby tree overlooking the hollow entrance. Preferentially hunts small arboreal mammals such as Squirrel Gliders and Ringtail Possums, but when loss of tree hollows decreases these prey populations the owl becomes more reliant on birds, invertebrates and terrestrial mammals such as rodents and rabbits. Can catch bats and moths on the wing, but typically hunts by sallying from a tall perch. Requires very large permanent territories in most habitats due to sparse prey densities. Monogamous pairs hunt over as much as 6000 hectares, with 2000 hectares being more typical in NSW habitats. Two or three eggs are laid in hollows of large, old trees. Living eucalypts are preferred though dead trees are also used. Nest sites are used repeatedly over years by a pair, but they may switch sites if disturbed by predators (e.g. goannas). Nesting occurs during mid-winter and spring but is variable between pairs and among years. As a rule of thumb, laying occurs during August and fledging in November. The female incubates for 5 weeks, roosts outside the hollow when chicks are 4 weeks old, then fledging occurs 2-3 weeks later. Young are dependent for several months. Territorial pairs respond strongly to recordings of Barking Owl calls from up to 6 km away, though humans rarely hear this response farther than 1.5 km. Because disturbance reduces the pair's foraging time, and can pull the female off her eggs even on cold nights, recordings should not be broadcast unnecessarily nor during the nesting season. Calls at all time of year, but strongest response in March-June. Avoid early nesting (July-Sept) when surveys pull the female off eggs on cold nights.		
Strigidae	*Ninox strenua*	Powerful Owl	V,P,3	The Powerful Owl inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. The Powerful Owl requires large tracts of forest or woodland habitat but can occur in fragmented	11	Moderate. No suitable nesting or roosting habitat as the *Subject Site* does not have habitat trees or dense foliage

landscapes as well. The species breeds and hunts in open or closed sclerophyll forest or woodlands and occasionally hunts in open habitats. It roosts by day in dense vegetation comprising species such as Turpentine Syncarpia glomulifera, Black She-oak Allocasuarina littoralis, Blackwood Acacia melanoxylon, Rough-barked Apple Angophora floribunda, Cherry Ballart Exocarpus cupressiformis and a number of eucalypt species.

The main prey items are medium-sized arboreal marsupials, particularly the Greater Glider, Common Ringtail Possum and Sugar Glider. There may be marked regional differences in the prey taken by Powerful Owls. For example in southern NSW, Ringtail Possum make up the bulk of prey in the lowland or coastal habitat. At higher elevations, such as the tableland forests, the Greater Glider may constitute almost all of the prey for a pair of Powerful Owls. Flying foxes are important prey in some areas; birds comprise about 10-50% of the diet depending on the availability of preferred mammals. As most prey species require hollows and a shrub layer, these are important habitat components for the owl.

Pairs of Powerful Owls demonstrate high fidelity to a large territory, the size of which varies with habitat quality and thus prey densities. In good habitats a mere 400 can support a pair; where hollow trees and prey have been depleted the owls need up to 4000 ha.

Powerful Owls nest in large tree hollows (at least 0.5 m deep), in large eucalypts (diameter at breast height of 80-240 cm) that are at least 150 years old. While the female and young are in the nest hollow the male Powerful Owl roosts nearby (10-200 m) guarding them, often choosing a dense "grove" of trees that provide concealment from other birds that harass him.

Powerful Owls are monogamous and mate for life. Nesting occurs from late autumn to mid-winter, but is slightly earlier in north-eastern NSW (late summer - mid autumn). Clutches consist of two dull white eggs and incubation lasts approximately 38 days.

Identifiable all year.

Tytonidae	*Tyto longimembris*	Eastern Grass Owl	V,P,3	Eastern Grass Owls are found in areas of tall grass, including grass tussocks, in swampy areas, grassy plains, swampy heath, and in cane grass or sedges on flood plains. They rest by day in a 'form' - a trampled platform in a large tussock or other heavy vegetative growth. If disturbed they burst out of cover, flying low and slowly, before dropping straight down again into cover. Always breeds on the ground. Nests are found in trodden grass, and often accessed by tunnels through vegetation. Breeding season is highly variable and dependent on environmental conditions, but in NSW nesting most typically occurs in autumn or winter.	1	Unlikely. No suitable habitat as the *Subject Site* lacks tall grass.
Tytonidae	*Tyto novaehollandiae*	Masked Owl	V,P,3	Lives in dry eucalypt forests and woodlands from sea level to 1100 m. A forest owl, but often hunts along the edges of forests, including roadsides. The typical diet consists of tree-dwelling and ground mammals, especially rats. Pairs have a large home-range of 500 to 1000 hectares. Roosts and breeds in moist eucalypt forested gullies, using large tree hollows or sometimes caves for nesting. Identifiable all year.	7	Moderate. No suitable nesting or roosting habitat as the *Subject Site* does not have habitat trees or dense foliage
Neosittidae	*Daphoenositta chrysoptera*	Varied Sittella	V,P	Inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland. Feeds on arthropods gleaned from crevices in rough or decorticating bark, dead branches, standing dead trees and small branches and twigs in the tree canopy. Builds a cup-shaped nest of plant fibres and cobwebs in an upright tree fork high in the living tree canopy, and often re-uses the same fork or tree in successive years. Generation length is estimated to be 5 years.	3	Low. No suitable habitat on the *Subject Site* as it lacks rough barked eucalypts

Artamidae	*Artamus cyanopterus cyanopterus*	Dusky Woodswallow	V,P		The Dusky Woodswallow is widespread in eastern, southern and southwestern Australia. In New South Wales it is widespread from coast to inland, including the western slopes of the Great Dividing Range and farther west. It is sparsely scattered in, or largely absent from, much of the Upper Western region The Dusky Woodswallow is often reported in woodlands and dry open sclerophyll forests, usually dominated by eucalypts, including mallee associations. It has also been recorded in shrublands and heathlands and various modified habitats, including regenerating forests; very occasionally in moist forests or rainforests. At sites where Dusky Woodswallows are recorded the understorey is typically open with sparse eucalypt saplings, acacias and other shrubs, including heath. The ground cover may consist of grasses, sedges or open ground, often with coarse woody debris. Birds are also often observed in farm land, usually at the edges of forest or woodland or in roadside remnants or wind breaks with dead timber. In western New South Wales this species is primarily associated with River Red Gum/Black Box/Coolibah open forest/woodland associated with larger river/creek systems and is less common and far more patchily distributed in other communities such as mallee and cypress-pine woodland.	2	Moderate Potential habitat on the *Subject Site*
MAMMALS							
Dasyuridae	*Dasyurus maculatus*	Spotted-tailed Quoll	V,P	E	Recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Individual animals use hollow-bearing trees, fallen logs, small caves, rock outcrops and rocky-cliff faces as den sites. Mostly nocturnal, although will hunt during the day; spends most of the time on the ground, although also an excellent climber and will hunt possums and gliders in tree hollows and prey on roosting birds. Use communal 'latrine sites', often on flat rocks among boulder fields, rocky cliff-faces or along rocky stream beds or banks. Such sites may be visited by multiple individuals and can be recognised by the	12	Moderate Potential habitat on the *Subject Site*

					accumulation of the sometimes characteristic 'twisty-shaped' faeces deposited by animals. A generalist predator with a preference for medium-sized (500g-5kg) mammals. Consumes a variety of prey, including gliders, possums, small wallabies, rats, birds, bandicoots, rabbits, reptiles and insects. Also eats carrion and takes domestic fowl. Females occupy home ranges up to about 750 hectares and males up to 3500 hectares. Are known to traverse their home ranges along densely vegetated creeklines. Average litter size is five; both sexes mature at about one year of age. Life expectancy in the wild is about 3-4 years.		
Dasyuridae	*Phascogale tapoatafa*	Brush-tailed Phascogale	V,P		Prefer dry sclerophyll open forest with sparse groundcover of herbs, grasses, shrubs or leaf litter. Also inhabit heath, swamps, rainforest and wet sclerophyll forest. Agile climber foraging preferentially in rough barked trees of 25 cm DBH or greater. Feeds mostly on arthropods but will also eat other invertebrates, nectar and sometimes small vertebrates. Females have exclusive territories of approximately 20 - 40 ha, while males have overlapping territories often greater than 100 ha. Nest and shelter in tree hollows with entrances 2.5 - 4 cm wide and use many different hollows over a short time span. Mating occurs May - July; males die soon after the mating season whereas females can live for up to three years but generally only produce one litter.	10	Low No nesting habitat (i.e. hollow bearing trees) on the *Subject Site* nor does the site represent open forest with sparse groundcover of herbs, grasses or shrubs.
Phascolarctidae	*Phascolarctos cinereus*	Koala	V,P	V	Inhabit eucalypt woodlands and forests. Feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species. Inactive for most of the day, feeding and moving mostly at night. Spend most of their time in trees, but will descend and traverse open ground to move between trees. Home range size varies with quality of habitat, ranging from less than two ha to several hundred hectares in size. Generally solitary, but have complex social	1947	Moderate Potential habitat for dispersing males only as the *Subject Site* is not considered potential koala habitat under the SEPP 44 definition.

					hierarchies based on a dominant male with a territory overlapping several females and sub-ordinate males on the periphery. Females breed at two years of age and produce one young per year.		
Petauridae	*Petaurus norfolcensis*	Squirrel Glider	V,P		Inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas. Prefers mixed species stands with a shrub or Acacia midstorey. Live in family groups of a single adult male one or more adult females and offspring. Require abundant tree hollows for refuge and nest sites. Diet varies seasonally and consists of Acacia gum, eucalypt sap, nectar, honeydew and manna, with invertebrates and pollen providing protein.	23	Low No nesting habitat (i.e. hollow bearing trees) on the *Subject Site* and no suitable foraging habitat.
Pteropodidae	*Pteropus poliocephalus*	Grey-headed Flying-fox	V,P	V	Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy. Individual camps may have tens of thousands of animals and are used for mating, and for giving birth and rearing young. Annual mating commences in January and conception occurs in April or May; a single young is born in October or November. Site fidelity to camps is high; some camps have been used for over a century. Can travel up to 50 km from the camp to forage; commuting distances are more often <20 km. Feed on the nectar and pollen of native trees, in particular Eucalyptus, Melaleuca and Banksia, and fruits of rainforest trees and vines. Also forage in cultivated gardens and fruit crops.	18	Moderate Potential foraging habitat only.
Emballonuridae	*Saccolaimus flaviventris*	Yellow-bellied Sheathtail-bat	V,P		Roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows. When foraging for insects, flies high and fast over the forest canopy, but lower in more open country. Forages in most habitats across its very wide range, with and without trees; appears to	2	Moderate Potential foraging habitat

					defend an aerial territory. Breeding has been recorded from December to mid-March, when a single young is born. Seasonal movements are unknown; there is speculation about a migration to southern Australia in late summer and autumn.		
Molossidae	*Mormopterus norfolkensis*	Eastern Freetail-bat	V,P		Occur in dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range. Roost mainly in tree hollows but will also roost under bark or in man-made structures. Usually solitary but also recorded roosting communally, probably insectivorous.	3	Moderate *Subject Site* does not contain the preferred roosting habitat (i.e. hollow bearing trees)
Vespertilionidae	*Chalinolobus dwyeri*	Large-eared Pied Bat	V,P	V	Roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (Petrochelidon ariel), frequenting low to mid-elevation dry open forest and woodland close to these features. Females have been recorded raising young in maternity roosts (c. 20-40 females) from November through to January in roof domes in sandstone caves and overhangs. They remain loyal to the same cave over many years. Found in well-timbered areas containing gullies. The relatively short, broad wing combined with the low weight per unit area of wing indicates manoeuvrable flight. This species probably forages for small, flying insects below the forest canopy. Likely to hibernate through the coolest months. It is uncertain whether mating occurs early in winter or in spring.	2	Low *Subject Site* does not contain the preferred habitat of well timbered areas and gullies. No roosting habitat (i.e. caves) on the *Subject Site*.
Vespertilionidae	*Falsistrellus tasmaniensis*	Eastern False Pipistrelle	V,P		Prefers moist habitats, with trees taller than 20 m. Generally roosts in eucalypt hollows, but has also been found under loose bark on trees or in buildings. Hunts beetles, moths, weevils and other flying insects above or just below the tree canopy. Hibernates in winter. Females are pregnant in late spring to early summer. Identifiable from mid spring to mid autumn.	4	Low *Subject Site* does not contain preferred moist habitat and there are no roosting habitat (i.e. hollow bearing trees) on the *Subject Site*.
Vespertilionidae	*Miniopterus australis*	Little Bentwing-bat	V,P		Moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense	16	Moderate Potential foraging habitat.

				coastal forests and banksia scrub. Generally found in well-timbered areas. Little Bentwing-bats roost in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats. They often share roosting sites with the Common Bentwing-bat and, in winter, the two species may form mixed clusters. In NSW the largest maternity colony is in close association with a large maternity colony of Eastern Bentwing-bats (Miniopterus schreibersii) and appears to depend on the large colony to provide the high temperatures needed to rear its young. Maternity colonies form in spring and birthing occurs in early summer. Males and juveniles disperse in summer. Only five nursery sites /maternity colonies are known in Australia. Identifiable Mid spring to mid-autumn		
Vespertilionidae	*Miniopterus schreibersii oceanensis*	Eastern Bentwing-bat	V,P	Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures. Form discrete populations centred on a maternity cave that is used annually in spring and summer for the birth and rearing of young. Maternity caves have very specific temperature and humidity regimes. At other times of the year, populations disperse within about 300 km range of maternity caves. Cold caves are used for hibernation in southern Australia. Breeding or roosting colonies can number from 100 to 150,000 individuals. Hunt in forested areas, catching moths and other flying insects above the tree tops. hibernate from June to August	3	Moderate. *Subject Site* does not contain preferred roosting habitat on the *Subject Site*.
Vespertilionidae	*Myotis macropus*	Southern Myotis	V,P	Generally roost in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage. Forage over streams and pools catching insects and small fish by raking their feet across the water surface.	2	Low. *Subject Site* does not contain preferred habitat such as streams or pools for foraging or suitable roosting habitat.

					In NSW females have one young each year usually in November or December. Identifiable from October to March		
Vespertilionidae	*Scoteanax rueppellii*	Greater Broad-nosed Bat	V,P		Utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest. Although this species usually roosts in tree hollows, it has also been found in buildings. Forages after sunset, flying slowly and directly along creek and river corridors at an altitude of 3 - 6 m. Open woodland habitat and dry open forest suits the direct flight of this species as it searches for beetles and other large, slow-flying insects; this species has been known to eat other bat species. Little is known of its reproductive cycle, however a single young is born in January; prior to birth, females congregate at maternity sites located in suitable trees, where they appear to exclude males during the birth and raising of the single young. Identifiable mid spring to mid autumn	10	Low *Subject Site* does not contain preferred foraging habitat such as creeks or rivers nor does it contain extensive native vegetation. No roosting habitat on the *Subject Site*.
Vespertilionidae	*Vespadelus troughtoni*	Eastern Cave Bat	V,P		Very little is known about the biology of this uncommon species. A cave-roosting species that is usually found in dry open forest and woodland, near cliffs or rocky overhangs; has been recorded roosting in disused mine workings, occasionally in colonies of up to 500 individuals. Occasionally found along cliff-lines in wet eucalypt forest and rainforest. Little is understood of its feeding or breeding requirements or behaviour.	2	Low *Subject Site* does not contain preferred habitat near cliffs or rocky overhangs. No roosting habitat (i.e. caves) on the *Subject Site*.
Muridae	*Pseudomys novaehollandiae*	New Holland Mouse	P	V	Known to inhabit open heathlands, woodlands and forests with a heathland understorey and vegetated sand dunes. It is a social animal, living predominantly in burrows shared with other individuals. Distribution is patchy in time and space, with peaks in abundance during early to mid stages of vegetation succession typically induced by fire	7	Moderate Potential habitat
Petaluridae	*Petalura gigantea*	Giant Dragonfly	E1		Live in permanent swamps and bogs with some free water and open vegetation. Adults emerge from late October and are short-lived, surviving for one summer	2	Low

				after emergence. Adults spend most of their time settled on low vegetation on or adjacent to the swamp. They hunt for flying insects over the swamp and along its margins. Adults fly over the swamp and along its margins hunting for flying insects. Males sometimes congregate waiting for females to mate with. Females lay eggs into moss, under other soft ground layer vegetation, and into moist litter and humic soils, often associated with groundwater seepage areas within appropriate swamp and bog habitats. The species does not utilise areas of standing water wetland, although it may utilise suitable boggy areas adjacent to open water wetlands. Larvae dig long branching burrows under the swamp. Larvae are slow growing and the larval stage may last 10 years or more. It is thought that larvae leave their burrows at night and feed on insects and other invertebrates on the surface and also use underwater entrances to hunt for food in the aquatic vegetation.		*Subject Site* does not contain preferred habitat such as permanent swamps and bogs.
Casuariidae	*Dromaius novaehollandiae*	Emu population in the New South Wales North Coast Bioregion and Port Stephens local government area	E2,P	On the NSW north coast, Emus occur in a range of predominantly open lowland habitats, including grasslands, heathland, shrubland, open and shrubby woodlands, forest, and swamp and sedgeland communities, as well as the ecotones between these habitats. They also occur in plantations of tea-tree and open farmland, and occasionally in littoral rainforest. Emus are omnivorous, taking a wide range of seeds and fruits, invertebrates (mainly insects) and foliage and other plant material. They take material directly from plants or bend down to take items from the ground, picking up the food and tossing them back in the throat before swallowing. The population of Emus in the NSW North Coast Bioregion and Port Stephens LGA is of significant conservation value as the last known population in northern coastal NSW, and for the role that birds play in dispersing large seeds of native plant species, and over long distances. Most breeding occurs in late autumn and winter, but better data are needed for the north-eastern NSW population. Eggs are laid on a platform of grass, twigs, leaves and bark on the ground, often at the base of some vegetation and with good views from the nest. Incubation and all parental care is by the male. Young are precocial and covered in down at hatching. They can walk within 5 to 24 hours of hatching.	1	Low Only one recorded occurrence of this species in the *Study Area*.

Family PLANTS	Scientific Name	Common Name	NSW status	Comm. status	Habitat Preference	Records	Likelihood of Occurrence
Myrtaceae	*Callistemon linearifolius*	Netted Bottle Brush	V,P,3		Grows in dry sclerophyll forest on the coast and adjacent ranges. Flowers spring – summer.	1	Unlikely. *Subject Site* does not provide suitable habitat for this species and not recorded during surveys.
Myrtaceae	*Eucalyptus parramattensis subsp. decadens*		V,P	V	Generally occupies deep, low-nutrient sands, often those subject to periodic inundation or where water tables are relatively high. It occurs in dry sclerophyll woodland with dry heath understorey. It also occurs as an emergent in dry or wet heathland. Often where this species occurs, it is a community dominant. In the Kurri Kurri area, E. parramattensis subsp. decadens is a characteristic species of 'Kurri Sand Swamp Woodland in the Sydney Basin Bioregion', an endangered ecological community under the TSC Act. In the Tomago Sandbeds area, the species is usually associated with the 'Tomago Swamp Woodland' as defined by NSW NPWS (2000). Very little is known about the biology or ecology of this species. Flowers from November to January. Propagation mechanisms are currently poorly known. Seed dispersal is likely to be effected by wind and animals. Likely to be sensitive to over-frequent fire, however there is evidence (i.e. coppicing, epicormic shoots) that the species may be tolerant of low intensity fires. The species has a canopy stored seed bank for dispersal after fire events.	3	Unlikely. Not recorded on the *Subject Site* during surveys.
Orchidaceae	^^*Diuris praecox*	Rough Doubletail	V,P,2	V	Grows on hills and slopes of near-coastal districts in open forests which have a grassy to fairly dense understorey. Exists as subterranean tubers most of the year. It produces leaves and flowering stems in winter. Undetectable except when in flower between July and August depending on prevailing climatic conditions.	667	Moderate Potential habitat on the *Subject Site* and a number of nearby records.
Orchidaceae	*Diuris arenaria*	Sand Doubletail	E1,P,2		Sand Doubletail is a small ground orchid. The light purple to mauve flowers appear between August and September and are 20-30 mm wide. There are usually two 15-50 cm long by 2-6 mm wide leaves that grow from the base of the plant. Sand Doubletail is known from the Tomaree Peninsula near Newcastle. This species occurs in coastal heath and dry grassy eucalypt forest on sandy flats. Grows in gently undulating country in eucalypt forest with a grassy understorey on clay soil.	175	Moderate Potential habitat on the Subject Site.

10. APPENDIX B: ASSESSMENT OF SIGNIFICANCE: BC ACT

Following review of BioNet and a site inspection and habitat assessment, the following species are considered to have potential habitat on the *Subject Site* and as such are subjected to an assessment of significance of impact from the proposed information centre.

Scientific Name	Common Name	Status TSC Act	Records
Crinia tinnula	Wallum Froglet	V,P	69
Haliaeetus leucogaster	White-bellied Sea-Eagle	V,P	73
Glossopsitta pusilla	Little Lorikeet	V,P	5
Ninox strenua	Powerful Owl	V,P,3	11
Tyto novaehollandiae	Masked Owl	V,P,3	7
Artamus cyanopterus cyanopterus	Dusky Woodswallow	V,P	2
Dasyurus maculatus	Spotted-tailed Quoll	V,P	12
Phascolarctos cinereus	Koala	V,P	###
Pteropus poliocephalus	Grey-headed Flying-fox	V,P	18
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V,P	2
Mormopterus norfolkensis	Eastern Freetail-bat	V,P	3
Miniopterus australis	Little Bentwing-bat	V,P	16
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V,P	3
Diuris praecox	Rough Doubletail	V,P	
Diuris arenaria	Sand Doubletail	E1,P	

Unless otherwise cited, information was obtained from the OEH species profiles and references contained therein.
http://www.environment.nsw.gov.au/threatenedSpeciesApp/

Effects on a Threatened Species

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

10.1.1 Wallum Froglet

Wallum Froglets are small (to about 20mm) and extremely variable in colour and pattern. They range from light grey or brown to dark grey above and usually white or light brown below (sparsely flecked or heavily mottled with darker patches). They have a relatively pointed snout that projects beyond the lower jaw. A fine median line of white dots often occurs on the underside on the throat that may continue across the belly. They have no webbing on their feet and toe pads are absent. Pupils are horizontal. The call is a distinctive short high-pitched ringing 'tching..tching..', heard throughout the year, particularly following rain.

Wallum Froglets are found along the coastal margin from Litabella National Park in south-east Queensland to Kurnell in Sydney.

Wallum Froglets are found in a wide range of habitats, usually associated with acidic swamps on coastal sand plains. They typically occur in sedgelands and wet heathlands. They can also be found along drainage lines within other vegetation communities and disturbed areas, and occasionally in swamp sclerophyll forests.

The species breeds in swamps with permanent water as well as shallow ephemeral pools and drainage ditches. Breeding is thought to peak in the colder months but can occur throughout the year following rain. Eggs of 1.1-1.2mm are deposited in water with a pH of <6 and tadpoles take 2-6 months to develop into frogs.

Wallum Froglets shelter under leaf litter, vegetation, other debris or in burrows of other species. Shelter sites are wet or very damp and often located near the water's edge. Males may call throughout the year and at any time of day, peaking following rain.

The *Subject Site* does not contain acid swamps, permanent water or shallow ephemeral pools. The drainage lines outside of the *Subject Site* are isolated from their preferred habitat and are unlikely to provide important habitat if any for this species. Drainage lines will not be directly impacted by works. Potential indirect impacts will be mitigated through the implementation of appropriate erosion and sediment control measures. Thus, the proposed works are considered unlikely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

10.1.2 White-bellied Sea-eagle

The White-bellied Sea-Eagle is a large eagle that has long broad wings and a short, wedge-shaped tail. Both sexes are similar in appearance but females are larger than the males. Juveniles are brown with lighter markings. White-bellied Sea-eagles may be solitary, or live in pairs or small family groups consisting of a pair of adults and dependent young.

The White-bellied Sea-eagle is distributed around the Australian coastline, including Tasmania, and well inland along rivers and wetlands of the Murray Darling Basin. In New South Wales it is widespread along the east coast, and along all major inland rivers and waterways.

Habitats are characterised by the presence of large areas of open water including larger rivers, swamps, lakes, and the sea. Occurs at sites near the sea or sea-shore, such as around bays and inlets, beaches, reefs, lagoons, estuaries and mangroves; and at, or in the vicinity of freshwater swamps, lakes, reservoirs, billabongs and saltmarsh. Terrestrial habitats include coastal dunes, tidal flats, grassland, heathland, woodland, and forest (including rainforest). Breeding habitat consists of mature tall open forest, open forest, tall woodland, and swamp sclerophyll forest close to foraging habitat. Nest trees are typically large emergent eucalypts and often have emergent dead branches or large dead trees nearby which are used as ‘guard roosts’. Nests are large structures built from sticks and lined with leaves or grass. Feed mainly on fish and freshwater turtles, but also waterbirds, reptiles, mammals and carrion. Hunts its prey from a perch or whilst in flight (by circling slowly, or by sailing along 10–20 m above the shore). Prey is usually carried to a feeding platform or (if small) consumed in flight, but some items are eaten on the ground. May be solitary, or live in pairs or small family groups consisting of a pair of adults and dependent young. Typically lays two eggs between June and September with young birds remaining in the nest for 65-70 days.

The *Subject Site* may contain marginal foraging habitat for this species and it is likely that this species is seen flying overhead, however the site lacks important habitat features such as large emergent trees suitable for roosting, breeding and nesting. As such, the Subject Site does not support an important population or pair of this species and thus, the proposed works are considered unlikely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

10.1.3 Little Lorikeet

The Little Lorikeet is a small (16-19 cm; 40 g) bright green parrot, with a red face surrounding its black bill and extending to the eye. The undertail is olive-yellow with a partly concealed red base, and the underwing coverts are bright green. The mantle is imbued with light brown. The call in flight is diagnostically different from other lorikeets, being a shrill and rolling screech: ‘zit-zit’ or ‘zzet’. Although difficult to observe while foraging high in treetops, a flock’s constantly chattering contact calls give it away. Flight is fast, direct and through or above the canopy.

The Little Lorikeet is distributed widely across the coastal and Great Divide regions of eastern Australia from Cape York to South Australia. NSW provides a large portion of the species' core habitat, with lorikeets found westward as far as Dubbo and Albury. Nomadic movements are common, influenced by season and food availability, although some areas retain residents for much of the year and 'locally nomadic' movements are suspected of breeding pairs.

- Forages primarily in the canopy of open Eucalyptus forest and woodland, yet also finds food in Angophora, Melaleuca and other tree species. Riparian habitats are particularly used, due to higher soil fertility and hence greater productivity.
- Isolated flowering trees in open country, e.g. paddocks, roadside remnants and urban trees also help sustain viable populations of the species.
- Feeds mostly on nectar and pollen, occasionally on native fruits such as mistletoe, and only rarely in orchards
- Gregarious, travelling and feeding in small flocks (<10), though often with other lorikeets. Flocks numbering hundreds are still occasionally observed and may have been the norm in past centuries.
- Roosts in treetops, often distant from feeding areas.
- Nests in proximity to feeding areas if possible, most typically selecting hollows in the limb or trunk of smooth-barked Eucalypts. Entrance is small (3 cm) and usually high above the ground (2–15 m). These nest sites are often used repeatedly for decades, suggesting that preferred sites are limited. Riparian trees often chosen, including species like Allocasuarina.
- Nesting season extends from May to September. In years when flowering is prolific, Little Lorikeet pairs can breed twice, producing 3-4 young per attempt. However, the survival rate of fledglings is unknown.

The *Subject Site* does not provide nesting habitat for this species as it lacks hollow-bearing trees, and it provides only limited foraging habitat in the Cheese Tree/Smooth-barked Apple/Bangalay Forest. The potential foraging habitat will not be impacted by the proposed works. Thus, the proposed works are considered unlikely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

10.1.4 Dusky Woodswallow

The dusky woodswallow is a medium-sized bird (16-19.5 cm, 35 g), with a longish tail. Mostly dark grey-brown, merging to blackish on the tail, with a small black-brown mask. Bluish bill with a black tip. Upper-wings are a dark blue-grey with a white leading edge. Conspicuous white corners on the tail. In flight the dark grey-brown under-body contrasts with the whitish under-wing. Juveniles may be distinguished by white streaking on the body and whitish tips on wing feathers. Immature individuals are similar to adults but retain pale-tipped wing feathers. No seasonal variation in appearance is evident, and sexes are alike. Calls consist of brassy chirps, chirups, a soft low 'vut vut' and a brisk 'peet peet'. Also known to mimic other birds, including the rufous whistler and grey shrike-thrush.

Dusky woodswallows are widespread in eastern, southern and south western Australia. The species occurs throughout most of New South Wales, but is sparsely scattered in, or largely absent from, much of the upper western region. Most breeding activity occurs on the western slopes of the Great Dividing Range.

Primarily inhabit dry, open eucalypt forests and woodlands, including mallee associations, with an open or sparse understorey of eucalypt saplings, acacias and other shrubs, and ground-cover of grasses or sedges and fallen woody debris. It has also been recorded in

shrublands, heathlands and very occasionally in moist forest or rainforest. Also found in farmland, usually at the edges of forest or woodland.

Primarily eats invertebrates, mainly insects, which are captured whilst hovering or sallying above the canopy or over water. Also frequently hovers, sallies and pounces under the canopy, primarily over leaf litter and dead timber. Also occasionally take nectar, fruit and seed.

Depending on location and local climatic conditions (primarily temperature and rainfall), the dusky woodswallow can be resident year round or migratory. In NSW, after breeding, birds migrate to the north of the state and to southeastern Queensland, while Tasmanian birds migrate to southeastern NSW after breeding. Migrants generally depart between March and May, heading south to breed again in spring. There is some evidence of site fidelity for breeding. Although dusky woodswallows generally breed as solitary pairs or occasionally in small flocks, large flocks may form around abundant food sources in winter. Large flocks may also form before migration, which is often undertaken with other species.

Nest is an open, cup-shape, made of twigs, grass, fibrous rootlets and occasionally casuarina needles, and may be lined with grass, rootlets or infrequently horsehair, occasionally unlined. Nest sites vary greatly, but generally occur in shrubs or low trees, living or dead, horizontal or upright forks in branches, spouts, hollow stumps or logs, behind loose bark or in a hollow in the top of a wooden fence post. Nest sites may be exposed or well concealed by foliage.

The *Subject Site* provides only limited foraging habitat and the habitat is considered sub-optimal as it is highly impacted by exotic invasion and native species have a low percent cover. There are only 2 recorded occurrences of this species in the north east of the *Study Area*. Thus, the *Subject Site* is not considered important habitat for this species and the proposed works are considered unlikely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

10.1.5 Powerful Owl

The Powerful Owl is the largest owl in Australasia. It is a typical hawk-owl, with large yellow eyes and no facial-disc. Adults reach 60 cm in length, have a wingspan of up to 140 cm and weigh up to 1.45 kilograms. Males are larger than females. The upper parts of the Powerful Owl are dark, greyish-brown with indistinct off-white bars. The underparts are whitish with dark greyish-brown V-shaped markings. Juvenile Powerful Owls have a white crown and underparts that contrasts with its small, dark streaks and dark eye patches. The call of this species may be heard at any time of the year, but it is more vocal during the autumn breeding season. It has a slow, deep and resonant double hoot, with the female's being higher pitched and expressing an upward inflection on the second note.

The Powerful Owl is endemic to eastern and south-eastern Australia, mainly on the coastal side of the Great Dividing Range from Mackay to south-western Victoria. In NSW, it is widely distributed throughout the eastern forests from the coast inland to tablelands, with scattered records on the western slopes and plains suggesting occupancy prior to land clearing. Now at low densities throughout most of its eastern range, rare along the Murray River and former inland populations may never recover.

The Powerful Owl inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest.

The Powerful Owl requires large tracts of forest or woodland habitat but can occur in fragmented landscapes as well. The species breeds and hunts in open or closed sclerophyll forest or woodlands and occasionally hunts in open habitats. It roosts by day in dense vegetation comprising species such as Turpentine Syncarpia glomulifera, Black She-oak

Allocasuarina littoralis, Blackwood *Acacia melanoxylon*, Rough-barked Apple *Angophora floribunda*, Cherry Ballart *Exocarpus cupressiformis* and a number of eucalypt species.

The main prey items are medium-sized arboreal marsupials, particularly the Greater Glider, Common Ringtail Possum and Sugar Glider. There may be marked regional differences in the prey taken by Powerful Owls. For example in southern NSW, Ringtail Possum make up the bulk of prey in the lowland or coastal habitat. At higher elevations, such as the tableland forests, the Greater Glider may constitute almost all of the prey for a pair of Powerful Owls. Flying foxes are important prey in some areas; birds comprise about 10-50% of the diet depending on the availability of preferred mammals. As most prey species require hollows and a shrub layer, these are important habitat components for the owl.

Pairs of Powerful Owls demonstrate high fidelity to a large territory, the size of which varies with habitat quality and thus prey densities. In good habitats a mere 400 can support a pair; where hollow trees and prey have been depleted the owls need up to 4000 ha.

Powerful Owls nest in large tree hollows (at least 0.5 m deep), in large eucalypts (diameter at breast height of 80-240 cm) that are at least 150 years old. While the female and young are in the nest hollow the male Powerful Owl roosts nearby (10-200 m) guarding them, often choosing a dense "grove" of trees that provide concealment from other birds that harass him.

Powerful Owls are monogamous and mate for life. Nesting occurs from late autumn to mid-winter but is slightly earlier in north-eastern NSW (late summer - mid autumn). Clutches consist of two dull white eggs and incubation lasts approximately 38 days. They are identifiable all year.

The *Subject Site* may contain foraging habitat for this species however the site lacks important habitat features such as large hollow-bearing trees suitable for nesting. As such, the Subject Site does not support an important population or pair of this species and thus, the proposed works are considered unlikely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

10.1.6 Masked Owl

A medium-sized owl to 40 - 50 cm long, with dark eyes set in a prominent flat, heart-shaped facial disc that is encircled by a dark border. The feet are large and powerful, with fully feathered legs down to the toes. The owl exists in several colour forms, with wide variation in plumage. The upperparts are grey to dark brown with buff to rufous mottling and fine, pale spots. The wings and tail are well barred. The underparts are white to rufous-brown with variable dark spotting. The palest birds have a white face with a brown patch around each eye; the darkest birds have a chestnut face. The dark form of the Masked Owl is much browner than the Sooty Owl Tyto tenebricosa.

Extends from the coast where it is most abundant to the western plains. Overall records for this species fall within approximately 90% of NSW, excluding the most arid north-western corner. There is no seasonal variation in its distribution.

This species lives in dry eucalypt forests and woodlands from sea level to 1100 m. A forest owl, but often hunts along the edges of forests, including roadsides. The typical diet consists of tree-dwelling and ground mammals, especially rats. Pairs have a large home-range of 500 to 1000 hectares. Roosts and breeds in moist eucalypt forested gullies, using large tree hollows or sometimes caves for nesting.

The Subject Site may contain foraging habitat for this species however the site lacks important habitat features such as large hollow-bearing trees or caves suitable for nesting. As such, the Subject Site does not support an important population or pair of this species and thus, the proposed works are considered unlikely to have an adverse effect on the life

cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

10.1.7 Spotted-tailed Quoll

The Spotted-tailed Quoll is about the size of a domestic cat, from which it differs most obviously in its shorter legs and pointed face. The average weight of an adult male is about 3500 grams and an adult female about 2000 grams. It has rich-rust to dark-brown fur above, with irregular white spots on the back and tail, and a pale belly. The spotted tail distinguishes it from all other Australian mammals, including other quoll species. However, the spots may be indistinct on juvenile animals.
The range of the Spotted-tailed Quoll has contracted considerably since European settlement. It is now found in eastern NSW, eastern Victoria, south-east and north-eastern Queensland, and Tasmania. Only in Tasmania is it still considered relatively common.

- Recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline.tr
- Individual animals use hollow-bearing trees, fallen logs, small caves, rock outcrops and rocky-cliff faces as den sites.
- Mostly nocturnal, although will hunt during the day; spends most of the time on the ground, although also an excellent climber and will hunt possums and gliders in tree hollows and prey on roosting birds.
- Use communal 'latrine sites', often on flat rocks among boulder fields, rocky cliff-faces or along rocky stream beds or banks. Such sites may be visited by multiple individuals and can be recognised by the accumulation of the sometimes characteristic 'twisty-shaped' faeces deposited by animals.
- A generalist predator with a preference for medium-sized (500g-5kg) mammals. Consumes a variety of prey, including gliders, possums, small wallabies, rats, birds, bandicoots, rabbits, reptiles and insects. Also eats carrion and takes domestic fowl.
- Females occupy home ranges up to about 750 hectares and males up to 3500 hectares. Are known to traverse their home ranges along densely vegetated creeklines.
- Average litter size is five; both sexes mature at about one year of age. Life expectancy in the wild is about 3-4 years.

The *Subject Site* lack denning opportunity for this species however may provide marginal foraging habitat. There have been limited recent records of this species in the Study Area, and the *Subject Site* is considered unlikely to provide important habitat for this species. Thus, the proposed works are considered unlikely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

10.1.8 Koala

The Koala is an arboreal marsupial with fur ranging from grey to brown above, and is white below. It has large furry ears, a prominent black nose and no tail. It spends most of its time in trees and has long, sharp claws, adapted for climbing. Adult males weigh 6 - 12 kg and adult females weigh 5 - 8 kg. During breeding, males advertise with loud snarling coughs and bellows.
The Koala has a fragmented distribution throughout eastern Australia from north-east Queensland to the Eyre Peninsula in South Australia. In NSW it mainly occurs on the central and north coasts with some populations in the west of the Great Dividing Range. It

was briefly historically abundant in the 1890s in the Bega District on the south coast of NSW, although not elsewhere, but it now occurs in sparse and possibly disjunct populations. Koalas are also known from several sites on the southern tablelands.

- Inhabit eucalypt woodlands and forests.
- Feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species.
- Inactive for most of the day, feeding and moving mostly at night.
- Spend most of their time in trees, but will descend and traverse open ground to move between trees.
- Home range size varies with quality of habitat, ranging from less than two ha to several hundred hectares in size.
- Generally solitary, but have complex social hierarchies based on a dominant male with a territory overlapping several females and sub-ordinate males on the periphery.
- Females breed at two years of age and produce one young per year.

The *Subject Site* lacks the preferred feed trees of this species (as listed in schedule 2 of SEPP 44) nor does it contain primary species listed in the Australian Koala Foundation (AKF, 2012) Trees that will save the Koala. Thus, the *Subject Site* is not defined as potential koala habitat. During site inspections, the base and trunks of canopy trees were inspected for signs of koalas such as scratch marks or scat however there was no evidence of use. While the Study Area is known Koala habitat, the *Subject Site* is considered unlikely to provide important habitat for this species. Thus, the proposed works are considered unlikely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

10.1.9 Grey-headed Flying-fox

The Grey-headed Flying-fox is the largest Australian bat, with a head and body length of 23 - 29 cm. It has dark grey fur on the body, lighter grey fur on the head and a russet collar encircling the neck. The wing membranes are black and the wingspan can be up to 1 m. It can be distinguished from other flying-foxes by the leg fur, which extends to the ankle.

Grey-headed Flying-foxes are generally found within 200 km of the eastern coast of Australia, from Rockhampton in Queensland to Adelaide in South Australia. In times of natural resource shortages, they may be found in unusual locations.

- Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops.
- Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy.
- Individual camps may have tens of thousands of animals and are used for mating, and for giving birth and rearing young.
- Annual mating commences in January and conception occurs in April or May; a single young is born in October or November.
- Site fidelity to camps is high; some camps have been used for over a century.
- Can travel up to 50 km from the camp to forage; commuting distances are more often <20 km.
- Feed on the nectar and pollen of native trees, in particular Eucalyptus, Melaleuca and Banksia, and fruits of rainforest trees and vines.

- Also forage in cultivated gardens and fruit crops.

The *Subject Site* provides some foraging habitat for this species through the presence of native trees however it is not a roost/nesting location. Thus, the proposed works are considered unlikely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

10.1.10 Yellow-bellied Sheathtail-bat

The Yellow-bellied Sheathtail-bat is a very distinctive, large, insectivorous bat up to 87 mm long. It has long, narrow wings, a glossy, jet-black back, and a white to yellow belly extending to the shoulders and just behind the ear. Characteristically, it has a flattened head and a sharply-pointed muzzle. The tail is covered with an extremely elastic sheath that allows variation in the tail-membrane area. Males have a prominent throat pouch; females have a patch of bare skin in the same place.
The Yellow-bellied Sheathtail-bat is a wide-ranging species found across northern and eastern Australia. In the most southerly part of its range - most of Victoria, south-western NSW and adjacent South Australia - it is a rare visitor in late summer and autumn. There are scattered records of this species across the New England Tablelands and North West Slopes.

- Roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows.
- When foraging for insects, flies high and fast over the forest canopy, but lower in more open country.
- Forages in most habitats across its very wide range, with and without trees; appears to defend an aerial territory.
- Breeding has been recorded from December to mid-March, when a single young is born.
- Seasonal movements are unknown; there is speculation about a migration to southern Australia in late summer and autumn.

The *Subject Site* lacks habitat trees and buildings for roosting. No burrows were observed during site inspections however it is noted that due to the density of vegetation, not all of the site was traversed. The *Subject Site* provides some foraging habitat for this species however as it is not dense native vegetation, it is unlikely to provide important foraging habitat. The proposed works require the clearing of 0.27 ha of disturbed coastal scrub. Thus, the proposed works are considered unlikely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

10.1.11 Eastern Freetail-bat

The Eastern Freetail-bat has dark brown to reddish brown fur on the back and is slightly paler below. Like other freetail-bats it has a long (3 - 4 cm) bare tail protruding from the tail membrane. Freetail-bats are also known as mastiff-bats, having hairless faces with wrinkled lips and triangular ears. They weigh up to 10 grams.

The Eastern Freetail-bat is found along the east coast from south Queensland to southern NSW.

The occur in dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range and roost mainly in tree hollows but will also roost under bark or in man-made structures. Usually solitary but also recorded roosting communally, probably insectivorous.

The *Subject Site* lacks habitat trees and buildings for roosting. The *Subject Site* provides

some foraging habitat for this species however as it is not dense native vegetation, it is unlikely to provide important foraging habitat. The proposed works require the clearing of 0.27 ha of disturbed coastal scrub. Thus, the proposed works are considered unlikely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

10.1.12 Little Bentwing-bat

Little Bentwing-bats are small dark chocolate brown insectivorous bats with a body length of about 45 mm. The tip of the wing is formed by a particularly long joint of the third finger, folded back and bent under the wing while the bat is at rest. The fur is long and thick, especially over the crown and around the neck, and is slightly lighter in colour on the belly. They have distinctly short muzzles, and short, rounded roughly triangular shaped ears. Distinguished from the Common Bentwing-bat by its smaller size.
East coast and ranges of Australia from Cape York in Queensland to Wollongong in NSW.

- Moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub. Generally found in well-timbered areas.
- Little Bentwing-bats roost in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats.
- They often share roosting sites with the Common Bentwing-bat and, in winter, the two species may form mixed clusters.
- In NSW the largest maternity colony is in close association with a large maternity colony of Eastern Bentwing-bats (Miniopterus schreibersii) and appears to depend on the large colony to provide the high temperatures needed to rear its young.
- Maternity colonies form in spring and birthing occurs in early summer. Males and juveniles disperse in summer.
- Only five nursery sites /maternity colonies are known in Australia.
- Identifiable Mid spring to mid-autumn

The *Subject Site* lacks suitable roosting habitat and foraging habitat on the *Subject Site* is sub-optimal as it does not consist of moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests, banksia scrub or well-timbered areas. The *Subject Site* provides some foraging habitat for this species however as it is not well-timbered vegetation, it is unlikely to provide important foraging habitat. Thus, the proposed works are considered unlikely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

10.1.13 Eastern Bentwing-bat

The Eastern Bentwing-bat has chocolate to reddish-brown fur on its back and slightly lighter coloured fur on its belly. It has a short snout and a high 'domed' head with short round ears. The wing membranes attach to the ankle, not to the base of the toe. The last bone of the third finger is much longer than the other finger-bones giving the "bent wing" appearance. It weighs up to 20 grams, has a head and body length of about 6 cm and a wingspan of 30 - 35 cm.

Eastern Bentwing-bats occur along the east and north-west coasts of Australia.

- Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures.

- Form discrete populations centred on a maternity cave that is used annually in spring and summer for the birth and rearing of young.
- Maternity caves have very specific temperature and humidity regimes.
- At other times of the year, populations disperse within about 300 km range of maternity caves.
- Cold caves are used for hibernation in southern Australia.
- Breeding or roosting colonies can number from 100 to 150,000 individuals.
- Hunt in forested areas, catching moths and other flying insects above the tree tops.
- Hibernate from June to August

The Subject Site lacks suitable roosting habitat such as caves and man made structures. The Subject Site provides some foraging habitat for this species however as it is not well-timbered vegetation, it is unlikely to provide important foraging habitat. Thus, the proposed works are considered unlikely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

10.1.14 Diuris praecox

A terrestrial herb with two or three linear leaves, 15 - 35 cm long, 3 - 5 mm wide, folded flat together lengthwise. Raceme 20 - 40 cm high, 6 - 10-flowered. Flowers nodding, yellow with a few dark brown markings at the base of the dorsal sepal and labellum, ca 2.5 cm across. Dorsal sepal narrow-ovate, 9 - 11 mm long, 4.5 - 6 mm wide, obliquely erect. Lateral sepals linear to lanceolate, 12 - 15 mm long, 1.5 - 2 mm wide, bent sharply downward, parallel. Petals obliquely erect, widely divergent, curved backwards; lamina narrow-elliptic to ovate, 8 - 12 mm long, 5 - 6 mm wide; claw 4 - 6 mm long, blackish. Labellum (median petal) 9 - 12 mm long; lateral lobes linear to more or less obovate, 3 - 4 mm long, 0.8 - 1.4 mm wide.

This species is known from between Bateau Bay and Smiths Lake where it grows on hills and slopes of near-coastal districts in open forests which have a grassy to fairly dense understorey. Exists as subterranean tubers most of the year. It produces leaves and flowering stems in winter.

In NSW North Coast, the Rough Doubletail is known to be associated with the following vegetation formations and classes.

Coastal Dune Dry Sclerophyll Forests

- Red Bloodwood - Smooth-barked Apple heathy woodland on coastal sands of the Central and lower North Coast
- Scribbly gum - Wallum Banksia - Prickly-leaved Paperbark heathy coastal woodland on coastal lowlands
- Smooth-barked Apple - Blackbutt - Old Man Banksia woodland on coastal sands of the Central and Lower North Coast
- Smooth-barked Apple - Blackbutt heathy open forest of the Tomaree Peninsula
- Smooth-barked Apple - White Stringybark - Red Mahogany - Melaleuca sieberi shrubby open forest on lowlands of the lower North Coast

The *Subject Site* is located nearby to a number of records, however the Coastal Sand Scrub on the *Subject Site* is sand and does not contain a grassy to fairly dense understory. In addition, surveys were conducted during the flowering period of this species (7 June 2018) when it is identifiable and no individuals were recorded. As the *Subject Site* provides only sub-optimal habitat, and there were no observations of this species in the *Subject Site*, the

proposed works are considered unlikely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

10.1.15 Diuris arenaria

Sand Doubletail is a small ground orchid. The light purple to mauve flowers appear between August and September and are 20-30 mm wide. There are usually two 15-50 cm long by 2-6 mm wide leaves that grow from the base of the plant.

Sand Doubletail is known from the Tomaree Peninsula near Newcastle. This species occurs in coastal heath and dry grassy eucalypt forest on sandy flats. Grows in gently undulating country in eucalypt forest with a grassy understorey on clay soil.

In NSW North Coast, the Sand Doubletail is known to be associated with the following vegetation formations and classes.

Coastal Dune Dry Sclerophyll Forests

- Smooth-barked Apple - Blackbutt - Old Man Banksia woodland on coastal sands of the Central and Lower North Coast
- Smooth-barked Apple - Blackbutt heathy open forest of the Tomaree Peninsula
- Smooth-barked Apple - White Stringybark - Red Mahogany - Melaleuca sieberi shrubby open forest on lowlands of the lower North Coast

Freshwater wetlands

- Fern-leaf Banksia - Prickly-leaved Paperbark-Tantoon - Leptocarpus tenax wet heath on coastal sands of the Central Coast and lower North Coast

The *Subject Site* is located in known habitat (Tomarre Peninsula) however the Disturbed Coastal Sand Scrub lacks a grassy understory on clay soil. There are only 2 records of this species in the north east of the broader *Study Area*. As the *Subject Site* provides only sub-optimal habitat and there are limited records of this species, the proposed works are considered unlikely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

<u>Effects on an Endangered Population</u>

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

N/A

<u>Effects on an Endangered Ecological Community</u>

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

N/A

<u>Effect on Habitat of a Threatened Species</u>

(d) in relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

The proposed works requires the clearing of approximately 2,792m^2 (0.28 ha) of Disturbed Coastal Sand Scrub. The condition of this vegetation has already been modified through weed invasion so the works are unlikely to further modify the composition. Proposed planting around the perimeter of the *Subject Site* may improve the quality of the vegetation in the immediate vicinity.

The *Subject Site* and Area of Impact are at the south-eastern end of the existing Coastal Sand Scrub. To the north and north east, it is bordered by roads and to the east residential areas. The southern portion of the *Subject Site* is part of the Birubi Point Aboriginal Place and will not be impacted by this development. As such, the proposed works will not result in the further fragmentation or isolation of habitat.

The Disturbed Coastal Sand Scrub provides only sub-optimal habitat for: Wallum Froglet as it lacks acid swamp; Dusky Woodswallow as there is only limited foraging habitat and the habitat which is highly impacted by exotic invasion; Little Lorikeet, Powerful Owl and Masked Owl as it lacks hollow bearing trees for nesting habitat; Spotted-tailed Quoll as it lacks suitable den sites and there are limited records; Yellow-bellied Sheathtail-Bat, Little Bentwing-Bat, Eastern Bentwing Bat and Eastern Freetail Bat as it lacks roost sites and is not well timbered; Koala as it lacks preferred feed trees; Grey-headed Flying-fox as it is not a roost site. The soil landscape is sub-optimal for *Diuris praecox* and *Diuris arenaria* as it lacks dense grassy understory. Thus, the *Subject Site* is not considered important habitat for any of the threatened species with potential habitat on the *Subject Site*.

(d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),

The *Subject Site* has not been declared as an area of outstanding biodiversity value.

Critical Habitat

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

N/A

Consistency with a Recovery or TAP

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan (TAP)

Recovery plans have been prepared for the following relevant species:

1. Koala
2. Large Forest Owls

1. Recovery Plan for the Koala (Phascolarctos cinereus)

The specific objectives of this plan include:

Objective 1: To conserve koalas in their existing habitat.

The proposed works do not require the removal of core koala habitat as defined under SEPP 44.

Objective 2: To rehabilitate and restore koala habitat and populations.

The Subject Site was not previously koala habitat. Port Stephens Council have not included koala feed trees in the list of species to be planted on the Subject Site as part of the Landscape Management Plan.

Objective 3: To develop a better understanding of the conservation biology of koalas.

This is outside the scope of the current proposal.

Objective 4: To ensure that the community has access to factual information about the distribution, conservation and management of koalas at a national, state and local scale.

This is outside the scope of the current proposal.

Objective 5: To manage captive, sick or injured koalas and orphaned wild koalas to ensure consistent and high standards of care.

This is outside the scope of the current proposal.

Objective 6: To manage overbrowsing to prevent both koala starvation and ecosystem damage in discrete patches of habitat.

This is outside the scope of the current proposal.

Objective 7: To coordinate, promote the implementation, and monitor the effectiveness of the NSW Koala Recovery Plan across NSW.

This is outside the scope of the current proposal.

2. Recovery Plan for the Large Forest Owls

The specific recovery objectives of this plan include:

Objective 1: Assess the distribution and amount of high quality habitat for each owl species across public and private lands to get an estimate of the number and proportion of occupied territories of each species that are, and are not, protected.

This is outside the scope of the current proposal.

Objective 2: To monitor trends in population parameters (numbers, distribution, territory fidelity and breeding success) across the range of the three species and across different land tenures and disturbance histories.

This is outside the scope of the current proposal.

Objective 3: To assess the implementation and effectiveness of forest management prescriptions designed to mitigate the impact of timber-harvesting operations on the three owl species and, (if necessary), to use this information to refine the prescriptions so that forestry activities on state forests are not resulting in adverse changes in species abundance and breeding success.

This is outside the scope of the current proposal.

Objective 4: Ensure the impacts on large forest owls and their habitats are adequately assessed during planning and environmental assessment processes.

No potential forest owl habitat trees will be removed as part of the current proposal.

Objective 5: Minimise further loss and fragmentation of habitat by protection and more informed management of significant owl habitat (including protection of individual nest sites).

No potential forest owl habitat trees will be removed as part of the current proposal.

Objective 6: To improve the recovery and management of the three large forest owls based on an improved understanding of key areas of their biology and ecology.

This is outside the scope of the current proposal.

Objective 7: To raise awareness of the conservation requirements of the three large forest owls amongst the broader community, to involve the community in owl conservation efforts and in so doing increase the information base about owl habitats and biology.

This is outside the scope of the current proposal.

Objective 8: To coordinate the implementation of the recovery plan and continually seek to integrate actions in this plan with actions in other recovery plans or conservation initiatives

This is outside the scope of the current proposal.

In summary, the proposed works are consistent with the objectives/actions of relevant recovery plan/threat abatement plans (TAP).

Constitutes a Key Threatening Process

(g) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process

The proposal does contribute to the Key Threatening Process *Clearing of Native Vegetation*. The vegetation that will be cleared as part of the proposed works is highly disturbed, with a high percentage cover of exotic species. A recommendation of this report is the use of local endemic natives in landscaping and around the perimeter of the *Subject Site* following completion of works.

Concluding Comments and Recommendations

Fifteen threatened species (1 amphibian, 5 birds, 7 mammals and 2 plants) previously recorded in the Study Area were considered to have potential habitat on the *Subject Site*. The proposed works require the removal of 0.28 ha of Disturbed Coastal Sand Scrub. This is considered unlikely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction. The proposed clearing will not result in further modification of the vegetation as it is already highly modified through weed invasion, nor will it result in fragmentation or isolation of habitat as the *Subject Site* is already partially isolated. The habitat to be removed is not considered important to the long-term survival of the species as it provides only sub-optimal habitat for Wallum Froglet as it lacks acid swamp, there is only limited foraging habitat for Dusky Woodswallow, there is no suitable habitat for hollow dependent species such as the Little Lorikeet, Powerful Owl, Masked Owl, there are no suitable den sites for Spotted-tailed Quoll and there are limited records, there are nil to limited suitable roost sites for Forest Bats, there are no preferred feed trees for Koalas and it is not a known roost site for Grey-headed Flying-fox. The *Subject Site* is sub-optimal for *Diuris praecox* and *Diuris arenaria* as it lacks dense grassy understory however there have been nearby records of *D. praecox*. This species flowers during winter and was not recorded on the *Subject Site* during surveys conducted in in *Area of Impact* in June. Thus, the *Subject Site* is not considered important habitat for any of the threatened species considered to have potential habitat on the *Subject Site*.

11. APPENDIX C: ASSESSMENT OF SIGNIFICANCE: EPBC ACT

A Protected Matters search was undertaken on 05/06/2018 within a 10x10 km area centred on the *Subject Site* to determine the likely occurrence of Matters of National Environmental Significance.

A summary of matters of National Environmental Significance is provided in Table A3 (Appendix 1), results of the Protected Matters Search Tool Results for Threatened Species listed under the EPBC Act with 10 km of the *Study Area* are provided in Table A4 (Appendix 1) and results of the Protected Matters Search Tool Results for Migratory Species listed under the EPBC Act with 10 km of the *Study Area* are provided in Table A5 (Appendix A).

The *Study Area* does not contain any World Heritage Properties, National Heritage Places, Great Barrier Reef Marine Park or Commonwealth Marine Areas. It does contain two Wetland of International Importance (Hunter Estuary Wetlands; Myall Lakes), seven listed threatened ecological communities, 80 listed threatened species and 74 listed migratory species.

Following a site inspection and habitat assessment:

The *Subject Site* does not form part of the Hunter Estuary Wetland or Myall Lakes and the proposal is unlikely to impact these wetlands.

The *Subject Site* does not contain the threatened ecological communities:

- Central Hunter Valley eucalypt forest and woodland (CE)
- Coastal Swamp Oak (*Casuarina glauca*) Forest of New South Wales and South East Queensland ecological community (E)
- Littoral Rainforest and Coastal Vine Thickets of Eastern Australia (CE)
- Lowland Rainforest of Subtropical Australia (CE)
- Posidonia australis seagrass meadows of the Manning-Hawkesbury ecoregion (E)
- Subtropical and Temperate Coastal Saltmarsh (V)
- White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (CE)

The *Subject Site* has potential habitat for:

• *Dasyurus maculatus*	Spotted-tailed Quoll	E
• *Phascolarctos cinereus*	Koala	V
• *Pseudomys novaehollandiae*	New Holland Mouse	V
• *Pteropus poliocephalus*	Grey-headed Flying-fox	V
• *Diuris praecox*	Rough Doubletail	V

CE – Critically Endangered, E=Endangered, V – Vulnerable under the EPBC Act

Significant Impact Guidelines (DEHWA, 2009) have been prepared in order to decide whether an action is likely to have a significant impact. In determining the nature and magnitude of an action's impact, it is important to consider matters such as:

- all on-site and off-site impacts,
- all direct and indirect impacts,
- the frequency and duration of the action,
- the total impact which can be attributed to that action over the entire geographic

area affected, and over time,

- the sensitivity of the receiving environment, and
- the degree of confidence with which the impacts of the action are known and understood.

11.1 ENDANGERED THREATENED SPECIES

The following threatened species have potential habitat within the *Study Area*:

1. *Dasyurus maculatus* Spotted-tailed Quoll E

11.1.1 Spotted-tailed Quoll

Four species of quolls are found in Australia. Most parts of the country were once inhabited by at least one quoll species and they were among the first native animals to be described by European scientists. All quoll species have declined in numbers since European settlement.

The spot-tailed quoll is the largest marsupial carnivore surviving on mainland Australia. They are more than 50 per cent larger than other quolls (eastern, western and northern) and, unlike other species, have white spots that extend along their tail. They have bright eyes, a moist pink nose and sharp teeth. They have a pointed snout and a long tail. Their fur has a coarse texture and is red-brown to dark brown with white spots of varying size.

Spot-tailed quolls are found in a range of forest environments, from rainforest to open woodland. They require forest with suitable den sites such as rock crevices, caves, hollow logs, burrows and tree hollows. They have a large home range and can cover more than six kilometres overnight. The spot-tailed quoll was once common throughout southeastern Australia, including Tasmania. However, since European settlement it has become rare across most of its range.

Spot-tailed quolls hunt mostly at night being largely nocturnal and solitary. Their diet appears to consist primarily of medium-sized mammals including gliders, possums, rabbits, and even small wallabies. They like carrion (dead animals), birds and eggs as well.

Small mammals, reptiles and invertebrates are also a significant part of the diet, particularly for juvenile quolls.

Spot-tailed quolls are sexually mature at two years of age. Adult males begin searching for females around May, and mating takes place in mid- June. The young are born in early July, and by mid-August are no longer attached to their mothers, although they feed from her and spend much time in the den. By early November at only 18 weeks of age, young are completely independent and they live for approximately five years.

Adult spot-tailed quolls have a territory of up to 500ha. There are few areas where such territories can exist without quolls encountering the effects of humans.

One of the main threats to the spot-tailed quoll is the loss and fragmentation of habitat, especially areas of suitable forest with sufficient numbers of den sites and prey.

The introduction of foxes and cats has had a major effect on many of Australia's unique species, including quolls. Not only are young quolls at risk of predation by foxes and cats

but these introduced species also compete for food. Poisoning by cane toads has led to the death of many quolls who try to eat them.

1080 poson is used to control fox and wild dog numbers. Unfortunately, female and juvenile spot-tailed quolls can also be susceptible to the poison. It is vital that when 1080 baits are used, best practice management guidelines are employed in order to keep impacts to native species to a minimum.

Since spot-tailed quolls favour habitats with abundant prey and refuges from predation, wildfire and controlled burns which reduce these are also a threat to the species.

In some areas quolls are killed in response to raids on poultry runs, having a devastating impact on local populations.

Other threats to the spot-tailed quoll include road mortality in some areas, due to scavenging of road-killed carcasses, as well as the impacts of climate change on fragmented habitat areas.

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

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

Spot-tailed quolls are found in a range of forest environments, from rainforest to open woodland. They require forest with suitable den sites such as rock crevices, caves, hollow logs, burrows and tree hollows. The *Subject Site* lacks forest with suitable den sites and therefore provides poor quality foraging and roosting habitat. The Spotted tailed Quoll is unlikely to rely on the *Subject Site* for breeding/nesting and as such, the proposed action will not result in a reduction in size of the population of this species as the

b) reduce the area of occupancy of the species

The proposed works require the clearing of approximately 0.27 ha of native vegetation however the *Subject Site* is considered sub-optimal habitat and this species is not known to have occurred in the *Subject Site*. The *Subject Site* does not occur at the limit of distribution or area of occupancy for this species.

c) fragment an existing population into two or more populations

The *Subject Site* provides only limited habitat and as it adjoins residential areas, it will not result in further fragmentation of a population if present.

d) adversely affect habitat critical to the survival of a species

The *Subject Site* does not represent critical habitat to the Spotted-tailed Quoll.

e) disrupt the breeding cycle of a population

Spot-tailed quolls are sexually mature at two years of age. Adult males begin searching for females around May, and mating takes place in mid- June. The young are born in early July, and by mid-August are no longer attached to their mothers, although they feed from her and spend much time in the den. By early November at only 18 weeks of age, young are completely independent and they live for approximately five years.

As discussed in section a) above, The *Subject Site* does not provide suitable dens sites or nesting habitat for this species. and as such, the proposal will not disrupt its breeding cycle.

f) modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

As the *Subject Site* provides sub-optimal habitat for this species, the proposal will not alter the habitat to the extent that this species is likely to decline.

g) result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat

The *Subject Site* is already impacted by Bitou Bush however the proposed clearing of the site is unlikely to result in the establishment of any new invasive species.

h) introduce disease that may cause the species to decline, or

The proposed works will not result in an introduction of a disease that may cause this species to decline.

i) interfere with the recovery of the species.

The proposal will not affect the recovery of these species.

11.2 VULNERABLE THREATENED SPECIES

Vulnerable species within the *Study Area*:

1.	*Phascolarctos cinereus*	Koala	V
2.	*Pseudomys novaehollandiae*	New Holland Mouse	V
3.	*Pteropus poliocephalus*	Grey-headed Flying-fox	V
4.	*Diuris praecox*	Rough Doubletail	V

11.2.1 Koala

The Koala is an arboreal marsupial with fur ranging from grey to brown above, and is white below. It has large furry ears, a prominent black nose and no tail. It spends most of its time in trees and has long, sharp claws, adapted for climbing. Adult males weigh 6 - 12 kg and adult females weigh 5 - 8 kg. During breeding, males advertise with loud snarling coughs and bellows.

The Koala has a fragmented distribution throughout eastern Australia from north-east Queensland to the Eyre Peninsula in South Australia. In NSW it mainly occurs on the central and north coasts with some populations in the west of the Great Dividing Range. It was briefly historically abundant in the 1890s in the Bega District on the south coast of NSW, although not elsewhere, but it now occurs in sparse and possibly disjunct populations. Koalas are also known from several sites on the southern tablelands.

They inhabit eucalypt woodlands and forests and feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species. They are inactive for most of the day, feeding and moving mostly at night and spend most of their time in trees, but will descend and traverse open ground to move between trees. Their home range size varies with quality of habitat, ranging from less than two ha to several hundred hectares in size. Koalas are generally solitary, but have complex social hierarchies based on a dominant male with a territory overlapping several females

and sub-ordinate males on the periphery. Females breed at two years of age and produce one young per year.

The Subject Site does not contain any of the preferred feed trees for this species and as such, it is unlikely to support an important population of Koalas.

11.2.2 New Holland Mouse

The New Holland Mouse is a small native rodent similar in size and appearance to the introduced House Mouse. It can be distinguished from the House Mouse by its dusky-brown tail which is longer than the rest of the body and darker on the dorsal surface, the absence of a notch on the upper incisors, and the absence of a distinctive 'mousy' odour.

The New Holland Mouse has a fragmented distribution across Tasmania, Victoria, New South Wales and Queensland. Genetic evidence indicates that the New Holland Mouse once formed a single continuous population on mainland Australia and the distribution of recent subfossils further suggest that the species has undergone a large range contraction since European settlement. Total population size of mature individuals is now estimated to be less than 10,000 individuals although, given the number of sites from which the species is known to have disappeared between 1999 and 2009, it is likely that the species' distribution is actually smaller than current estimates.

It is known to inhabit open heathlands, woodlands and forests with a heathland understorey and vegetated sand dunes. It is a social animal, living predominantly in burrows shared with other individuals. Their distribution is patchy in time and space, with peaks in abundance during early to mid stages of vegetation succession typically induced by fire.

11.2.3 Grey-headed Flying-fox

The Grey-headed Flying-fox is the largest Australian bat, with a head and body length of 23 - 29 cm. It has dark grey fur on the body, lighter grey fur on the head and a russet collar encircling the neck. The wing membranes are black and the wingspan can be up to 1 m. It can be distinguished from other flying-foxes by the leg fur, which extends to the ankle.

Grey-headed Flying-foxes are generally found within 200 km of the eastern coast of Australia, from Rockhampton in Queensland to Adelaide in South Australia. In times of natural resource shortages, they may be found in unusual locations.

They occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy. Individual camps may have tens of thousands of animals and are used for mating, and for giving birth and rearing young. Annual mating commences in January and conception occurs in April or May; a single young is born in October or November. Site fidelity to camps is high; some camps have been used for over a century. They can travel up to 50 km from the camp to forage; commuting distances are more often <20 km and they feed on the nectar and pollen of native trees, in particular *Eucalyptus, Melaleuca* and *Banksia*, and fruits of rainforest trees and vines. They also forage in cultivated gardens and fruit crops.

The Subject Site

11.2.4 Rough Doubletail

A terrestrial herb with two or three linear leaves, 15 - 35 cm long, 3 - 5 mm wide, folded flat together lengthwise. Raceme 20 - 40 cm high, 6 - 10-flowered. Flowers nodding, yellow with a few dark brown markings at the base of the dorsal sepal and labellum, ca 2.5 cm across. Dorsal sepal narrow-ovate, 9 - 11 mm long, 4.5 - 6 mm wide, obliquely erect. Lateral sepals linear to lanceolate, 12 - 15 mm long, 1.5 - 2 mm wide, bent sharply downward,

parallel. Petals obliquely erect, widely divergent, curved backwards; lamina narrow-elliptic to ovate, 8 - 12 mm long, 5 - 6 mm wide; claw 4 - 6 mm long, blackish. Labellum (median petal) 9 - 12 mm long; lateral lobes linear to more or less obovate, 3 - 4 mm long, 0.8 - 1.4 mm wide.

This species is known from between Bateau Bay and Smiths Lake where it grows on hills and slopes of near-coastal districts in open forests which have a grassy to fairly dense understorey. It exists as subterranean tubers most of the year. It produces leaves and flowering stems in winter.

The Subject Site is relatively flat sand dunes with patches of bitou Bush. It does not contain hills and slopes of open forest with grassy to dense understory. As such, the Subject Site is considered unlikely to provide habitat for this species despite nearby records.

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

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

Under the meaning of the Act, an "important" population is one that is necessary for a species' long-term survival and recovery, and may include key source populations for breeding and dispersal, populations necessary for maintaining genetic diversity and populations near the limit of the species range.

The *Subject Site* does not support an important population of Koalas as it lacks potential koala habitat (as defined under SEPP 44) and it provides only marginal foraging habitat for the Grey-headed Flying-fox. The majority of records for New Holland Mouse are over 20 years old with the exception of one record from 2015 near Salamander Bay. Distribution of New Holland Mouse is patchy in time and space, with peaks in abundance during early to mid stages of vegetation succession typically induced by fire. The *Subject Site* is not in the early to mid stages of vegetation succession and there is no evidence of recent fire. The Subject Site is largely dominated by Bitou Bush and sand and does not appear to have been subjected to fire recently. The Subject Site is not defined as open heathland, woodland or forest and as such, is considered unlikely to support an important population of New Holland Mouse. *Diuris praecox* has been recorded in habitat nearby to the *Subject Site* however the *Subject Site* does lack a dense grassy understory which is considered important habitat for this species. Surveys were conducted on 7 June 2018 which is within the flowering period of this species (i.e. when it is detectable) however no individual *D. praecox* were recorded. As such, it is considered unlikely that the *Subject Site* supports an important population of this species.

b) reduce the area of occupancy of an important population

As discussed, the *Subject Site* is considered unlikely to support an important population of Koala, Grey-headed Flying-fox, *D. praecox* or New Holland Mouse so the removal of 0.27 ha of vegetation is unlikely to reduce the area of occupancy of an important population.

c) fragment an existing important population into two or more populations

The *Subject Site* adjoins residential areas thus further clearing will not contribute to fragmentation of habitat or an important population.

d) adversely affect habitat critical to the survival of a species

The *Subject Site* provides potential, but sub-optimal habitat for these species. As such, the proposal will not effect habitat critical to their survival.

e) disrupt the breeding cycle of an important population

The *Subject Site* does not provide breeding habitat for Grey-headed Flying-fox and does not

support an important population of any of the three vulnerable species.

f) modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

The habitat on the *Subject Site* is not considered important to the survival of these species and as such, the removal of 0.27ha of native vegetation is unlikely to lead to a species decline.

g) result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat

The proposed works will not result in an introduction of an invasive species that may cause these species to decline.

h) introduce disease that may cause the species to decline, or

The proposed works will not result in an introduction of a disease that may cause these species to decline.

i) interfere substantially with the recovery of the species.

The proposed works will not interfere with the recovery of this species.

11.3 CONCLUSION

The proposed works (clearing of 0.27 ha of vegetation) will not substantially impact upon the endangered Spotted tailed Quoll or the vulnerable Koala, Grey-headed Flying-fox, New Holland Mouse or *D. praecox* with potential habitat in the broader *Study Area* as the *Subject Site* does not provide important habitat features for these species. The *Subject Site* lacks primary feed trees for Koalas, does not contain roost sites for the Grey-headed Flying-fox, lacks den sites for the Spotted-tailed Quoll and the stage of vegetation succession is not preferred by the New Holland Mouse. *Diuris praecox* prefers a dense grassy understory which is lacking on the *Subject Site*. Subsequently, it is considered that the *Subject Site* does not support an important population of these species.

Based on the above assessment it is considered that a referral to SEWPaC is not required.

12. APPENDIX D. VEGETATION DATA SHEETS

BAM Site – Field Survey Form

Site Sheet no: 1 6

		Survey Name	Zone ID	Recorders			
Date	7 6 18	BRUBI		Kristy McQueen			
Zone 56	Datum AMG		Plot ID 1	Plot dimensions	20×20 20×50	Photo #	1-3
Easting 413890	Northing 6372956	IBRA region NNC	Karuah-Manning Subregion	Midline bearing from 0 m	55W		
Vegetation Class		Bangalay / Cheese Tree / ~~Rough~~ Smooth barked Apple				Confidence H M L	
Plant Community Type	1645	Old Man Banksia - Rough-barked Apple - Bangalay shrubby open forest on Coastal Sands of the Central Coast			EEC:	Confidence H M L	

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	4
	Shrubs	2
	Grasses etc.	0
	Forbs	1
	Ferns	0
	Other	1
Sum of Cover of native vascular plants by growth form group	Trees	16
	Shrubs	3
	Grasses etc.	0
	Forbs	0.5
	Ferns	0
	Other	0.1
High Threat Weed cover		31.6

BAM Attribute (1000 m² plot)		
DBH	# Tree Stems Count	# Stems with Hollows
80 + cm		
50 – 79 cm	1	
30 – 49 cm	𝍸 𝍸	
20 – 29 cm	𝍸 11	
10 – 19 cm	𝍸 111	
5 – 9 cm		
< 5 cm		n/a
Length of logs (m) (≥10 cm diameter, >50 cm in length)	10m	

3 exotic included

Counts apply when the number of tree stems within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30 ... 100, 200, 300 ...). For a multi-stemmed tree, only the largest living stem is included in the count/estimate. Tree stems must be living.

For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each)	97	45	37	75	30	3	5	2	0	0	0	0	1	0	0	0	0	0	0	0
Average of the 5 subplots	56.8					2					0.2					0				

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing (inc. logging)	3	NR	Clearing for track
Cultivation (inc. pasture)	3	R	Planting exotics & garden varieties
Soil erosion	–		
Firewood / CWD removal	–		
Grazing (identify native/stock)	–		
Fire damage	–		
Storm damage	–		
Weediness	3	NR	As above
Other			

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

400 m² plot: Sheet 2 of 6	Survey Name	Plot Identifier	Recorders
Date 7 6 18	BVRVB1	1	KRISTY M^CQUEEN

GF Code	Top 3 native species in each growth form group: Full species name mandatory. All other native and exotic species: Full species name where practicable	N, E or HTE	Cover	Abund	stratum	voucher
–	Tradescantia fluminensis - Wandering Jew	HTE	15	1,000	L	
–	Petroselinum crispum - Parsley	E	<0.1	3	L	
S	Breynia oblongifolia	N	1	2	L	
P	Doryanthes excelsa	N	0.1	1	L	
–	Asarum - Wild Ginger	HTE	0.4	18	L	
–	Mentha sp - Mint	E	0.1	5	L	
–	~~Rubus~~ Tradescantia spathacea - Rhoeo	E	0.4	22	L	
–	Yucca aloifolia L	E	0.1	1	L	
–	Cruzmania sp - Bromeliad	E	0.1	1	L	
–	- Succulent	E	0.1	1	L	
–	Dracaena sp - Dracena	E	0.2	2	L	
–	Stellaria media - chickweed	E	0.6	300	L	
–	Pennisetum clandestinum - Kikuyu	E	30	1000	L	
–	Ehrharta erecta - African Veldt Grass	HTE	0.1	20	L	
–	Panicum maximum - Guinea Grass	E	0.1	20	L	
–	Poa annua - Winter Grass	E	0.1	20	L	
–	Cenchrus echinatus Spiny-burr Grass	HTE	0.1	20	L	
F	Dichondra repens	N	0.5	2,500	L	
–	Liquidambar styraciflua	E	15	1	U	
T	Glochidion ferdinandi	N	10	10	U	
–	Erythrina x sykesii - Coral Tree	HTE	10	2	U	
T	Angophora floribunda	N	5	2	U	
T	Eucalyptus botryoides	N	5	1	U	
T	Angophora costata	N	8	3	U	
S	Pittosporum undulatum	N	3	1	M	
–	Lantana camara	HTE	5	100	M	
–	Camphor laurel - Cinnamomum camphora	HTE	1	1	U	
	Outside Quadrat					
	Ficus sp					
	Araucaria heterophylla NFI Pine					
	Nephrolepis cordifolia Fishbone Fern					
	Livistonea australis Cabbage Tree Palm					
	Bryophyllum sp Mother of Millions					
	Asparagus virgatus Asparagus Fern					

GF Code: see Growth Form definitions in Appendix 1 **N:** native, **E:** exotic, **HTE:** high threat exotic **GF – circle code** if top 3.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover). ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ..., 100, 200, ..., 1000, ...

BAM Site – Field Survey Form

Site Sheet no: 3 of 6

		Survey Name	Zone ID	Recorders			
Date	7/6/18	BIRUBI		KRISTY MCQUEEN			
Zone: 56	Datum: MGA	Plot ID	2	Plot dimensions	20×20 20×50	Photo #	✓
Easting: 413913	Northing: 6373018	IBRA region: NNS	Karuah - Manning sub-region	Midline bearing from 0 m	SW		
Vegetation Class		Coastal Sand Apple-Blackbutt Forest				Confidence: H M L	
Plant Community Type		Disturbed Vegetation		EEC:		Confidence: H M L	

Record easting and northing at 0 m on midline. Orientation (Bearing) of 0-04 m take-off.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	0
	Shrubs	3
	Grasses etc.	0
	Forbs	1
	Ferns	0
	Other	0
Sum of Cover of native vascular plants by growth form group	Trees	0
	Shrubs	22.7
	Grasses etc.	0
	Forbs	0.1
	Ferns	0
	Other	0
High Threat Weed cover		6.7

BAM Attribute (1000 m² plot)		
DBH	# Tree Stems Count	# Stems with Hollows
80 + cm		
50 – 79 cm		
30 – 49 cm	III	0
20 – 29 cm	I	0
10 – 19 cm	III	0
5 – 9 cm	III	0
< 5 cm	II	n/a
Length of logs (m) (≥10 cm diameter, >50 cm in length)	5m	

Counts apply when the number of tree stems within a size class is ≤ 10. Estimates can be used when > 10 (eg. 15, 20, 30, ... 100, 200, 300, ...). For a multi-stemmed tree, only the largest living stem is included in the count/estimate. Tree stems must be living.

For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each)	0	28	25	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
Average of the 5 subplots	10.6					0.4					0					0				

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred on 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes wood, seeds, twigs, branchlets and material less than 10 cm in diameter. Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site drainage		Outcrop or exposed rock and type	

Plot Disturbance	Severity code	Age code	Observations evidence
Clearing (inc. logging)	3	NR	clearing + weed invasion
Cultivation (inc. pasture)			
Soil erosion			
Firewood / CWD removal			
Grazing (pest, native/feral)			
Fire damage			
Storm damage			
Weeds/exotics	3	NR	High weed invasion E + HTE
Other			

Severity: 0=no evidence, 1=slight, 2=moderate, 3=severe

Age: R=recent (<5yrs), I=intermediate (5-20yrs), O=old (>20yrs), NR=not recorded

400 m² plot: Sheet 1 of 1	Survey Name	Plot Identifier	Recorders
Date 7/6/18	Birdsi	2	KRISTY McQUEEN

GF Code	Top 3 native species in each growth form group: Full species name mandatory. All other native and exotic species: Full species name where practicable	N, E or HTE	Cover	Abund	stratum	voucher
S	Leptospermum laevigatum	N	10	10	M	
–	Ricinus communis	HTE	0.6	2	L	
S	Acacia terminalis	N	12.5	22	M/L	
–	Lantana camara	HTE	5	1	M	
–	Ehrharta erecta	HTE	0.5	100	L	
–	Panicum maximum	E	5	1000	L	
–	Setaria gracilis	E	0.1	80	L	
–	Paspalum dilatatum	HTE	0.2	100	L	
–	Festuca elatior	E	3	400	L	
–	Conchrus echinatus	HTE	0.1	50	L	
–	Anthemis cotula ?	E	6	700	L	
–	Verbena bonariensis	E	0.1	6	L	
–	Chrysanthemoides monilifera Bitou Bush	HTE	0.1	3	L	
–	Bidens pilosa	HTE	0.1	10	L	
S	Acacia longifolia subsp sophorae	N	0.2	5	M	
–	Alanthus altissima	E	1	3	M	
–	Oenothera drummondii Beach Evening Primrose	E	0.1	8	L	
–	Rumex sagitata Turkey Rhubarb	E	0.1	12	L	
–	Plantago lanceolata Lambs Tongue	E	0.1	50	L	
–	Hypochaeris radicata	E	0.1	30	L	
–	Tecoma capensis	E	3	20	M	
–	Tagetes minuta -Stinking Roger	E	0.1	5	L	
–	Stellaria media	E	0.1	50	L	
–	Alternanthera pungens	HTE	0.1	2	L	
F	Wahlenbergia communis	N	0.1	5	L	

GF Code: see Growth Form definitions in Appendix 1 **N:** native, **E:** exotic, **HTE:** high threat exotic **GF – circle code** if top 3.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ... 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

BAM Site – Field Survey Form

Site Sheet no: 5 6

		Survey Name	Zone ID	Recorders			
Date	7/6/18	Birubi		Kristy McQueen			
Zone 56	Datum MGA	Plot ID	3	Plot dimensions	20×20 20×50	Photo #	✓
Easting 413844	Northing 6372942	IBRA region NNC	Karuah-Manning Sub-region	Midline bearing from 0 m	SW		
Vegetation Class		Coastal Sand Scrub				Confidence H M L	
Plant Community Type				EEC:		Confidence H M L	

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	0
	Shrubs	2
	Grasses etc.	0
	Forbs	0
	Ferns	0
	Other	0
Sum of Cover of native vascular plants by growth form group	Trees	0
	Shrubs	2.3
	Grasses etc.	0
	Forbs	0
	Ferns	0
	Other	0
High Threat Weed cover		9

BAM Attribute (1000 m² plot)		
DBH	# Tree Stems Count	# Stems with Hollows
80 + cm		
50 – 79 cm		
30 – 49 cm		
20 – 29 cm		
10 – 19 cm	11	0
5 – 9 cm		
< 5 cm		n/a
Length of logs (m) (≥10 cm diameter, >50 cm in length)	0	

Counts apply when the number of tree stems within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30 ... 100, 200, 300 ...). For a multi-stemmed tree, only the largest living stem is included in the count/estimate. Tree stems must be living.

For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each)	0	0	0	0	0	100	100	100	100	5	0	0	0	0	0	0	0	0	0	0
Average of the 5 subplots	0					80.1					0					0				

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture	Sand	Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing (inc. logging)			
Cultivation (inc. pasture)			
Soil erosion	2		Beach erosion
Firewood / CWD removal			
Grazing (identify native/stock)			
Fire damage			
Storm damage			
Weediness	3		Bitou bush invasion
Other			

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Age: R=recent (<3yrs); NR=not recent (3-10yrs); O=old (>10yrs)

400 m² plot: Sheet 6 of 6	Survey Name	Plot Identifier	Recorders
Date 7 6 18	BIRUBI	3	KRISTY M°QUEEN

GF Code	Top 3 native species in each growth form group. Full species name mandatory. All other native and exotic species: Full species name where practicable	N, E or HTE	Cover	Abund	stratum	voucher
–	Chrysanthemoides monilifera	HTE	8	60		
S	Acacia longifolia subsp sophorae	N	0.3	1		
S	Leptospermum laevigatum	N	2	2		
–	Erythrina x sykesii	HTE	1	1		
–	Oenothera drummondii	E	0.1	5		
–	Cakile edentula American Searocket	E	0.1	1		
–	Hydrocotyle bonariensis	E	0.1	1		
–	Euphorbia paralias	E	0.1	1		

Outside Quadrat
Carpobrotus glaucescens Pigface
Ficinia (Isolepis) nodosa
Banksia integrifolia

GF Code: see Growth Form definitions in Appendix 1 **N:** native, **E:** exotic, **HTE:** high threat exotic **GF – circle code** if 'top 3'.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover). ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across. 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ..., 100, 200, ..., 1000, ...

Appendix E - Transport Impact Assessment

Birubi Information Centre
Transport and Engineering Advice

Prepared for McGregor Coxall by Haskoning Australia Pty Ltd (a company of Royal HaskoningDHV)

FINAL

Project No. PA1845

28 June 2018

Royal HaskoningDHV
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Issue History

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Rev A	Draft	Alex van Gent	Miriam Knollys		19/06/2018
	Final	Alex van Gent	Miriam Knollys	René Zijlstra	28/06/2018

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1 INTRODUCTION

1.1 Preamble

This **Birubi Point Information Centre – Transport and Engineering Advice** has been prepared by Royal HaskoningDHV (RHDHV) for McGregor Coxall (MCGC).

Preliminary advice was provided during a workshop (1 May 2018).

Information presented in this report is deliberately selective and project specific.

The document is structured as follows:

- **Section 2** – Traffic Impact Assessment;
- **Section 3** – Lay-Out of the Information Centre, including assessment of the Accessibility of the Project Site and Design Advice.

1.2 Project Background

Port Stephens Council is planning to develop a new Information Centre at Anna Bay NSW to cater for the growing demand for international and domestic tourism activities on the Worimi Conservation Lands (WCL) and Birubi Point Aboriginal Place. The demand for sand dune adventure tourism and cultural heritage experiences has grown to such a point that urgent planning for a new Information Centre is being co-funded by the NSW Government's Tourism Demand Driver Infrastructure Fund and Port Stephens Council.

The design for the site will include the following:

- a cultural interpretive centre;
- suitable undercover drop off areas for large coaches;
- kiosks and shop fronts for the booking of tours and for tour operators to receive customers from the coaches;
- a central kiosk/information point;
- toilets;
- parking for buses, coaches, cars and bicycles; and,
- landscaping and signage that is in keeping with the concept theme.

McGregor Coxall is working on behalf of Port Stephen's Council to design and develop the Information Centre outside of the Aboriginal Place to provide a new gateway for visitors to the WCL. The aim of the Information Centre is to reduce traffic and parking congestion on the headland which currently puts pressure on the archaeological and cultural values. It is also an opportunity to carefully design an integrated gateway to the WCL and Birubi Point to retain the scenic value and sense of arrival that attracts visitors.

The proposed transport hub would be accessed from the existing Beach Access Road off, Gan Gan Road and would provide facilities for bus/coach and car parking and bicycle parking.

2 TRAFFIC IMPACT ASSESSMENT

2.1 Existing environment and accessibility

The proposed development area comprises of the following existing elements:

Road network
The Project site is located on the south-east corner of the intersection Gan Gan Road and the existing Beach Access Road.

- Gan Gan Road is the main road in the project area and a regional road.
    - Speed limit of 50 km/h, though designed for 80 km/h.
    - Intersects with James Paterson Street and the existing Beach Access Road.
    - Bus stop east of intersection of Gan Gan Road and the Beach Access Road.
    - At this bus stop, council placed a speed hump and road narrows to reduce speed of motorised traffic. There is a sign indicating a recommended speed of 25 km/h.
    - Shared path, for cyclists and pedestrians, along south side of Gan Gan Road.
- James Paterson Street (50 km/h) is a local street and provides access to the current Tourist Site at Birubi Beach, the SLSC and properties and beach resorts along James Paterson Street.
    - Traffic calming measures (speed humps).
    - Shared path, for cyclists and pedestrians, along east side James Paterson Street.
- The existing Beach Access Road is an unsealed road, providing beach access from Gan Gan Road.

Figure 1: Project area (Source: Nearmap, 2015).

Active Transport access

- Pedestrian accessibility around the proposed development site is generally good with a shared path along Gan Gan Road, leading to the properties and holiday parks along James Paterson Street. and retail shops and bus stops in the township of Anna Bay.

- There is no dedicated cycleway provided within the proposed development area. There is some existing cycling infrastructure in the form of the shared paths along Gan Gan Road and James Paterson Street.

- There are currently no bicycle racks or areas for parking of bicycles within the proposed development area.

Public Transport Access

- There is a bus stop at Gan Gan Road, east of the intersection with the existing Beach Access Road. Bus lines 130, 134 and 135, connect Birubi Point to Anna Bay, Nelson Bay and Fingal Bay in the north east and Newcastle to the west.

Figure 2: Bus network Anna Bay

Tourists – Day trips from Sydney

- A large proportion of the tourists heading for the Tourist Site at Birubi Beach arrive by coach on a day trip from Sydney to Port Stephens.

Parking

In the current situation, parking is allowed at the following locations:

- On the current Birubi Tourist Location at the beach
- James Paterson Street:
    - In a designated parking area at the Surf Life Savers Club (SLSC) near the headland (known as the Upper Carpark).
    - Along the west side of James Paterson Street.
- In a designated parking area off Fitzroy Street.
- In designated coach parking areas along James Paterson Street and on the Tourist Site at Birubi Beach, adjacent to the SLSC (known as the Lower Carpark).

Figure 3: Current Tourist Site at Birubi Beach adjacent to the SLSC (Source: Nearmap, 2015).

Current traffic and parking issues

The main traffic related issues are likely to be caused by the current parking situation on James Paterson Street on days when the beach attracts many tourists and locals. This is primarily during the weekends and on public holidays with problems rarely experienced on weekdays.

The current parking issues that lead to traffic congestion on James Paterson Street include:

- Parked vehicles on the road side leading to reduced road width, and, in extreme situations, leading to parked vehicles back to 400m north of the SLSC.
- Reduced capacity due to vehicle drivers making parking manoeuvres.
- Vehicle drivers looking for a free parking spaces or waiting for spaces to become available.

The aim of the Information Centre is to reduce traffic and parking congestion on the headland which is currently putting increasing pressure on the archaeological and cultural values of the area.

Figure 4: Birubi Beach headland, with parked vehicles on the background (Source: website crestbirubibeach.com.au)

Figure 5: Traffic calming measures at Gan Gan Road (Source: Google Maps, 2008).

Figure 6: Shared path along east side James Paterson Street. (Source: Google Maps, 2008).

Figure 7: Current Tourist Site at Birubi Beach adjacent to the SLSC (Source: Port Stephens Examiner, Ellie-Marie Watts).

Figure 8: Current Tourist Site at Birubi Beach adjacent to the SLSC (Source: Port Stephens Examiner).

Figure 9: Current Tourist Site at Birubi Beach adjacent to the SLSC (Source: Port Stephens Examiner, Ellie-Marie Watts).

2.2 Analysis of Traffic Volumes

This section presents an analysis of the traffic counts available on James Paterson Street and the existing Beach Access Road.

James Paterson Street

Traffic counts for this area are available from September and October 2016. These were conducted on James Paterson Street during a school holiday which included a public holiday. These counts give insight to the current traffic pattern in a relatively busy period.

Traffic count September 2016

- On an average weekday: Between 600-800 motorised vehicles enter James Paterson Street
- On an average weekend day: Around 1,200 motorised vehicles enter James Paterson Street
- Around 95% of these vehicles are passenger cars. On busier days the increase in traffic is primarily due to additional passenger cars.
- All days: Between 30-40 mini busses (small service trucks) and up to 4 coaches per day
- During weekdays: hourly peak between 12am-1pm with around 80 vehicles per hour
- During weekends: hourly peak later, around 1pm, with up to 120 vehicles per hour
- On a very busy Sunday (school holiday / long weekend): Around 1,700 motorised vehicles enter James Paterson Street, leading to vehicles parking along the road over 400m north of the SLSC.
- On a very busy Sunday: hourly peak of up to 220 vehicles per hour.
- Most people visit between 8am-3pm.

Despite the congestion issues during busy days, the traffic volumes presented are well below the capacity of James Paterson Street. It is likely that the congestion issues are related to the parking situation.

The following destinations can be accessed from James Paterson Street:

- SLSC (http://birubipointslsc.org.au/)
- Restaurant Crest Birubi Beach (https://crestbirubibeach.com.au/)
- Birubi Beach Holiday Park (http://glhp.com.au/parks/birubi-beach)
- Birubi Beach
- Current Tourist location at the Beach

Figure 10: Destinations along James Paterson Street. (Source: Google Maps, 2018).

Figure 11: Restaurant Crest Birubi Beach (Source: website restaurant).

There is no information available on the sites/facilities that people arriving in the vehicles are using (e.g. the beach, the SLSC, the restaurant or tourists visiting activities at Birubi Beach) or how long the vehicles are staying in the area. It can be assumed that the majority of the mini busses (small service trucks) and coaches are heading for the Birubi Tourist activities. These vehicles will be redirected to the proposed location of the new Information Centre.

Existing Beach Access Road

There are two traffic counts available for the existing Beach Access Road. These counts were undertaken in 2012 and 2014. The information from the traffic counts is summarised and presented below:

- During weekdays around 200 per day drive on the existing Beach Access Road (total of both directions).
- During weekends the daily amount of vehicles is around 400 per day.
- During Autumn and Winter months (April – June) these numbers decrease to around 10 on weekdays and 50 on weekend days.
- In the last week of December 2011 there were higher traffic densities, with over 1,500 vehicles on the busiest day and densities up to 1,000 vehicles for the days prior to this. It is possible that this may have been due to a specific event at the beach.
- The vehicles counted on the existing Beach Access Road are probably 4WD vehicles, as the road is unpaved and leads to the beach.

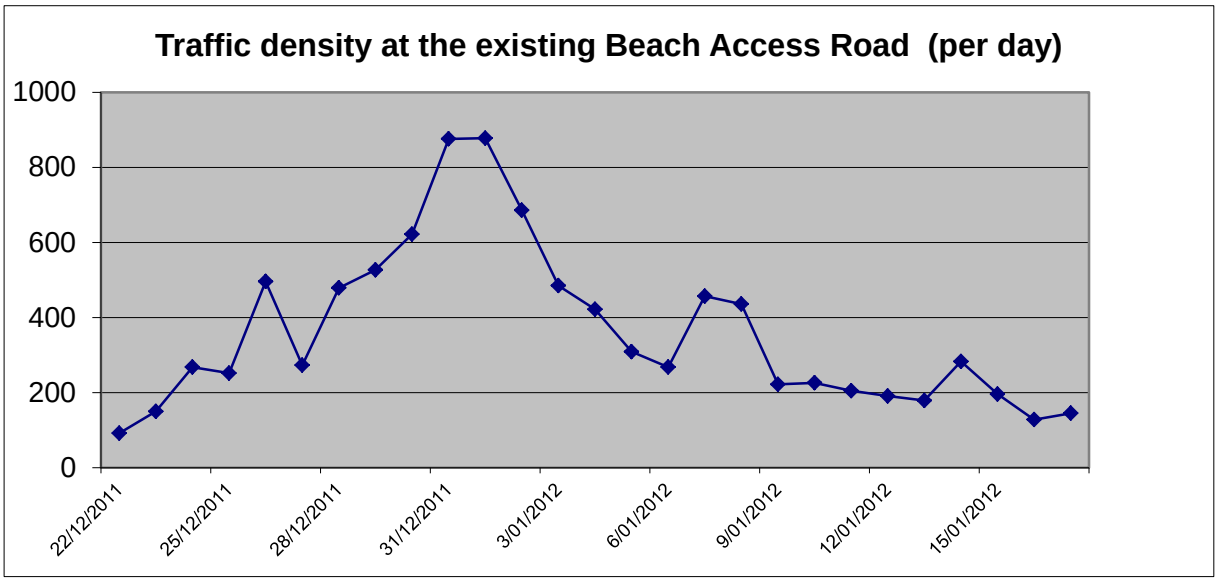

Figure 12: Traffic density at the existing Beach Access Road in December 2011 – January 2012 (direction towards Gan Gan Road)

2.3 Potential impacts

2.3.1 Operational phase

2.3.1.1 Road Network, Traffic and Parking

The project aims to redirected Birubi Tourist traffic from James Paterson Street to the Information Centre along Gan Gan Road. The coaches currently heading to the parking facilities at the SLSC will be redirected to the new Information Centre. This will reduce the number of vehicles currently using James Paterson Street.

Passenger vehicles belonging to residents or heading for amenities along James Paterson Street, for example, Birubi Point SLSC, the restaurant, the holiday park or the beach (surfers), are likely to continue to use parking facilities accessed along, or from, James Patterson Street.

When assuming that a third of the passenger cars are heading to the tourist activities at the beach[1], this will mean that on a weekend during a peak hour (between 12am-2pm) around 40 vehicles per hour will enter the Information Centre (based on the traffic count in September 2016: a third of 120 vehicles per hour). This is less than one vehicle per minute. This traffic volume should not lead to traffic congestion at the Information Centre. On extremely busy days this hourly density can increase up to twice this amount. This would lead to a vehicle entering the Information Centre every 40 seconds (approximately 80 vehicles per hour). It will depend on the average parking duration whether this amount would exceed capacity (50 parking spaces).

James Paterson Street
The development of the Information Centre will have a beneficial effect on James Paterson Street by reducing the number of cars and coaches accessing and parking on this street. This in turn should lead to a decrease in parking related congestion on James Paterson Street.

Existing Beach Access Road
The development of the Information Centre will increase vehicle traffic on the existing Beach Access Road as well as increasing movements of 4WD vehicles between the Information Centre, the dunes and the beach. These amounts, however, are well below the capacity of the existing Beach Access Road, and unlikely to lead to congestion.

Gan Gan Road
The development of the Information Centre is likely to have a minimal impact on traffic flow at Gan Gan Road. The current road capacity of Gan Gan Road is sufficient to handle the redirected traffic. In addition to this, the largest share of this traffic is currently already driving via Gan Gan Road and will turn into the existing Beach Access Road instead of James Paterson Road.

Intersection Gan Gan Road with the existing Beach Access Road
Traffic flow at the intersection of Gan Gan Road with the existing Beach Access Road is not likely to be impacted by the development. In the proposed situation the same amount of vehicles will be using this intersection. The effect of the proposal will be that vehicles on Gan Gan Road that were turning right at James Paterson Street, will now turn right at the existing Beach Access Road. In order to facilitate the extra turning movements on this intersection, an extra right turning lane will be provided. This will also increase road safety.

In extreme situations, when all parking places at the new Information Centre will be occupied, there is a chance that traffic congestion at the parking area of the Information Centre will lead to a queue along the Beach Access Road back to Gan Gan Road.

2.3.1.2 Pedestrians and Cyclists

The development of the Information Centre is likely to have a positive effect on access for pedestrians and cyclists (Active Transport), as James Paterson Street is their main access to the beach and will be less congested. This should lead to a more pleasant environment in which to walk and cycle. The Information Centre will be designed taking into account the needs of pedestrians and cyclists with existing shared pedestrian/cycling paths extended to access the site.

[1] Estimated distribution destination traffic on James Paterson Street: a third to the tourist activities at the beach and two third to the SLSC and restaurant.

2.3.1.3 Public Transport

The development of the Information Centre is likely to have a positive effect on public transport access, as the centre will be located closer to existing bus stops.

2.3.2 Construction phase

As the new site for the proposed Information Centre is at a location set back from the main roads, the construction phase is unlikely to affect the traffic and parking situation at James Paterson Street. Upgrading the intersection between Gan Gan Road and the existing Beach Access Road and upgrading the surface of the existing Beach Access Road (from a track to a paved road) will also be undertaken as part of the proposed development.

Construction traffic will have the following potential impacts:

- localised changes to traffic conditions to support construction of the entrance way to the Information Centre on the existing Beach Access Road,
- temporary road closures and diversions due to paving the existing Beach Access Road, and upgrading the intersection with Gan Gan Road. This will include the addition of a right turning lane from Gan Gan Road into the existing Beach Access Road. The road closures and traffic diversions would be coordinated with Roads $ Maritime Services (RMS) and the Transport Management Centre and undertaken at appropriate times which will minimise the impact to road users and existing bus services.
- minor increases in traffic along Gan Gan Road, including heavy vehicles, due to construction traffic and workers.

The upgrade of the intersection of Gan Gan Road with the existing Beach Access Road should improve traffic flow capacity at Gan Gan Road as vehicles turning right into the Beach Access Road will be separated from the through traffic. This will benefit road safety, as it reduces the risk of collisions.

A right hand turning lane on Gan Gan Road for traffic coming from the north-west direction is recommended as it improves both traffic flow and road safety at Gan Gan Road. A left hand turning lane on Gan Gan Road for traffic coming from a south-east direction is not recommended, as this could increase the risk of so called ‘blocked-view accidents’. Left turning traffic from Gan Gan Road into the Beach Access Road driving on this left turning lane could obstruct the view of vehicles from the Beach Access Road that intend to enter Gan Gan Road on vehicles that drive on Gan Gan Road behind the left turning vehicle.

During the road works on the intersection, the contractor could provide for an alternative route via Old Main Road.

Figure 13: Intersection Gan Gan Road with the Existing Beach Access Road

A detailed construction methodology and associated management plans could be developed during the detailed design phase of the proposal to manage these potential impacts.

Throughout the construction phase deliveries and movements of construction vehicles would be planned to minimise potential impacts. All construction vehicles would access and egress the construction site via the existing Beach Access Road.

Construction parking can be organised on the project site and along the existing Beach Access Road.

2.4 Mitigation measures

Potential mitigation measures include:

- Traffic regulators on extremely busy days to prevent traffic from Gan Gan Road entering the existing Beach Access Road, when the carpark at the Information Centre is full. If possible they could redirect traffic to an alternative location, that is in accordance with the parking policy of Port Stephens Council.
- Dynamic road signage at Gan Gan Road when the carpark at the Information Centre is full.

Appendix F - Water Management Plan

BIRUBI POINT
WATER MANAGEMENT PLAN

DA Report

June 2018

Project client: Port Stephens Council

Project name: Birubi Point Stage 2

Project number: 0672SYD

Date: June 2018

Studio: Sydney

Report contact: Alexa McAuley

Revision	Status	Date	By	Checked
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CONTENTS

1 INTRODUCTION

This water management plan has been developed to support the design development for the proposed Birubi Point Information Centre

On behalf of Port Stephens Council an Information Centre is proposed for the subject site, Lot 312 DP753024. This site has been identified through a process of masterplanning and community engagement. It is located on Crown Land in a RU2 zone, adjacent to E2 and RE1 lands and the Birubi Point Aboriginal Place. The site is a disturbed area of dune landscape that is framed by vegetation along Gan Gan Road and James Paterson Road. The proposed information centre has been designed as a functional asset that resolves current parking and congestion issues around visitor activity at Birubi Point. The asset consists of 1325m2 of sheltered space and provides space for dune operators and amenities, including public toilets and a kiosk. The site has 50 car parking spaces, including 3 disabled spaces, 10 coach parking spaces with a drop-off zone that can accommodate 2 coaches, and provisions for pedestrians and cyclists. The proposal includes site specific Architecture and Landscape design that is integrated with sustainable water solutions. Heritage considerations, traffic management and an ecological assessment have also been incorporated into the proposed outcome.

The concept design for the proposed development is shown in Figure 1.

This report has been prepared to consider water management on the site, specifically:

- Existing conditions relating to both surface and groundwater
- Potential impacts of the proposed development
- Approval requirements
- Recommended measures to manage water and mitigate impacts

The water management plan covers surface water and groundwater, including both water quality and water balance. However its main focus is water sensitive urban design (WSUD), while a separate stormwater drainage plan covers drainage and on-site detention.

The plan has been developed to meet the requirements of Port Stephens Council's DCP, particularly the water quality requirements in Part B4.C. It also addresses riparian corridors (Part B4.D). Refer to the separate stormwater drainage plan for Parts B4.A and B4.B.

Figure 1: Concept design for proposed development

2 EXISTING CONDITIONS

The Information Centre site is located in a sensitive coastal environment, with a complex topography created my mobile sand dunes

Currently, the site is undeveloped. Rainfall either infiltrates into the sandy soil or runs off via ephemeral drainage lines. There are no drainage structures on site.

2.1 RAINFALL

Average monthly rainfall is shown in Figure 2. The mean annual rainfall is 1346 mm/year. This is based on the rain gauge at Nelson Bay (Nelson Head), which has been operating for more than 100 years. It is located approximately 11 km away.

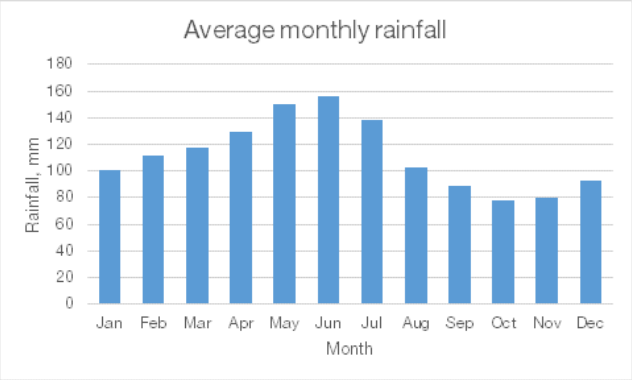

Figure 2: Average monthly rainfall

2.2 SURFACE WATER

Existing site catchments are shown in Figure 3. The catchment properties are summarised in Table 1.

Table 1: Existing catchment properties

Catchment	Area, ha	Drains to
A	11.87	Gan Gan Road to the north of the site
B	4.69	Private property to the south-west of the site
C	1.12	Stockton Beach to the south of the site

Catchment A, which represents two thirds of the site, drains to the north where stormwater pits on Gan Gan Road and James Paterson Street accept surface flows.

Catchment B drains to the south-west and into private properties along James Paterson Street. Nos 4, 6, and 8 James Paterson Street are located immediately adjacent to the site.

Soils on site are sandy and it is likely that infiltration capacity is relatively high, and runoff is low. Port Stephens Council Hydrologic Mapping indicates that the soil group on site is Group A— "soils having high infiltration rates, even when thoroughly wetted and consisting chiefly of deep, well to excessively-drained sands or gravels. These soils have a high rate of water transmission."

2.3 WATERCOURSES

There are no rivers, lakes or estuaries within 40 m of the site. There are only indistinct ephemeral watercourses on site, as shown in Figure 3.

2.4 GROUNDWATER

Immediately adjacent to the site is an area defined as a "Special Area" by Hunter Water. This Stockton Sandbeds Special Area protects an unconfined sand aquifer which extends from Fullerton Cove to Anna Bay. Hunter Water does not currently extract groundwater from this aquifer, but would do so in the event of a water shortage. Therefore there are measures in place to protect it from water quality impacts.

The subject site is outside the area identified as the Stockton Sand Beds Special Area. However:

- Soils on the site are sandy and therefore groundwater recharge is likely to occur on the site
- There is potentially some connection between groundwater on the site and the Stockton Sandbeds system

Figure 3: Existing surface water catchments

Figure 4: Groundwater Special Area

3 PROPOSED WORKS

From a water management perspective, the key features of the proposed works are an increase in impervious area and the introduction of facilities with water demands and wastewater flows

3.1 POST-DEVELOPMENT LAND USE AND POLLUTANT LOADS

The proposed site areas are shown in Table 2.

Table 2: Proposed site areas

Surface type	Area, sqm
Roads	1,800
Parking areas	2,750
Paths	550
Roof	1,500
Landscaped areas	2,950
Undeveloped areas	8,160
Total	**17,710**

MUSIC has been used to estimate post-development pollutant loads and size water quality treatment systems. MUSIC-Link was used to set up the MUSIC model with parameters appropriate to the Anna Bay and Nelson Bay area. The default catchment in sandy soil parameters have been adopted.

In the MUSIC model, roads and parking areas have been modelled with pollutant parameters typical of urban roads, boardwalks and landscaped areas have been modelled with pollutant parameters typical of mixed urban areas, roofs have been modelled with pollutant parameters typical of urban roofs, and undeveloped areas have been modelled with pollutant parameters typical of natural catchments.

Post-development pollutant loads estimated for the total site are estimated as shown in Note that road and paved parking areas could be constructed using semi-permeable materials, however for the purposes of water quality modelling these were assumed to function as impervious areas, as runoff from these areas should be pre-treated before it is allowed to infiltrate. This is discussed further in Section 5.

Table 3.

Note that road and paved parking areas could be constructed using semi-permeable materials, however for the purposes of water quality modelling these were assumed to function as impervious areas, as runoff from these areas should be pre-treated before it is allowed to infiltrate. This is discussed further in Section 5.

Table 3: Post-development pollutant loads (baseline)

Pollutant	Mean annual loads		
	Developed portion of site	Undeveloped portion of site	Total
Flow (ML/yr)	6.89	1.76	8.65
Total Suspended Solids (kg/yr)	1,575	65	1,640
Total Phosphorus (kg/yr)	2.9	0.1	3.0
Total Nitrogen (kg/yr)	15.1	1.4	16.5
Gross Pollutants (kg/yr)	157	0	157

3.2 NON-POTABLE WATER DEMANDS

Water used for toilet flushing and irrigation can be supplied from non-potable sources such as rainwater.

Irrigation demands are expected to be low – the design intent is to plant with locally native species suited to the dune environment, which can tolerate the natural conditions.

A significant proportion of the water used on site will be for toilet flushing. Toilet flushing demands have been estimated for the site based on the following assumptions:

– The site will accommodate 50 visitor cars, ten

coaches and fourteen 4WD operators

- Average occupancy in the cars is three people, and in the coaches is 50 people
- Visitors spend an average of half the day on site, and uses the toilet an average of two times
- 4WD operators will have an average of 2 staff, who spend all day on site and use the toilet an average of four times
- Toilet water demands will be an average of 4.5 L per flush
- A peak day's toilet flushing demand will therefore by 12 kL/day
- A peak month's toilet flushing demand will be 378 kL/month
- Peak months will be November to February
- The distribution of non-potable water demands through the remainder of the year will follow a similar pattern to the existing surf club, where approximately 48% of the water use falls within November to February

The expected toilet flushing demands on the site are shown in Figure 5.

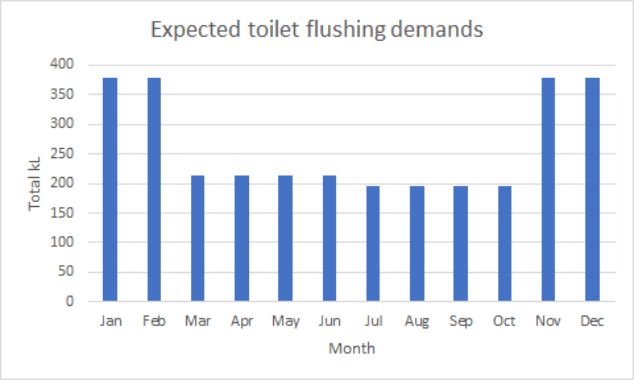

Figure 5: Expected toilet flushing demands at the site

The expected mean annual toilet flushing demands add up to approximately 3,150 kL/year. This is similar to the current total annual demand at the surf club (based on March 2017 to February 2018 usage in common and public areas, surf club facilities, café areas, and caretaker residence, which totalled 3,640 kL). Therefore the demand estimate is consistent with an increase in total visitor numbers with the Information Centre in place.

Note that the rainwater tank modelling has tested demands ranging from 1,000 to 5,000 kL per year, due to the uncertainty in future demands.

4 DEVELOPMENT CONTROLS

Port Stephens Council DCP 2014 includes controls for drainage and water quality, which are summarised here

Port Stephens Council's DCP 2014 Chapter B4 covers drainage and water quality. This chapter applies to the proposed development, as it increases impervious surfaces and drains to the public drainage system.

Chapter B4 calls for the following items to be addressed:

- A stormwater drainage plan
- On-site detention/infiltration
- Water quality (WSUD) measures
- Protection of riparian corridors

Each of these items is summarised in Table 4.

Table 4: DCP controls for drainage and water quality, as they apply to the site

Topic	Applicability to this site	DCP requirements
Legal and physical point of discharge	Required based on the facts that: - The development increases impervious surfaces; and - The development drains to the public drainage system	To ensure the stormwater drainage plan details a legal and physical point of discharge to minimise impacts on water balance, surface water and groundwater flow and volume regimes and flooding
On-site detention/on-site infiltration	Required based on the facts that: - The post-development flow rate or volume exceeds the pre-development flow rate or volume; and - Impervious surfaces exceed the total percentage of site area listed under Figure BD (p. B-29)	Sized so that the post-development flow rate and volume equals the predevelopment flow rate and volume for all storm events up to and including the 1% Annual Exceedance Probability (AEP) storm event
Water quality	Based on Figure BF in the DCP: - The site area is >2,500 m^2 - The proposed development is outside a drinking water catchment	Before water is released into public drainage it must achieve Council's water quality stripping targets: a. Total nitrogen retention post-development load: 45% b. Total phosphorus retention post-development load: 60% c. Total suspended solids post-development load: 90% d. Gross pollutants post-development load: 90% Use water quality modelling, such as MUSIC modelling, to demonstrate compliance.
Riparian corridors	The development does not involve any controlled activity within waterfront land	NA

5 WATER MANAGEMENT STRATEGY

The proposed water management strategy includes rainwater harvesting and wetlands to meet water quality treatment targets

5.1 RAINWATER HARVESTING

It is proposed to connect a rainwater tank to the roof of the main building on site, to supply toilet flushing demands inside.

The following rainwater tank scenarios have been tested:

- Connected roof area of 50%, 75% or 100% of the proposed 1,500 sqm roof
- Rainwater demands ranging from 1,000 to 5,000 kL/year, with the seasonal profile as shown in Figure 5.
- Tank volumes ranging from 10 to 200 kL

Results are shown in Figure 6. These show that:

- A tank volume of at least 50 kL is recommended, and 100 kL is encouraged
- For any of the demands tested, it is worth trying to maximise the connected roof area, as the roof area is a limiting factor in the ability to supply requested demands

5.2 WATER QUALITY TREATMENT

The post-development water quality model configuration is shown in Figure 7 and has been set up based on the following:

- The same MUSIC-Link parameters as described above (Anna Bay and Nelson Bay area, default catchment in sandy soil)
- Undeveloped parts of the site have been excluded from the treatment train. As shown in Table 3, these areas contribute very low pollutant loads compared to the developed parts of the site.
- A 50 kL rainwater tank has been included, connected to the whole roof and an annual demand of 3,150 kL/year
- A range of wetland areas were tested, to establish the wetland area required to meet Council's water quality targets for the site as a whole
- All impervious areas and stormflow from landscaped pervious areas have been directed to the wetland. Pervious baseflows bypass
- An infiltration rate of zero was assumed in the model. While infiltration zones may be included in the design, pre-treatment is recommended upstream of infiltration zones, and the intent of this assumption in the model is to show how water quality treatment targets can be achieved before water is lost to infiltration.

Note that some proposed elements of the treatment train have not been included in this model (e.g. swales within the car park). As the design develops the modelling can be refined to account for these, however at this stage the intent is to ensure that a sufficient area has been defined for the water quality treatment wetland/s.

Model results are shown in Figure 8. This shows that a wetland with a 500 sqm macrophyte zone can meet Council's water quality targets. It achieves:

- 90% removal of total suspended solids
- 79% removal of total phosphorus
- 55% removal of total nitrogen

It would also achieve 100% removal of gross pollutants.

The wetland with a 500 sqm macrophyte zone has been modelled with a 100 m^3 inlet pond, 0.5 m extended detention and a permanent pool volume of 100 m^3. The outlet condition has been set to achieve an extended detention time of 72 hours.

Allowing for the inlet pond, macrophyte zone and batter zones, it is recommended that an area of approximately 850 sqm should be allowed for the wetland.

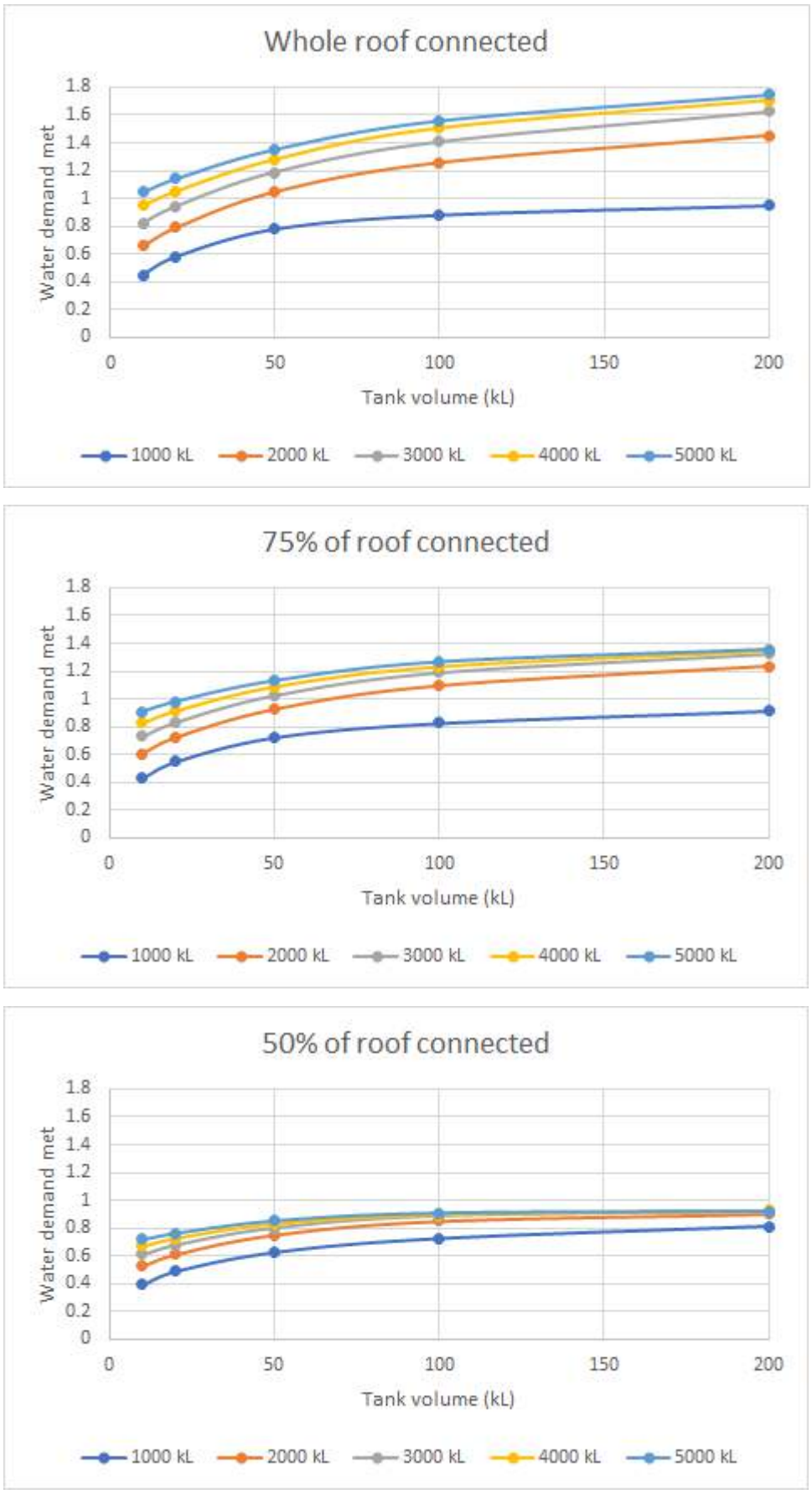

Figure 6: Rainwater tank modelling results

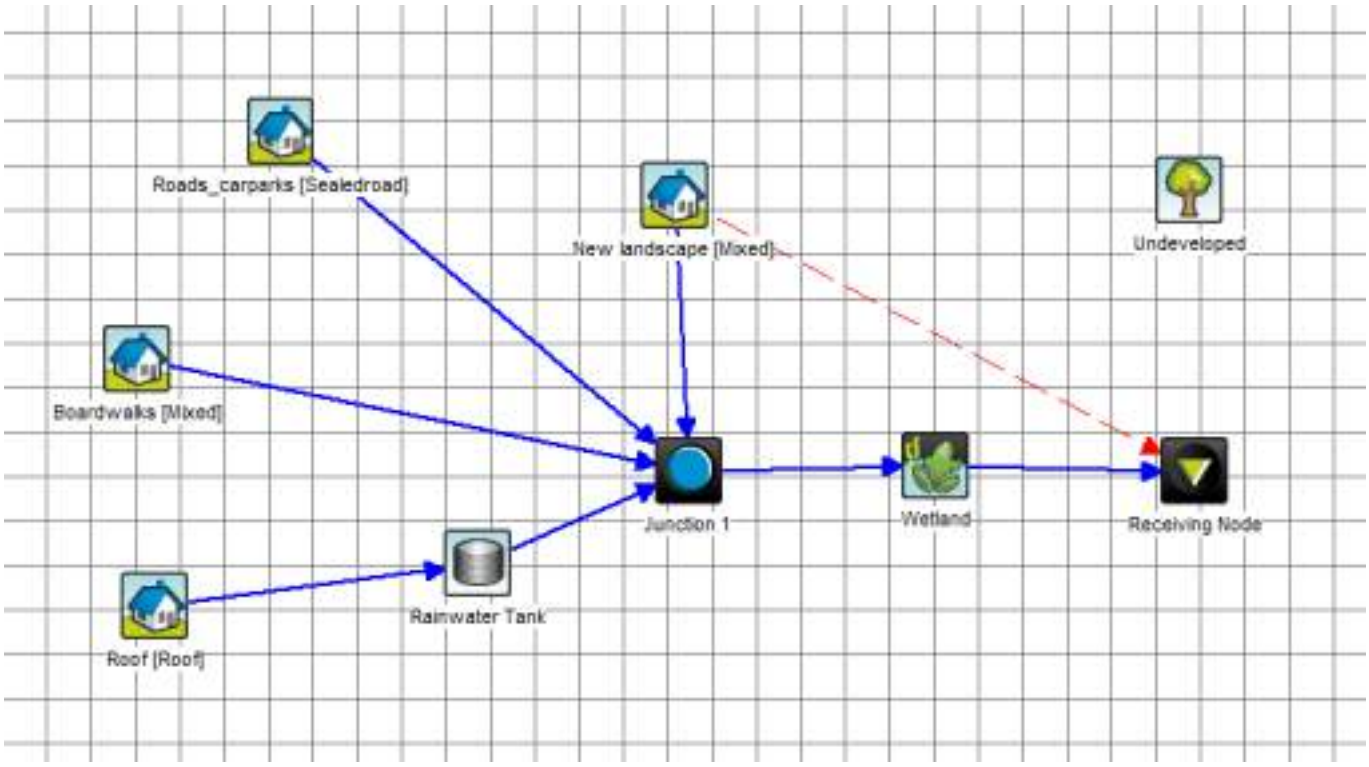

Figure 7: MUSIC model configuration

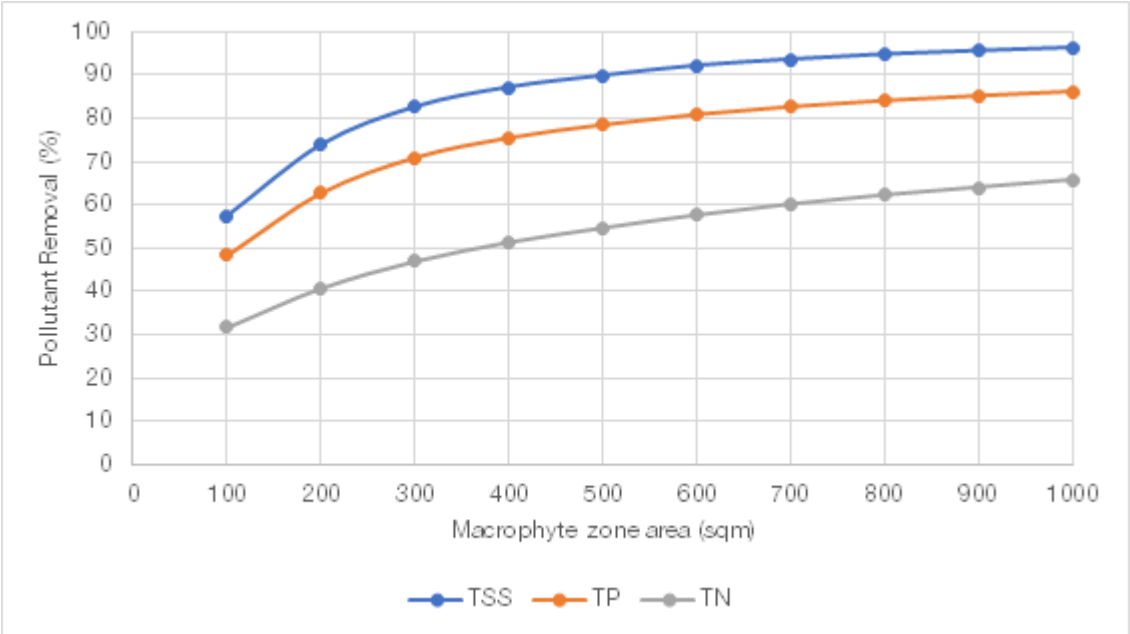

Figure 8: Water quality treatment train results for different wetland areas

Note that a wetland with a 300 sqm macrophyte zone would meet the targets for TN (45%) and TP (60%). A larger wetland is required to meet the TSS target (90%). It may be possible to refine the stormwater treatment train design to provide improved pre-treatment for suspended solids (e.g. in swales) and reduce the size of the wetland.

6 CONCLUSIONS AND RECOMMENDATIONS

This water management plan recommends a rainwater tank and wetland to meet Port Stephens Council's water quality targets

This water management strategy recommends the following elements to be included in the design of the Birubi Point Information Centre, in order to meet Port Stephens Council's water quality targets:

- **Rainwater tank**: minimum 50 kL tank collecting roof runoff from the proposed building and supplying toilet flushing demands in the proposed facility
- **Wetland**: including a 100 m^3 inlet pond and 500 sqm macrophyte zone

This treatment train is expected to achieve the following pollutant load reductions (in terms of mean annual loads):

- 90% of TSS
- 79% of TP
- 55% of TN
- 100% of gross pollutants

This plan also makes the following recommendations about how water management should be implemented on site:

- While infiltration can be encouraged in the sandy soils, stormwater runoff should be pre-treated prior to infiltration, to protect groundwater quality
- Where possible, car park runoff should be pre-treated in swales before it reaches the wetland. This could improve the performance of the wetland and reduce the wetland area required to meet the water quality targets.

Note that on-site detention will also be required and this is described in a separate stormwater drainage report.

REPORT

Addendum to Birubi Information Centre Statement of Environmental Effects

Client: McGregor Coxall

Reference: PA1845-RHD-ZZ-XX-RP-Z-0001

Status: Draft/P01.01

Date: 24/05/2019

Royal HaskoningDHV

Enhancing Society Together

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Document title: Addendum to Birubi Information Centre Statement of Environmental Effects

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Date: 24/05/2019
Project name: Birubi
Project number: PA1845
Author(s): Miriam Knollys

Drafted by:	Miriam Knollys
Checked by:	Nick Lewis
Date / initials:	
Approved by:	
Date / initials:	

Classification
Internal use only

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Table of Contents

1 Introduction

This document forms an addendum to the Statement of Environmental Effects (SEE) submitted by Port Stephens Council in June 2018 as part of their Development Application (DA) 16-2018-434-1 for a new Tourist Information Centre at Birubi Point.

The proponent, Port Stephens Council, propose to amend the original design of the Information Centre following acquisition of an adjoining lot of land to the west (Lot 32 DP 1146884 Gan Gan Road, Anna Bay; Figure 2-1) to allow for an alternative access route through the newly acquired land.

The addendum is being submitted for a revision in the proposed Information Centre design. The acquisition of this land has allowed for improvements to access in and out of the Information Centre.

The revised design has the potential to lead to additional environmental effects, positive and negative. These additional effects and any subsequent mitigation requirements are detailed in the subsections below.

2 Project Proposal

2.1 General

The additional site area is highlighted in **Figure 1** below. This additional area consists of approximately 880m^2 of hardscape (access roads) and 8,570m^2 of undeveloped sand dunes.

Figure 2-1 Additional site area subject of this addendum

2.2 Justification of the Proposed Works

The Information Centre will facilitate a world-class visitor experience providing sustainable access and connectivity to the Worimi Conservation Lands, while allowing for increased services and additional amenities catering to future demand. The design incorporates the landscape as a key educational component, achieved through the incorporation of educational elements such signage and information booths for visitors and locals to have an enhanced understanding of place, it's history and current uses. These initiatives and aspects of the design were based on consultation with the Worimi and National Parks.

Specific to the additional lot, an additional length of roadway would be compacted and capped with light aggregate. This roadway would be separated from the original proposed site access and would include a second entrance from the beach access track into the site. The road expands at the information centre to provided pull in parking bays for tour vehicles and a one way exit route back out onto the beach access track.

The revised design will allow for the separation of tour vehicles and public vehicles entering the site. It will create a one-way system and limit the requirements for turning, which will reduce the potential for congestion. One-way signalling will be incorporated into the design to direct the flow of traffic.

A pressure release exit point has been included at the top of the private car park to assist with traffic management within the facility during peak use.

The amount of toilets will be increased by 1.5x to account for the increased capacity at the site. A ticket booth has been removed from the original design to allow space for the toilets. The amount of covered area that the project would create would not be increased.

Interpretative signage will be increased and installed under the covered area at the Information Centre. This signage will provide information on the sand dunes, Woirimi People and National Parks and Wildlife Service.

3 Updates to Planning Context and Other Approvals

3.1 Land Ownership, Zoning, and Permissibility

The additional land area, Lot 32 DP1146884, is on land classified as Rural Landscape (RU2) under the Port Stephens Local Environmental Plan (PSLEP) (Port Stephens Council, 2013). The land is Crown land under the management of Port Stephens Council.

Lot 32 DP1146884 is immediately adjacent to land classified for Environmental Conservation (E2) to the south and west of the site. The land to the east (Lot 312 DP753024), which comprised the original DA and main information centre facilities, is also on land classified as Rural Landscape (RU2).

The Information Centre (to be contained in Lot 32 DP1146884, as well as Lot 32 DP1146884 adjacent) is to function as an information and education facility, defined by the Port Stephens Local Environmental Plan (PSLEP) (Port Stephens Council, 2013) as *a building or place used for providing information or education to visitors, and the exhibition or display of items, and includes an art gallery, museum, library, visitor information centre and the like*. The proposed land use (tourist information centre) of both Lot 32 DP1146884 and Lot 32 DP1146884 is therefore considered permitted with consent in land classified as Rural Landscape (RU2) under the Port Stephens Local Environmental Plan 2013.

Port Stephens Council remains the consent authority for the proposal.

4 Updates to Environmental Assessment

4.1 Geology and Soils

4.1.1 Potential Effects

The revised access into and out of the site would lead to additional minor disturbances of soils caused by the compaction of the roadways and additional parking areas.

Additional areas of vegetation will be lost due to the new road access. This has the potential to lead to destabilisation of the soils and increase in wind-blown sediments.

4.1.2 Recommended Control Measures

- Site specific geotechnical investigation to be extended to Lot 32 DP1146884
- Waste classification and testing for ASS to be extended to Lot 32 DP1146884
- Scheme of planting to take into account additional vegetation loss from road construction on Lot 32 DP1146884

4.2 Flood Risk and Coastal Processes

4.2.1 Potential Effects

Removal of additional vegetation may lead to increase in erosion and potential release, or more rapid transport, of wind-blown sediments from and across the development site.

4.2.2 Recommended Control Measures

- Installation of a sediment fence and planting of native vegetation along the western boundary of the proposed development site to prevent encroachment of wind-blown sediments into the site.
- Installation of a sediment fence and planting of native vegetation along the new access road to prevent encroachment of wind-blown sediments into the site.
- Retention of the existing vegetation on Lot 32 DP1146884 as far as possible to prevent any increase in erosion and release of sediments from the site.
- Site drainage plan amended to take account of additional roadway on Lot 32 DP1146884 (see Water Quality and Stormwater)

4.3 Ecology and Biodiversity

4.3.1 Existing Environment

An updated biodiversity assessment was undertaken to provide a detailed assessment of the land at Lot 32 DP1146884 and immediately surrounding it. The assessment is appended.

4.3.2 Potential Effects

The area of impact within Lot 32 is estimated at 1,600m2, consisting mainly of Sand Dunes with Bitou Bush. Lot 32 does not contain any additional habitat features such as hollow bearing trees, wet areas or vegetation types not already considered in the BA. As such, the inclusion of Lot 32 into the Birubi Information Centre does not alter the original assessment of significance of impact prepared in accordance with state and federal legislation (Threatened Species Conservation Act and Environment Protection and Biodiversity Conservation Act, respectively) and presented in the BA. Therefore, no further assessment is required.

4.3.3 Recommended Control Measures

To mitigate the loss of additional vegetation clearing, it is recommended that the remainder of Lot 32 and Lot 312 DP 753204 that will not directly be impacted by works, be included in the restoration of the site. Restoration should include revegetation using flora species listed in section 7 of the BA and gradual weed removal. Density of planting should aim to cover 80% surface area after 5 years. This would limit the spread of Bitou Bush which is a priority weed in Port Stephens Council LGA.

4.4 Traffic and Transport

4.4.1 Existing Environment

The Transport Assessment has been revised to take account of the proposed additional access route into and out of the Information Centre. This update includes a new swept path analysis model to understand

the movements of traffic into and out of the new access as well as qualitative description of any change in impact to the road network. The vehicle tracking for the revised design is shown in **Figure 5.1**.

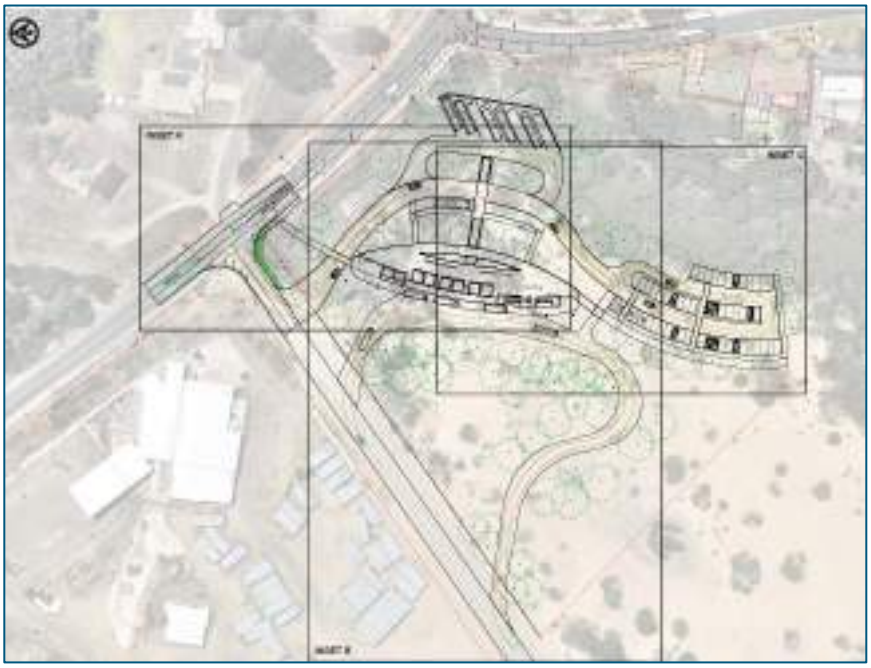

Figure 4-1 *Vehicle Tracking*

4.4.2 Potential Effects

The revised design would lead to better management of vehicle traffic on the existing beach access road by separating the movements of 4WD vehicles between the Information Centre, the dunes and the beach and visitor traffic entering the drop off and parking areas at the information centre.

In extreme situations, when all parking places at the proposed Information Centre are occupied, there is potential that this would lead to traffic congestion on the beach access road and at the new intersection with Gan Gan Road.

4.4.3 Recommended Control Measures

- A pressure release exit point has been included at the top of the private car park to ease traffic management within the facility during peak use. This measure will reduce any congestion impacts on Gan Gan Road.
- Five additional car parking spaces will be added to increase capacity for vehicles parking at the site. This measure will reduce pressure on Gan Gan Road at peak use by increasing the capacity of the information centre.

4.5 Water Quality and Stormwater

4.5.1 Potential Effects

Water Quality

An amendment to the Water Management Plan is appended. The Water Management Plan addendum recommends a slightly larger wetland area to be included in the updated design of the Birubi Point.

Stormwater

Of the additional area acquired, runoff from approximately 700m^2 of hardscape and 6,300 m^2 sand dunes will runoff eastwards, and into the site's water capture system. The addition of impervious area increases the peak runoff generated from the site, and hence additional detention storage requirements have been determined to attenuate the peak flow in the 1% Annual Exceedance Probability (AEP) design storm.

The hydrology model was also updated to account for a higher site slope of 3%. The Existing Case peak flow was estimated as 0.55m3/s (45min critical duration). The Proposed Case peak flow was estimated as 0.89m3/s (20min critical duration).

The proposed case peak flow was designed to be attenuated using a detention basin (wetland) to achieve a peak flow of 0.53m^3/s (45min critical duration). This peak flow is slightly less than the pre-development peak flow of 0.55 m^3/s.

4.5.2 Recommended Control Measures

Water Quality

Information Centre to meet Port Stephens Council's water quality targets. The wetland should include a 120m^3 inlet pond and 600m^2 macrophyte zone. The other recommendations in the original water management strategy remain the same.

The updated treatment train is expected to achieve the following pollutant load reductions (in terms of mean annual loads):

- 91% of TSS;
- 80% of TP;
- 55% of TN; and
- 100% of gross pollutants.

Note that a conveyance swale is proposed along the new hardscape area and this is described in a separate stormwater drainage report.

Stormwater

The basin previously proposed was deepened and the footprint increased to account for the additional storage required. The following simple trapezoidal basin dimensions were required to achieve no net increase in peak discharge offsite up to and including the 1% AEP design event:

a. Bottom dimensions: 25m x 10m
b. Slopes: 1:4
c. Top widths at 1.3m from basin invert: 37m x 22m (previously 35m x 20m).
d. Spillway invert: 1.2m above basin invert (previously 1.0m).

The size of the estimated detention footprint has increased by 16%.

As is demonstrated from the hydrological assessment amendments above, rainfall runoff is estimated to increase from a peak of 0.55m^3/s to 0.89m^3/s. The negative impacts of increased runoff are proposed to be mitigated using attenuation through onsite detention. The onsite detention has been sized appropriately and tested to ensure that the peak runoff in the 100 year ARI does not exceed pre-development values.

4.6 Visual Impacts

4.6.1 Potential Effects

4.6.1.1 Construction Phase

The construction area will increase which will increase the visual impact during construction. Impacts would be in the form of earthworks, the presence of vehicles, plant, equipment and temporary stockpiling of materials.

4.6.1.2 Operational Phase

The additional access road for tour vehicles would lead to additional vegetation being removed from Lot 32 DP1146884.

4.6.2 Recommended Control Measures

- Planting of native vegetation, for screening and stabilisation purposes, will need to account for the construction and maintenance of the additional roadway.

4.7 Public Access and Safety

4.7.1 Potential Effects

4.7.1.1 Construction Phase

Lot 32 DP1146884 is also publicly accessible land and can be accessed from the beach access track, beach and private residencies.

4.7.1.2 Operational Phase

Access to the pickup location for 4x4 tours will be separated from the public vehicle access. This will reduce congestion and improve safety of vehicle access in and out of the Information Centre.

5 Conclusion

The re-design of the vehicle access in and out of the proposed Information Centre will lead to minimal additional environmental effects. There will be a small additional amount of vegetation removed from the site but this will be compensated for through planting of native species in areas of ground which are currently bare, or contain weeds. The re-design of the vehicle access in and out of the Information Centre, plus additional parking spaces will lead to reduced congestion of vehicles and improved public access and safety within the Information Centre car park. Stormwater quality and quantity are addressed through an increase in the size of the wetland / detention area.

Environmental Assessments
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ABN: 249 246 74371

Ref: KM/180525/190523

23 May 2019

Royal HaskoningDHV

Level 14 56 Berry St

North Sydney NSW 2060

Attention: Nick Lewis

Dear Nick,

RE: Birubi Information Centre Addendum, incorporation of Lot 32 DP 1146884 Gan Gan Road, Anna Bay into existing DA 16-2018-434-1

Introduction

A development application was submitted in June 2018 for the Birubi Information Centre (DA 16-2018-434-1) on Lot 312 DP 753204 Gan Gan Road, Anna Bay. The Client, Port Stephens Council, propose to amend the original design of the Birubi Information centre following acquisition of an adjoining lot of land to the west (Lot 32 DP 1146884 Gan Gan Road, Anna Bay; Figure 1) to allow for an alternative access route through the newly acquired land.

Method/Results

A site inspection of Lot 32 was undertaken on 23 May 2019 by Coast Ecology. Flora species recorded (Table 1) on Lot 32 were consistent with those previously reported in the Biodiversity Assessment (BA) by Coast Ecology (October 2018). Lot 32 was mapped as containing approximately 1,299m^2 *Disturbed Coastal Sand Scrub* and 8,176m^2 *Sand Dunes with Bitou Bush* (Figure 1). Both vegetation communities were mapped previously on Lot 312 and are described in the BA. No threatened flora, fauna or endangered ecological communities were recorded on Lot 32.

Assessment

The area of impact within Lot 32 is estimated at 1,600m^2, consisting mainly of *Sand Dunes with Bitou Bush*. Lot 32 does not contain any additional habitat features such as hollow bearing trees, wet areas or vegetation types not already considered in the BA. As such, the inclusion of Lot 32 into the Birubi Information Centre does not alter the original assessment of significance of impact prepared in accordance with state and federal legislation (*Threatened Species Conservation Act* and *Environment Protection and Biodiversity Conservation Act*, respectively) and presented in the BA. Therefore, no further assessment is required.

Mitigation Measures

To mitigate the loss of additional vegetation clearing, it is recommended that the remainder of Lot 32 and Lot 312 DP 753204 that will not directly be impacted by works, be included in the restoration of the site. Restoration should include revegetation using flora species listed in section 7 of the BA and gradual weed removal. Density of planting should aim to cover 80% surface area after 5 years. This would limit the spread of Bitou Bush which is a priority weed in Port Stephens Council LGA.

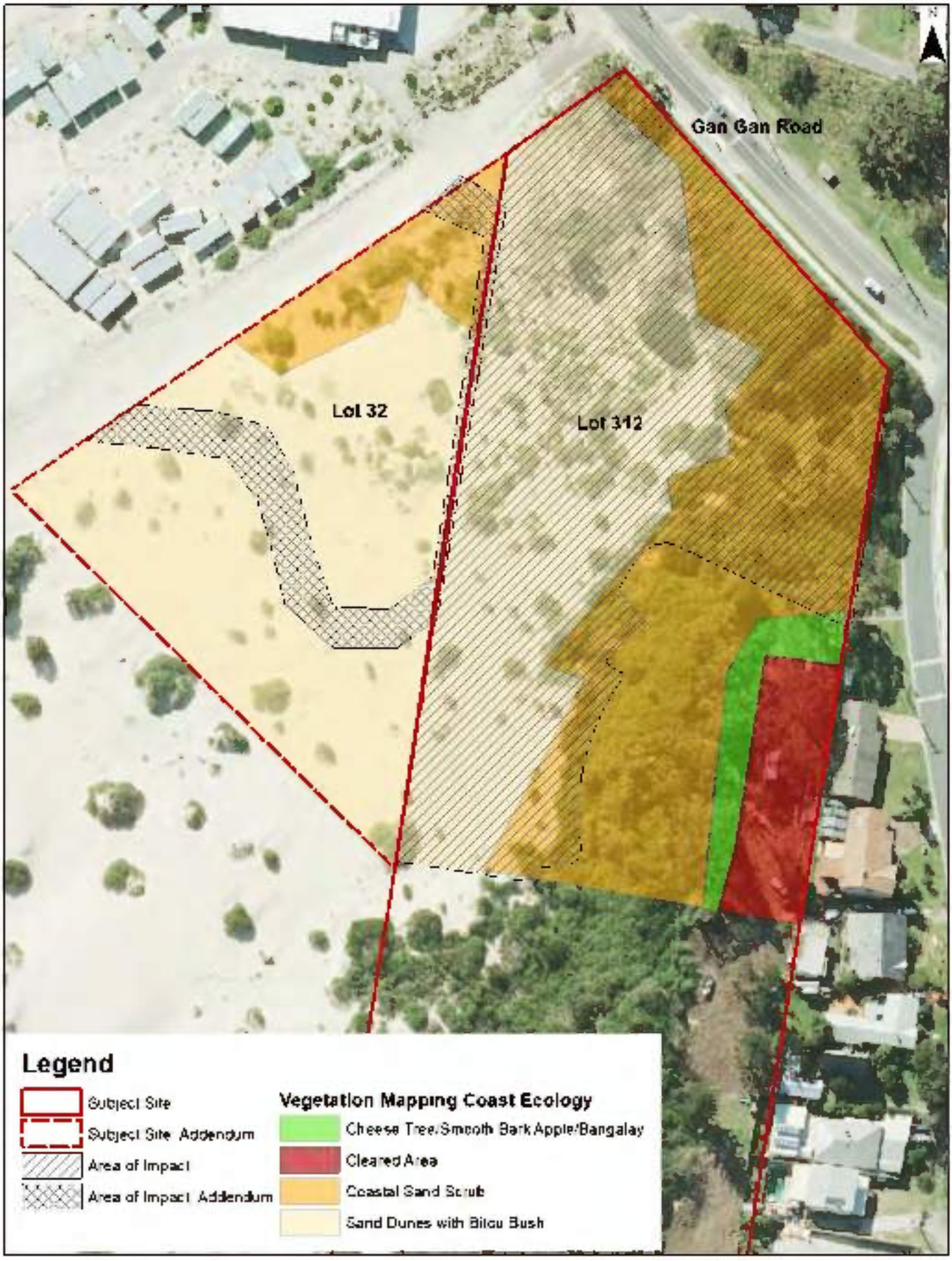
If you have any queries in relation to this addendum, please do not hesitate to contact me.

Regards,

Kristy McQueen

Table 1. Flora Species Recorded on Lot 32 on 23/05/2019

Scientific Name	Common Name
Acacia longifolia var. *sophorae*	Coastal Wattle
Acacia terminalis	Sunshine Wattle
*Ailanthus altissima**	Tree of Heaven
*Alternanthera pungens**	Khaki Weed
Angophora costata	Smooth-barked Apple
Angophora floribunda	Rough-barked Apple
Anthemis cotula	Stinking chamomile
*Araucaria heterophylla**	Norfolk Island Pine
*Asparagus aethiopicus**	Asparagus Fern
Banksia integrifolia subsp. *integrifolia*	Coast Banksia
*Cakile edentula**	American Sea Rocket
Carpobrotus glaucescens	Pigface
Cenchrus echinatus	Spiny Burr Grass
Chrysanthemoides monilifera subsp. *monilifera**	Bitou Bush
*Conyza bonariensis**	Flax-leaf Fleabane
Cucumis melo L.	Paddy Melon
Cynodon dactylon	Common Couch
*Cyperus eragrostis**	Umbrella Sedge
*Erythrina x sykesii**	Coral Tree
Gloriosa superba	Glory Lily
*Hydrocotyle bonariensis**	Pennywort
*Hypochaeris radicata**	Flatweed
*Lantana camara**	Lantana
Leptospermum laevigatum	Coast Tea-tree
Oenothera drummondii	Beach Evening Primrose
*Panicium maximus**	Guinea Grass
*Plantago lanceolata**	Ribwort
*Ricinus communis**	Castor Oil Plant
*Sida rhombifolia**	Paddy's Lucerne



COAST ECOLOGY
ENVIRONMENTAL ASSESSMENTS

Figure 1. Vegetation Mapping: Coast Ecology
Addendum to Biodiversity Assessment
Birubi Information Centre Date: 23/05/2019

1 ADDENDUM TO BIRUBI POINT WATER MANAGEMENT PLAN

This addendum has been developed to support the S55a development application for the proposed Birubi Point Information Centre

1.1 INTRODUCTION

Subject to Port Stephens Councils acquisition of Lot 32 DP1146884, this addendum has been developed to account for the additional site area and associated implications on the proposed water management strategy for the proposed Birubi Point Information Centre. The additional site area is highlighted in Figure 1 below.

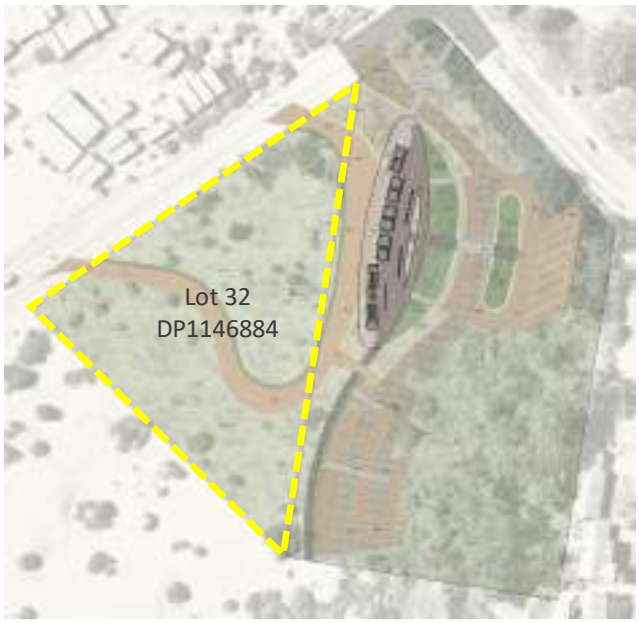


Figure 1: Concept design for proposed development

1.2 POST-DEVELOPMENT LAND USE AND POLLUTANT LOADS

The additional area consists of some 880m^2 of hardscape and 8,570m^2 of undeveloped sand dunes. Updated proposed site areas are shown in Table 1.

Table 1: Proposed site areas

Surface type	Area (m^2)
Roads	2,680
Parking areas	2,750
Paths	550
Roof	1,500
Landscaped areas	2,950
Undeveloped areas	16,730
Total	**27,160**

1.3 WATER QUALITY TREATMENT

The design approach, modelling configuration and assumptions of the original water management strategy have been maintained for the addendum. Wetland areas were modelled in MUSIC with increased hardscape and undeveloped area as per Table 1.

Post-development pollutant loads for the updated total site are shown in Table 2.

Table 2: Post-development pollutant loads (baseline)

Pollutant	Mean annual loads		
	Developed portion of site	Undeveloped portion of site	Total
Flow (ML/yr)	7.7	3.6	11.3
Total Suspended Solids (kg/yr)	1,861	139	2,000
Total Phosphorus (kg/yr)	3.3	0.2	3.5
Total Nitrogen (kg/yr)	16.9	3.1	20
Gross Pollutants (kg/yr)	178	0	178

Model treatment train pollutant removal results of the updated site area are shown in Figure 2. This shows that a wetland with a 600m^2 macrophyte zone can meet Council's water quality targets. It achieves:

- 91% removal of total suspended solids
- 80% removal of total phosphorus
- 55% removal of total nitrogen

It would also achieve 100% removal of gross pollutants.

The wetland with a 600m^2 macrophyte zone has been modelled with a 120m^3 inlet pond, 0.5m extended detention and a permanent pool volume of 120m^3. The outlet condition has been set to achieve an extended detention time of 72 hours.

Allowing for the inlet pond, macrophyte zone and batter zones, it is recommended that an area of approximately 1,020m^2 should be allowed for the wetland. This area is provided for in the design.

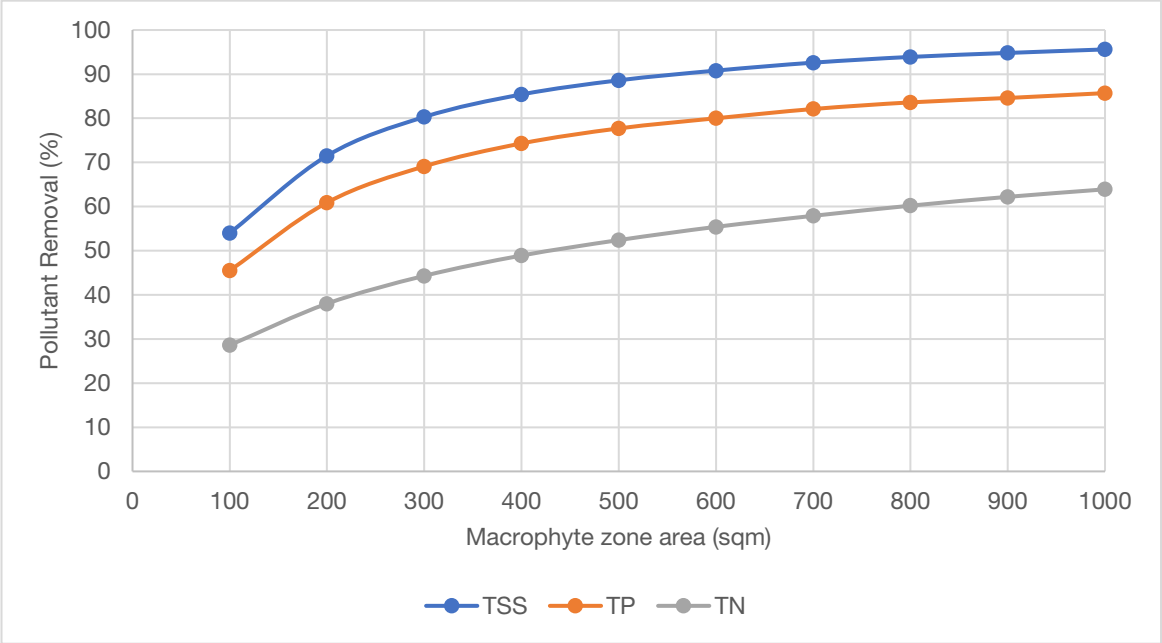


Figure 2: Water quality treatment train results for different wetland areas

Note that a wetland with a 300m^2 macrophyte zone would meet the targets for TN (45%) and TP (60%). A larger wetland is required to meet the TSS target (90%). It may be possible to refine the stormwater treatment train design to provide improved pre-treatment for suspended solids (e.g. in swales) and reduce the size of the wetland.

1.4 CONCLUSION AND RECOMMENDATIONS

This addendum recommends a slightly larger wetland area to be included in the updated design of the Birubi Point Information Centre to meet Port Stephens Council's water quality targets. The wetland should include a 120m^3 inlet pond and 600m^2 macrophyte zone. The other recommendations in the original water management strategy remain the same.

The updated treatment train is expected to achieve the following pollutant load reductions (in terms of mean annual loads):

- 91% of TSS
- 80% of TP
- 55% of TN
- 100% of gross pollutants

Note that a conveyance swale is proposed along the new hardscape area and this is described in a separate stormwater drainage report.

ACID SULFATE SOILS MANAGEMENT PLAN
BIRUBI INFORMATION CENTRE – DA 16-2018-434-1
98 GAN GAN ROAD, ANNA BAY

OVERVIEW

This Acid Sulfate Soils Management Plan (ASSMP) has been prepared for the proposed Birubi information centre development at 98 Gan Gan Road, Anna Bay.

Subject to Council's mapping, the proposed development site is within the Class 4 category. An ASSMP is required for any works below 2m of the natural ground surface. The proposed structure may require excavation to this depth. The exact volume of materials to be excavated and construction techniques have not been finalised at the time of preparing this ASSMP.

TREATMENT PLAN

The following treatment measures are to be adopted for excavation for the footings:

- Proposed potential acid sulfate soil (PASS) is to be stockpiled and covered by a guard layer such as an impermeable liner or similar material (e.g. plastic sheeting). This will prevent leachate contaminating the underlying soil. The stockpile is to be surrounded by a bunded area to contain the stockpile, retain any leachate inside the bund and redirect stormwater around the stockpile. The stockpiles are to be covered, with the cover extending over the bund crest to redirect rainwater runoff away from the stockpile.
- All disturbed PASS is to be treated with agricultural lime at an appropriate liming rate to achieve a neutralising value of 90%. For thorough mixing of lime with the soil profile, spread lime and then mix with appropriate earthmoving equipment. A suitable supply of lime should be available on-site during construction works to enable efficient neutralisation of PASS. A lime register should be maintained by the contractor to record the amount of lime delivered to the site.
- Agricultural lime quantities above calculated dosing rates may be required to allow for difficulties in mixing to act as a backup buffer under such circumstances.
- Any leachate collected from the bunded stockpiles of untreated soil is to be neutralised with lime and tested to ensure suitability for reuse on-site or for off-site disposal.
- Effectiveness of adopted dosing rates should be confirmed by regular sample screening of treated material using pH and peroxide pH field tests.
- As a precautionary measure, treatment works involving agricultural lime should not be conducted during windy conditions, unless the material can be appropriately conditioned to avoid dust generation.

- Adopt safe procedures for storage and handling of neutralising agents. This should include sufficient training of staff in health and safety relating to the use of neutralising agents.

RECORD KEEPING

Complete records of all treatment and any further verification testing shall be maintained by the construction contractor. Records should indicate as a minimum:

- Excavated soil volume.
- Photographic evidence of lime treatment and soil stockpile bunding and cover.
- Details of leachate tests, test results and test certifications.
- Calculated liming rates for leachate treatment.
- A liming register, including a list of all lime delivered to the site, verified with delivery dockets and usage details such as soil volumes treated, lime quantities used and liming rates.

VERIFICATION AND MONITORING

Suitability of the treatment plan should be verified by monitoring pH after oxidisation or oxidisable sulphur of excavated material. The following monitoring (Table 1) should be carried out to confirm acceptable neutralisation of excavated ASS and leachate.

Table 1: Recommended monitoring of excavated ASS and collected water.

Type	Frequency	Action level
Soil pH	Daily in distilled water and hydrogen peroxide[1]	<4 (in distilled water) <3 (in hydrogen peroxide)
sPOCAS/ CRS methods	1 / 50 m^3 (or part thereof) of neutralised soil	for < 1000 tonne disturbance: 0.03% oxidisable sulphur 18 molH+/t TPA/TSA
Treated Leachate Water and collected ground water for disposal	Daily	pH < 7

Notes: [1] Continued until required levels are achieved.

(Acid Sulfate Soil Assessment Guidelines 1998)

CERTIFICATIONS

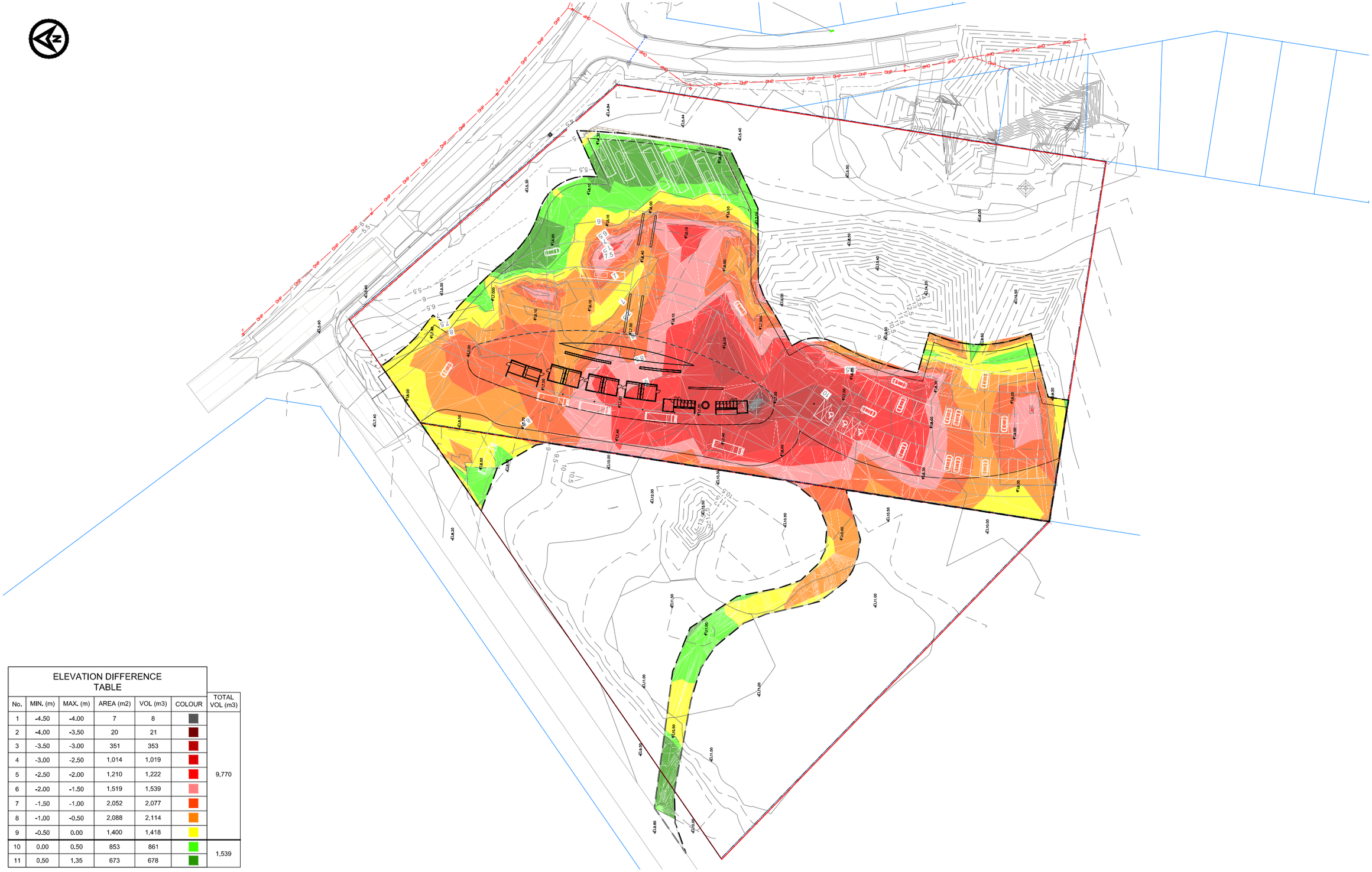
Following completion of the treatment process, a report is to be prepared by a suitably qualified person demonstrating that the requirements of this management plan have been met.

WASTE GENERATION

Excavated soils containing PASS, which are treated with lime, may be reused on-site as general fill material above the water table subject to geotechnical advice. Excess material may be disposed of to an appropriately licensed landfill facility following waste classification. Following off-site disposal of the acid sulfate soils, no further testing is required for acid sulfate soil purposes.

BIRUBI POINT

SITE GRADING PLAN



ELEVATION DIFFERENCE TABLE						
No.	MIN. (m)	MAX. (m)	AREA (m2)	VOL (m3)	COLOUR	TOTAL VOL (m3)
1	-4.50	-4.00	7	8		
2	-4.00	-3.50	20	21		
3	-3.50	-3.00	351	353		
4	-3.00	-2.50	1,014	1,019		
5	-2.50	-2.00	1,210	1,222		9,770
6	-2.00	-1.50	1,519	1,539		
7	-1.50	-1.00	2,052	2,077		
8	-1.00	-0.50	2,088	2,114		
9	-0.50	0.00	1,400	1,418		
10	0.00	0.50	853	861		1,539
11	0.50	1.35	673	678		

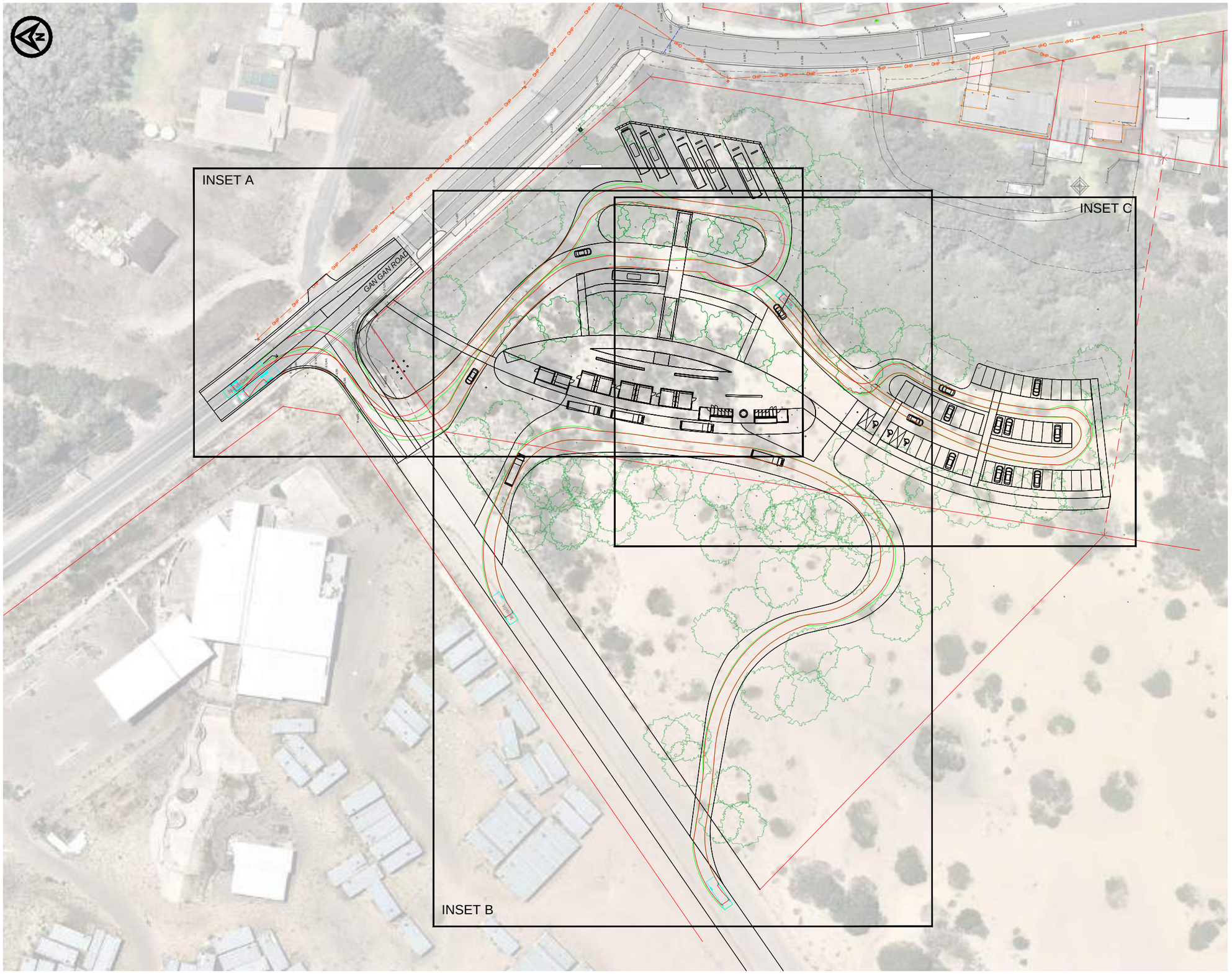
AUSTRALIAN HEIGHT DATUM

NOT FOR CONSTRUCTION

10 0 10 20 30 40 50m

1:1000 (A3) 1:500 (A1)

BIRUBI POINT
VEHICLE TRACKING
FIGURE 1



OVERVIEW PLAN
1:1000 (A3)

NOT FOR CONSTRUCTION

10 0 10 20 30 40 50m
1:1000 (A3) 1:500 (A1)

I:\PA1845\Technical_Data\~PA1845 - Birubi Point\E02 Working Drawings\1.Transport\PA1845-TR-Swept Path.dwg

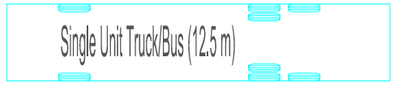
SAVED: 22-May-19

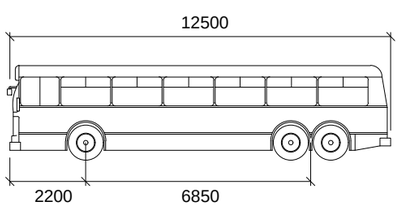
Royal HaskoningDHV
Enhancing Society Together

BIRUBI POINT
VEHICLE TRACKING
INSET A

NOTES

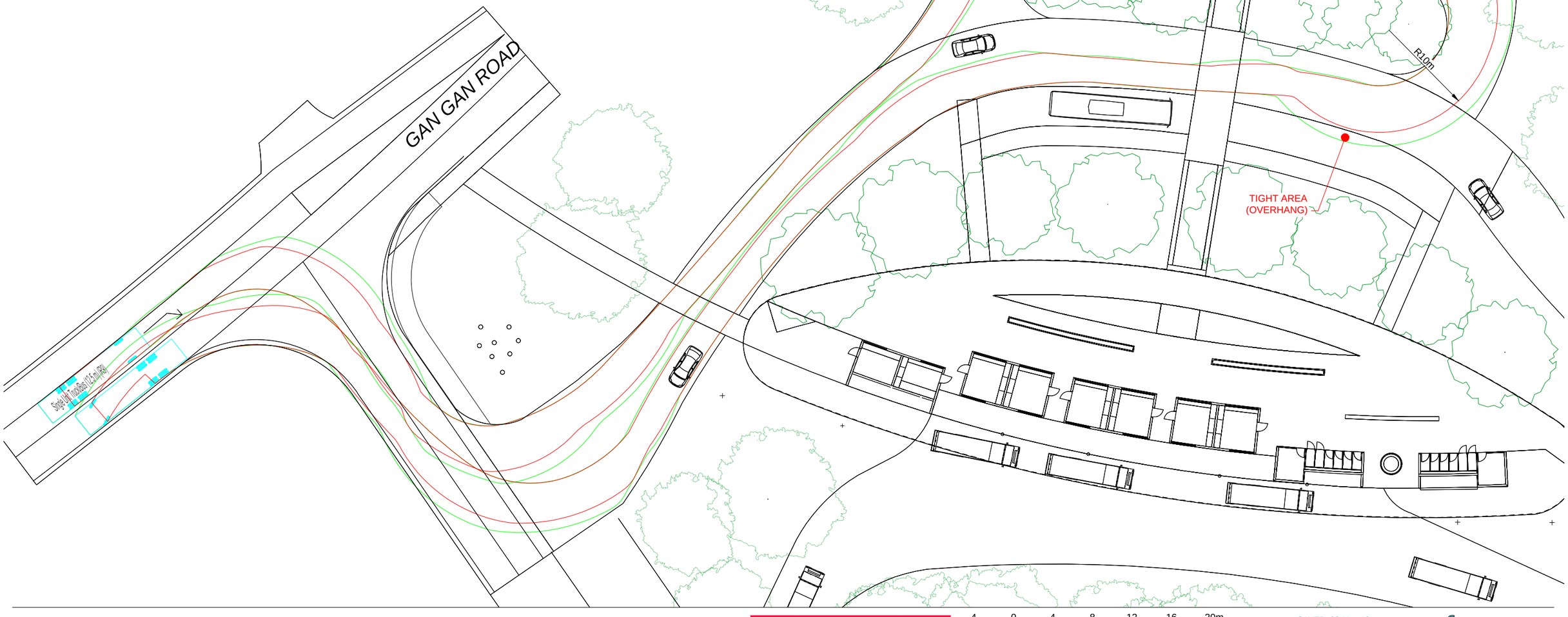
1. SINGLE UNIT TRUCK/BUS (12.5m) (AUSTROADS, 2006) USED FOR COACHES.





BUS

		mm
Width	:	2500
Track	:	2500
Lock to Lock Time	:	6.0
Steering Angle	:	36.6



I:\PA1845\Technical_Data\~PA1845 - Birubi Point\E02 Working Drawings\1.Transport\PA1845-TR-Swept Path.dwg

NOT FOR CONSTRUCTION

4 0 4 8 12 16 20m

1:400 (A3) 1:200 (A1)

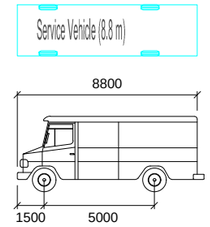
SAVED: 22-May-19

Royal HaskoningDHV
Enhancing Society Together

BIRUBI POINT
VEHICLE TRACKING
INSET B

NOTES

1. SERVICE TRUCK (8.8m) (AUSTROADS, 2006) USED FOR 4WD TOUR BUSES.



SERVICE VEHICLE

		mm
Width	:	2500
Track	:	2500
Lock to Lock Time	:	6.0
Steering Angle	:	38.7

R10m

5 0 5 10 15 20 25m

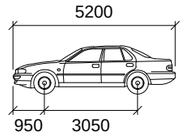
1:500 (A3) 1:250 (A1)

NOT FOR CONSTRUCTION

BIRUBI POINT
VEHICLE TRACKING
INSET C

NOTES

1. CAR/VAN VEHICLE (5.2m) (AUSTROADS, 2006)



PASSENGER-CAR

		mm
Width	:	1940
Track	:	1840
Lock to Lock Time	:	6.0
Steering Angle	:	33.6

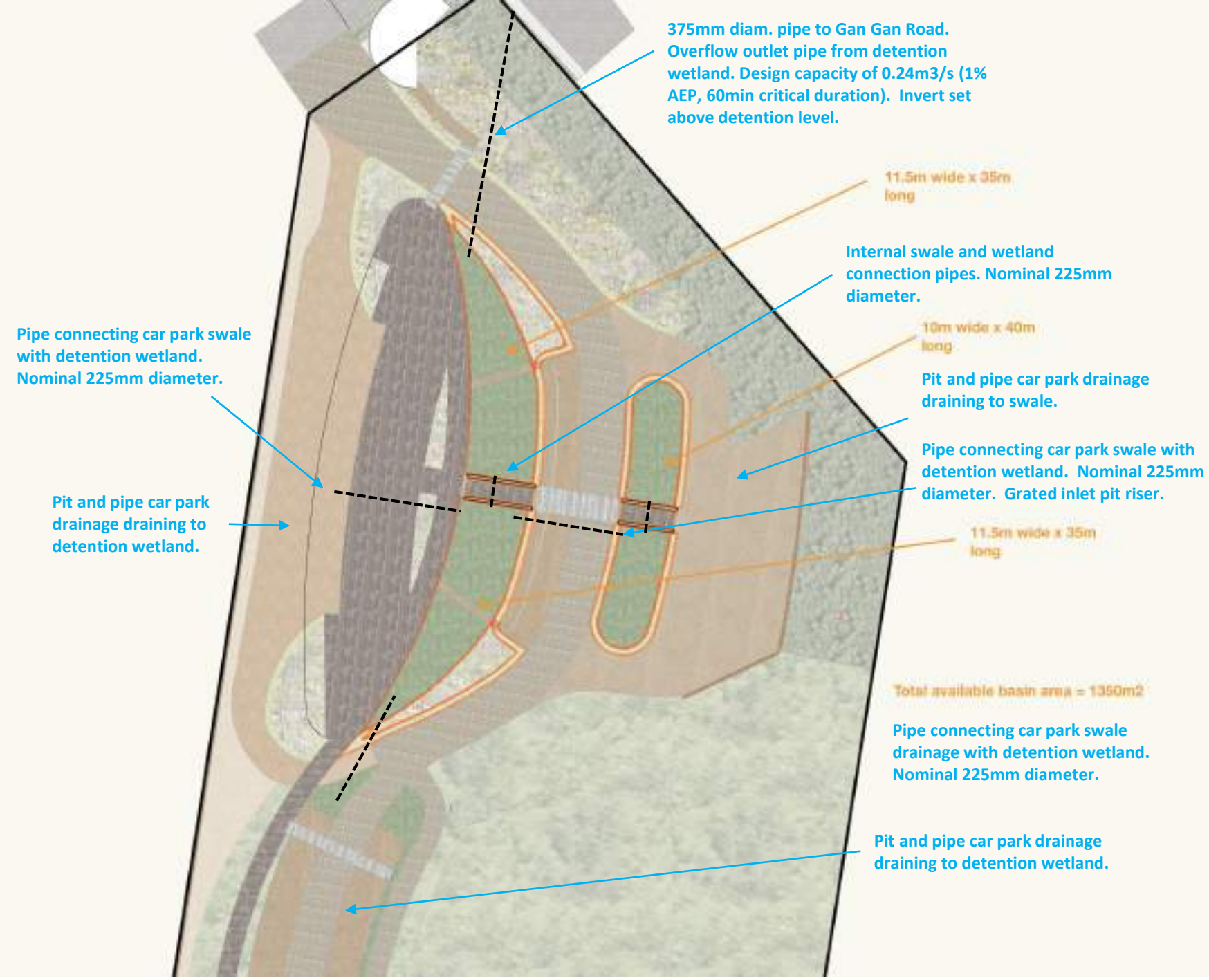

375mm diam. pipe to Gan Gan Road. Overflow outlet pipe from detention wetland. Design capacity of 0.24m3/s (1% AEP, 60min critical duration). Invert set above detention level.
11.5m wide x 35m long
Internal swale and wetland connection pipes. Nominal 225mm diameter.
Pipe connecting car park swale with detention wetland. Nominal 225mm diameter.
10m wide x 40m long
Pit and pipe car park drainage draining to swale.
Pipe connecting car park swale with detention wetland. Nominal 225mm diameter. Grated inlet pit riser.
Pit and pipe car park drainage draining to detention wetland.
11.5m wide x 35m long
Total available basin area = 1350m2
Pipe connecting car park swale drainage with detention wetland. Nominal 225mm diameter.
Pit and pipe car park drainage draining to detention wetland.

Chart No. A1-2

Discharge in cubic metres per second

Discharge in litres per second

Pipeline grade (S)

Manning's n = 0.013

VELOCITY METRES PER SECOND

INTERNAL DIAMETER

6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5

1350 mm 1200 mm 1050 mm 900 mm 750 mm 600 mm 525 mm 450 mm 375 mm 300 mm 225 mm 150 mm 100 mm

0.8 0.7 0.6 0.5 0.4 0.3 0.2 0.1 0.09 0.08 0.07 0.06 0.05 0.04 0.03 0.02 0.01 0.009 0.008 0.007 0.006 0.005 0.004

800 700 600 500 400 300 200 100 90 80 70 60 50 40 30 20 10 9 8 7 6 5 4

1/5 1/6 1/7 1/8 1/9 1/10 1/20 1/30 1/40 1/50 1/60 1/70 1/80 1/90 1/100 1/400 1/500 1/600 1/700 1/800 1/900 1/1000 1/2000 1/3000 1/4000 1/5000 1/6000 1/7000 1/8000 1/9000 1/10000

CHROFI

3/1 The Corso
Manly NSW 2095
02 8096 85 00
sydney@chrofi.com
www.chrofi.com

ACCESSIBILITY STATEMENT

BIRUBI INFORMATION CENTRE – Worimi Conservation Lands

June 2018

Introduction

On behalf of Port Stephens Council an Information Centre is proposed for the subject site, Lot 312 DP753024. This site has been identified through a process of masterplanning and community engagement. It is located on Crown Land in a RU2 zone, adjacent to E2 and RE1 lands and the Birubi Point Aboriginal Place. The site is a disturbed area of dune landscape that is framed by vegetation along Gan Gan Road and James Paterson Road. The proposed information centre has been designed as a functional asset that resolves current parking and congestion issues around visitor activity at Birubi Point. The asset consists of 1500m2 of sheltered area and provides space for dune operators and amenities, including public toilets and a kiosk. The site has 54 car parking spaces, including 3 disabled spaces, 8 coach parking spaces with a drop-off zone that can accommodate 2 coaches, and provisions for pedestrians and cyclists. Signs and landscape markers will identify the land as the entrance to the Worimi Conservation lands. The proposal includes site specific Architecture and Landscape design that is integrated with sustainable water solutions. Heritage considerations, traffic management and an ecological assessment have also been incorporated into the proposed outcome. The site will be managed by Port Stephens Council in collaboration with the Birubi Point Cultural Heritage Advisory Panel.

This Accessibility Statement is provided as a review of the proposed Birubi Information Centre, to support the Development Application to Port Stephens Council.

Approach from Coach Drop-off (CHROFI)

CHROFI

3/1 The Corso
Manly NSW 2095
02 8096 85 00
sydney@chrofi.com
www.chrofi.com

Functional Brief

The central purpose of the Birubi Information Centre is to provide for an interchange which will facilitate a world-class visitor experience providing sustainable access and connectivity to the Worimi Conservation Lands, while allowing for increased services and additional amenities catering to future visitor demand.

The following uses are to be accommodated:

- Provide a Gateway arrival experience to the Worimi Conservation Lands
- Provide dedicated and clearly delineated parking zones for bicycles, cars and tourist coaches
- An arrival and embarkation spatial sequence
- Coach parking for ten 55-seat coaches
- Coach passenger set down zone (2 x coaches) near interchange
- Visitor Car parking (including accessible spaces) for at least 50 vehicles,
- Allow for 8 x 4WD operators with the following:
    - 1 booth/kiosk per operator for selling of tickets, distribution of pamphlets, answering of questions (allow for counter for 2 staff, 2 workstations, coffee/tea making, printer, bar fridge – nom 4x3m)
    - Total adjacent parallel parking for 1 x 4WD vehicle per operator to allow for pick up and set down activities;
    - Additional nearby lay-by parking for 16 x 4WD vehicles;
- Shaded and protected waiting areas for visitors, passengers and tour customers (incl undercover seating)
- Toilet facilities – provide (for visitors and staff):
    - 5 female WC pans; 2 male pans, 3 male urinals; 1 unisex accessible WC; 6 common handwash basins
- Visual viewpoints and physical access points to the adjacent Aboriginal Place, the National Park and the Worimi Conservation Lands
- Office for Site/ Facility/ Grounds Management?
- Waste Storage:
    - 12 x 240L wheelie bins for co-mingled garbage and recyclables – stored and locked in a secure, well ventilated room/cage near operator booths – wheeled out each day by operators for visitor use;
    - 2 x 3 cubic metre skip bins to be well screened near carpark – lockable to prevent after-hours access

CHROFI

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Manly NSW 2095
02 8096 85 00
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Objectives

This review considers user groups of the proposed development, who include staff and visitors and attempts to ensure equality, independence and functionality to people with disabilities inclusive of people with sensory, mobility and dexterity impairments. This review seeks to eliminate, as far as possible, discrimination against people on the grounds of disability.

Statutory Requirements

The following standards and regulatory controls have been considered in this review:

AS 1428.1 (2009) – Design for Access and Mobility

AS 2890.6 (2009) – Car Parking for People with a Disability

NCC – National Construction Code 2016

Port Stephens Council Development Control Plan 2018 (amendment no.4)

DDA - Disability Discrimination Act

Site Access, Paths of Travel

In general, the circulation spaces and paths of travel across the site providing access to and from coach parking and drop-off areas and to and from car parking will be of an appropriate compliant width and grade and will be wheelchair accessible.

Access to and within the interchange, including circulation within sanitary facilities, operator kiosks, food service outlet and site manager office will be wheelchair accessible.

Sanitary Facilities

There is a bank of male and female toilets at the south end of the Interchange. There is also a unisex accessible toilet for wheelchair users. The accessible toilet has an internal dimension compliant with AS 1428.1 (2009). All fixtures within the accessible toilet will be located in accordance with AS1428.1

There is an ambulant cubicle within both the male and female toilets. Both ambulant cubicles will have appropriate clearance at the cubicle door compliant with AS1428.1.

Accessible Carparking

There are a total of 50 car parking bays for use by visitors and staff. Of that total, there are a total of three (3) accessible car parking bays, located in close proximity to the Information Centre. This is in accordance with Section B9 – Road Network and Parking of the Port Stephens DCP. Each of the 3 accessible car spaces have been set out in accordance with AS2890.6(2009).

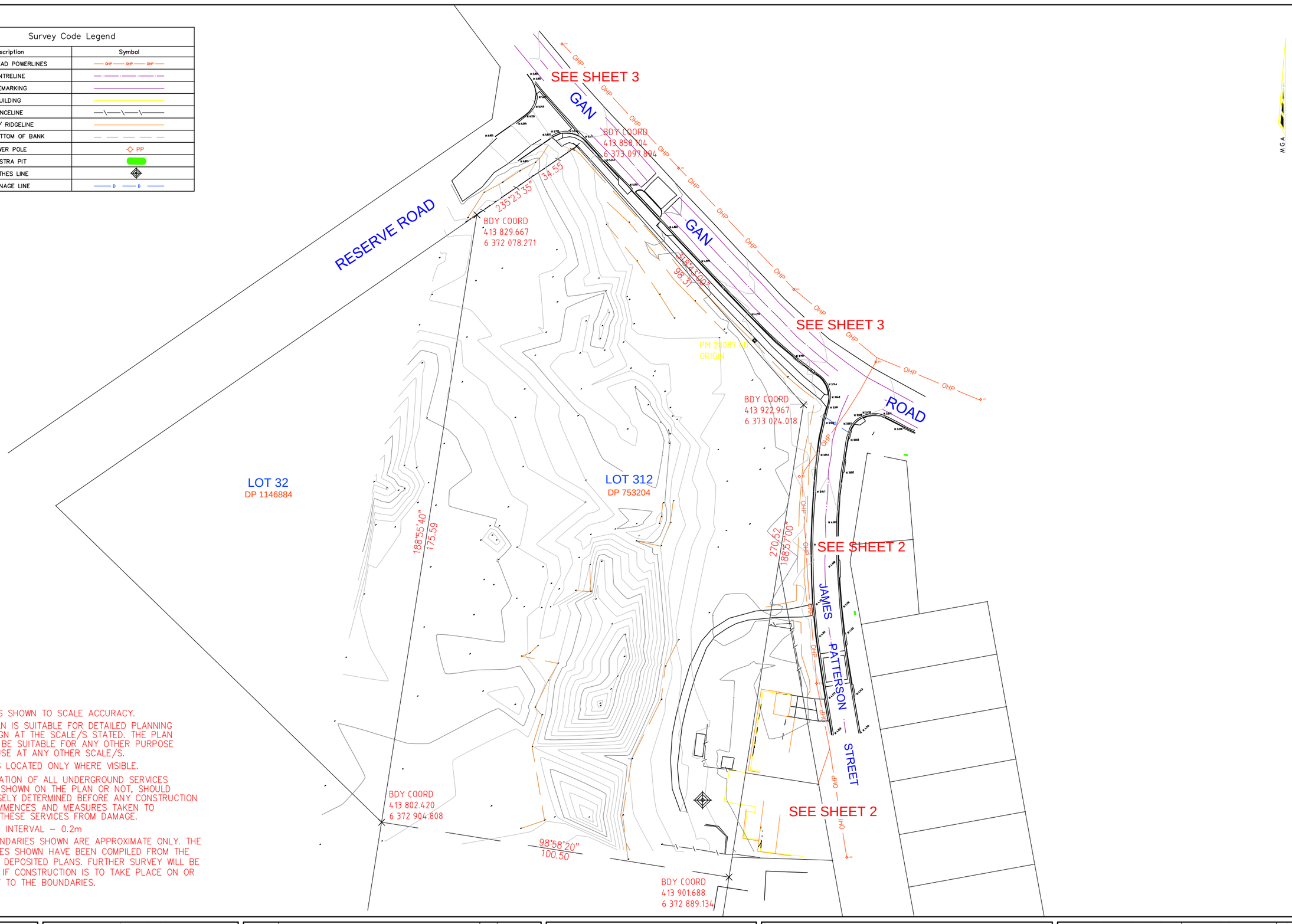
Signage

Signage shall comply with the BCA clause D3.6 (signage specifications)

Lighting

Levels of illumination will comply with AS1680.

Survey Code Legend	
Description	Symbol
OVERHEAD POWERLINES	OHP
CENTRELINE	
LINEMARKING	
BUILDING	
FENCELINE	
ROOF/ RIDGELINE	
TOP/BOTTOM OF BANK	
POWER POLE	PP
TELSTRA PIT	
CLOTHES LINE	
DRAINAGE LINE	D



NOTES :

1. FEATURES SHOWN TO SCALE ACCURACY.
2. THIS PLAN IS SUITABLE FOR DETAILED PLANNING AND DESIGN AT THE SCALE/S STATED. THE PLAN MAY NOT BE SUITABLE FOR ANY OTHER PURPOSE OR FOR USE AT ANY OTHER SCALE/S.
3. SERVICES LOCATED ONLY WHERE VISIBLE.
4. THE LOCATION OF ALL UNDERGROUND SERVICES WHETHER SHOWN ON THE PLAN OR NOT, SHOULD BE PRECISELY DETERMINED BEFORE ANY CONSTRUCTION WORK COMMENCES AND MEASURES TAKEN TO PROTECT THESE SERVICES FROM DAMAGE.
5. CONTOUR INTERVAL – 0.2m
6. THE BOUNDARIES SHOWN ARE APPROXIMATE ONLY. THE BOUNDARIES SHOWN HAVE BEEN COMPILED FROM THE RELEVANT DEPOSITED PLANS. FURTHER SURVEY WILL BE REQUIRED IF CONSTRUCTION IS TO TAKE PLACE ON OR ADJACENT TO THE BOUNDARIES.

DATUM PM 28087
A.H.D. RL 4.075

SURVEY :	K HUMPHRIES	20/11/15
DESIGNED :	--	--
CHECKED :	J EVANS	25/11/15

Scales @ A3

0 1 2 3 4 5 10 15 20 25

Bar Scale 1: 250 (A1), 1: 500 (A3)

Date	Amendment	Rev	Officer
26/11/15	DETAIL SURVEY	A	KH

Project: BIRUBI TOURISM INTERCHANGE
DETAIL AND BOUNDARY SURVEY

Drawing Title:

Trim File No: PSC2014 13-00487 | Job No: 2015-53 | Revision: A

Plan No:

FOR DESIGN

SHEET No: 1 of 3

Date 26/11/15

Sheet Size A3

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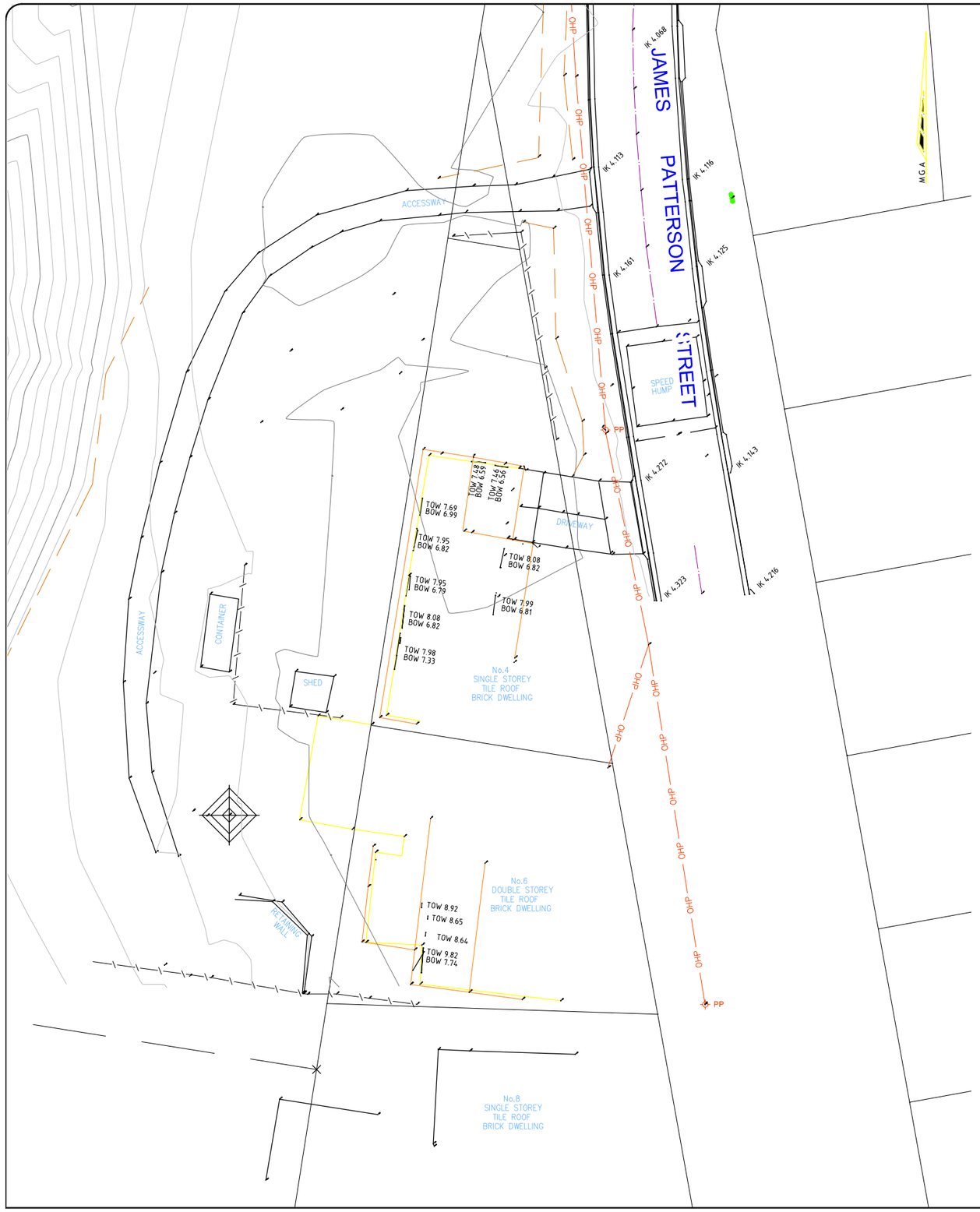

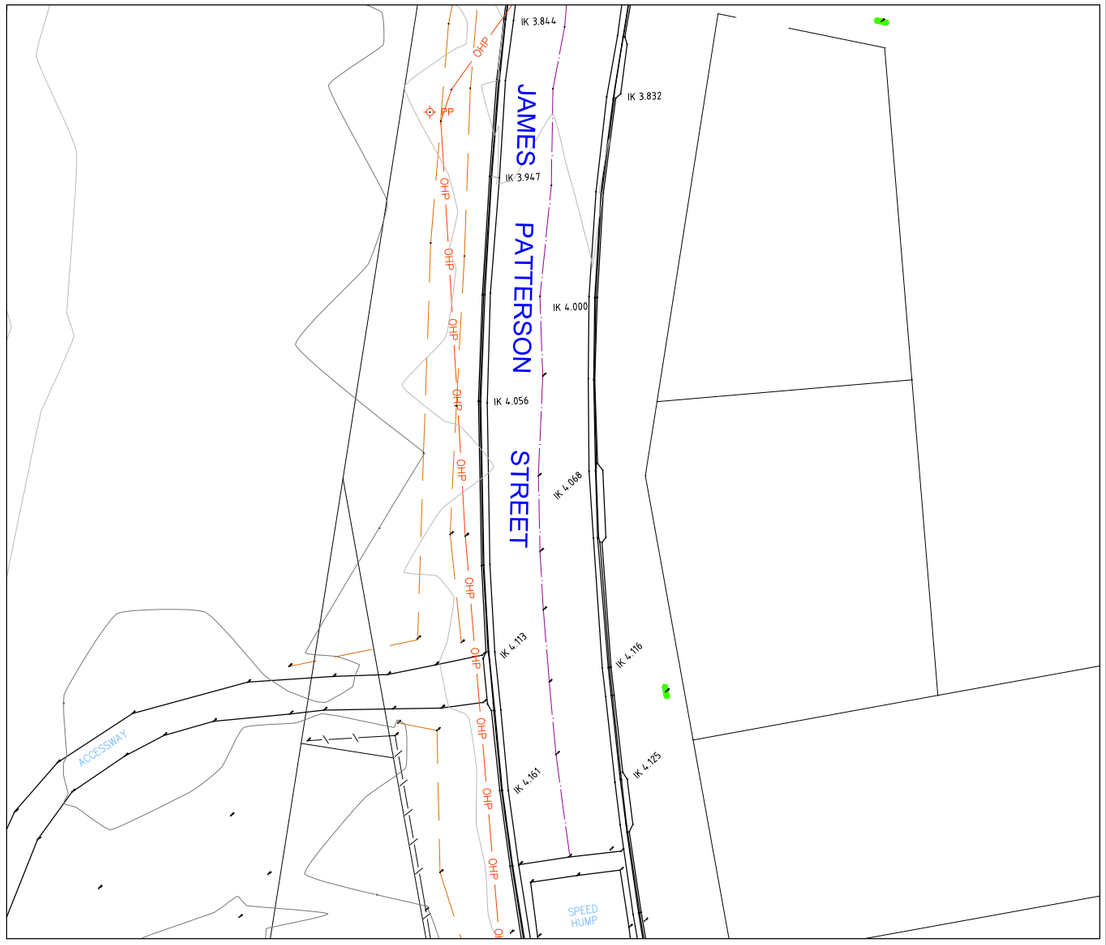

DATUM	PM 28087		
A.H.D.	RL 4.075		
SURVEY : K HUMPHRIES	20/11/15		
DESIGNED : --	--		
CHECKED : J EVANS	25/11/15		

Scales @ A3

0 1 2 3 4 5 7.5 10

Bar Scale 1: 100 (A1), 1: 200 (A3)

Date	Amendment	Rev	Officer
26/11/15	DETAIL SURVEY	A	KH

Project:
BIRUBI TOURISM INTERCHANGE
DETAIL AND BOUNDARY SURVEY

Drawing Title:

Trim File No: PSC2014 13-00487	Job No: 2015-53
Plan No:	

FOR DESIGN

Revision:	A
SHEET No:	2 of 3
Date	26/11/15
Sheet Size	A3

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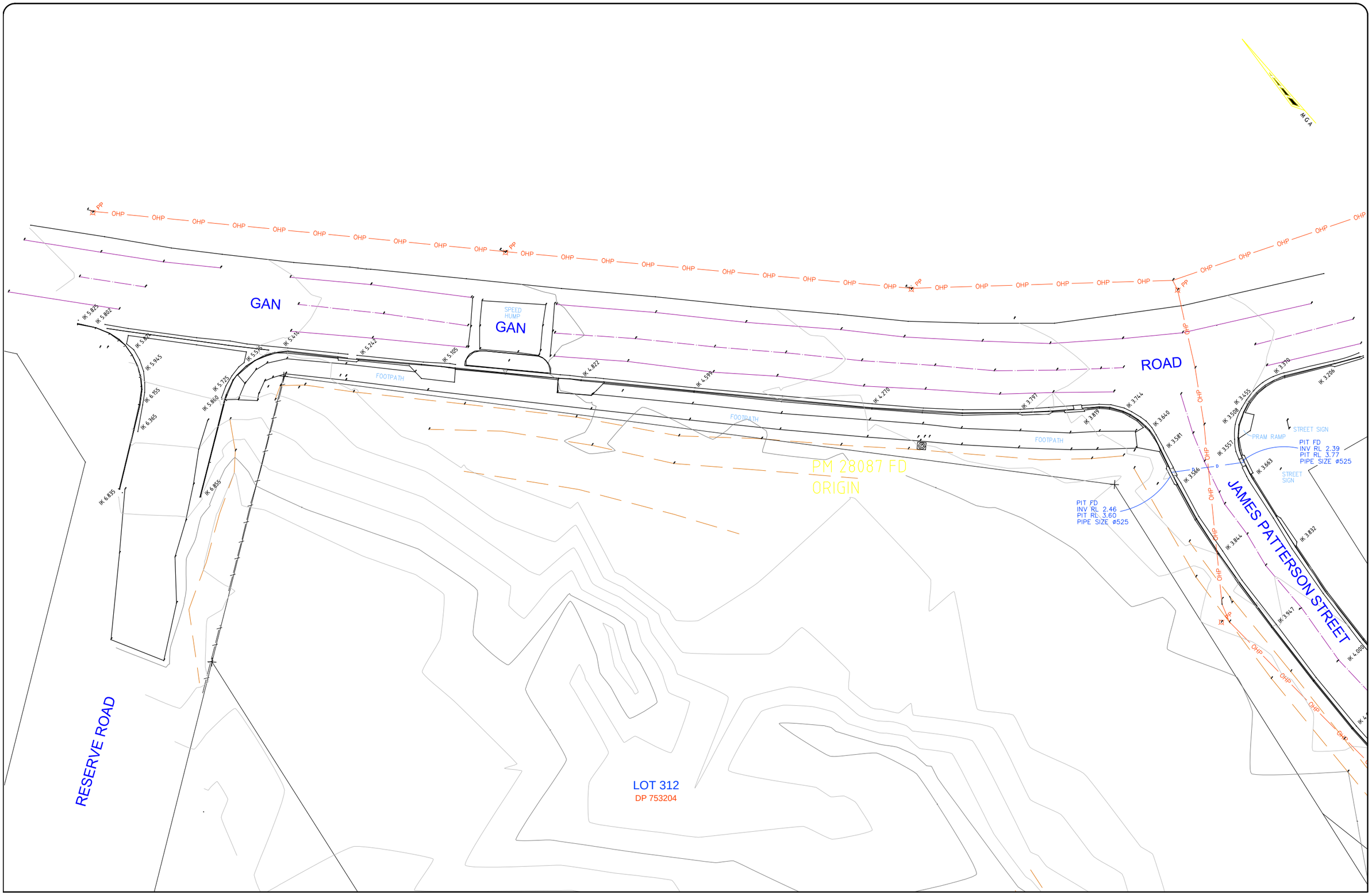

DATUM	PM 28087		
A.H.D.	RL 4.075		
SURVEY : K HUMPHRIES	20/11/15		
DESIGNED : --	--		
CHECKED : J EVANS	25/11/15		

Scales @ A3

0 1 2 3 4 5 7.5 10

Bar Scale 1: 100 (A1), 1: 200 (A3)

Date	Amendment	Rev	Officer
26/11/15	DETAIL SURVEY	A	KH

Project: BIRUBI TOURISM INTERCHANGE
DETAIL AND BOUNDARY SURVEY

Drawing Title:

Trim File No: PSC2014 13-00487 | Job No: 2015-53

Plan No:

FOR DESIGN

Revision: A
SHEET No: 3 of 3
Date 26/11/15
Sheet Size A3

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COST PLAN

mbm

Birubi Information Centre

Cost Plan 2 - Stage 1

McGregor Coxall

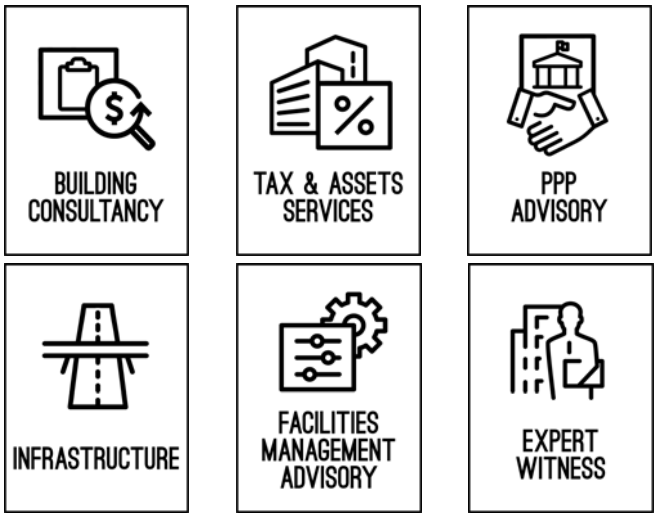
0119-0021

Birubi Information Centre

McGregor Coxall

Cost Plan 2 - Stage 1

mbm Experts DELIVERING CERTAINTY



Project Number: 0119-0021	**Reviewed By:** Matthew Mead / David Madden	**Prepared By:** Autumn Lu
Document Title	Issued To:	Issue Date:
Cost Plan 02	McGregor Coxall	27 June 2018

SUMMARY

Client: McGregor Coxall
Project: Birubi Information Centre

Details: Cost Plan 2 - Stage 1
MBM0119-0021
Date - 27/06/2018

Code	Description	Page	% of Cost	Cost/m2	Total
1	**STAGE ONE**				
2	Introduction	4			0
3	Consultants	4			0
4	Drawings	4			0
5	Exclusions	4			0
6	Demolition	5	0.96		57,600
7	Groundworks	5	7.03		421,070
8	Roads, Footpaths and Paved Areas	5	15.27		915,346
9	Fitments and Furniture	6	1.49		89,400
10	Signs and Display	6	2.25		135,000
11	Boundary Walls, Fences and Gates	6	3.75		224,496
12	Outbuildings and Covered Ways	6	28.41		1,702,936
13	Landscaping	9	6.00		359,575
14	Services	9	4.92		294,719
15	**Subtotal Trade Cost**		70.08		**4,200,143**
16	Preliminaries (10%)		7.01		420,014
17	Margin (4%)		3.08		184,806
18	**Subtotal Construction Cost**		80.17		**4,804,963**
19	Professional Fees (8%)		6.41		384,397
20	Escalation - to Construction Commencement (say Dec 2019, 5%)		4.33		259,468
21	Design and Construction Contingency (10%)		9.09		544,883

GFA: 0.00 m2 Cost/m2 (excl GST): N/A/m2 **Project Total (excl GST): 5,993,711**

REPORT DETAILS

Client: McGregor Coxall
Project: Birubi Information Centre

Details: Cost Plan 2 - Stage 1
MBM0119-0021
Date - 27/06/2018

Code	Description	Quantity	Unit	Rate	Amount
2	**Introduction**				
2.1	**Cost Plan 2 - Stage 1**				
2.2	*Project: Birubi Information Centre*				
2.3	*Client: McGregor Coxall*				
2.4	Prepared By: Autumn Lu				
2.5	Reviewed By: Matthew Mead / David Madden				
2.6	**Introduction**				
2.7	This cost plan has been developed to assist with the estimated cost of works to develop the Birubi Information Centre Stage 1		note		
2.8	This cost plan is based on our professional opinion and the source material listed below.		note		
2.9	Owing to the conceptual nature of the current design we have made various assumptions regarding the construction material and methodology. The estimate should therefore be considered as indicative only		note		
2.10	**Issue Schedule**				
2.11	Cost Plan 1 - 21/06/2018		note		
2.12	Cost Plan 2 - 27/06/2018		note		
					0
3	**Consultants**				
3.1	Architect				
3.2	Chrofi				
3.3	Landscape Architect				
3.4	McGregor Coxall				
3.5	Quantity Surveyor				
3.6	MBMpl Pty Ltd				
					0
4	**Drawings**				
4.1	Drawings received on 06 June 2018				
4.2	Pre-DA costing package developed by Chrofi dated 06/06/2018				
4.3	Drawings received on 19 June 2018				
4.4	DA Draft Architectural package developed by Chrofi Iss01 dated 19/06/2018				
4.5	Landscape Design Report developed by McGregor Coxall RevA dated 19/06/2018				
4.6	Drawings received on 26 June 2018				
4.7	LD-SK-05 Landscape Plan developed by McGregor Coxall RevB dated 26/06/2018				
					0
5	**Exclusions**				
5.1	Items noted "EXCL" in the Cost Plan		item		EXCL
5.2	Irrigation to planting		item		EXCL

Code	Description	Quantity	Unit	Rate	Amount
5.3	Archaeological investigation cost beyond what has been allowed in professional fees		item		EXCL
5.4	Unknown Site conditions in excess of allowances made		item		EXCL
5.5	Any works outside the extent of works shown on the drawings		item		EXCL
5.6	Legal costs, Land holding cost, stamp duty etc		item		EXCL
5.7	Out of hours works		item		EXCL
5.8	Financial Holding and Interest Costs		item		EXCL
5.9	Operation and Maintenance costs for the Amenities Building and Kiosks		item		EXCL
					0
6	**Demolition**				
6.1	Remove vegetation - trees & shrubs	4,660	m2	10.00	46,600
6.2	Removal of existing large trees	2	No	500.00	1,000
6.3	Allowance to protect existing trees and shrubs to be retained	1	Item	10,000.00	10,000
					57,600
7	**Groundworks**				
7.1	**Dewatering**				
7.2	Allowance for keeping excavation free from water	1	Item	20,000.00	20,000
7.3	**Bulk Excavation**				
7.4	Cut to fill (quantity advised by Chrofi)	2,500	m3	30.00	75,000
7.5	Excavate over site including dispose off-site as VENM (quantity advised by Chrofi)	3,500	m3	50.00	175,000
7.6	Form batters to surface of excavation for Swale	1,450	m2	15.00	21,750
7.7	**Site Preparation**				
7.8	Trim, grade over site to receive pavements and compact surface of excavation to 100% SMDD	6,466	m2	20.00	129,320
					421,070
8	**Roads, Footpaths and Paved Areas**				
8.1	**Pavements**				
8.2	Crushed Stabilised Rock Carparking Area compacted at 92% including excavation, 75mm deep drainage aggregate and geotextile layer	2,180	m2	65.00	141,700
8.3	Permeable Paving Roads, comprising turf grid paver (paver $75/m2 supply only) laid on 30mm sand bed, geotextile layer and 150mm thick base course, including excavation and drainage aggregate infill	1,800	m2	175.00	315,000
8.4	Decomposed Granite Coach Parking Area spread, leveled and compacted, including excavation, 75mm gravel and 100mm base course	900	m2	45.00	40,496
8.5	Insitu Concrete Footpath, comprising 125mm reinforced concrete slab on ground including 25mm compacted sandstone base course, 25MPa concrete, formwork and mesh reinforcement	240	m2	85.00	20,400
8.6	Concrete Precast Decking to bridge footpaths, comprising 200mm thk concrete slab and 400mm wide x 600mm depth piers to both sides	60	m2	1,000.00	60,000
8.7	Hardwood Floor Decking to boardwalk, comprising support framing, 23mm thick flooring and staining finish	550	m2	250.00	137,500
8.8	Hardwood Floor Decking under roof structure, comprising support framing, 23mm thick flooring and staining finish	481	m2	250.00	120,250

Code	Description	Quantity	Unit	Rate	Amount
8.9	**Existing Road**				
8.10	Allowance for upgrading existing intersection	1	Item	80,000.00	80,000
8.11	**Edges**				
8.12	Allowance for precast concrete edges to landscape area	1,055	m		Excluded
					915,346
9	**Fitments and Furniture**				
9.1	**Furniture**				
9.2	Precast concrete integrated seating along boardwalk edge	17	m	1,200.00	20,400
9.3	Precast concrete communal hand wash zone	7	m	2,000.00	14,000
9.4	**Wheel stops**				
9.5	1800mm Precast concrete wheel stops	60	No	150.00	9,000
9.6	**Line Marking / Traffic wayfinding**				
9.7	General allowance for line marking / traffic wayfinding	1	Item	25,000.00	25,000
9.8	**Bollards**				
9.9	Allowance for removable bollards (assumed required)	30	No	700.00	21,000
					89,400
10	**Signs and Display**				
10.1	Allowance for general wayfinding	1	Item	35,000.00	35,000
10.2	Allowance for gateway markers / signage	1	Item	100,000.00	100,000
					135,000
11	**Boundary Walls, Fences and Gates**				
11.1	**Retaining Walls**				
11.2	600 x 400mm Reinforced concrete strip footing c.o.p. to retaining wall including excavation, 25MPa concrete and reinforcement (80 kg/m3) (assumed size of footing)	358	m	140.00	50,121
11.3	Sandstone retaining wall including backfilling against wall (allowed 1m average height)	358	m2	450.00	161,100
11.4	**Fences**				
11.5	Barrier fence for dune stablisation	177	m	75.00	13,275
					224,496
12	**Outbuildings and Covered Ways**				
12.1	Specifications assumed, subject to change based on structural engineers advice		Note		
12.2	**Amenities Building**				
12.3	Structure				
12.4	600 x 600mm Reinforced concrete strip footing to edge of external walls including detail excavation, 25MPa concrete and bar reinforcement (80kg/m3)	38	m	200.00	7,600
12.5	150mm Reinforced concrete slab on ground with exposed aggregate finish concrete slab including 100mm base course, 50mm sand blinding, 32MPa concrete, formwork, mesh reinforcement and finish	58	m2	120.00	6,960

Code	Description	Quantity	Unit	Rate	Amount
12.6	190mm Corefilled blockwork walls with N16 vertical reinforcement at 400mm centres and render finish to both sides	168	m2	260.00	43,680
12.7	Single door including frame, hardware and paint finish	3	No	1,200.00	3,600
12.8	Roofing				
12.9	Roof framing	58	m2	120.00	6,960
12.10	Metal roof sheeting	58	m2	90.00	5,220
12.11	Insulation and sarking to soffit of roof	58	m2	20.00	1,160
12.12	Roof plumbing	58	m2	30.00	1,740
12.13	Finishes				
12.14	External Wall Cladding comprising hardwood battens over 28mm furring channel fixed to blockwork external wall to one side	119	m2	175.00	20,825
12.15	Extra Over for cladding over single doors	3	No	1,000.00	3,000
12.16	Wall tiling to Amenities	122	m2	150.00	18,300
12.17	Tiled flooring to Amenities	36	m2	120.00	4,320
12.18	Moisture resistant plasterboard suspended ceiling including painting to Amenities	36	m2	110.00	3,960
12.19	Toilet Accessories				
12.20	Toilet cubicles	7	No	3,000.00	21,000
12.21	Toilet paper holder	8	No	300.00	2,400
12.22	Grab rails in disabled toilet	1	No	2,500.00	2,500
12.23	Soap dispenser in disabled toilet	1	No	200.00	200
12.24	Mirror over hand basin in disabled toilet	1	No	400.00	400
12.25	Hand dryer in disabled toilet	1	No	600.00	600
12.26	Baby changing station in disabled toilet	1	No	750.00	750
12.27	**Operator Kiosk**				
12.28	Fit out to be completed by others as advised		Note		
12.29	Structure				
12.30	600 x 600mm Reinforced concrete strip footing to edge of external walls including detail excavation, 25MPa concrete and bar reinforcement (80kg/m3)	105	m	200.00	21,000
12.31	150mm Reinforced concrete slab on ground with exposed aggregate finish concrete slab including 100mm base course, 50mm sand blinding, 32MPa concrete, formwork, mesh reinforcement and finish	165	m2	120.00	19,800
12.32	92mm External stud wall with 13mm plasterboard to one side, 75mm thick 11kg/ m3 insulation to cavity	265	m2	85.00	22,525
12.33	92mm Internal stud wall with 13mm plasterboard to both sides, 75mm thick 11kg/ m3 insulation to cavity	56	m2	115.00	6,440
12.34	Powder-coated aluminum operable windows comprising single glazed solar performance laminated safety glass	54	m2	1,500.00	81,000
12.35	Single door including frame, hardware and paint finish	8	No	1,200.00	9,600
12.36	Roofing				
12.37	Roof framing	165	m2	120.00	19,800
12.38	Metal roof sheeting	165	m2	90.00	14,850
12.39	Insulation and sarking to soffit of roof	165	m2	20.00	3,300
12.40	Roof plumbing	165	m2	30.00	4,950

Code	Description	Quantity	Unit	Rate	Amount
12.41	Finishes				
12.42	External Wall Cladding comprising hardwood battens over 28mm furring channel for external stud wall to one side	336	m2	315.00	105,840
12.43	Extra Over for cladding over single doors	8	No	700.00	5,600
12.44	Extra Over for operable awning with timber batten panel including HDG steel frame and gas struts (manually operated)	73	m2	200.00	14,600
12.45	Set plasterboard ceiling including support system	141	m2	105.00	14,805
12.46	**Site Manager / Food Kiosk**				
12.47	Food kiosk fit out to be completed by others as advised		Note		
12.48	Structure				
12.49	600 x 600mm Reinforced concrete strip footing to edge of external walls including detail excavation, 25MPa concrete and bar reinforcement (80kg/m3)	25	m	200.00	5,000
12.50	150mm Reinforced concrete slab on ground with exposed aggregate finish concrete slab including 100mm base course, 50mm sand blinding, 32MPa concrete, formwork, mesh reinforcement and finish	35	m2	120.00	4,200
12.51	92mm External stud wall with 13mm plasterboard to one side, 75mm thick 11kg/ m3 insulation to cavity	68	m2	85.00	5,780
12.52	92mm Internal stud wall with 13mm plasterboard to both sides, 75mm thick 11kg/ m3 insulation to cavity	36	m2	115.00	4,140
12.53	Powder-coated aluminum operable windows comprising single glazed solar performance laminated safety glass	8	m2	1,500.00	12,000
12.54	Single door including frame, hardware and paint finish	2	No	1,200.00	2,400
12.55	Roofing				
12.56	Roof framing	35	m2	120.00	4,200
12.57	Metal roof sheeting	35	m2	90.00	3,150
12.58	Insulation and sarking to soffit of roof	35	m2	20.00	700
12.59	Roof plumbing	35	m2	30.00	1,050
12.60	Finishes				
12.61	External Wall Cladding comprising hardwood battens over 28mm furring channel for external stud wall to one side	80	m2	315.00	25,200
12.62	Extra Over for cladding over single doors	2	No	700.00	1,400
12.63	Extra Over for operable awning with timber batten panel including HDG steel frame and gas struts (manually operated)	18	m2	200.00	3,600
12.64	Set plasterboard ceiling including support system	18	m2	105.00	1,890
12.65	Tiled flooring to site manager office	10	m2	120.00	1,200
12.66	Timber skirting to site manager office	13	m	30.00	390
12.67	Paint to walls of site manager office	36	m2	12.00	432
12.68	Joinery				
12.69	Working bench to site manager office	5	m	1,200.00	6,000
12.70	**Large Shelter Structure**				
12.71	Structure				
12.72	Reinforced concrete supporting footing to columns	16	No	2,500.00	40,000
12.73	Structural steel columns including base plate, timber inlay and galvanizing finish	16	No	6,000.00	96,000
12.74	Structural steel roof framing	1,341	m2	260.00	348,660
12.75	Roofing				

Code	Description	Quantity	Unit	Rate	Amount
12.76	Barrel rolled polycarbonate roof sheeting	1,341	m2	300.00	402,300
12.77	Expanded metal mesh ceiling to soffit of roof	1,341	m2	110.00	147,510
12.78	Allowance for 1.5m wide rainwater spitter to one side of roof perimeter c.o.p.	91	m	950.00	86,450
					1,702,936
13	**Landscaping**				
13.1	**Top Soil**				
13.2	Swale comprising of 150mm deep cultivated subgrade, 200mm deep site topsoil, 50-100mm crushed sandstone rubble and 50mm organic mulch	1,450	m2	38.00	55,100
13.3	Understory Planting with shrubs comprising of 150mm deep cultivated subgrade, soil conditioner, 200mm deep site topsoil and 50mm organic mulch	1,500	m2	28.00	42,000
13.4	Extra Over for tree pits	35	no	55.00	1,925
13.5	**Swale Planting**				
13.6	Native grass planting to Swale (assumed 50mm, 7 no. per m2)	10,150	No	7.00	71,050
13.7	**Understory Planting**				
13.8	Native grass planting (assumed 50mm, 5 no. per m2)	7,500	No	7.00	52,500
13.9	Native shrubs (assumed 150mm pot size, 2 no. per m2)	3,000	No	14.00	42,000
13.10	**Trees**				
13.11	Proposed trees (assumed quantity)	35	no	1,000.00	35,000
13.12	**Establishment**				
13.13	Allowance for establishment and maintenance	1	item	60,000.00	60,000
					359,575
14	**Services**				
14.1	**Service Trenching**				
14.2	Trenching for in ground stormwater, power, sewer and water supply extension including backfill	150	m	200.00	30,000
14.3	**Stormwater Drainage**				
14.4	Allowance for connecting stormwater	1	Item	5,000.00	5,000
14.5	Allowance for piping connecting swales	1	Item	10,000.00	10,000
14.6	**Hydraulic Services**				
14.7	Sanitary Fixtures (installation priced within pipework & reticulation)				
14.8	WC suites (PC supply WC $770; seat $140)	7	No	910.00	6,370
14.9	Single stall urinals (PC supply $730)	3	No	730.00	2,190
14.10	Disabled WC suites (PC supply WC $840; seat $170)	1	No	1,010.00	1,010
14.11	Basin in disabled toilet (PC supply basin $420; tapware $550)	1	No	970.00	970
14.12	Prefabricated concrete basins with stainless steel fixtures (PC supply basin $700 each; tapware $490 each)	6	No	1,190.00	7,140
14.13	Floor drain	3	No	210.00	630
14.14	Hydraulic Supply				
14.15	Allowance for sewer connection	1	Item	25,000.00	25,000
14.16	Allowance for extension of water and sewer	1	Item	15,000.00	15,000
14.17	Pipework and reticulation	1	Item	31,200.00	31,200

Code	Description	Quantity	Unit	Rate	Amount
14.18	Provision for hot water supply	1	Item	5,000.00	5,000
14.19	Provision for gas supply (assume not required)	1	item		EXCL
14.20	Provision for hose reels & hydrants	1	item	13,000.00	13,000
14.21	Provisions for 50kl tank for WC including connections and associated pumps	1	item	50,000.00	50,000
14.22	**Fire Services**				
14.23	Assumed no wet fire services required		Note		
14.24	Provision for fire extinguishers (allow 4 nos)	1	item	1,600.00	1,600
14.25	Supply and install fire alarm, speakers, smoke detectors etc to amenities building and kiosks	257	m2	25.00	6,425
14.26	**Electrical Services**				
14.27	Allow for transformer upgrade (assumed not required)	1	Item		EXCL
14.28	Allowance for connecting power	1	Item	25,000.00	25,000
14.29	Allowance for extension of power	1	Item	10,000.00	10,000
14.30	Provisional Sum for service pits (not shown on drawings)	1	Item	15,000.00	15,000
14.31	Wall mounted electrical distribution board installed to false wall	1	Item	2,500.00	2,500
14.32	Lighting allowance is for day time activities only		Note		
14.33	Allow for pathway lighting (Not required)	1	Item		EXCL
14.34	Luminaries to amenities building and kiosks	257	m2	50.00	12,850.00
14.35	Spot light fitting installed inside ceiling above mesh (assumed quantity)	40	No	120.00	4,800
14.36	**BWIC**				
14.37	Allowance for builders work in connection (5%)	1	item	14,034.25	14,034
					294,719

DISCLAIMER

Client: McGregor Coxall
Project: Birubi Information Centre

Details: Cost Plan 2 - Stage 1
MBM0119-0021
Date - 27/06/2018

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This report is qualified in its entirety by and should be considered in the light of the agreed terms of engagement and the following:

This report has been prepared for the exclusive use of the Addressee and shall not be relied upon by any other third party for any other purposes unless expressly permitted or required by law and then only in connection with the purpose in respect of which this report is provided.

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MBM has used its reasonable endeavour so that the data contained in this report reflects the most accurate and timely information available and is based on information that was current as of the date of this report.

The preparation of this report has relied on information provided by the Addressee and by third parties. MBM has not verified this information and we assume no responsibility and make no representations with respect to adequacy, accuracy or completeness of such information.

This report is based on estimates, assumptions and other information developed by MBM from our independent research, intelligence, general knowledge of the industry and consultations with the addressee, addressee employee and representatives.

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OUR LOCATIONS

MBM has offices in Sydney, Melbourne, Brisbane, Perth, Canberra, Adelaide and the Gold Coast.

We operate as a single entity and are able to utilise specialised skills from any office to deliver a successful outcome for your project or development.

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wa@mbmpl.com.au

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07 5591 6732
gc@mbmpl.com.au

Adelaide
Balcony Level
109 Gays Arcade
Adelaide 5000
08 8423 4540
sa@mbmpl.com.au

Development and/or Construction Certificate Application Form

Under Section 4.12 Environmental Planning and Assessment Act 2017

116 Adelaide Street,
Raymond Terrance NSW 2324

PO Box 42
Raymond Terrace NSW 2324

p (02) 49880255 | **f** (02) 49873612
e council@portstephens.nsw.gov.au

DX 21406 | **ABN** 16 744 377 876

FOR OFFICE USE ONLY	Date lodged		Application Number	

ABOUT THIS FORM

This form is required to be filled out to request approval to undertake development within the Port Stephens Local Government Area where Council is the consent authority.

The development application process page which is available on Council's website will help you complete your application.

Failure to submit the relevant information or pay the appropriate fees may result in the application being returned or its assessment being delayed.

To lodge the application, this form must be filled in, duly signed by the applicant and properties' owners and provided to Council together with all the required supporting documentation.

Lodgement can be done at Council's Administration Building, by mail or email. Application and accompanying documentation may be provided in electronic format.

- If you choose to lodge the application in electronic format, please visit the Council website and follow the guidelines described.
- If you choose to lodge the application in paper form a scanning fee will apply.

PRIVACY

The information provided may contain personal information as defined under the Privacy and Personal Information Protection Act 1998 (NSW). The purpose of collecting this information is to enable Council to consider matters under related legislation, issue related documentation where required and other associated matters as provided by law and will be utilised by Council officers in assessing the proposal and other associated activities. The information may also be made available to other persons in accordance with the relevant Acts and regulations, such as the Government Information (Public Access) Act 2009 (NSW) and will be stored in Council's record system. Council will display plans and reports (which may be subject to copyright law) online on its DA Tracker portal for the required exhibition period of the application. Following this period plans and reports may be inspected at Council's Administration Building. No personal information will be displayed. Section 79 of the Environmental Planning and Assessment Act 1979 (NSW), requires Council to make applications and accompanying information, including plans, publicly available during the submission period.

THIS FORM IS TO BE USED FOR DEVELOPMENT APPLICATIONS (DA), CONSTRUCTION CERTIFICATES (CC) OR A COMBINED DA/CC.

PLEASE SELECT WHAT YOU ARE APPLYING FOR: ◯ DA ◯ CC ☐ DA/CC

PART A

Property details

Unit/Street Numbers	Street Name	Suburb	Postcode	Lot Number	DP/SP
98	GAN GAN ROAD	ANNA BAY	2316	312	753204
84A	GAN GAN ROAD	ANNA BAY	2316	32	1146884

Value of development

The estimated value of the development or building / subdivision works: 6,000,000

The cost of the development is the genuine estimate of: (a) the cost associated with the construction of the building, and (b) the cost associated with the preparation of the building for the purpose for which it is to be used (such as the cost of installing plant, fittings, fixtures and equipment). Owner builders will need to include a full cost of labour.

Applicant details

First Name BROCK Family Name LAMONT

Company/organisation/agency PORT STEPHENS COUNCIL

Position COMMUNITY AND RECREATION COORDINATOR

Description of proposed development

Residential

New | Alteration

- ☐ ☐ Dwelling house (1 storey single dwelling)
- ☐ ☐ Dwelling house (2+ storey single dwelling)
- ☐ ☐ Semi-detached dwelling (dwelling on its own lot attached to only 1 other dwelling)
- ☐ ☐ Secondary dwelling ("granny flat" under 60m² or 40% surface of main dwelling)
- ☐ ☐ Dual occupancy (2 dwellings on one lot of land)
- ☐ ☐ Attached dwellings (3+ dwellings, attached on separate lots)
- ☐ ☐ Multi-dwelling housing (3+ dwellings on 1 lot of land each with access at ground level)
- ☐ ☐ Residential flat building

Other residential items:

(please tick as required)

☐ Pergola ☐ Enclosure ☐ Retaining walls ☐ Carport ☐ Garden Structure ☐ Cabana

☐ Swimming Pool ☐ Garage ☐ Patio Cover ☐ Fence ☐ Shed ☐ Other

Non residential

New | Alteration

- ☐ ☐ Commercial / Retail / Office
- ☐ ☐ Change of Use (please describe below existing use of the site and proposed hours of operation – Monday to Sunday)
- ☐ ☐ Industrial
- ☐ ☐ Home Business / Home Industry
- ☐ ☐ Infrastructure
- ☐ ☐ Community Facility
- ☑ ☐ Tourism

Other non residential items:

(please tick as required)

☐ Signage ☐ Demolition ☑ Earthworks (including landfill, clearing, dams etc) ☐ Temporary Event / Land Use

Subdivision Number of lots existing Number of lots proposed

☐ Strata subdivision ☐ Torrens title ☐ Community title

☐ **Other**

Briefly describe your proposal, including all components, any demolition and the proposed/existing use/s.

An Information Centre is proposed for the subject site, Lot 312 DP753024. This site has been identified through a process of master planning and community engagement. It is located on Crown Land in a RU2 zone, adjacent to E2 and RE1 lands and the Birubi Point Aboriginal Place. The site is a disturbed area of dune landscape that is framed by vegetation along Gan Gan Road and James Paterson Road. The proposed information centre has been designed as a functional asset that resolves current parking and congestion issues around visitor activity at Birubi Point. The asset consists of 1500m2 of sheltered area and provides space for dune operators and amenities, including public toilets and a kiosk. The site has 54 car parking spaces, including 3 disability access spaces, 8 coach parking spaces with a drop-off zone that can accommodate 2 coaches, and provisions for pedestrians and cyclists. Signs and landscape markers will identify the land as the entrance to the Worimi Conservation Lands. The proposal

THIS PAGE APPLIES TO **DEVELOPMENT APPLICATION** (DA) ONLY

Integrated development

Integrated development is development that in order for it to occur requires development consent and approval from one or more of the authorities listed below (refer to the DA Guide for more information). Please tick as required.

A cheque made payable to the relevant agency must be provided by the applicant ($340 to RMS and $320 to any other authority). Council will forward it together with a copy of this Development Application to the authorities you have selected.

Responsible Authority		Approval being sought
Council or RMS for classified roads	☑	Erect or interfere with a structure; remove a tree; or carry out a work in or cover a public road
	☐	Pump water into a public road from any land adjoining the road
	☐	Connect a road (whether public or private) to a classified road
Department of Primary Industries - Fisheries	☐	Carry out aquaculture, dredging, or cut, remove or destroy marine vegetation or net/dam/weir
Heritage Council of NSW	☐	Revocation/modification conservation orders/state heritage item
National Parks and Wildlife Service	☑	Works within area of relics or Aboriginal place
Environment Protection Authority	☐	Environment protection licence to authorise carrying out of scheduled development work at any premises
	☐	Environment protection licence to authorise carrying out of scheduled activities at any premises
	☐	Environment protection licence to control carrying out of non-scheduled activities for the purposes of regulating water pollution resulting from the activity
Rural Fire Service	☐	Bushfire safety - subdivision of land or use of fire prone land for a school, child care centre, hospital, hotel, motel, senior housing or any other purpose prescribed by the Rural Fires Act 1997
Office of Water	☐	Water use or water management or activity approval on waterfront land
Various	☐	Other uses are listed in s91 related to mining, mine subsidence and off shore petroleum

Designated development

Designated Development would generally be a type of Local Development that has the potential for significant environmental effects as defined in Schedule 3 of the Environmental Planning & Assessment Regulation 2000. Is the application defined as designated development?

☑ **No** ☐ **Yes** – please submit Environmental Impact Statement that has been prepared in accordance to the Director General's requirements issued by the Department of Planning and Infrastructure.

Environmental impact

Is your proposal on land that is, or is part of, critical habitat, or is your proposal likely to have a significant affect on threatened species, populations, ecological communities or their habitats?

☑ **No** ☐ **Yes** – please attach a Species Impact Statement (SIS) that has been prepared in accordance with the Director General's requirements issued by the Office of Environment and Heritage.

Other approvals

Are you applying for approval for one of the matters listed under Section 68 of the Local Government Act 1993? If so, please provide the relevant documentation as outlined in the supporting documentation guide on the Council website.

☐ Carry out stormwater drainage work

☐ Install a manufactured home, moveable dwelling or associated structure on land

☐ Install, construct or alter a waste treatment device

☐ Operate a system of sewage management

☐ Operate a caravan park, camping ground or a manufactured home state

☐ Other

Are you applying for works within the road reserve in accordance to section 138 of the Roads Act 1993

☑ **No** ☐ **Yes** – please attach the Roads Act Application form (available from the Council website) and required documentation.

THIS PAGE APPLIES TO **CONSTRUCTION CERTIFICATES APPLICATIONS** (CC) ONLY

Principal certifying authority

I appoint Port Stephens Council as Principal Certifying Authority for the development.

☐ **No** ☐ **Yes** – you are required to complete the PCA - Appointment of Port Stephens Council as Certifying Authority form (available from the Council website). For more information about the agreement please see Schedule of PCA requirements.

Builder or owner builder details

Previous development consent (if applicable)

☐ Builder ☐ Owner builder (Owner Builder Permit required if value of building is over $10,000) ☐ To be advised

Name (or Company)

Address Post Code

Email Licence number

Phone Mobile

Subdivision works

Number of lots created Road works length

Lineal metres of drainage Number of water quality structures

Australian Bureau of Statistics schedule

Number of dwellings Number of dwellings to be demolished Number of pre-existing dwellings

Maximum number of storeys (including garage, attic room or storage level)

Gross floor area of addition or new building m^2

Documentation to be provided with your Construction Certificate application

If you are applying for a Construction Certificate together with your DA, in addition to the documentation required for the DA (see last page of this form) "specifications and construction details" must be supplied.

If you are applying only for a Construction Certificate the "specifications and construction details" must be supplied together with a set of plans that fully describe the approved development at the DA stage. Not all the documents required and approved with the DA are required.

Council can process your application and issue a Construction Certificate without the following documents; however you should be aware that commencement of work will be delayed until these details are supplied:

Hunter Water written confirmation/stamped plans

Prior to the commencement of work written confirmation must be provided by Hunter Water Corporation (HWC) stating that the approved works do not impact upon existing or proposed HWC infrastructure. A copy of HWC's written confirmation or stamped plans shall be provided to Council within 10 days of issue.

Home Warranty Insurance Option

Prior to the first inspection we require a copy of the contract of insurance (under Part 6 of the Home Building Act 1989) if the value of specified works is over $20,000.

Owner Builder Permit

Prior to the first inspection we require a copy of the Owner Builders Permit if the value of work is over $10,000. It can be obtained from "Service NSW" once your proposed development has received approval from Council. If the value of works is over $20,000 you may also be required to undertake a short course prior to the issue of your permit.

PART B

FOR OFFICE USE ONLY Date lodged Application Number

Property details

Unit/Street Number/Lot	Street Name	Suburb	Postcode	Lot Number	DP/SP
98	GAN GAN ROAD	ANNA BAY	2316	312	753204
84A	GAN GAN ROAD	ANNA BAY	2316	32	1146884

Applicant details

First Name BROCK Family Name LAMONT

Company/organisation/agency PORT STEPHENS COUNCIL

Position COMMUNITY AND RECREATION COORDINATOR

Address 116 ADELAIDE STREET RAYMOND TERRACE Post Code 2324

Email brock.lamont@portstephens.nsw.gov.au

Phone 02 4988 0243 Mobile 0400 632 493

Please indicate preferred method of contact Australia Post Email

I hereby make application to Council for permission to develop as per plans and specifications submitted. I understand that if the information submitted is incomplete, the application may be delayed, rejected or more information may be requested. I undertake to develop in conformity with such approval and Acts & Codes, and to indemnify the Council of Port Stephens against all claims which may arise whether from negligence or otherwise as a result of my carrying out or instructing a third party to carry out the above work or any other work within the road reservation at the above premises. I/We the Applicant/Owner/s authorise the use of all documents associated with the development application for the purposes of the development assessment process. I/We indemnify Council under the Environmental Planning and Assessment Act 1979 (NSW) and the Copyright Act 1968 (Cth) with regard to documents subject to copyright law. By signing this form I advise I have taken all reasonable steps to obtain copyright owner's consent. I have/will advise Council in writing if this is not the case

Applicant's signature Date (DD/MM/YYYY) 29/8/19

Owner's consent

ALL owners of the land to be developed must sign the application. If the land is Crown Land, an authorised officer of the NSW Department of Lands must sign the application. If the owner is a company, then two directors, a director and a secretary or an authorised delegate must sign the application and state their position. If the property is under strata or community title, if any works are proposed on common property the common seal of the owner's corporation must be stamped on this form as well as the owner's signature. An original signature must be provided and every owner must sign the form

As owner/s of the land to which this application relates, I/we consent to this application. I/we also consent to authorised Council officers entering the land to carry out inspection relating to this application. I/we accept that all communication regarding the application will be through the nominated applicant.

Name/s (and position/s if a company)	Address	Signature/s	Date (DD/MM/YYYY)
GREG KABLE, GROUP MANAGER FACILITIES AND SERVICES	116 ADELAIDE STREET RAYMOND TERRACE		29/8/19
refer to attached Government Gazette #63 - 22 June 2018			

Common seal to be attached here if required

Applications will not be accepted without signatures

Probity

Is the applicant or owner a staff member, councillor or contractor of Port Stephens Council or is the applicant or owner related to someone who is a staff member, councillor or contractor of Port Stephens Council?

No ✓ Yes - please state relationship STAFF MEMBER - MAKING APPLICATION ON BEHALF OF PORT STEPH

Political gifts and donations

Have you, or any person with a financial interest in this application, made a political donation or gift (greater than $1,000) in the previous two years?

✓ No Yes - please submit a Statement of Disclosure of Political Donations and Gifts form with your application

Documentation to supply with your DA based on the development type

		DEVELOPMENT TYPE	Dwelling House (1 storey)	Dwelling House (2+ storey)	Semi-Detached Dwelling	Secondary Dwelling	Dual Occupancy	Attached Dwellings	Multi-Dwelling Housing	Residential Flat Building	Alterations /Additions	Outbuildings (i.e. pergolas)	Pools	Commercial / Retail / Office	Change of Use	Industrial	Home Business / Home Industry	Community Facility	Tourism	Signage	Demolition	Earthworks	Temporary Event / Land Use	Subdivision
SUPPORTING DOCUMENTATION PLANS	PLANS	Elevation Plans	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓		✓	✓	✓				
		Erosion Sedimentation Plan	B	B	B	B	B	B	B	B	B	B	B	B		B		B	B		B	✓		DCP
		Floor Plans	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓					
		Landscape Plan					✓	✓	✓	✓				✓		✓		✓	✓					DCP
		Notification Plan (A4)		✓	✓	✓	✓	✓	✓	✓	2**			✓	✓	✓	✓	✓	✓				✓	DCP
		Sections	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓			✓		
		Signage Plan																		✓				
		Site Plan	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Site Analysis Plan*	B	B	✓	✓	✓	✓	✓	✓	B	B		✓		✓		✓	✓					✓
		Stormwater Drainage Plan	B	B	✓	✓	✓	✓	✓	✓	B		B	✓		✓		✓	✓					✓
		Survey Plan/Reference Levels	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓			✓		✓
		BASIX Certificate	✓	✓	✓	✓	✓	✓	✓	✓	C		C											
		Subdivision Plan																						✓
	REPORTS	Demolition Plan																			✓			
		Statement of Environmental	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Waste Management Plan	B	B	B	B	B	B	B	B	B	B	B	B		B		B	B					

✓ Mandatory. Application will not be accepted without this documentation.

* Can be incorporated on site plan

2** For 2+ Storey Structure

C BASIX certificate is also required for residential alteration/additions with a value greater than $50,000 and pools with more than 40,000 litres.

B Beneficial. It will facilitate and speed up the assessment process. May be requested during assessment if not provided at lodgement

DCP The DCP contains specific lodgement requirements for these documents and development types. Please refer to the relevant section of the DCP.

Other documentation commonly requested with a DA based on other conditions

Document / Plan	Condition
Bushfire Assessment Report	For development on bushfire prone land
Cut and Fill Plan	Where the proposal includes cut/fill and/or retaining walls
Cost Summary Report	The estimated cost of the development is between $100,000 and $3million
Detailed Cost Report	When the estimated cost of the development is over $3million. Must be signed by a Quantity Surveyor
Driveway Profile	Where the difference in level between the kerb and the garage floor is greater than +/- 600mm
Flora and Fauna Survey	Development located on land or in proximity to areas of environmental significance (see DCP)
Flood Study	Development in flood planning area or below the flood planning level (FPL) (see DCP)
Geotechnical Report	Significant bulk excavation works are proposed and for major subdivisions
Waste Water Report	Required where a lot does not have access to the reticulated sewer system that require on-site waste water disposal
Shadow Diagrams	Where residential development proposed is two storeys in height and/or potentially overshadows neighbours

For more information about all the documents that you might be required to provide with your development application (DA) please review the supporting documentation guide or use the DA Enquirer tool on the Council website.

IN the Government Gazette of 23 February 2018, folio 810 under the heading "Withdrawal of lands from Western Lands Leases", the reference in Column 5 to title 5302/768217 and 35/1204804 should have read 3772.

IN the Government Gazette of 23 February 2018, folio 810 under the heading "Withdrawal of lands from Western Lands Leases", the reference in Column 5 to title 5304/768219 should have read 4124.

File Reference: 14/07882

[n2018-2093]

APPOINTMENT OF CORPORATION TO MANAGE RESERVE TRUST

Pursuant to section 95 of the *Crown Lands Act 1989*, the corporation specified in Column 1 of the Schedule hereunder is appointed to manage the affairs of the reserve trust specified opposite thereto in Column 2, which is trustee of the reserve referred to in Column 3 of the Schedule.

The Hon Paul Toole, MP
Minister for Lands and Forestry

Schedule

Column 1	Column 2	Column 3
Port Stephens Council For a term commencing the date of this notice	Anna Bay Tourist Facilities & Services (R1014489) Reserve Trust	Reserve No. 1014489 Public Purpose: tourist facilities and services Notified: 8 February 2008 File Reference: 07/4394#01

[n2018-2094]

REMOVAL FROM OFFICE OF CORPORATION MANAGER OF RESERVE TRUST

Pursuant to section 96(2) of the *Crown Lands Act 1989*, the corporation specified in Column 1 hereunder is removed from the office of manager of the reserve trust specified in Column 2, which is trustee of the reserve referred to in Column 3.

The Hon Paul Toole, MP
Minister for Lands and Forestry

Schedule

Column 1	Column 2	Column 3
Lands Administration Ministerial Corporation	Anna Bay Tourist Facilities & Services (R1014489) Reserve Trust	Reserve No. 1014489 Public Purpose: tourist facilities and services Notified: 8 February 2008 File Reference: 07/4394#01

[n2018-2095]

APPOINTMENT OF TRUST BOARD MEMBERS

Pursuant to section 93 of the *Crown Lands Act 1989*, the persons whose names are specified in Column 1 of the Schedule hereunder are appointed, for the terms of office specified in that Column, as members of the trust board for the reserve trust specified opposite thereto in Column 2, which has been established and appointed as trustee of the reserve referred to opposite thereto in Column 3 of the Schedule.

The Hon Paul Toole, MP
Minister for Lands and Forestry


BIRUBI


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CONSERVATION LANDS


BIRUBI

SAND MANAGEMENT PLAN

Introduction;

Management of wind-blown sand across the subject site is based on the procedures developed for the lower carpark at Birubi Point. This process has been refined over a 10-year period.

The lessons learned from this level of experience are deemed appropriate and relevant to the subject site. The scenario for the lower carpark at Birubi point is considered a worst-case scenario; it is highly exposed to the South with no vegetation buffer or sand fences. The subject site for this DA is less exposed that the lower carpark.

Sand Management Measures;

- The subject site will be buffered by revegetation of the surrounding dunescape within the site and integrate sand trap fences.
- The existing heavily vegetated and established planting buffer on the dunes between the site and the existing residencies will be maintained.
- The vegetated wetlands will be maintained in the follow manner. If sand accumulates quickly and is required to be removed frequently, hand removal techniques will minimise vegetation damage. If accumulation is slower and it can be removed less often (e.g. at intervals of several years), is would be done with an excavator, accepting the vegetation damage at the time and then restoring vegetation afterward. To minimise the need for hand removal, an effective buffer on the windward edges/side of swales/wetlands is proposed to minimise the amount of sand that gets in. This includes incorporation of a densely planted vegetated buffer (e.g. Lomandra), permanent silt fence and built features like seating walls.
- The removal of sand from the hard surfaces and buildings, which although more straight forward, would likely comprise the bulk of the material. As part of the increased hardscape any additional sand run off will be swept up as required and integrated into the weekly or monthly management tasks.

Procedures;

- Minor sand management tasks (manual handling and or small posi-track excavator) will be done weekly (manual tasks) and monthly (posi-track excavator).
- All sand deemed the be VENM (Virgin Excavated Natural Material) or ENM (Excavated Natural Material) will be repositioned on site where possible (to fill voids or landscape features) or taken off site to DA approved sites requiring fill (estimated to be 90% of all sand captured).
- Sand that is not deemed to be VENM or ENM will be disposed to a licensed landfill site (estimated to be 10% of all sand captured)

Costs;

- Number of major sand removal maintenance actions per year: 4
- Expected tonnes of sand removed per maintenance action: 100 (based on lower range of maintenance data from lower car park at Birubi headland)
- Cost to undertake sand removal maintenance action: $2000 per action
- Estimated annual cost to undertaken sand management actions is $25,000 including disposal of 50 tonnes of waste sand to licensed landfill site.
- Note: the costs associated with the sand management plan have been factored into the business case for the information centre.