Broome Boating Facility Project: Migratory Shorebird Assessment

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Abstract

The Department of Transport is proposing to develop the Broome Boating Facility (BBF) upgrade at Entrance Point in the Port of Broome. Bird surveys were conducted for the Kimberley Marine Support Base (KMSB) project at Broome Port and Roebuck Bay from December 2019 to February 2020, which covered the area of interest for the BBF project. Data from the KMSB surveys are used in this report with permission from KMSB. The surveys were designed in accordance with EPBC Act Policy Statement 3.21, (Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species) and additionally collected data on species listed under the China-Australia Migratory Bird Agreement (CAMBA), Japan-Australia Migratory Bird Agreement (JAMBA) and the Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA).

Data from four field trips (each composed of at least six shorebird surveys) conducted during December 2019 to February 2020, confirmed the presence of 11 migratory shorebird species and five other EPBC Act listed species within the proposed BBF impact area. However, none of these species were detected in conservation significant numbers within the BBF impact area, nor did the site support a conservation significant total abundance or diversity of migratory shorebirds. Fieldwork conducted for KMSB (used with permission for this report) in the surrounding Yawuru Nagulagun / Roebuck Bay Marine Park and Roebuck Bay Ramsar wetlands found several sites supporting much greater, nationally significant, numbers of foraging and roosting migratory shorebirds.

Although the proposed BBF site did not support conservation significant numbers of migratory shorebirds, several mitigation procedures and recommendations have been proposed in this report to offset any potential negative impact on the low numbers of migratory shorebirds that were recorded in the proposed BBF impact area.

Introduction

Project Description

The Department of Transport (DoT) is proposing to develop the Broome Boating Facility (BBF) at Entrance Point, Broome. The proposed development will consist of an expanded carpark over the existing facility, four-lane boat ramp with finger jetties that extends out over the intertidal zone and an offshore breakwater (Fig. 1). The facility will serve as a recreational boat ramp of increased capacity to the current site facility.

Migratory Shorebirds

This report is focused on 37 migratory shorebird species listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) which breed in the northern hemisphere and migrate to Australia along the East Asian-Australasian flyway during the northern hemisphere winter. Australia's coastal and freshwater wetlands provide vital habitat for these birds during their non-breeding season, where they must increase their body weight significantly to build sufficient energy reserves to travel the long distance back to their breeding grounds (Duijns *et al.* 2017). They rest during high-tide at suitable roosting sites, such as an ocean beach or in salt marshes bordering the coastal wetlands. Despite legislative protection and international bilateral conservation agreements, many of these shorebirds have suffered massive population declines in the last 30 years. This report includes additional observations of other migratory bird species (aside from migratory shorebirds) listed under the EPBC Act (see attached document EPBC Act Protected Matters Report BBF July 2020), and under bilateral migratory bird agreements between Australia and China (CAMBA), Japan (JAMBA), and Republic of Korea (ROKAMBA).

Scope of Work

Ornithological Technical Services (OTS) was engaged by Teal Solutions to provide a desktop assessment of migratory shorebirds in the BBF Project area and general region. Recent, targeted migratory shorebird surveys were conducted for the Kimberley Marine Support Base (KMSB) project, and these surveys also covered the area of interest for the proposed BBF Project. KMSB provided their data (data exchange facilitated by O2 Marine) which was used with permission of KMSB in this desktop assessment. The aim of this assessment is to complete a detailed assessment in accordance with EPBC Policy Statement 3.21 to evaluate the significance of the habitat and potential impacts on migratory birds from the proposed BBF. Specifically, the objectives of this investigation are to:

- Assess the abundance, diversity, behaviour and distribution of the 37 migratory shorebird species listed under the EPBC Act in both a local and regional context
- Present observations of other migratory bird species (excluding the 37 migratory shorebirds listed in the EPBC Act) listed under the China-Australia Migratory Bird Agreement (CAMBA), Japan-Australia Migratory Bird Agreement (JAMBA) and Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA)
- Identify internationally- and nationally-significant shorebird habitats within the BBF Project area and in the wider region
- Assess the potential impacts on EPBC Act listed migratory shorebirds from the BBF Project targeting sites that are identified as nationally significant for migratory shorebirds
- Consider the potential impacts of the Project at local and regional scales on EPBC Act listed migratory shorebirds

- Provide recommendations for mitigating potential significant impacts on EPBC Act listed migratory shorebirds

Figure 1. Proposed Broome Boating Facility design concept and infrastructure layout, located at Entrance Point, Broome, south of the Broome Jetty.

EPBC Act Policy Statement 3.21 Survey Requirements

The survey data discussed in this assessment were collected for the KMSB Project in accordance with the requirements of the EPBC Act Policy Statement 3.21 (Commonwealth of Australia 2017). This includes minimum requirements on survey coverage, timing, and effort, data requirements, definition of significant shorebird habitat, definition of significant impacts on migratory shorebirds, and mitigating impacts on migratory shorebirds.

Methods

This report was prepared in accordance with the requirements of the EPBC Act Policy Statement 3.21 guidelines. The observation data presented and discussed in the following sections were collected for KMSB (data collected for the KSMB project included the area of the proposed BBF). KMSB confirmed (via O2 Marine) that permission was granted for their data to be re-used in this report. The methods used to collect the data for KMSB are presented below for reference.

Survey Areas

The Broome Peninsula is located at the Northwest of Roebuck Bay, a large bay containing significant undisturbed areas of beaches, mangroves and mudflats (Fig 2). Covering most of the Bay are the Yawuru Nagulagun / Roebuck Bay Marine Park and the Roebuck Bay wetland of international importance (under the Ramsar Convention), which is one of the most important sites for migratory shorebird conservation in the World. The Port of Broome waters border the Yawuru Nagulagun / Roebuck Bay Marine Park. The Roebuck Bay RAMSAR Wetland is located ~30 km to the west and 15 km to the north of Entrance Point. The area also supports the Roebuck Bay Mudflats Threatened Ecological Community (listed as vulnerable under the WA Minister Environmentally Sensitive Areas list) and is an important area for the local community and Traditional Custodians/Owners. The Port of Broome waters do not overlap with any of these important areas.

Study Areas:

- Roebuck Bay study area (Fig. 2 inset A) consisted of 13 discreet sites covering approximately 2.3 km of surveyed coastline.
- Broome Peninsula study area (Fig. 2 inset B; Fig. 3) included the targeted survey sites A1-A4 along with two adjacent comparison sites, altogether covering approximately 3.4 km of coastline.

Project Area: The BBF project development envelope of approximately 4.85 ha.

Survey Coverage

Within the Roebuck Bay study area, 13 survey sites were chosen along the length of the reserve (Fig. 2 inset A) due to easy access from the road (reducing the time required for the survey). The sites cover approximately six kilometres of coastline between Crab Creek Road and Broome Bird Observatory. The habitat along this stretch of coastline consists of beaches, rocks, and extensive mudflats (at low tide), with some sparse patches of mangrove trees. This section of Roebuck Bay was surveyed to put the Broome Peninsula study area into regional context.

Beaches, rocks and mudflats comprise the habitat within the Broome Peninsula study area for shorebird surveys. This area was divided into six sites (A0 to A5), each separated by rocky headlands (Fig. 3). Site A2 is the location of the BBF Project (Fig. 3). The surrounding sites form the entire area of contiguous habitat that migratory shorebirds are likely to use. The extent of habitat available in these

sites varies considerably with the tide (Fig. 3). At low tide, the area of beach and exposed rock is extensive with several rocky islets just offshore. At high tide, most of the rocky islets are submerged and there is little exposed beach habitat. Sites A0 to A3 are similar in habitat, with a mixture of beach and rock submerged at high tide, some exposed rocks at all tides, and rocky islets. The habitat in A4 is a mixture of beach and mudflats with scattered mangrove trees and some rocky areas that are not submerged at high tide. Site A5 consists of beaches, extensive mudflats (at low tide) and sparse patches of mangrove trees. These large mudflats are usually separated from the small mudflats in site A4, however on extremely low spring tides the two areas may connect.

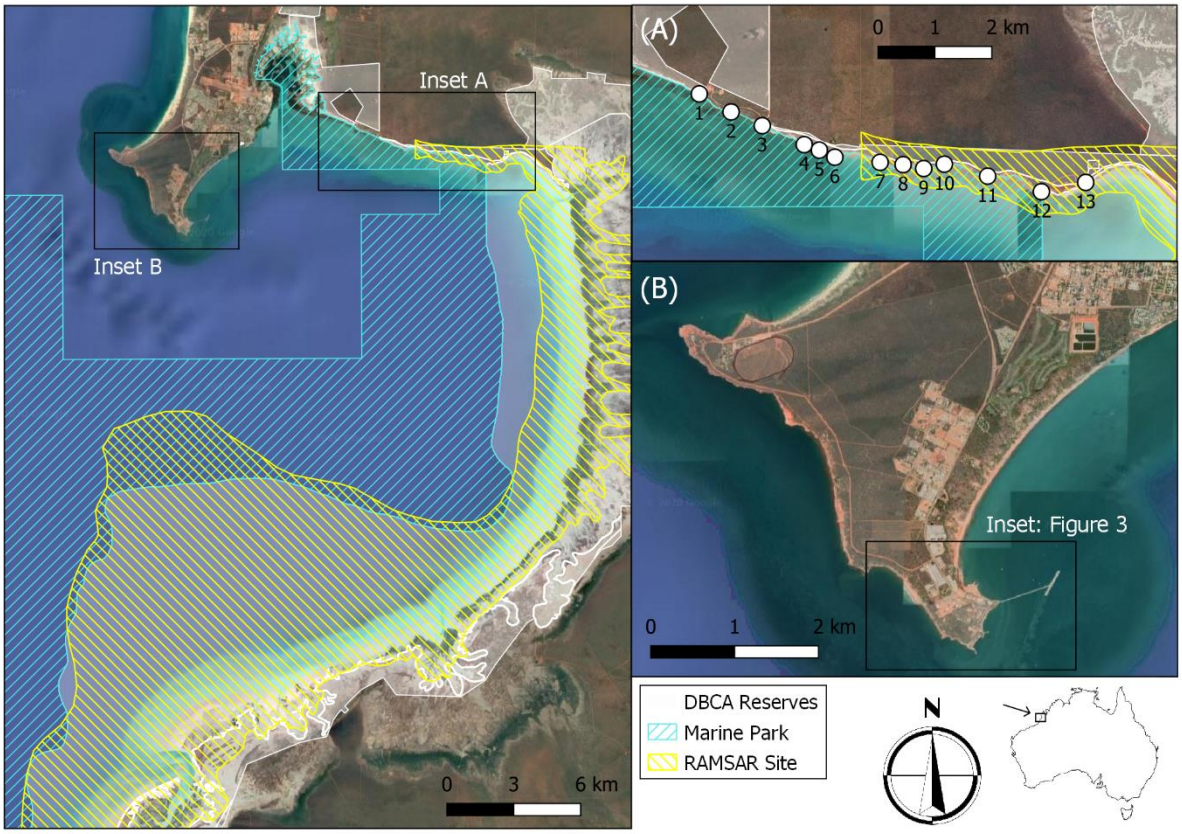

Figure 2. Satellite imagery of Roebuck Bay, northwest Australia, showing the location of the two survey areas: Roebuck Bay study area (inset A) and the Broome Peninsula study area south of the town (inset B). White circles in Inset A show the 13 survey sites of the Roebuck Bay study area. See Figure 3 for a detailed map of the Broome Peninsula study area. Protected areas are displayed: Yawuru Nagulagun / Roebuck Bay Marine Park (blue hashed area), DBCA Legislated Lands and Waters (translucent white areas), and Roebuck Bay RAMSAR Wetland of international importance (yellow hashed area).

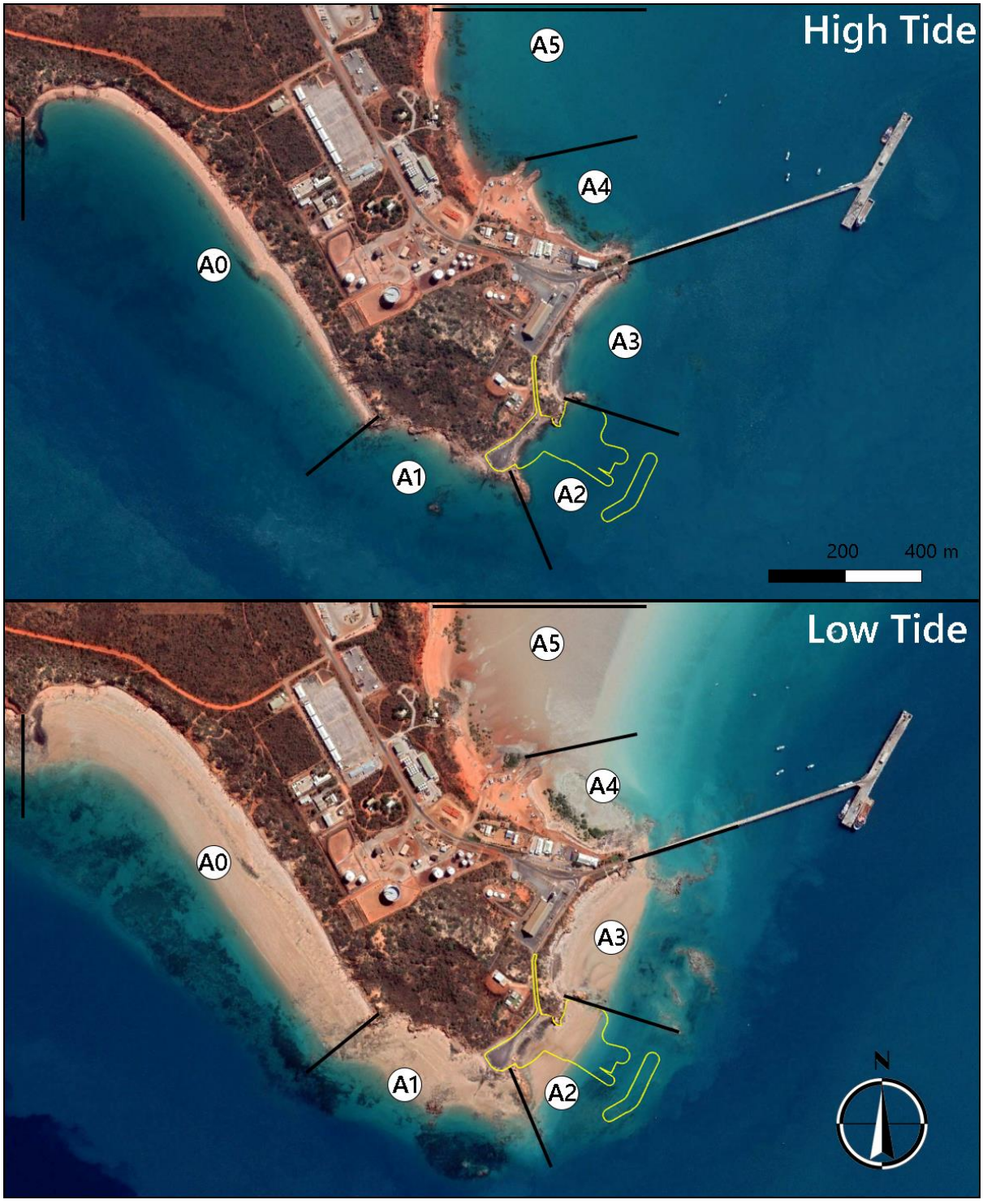

Figure 3. Satellite imagery of the Broome Peninsula study area where shorebird surveys were conducted in 2019 and 2020. High tide (top) and low tide (bottom) maps show the daily variation in habitat availability. The survey sites are labelled A0 to A5, with black lines showing their boundaries. The BBF Project area occurs within site A2 (yellow outline).

Survey Timing

Surveys of the Broome Peninsula study area were conducted over four separate trips during the period when most migratory shorebirds were in the region: one in December 2019, two in January 2020, and one in February 2020 (Table 1). One trip (January 2020) coincided with a neap tide, and the other trips coincided with spring tides.

A minimum two high tide (roosting) surveys and two low tide (foraging) surveys were conducted on each trip to assess the variability in shorebird numbers. Surveys for roosting shorebirds were conducted as close to high tide time as possible, and always within two hours either side of high tide. Surveys for foraging shorebirds were conducted as close to low tide as possible, and always within two hours either side of low tide.

Sites A1-A4 were targeted during each survey of the Broome Peninsula study area. When weather and time permitted, surveys were conducted at sites A0 and A5. The mudflats at A5 were vast at low tide, so time did not permit a survey along the whole length of this habitat; however, these two sites were surveyed at least once per trip.

Additional surveys of the Broome Peninsula study area were conducted during rising or falling tides (outside of the time period restrictions for low and high tides). During heavy rainfall or high winds surveys were delayed, if time permitted, or cancelled. Survey timing was also scheduled to avoid major disturbances such as dog walkers and fishermen where practicable. Details of tide times and surveys in the Broome Peninsula study area are shown in Table 1.

The Roebuck Bay study area was surveyed at least once per trip. These surveys were time-consuming, and priority was given to scheduling the Broome Peninsula study area surveys so that they occurred in accordance with EPBC Act Policy Statement 3.21 timing requirements. Therefore, surveys of the Roebuck Bay study area were undertaken during variable heights of the tidal range (i.e. high, ebb, low, and flood tides).

Survey Effort

Four separate field trips took place between December 2019 and February 2020. Each field trip consisted of multiple surveys in the Broome Peninsula study area (minimum two high-tide and two low-tide surveys per field trip). Each survey (e.g. survey S01: 13 Dec 2019 low tide at 17:30) covered all four targeted survey sites (A1-A4). Some surveys Roebuck Bay surveys covered all 13 sites within the study area.

Surveys at low tide were conducted by walking along the length of the sites close to the water's edge along beaches and onto rocky headlands, using a telescope to check for birds on rocky islets. High tide surveys were conducted in the same way, or with stationary counts from a high vantage point where the whole site could be seen. All bird species, their numbers and their behaviour were recorded, along with spatial data to identify preferred roosting and foraging locations by shorebirds.

Species abundance, maximum abundance, total abundance, species richness, total species richness and birds per km were calculated for the targeted study sites (A1-A4), each site individually (A0 to A5, RB1 to RB13), and for Roebuck Bay all sites combined.

- Species abundance is the number of individuals observed for each species per survey (e.g. Ruddy Turnstone abundance on survey S01 was 21 individuals).
- Maximum abundance is the highest species abundance recorded during any survey (e.g. the maximum abundance of Ruddy Turnstone in sites A1-A4 was 111 individuals on survey S08).

- Total abundance is the number of individuals observed for all migratory shorebird species per survey (e.g. migratory shorebird abundance on survey S01 was 416 individuals).
- Species richness is the number of migratory shorebird species observed per survey.
- Total species richness is the total number of migratory shorebird species observed over the four field trips (Dec 2019 to Feb 2020).
- Birds per km for each site/area is the maximum abundance per species divided by the length (in kilometres) of coastline surveyed (e.g. sites A1-A4 covered approximately 1.9 km and the maximum abundance of Ruddy Turnstone for these sites was 111, so 59.04 Ruddy Turnstones per km were seen in A1-A4.

Each field trip was conducted by one of three ornithologists who have extensive experience working as shorebird experts throughout Western Australia, including in the northwest coast and on RAMSAR wetlands of international importance.

Additional Data

Observations on shorebird disturbance were recorded at Broome Peninsula study area sites during shorebird surveys. Potential nocturnal roosts were identified in the Broome Peninsula study area, and one of these was surveyed during the night.

Table 1. Schedule of shorebird surveys at targeted sites from Broome Peninsula study area (sites A1-A4) from December 2019 to February 2020. The boxes in the 'Field Trip' column summarise the number of high, low, and falling/rising (mid) tides that were surveyed during each trip. All surveys were conducted within two hours either side of the respective low/high tide, except those noted as falling or rising tide surveys.

Field Trip	Unique Survey No.	Survey Date	Tide Height (m)		Tide Time	Notes
(1) December	S01	13 Dec 2019	1.41	Low	05:20	Survey rising tide 9:30
	S02		2.13	Low	17:30	
[2x high]	S03	14 Dec 2019	1.27	Low	05:55	
[4x low]	S04		8.92	High	11:53	
[2x mid]	S05		2.07	Low	18:07	
	S06	15 Dec 2019	1.34	Low	06:30	
	S07		8.88	High	12:28	
	S08		2.16	Low	18:42	Survey falling tide 17:00
(2) January	S09	02 Jan 2020	2.99	Low	08:33	
	S10		7.80	High	14:43	
[2x high]	S11	03 Jan 2020	3.49	Low	09:05	
[3x low]	S12		7.43	High	15:22	
[1x mid]	S13	04 Jan 2020	6.40	High	03:31	Survey falling tide 5:25
	S14		4.01	Low	09:45	
(3) January	S15	14 Jan 2020	1.24	Low	07:04	
	S16		9.20	High	13:00	
[3x high]	S17		1.86	Low	19:20	
[4x low]	S18	15 Jan 2020	1.45	Low	07:40	
[2x mid]	S19		9.13	High	13:38	
	S20		2.04	Low	19:58	Survey falling tide 18:30
	S21	16 Jan 2020	1.85	Low	08:17	
	S22		8.91	High	14:17	

	S23		2.39	Low	20:36	Survey falling tide 17:10
(4) February	S24	26 Feb 2020	9.39	High	12:26	
	S25		1.64	Low	18:48	Survey falling tide 15:05
[3x high]	S26	27 Feb 2020	1.40	Low	06:59	
[2x low]	S27		9.41	High	12:50	
[1x mid]	S28	28 Feb 2020	1.58	Low	07:21	
	S29		9.33	High	13:13	

Survey Results

A minimum of two high-tide and two low-tide surveys of targeted sites (A1-A4) within the Broome Peninsula study area were completed on all four trips (Table 1), despite occasional delays or abandoned surveys due to heavy rainfall. A total of 29 surveys were completed at these sites (10 high tide and 13 low tide). Adjacent sites A0 and A5 were surveyed at least once per trip, and Roebuck Bay study area sites were surveyed at least once per trip.

Broome Peninsula Study Area

Shorebird abundance and richness statistics for targeted sites of the Broome Peninsula study area (A1-A4) are summarised in Table 2, and a detailed breakdown is available in Appendix 1. The total species richness was 17 migratory shorebird species across the four sites. Site A3 had a total species richness of seven migratory shorebird species and highest total recorded abundance of 105 individuals. Site A4 supported 17 species and a highest total abundance of 388 individuals. Sites A1 and A2 were similar to each other with 12 and 11 species respectively, and maximum total abundance of 32 and 39 individuals, respectively.

Sites A1 and A2 (the BBF study area) were found to not support any species in numbers of national significance. Ruddy Turnstone was occasionally present in nationally significant numbers (at least 0.1% of the species' flyway population) at both high and low tides at site A3; however, this was infrequent (10% of surveys). Four species were present in nationally significant numbers at site A4. Grey-tailed Tattler was nationally significant at both high and low tides on 34% of surveys. Ruddy Turnstone, Sanderling and Terek Sandpiper were infrequently observed in nationally significant numbers and only at either high or low tide: Ruddy Turnstone at high tide (3% of surveys), Sanderling at high tide (3%), and Terek Sandpiper at low tide (3%).

Targeted sites of the Broome Peninsula study area (A1-A4) do not meet the EPBC Act Policy Statement 3.21 criteria for an area supporting internationally significant migratory shorebirds. However, site A4 supports more than 15 species of migratory shorebirds, and both A3 and A4 support at least one species of migratory shorebird in numbers greater than 0.1% of their respective flyway populations. In accordance with the EPBC Act Policy Statement 3.21 criteria, sites A4 and A3 should both be regarded as nationally significant areas for migratory shorebirds.

Table 2. Maximum abundance of the 17 migratory shorebird species that were recorded at the Broome Peninsula main study areas (sites A1 to A4) from December 2019 to February 2020. The main impact site (A2) is shaded in grey. Pink cells indicate statistics that cross the national significance threshold.
*National significance thresholds as defined in EPBC Act Policy Statement 3.21.

†Flyway population estimates sourced from Hansen *et al.* (2016).

Species	National significance threshold* (0.1% flyway population†)	Maximum abundance			
		A1	A2	A3	A4
Bar-tailed Godwit	325	0	0	0	96
Common Greenshank	110	0	0	0	10
Common Sandpiper	190	12	4	3	5
Curlew Sandpiper	90	1	7	0	42
Great Knot	425	0	0	0	112
Greater Sand Plover	200	15	10	40	150
Grey Plover	80	1	2	0	30
Grey-tailed Tattler	70	6	10	38	280
Lesser Sand Plover	180	5	2	0	14
Pacific Golden Plover	120	5	4	6	20
Red Knot	110	1	0	0	40
Red-necked Stint	475	1	2	0	60
Ruddy Turnstone	30	25	15	40	70
Sanderling	30	4	17	0	40
Sharp-tailed Sandpiper	85	0	0	0	2
Terek Sandpiper	50	0	0	15	80
Whimbrel	65	1	1	4	12
	National significance threshold*	**A1**	**A2**	**A3**	**A4**
Total abundance	2,000 migratory shorebirds	32	39	105	388
Total species richness	15 migratory shorebird species	12	11	7	17

The distribution of shorebird sightings from the Broome Peninsula study area during all high and low tides are presented in Figure 4. The mudflat of site A4 and nearby similar habitat to the north is the most important foraging location in the Broome Peninsula study area. In contrast, some species such as the Ruddy Turnstone were not well represented on the mudflats, and their main foraging areas were on the beaches at sites A3 and A1 (Fig. 5). Major shorebird roosting locations were at sites A4 and A5 (Fig. 5). These were rocky areas near the mudflats and supported large flocks of roosting shorebirds (e.g. 280 Grey-tailed Tattler on one occasion). Smaller groups of shorebirds were seen roosting on rocky islets from A1 to A3. Most of these islets are submerged during high tides, except one islet at A1 which was more frequently observed to be used as a roosting location (Fig. 5).

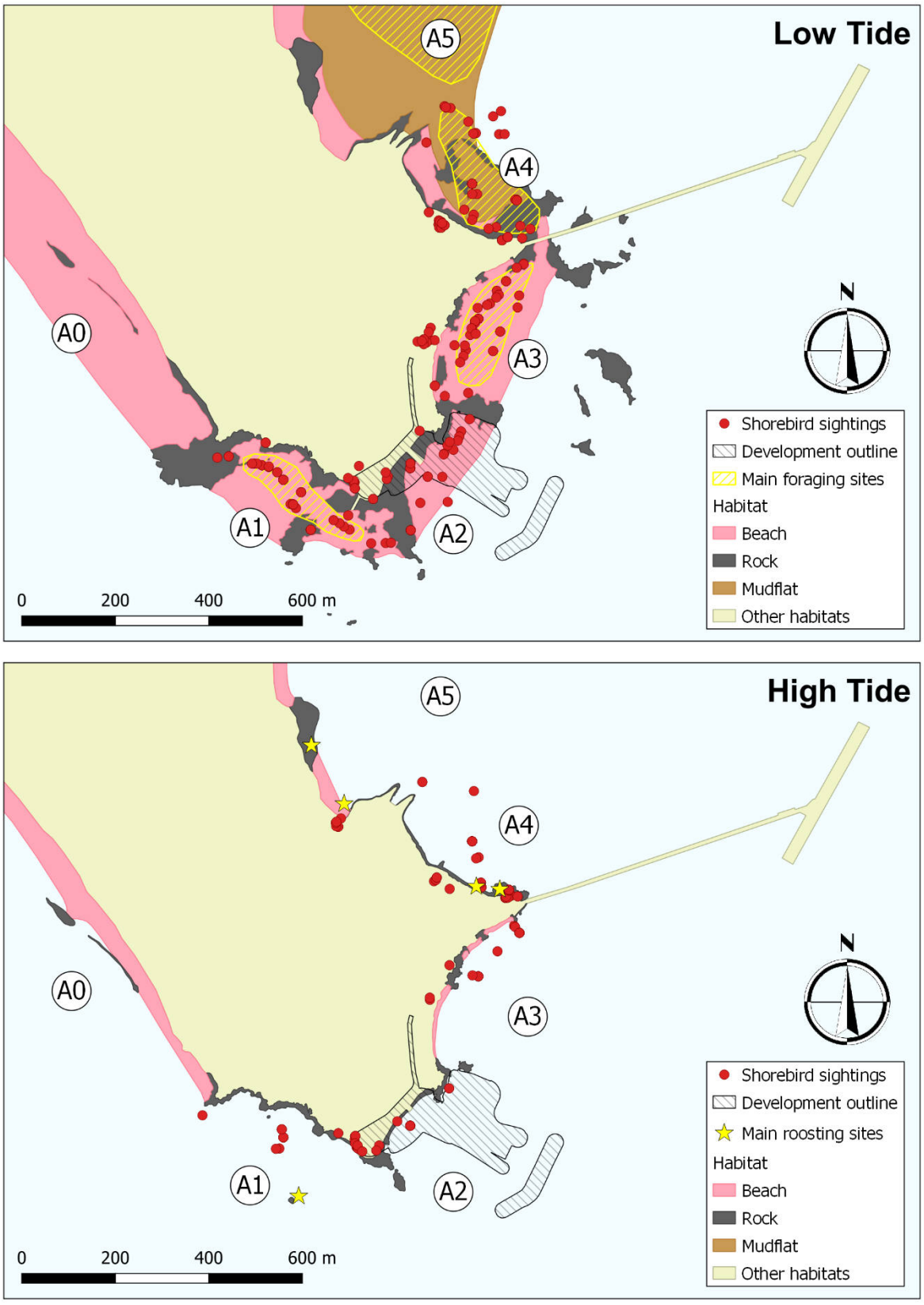

Figure 5. Major shorebird habitats within the Broome Peninsula study area (A0-A5). The low tide map shows GPS locations of all low tide migratory shorebird sightings in sites A1-A4, as well as the main foraging areas for shorebirds. The high tide map shows GPS locations of all high tide migratory shorebird sightings in sites A1-A4, as well as the main roosting locations for shorebirds. Note that GPS points were recorded from the observer's

location in many cases (especially when recording roosting birds), so clusters of points do not always align with main feeding/roosting areas.

Levels and sources of disturbance to shorebirds varied between sites. Site A4 was the least disturbed. Here disturbances include crabbers walking on the mudflats, fishermen on the rocks underneath the Broome Jetty, and potentially commercial vessels launched from the Port of Broome Slipway (not observed). Disturbances at site A3 included recreational activities on the beach (walking, swimming, dog walking, etc.), and fishermen on the rocks and beach. These disturbances were frequent during low tide, and infrequent during high tide. Similar disturbances were observed at sites A1 and A2, as well as the presence and noise from vehicles and boats, as a public boat ramp is located within both areas. The frequency of disturbance at sites A1 and A2 (the BBF study area) was extremely high due to the ease of access from the adjacent car park. Only the islets remained undisturbed at these two sites.

Site A4 and the extensive habitat nearby at A5 are the most likely refuge areas for shorebirds to move to after disturbance from the beaches at A1-A3, both at high and low tides (although birds that prefer beach habitat may move west around the peninsula at low tide instead). The high tide roosts in and near site A4 also present the most likely candidates for nocturnal roost sites, due to their relatively low levels of disturbance and the high numbers of roosting birds noted during the day.

The results for the other migratory bird species listed under the CAMBA, JAMBA or ROKAMBA (referenced in text below as CJR), excluding shorebirds, which were observed in the Broome Peninsula study area are presented in Table 3. A total of eight species were observed within the Broome Peninsula study area. None of these species were observed in numbers greater than 0.1% of their respective global populations. The nearest was Little Tern (0.09% of global population).

Table 3. Bird survey results at the Broome Peninsula study area (A0-A5) from December 2019 to February 2020. Species included here are those listed under the CAMBA, JAMBA or ROKAMBA, excluding the migratory shorebird species already presented above. Statistics represent the maximum abundance at each site during any survey, per species. The proposed BBF site (A2) is shaded in grey.

Species	Maximum abundance					
	A0	A1	A2	A3	A4	A5
Brown Booby	0	18	50	12	0	0
Lesser Frigatebird	0	0	0	1	0	0
Caspian Tern	0	0	0	0	0	0
Common Tern	2	30	10	13	60	211
Little Tern	8	46	11	8	109	15
Gull-billed Tern	1	18	0	0	20	2
Greater Crested Tern	0	35	37	110	50	12
White-winged Tern	0	3	0	0	1	0
Barn Swallow	0	2	36	0	0	0

Broome Port Peninsula Study Area: Supplementary Sites

Shorebird statistics from the supplementary sites A0 and A5 are compared to the targeted sites of the Broome Peninsula study area in Table 4. The beach habitat at site A0 supports less shorebirds than any site within A1-A4. The total species richness was nine migratory shorebird species, with a maximum total abundance of 38. No species was seen in numbers exceeding 0.1% of their flyway

populations. Conversely, the mudflat and rock habitat at site A5 supported a higher abundance of shorebirds at both high and low tides. The total species richness was only 13 species, but the total abundance was much higher at 1,416 migratory shorebirds, although still below the national significance threshold of 2,000. Five species were present in nationally significant numbers. Grey-tailed Tattler and Terek Sandpiper were nationally significant in A5 (and A4), while Curlew Sandpiper, Great Knot and Greater Sand Plover were also nationally significant but only in A5. Within site A5 shorebirds were widely spread foraging across the expansive mudflats at low tide, and at high tide shorebirds roosted in large flocks on rocky areas (Fig. 5).

Table 4. Maximum abundance of the 17 migratory shorebird species that were recorded in the proposed BBF site (A2), and supplementary sites (A0 and A5) which were adjacent to the targeted study area (A1-A4), from December 2019 to February 2020. The main impact site is shaded in grey. Pink cells indicate statistics that exceed the national significance threshold.

*National significance thresholds as defined in EPBC Act Policy Statement 3.21.

†Flyway population estimates sourced from Hansen *et al.* (2016).

Species	**National significance threshold* (0.1% flyway population†)**	**Maximum abundance**		
		A0	**A2**	**A5**
Bar-tailed Godwit	325	0	0	24
Common Greenshank	110	0	0	56
Common Sandpiper	190	3	4	11
Curlew Sandpiper	90	0	7	260
Great Knot	425	0	0	460
Greater Sand Plover	200	6	10	270
Grey Plover	80	2	2	0
Grey-tailed Tattler	70	0	10	173
Lesser Sand Plover	180	1	2	40
Pacific Golden Plover	120	2	4	1
Red Knot	110	0	0	0
Red-necked Stint	475	2	2	40
Ruddy Turnstone	30	7	15	16
Sanderling	30	14	17	0
Sharp-tailed Sandpiper	85	0	0	0
Terek Sandpiper	50	0	0	110
Whimbrel	65	1	1	17
	National significance threshold*	**A0**	**A2**	**A5**
Total abundance	2000 migratory shorebirds	38	39	1,416
Total species richness	15 migratory shorebird species	9	11	13

Disturbance at sites A0 and A5 was relatively low compared to the targeted sites (A1–A4). Disturbance-causing activities at A5 were similar to those at A4, and activities at A0 were similar to those at A3. The frequency of disturbance in both cases was lower than in the targeted sites A1-A4, possibly because A0 and A5 are located further from parking areas.

Sites A0 and A5 support fewer CJR listed migratory species than the main study area (Table 3). At site A0, only three species were observed, all in low numbers. Site A5 also supported few CJR species, but Common Tern was seen in higher numbers here than anywhere else. These Terns were seen roosting

on the mudflats and feeding nearby along with three other tern species. As with the targeted sites, CJR species were not observed in numbers greater than 0.1% of the global population at either site.

Roebuck Bay Study Area

Shorebird statistics from Roebuck Bay study area are compared to the BBF Project site (A2) in the Broome Peninsula study area in Table 5. The entire length of the Roebuck Bay study area was utilised for foraging, with extensive mudflats exposed at low tide along the coastline. Roosting locations were observed at every site and some held particularly high numbers of roosting shorebirds (e.g. sites 3 and 12). Migratory shorebird numbers in several Roebuck Bay sites were higher than any site in the Broome Peninsula study area. A detailed breakdown of shorebird abundance for each site in Roebuck Bay is shown in Appendix 2. Over the entire Roebuck Bay study area, the highest total abundance was 11,177 migratory shorebirds of 22 species, both well above the criteria threshold for nationally important wetlands. Of the 22 species recorded, 16 were observed in numbers greater than 0.1% of their respective flyway populations (note that when considering individual sites, only 13 species were recorded in significant numbers (e.g. Table 5) – this becomes 16 species when totals across all Roebuck Bay sites are considered). Only four of these 22 species were recorded in nationally significant numbers in the Broome Peninsula study area, and just one species, Terek Sandpiper, was more abundant in the Broome Peninsula than in the Roebuck Bay study area (however Terek Sandpiper was not recorded from site A2).

The Roebuck Bay study area covers a broader spatial range than the Broome Peninsula study area, so it is not surprising that a higher total abundance of shorebirds was recorded. Single sites from Roebuck Bay study area supported far more shorebirds than single sites in the Broome Peninsula study area. Roebuck Bay study area also supported more shorebirds per kilometre of surveyed coastline than the Broome Peninsula study area for most species (Appendix 3), especially when comparing site A2 to Roebuck Bay (Table 5). Several species seen in site A2 were at least 10 times more abundant, per kilometre, in Roebuck Bay. Pacific Golden Plover abundance was similar in Roebuck Bay and site A2, and the only species that was significantly more abundant in site A2 than Roebuck Bay was Common Sandpiper.

Table 5. Shorebird survey results at the proposed BBF Project site (A2) compared to 13 sites in Roebuck Bay study area from December 2019 to February 2020 for the 22 migratory shorebird species that were recorded in either area. Pink cells indicate statistics that exceed the national significance threshold.
*Maximum abundance statistics refer to the maximum abundance of shorebirds recorded during a single survey of site A2, or of any single site in Roebuck Bay. Birds per km statistics refer to the maximum recorded on a survey of site A2, or on an entire survey covering the length of Roebuck Bay (RB1-RB13).
*National significance thresholds as defined in EPBC Act Policy Statement 3.21.
†Flyway population estimates sourced from Hansen *et al.* (2016).

Species	National significance threshold* (0.1% flyway population†)	Maximum abundance		Birds per km	
		A2	RB single site	A2	RB all sites
Bar-tailed Godwit	325	0	2,000	0	1,029.4
Black-tailed Godwit	160	0	500	0	212.8
Broad-billed Sandpiper	30	0	30	0	12.8
Common Greenshank	110	0	60	0	59.6
Common Sandpiper	190	4	3	11.1	1.3
Curlew Sandpiper	90	7	1,200	19.4	511.1
Far Eastern Curlew	35	0	300	0	217.0

Great Knot	425	0	4,000	0	1,980.4
Greater Sand Plover	200	10	1,000	27.8	595.7
Grey Plover	80	2	40	5.6	37.9
Grey-tailed Tattler	70	10	410	27.8	174.5
Lesser Sand Plover	180	2	125	5.6	53.2
Oriental Plover	230	0	1	0	0.4
Oriental Pratincole	2,880	0	20	0	22.6
Pacific Golden Plover	120	4	20	11.1	13.2
Red Knot	110	0	100	0	97.0
Red-necked Stint	475	2	4,000	5.6	1,737.9
Ruddy Turnstone	30	15	200	41.7	85.1
Sanderling	30	17	200	47.2	170.2
Sharp-tailed Sandpiper	85	0	40	0	17.9
Terek Sandpiper	50	0	50	0	22.6
Whimbrel	65	1	100	2.8	76.6
	National significance threshold*	**A2**	**RB single site**	**A2**	**RB all sites**
Total abundance	2,000 migratory shorebirds	39	8,951	108.3	4,756.2
Total species richness	15 migratory shorebird species	11	17		

Disturbance at the Roebuck Bay sites was very low, and no cases of human or human-related disturbances to shorebirds were observed. There is very little infrastructure in the area that may lead to shorebird disturbance (e.g. jetties or boat ramps).

Roebuck Bay supported fewer CJR-listed migratory species than the main study area (Table 6). One species (Caspian Tern) was seen in Roebuck Bay and not in the Broome Peninsula study area sites. Roebuck Bay, with its extensive mudflats, is generally more suited to shorebirds than terns. As found for the Broome Peninsula study area, none of the CJR species were observed in numbers greater than 0.1% of the global population.

Table 6. Bird survey results at the proposed BBF Project site (A2) compared to 13 sites in Roebuck Bay study area from December 2019 to February 2020. Species included here are those listed in any one of the CAMBA, JAMBA or ROKAMBA, excluding the migratory shorebird species already presented above.
*Maximum abundance statistics refer to the maximum abundance of birds recorded on a survey of site A2, or of any single site in Roebuck Bay. Birds per km statistics refer to the maximum recorded on a survey of site A2, or on an entire survey covering the length of Roebuck Bay (RB1-RB13).

Species	**Maximum Abundance**		**Birds per km**	
	A2	**RB single site**	**A2**	**RB all sites**
Brown Booby	50	0	138.9	0
Lesser Frigatebird	0	0	0	0
Caspian Tern	0	40	0	17.0
Common Tern	10	80	27.8	34.0
Little Tern	11	80	30.6	34.0
Gull-billed Tern	0	17	0	10.6
Greater Crested Tern	37	80	102.8	34.0

White-winged Tern	0	0	0	0
Barn Swallow	36	0	100.0	0

Potential Significant Impacts on Migratory Shorebirds

In Australia, important migratory shorebird habitat is protected under the EPBC Act. Approval is required for any action that is likely to have a significant impact on migratory shorebirds and the habitats they use. As described in the EPBC Matters of National Significance (MNES) Significant Impact Guidelines 1.1 (the guidelines), an action is likely to have a significant impact on migratory shorebirds if there is a real possibility that it will:

- substantially modify, destroy, or isolate an area of important habitat; or
- result in an invasive species that is harmful to migratory shorebirds becoming established in an area of important habitat; or
- seriously disrupt the lifecycle of an ecologically significant proportion of a migratory shorebird species.

The MNES Guidelines state that an area of 'important habitat' for a migratory species is:

- habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species, and/or
- habitat that is of critical importance to the species at particular life-cycle stages, and/or
- habitat utilised by a migratory species which is at the limit of the species range, and/or
- habitat within an area where the species is declining.

During this study, the proposed BBF Project area (site A2) did not meet any criteria for identifying important habitat for migratory shorebirds. The site supported less than 2,000 individuals and less than 15 migratory shorebird species, and no species were present in nationally significant numbers (at least 0.1% of the species' flyway population).

The BBF project area does not qualify as important habitat for migratory shorebirds, and no species were present in nationally significant numbers, however the site is still of value to several species of shorebirds in low numbers. We have therefore included below advice regarding identifying and mitigating potential impacts to shorebirds resulting from the proposed BBF Project.

Identifying Potential Significant Impacts

Actions most likely to result in significant impacts to migratory shorebirds are those that lead to habitat loss, habitat degradation, increased disturbance to shorebirds, and/or direct mortality of shorebirds, leading to a substantial reduction in migratory shorebird numbers.

Habitat Loss

The area of habitat lost following completion of the BBF Project development will be confined to site A2. The area of shorebird habitat lost will be approximately 2.03 ha (61.4% of the total area of shorebird habitat in A2), which includes approximately 0.71 ha of beach (67.0% of the total beach area in A2). Habitat areas were calculated for low tide, when the largest proportion of habitat is exposed and available for use by shorebirds.

Habitat Degradation

The BBF Project may potentially reduce the quality of the remaining migratory shorebird habitat in site A2. Habitat degradation in relation to the BBF Project could result from actions either relating to the physical structure itself (sub-section 1 below), or to the operational activities of the facility (sub-sections 2-4).

1. Longshore Drift

The proposed BBF development will change the shape of the coastline which has the potential to affect the current movements and flow intensity in the study area. Sediment deposits may shift as a result, however this is not within the scope of the migratory shorebird assessment and will not be discussed further in this report. DoT have commissioned an assessment on coastal processes impacts.

2. Biosecurity and Invasive Species

Invasive marine species may be introduced or translocated on the hulls of vessels and vehicles, although the chance of this is low as all vessels accessing the facility will be via trailer. Some invasive species have the potential to negatively impact migratory shorebirds by modifying the habitat and/or the productivity of benthic communities on which shorebirds feed. Invasive weeds such as *Spartina* species are known to modify intertidal habitat and make it less suitable for foraging shorebirds (Commonwealth of Australia 2017).

3. Spills and Pollutants

Accidental spills of hydrocarbons, oil or other substances (including runoff of substances from the parking area into the water) may have toxic effects on the Benthic Communities and Habitats (BCH) in the vicinity of the development, with negative effects on migratory shorebirds which feed on BCH. The material used to seal the surface of the parking area may also have a negative effect on the BCH. For example, a tarmac surface may lead to hydrocarbon runoff into the water. Accidental spills also have the potential to directly impact shorebirds by increasing the chance of direct mortality.

4. Construction

Temporary degradation of part of the beach habitat is possible during the construction process, as vehicles and plant will need to drive onto the beach. The extent of this should be restricted to the construction footprint of the project (habitat which will be lost anyway), leaving the habitat outside the footprint unaffected. Any habitat degradation outside the construction footprint will be temporary, and the habitat will likely recover once construction is completed.

Disturbance

Actions that cause disturbance to shorebirds include visual disturbance from human activities (e.g. vehicles, walking dogs, lights, etc.), loud noises and/or vibrations (e.g. construction/demolition activities), and presence of other animals (e.g. feral predators). These actions may lead to significant impacts if they take place within an area of important habitat. Roosting and foraging birds are particularly sensitive to discrete, unpredictable disturbances such as sudden loud noises. The BBF Project development includes several actions which have the potential to disturb migratory shorebirds, which broadly fit into three categories: construction, operation, and recreation, which are addressed below.

1. Construction

Site staff, vehicles and plant involved in construction activities may cause disturbance to migratory shorebirds, however these activities should be restricted to the development footprint of the project leaving most of site A2 unaffected. Loud, unpredictable noises and strong vibrations will disturb shorebirds, potentially at a longer distance than visual disturbances such as moving vehicles. Nocturnal work activity utilizing bright artificial lighting may also disturb shorebirds in site A2. Finally, temporary and permanent artificial structures and food waste inside the construction site will attract non-native pest species such as Black Rat (*Rattus rattus*), which in turn is likely to attract feral

predators such as feral cat (*Felis silvestris*) and Red Fox (*Vulpes vulpes*). These predators will disturb migratory shorebirds and lead to direct mortality of shorebirds.

2. Operation

As with the construction phase, sudden loud noises will lead to disturbance of shorebirds especially if irregular and unexpected. Nocturnal lighting from the usual operation of the facility may impact migratory shorebirds (Poot et al. 2008). Artificial structures may provide shelter for pest animals, possibly attracting feral predators as discussed in the construction phase above. Food waste, especially around fish cleaning stations, is likely to attract pest animals and feral predators to the area.

Beach-based recreational activities such as four-wheel-driving, dog walking, fishing, and boat launching from the beach all have the potential to disturb migratory shorebirds. All these activities already take place on the beach in site A2. The proposed development will provide pedestrian access to the remaining beach habitat, and we recommend that vehicle access to the beach is limited or prevented altogether. The provision of additional parking and improved pedestrian access to the beach may lead to an increase in disturbance for shorebirds using the site, particularly if dog walking continues to be permitted on the beach.

Direct Mortality to Shorebirds

Actions which increase the risk of mortality to shorebirds (e.g. collision, or predation) in important habitat may result in a significant impact. Two actions relating to the BBF development have the potential to increase the risk of mortality. These two actions are only mentioned here for completeness, as they have all been discussed in the habitat degradation or disturbance sections above. Spills of fuel or other substances associated with BBF operations will have toxic effects on shorebirds if they come into contact. Oily substances can also coat the birds' feathers and compromise their ability to fly and find food. Artificial structures and inadequate waste management may attract pests and predators, which may also predate directly on migratory shorebirds.

Off-lead dog walking is a significant cause of disturbance to migratory shorebirds and may result in direct mortality to shorebirds if dogs are not controlled. If the BBF Project directly or indirectly leads to increased use of the beach by dog walkers, this will lead to increased risk of direct mortality to shorebirds from uncontrolled dogs.

Mitigating Potential Significant Impacts

Some potential impacts on migratory shorebirds may be avoided altogether through careful planning, but some impacts cannot be avoided and instead should be minimised or mitigated as much as possible.

The proposed impact area lies within the Port of Broome waters (Kimberley Port Authority port waters), adjacent to but not within the Yawuru Nagulagun / Roebuck Bay Marine Park. The Yawuru Nagulagun / Roebuck Bay Marine Park management plan represents consensus around the Port of Broome annex as an area designated for future onshore/offshore industrial development (Department of Parks and Wildlife 2016). The annex was adopted to help facilitate the development and expansion of the Port of Broome, while recognising the much higher conservation significance of nearby Roebuck Bay protected areas.

Habitat Loss

Loss of shorebird habitat is unavoidable with the proposed development as the structure will remove foraging habitat. The project will include an offshore breakwater which has the potential to become

an artificial roosting site for shorebirds. This structure, being separated from the mainland, would provide a predator-free alternative roosting habitat for birds and would be permanently available as a roosting site during high tides. Research has shown that the presence of offshore roost sites near feeding areas correlates to higher densities of foraging shorebirds including Ruddy Turnstones (Whittingham *et al.* 2020). The proposed offshore breakwater may provide an alternative roost site closer to the remaining foraging area in A2, thus requiring less energy on the part of shorebirds to maintain daily routines. This would potentially offset the loss and degradation of migratory shorebird foraging habitat within the A2 impact area. Every effort must therefore be made to help facilitate the offshore breakwater as a roost site if this mitigation is a preferred option. The major constraint on this feature being used as a roost site will be open access to the general public and therefore the structure will need to be signed as no-access to general public for it to function as a potential roost site for migratory shorebirds. There is no guarantee that migratory shorebirds would use an artificial roost site installed at the site of the BBF project, however many species of migratory shorebirds show willingness to use artificial roost sites even in the presence of boats (Peters & Otis 2007).

Habitat Degradation

The proposed BBF development will change the shape of the coastline which has the potential to affect the current movements and flow intensity in the study area. Sediment deposits may shift as a result, however this is not within the scope of the migratory shorebird assessment and will not be discussed further in this report. DoT have commissioned an assessment on coastal processes impacts.

3. Biosecurity and Invasive Species

We recommend the implementation of strict biosecurity protocols reflecting current best practice to mitigate the risk of invasive species becoming established in the area. This should include a pest management plan and waste management procedures.

4. Spills and Pollutants

We recommend strict Safe Work Methodology Statement reflecting current best-practice around managing and mitigating potential pollutants and the marine environment. We recommend the use of only biodegradable products for all maintenance and cleaning of the facilities wherever possible to mitigate the potential negative impact of non-biodegradable contaminants. We also recommend effective drainage / stormwater management to minimise runoff to the marine environment.

5. Construction

Potential spills of fuel and other substances should be strictly managed as discussed above (see Pollutants). Vehicles should stay within the construction footprint and will use regular access routes and movement paths to keep the impacted area to a minimal size.

Disturbance

1. Construction

The timing of the construction phase will be essential to mitigating shorebird disturbance. We recommend the construction phase being scheduled during the times of year when most shorebirds are not present in the area (May to August, during the Austral winter) while they are on their Arctic breeding grounds. This represents the most effective strategy for mitigating potential disturbance impacts to migratory shorebirds.

Construction work activities that cannot be completed during the Austral winter will take further steps to mitigate potential disturbance to shorebirds. Loud, unpredictable noise can be a significant

disturbance to shorebirds (Commonwealth of Australia 2017) especially near roost sites, however generally birds will become habituated to loud noise if it is predictable and consistent (e.g. at airports).

Loud noise should be limited to certain periods during the day or night wherever possible and noise-generating work activities should be planned to coincide with each other. Noise-generating work should be planned to avoid high-tide times when shorebirds may be roosting nearby and, if possible, to avoid low-tide times when shorebirds may be foraging – mid-tide times are the preferred compromise. We recommend that all noise-generating activities have a maximum decibel level of 100 dB (A), based on shorebird responses to different perceived dB (A) measurements (actual volume of the noise stimulus attenuates over distance), and the size of the beach (Wright, Goodman & Cameron 2010). Sirens, ship horns, etc. should be started at low volume and gradually increased in volume over a few seconds.

Bright artificial light can disturb shorebirds at night (Commonwealth of Australia 2020) particularly if the light source is moving and/or flashing/flickering. Some research suggests that shorebirds can benefit from artificial illumination at foraging areas by allowing them to use visual foraging strategies and increase their foraging efficiency (Dwyer et al. 2013; Santos et al. 2010). It is unclear whether lighting from construction of the proposed development will impact migratory shorebirds, but steps should still be taken to mitigate potential impacts. Disturbance from bright artificial lighting during nocturnal works should be mitigated by ensuring that construction lights are aimed away from shorebird feeding and roosting areas wherever possible, and that lights are static and not flickering.

Visual disturbance from personnel and vehicles can be kept to a minimum by ensuring that all construction activities are kept within the construction footprint of the project, and by erecting barriers around the work site to hide activities from the view of nearby shorebirds.

We recommend a pest management plan as part of the biosecurity and invasive species mitigation procedures – this plan should include pest management during the construction phase with emphasis on controlling non-native mammalian predators.

2. Operation

Operational use of the facility cannot be limited to the Austral winter as with construction activities. Mitigation strategies for noise and lighting disturbance during the construction phase are also relevant during operational use (see Construction above). Permanent lighting for the facility should be as environmentally-friendly as possible while maintaining necessary operational standards, and not be directed toward shorebird feeding or roosting areas.

The development is likely to increase the amount of human disturbance in the area. To mitigate this increased disturbance, we suggest the creation and posting of clear signage outlining information about migratory shorebirds and the importance of Roebuck bay as a migration stop. It should highlight the damages disturbance can have on foraging and roosting shorebirds, with particular focus on the impact of dogs chasing shorebirds. Through improved awareness this measure can encourage cooperation by the public and reduce the impact of the disturbance. Training of the local ranger service in shorebird identification and biology is another step that could be taken to improve the public understanding and conduct around migratory shorebirds and will give them the understanding and awareness to help enforce correct conduct on the site.

The pest management plan recommended as part of the biosecurity and invasive species mitigation procedures will also mitigate potential disturbance from introduced pests, especially non-native mammalian predators.

Direct Mortality to Migratory Shorebirds

With increased usage by the public the likelihood of direct mortality to shorebirds by uncontrolled dogs is increased. Public information signage, as described under the Disturbance section above, will help reduce the risk of direct mortality to shorebirds by uncontrolled dogs. Signage at all access points will serve to remind and inform beach users about the importance of the habitat for migratory shorebirds, and about proper conduct and behaviour around shorebird areas with emphasis on not allowing dogs to chase shorebirds.

The previously recommended pest management plan as part of the biosecurity and invasive species will act as a mitigator, reducing the likelihood of direct mortality to shorebirds resulting from pests, especially non-native mammalian predators.

Spills of fuel and other substances should be managed to avoid potential habitat degradation as discussed in that section above, but proper management of pollutants will also help minimise the likelihood of direct mortality to shorebirds through ingestion of toxic substances or contact with oily substances. We recommend against the use of bird deterrent products (e.g. alpha-chloralose), especially products with bioaccumulation effects.

Conclusion and Recommendations

Results from the survey data presented in this report demonstrate that the impact area of the proposed BBF project (site A2) does not support any shorebird species in numbers of national or international significance. The overall shorebird abundance and diversity do not meet national significance criteria either, so the site should be not be regarded as important for migratory shorebirds. When the area of the proposed BBF is considered in the context of the adjoining and surrounding control count areas, it has a relatively low conservation importance for migratory shorebirds. Despite this, the site still provides valuable foraging habitat for the low numbers of shorebirds that use the site, so we recommend that steps are taken wherever possible to avoid or mitigate the potential for the project to negatively impact these shorebirds.

Note that no surveys were conducted during the migratory shorebird breeding season (Austral winter). The EPBC Act Policy Statement 3.21 states that at least one survey must be conducted to assess shorebird numbers during this period. A further recommendation of this report is that one more field trip takes place in July or August to comply with the survey requirements of the EPBC Act Policy Statement 3.21.

Low numbers of shorebirds may be impacted by the proposed BBF project primarily from habitat loss, and potentially also from habitat degradation, disturbance to shorebirds, and direct mortality to shorebirds. Sources of potential habitat degradation include the possibility of pollution via spills, and the possibility of accidental introduction of invasive species. Potential disturbance to shorebirds may result from construction activities (loud noise, vibration, artificial lighting, moving personnel and vehicles, pest predators), and from operational use of the facility (loud noise, artificial lighting, pest predators, beach users and unrestrained dogs). Direct mortality to shorebirds may result from accidental introduction of pests, especially mammalian predators, increased use of the beach involving unrestrained dog-walking, and spills of fuel or other substances.

We are confident that the adoption of the recommended mitigation measures outlined in this report will reduce the chance of any significant impacts on migratory shorebirds using the site A2 where the proposed BBF project will be located.

Acknowledgements

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Appendix 1. Detailed breakdown of abundance and richness for 17 migratory shorebird species recorded in the Broome Peninsula study area (sites A1-A4) from December 2019 to February 2020. Maximum abundance for any single survey and mean abundance across all surveys (± one standard error) are shown for each species within each site, and each tide level (high/low). Total abundance and species richness are also shown in this way, while total species richness is shown for each site (combining tidal levels). Rows and cells which are shaded indicate statistics that cross the national significance threshold.

Species	National significance threshold (0.1% flyway population)	A1				A2				A3				A4			
		Low Tide		High Tide		Low Tide		High Tide		Low Tide		High Tide		Low Tide		High Tide	
		Max	Mean ± SE	Max	Mean ± SE	Max	Mean ± SE	Max	Mean ± SE	Max	Mean ± SE	Max	Mean ± SE	Max	Mean ± SE	Max	Mean ± SE
Bar-tailed Godwit	325	0	0	0	0	0	0	0	0	0	0	0	0	25	3.8 ± 2.2	96	7.4 ± 7.4
Common Greenshank	110	0	0	0	0	0	0	0	0	0	0	0	0	10	1.0 ± 0.7	10	0.8 ± 0.8
Common Sandpiper	190	12	2.1 ± 0.9	3	0.5 ± 0.2	4	1.1 ± 0.3	2	0.3 ± 0.2	3	0.8 ± 0.2	2	0.3 ± 0.2	5	0.9 ± 0.4	1	0.4 ± 0.1
Curlew Sandpiper	90	1	0.1 ± 0.1	0	0	0	0	7	0.5 ± 0.5	0	0	0	0	42	4.1 ± 2.7	10	1.8 ± 0.9
Great Knot	425	0	0	0	0	0	0	0	0	0	0	0	0	112	16.5 ± 9.1	32	2.9 ± 2.4
Greater Sand Plover	200	0	0	15	1.5 ± 1.1	3	0.7 ± 0.3	10	0.8 ± 0.8	4	0.9 ± 0.3	40	3.3 ± 3.1	150	23.3 ± 10.1	69	13.8 ± 7.0
Grey Plover	80	3	0.8 ± 0.3	0	0	2	0.2 ± 0.1	0	0	0	0	0	0	30	2.6 ± 1.9	15	1.5 ± 1.2
Grey-tailed Tattler	70	1	0.1 ± 0.1	1	0.1 ± 0.1	0	0	10	0.8 ± 0.8	38	3.4 ± 2.5	14	1.2 ± 1.1	280	51 ± 18.2	250	60.4 ± 18.9
Lesser Sand Plover	180	6	0.4 ± 0.4	5	0.4 ± 0.4	2	0.2 ± 0.1	0	0	0	0	0	0	14	10.6 ± 1.0	0	0
Pacific Golden Plover	120	1	0.1 ± 0.1	5	0.6 ± 0.4	2	0.6 ± 0.2	4	0.3 ± 0.3	2	0.3 ± 0.2	6	0.6 ± 0.5	20	1.8 ± 1.2	15	2.5 ± 1.2
Red Knot	110	4	1.0 ± 0.3	1	0.1 ± 0.1	0	0	0	0	0	0	0	0	40	2.7 ± 2.5	30	2.3 ± 2.3
Red-necked Stint	475	0	0	1	0.1 ± 0.1	0	0	2	0.2 ± 0.2	0	0	0	0	60	8.3 ± 4.3	60	4.6 ± 4.6
Ruddy Turnstone	30	23	4.6 ± 1.7	25	6.9 ± 2.8	6	1.6 ± 0.4	15	2.2 ± 1.3	33	7.1 ± 2.3	40	5.5 ± 3.8	25	3.7 ± 1.9	70	10.8 ± 5.6
Sanderling	30	1	0.1 ± 0.1	4	0.3 ± 0.3	17	1.8 ± 1.3	0	0	0	0	0	0	0	0	40	3.1 ± 3.1
Sharp-tailed Sandpiper	85	0	0	0	0	0	0	0	0	0	0	0	0	2	0.1 ± 0.1	0	0
Terek Sandpiper	50	0	0	0	0	0	0	0	0	1	0.1 ± 0.1	15	1.2 ± 1.1	80	12.3 ± 5.2	40	8.2 ± 3.9
Whimbrel	65	1	0.1 ± 0.1	0	0	0	0	1	0.1 ± 0.1	4	0.8 ± 0.3	4	0.5 ± 0.3	6	1.9 ± 0.6	12	1.8 ± 0.9
Total abundance	2,000 migratory shorebirds	32	9.4 ± 2.6	31	10.5 ± 3.4	23	6.1 ± 1.7	39	5.1 ± 3.1	41	13.4 ± 3.4	105	12.6 ± 8.7	383	135.4 ± 33.9	388	122.2 ± 33.4
Species richness	15 migratory shorebird species	7	2.6 ± 0.6	5	1.9 ± 0.5	5	2.3 ± 0.5	7	0.9 ± 0.5	5	2.8 ± 0.3	7	1.2 ± 0.6	12	5.9 ± 1.0	9	4.7 ± 0.8
Total species richness	15 migratory shorebird species	12				11				7				17			

Appendix 2. Maximum abundance of 22 migratory shorebird species that were recorded in Roebuck Bay Nature Reserve from December 2019 to February 2020. Each site was surveyed several times and the maximum abundance for each species is shown. Rows and cells which are shaded indicate statistics that cross the national significance threshold. Some species were not present in nationally significant numbers in any one site, but were significant across an entire survey of Roebuck Bay (Common Greenshank, Grey Plover, Red Knot). Rows and cells which are shaded indicate statistics that cross the national significance threshold.

Species	National significance threshold (0.1% flyway population)	Maximum abundance												
		RB01	RB02	RB03	RB04	RB05	RB06	RB07	RB08	RB09	RB10	RB11	RB12	RB13
Bar-tailed Godwit	325	300	30	90	42	60	50	1	150	81	190	100	2000	15
Black-tailed Godwit	160	0	0	0	2	0	0	0	1	0	2	0	500	0
Broad-billed Sandpiper	30	0	0	30	0	0	0	0	0	0	0	0	10	0
Common Greenshank	110	0	60	15	5	27	1	5	30	8	50	60	0	0
Common Sandpiper	190	0	3	3	0	0	0	0	1	1	0	0	0	0
Curlew Sandpiper	90	0	0	0	0	0	0	1	0	0	0	0	1200	0
Far Eastern Curlew	35	0	0	1	136	60	150	50	300	0	0	0	10	0
Great Knot	425	0	0	300	30	10	40	80	220	0	110	65	4000	0
Greater Sand Plover	200	1000	80	800	50	85	20	10	50	40	240	15	700	600
Grey Plover	80	0	0	40	0	20	14	0	6	25	25	5	30	0
Grey-tailed Tattler	70	0	30	75	20	30	3	0	40	410	200	3	200	0
Lesser Sand Plover	180	0	0	125	5	0	5	0	0	25	17	2	50	0
Oriental Plover	230	0	0	0	0	0	0	0	0	0	0	0	1	0
Oriental Pratincole	2880	0	0	3	10	5	0	20	0	0	0	15	0	0
Pacific Golden Plover	120	0	20	11	0	12	0	0	10	0	2	1	4	6
Red Knot	110	0	0	100	25	15	20	1	60	6	0	5	4	0
Red-necked Stint	475	1000	0	2000	60	40	100	80	0	30	300	4000	200	0
Ruddy Turnstone	30	0	0	200	2	40	5	8	30	21	34	2	10	0
Sanderling	30	0	0	200	0	0	30	0	0	0	200	0	0	0
Sharp-tailed Sandpiper	85	0	0	0	0	12	3	0	40	40	0	0	0	30
Terek Sandpiper	50	0	0	0	0	1	2	1	10	10	30	0	50	0
Whimbrel	65	40	60	60	3	14	45	2	20	33	4	100	15	5
	National significance threshold	**RB01**	**RB02**	**RB03**	**RB04**	**RB05**	**RB06**	**RB07**	**RB08**	**RB09**	**RB10**	**RB11**	**RB12**	**RB13**
Total abundance	2,000 migratory shorebirds	2340	283	2962	240	260	240	132	443	416	1011	4000	8951	656
Total species richness	15 migratory shorebird species	4	7	17	13	15	15	12	15	13	14	13	17	5

Appendix 3. Maximum number of birds per kilometre of coastline of 22 migratory shorebird species that were recorded in Roebuck Bay Nature Reserve or Broome Peninsula study area from December 2019 to February 2020. Birds per km statistics for each site were based on the maximum abundance per species for each site. Birds per km for A1-4 combined and RB all sites combined are based on the maximum abundance per species for all sites across an entire single survey of Broome Peninsula sites and Roebuck Bay sites, respectively.

Species	Maximum birds per km of coastline							
	A0	**A1**	**A2**	**A3**	**A4**	**A5**	**A1-4 combined**	**RB all sites combined**
Bar-tailed Godwit	0	0	0	0	47.2	171.4	51.1	1,029.4
Black-tailed Godwit							0	212.8
Broad-billed Sandpiper							0	12.8
Common Greenshank	0	0	0	0	18.9	400.0	5.3	59.6
Common Sandpiper	2.2	23.5	11.1	6.3	9.4	78.6	10.6	1.3
Curlew Sandpiper	0	2.0	19.4	0	79.2	1,857.1	22.9	511.1
Far Eastern Curlew							0	217.0
Great Knot	0	0	0	0	211.3	3,285.7	59.6	1,980.4
Greater Sand Plover	4.3	0	27.8	8.3	283.0	1,928.6	85.1	595.7
Grey Plover	1.4	5.9	5.6	0	56.6	0	16.0	37.9
Grey-tailed Tattler	0	2.0	27.8	79.2	528.3	1,235.7	148.9	174.5
Lesser Sand Plover	0.7	11.8	5.6	0.0	26.4	285.7	7.4	53.2
Oriental Plover							0	0.4
Oriental Pratincole							0	22.6
Pacific Golden Plover	1.4	2.0	11.1	4.2	37.7	7.1	12.8	13.2
Red Knot	0	7.8	0	0	75.5	0	21.3	97.0
Red-necked Stint	1.4	0	5.6	0	113.2	285.7	31.9	1,737.9
Ruddy Turnstone	5.0	45.1	41.7	68.8	47.2	114.3	59.0	85.1
Sanderling	10.1	2.0	47.2	0	0	0	23.4	170.2
Sharp-tailed Sandpiper	0	0	0.0	0	3.8	0	1.1	17.9
Terek Sandpiper	0	0	0	2.1	150.9	785.7	42.6	22.6
Whimbrel	1.4	2.0	2.8	8.3	11.3	121.4	6.9	76.6
All species	28.1	62.7	108.3	85.4	722.6	9,278.6	234.0	4,756.2

Appendix 4. Conservation significant migratory shorebirds listed under the EPBC Act, and terns included in the CAMBA, JAMBA and/or ROKAMBA bilateral shorebird agreements. All species included here are listed in international agreements (IA) and some species are listed as threatened: vulnerable (VU), endangered (EN) or critically endangered (CR).

Species Name		Cons. Code		Habitat	Likelihood of Occurrence	Suitable Habitat				Comments on likelihood in Study Area
Scientific	Common	Cth	WA			Beach	Rock Outcrops	Dunes	Disturbed areas	
Charadriiformes										
Actitis hypoleucos	Common Sandpiper	IA	IA	A non-breeding migrant to Australia, occupying a wide range of coastal or inland wetlands feeding on rocky or muddy shores. Often found around estuaries however can have a strong preference for rocky areas including rocky coastal shores or breakwaters. Do not favour open mudflats.	High	Y	Y	-	Y	Site contains suitable foraging, loafing and roosting areas.
Arenaria interpres	Ruddy Turnstone	IA	IA	Non-breeding migrant to Australia. Occurring in a wide range of habitats within Australia tending towards coastal regions including rocky shores, tidal pools, and open mudflats. Often roosting on beaches above the tide line, among rocks or other debris for shelter, or on rocky platforms.	High	Y	Y	-	-	Site contains suitable foraging, loafing and roosting areas.
Calidris acuminata	Sharp-tailed Sandpiper	IA	IA	A non-breeding migrant, Australia is used as an overwintering site for most of the world's population. They feed on exposed mud or in shallow water, foraging along the water's edge of brackish wetlands, across intertidal mudflats and around estuaries. Roost along the edges of wetlands, on open mud or among saltmarsh.	Moderate	Y	-	-	-	Site contains suitable foraging, and roosting areas.

Calidris alba	Sanderling	IA	IA	Non-breeding migrant to Australia. Almost always on the coast, usually on open beaches, sand bars, sand spits, and other areas exposed to waves. Forages among the waves on the shore's edge, running with the water movements. Sometimes among beach washed debris or kelp, often roosting on bare sand among clumps of debris for shelter.	High	Y	-	-	-	Site contains suitable foraging, loafing and roosting areas.
Calidris canutus	Red Knot	IA, EN	IA, EN	Non-breeding migrant to Australia found predominantly on the coast. Feeding on exposed intertidal mudflats and in soft substrate along water's edge of sandy beaches. May feed in nearby brackish estuaries or lagoons during high tides, but very rarely found in freshwater.	High	Y	Y	-	-	Site contains suitable foraging, loafing and roosting areas.
Calidris ferruginea	Curlew Sandpiper	IA, CR	IA, CR	A non-breeding migrant to Australia which prefers intertidal mudflats in more sheltered areas including bays, estuaries, lagoons. They also use non-tidal lakes and swamps near the coast. Foraging on both exposed wet mud and in shallow water.	High	-	-	-	-	Site contains suitable foraging, loafing and roosting areas.
Calidris melanotos	Pectoral Sandpiper	IA	IA,	A rare non-breeding austral summer migrant to Australia. A coastal or near-coastal species that is found along estuaries, saltmarshes, coastal lagoons and fresh to saline wetlands. Rarely on open mudflats, preferring shallow water or along edges of wetlands.	Low	-	-	-	-	Site contains possible roosting area for migrants, but species is more associated with freshwater.

Calidris ruficollis	Red-necked Stint	IA	IA	Non-breeding migrant and Australia's most common Palearctic shorebird. Widespread across all coastal regions, with sporadic inland records. Occurring on intertidal mudflats, lagoons, sand bars and wetlands mostly foraging on exposed wet mud or in very shallow water.	High	Y	Y	-	-	Site contains suitable foraging, loafing and roosting areas.
Calidris subminuta	Long-toed Stint	IA	IA	A regular summer visitor to Australia, preferring fresh or brackish water. Using a wide variety of shallow-water habitats including wetlands, river floodplains, muddy shorelines, ephemeral lakes, and lagoons.	Low	Y	Y	-	-	Site contains possible foraging or roosting area, but species is more associated with freshwater.
Calidris tenuirostris	Great Knot	IA, CR	IA, CR	Non-breeding migrant to Australia found on large intertidal mudflats and sandflats including inlets, estuaries, lagoons, and bays. They forage on bare soft substrate or in shallow water often following the receding tide line.	High	Y	Y	-	-	Site contains suitable foraging, loafing and roosting areas.
Charadrius dubius	Little Ringed Plover	IA	IA	A vagrant to Australia found on inland habitats such as the muddy shores of lakes, wetlands, and rivers. May also use grassy fields near water, and are occasionally seen on intertidal coastal areas, tidal creeks, estuaries, and mudflats.	Low	-	-	-	-	Site could host a migrant in transit however
Charadrius leschenaultii	Greater Sand Plover	IA, VU	IA, VU	A Non-breeding migrant to Australia and almost entirely coastal. Roosting on sand bars or beaches and can be found foraging on the bare, exposed areas of intertidal mudflats or sandflats.	High	Y	-	-	-	Site contains suitable foraging, loafing and roosting areas.

Charadrius mongolus	Lesser Sand Plover	IA, EN	IA, EN	Non-breeding migrant to Australia. Found on sheltered estuaries and bays that have intertidal mudflats or sandflats.	High	Y	-	-	-	Site contains suitable foraging, loafing and roosting areas.
Charadrius veredus	Oriental Plover	IA	IA	A Non-breeding visitor to Australia generally found inland, in arid and semi-arid zones, except for at migration times. Utilizing a wide variety of habitat including terrestrial wetlands, estuarine mudflats, claypans, sparsely vegetated plains and tidal mudflats and beaches.	Moderate	Y	-	-	-	Site contains beach and rocky areas that could host a migrant in transit.
Gallinago megala	Swinhoe's Snipe	IA	IA	A Non-breeding migrant to Australia, its distribution here is not well known. In Non-breeding regions occurring in dense rushes and grasses around the edges of fresh and brackish waters such as wetlands and marshes.	Low	-	-	-	-	Although sand area could be suitable for feeding it is unlikely due to exposure of site and lack of cover.
Gallinago stenura	Pin-tailed Snipe	IA	IA	An uncommon Non-breeding migrant to Australia, its distribution here is not well known. In non-breeding regions they tend occur in a wide variety of wetland habitats, foraging along the muddy shores of flooded fields, swamps, streams, and marshland.	Low	-	-	-	-	Although sand area could be suitable for feeding it is unlikely due to exposure of site and lack of cover.
Glareola maldivarum	Oriental Pratincole	IA	IA	Non-breeding migrant to Australia. Occurring on open ground, often near water. Suitable habitat is varied including flood plains, mudflats, coastal wetlands and other areas with sparse vegetation and open ground. Often using disturbed areas such as airports, parking lots and fields. They forage by hawking over open ground and wetlands.	High	Y	Y	-	Y	Site contains suitable foraging, loafing and roosting areas.

Tringa brevipes (formerly *Heteroscelus brevipes*)	Grey-tailed Tattler	IA	IA	Non-breeding migrant to Australia. Found on sheltered coasts with rocky areas that become exposed at low tide. Also use intertidal mudflats and estuaries, though they usually forage on hard intertidal substrates.	High	Y	Y	-	-	Site contains suitable foraging, loafing and roosting areas.
Limicola falcinellus	Broad-billed Sandpiper	IA	IA	A non-breeding migrant in Australia found predominantly in coastal regions. Feeds on exposed, soft intertidal mudflats, around the edges of coastal wetlands and on soft mud in estuaries and around mangroves. Roosting on sheltered sand or shell beaches.	High	Y	-	-	-	Site contains suitable foraging, loafing and roosting areas.
Limnodromus semipalmatus	Asian Dowitcher	IA	IA	Regular summer visitor to NW Australia in small numbers and a rare vagrant elsewhere. Occurring in sheltered coastal habitats with exposed mud or sand flats. These include estuaries, tidal creeks, and lagoons..	Moderate	Y	Y	-	-	Site contains beach and rocky areas that could host a migrant in transit but is not favoured habitat.
Limosa lapponica baueri	Bar-tailed Godwit (Western Alaskan *ssp*.)	IA, VU	IA, VU	Non-breeding migrant to Australia. They are mainly coastal, preferring large intertidal sandflats and sand bars, but also found on mudflats, inlets, coastal lagoons, and estuaries. The forage in soft substrate near the water's edge or in shallow water.	High	Y	-	-	-	Site contains suitable foraging roosting areas.
Limosa lapponica menzbieri	Bar-tailed Godwit (Northern Siberian s*sp*.)	IA, CR	IA, CR	Non-breeding migrant to Australia. Mainly coastal, preferring large intertidal sandflats and sand bars, but also found on mudflats, inlets, coastal lagoons, and estuaries. They forage in soft substrate near the water's edge or in shallow water.	High	Y	-	-	-	Site contains suitable foraging and roosting areas.

Limosa limosa	Black-tailed Godwit	IA	IA	Non-breeding migrant to Australia. In Australia predominantly coastal, usually found in sheltered lagoons, estuaries and bays with large intertidal mudflats and sandflats. Also known to frequent drying marshy wetlands or saltmarsh. Similar to Bar-tailed Godwit, they feed in soft mud and shallow waters.	High	Y	-	-	-	Site contains suitable foraging and roosting areas.
Numenius madagascariensis	Eastern Curlew	IA, CR	IA, CR	Non-breeding migrant to Australia they are found in coastal and near-coastal regions, usually in estuaries, lagoons, and inlets with large intertidal mudflats. Occasionally on coastal beaches and may also roost and forage on islets and rocky platforms.	High	Y	Y	-	-	Site contains suitable foraging and roosting areas.
Numenius minutus	Little Curlew	IA	IA	A regular non-breeding migrant to Australia. Prefer short grasslands, dry flood plains and open ground. They occasionally are found in dry saltmarshes or on mudflats or sandflats of sheltered estuaries or coastal swamps.	Moderate	Y	-	-	-	Site contains beach and rocky areas that could host a migrant in transit but is not favoured habitat.
Numenius phaeopus	Whimbrel	IA	IA	A regular non-breeding migrant to Australia found in coastal and near-coastal regions, usually in estuaries, harbours, and inlets with intertidal mudflats and possibly mangroves.	High	Y	Y	-	-	Site contains suitable foraging, and roosting areas.
Phalaropus lobatus	Red-necked Phalarope	IA	IA	Rare summer visitor to Australia. Infrequently encountered on coasts or in near-coastal wetlands, more often in pelagic waters outside of breeding season. Occasionally they visit coastal wetlands, lagoons, estuaries, and small pool or lakes.	Low	-	-	-	-	Not often on shore or close to shore when foraging. Could potentially roost on beach.

Philomachus pugnax	Ruff	IA	IA	A rare summer visitor to Australia they can be found in fresh, brackish, or saline wetlands. They forage along the exposed mudflat at the edges of the water or across stretches of exposed mud or shallow water.	Low	Y	-	-	-	Site contains possible foraging or roosting area, but species is more associated with freshwater.
Pluvialis fulva	Golden Plover (Pacific Golden Plover)	IA	IA	Uncommon non-breeding migrant to Australia. Found in coastal regions on sandy and rocky shores, saltmarsh, and intertidal mudflats. They forage along the edges of saline coastal wetlands and lagoons.	High	Y	Y	-	-	Site contains suitable foraging, loafing and roosting areas.
Pluvialis squatarola	Grey Plover	IA	IA	Common non-breeding migrant to Australia. Common in coastal regions they can be found along sandy and rocky coastal beaches, exposed reefs, sand bars, areas of intertidal mudflats and tidal pools. They also forage along the edges of saline wetlands and lagoons.	High	Y	Y	-	Y	Site contains suitable foraging, loafing and roosting areas.
Tringa glareola	Wood Sandpiper	IA	IA	Common non-breeding migrant to Australia they prefer fresh or brackish water. They use a wide variety of shallow-water habitats including wetlands, estuaries, muddy shorelines, ephemeral lakes, and lagoons.	Moderate	Y	Y	-	-	Site contains possible foraging or roosting area, but species is more associated with freshwater.
Tringa nebularia	Common Greenshank	IA	IA	Common non-breeding migrant to Australia they use a wide variety of including wetlands, estuaries, intertidal mudflats, muddy shorelines, ephemeral lakes, and lagoons. They forage predominantly on exposed mud or in shallow water over soft substrates.	High	Y	-	-	-	Site contains suitable foraging, loafing and roosting areas.

Tringa stagnatilis	Marsh Sandpiper	IA	IA	Non-breeding migrant to Australia. They predominantly feed on exposed mudflats and in soft substrate along water's edge. It occurs in both fresh and saline habitats but in some areas seems to have a preference to one. Forages in shallow intertidal and non-tidal water sources, in the soft mud of estuaries, lagoons and wetlands.	Moderate	Y	-	-	-	Site contains possible foraging or roosting area, but species is more associated with freshwater.
Tringa totanus	Common Redshank	IA	IA	Non-breeding migrant and vagrant to parts of Australia. During migrations they may visit inland flooded grasslands and the muddy shores of rivers and lake. On their wintering grounds they are largely coastal, frequenting tidal estuaries, mudflats, saltmarshes, both rocky and sandy beaches, and lagoons.	Moderate	Y	Y	-	-	Site contains suitable foraging, loafing and roosting areas.
Xenus cinereus	Terek Sandpiper	IA	IA	Non-breeding migrant to Australia. On non-breeding grounds they usually feed on exposed mudflats or sand bars in open intertidal estuaries, saltmarsh creeks and coastal lagoons. During migration they may visit freshwater wetlands and lakes with muddy edges.	High	Y	-	-	-	Site contains suitable foraging, loafing and roosting areas.
Hydroprogne caspia	Caspian Tern	IA	IA	Resident breeder in Australia. They use a variety of habitats, both fresh and saline, including estuaries, wetlands, lakes, lagoons, and open coastal waters. They prefer clear waters as they forage by sight, and they use sand spits, beaches, or islands when roosting.	High	Y	Y		Y	Site contains suitable foraging, loafing and roosting areas.

Sterna hirundo	Common Tern	IA	IA	A non-breeding migrant to northern Australia and a vagrant further south, they are a coastal species. They occur in all marine zones but are more typical in offshore and pelagic regions, foraging in coastal waters. They roost on sand bars, intertidal sandy ocean beaches and lagoon shores.	High	Y	Y	-	-	Site contains suitable foraging, loafing and roosting areas.
Sternula albifrons	Little Tern	IA	IA	Both a resident breeder and migrant visitor to Australia, they are a coastal species. Occurring in many coastal environments including estuaries, lakes, bays, inlets, and lagoons, they tend not to venture far from shore. They forage in shallow waters of sheltered areas such as river mouths or lagoons, and roost on sand spits, islets, and sandy ocean beaches.	High	Y	Y	-	-	Site contains suitable foraging, loafing and roosting areas.
Gelochelideon nilotica	Gull-billed Tern	IA	IA	There are two subspecies: one a migratory non-breeder and the other a resident breeder. They occur in either fresh or saline water environments. They forage in shallow wetlands, lakes and lagoons, preferring ones with mudflats.	High	Y	Y	-	-	Site contains suitable foraging, loafing and roosting areas.
Thalasseus bergii	Greater Crested Tern (Crested tern)	IA	IA	Resident breeder in Australia. They use a wide variety of habitats, both fresh and saline, including estuaries, wetlands, lakes, and lagoons, particularly those with mudflats, tidal sand flats, or sand spits. Very often forage in open waters along the coast or around islands.	High	Y	Y	-	Y	Site contains suitable foraging, loafing and roosting areas.

Chlidonias leucopterus	White-winged Tern	IA	IA	Non-breeding migrant to Australia that occurs in coastal and near-coastal areas of both fresh and saline water. They forage aerially, hawking over water or the muddy edges of wetlands. They use sand spits, islets, banks, and rocks around the edge of wetlands to roost and loaf.	High	Y	Y	-	-	Site contains suitable foraging, loafing and roosting areas.

Australian Government
Department of the Environment and Energy

EPBC Act Protected Matters Report

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

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

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

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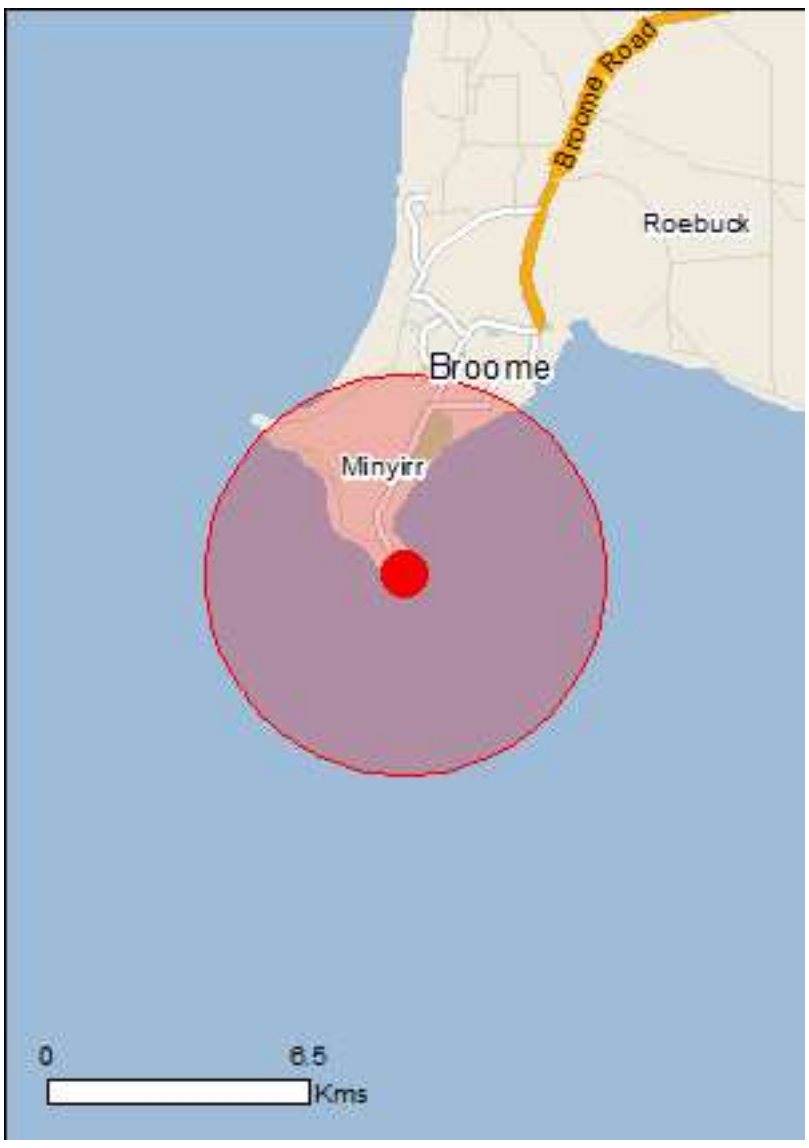

Coordinates
Buffer: 5.0Km

Summary

Matters of National Environmental Significance

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

World Heritage Properties:	None
National Heritage Places:	1
Wetlands of International Importance:	1
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	1
Listed Threatened Species:	29
Listed Migratory Species:	65

Other Matters Protected by the EPBC Act

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

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

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

Commonwealth Land:	2
Commonwealth Heritage Places:	None
Listed Marine Species:	104
Whales and Other Cetaceans:	12
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

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

State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	12
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

National Heritage Properties		[Resource Information]
Name	State	Status
Natural		
The West Kimberley	WA	Listed place

Wetlands of International Importance (Ramsar)	[Resource Information]
Name	Proximity
Roebuck bay	Within 10km of Ramsar

Listed Threatened Ecological Communities		[Resource Information]

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

Name	Status	Type of Presence
Monsoon vine thickets on the coastal sand dunes of Dampier Peninsula	Endangered	Community likely to occur within area

Listed Threatened Species		[Resource Information]
Name	Status	Type of Presence
Birds		
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Roosting known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Roosting known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat likely to occur within area
Limosa lapponica baueri Bar-tailed Godwit (baueri), Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat known to occur within area
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Bar-tailed Godwit (menzbieri) [86432]	Critically Endangered	Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Papasula abbotti Abbott's Booby [59297]	Endangered	Species or species habitat may occur within area

Name	Status	Type of Presence
Polytelis alexandrae Princess Parrot, Alexandra's Parrot [758]	Vulnerable	Species or species habitat likely to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Tyto novaehollandiae kimberli Masked Owl (northern) [26048]	Vulnerable	Species or species habitat may occur within area
Mammals		
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Macrotis lagotis Greater Bilby [282]	Vulnerable	Species or species habitat known to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Breeding known to occur within area
Saccolaimus saccolaimus nudicluniatus Bare-rumped Sheath-tailed Bat, Bare-rumped Sheathtail Bat [66889]	Vulnerable	Species or species habitat likely to occur within area
Plants		
Seringia exastia Fringed Fire-bush [88920]	Critically Endangered	Species or species habitat known to occur within area
Reptiles		
Aipysurus apraefrontalis Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat likely to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding likely to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Sharks		
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area
Pristis pristis Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat known to occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Breeding known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species

Name	Status	Type of Presence
		habitat may occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Anous stolidus Common Noddy [825]		Species or species habitat likely to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat known to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat known to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat known to occur within area
Sternula albifrons Little Tern [82849]		Foraging, feeding or related behaviour known to occur within area
Migratory Marine Species		
Anoxypristis cuspidata Narrow Sawfish, Knifetooth Sawfish [68448]		Species or species habitat likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Crocodylus porosus Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Dugong dugon Dugong [28]		Foraging, feeding or related behaviour known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding likely to occur within area
Manta alfredi Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta		Species or species habitat may occur within

Name	Threatened	Type of Presence
Ray [84994]		area
Manta birostris		
Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat may occur within area
Megaptera novaeangliae		
Humpback Whale [38]	Vulnerable	Breeding known to occur within area
Natator depressus		
Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Orcaella heinsohni		
Australian Snubfin Dolphin [81322]		Species or species habitat known to occur within area
Orcinus orca		
Killer Whale, Orca [46]		Species or species habitat may occur within area
Pristis clavata		
Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area
Pristis pristis		
Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat known to occur within area
Pristis zijsron		
Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Breeding known to occur within area
Rhincodon typus		
Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Sousa chinensis		
Indo-Pacific Humpback Dolphin [50]		Breeding known to occur within area
Tursiops aduncus (Arafura/Timor Sea populations)		
Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat known to occur within area
Migratory Terrestrial Species		
Cecropis daurica		
Red-rumped Swallow [80610]		Species or species habitat may occur within area
Cuculus optatus		
Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat known to occur within area
Hirundo rustica		
Barn Swallow [662]		Species or species habitat known to occur within area
Motacilla cinerea		
Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava		
Yellow Wagtail [644]		Species or species habitat known to occur within area
Migratory Wetlands Species		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat known to occur within area
Arenaria interpres		
Ruddy Turnstone [872]		Roosting known to occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]		Roosting known to occur

Name	Threatened	Type of Presence
		within area
Calidris alba Sanderling [875]		Roosting known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Calidris ruficollis Red-necked Stint [860]		Roosting known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Roosting known to occur within area
Charadrius bicinctus Double-banded Plover [895]		Roosting known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Roosting known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Roosting known to occur within area
Gallinago megala Swinhoe's Snipe [864]		Roosting likely to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area
Glareola maldivarum Oriental Pratincole [840]		Roosting known to occur within area
Limicola falcinellus Broad-billed Sandpiper [842]		Roosting known to occur within area
Limnodromus semipalmatus Asian Dowitcher [843]		Roosting known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Roosting known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting known to occur within area
Numenius phaeopus Whimbrel [849]		Roosting known to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area

Name	Threatened	Type of Presence
Pluvialis squatarola		
Grey Plover [865]		Roosting known to occur within area
Tringa brevipes		
Grey-tailed Tattler [851]		Roosting known to occur within area
Tringa glareola		
Wood Sandpiper [829]		Roosting known to occur within area
Tringa nebularia		
Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Tringa stagnatilis		
Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area
Tringa totanus		
Common Redshank, Redshank [835]		Roosting known to occur within area
Xenus cinereus		
Terek Sandpiper [59300]		Roosting known to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [Resource Information]

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

Name
Commonwealth Land -
Defence - BROOME TRAINING DEPOT

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat known to occur within area
Anous stolidus		
Common Noddy [825]		Species or species habitat likely to occur within area
Anseranas semipalmata		
Magpie Goose [978]		Species or species habitat may occur within area
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat known to occur within area
Ardea ibis		
Cattle Egret [59542]		Species or species habitat may occur within area
Arenaria interpres		
Ruddy Turnstone [872]		Roosting known to occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]		Roosting known to occur within area

Name	Threatened	Type of Presence
Calidris alba Sanderling [875]		Roosting known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Calidris ruficollis Red-necked Stint [860]		Roosting known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Roosting known to occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat known to occur within area
Charadrius bicinctus Double-banded Plover [895]		Roosting known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Roosting known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Charadrius ruficapillus Red-capped Plover [881]		Roosting known to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Roosting known to occur within area
Chrysococcyx osculans Black-eared Cuckoo [705]		Species or species habitat known to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat known to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat known to occur within area
Gallinago megala Swinhoe's Snipe [864]		Roosting likely to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area
Glareola maldivarum Oriental Pratincole [840]		Roosting known to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Heteroscelus brevipes Grey-tailed Tattler [59311]		Roosting known to occur within area
Himantopus himantopus Pied Stilt, Black-winged Stilt [870]		Roosting known to occur within area

Name	Threatened	Type of Presence
Hirundo daurica Red-rumped Swallow [59480]		Species or species habitat may occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat known to occur within area
Limicola falcinellus Broad-billed Sandpiper [842]		Roosting known to occur within area
Limnodromus semipalmatus Asian Dowitcher [843]		Roosting known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Roosting known to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting known to occur within area
Numenius phaeopus Whimbrel [849]		Roosting known to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Papasula abbotti Abbott's Booby [59297]	Endangered	Species or species habitat may occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area
Pluvialis squatarola Grey Plover [865]		Roosting known to occur within area
Recurvirostra novaehollandiae Red-necked Avocet [871]		Roosting known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
Sterna albifrons Little Tern [813]		Foraging, feeding or related behaviour known to occur within area
Tringa glareola Wood Sandpiper [829]		Roosting known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur

Name	Threatened	Type of Presence
		within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area
Tringa totanus Common Redshank, Redshank [835]		Roosting known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Roosting known to occur within area
Fish		
Campichthys tricarinatus Three-keel Pipefish [66192]		Species or species habitat may occur within area
Choeroichthys brachysoma Pacific Short-bodied Pipefish, Short-bodied Pipefish [66194]		Species or species habitat may occur within area
Choeroichthys suillus Pig-snouted Pipefish [66198]		Species or species habitat may occur within area
Corythoichthys flavofasciatus Reticulate Pipefish, Yellow-banded Pipefish, Network Pipefish [66200]		Species or species habitat may occur within area
Cosmocampus banneri Roughridge Pipefish [66206]		Species or species habitat may occur within area
Doryrhamphus excisus Bluestripe Pipefish, Indian Blue-stripe Pipefish, Pacific Blue-stripe Pipefish [66211]		Species or species habitat may occur within area
Doryrhamphus janssi Cleaner Pipefish, Janss' Pipefish [66212]		Species or species habitat may occur within area
Filicampus tigris Tiger Pipefish [66217]		Species or species habitat may occur within area
Halicampus brocki Brock's Pipefish [66219]		Species or species habitat may occur within area
Halicampus grayi Mud Pipefish, Gray's Pipefish [66221]		Species or species habitat may occur within area
Halicampus nitidus Glittering Pipefish [66224]		Species or species habitat may occur within area
Halicampus spinirostris Spiny-snout Pipefish [66225]		Species or species habitat may occur within area
Haliichthys taeniophorus Ribboned Pipehorse, Ribboned Seadragon [66226]		Species or species habitat may occur within area
Hippichthys penicillus Beady Pipefish, Steep-nosed Pipefish [66231]		Species or species habitat may occur within area
Hippocampus histrix Spiny Seahorse, Thorny Seahorse [66236]		Species or species habitat may occur within area
Hippocampus kuda Spotted Seahorse, Yellow Seahorse [66237]		Species or species

Name	Threatened	Type of Presence
		habitat may occur within area
Hippocampus planifrons Flat-face Seahorse [66238]		Species or species habitat may occur within area
Hippocampus spinosissimus Hedgehog Seahorse [66239]		Species or species habitat may occur within area
Hippocampus trimaculatus Three-spot Seahorse, Low-crowned Seahorse, Flat-faced Seahorse [66720]		Species or species habitat may occur within area
Micrognathus micronotopterus Tidepool Pipefish [66255]		Species or species habitat may occur within area
Solegnathus hardwickii Pallid Pipehorse, Hardwick's Pipehorse [66272]		Species or species habitat may occur within area
Solegnathus lettiensis Gunther's Pipehorse, Indonesian Pipefish [66273]		Species or species habitat may occur within area
Solenostomus cyanopterus Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183]		Species or species habitat may occur within area
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
Trachyrhamphus bicoarctatus Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within area
Trachyrhamphus longirostris Straightstick Pipefish, Long-nosed Pipefish, Straight Stick Pipefish [66281]		Species or species habitat may occur within area
Mammals		
Dugong dugon Dugong [28]		Foraging, feeding or related behaviour known to occur within area
Reptiles		
Acalyptophis peronii Horned Seasnake [1114]		Species or species habitat may occur within area
Aipysurus apraefrontalis Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat likely to occur within area
Aipysurus duboisii Dubois' Seasnake [1116]		Species or species habitat may occur within area
Aipysurus eydouxii Spine-tailed Seasnake [1117]		Species or species habitat may occur within area
Aipysurus laevis Olive Seasnake [1120]		Species or species habitat may occur within area
Aipysurus tenuis Brown-lined Seasnake [1121]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Astrotia stokesii Stokes' Seasnake [1122]		Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Crocodylus johnstoni Freshwater Crocodile, Johnston's Crocodile, Johnston's River Crocodile [1773]		Species or species habitat may occur within area
Crocodylus porosus Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Disteira kingii Spectacled Seasnake [1123]		Species or species habitat may occur within area
Disteira major Olive-headed Seasnake [1124]		Species or species habitat may occur within area
Emydocephalus annulatus Turtle-headed Seasnake [1125]		Species or species habitat may occur within area
Ephalophis greyi North-western Mangrove Seasnake [1127]		Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding likely to occur within area
Hydrelaps darwiniensis Black-ringed Seasnake [1100]		Species or species habitat may occur within area
Hydrophis elegans Elegant Seasnake [1104]		Species or species habitat may occur within area
Hydrophis mcdowelli null [25926]		Species or species habitat may occur within area
Hydrophis ornatus Spotted Seasnake, Ornate Reef Seasnake [1111]		Species or species habitat may occur within area
Lapemis hardwickii Spine-bellied Seasnake [1113]		Species or species habitat may occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Pelamis platurus Yellow-bellied Seasnake [1091]		Species or species habitat may occur within area

Whales and other Cetaceans		[Resource Information]
Name	Status	Type of Presence
Mammals		

Name	Status	Type of Presence
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Delphinus delphis Common Dophin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Breeding known to occur within area
Orcaella brevirostris Irrawaddy Dolphin [45]		Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Breeding known to occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat known to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area

Extra Information

Invasive Species [Resource Information]

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

Name	Status	Type of Presence
Birds		
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Frogs		
Rhinella marina Cane Toad [83218]		Species or species

Name	Status	Type of Presence
		habitat may occur within area
Mammals		
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Plants		
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat likely to occur within area
Dolichandra unguis-cati Cat's Claw Vine, Yellow Trumpet Vine, Cat's Claw Creeper, Funnel Creeper [85119]		Species or species habitat likely to occur within area
Jatropha gossypifolia Cotton-leaved Physic-Nut, Bellyache Bush, Cotton-leaf Physic Nut, Cotton-leaf Jatropha, Black Physic Nut [7507]		Species or species habitat likely to occur within area
Reptiles		
Hemidactylus frenatus Asian House Gecko [1708]		Species or species habitat likely to occur within area
Ramphotyphlops braminus Flowerpot Blind Snake, Brahminy Blind Snake, Cacing Besi [1258]		Species or species habitat known to occur within area

Caveat

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

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

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

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

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

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

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

- migratory and
- marine

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

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

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

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

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

Coordinates

-18.00726 122.20977

Acknowledgements

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

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

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

Please feel free to provide feedback via the Contact Us page.

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