Environmental Approval & Compliance Solutions

Shorebird Monitoring Study for Townsville Port Expansion Project October 2021 to February 2022

Port of Townsville Limited

Document Control Summary

NRA Environmental Consultants

NRA Filepath:	F:\AAA\349_TPort\349011-CU Shorebird Monitoring 2021-2022\Rpt\R02\CU_Shorebird_Monit21-22_rpt R02.docx		
Status:	R02	**Date of Issue:**	30 August 2022
Project Manager:	Peter Buosi		
Title:	Shorebird Monitoring Study for Townsville Port Expansion Project October 2021 to February 2022		
Client:	Port of Townsville Limited		
Client Contact:	Tim Smith, Environmental Advisor		
Copies Dispatched:	PDF via email		
Other Info or Requirements:	–		

Report Summary	
Key Words	Port of Townsville Limited, migratory, shorebird, expansion, Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999, EPBC Act
Abstract	Port of Townsville Limited has commenced Stage 1 of the Port Expansion Project (PEP). This report presents the results of the third annual shorebird monitoring study conducted coincidental with the construction phase of Stage 1 of the PEP. The monitoring study is a requirement of the PEP Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999 approval.

Citation
This report should be cited as: NRA 2022, *Shorebird Monitoring Study for Townsville Port Expansion Project October 2021 to February 2022*, R02, prepared by NRA Environmental Consultants for Port of Townsville Limited, 30 August 2022

Quality Assurance					
Author	**Technical Review**	**Editor**	**Document Version**	**Approved for Issue by QA Manager**	
				Date	**Signature**
Peter Buosi BAppSc(Hons)	Lindsay Popple PhD, BSc(Hons)	Kirsty Anderson BA(Hons)	R01	31/3/2022	
Peter Buosi BAppSc(Hons)	-	Nadine Hunt BA, GDipEd	R02	30/08/2022	

Certified Integrated Management System

Safety ISO 45001 www.globalcertification.com.au

Quality ISO 9001 www.globalcertification.com.au

Environment ISO 14001 www.globalcertification.com.au

JAS-ANZ www.jas-anz.com.au/register

Limitations of this Report

The information in this report is for the exclusive use of Port of Townsville Limited, the only intended beneficiary of our work. NRA cannot be held liable for third party reliance on this document. This disclaimer brings the limitations of the investigations to the attention of the reader. The information herein could be different if the information upon which it is based is determined to be inaccurate or incomplete. The results of work carried out by others may have been used in the preparation of this report. These results have been used in good faith, and we are not responsible for their accuracy. The information herein is a professionally accurate account of the site conditions at the time of investigations; it is prepared in the context of inherent limitations associated with any investigation of this type. It has been formulated in the context of published guidelines, legislation in force at the date of this report, field observations, discussions with site personnel, and results of laboratory analyses. Any change to published guidelines or legislation may change the opinions of NRA expressed in this document. NRA's opinions in this document are subject to modification if additional information is obtained through further investigation, observations or analysis. They relate solely and exclusively to environmental management matters, and are based on the technical and practical experience of environmental practitioners. They are not presented as legal advice, nor do they represent decisions from the regulatory agencies charged with the administration of the relevant Acts. Any advice, opinions or recommendations contained in this document should be read and relied upon only in the context of the document as a whole and are considered current as of the date of this document.

Table of Contents

Tables

Graphs

Figures

Plates

Appendices

1. Introduction

On 5 February 2018, Port of Townsville Limited (Port) received approval under the Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act) for the Townsville Port Expansion Project (PEP). Condition 12 of the EPBC Act approval (EPBC 2011/5979) requires the implementation of '*a program to monitor the potential impacts to shorebirds before and during construction activities in the marine environment*'. In response to this requirement, Port has developed and commenced a Shorebird Monitoring Program to achieve the following objectives.

- **Objective One**: develop a Shorebird Monitoring Program to monitor potential impacts to shorebirds before and during construction activities.
- **Objective Two**: conduct a survey of shorebirds in the PEP area and on the nearby Ross River sand spit prior to construction to identify and record the abundance of each bird species.
- **Objective Three**: monitor and report on changes to shorebird roosting and foraging, beyond natural spatial and temporal variation, during the project construction activities in the marine environment to identify any impacts from the project on shorebirds.
- **Objective Four**: provide recommendations on key areas of actual impact and potential mitigation measures should impacts be detected.
- **Objective Five**: contribute to improving public awareness on local avifauna biodiversity and species richness in the vicinity of the project area.

A shorebird survey was completed in early 2019 (NRA 2019) prior to construction works, fulfilling Objectives One and Two. Pre-construction works for Stage 1 of the PEP, the Channel Upgrade (CU) project, commenced soon after the completion of the NRA (2019) study. NRA (2020a) documented the results of the first annual monitoring event coincidental with the CU project. The CU project involves the following works (locations as per mapping in **Appendix A**):

- supply and haulage of marine-grade armour rock required for rock walls and revetments
- creation of a new reclamation area (approximately 62 ha), via the construction of rock walls and revetments, to receive capital dredge material from channel widening works
- capital dredging to widen the Platypus Channel
- capital dredging to widen the Sea Channel.

1.1 Scope

NRA Environmental Consultants (NRA) was commissioned by Port to continue works to address Objectives Three and Four. The scope relevant to the 2021/22 monitoring study is as follows.

- Five shorebird monitoring events will be implemented.
  - Surveys will nominally occur once per month between October 2021 and February 2022 (the period of peak shorebird abundance at the site).
  - The surveys will be designed to permit comparison with previous work (NRA 2012a, 2019, 2020a, 2021), be repeatable during and following construction, and address the PEP EPBC Act approval requirement for monitoring.
- Annual reporting following the shorebird monitoring surveys will:
  - describe study context, scope and methods

- describe shorebird habitat within the study area
- describe shorebird species composition (*ie* a species list) present in the study area
- identify shorebird species listed as Critically Endangered, Endangered, Vulnerable, Near Threatened and/or Migratory under the EPBC Act and/or the Queensland *Nature Conservation Act* 1992 (NC Act) occurring in the study area, and their abundance
- assess the significance of observed species, abundances and habitats with reference to the EPBC Act
- compare the results of surveys before (NRA 2019) and during CU project construction activities (NRA 2020a, 2021), and previous surveys reported in NRA (2012a), noting any changes in the significance of identified values to shorebirds and potential CU project-related impacts
- include recommendations if any adverse impacts to shorebirds are detected.

The study area will, to the extent that is practical given safety and logistical matters associated with the CU project, replicate that assessed by NRA (2012a, 2019, 2020a, 2021) and will comprise:

- Port of Townsville (PoT) land:
  - Eastern Reclamation Area between Marine Precinct and proposed reclamation area
  - vacant area of Marine Precinct (southern area)
  - rock walls along Eastern Reclamation Area and Marine Precinct
  - intertidal area between Marine Precinct and Benwell Road (an undeveloped section of Lot 773 on SP223346)
- sand spit area at mouth of Ross River (**Figure 1**).

1.2 Terms

Shorebirds, also known as waders, refer to a subset of bird families, notably Charadriidae (*eg* plovers and dotterels) and Scolopacidae (*eg* curlews, godwits and sandpipers), belonging to the order Charadriiformes. These birds commonly feed by wading in shallow water or saturated substrate along the shores of lakes, rivers, and the sea (Geering *et al*. 2007). They include a large group of species that migrates annually along the East Asian–Australasian flyway (EAA flyway) between Australia and areas as far north as the Arctic Circle, and a smaller group of species that permanently resides in Australia. Many of these migratory and resident species are listed as Migratory under the EPBC Act.

Shorebirds often share their habitats with a range of other waterbirds, notably seabirds of the family Laridae (terns and gulls) and various wetland species in the families Accipitridae (kites, osprey and sea eagle), Ardeidae (herons and egrets), Threskiornithidae (spoonbills and ibis), Haematopodidae (oystercatchers) and Anatidae (ducks, geese and swans). Some species in the Laridae family are listed as Migratory under the EPBC Act. The coastal Migratory seabird populations around Townsville undertake seasonal movements, sometimes into and out of the region, though most do not undertake transcontinental migrations.

Some of the above bird species are listed as Threatened under the EPBC Act and NC Act. Threatened species categories under the EPBC Act comprise Critically Endangered, Endangered or Vulnerable. Under the NC Act, Threatened is limited to the Endangered or Vulnerable categories. Species that are Migratory under the EPBC Act—but not Threatened—are recognised as Special Least Concern under the NC Act.

Figure 1: Shorebird monitoring study area

Project: Shorebird Monitoring Study for Townsville Port Expansion Project October 2021 to February 2022

- CU project reclamation area
- Lot 773 on plan SP223346
- Rock wall
- Eastern reclamation area
- Marine precinct
- Ross River mouth sand spit
- Intertidal flats

N

0 1

Kilometres

Source:
Google Earth, Port of Townsville Limited

NRA Ref: 349011
Date: August 2022

T:_Temp Mapping 2022\349\WOR\349011 \349011_PortExpansion_220811.wor

Recommended print size: A4

2. Background

2.1 Study area

The PEP area occurs near the mouth of Ross River in Townsville (**Figure 1**). The Ross River mouth area contains terrestrial, intertidal and inshore marine habitats that are used by a diverse range of bird species. Of particular significance in this area is the sand spit near the river mouth and intertidal banks (or flats) that extend from the river mouth south-east along Cleveland Bay. The intertidal areas and sand spit provide ideal foraging and roosting habitat for a variety of shorebirds and other waterbirds. Previous studies have found that the area supports Migratory shorebird populations that are of national and international significance with respect to species richness and abundance (NRA 2005, 2008, 2012a, 2019, 2020a, 2020b, 2021, Driscoll 2009), with the majority of this population being transient. While the sand spit is outside the PEP area, it plays an important role in the dynamics of the local shorebird population; therefore, it is included in the study area.

PoT is on the northern bank of the Ross River mouth. The developed areas are predominantly built on reclaimed land and contain administration buildings, ship loading facilities, and storage facilities. PoT also contains recently reclaimed areas where future development is planned, and areas undergoing land reclamation transition from aquatic to terrestrial environments. The transition is gradual, and during the latter stages the reclamation areas resemble wetland habitats. NRA (2012a) recorded Migratory shorebirds foraging in, and roosting on, sections of reclaimed land; certain species were sometimes present in nationally significant numbers. As the land reclamation progresses, the way in which Migratory shorebirds use these areas is changing (NRA 2020a, 2021).

The PoT's northern and eastern boundaries are protected by constructed rock walls. The seaward edge of the rock walls is subject to tidal inundation and spray from wave action. These conditions are favourable for many species of mollusc and crustacean, which are a food source for a variety of waterbirds. Rock walls may be used by waterbirds as perches for hunting, feeding and resting. These man-made structures provide similar habitats to naturally occurring rocky headlands and foreshores, such as those found nearby at Kissing Point and Magnetic Island (approximately 4 km and 8 km from the study area respectively). NRA (2012a, 2019, 2020a, 2021) recorded small numbers of Migratory shorebirds around the Marine Precinct rock walls, but very little bird activity around the Eastern Reclamation Area rock walls.

2.2 General bird use patterns of Ross River mouth and surrounds

Based on work by NRA (2005, 2008, 2012a, 2019, 2020a, 2020b, 2021) and Driscoll (2009), during high tide, most shorebirds and various other waterbirds move to the sand spit in the Ross River mouth to roost. This site is an ideal roost because it is near suitable foraging habitat, provides unobstructed visibility of potential predators and is relatively isolated from the mainland at high tide. Isolation at high tide is important because it affords roosting birds a degree of protection from land-based predators and human disturbance. Such areas are uncommon along the Queensland coastline, including the Townsville region. Driscoll (1997, 2009) assessed the Ross River site as being the most significant in the region and ranking within the top 40 sites for shorebirds along the east coast of Queensland.

As the tide recedes, the majority of shorebirds move off the sand spit to forage on the flats south-east of the river mouth (*ie* Cleveland Bay), notably the area near Sandfly Creek (approximately 2.3 km south-east of sand spit), with smaller numbers venturing farther south into Cleveland Bay or along the banks of Ross River (NRA 2005, 2008, 2011, 2012a–d, 2019, 2020a, 2020b, 2021, Driscoll 2009). The historical preference of shorebirds for the Sandfly Creek area could be related to the nutrient rich outfall from the Cleveland Bay Sewage Treatment Plant (Pell & Lawler 1996). The Sewage Treatment Plant was recently upgraded, and the impacts of the upgrade on this foraging area have not been reported.

Seabirds and other waterbirds also forage in the surrounding environments, though their movements away from the sand spit roost are less defined by the tide (*cf* shorebirds). The exception is the Little Tern (*Sternula albifrons*; Migratory, EPBC Act), which breeds on the sand spit in spring and summer (NRA 2005, 2008, 2011, 2012a–d, 2019, 2020a, 2020b) and maintains a regular presence on the sand spit when caring for eggs or young.

While the majority of local Migratory shorebirds roost on the sand spit and forage on nearby intertidal banks, NRA (2012a, 2019, 2020a, 2021) found that some shorebirds from this population used habitats on PoT. This included 18 Migratory bird species and six Threatened (EPBC Act and/or NC Act) species[1]. Of the Migratory birds using PoT, the Lesser Sand Plover (*Charadrius mongolus*), Greater Sand Plover (*Charadrius leschenaultii*), Sharp-tailed Sandpiper (*Calidris acuminata*) and Red-necked Stint (*Calidris ruficollis*) were the most abundant and were sometimes observed in nationally significant numbers[2].

Low levels of bird activity occur along the PoT rock walls (*eg* breakwaters). NRA (2012a, 2019, 2020a, 2021) recorded small numbers of Grey-tailed Tattler (*Tringa brevipes*), Common Sandpiper (*Actitis hypoleucos*), Whimbrel (*Numenius phaeopus*)[3], Sooty Oystercatcher (*Haematopus fuliginosus*) and/or Striated Heron (*Butorides striata*) using these areas, particularly the rock walls around the Marine Precinct. The Migratory Caspian Tern (*Hydroprogne caspia*), Crested Tern (*Thalasseus bergii*) and Little Tern occasionally forage in waters adjacent to the rock walls.

2.3 Assessing significance

Under the EPBC Act, 'important habitat' is a key concept for assessing the significance of an area to Migratory shorebirds (DoEE 2017). EPBC Act Policy Statement 3.21 *Industry Guidelines for Avoiding, Assessing and Mitigating Impacts on EPBC Act Listed Migratory Shorebird Species* (DoEE 2017) states that sites contain important habitat when they support 2,000 or more Migratory shorebirds, 15 or more Migratory shorebird species[4], or individual Migratory shorebird species abundance above thresholds for national significance. The threshold for national significance is 0.1% of the EAA flyway population for a given species. The most recent EAA flyway population estimates are available in Hansen *et al.* (2016). Sites supporting 20,000 or more shorebirds or ≥1% of the EAA flyway species population are considered to be of international significance.

[1] The legislative status for some species has changed since NRA (2012a).

[2] Lesser Sand Plover and Greater Sand Plover are also Threatened species under the EPBC Act and/or NC Act.

[3] Grey-tailed Tattler, Common Sandpiper and Whimbrel are Migratory species under the EPBC Act.

[4] Referring to species richness.

2.4 Species status

The legislative status of some species under the EPBC Act and/or NC Act changed in the period between NRA (2012a) and NRA (2019); these are documented in NRA (2019). No further changes in legislative status relevant to the monitoring program have occurred since NRA (2019). Species status reported herein is current as at 1 March 2022.

3. Methods

3.1 Overview

3.1.1 General methods

The surveys were conducted between October 2021 and February 2022 on the dates shown in **Table 1**. The survey period was primarily chosen because overall shorebird abundance in the Ross River mouth (*ie* sand spit and adjacent intertidal areas) is highest during spring and summer (Driscoll 2009, NRA 2020b). The survey area comprised developed (Marine Precinct and Eastern Reclamation Area) and undeveloped (intertidal area between the Marine Precinct and Benwell Road) sections of PoT, and the Ross River mouth sand spit (**Figures 1** and **2**).

The surveys were undertaken using binoculars (10 x 42) and, when necessary, a spotting scope (Swarovski ATS 65 mm).

Table 1: Survey dates, locations and corresponding tides during 2021/22 CU project shorebird monitoring study

Date	Survey area[1]	Tide times	Tide height (m)
12 October 2021	PoT	1554 (high)	2.93
19 October 2021	Sand spit	0814 (high)	3.04
15 November 2021	Sand Spit	0701 (high)	3.63
15 November 2021	PoT	1628 (low)	1.10
16 November 2021	PoT	1037 (high)	3.50
14 December 2021	Sand spit	0558 (high)	2.86
15 December 2021	PoT	0640 (high)	3.19
13 January 2022	PoT	0715 (high)	3.10
13 January 2022	PoT	1313 (low)	1.55
14 January 2022	Sand Spit	0820 (high)	3.45
10 February 2022	PoT	0640 (high)	2.93
10 February 2022	PoT	1320 (low)	1.64
11 February 2022	Sand Spit	0705 (high)	3.11

[1] The PoT survey areas comprised developed sections (Marine Precinct and Eastern Reclamation Area) and undeveloped sections (intertidal area between the Marine Precinct and Benwell Road). The sand spit extends east of the Ross River mouth.

3.1.2 Variation in methods

While the survey methods generally followed those previously implemented (NRA 2012a, 2019, 2020a, 2021), the following variations occurred.

- **Survey timing**. For the current (2021/22) and 2020/21 studies, a high tide survey occurred each month over 5 months compared with the three earlier studies (2011/12, 2018/19 and 2019/20) where monthly surveys spanned 4 months. Surveys at low tide have occurred during all studies though with some variation in the number of monthly surveys: three surveys for the current and 2020/21 studies, two surveys for the 2019/20 study, four surveys for the 2018/19 study and six surveys for the 2011/12 study. The accumulation of site-specific data has provided the opportunity to optimise the survey design and has contributed to the variations described above.
- **Rock wall count areas**. The initial studies (NRA 2012a, 2019) had nine fixed count areas along the rock wall (RW1 to RW9). Due to construction works, access to RW1 to RW5 was not possible from 2019/2020 onwards, and not possible for RW6 from

2020/21 onwards. The initial studies (NRA 2012a, 2019) reported very low levels of bird activity along the rock walls, including areas encompassing RW1 to RW6.

3.2 Port of Townsville land

Surveys within the PoT section of the study area involved formal bird counts at fixed locations, informal searches for birds, and habitat assessments. The survey period was approximately 2 hours either side of the high or low tide. Formal counts involved visiting count areas (**Figure 2**) and recording the abundance of each bird species and noting their behaviours. The survey approach is summarised as follows.

- The rock wall was divided into three count areas (RW7 to RW9, **Figure 2**) 250 m apart. Included in the counts were birds perching or foraging along the rock wall and/or foraging within 250 m in the adjacent ocean waters. The overlap between count areas was intentionally done to counteract the obscured visibility caused by the rocks.
- The Marine Precinct (reclaimed land and rock walls) and the adjoining intertidal area of South Townsville Beach were divided into two (MP1 and MP2, **Figure 2**) and three (STB1a to STB1c, **Figure 2**) count areas respectively. Counts were made from vantage points along the western rock wall of the Marine Precinct.
- The Eastern Reclamation Area was divided into six count areas (ER1 to ER6, **Figure 2**). Counts were made from vantage points that offered good visibility without causing birds to flee. In January 2019, temporary offices and support facilities were constructed over most of ER2, with ER1 used for material storage and drainage. This infrastructure and site usage remains in place.

3.3 Sand spit

A boat was used to access the sand spit, and land-based counts were made from vantage points that offered optimal views without disturbing birds. Surveys commenced approximately 1.5 hours prior to high tide and ended when a satisfactory count was achieved, usually within the hour after high tide.

Figure 2: Formal count areas used during the 2021/22 shorebird surveys

Project: Shorebird Monitoring Study for Townsville Port Expansion Project October 2021 to February 2022

CU project reclamation area

Sand spit

Formal count areas

South Townsville Beach (STB)

Marine Precinct (MP)

Eastern Reclamation Area (ER)

Rock wall (RW)

N

0 1

Kilometres

Source:
NRA, Google Earth, Port of Townsville Limited

NRA Ref: 349011
Date: August 2022

T:_Temp Mapping 2022\349\WOR\349011\349011_CountAreas_220811.wor

Recommended print size: A4

4. Results

4.1 Survey conditions

4.1.1 Changes to Migratory shorebird habitats

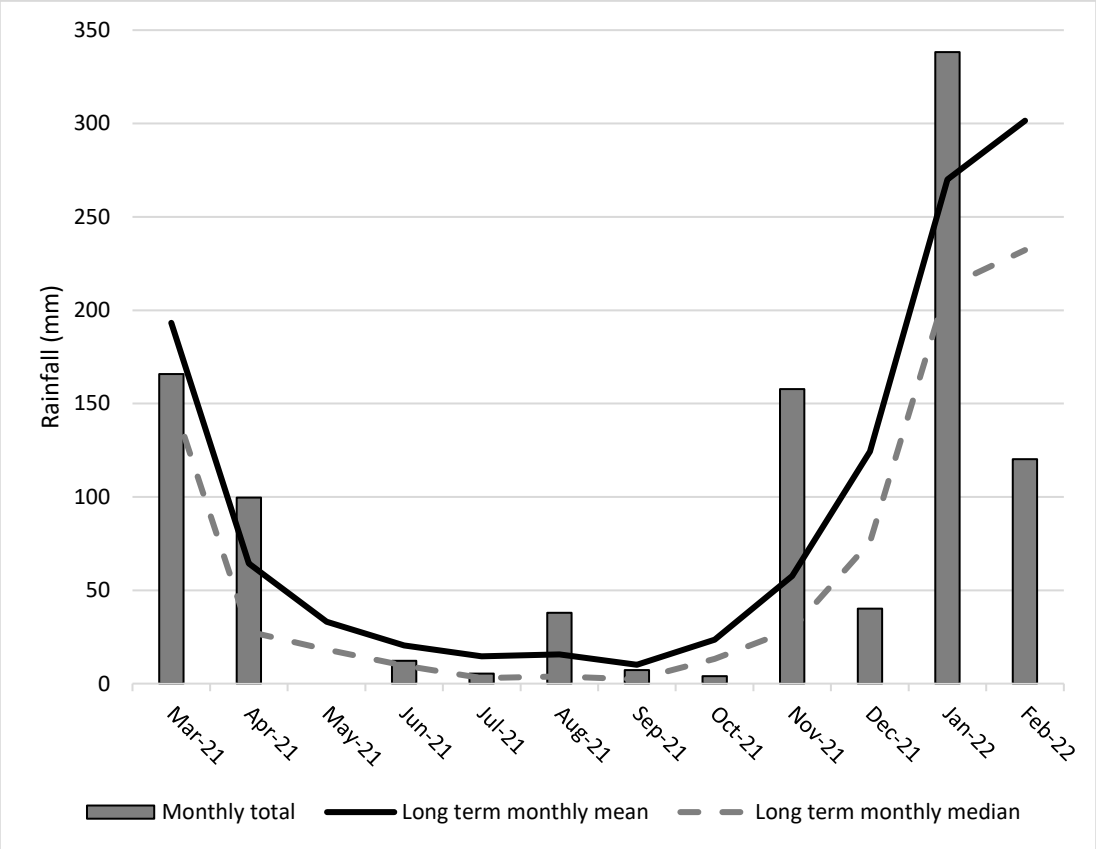
The habitats within the study area have changed little to those reported by NRA (2019) during the baseline assessment. As described in NRA (2019), these conditions differ markedly to those reported by NRA (2012a) during the impact assessment phase. The main differences are a reduced extent of artificial wetland habitats[5] in the Eastern Reclamation Area and Marine Precinct, and mangrove colonisation of the intertidal flats on the northern river bank (**Figure 1**). These changes reduced the quality of these sites as habitat for shorebirds.

The amount of construction activity associated with the CU project, and in areas used by shorebirds, was higher during the current study relative to the baseline study (NRA 2019), though similar to the previous two studies (NRA 2020a, 2021). Construction activity during the current study was concentrated in the area west and north of ER1 (**Figure 2**), and involved rock and sand stockpile management, rock wall construction and piling to create the Unloading Facility at the CU Project reclamation area, and dredging and reclamation of the Unloading Facility access channel.

4.1.2 Weather

No extreme weather events (*eg* tropical cyclones, flooding) occurred during or immediately prior to the 2021/22 surveys. Monthly rainfall totals for the survey period and preceding months are shown on **Graph 1**. Weather data was obtained from the Bureau of Meteorology website (www.bom.gov.au) and is based on records from Townsville Aero (station 032040), which is approximately 7 km from the study area. Total rainfall for the survey period was below average, though with above average rainfall in November 2021 and January 2022 (**Graph 1**). These rainfall patterns are relevant given that some bird species behaviours are influenced by rainfall.

[5] The land reclamation process results in temporary artificial wetland habitats. During the NRA (2012a) study, ER2 and MP2 contained sections of shallow water that were used by large numbers of certain Migratory shorebird species.



Source: BOM (2022).

Graph 1: Monthly rainfall (2021/22) and long-term average and median rainfall (1940 to February 2022) recorded at Townsville Aero weather station

4.2 Field survey results

4.2.1 Overview

The following sections focus on results relating to Migratory bird species recorded on PoT, *ie* less attention is devoted to non-Migratory species and results from the sand spit. Of the observed species, the Beach Stone Curlew (*Esacus magnirostris*; Vulnerable, NC Act) is the only Threatened species that is not also listed as Migratory.

4.2.2 Species composition, richness and abundance

Species composition and richness

Sixty-three bird species were recorded during the survey period (all sites including the sand spit). The species, their legislative status and general distribution are shown in **Table 2**.

While more bird species were recorded on PoT (54 species) than on the sand spit (35 species), PoT supported fewer Migratory species (17 species) than the sand spit (19 species) (**Table 2**). The minimum and maximum monthly species richness for Migratory birds across the survey period were as follows.

- PoT (Rock Wall, Eastern Reclamation Area, Marine Precinct and STB1a to STB1c) (**Table 3**):
  - high tide (five surveys): four species (November 2021, January and February 2022) to seven species (December 2021)
  - low tide (three surveys): no species (January 2022) to six species (November 2021).

- Sand spit (high tide only):
  - high tide (five surveys): seven species (December 2021 and February 2022) to 16 species (November 2021) (**Table 4**).

Migratory bird species abundance

The abundance of Migratory bird species recorded on PoT is shown in **Table 3**. No species were recorded in nationally significant abundance. Caspian Tern was the most abundant Migratory bird species (**Table 3**).

The abundance of Migratory bird species recorded on the sand spit is shown in **Table 4**. Four species were present in nationally significant abundances during at least one survey event (Greater Sand Plover, Whimbrel, Eastern Curlew (*Numenius madagascariensis*) and Great Knot (*Calidris tenuirostris*), with the Great Knot the most abundant species overall (**Table 4**).

Between <1% and 6% (average = 4%, n = 5) of the local Migratory bird population used PoT (primarily for roosting) at high tide, with the majority using the sand spit (average 96%, n = 5) (**Table 5**). Within PoT, Migratory bird abundances at high tide were greatest in the Eastern Reclamation Area; on average, 4% (n = 5) of the local population used this area (**Table 5**).

Table 2: Bird species recorded at PoT and sand spit during 2021/22 survey period and their legislative status

Common name	Scientific name	Status [A]		Location	
		EPBC Act	NC Act	PoT [B]	Sand spit
Threatened species					
Eastern Curlew	*Numenius madagascariensis*	CE/M	E	✓	✓
Great Knot	*Calidris tenuirostris*	CE/M	E		✓
Lesser Sand Plover	*Charadrius mongolus*	E/M	E	✓	✓
Red Knot	*Calidris canutus*	E/M	E		✓
Western Alaskan Bar-tailed Godwit	*Limosa lapponica baueri*	V/M	V	✓	✓
Greater Sand Plover	*Charadrius leschenaultii*	V/M	V		✓
Beach Stone Curlew	*Esacus magnirostris*	-	V	✓	✓
Non-Threatened Migratory species					
Caspian Tern	*Hydroprogne caspia*	M	SL	✓	✓
Common Greenshank	*Tringa nebularia*	M	SL	✓	✓
Common Sandpiper	*Actitis hypoleucos*	M	SL	✓	
Common Tern	*Sterna hirundo*	M	SL	✓	✓
Crested Tern	*Thalasseus bergii*	M	SL	✓	✓
Eastern Osprey	*Pandion cristatus*	M	SL	✓	✓
Grey Plover	*Pluvialis squatarola*	M	SL		✓
Grey-tailed Tattler	*Tringa brevipes*	M	SL	✓	✓
Gull-billed Tern	*Gelochelidon nilotica*	M	SL	✓	✓
Little Tern	*Sternula albifrons*	M	SL	✓	✓
Marsh Sandpiper	*Tringa stagnatilis*	M	SL	✓	
Red-necked Stint	*Calidris ruficollis*	M	SL	✓	✓
Sharp-tailed Sandpiper	*Calidris acuminata*	M	SL	✓	✓
Terek Sandpiper	*Xenus cinereus*	M	SL	✓	✓
Whimbrel	*Numenius phaeopus*	M	SL	✓	✓
Other non-Threatened and non-Migratory species					
Australian Pipit	*Anthus novaeseelandiae*	-	LC	✓	
Bar-shouldered Dove	*Geopelia humeralis*	-	LC		✓
Black-faced Cuckoo Shrike	*Coracina novaehollandiae*	-	LC	✓	
Brahminy Kite	*Haliastur indus*	-	LC	✓	
Brown Honeyeater	*Lichmera indistincta*	-	LC	✓	
Bush Stone-curlew	*Burhinus grallarius*	-	LC	✓	
Common Myna	*Sturnus tristis*	-	I	✓	
Golden-headed Cisticola	*Cisticola exilis*	-	LC	✓	
Magpie-lark	*Grallina cyanoleuca*	-	LC	✓	
Mangrove Honeyeater	*Gavicalis fasciogularis*	-	LC	✓	
Nankeen Kestrel	*Falco cenchroides*	-	LC	✓	
Nutmeg Mannikin	*Lonchura punctulata*	-	LC	✓	
Peregrine Falcon	*Falco peregrinus*	-	LC	✓	
Rainbow Bee-eater	*Merops ornatus*	-	LC	✓	
Red-backed Fairy Wren	*Malurus melanocephalus*	-	LC	✓	
Rock Dove	*Columba livia*	-	I	✓	
Welcome Swallow	*Hirundo neoxena*	-	LC	✓	
Australasian Grebe	*Tachybaptus novaehollandiae*	-	LC	✓	
Australian Pelican	*Pelecanus conspicillatus*	-	LC	✓	✓
Australian Pied Oystercatcher	*Haematopus longirostris*	-	LC		✓
Australian White Ibis	*Threskiornis molucca*	-	LC	✓	✓
Black-winged Stilt	*Himantopus himantopus*	-	LC	✓	
Eastern Great Egret	*Ardea modesta*	-	LC	✓	✓
Grey Teal	*Anas gracilis*	-	LC	✓	✓
Lesser Crested Tern	*Thalasseus bengalensis*	-	LC	✓	✓
Little Egret	*Egretta garzetta*	-	LC	✓	✓
Little Pied Cormorant	*Microcarbo melanoleucos*	-	LC		✓
Masked Lapwing	*Vanellus miles*	-	LC	✓	
Pacific Black Duck	*Anas superciliosa*	-	LC	✓	
Pied Cormorant	*Phalacrocorax varius*	-	LC	✓	
Plumed Whistling-duck	*Dendrocygna eytoni*	-	LC	✓	✓
Radjah Shelduck	*Radjah radjah*	-	LC		✓
Red-capped Plover	*Charadrius ruficapillus*	-	LC	✓	✓
Royal Spoonbill	*Platelea regia*	-	LC	✓	
Silver Gull	*Chroicocephalus novaehollandiae*	-	LC	✓	✓
Singing Bushlark	*Mirafra cantillans*	-	LC	✓	
Sooty Oystercatcher	*Haematopus fuliginosus*	-	LC	✓	
Striated Heron	*Butorides striata*	-	LC	✓	✓
Wandering Whistling-Duck	*Dendrocygna arcuata*	-	LC	✓	
White-bellied Sea-eagle	*Haliaaetus leucogaster*	-	LC		✓
White-faced Heron	*Egretta novaehollandiae*	-	LC	✓	

[A] Status according to Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act) and/or Queensland *Nature Conservation Act* 1994 (NC Act): Critically Endangered (CE), Endangered (E), Vulnerable (V), Migratory (M), Special Least Concern (SL), Least Concern (LC) and Introduced (I).

[B] PoT species records from incidental observations and from formal count areas (Rock Wall, Eastern Reclamation Area, Marine Precinct, and South Townsville Beach (**Figure 2**)).

Table 3: Abundance of Threatened and Migratory bird species recorded on PoT land[A] during 2021/22 survey period

Common name	Scientific name	Status		October 2021		November 2021		December 2021		January 2022		February 2022		Significance thresholds [C]	
		EPBC Act	NC Act	High tide	Low tide	High tide	Low tide	High tide	Low tide	High tide	Low tide	High tide	Low tide	I	N
Caspian Tern	*Hydroprogne caspia*	M	SL	10	NO SURVEY CONDUCTED	4	0	37	NO SURVEY CONDUCTED	26	0	12	0	NA	NA
Common Greenshank	*Tringa nebularia*	M	SL	2		0	1	1		2	0	0	0	1100	110
Common Sandpiper	*Actitis hypoleucos*	M	SL	0		0	0	2		2	0	2	0	1900	190
Common Tern	*Sterna hirundo*	M	SL	0		0	0	0		0	0	0	1	NA	NA
Crested Tern	*Thalasseus bergii*	M	SL	1		0	0	0		0	0	0	0	NA	NA
Eastern Curlew	*Numenius madagascariensis*	CE/M	E	0		0	1	0		0	0	0	1	350	35
Eastern Osprey	*Pandion cristatus*	M	SL	0		0	2	0		0	0	0	0	NA	NA
Grey-tailed Tattler	*Tringa brevipes*	M	SL	0		0	2	0		0	0	0	0	700	70
Gull-billed Tern	*Gelochelidon nilotica*	M	SL	11		0	1	1		0	0	0	0	NA	NA
Lesser Sand Plover	*Charadrius mongolus*	E/M	E	0		0	0	4		0	0	0	0	1800	180
Little Tern	*Sternula albifrons*	M	SL	0		4	0	2		0	0	0	0	NA	NA
Marsh Sandpiper	*Tringa stagnatilis*	M	SL	0		0	0	0		0	0	0	2	1300	130
Red-necked Stint	*Calidris ruficollis*	M	SL	0		1	0	0		0	0	5	0	4750	475
Sharp-tailed Sandpiper	*Calidris acuminata*	M	SL	0		0	0	26		0	0	0	0	850	85
Terek Sandpiper	*Xenus cinereus*	M	SL	1		1	0	0		0	0	0	0	500	50
Western Alaskan Bar-tailed Godwit	*Limosa lapponica*	V/M	V	0		0	0	0		0	0	0	1	3250	325
Whimbrel	*Numenius phaeopus*	M	SL	2		0	4	0		3	0	3	1	650	65
Beach Stone Curlew	*Esacus magnirostris*	-	V	0		0	0	0		0	0	0	1	NA	NA
Migratory bird species abundance				27	-	10	11	73	-	33	0	22	6	-	-
Migratory bird species richness				6	-	4	6	7	-	4	0	4	5	-	-
Threatened & migratory bird species richness				6	-	4	6	7	-	4	0	4	6	-	-

Shaded cells indicate counts that exceed significance thresholds (no thresholds were exceeded).

[A] PoT land comprises the following formal count areas: Rock Wall, Eastern Reclamation Area, Marine Precinct and South Townsville Beach (**Figure 2**).

[B] Status according to Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act) and/or Queensland *Nature Conservation Act* 1994 (NC Act): Critically Endangered (CE), Endangered (E), Vulnerable (V), Migratory (M), Special Least Concern (SL).

[C] International (I) and national (N) thresholds for significance with reference to DoEE (2017) and Hansen *et al.* (2016). NA = not available.

Table 4: Abundance of Threatened and Migratory bird species recorded at high tide on PoT land[A] and/or sand spit during 2021/22 survey period

Common name	Scientific name	Status [B]		October 2021		November 2021		December 2021		January 2022		February 2022		Significance thresholds [C]	
		EPBC Act	NC Act	PoT	Sand spit	PoT	Sand spit	PoT	Sand spit	PoT	Sand spit	PoT	Sand spit	I	N
Caspian Tern	*Hydroprogne caspia*	M	SL	10	2	4	2	37	0	26	5	12	90	NA	NA
Common Greenshank	*Tringa nebularia*	M	SL	2	0	0	2	1	0	2	0	0	0	1100	110
Common Sandpiper	*Actitis hypoleucos*	M	SL	0	0	0	0	2	0	2	0	2	0	1900	190
Common Tern	*Sterna hirundo*	M	SL	0	0	0	0	0	0	0	0	0	10	NA	NA
Crested Tern	*Thalasseus bergii*	M	SL	1	1	0	10	0	0	0	0	0	0	NA	NA
Eastern Curlew	*Numenius madagascariensis*	CE/M	E	0	35	0	121	0	201	0	193	0	49	350	35
Eastern Osprey	*Pandion cristatus*	M	SL	0	0	0	2	0	0	0	0	0	0	NA	NA
Great Knot	*Calidris tenuirostris*	CE/M	E	0	40	0	420	0	475	0	80	0	0	4250	425
Greater Sand Plover	*Charadrius leschenaultii*	V/M	V	0	210	0	27	0	0	0	0	0	0	2000	200
Grey Plover	*Pluvialis squatarola*	M	SL	0	15	0	2	0	15	0	10	0	0	800	80
Grey-tailed Tattler	*Tringa brevipes*	M	SL	0	5	0	0	0	0	0	0	0	0	700	70
Gull-billed Tern	*Gelochelidon nilotica*	M	SL	11	1	0	26	1	0	0	1	0	1	NA	NA
Lesser Sand Plover	*Charadrius mongolus*	E/M	E	0	90	0	60	4	0	0	0	0	0	1800	180
Little Tern	*Sternula albifrons*	M	SL	0	15	4	70	2	65	0	0	0	1	NA	NA
Marsh Sandpiper	*Tringa stagnatilis*	M	SL	0	0	0	0	0	0	0	0	0	0	1300	130
Red Knot	*Calidris canutus*	E/M	E	0	0	0	0	0	3	0	0	0	0	1100	110
Red-necked Stint	*Calidris ruficollis*	M	SL	0	330	1	225	0	0	0	0	5	0	4750	475
Sharp-tailed Sandpiper	*Calidris acuminata*	M	SL	0	60	0	22	26	0	0	2	0	0	850	85
Terek Sandpiper	*Xenus cinereus*	M	SL	1	0	1	2	0	0	0	0	0	0	500	50
Western Alaskan Bar-tailed Godwit	*Limosa lapponica*	V/M	V	0	195	0	200	0	220	0	210	0	220	3250	325
Whimbrel	*Numenius phaeopus*	M	SL	2	83	0	160	0	237	3	32	3	130	650	65
Beach Stone Curlew	*Esacus magnirostris*	-	V	0	0	0	1	0	3	0	3	0	1	NA	NA
Migratory bird species abundance				27	1082	10	1351	73	1216	33	533	22	501	-	-
Migratory bird species richness				6	14	4	16	7	7	4	8	4	7	-	-
Threatened & migratory bird species richness				6	14	4	17	7	8	4	9	4	8	-	-

Shaded cells indicate counts that exceed significance thresholds.

[A] PoT comprises the following count areas: Rock Wall, Eastern Reclamation Area, Marine Precinct and South Townsville Beach (**Figure 2**).

[B] Status according to Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act) and/or Queensland *Nature Conservation Act* 1994 (NC Act): Critically Endangered (CE), Endangered (E), Vulnerable (V), Migratory (M), Special Least Concern (SL).

[C] International (I) and national (N) thresholds for significance with reference to DoEE (2017) and Hansen *et al.* (2016). NA = not available.

Table 5: Proportion of local Migratory bird population recorded at high tide on PoT land[A] and sand spit during 2021/22 survey period

Count month	PoT formal count areas [A]				Sand spit
	STB	MP	ER	RW	
October 2021	0%	<1%	2%	<1%	98%
November 2021	0%	<1%	<1%	<1%	99%
December 2021	0%	1%	6%	0%	94%
January 2022	0%	<1%	5%	0%	94%
February 2022	0%	<1%	3%	0%	96%
Average	**0%**	**<1%**	**4%**	**<1%**	**96%**

[A] PoT comprises the following formal count areas: Rock Wall (RW), Eastern Reclamation Area (ER), Marine Precinct (MP) and South Townsville Beach (STB) (**Figure 2**). Proportions are rounded to the nearest whole number, except for values less than 1% (shown as <1%).

4.2.3 Habitats and use patterns

Overview

The terrestrial habitats within the developed section of the PoT study area are man-made and created by land reclamation. The fill material used in the reclamation areas includes marine sediments obtained during dredging for the PoT. Land reclamation is a gradual process and the PoT contains areas at, or approaching, final ground surface levels as well as areas just below final levels and that will be filled. The lower lying areas hold water after sustained rainfall and resemble wetland habitats. They are transitional habitats and the use of these areas by Migratory birds (**Table 2**) will change throughout the reclamation process.

The following general habitat types occur in the study area.

- Habitats within the developed sections of PoT:
  - rock walls
  - artificial wetlands
  - active work areas
  - raised ground – mostly vegetated
  - raised ground – mostly bare.
- Habitats immediately adjacent to the developed sections of PoT:
  - estuarine and marine coastal waters
  - intertidal banks/flats
  - sand spit.

When the count areas were first established by NRA (2012a), they each contained one predominant habitat type. Some count areas now contain multiple habitat types due to progression of the land reclamation process. The habitat types present in the count areas of the developed sections of PoT are summarised in **Table 6**, with descriptions of each habitat type provided below.

Table 6: Dominant and minor habitat types present in count areas of the developed sections of PoT

Count area [B]	Habitat types [A]				
	Rock walls	Artificial wetlands	Active work areas	Raised ground – mostly vegetated	Raised ground – mostly bare
RW7–RW9	D				
ER1		m	D		m
ER2		m	D		m
ER3		D		m	

Count area [B]	Habitat types [A]				
	Rock walls	Artificial wetlands	Active work areas	Raised ground – mostly vegetated	Raised ground – mostly bare
ER4		D	m	D	m
ER5		D			
ER6		D			
MP1	m	m	m		D
MP2	m	D		m	

[A] D = dominant; m = minor.

[B] PoT comprises the following count areas: Rock Wall (RW), Eastern Reclamation Area (ER) and Marine Precinct (MP) (**Figure 2**).

Rock walls

The rock wall consists of irregularly shaped boulders. The seaward edge of the rock wall provides favourable habitat for molluscs and crustaceans, which are a food source for a variety of waterbirds. The rock wall may also be used as perches for hunting, feeding and resting. These built structures provide similar habitats to naturally occurring rocky headlands and foreshores.

Small numbers (≤3 of any one species) of Migratory birds (Common Greenshank, Terek Sandpiper, Common Sandpiper and Whimbrel) were commonly observed roosting along the rock walls of the Marine Precinct. The rock walls (RW7 to RW9) of the Eastern Reclamation Area were rarely used by Migratory birds; limited to two Grey-tailed Tattler perching on the rock wall in November 2021.

A boat-based survey in January 2022 recorded 94 Great Knot roosting on the eastern side of the newly constructed rock wall of the CU project reclamation area (**Figure 1**, **Plate 1**). This survey effort is outside of the existing monitoring program but was included to assess bird activity on this new structure. A repeat of this survey in February 2022 recorded no birds.

Artificial wetlands

ER5 and ER6 are evaporation and settling ponds for dredge material from maintenance dredging operations around PoT. These sites hold water most of the year, with water levels varying according to dredging operations, maintenance schedules and weather (rainfall and evaporation rates). There are no aquatic macrophytes, and sparse vegetation (mostly saltmarsh and small exotic grasses and forbs) occurs along the pond margins. During the survey period, waterbird activity at ER5 was low due to maintenance works at the site.

Caspian Tern (maximum count: 37 birds, December 2021), Gull-billed Tern (maximum count: 11 birds, October 2021), Common Greenshank (maximum count: two birds, January 2022) and Common Sandpiper (maximum count: one bird in December 2021 and January 2022) were the only Migratory species observed in ER5 and ER6. These species co-occurred with other waterbirds with the highest combined species abundances occurring in December 2021 (75 birds) and January 2022 (138 birds). Black-winged Stilt, Grey Teal and Caspian Tern were the most abundant species. All species used ER5 and ER6 for roosting, resting and/or feeding.

ER1, ER2, ER3, ER4, MP1 and MP2 are reclamation areas. Following sustained rainfall, shallow pools or ponding temporarily occurs in portions of ER1, ER2, ER4 and MP1, and cover most of ER3 and MP2. In the absence of rainfall, all sites are dry. ER3 and MP2 are lower lying and tend to hold water for longer periods (weeks to months) than ER1, ER2, ER4 and MP1 (days to months). Saltmarsh communities fringe ER3 and MP2, though are sparse at the other sites. Waterbird activity at all these sites corresponds with the presence of water, with lower activity when dry and higher activity when wet. **Plate 2** contains

photographs of ER3 and shows the change in habitat conditions that occur following sustained rainfall.

ER3 and ER4 had consistent bird activity; however, Migratory species were present only in small numbers and only in December 2021 and February 2022. The species and their combined maximum counts comprised 32 birds in December 2021 (Lesser Sand Plover, Red-necked Stint, Sharp-tailed Sandpiper and Little Tern) and nine birds in February 2022 (Common Sandpiper, Marsh Sandpiper and Caspian Tern). The most abundant birds in ER3 and ER4 were non-Migratory species. The species and maximum counts comprised Pacific Black Duck (29 birds, December 2021), Plumed Whistling Duck (65 birds, February 2022), Grey Teal (46 birds, December 2021), Black-winged Stilt (40 birds, February 2022) and Silver Gull (59 birds, February 2022).

Bird activity was generally low at ER1, ER2, MP1 and MP2 and the most abundant birds were non-Migratory species. The highest bird abundances were recorded in February 2022, when 58 Plumed Whistling Duck and 27 Wandering Whistling Duck were recorded in MP2 and 22 Red-capped Plover were recorded in ER2 (all three species are non-Migratory). Small numbers (≤5 birds) of Migratory birds (Common Greenshank, Common Sandpiper, Terek Sandpiper and Whimbrel) were regularly seen in or along the rock walls of MP2, and five Red-necked Stint were recorded in ER2 in February 2022.

Active work areas

Active work areas cover most of ER1 and ER2. These areas are at, or close to, final ground levels. ER2 is mostly covered by an office area (demountable buildings and car park). Most of ER1 is used for rock stockpiling and storage of construction material for the CU project. Anthropogenic activities influence bird use of these sites. No Migratory birds were recorded in the active work areas, nor were high numbers of any non-Migratory species.

Raised ground – mostly vegetated

This habitat covers large parts of ER4 and small parts of ER3 and MP2. The vegetated areas consist of a sparse to dense coverage of native and exotic grasses and forbs, interspersed with bare patches and saltmarsh in the lower lying areas. Some of the soil material was removed from the south-eastern portion of ER4 in December 2021.

No Migratory species or large numbers of non-Migratory species were observed using this habitat. It is mostly used by ground-dwelling specialist birds (*eg* Golden-headed Cisticola, Bush Stone-curlew and Australian Pipit) and birds that hunt on the wing (*eg* Nankeen Kestrel and Welcome Swallow).

Raised ground – mostly bare

This is the dominant habitat of MP1. The habitat comprises a dredge spoil stockpile that is mostly devoid of vegetative cover. Some of the soil material was removed between December 2021 and February 2022.

No Migratory species or large numbers of non-Migratory species were observed using this habitat. A single Beach Stone Curlew (Vulnerable, NC Act) was recorded at this site in February 2022.

ER1, ER2 and ER4 also have small patches of this habitat.

Estuarine and marine coastal waters

This habitat type refers to the inshore waters immediately adjacent to the PoT land. The marine waters adjacent to the rock wall were used infrequently and by very small numbers of birds, mostly Silver Gull, though also the Migratory Little Tern, Crested Tern and Eastern Osprey.

Intertidal banks/flats

Intertidal banks/flats (mud and sand with some areas of dense mangrove) occur along the northern and southern banks of the Ross River mouth and to the south in Cleveland Bay. The section of Lot 773 on SP223346 between the Marine Precinct and Benwell Road (*ie* sites STB1a to STB1c (**Figure 2**)) was the only intertidal area surveyed during the study. STB1c and STB1b are mostly covered by mangrove forest. This forest coverage reduces its suitability as foraging habitat for shorebirds. Common Greenshank, Bar-tailed Godwit, Eastern Curlew, Whimbrel and Gull-billed Tern were the only Migratory birds recorded using STB1a to STB1c, and they were only present in very small numbers (maximum count was during November 2021 survey; combined species total was seven birds). They were observed foraging along small sections of unvegetated mud flats.

Sand spit

Suitable roost sites are critical for the persistence of shorebirds in an area. The sand spit in the Ross River mouth is approximately 1.8 km long, and the western extent of this sand spit submerges during the highest spring high tides. While the birds use the entire length, the westerly extent is most-used. The size of the sand spit allows birds to move to different parts of the spit when disturbed. Monthly totals of Migratory birds roosting at this site ranged between 501 (February 2022) and 1,351 (November 2021).

Plate 1: Great Knot roosting on newly constructed rock wall of CU project reclamation area (11 February 2022)

Plate 2: ER3 in October 2020 (dry season: left) and January 2021 (wet season: right)

5. Discussion

5.1 Summary of results

Small numbers of Migratory shorebirds continue to use PoT during spring and summer, with the observed abundances in the 2021/22 study well below the thresholds for national significance. Consistent with the three previous monitoring studies (NRA 2019, 2020a, 2021), shorebirds are primarily using PoT at high tide when they are roosting. Foraging was rarely observed, suggesting the Migratory shorebirds using PoT acquire most of their sustenance from sites external to PoT.

5.2 Comparison with previous survey results

5.2.1 Factors influencing Migratory bird presence on PoT and locally

An objective of the current study is to assess the impact of CU project construction activities on shorebirds. Repeated counts across a season, as per the current and previous studies (NRA 2012a, 2019, 2020a, 2021), provide a means for comparing annual changes in Migratory shorebird presence and a basis for identifying potential impacts. However, multiple factors can influence Migratory shorebird presence, making it difficult to ascribe an observed change to a single causal factor. These factors are described below and help contextualise the observed changes discussed in **Section 5.2.2**.

Migratory shorebird species composition and abundance on PoT are influenced by site-specific conditions and external factors. External factors include the likely continued decline of the EAA flyway shorebird population and changes in the condition of shorebird habitats in the local area. As described in Clemens *et al.* (2016), factors outside of Australia are primarily responsible for the declines reported for the EAA flyway shorebird population. There is insufficient data on global shorebird populations to determine the degree to which global population trends may affect the results reported for PoT.

Habitats in the local area are changing, though the full impact of these changes on the dynamics of the local Migratory shorebird population (*eg* local abundance and areas used) is not quantifiable. For example, the dimensions of the sand spit at the Ross River mouth changed following heavy rainfall and flooding in February 2019. This change reduced shorebird roosting on the western extent of the sand spit and increased roosting on the eastern extent. Certain shorebird groups have slightly different preferences of roost site selection, and it is not clear if the changes to the sand spit had other, more subtle, impacts on the dynamics of the local shorebird population. Coastal habitats are dynamic, and it is likely that other habitats in the region are also experiencing change. These changes will influence where shorebirds proportion their time.

Changes to local shorebird habitats have also occurred in response to the construction of the Townsville Marine Precinct (2011/12) and the bridge over Ross River (2012), with impacts occurring directly via habitat loss and indirectly via changes to sediment movement and local geomorphology. Soon after, and potentially in response to changes in local geomorphology caused by these developments, mangroves expanded their distribution on the southern and northern banks of the river mouth. Most shorebird species in the local population prefer to forage in open, un-forested, areas. Therefore, the mangrove expansion has reduced the area and/or quality of available foraging habitat for the local shorebird population. The impact of this habitat reduction on local Migratory shorebird population dynamics is difficult to quantify.

The site-specific conditions that influence Migratory shorebird presence on PoT include factors related to Port activities (including the CU project) and weather. Of these factors, the changes in habitat from land reclamation and development will have the greatest and most enduring impact on Migratory shorebird presence[6]. Construction may also impact birds by disrupting their normal patterns of behaviour; however, the impact will be limited to the construction period (*ie* short-term) and will vary according to each species' sensitivity to the construction stimuli. For example, Eastern Curlew and Whimbrels are very sensitive to human presence (Weston *et al.* 2012) and may vacate areas in response to relatively low levels of disturbance, whereas Greater Sand Plover, Lesser Sand Plover and Red-necked Stint are more tolerant, as indicated by their presence near active work areas during the current and previous studies (NRA 2020a, 2021).

Extreme weather events such as cyclones have the potential to impact Migratory shorebirds and influence their presence in the local area. Because many of these species are migratory, a cyclone anywhere along the EAA Flyway may have an effect. Impacts may include disruption to normal migration patterns and the death of individuals. As discussed in **Section 5.2.2**, ordinary weather conditions may also influence shorebird presence on PoT.

5.2.2 Changes in Migratory bird presence on PoT

Graph 2 uses data from low tide surveys and represents Migratory bird presence on PoT when most shorebirds are foraging. The habitats on PoT during the 2021/22 study were similar to the three previous studies, though markedly different to those in the 2011/12 study. The land reclamation progressed substantially between 2011 and 2018[7]; consequently, the extent of land supporting shallow water (artificial wetlands), where the Migratory birds forage, greatly reduced during this period. This habitat change had reduced Migratory bird presence on PoT at low tide (**Table 7**; **Graph 2**) prior to commencement of the PEP. The low tide results from the 2018/19 study onwards are comparable (**Graph 2**), suggesting the CU project has not caused the lower abundances of Migratory birds on PoT at low tide.

Graph 3 uses data from high tide surveys and represents Migratory bird presence on PoT when intertidal areas are not available for foraging and most shorebirds are at their roost site. Migratory birds continue to roost on PoT, though in lower numbers than in previous studies (**Table 7**; **Graph 3**). The lower abundances in the 2021/22 study compared with the 2011/12 study may in part be due to the reduction of wetland habitats on PoT; however, this habitat change does not explain the ongoing decline in Migratory bird presence since the 2018/19 study when habitats have changed little. It is also unlikely that construction, and its impact on Migratory bird behaviours, was responsible for the lower abundances. Similar to the past two studies, construction around the Eastern Reclamation Area and Marine Precinct in the 2021/22 study was concentrated in relatively small areas and is unlikely to have caused Migratory birds to move away *en masse*. Therefore, activities associated with the CU project are likely to have had a minor influence on the post-2018/19 decline.

Of relevance is that the most abundant Migratory shorebird species on PoT (Red-necked Stint, Sharp-tailed Sandpiper and Sand Plover (Greater and Lesser)) have declined on PoT and also locally (**Table 8**). There is no identifiable link between the CU project and the reduced abundances of these species roosting on the sand spit (the main roost for the local

[6] Noting the area started as unsuitable habitat for shorebirds (open water), became suitable (artificial wetlands) to varying degrees during the land reclamation process, and ultimately will be unsuitable habitat (developed land) once reclamation is complete.

[7] The change in land surface conditions was most pronounced at ER1, ER2 and MP2.

population). This supports the assertion that the CU project is likely to have had minor influence on the declines identified on PoT, and that external factors are the more likely cause.

Rainfall is also influencing the abundance of Migratory birds on PoT. **Graph 4** shows that peaks in Migratory bird abundance on PoT coincide with large rainfall events, though the relationship is not linear, with Migratory birds apparently using PoT in higher numbers when rainfall exceeds certain threshold quantities. Rogers *et al.* (2006) found that roost site selection by Great Knot was influenced by proximity to foraging grounds and micro-climate, with birds preferring nearby roosts where they could stand on cool, wet substrates. It is likely that Red-necked Stint, Sharp-tailed Sandpiper and Sand Plover (Greater and Lesser) have similar preferences, meaning the suitability of PoT as a roost site is contingent upon sustained rainfall.

5.3 Monitoring program review and future considerations

The sampling intensity implemented in this study is generally consistent with the minimum effort recommended by DoEE (2017) for determining the presence of 'important habitat'; *ie* four surveys for roosting shorebirds during the period when the majority of shorebirds is present in the area. DoEE (2017) recognises that replicate surveys over this period are important to measure population variability, and that in most cases one survey in December, two surveys in January, and one survey in February are adequate. However, measuring local scale population changes at some locations, *ie* the Ross River mouth, where shorebird populations may vary substantially daily or weekly (NRA 2008, 2019, 2020a, 2020b, 2021), requires higher intensity sampling.

The sampling intensity recommended by NRA (2019) during the construction period, and adopted for the current study, together with general observations, allows for detection of gross scale changes in, or impacts concerning, the Migratory bird population using PoT. However, the ability to decipher finer scale impacts from the natural background variation is limited. This is an acceptable level of precision for the current context.

The current study has confirmed the limited value of low tide surveys, and the continuation of a reduced effort at low tide is recommended. The recommended low tide survey effort is one survey each in November, January and February. High tide surveys are providing data of value to the Shorebird Monitoring Program, and it is recommended that monthly high tide surveys between October and February continue.

In January 2022, Great Knots were recorded roosting on the eastern side of the newly constructed rock wall of the CU project reclamation area. This is an unusual observation as the species does not typically use such structures and settings for roosting, preferring more open areas, and often at the water's edge or in shallow water (Higgins & Davies 1996). A boat-based survey of the seaward face of the rock wall should be included in future surveys.

Table 7: Abundance of Migratory birds recorded on PoT during spring and summer of 2011/12, 2018/19, 2019/20 and 2020/21[A]

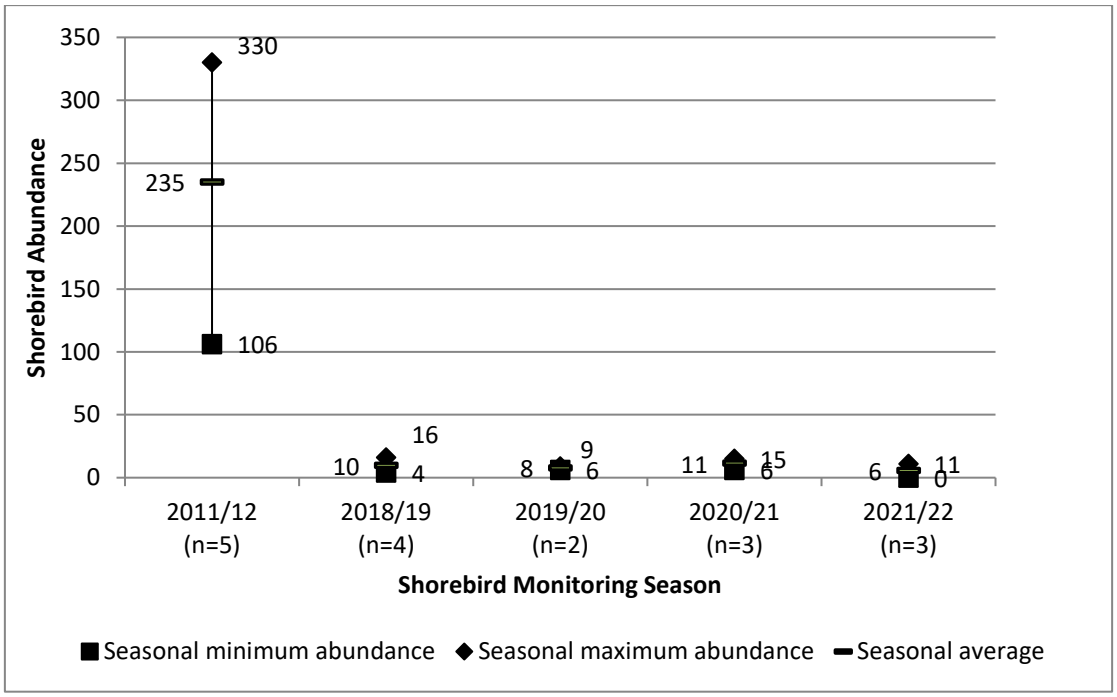
Survey season	Abundance of Migratory birds per month							Average
	October	November	November	November	December	January	February	
2011/12 (NRA 2012a)	NA	552 (222/330)	– (85/–)	– (–/312)	423 (104/319)	993 (885/108)	1001 (895/106)	742 (438/235)
2018/19 (NRA 2019)	564 (556/8)	600 (589/11)	NA	NA	840 (836/4)	376 (360/16)	NA	595 (585/10)
2019/20 (NRA 2020a)	NA	– (63/–)	NA	NA	– (207/–)	114 (105/9)	810 (804/6)	462 (295/8)
2020/21 (NRA 2021)	– (197/–)	19 (13/6)	NA	NA	– (321/–)	67 (61/6)	67 (52/15)	51 (129/11)
2021/22 (this study)	– (27/–)	21 (10/11)	NA	NA	– (73/–)	33 (33/0)	28 (22/6)	27 (33/6)

[A] Total abundance is provided with high and low tide results in parenthesis. 'NA' = months where survey data is not available because no survey was conducted. For some months, only a high or low tide survey was conducted; the '–' symbol denotes the absence of a corresponding estimate.

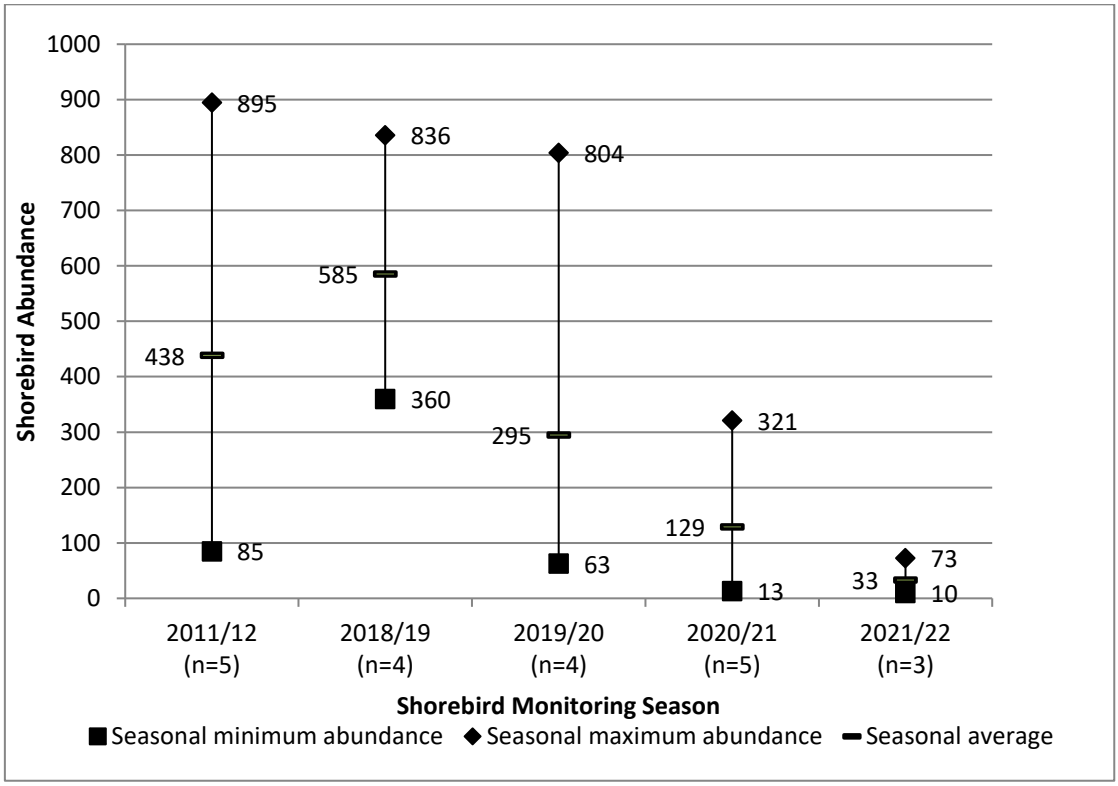
Table 8: Local population abundance[A] of the main Migratory bird species that occur on PoT

Common name	Status		Average species abundance (minimum – maximum)				
	EPBC Act	NC Act	2011/12 (NRA 2012a)	2018/19 (NRA 2019)	2019/20 (NRA 2020a)	2020/21 (NRA 2021)	2021/22 (this study)
Red-necked Stint	M	SL	681 (509–848)	398 (10–695)	205 (40–570)	89 (0–320)	112 (0–330)
Sharp-tailed Sandpiper	M	SL	157 (92–326)	169 (42–314)	36 (9–64)	26 (10–41)	22 (0–60)
Greater Sand Plover	V/M	V	90 (21–200)	139 (5–274)	183 (30–350)	97 (0–273)	47 (0–210)
Lesser Sand Plover	E/M	E	133 (62–242)	47 (0–115)	25 (0–60)	101 (0–292)	31 (0–90)
Combined average			265	188	112	78	53

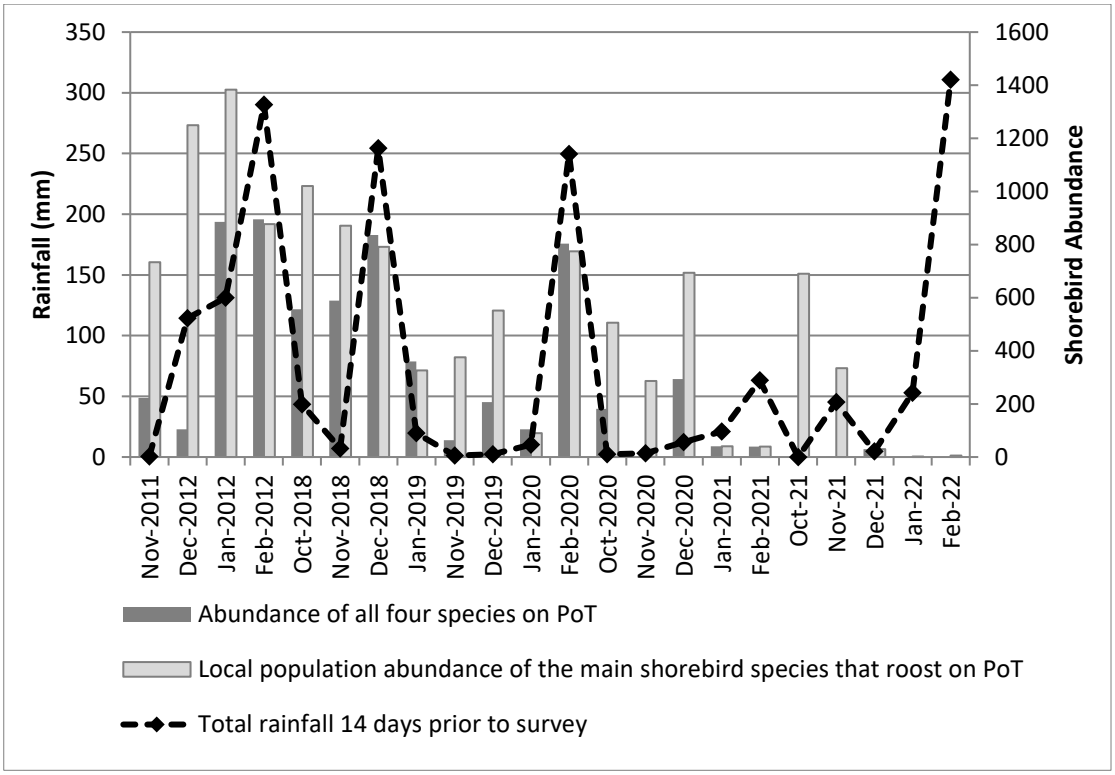
[A] Local population abundance is based on counts made at high tide at the Ross River mouth sand spit and PoT.



Graph 2: Abundance of Migratory birds on PoT at low tide



Graph 3: Abundance of Migratory birds on PoT at high tide



[A] Red-necked Stint, Sharp-tailed Sandpiper and Sand Plover (Greater and Lesser).

Graph 4: Abundance of main Migratory bird species[A] that roost on PoT at high tide in relation to local population size and rainfall

6. Conclusion

Migratory shorebirds continue to use PoT during spring and summer, primarily as a high tide roost site. Foraging was rarely observed, suggesting the Migratory shorebirds using PoT acquire most of their sustenance from sites external to PoT. Similar to the 2020/21 study, but unlike the previous studies (NRA 2012a, 2019, 2020a), no Migratory bird species were recorded in nationally significant numbers at PoT in the 2021/22 study.

The abundance of Migratory shorebirds using PoT in the 2021/22 study was less than in previous studies. The decline since the 2018/19 study is primarily due to fewer Migratory shorebirds using PoT at high tide. The decline is attributable to external factors and the progressive loss of the artificial wetlands on PoT, which formed during the land reclamation and are reducing in extent and suitability (as shorebird habitat) as the reclamation progresses. Activities associated with the CU project are likely to have had a minor impact.

It is recommended that the 2022/23 monitoring event involve monthly surveys at high tide between October 2022 and February 2023, and low tide surveys in November 2022, January 2023 and February 2023. The general survey approach and locations should, as far as practical, replicate those implemented for the 2021/22 study, with the addition of a boat-based survey of the newly constructed rock wall of the CU project reclamation area.

7. References

BOM 2022, *Weather data for Townsville Aero (Station 032040)*, Bureau of Meteorology, accessed 16 March 2022.

Clemens, RS, Rogers, DI, Hansen, BD, Gosbell, K, Minton, CDT, Straw, P, Bamford, M, Woehler, EJ, Milton, DA, Weston, MA, Venables, B, Weller, DR, Hassell, C, Rutherford, B, Onton, K, Herrod, A, Studds, CE, Choi, CY, Dhanjal-Adams, KL, Murray, NJ, Skilleter, G, & Fuller, RA 2016, 'Continental-scale decreases in shorebird populations in Australia', *Emu* 116: 119–135.

DoEE 2017, *EPBC Act policy statement 3.21, Industry Guidelines for Avoiding, Assessing and Mitigating Impacts on EPBC Act Listed Migratory Shorebird Species*, Australian Department of Environment and Energy.

Driscoll, P 1997, 'The distribution of waders along the Queensland coastline', in P Shaw (ed.), *Shorebird conservation in the Asia-Pacific region*, The Australasian Wader Studies Group of Birds Australia.

Driscoll, P 2009, *Avifauna Assessment Report for Marine Precinct EIS*, Port of Townsville Limited, prepared for GHD Australia, April 2009.

Geering, A, Agnew, L & Harding, S 2007, *Shorebirds of Australia*, CSIRO Publishing, Australia.

Hansen, BD, Fuller, RA, Watkins, D, Rogers, DI, Clemens, RS, Newman, M, Woehler, EJ, & Weller, DR 2016, *Revision of the East Asian-Australasian Flyway Population Estimates for 37 listed Migratory Shorebird Species*, unpublished report for Department of the Environment, BirdLife Australia, Melbourne.

Higgins, PJ & Davies, SJJF 1996, Handbook o Australian, New Zealand & Antarctic Birds, Volume 3 Snipe to Pigeons, Oxford University Press, Melbourne.

NRA 2005, *Townsville Port Access Project: Migratory Bird Impact Assessment*, prepared by NRA Environmental Consultants for Queensland Department of Transport and Main Roads, December 2005.

NRA 2008, *Use Patterns of the Ross River Mouth by Migratory Birds*, prepared by NRA Environmental Consultants for Maunsell Australia Pty Ltd, February 2008.

NRA 2011, *Shorebird Monitoring for the Townsville Port Access Project – October 2011*, prepared by NRA Environmental Consultants for Abigroup Seymour Whyte Joint Venture, 4 November 2011.

NRA 2012a, *Avifauna Survey for the Townsville Port Expansion Project November 2011 to February 2012*, prepared by NRA Environmental Consultants for AECOM, April 2012.

NRA 2012b, *Shorebird Monitoring for the Townsville Port Access Project November – December 2011*, prepared by NRA Environmental Consultants for Abigroup Seymour Whyte Joint Venture, January 2012.

NRA 2012c, *Shorebird Monitoring for the Townsville Port Access Road January – February 2012*, prepared by NRA Environmental Consultants for Abigroup Seymour Whyte Joint Venture, February 2012.

NRA 2012d, *Shorebird Monitoring for the Townsville Port Access Road February – March 2012*, prepared by NRA Environmental Consultants for Abigroup Seymour Whyte Joint Venture, 29 March 2012.

NRA 2019, *Baseline Shorebird Monitoring Study for the Townsville Port Expansion Project October 2018 to January 2019*, R02 (Final), prepared by NRA Environmental Consultants for Port of Townsville Limited, 2 May 2019.

NRA 2020a, *Shorebird Monitoring Study for the Townsville Port Expansion Project November 2019 to February 2020*, R02, prepared by NRA Environmental Consultants for Port of Townsville Limited, 21 May 2020.

NRA 2020b, *Townsville Eastern Access Rail Corridor, Threatened and Migratory Coastal Bird Survey Report (2019/20)*, R03, prepared by NRA Environmental Consultants for Queensland Department of Transport and Main Roads, 10 August 2020.

NRA 2021, *Shorebird Monitoring Study for the Townsville Port Expansion Project October 2020 to February 2021*, R02, prepared by NRA Environmental Consultants for Port of Townsville Limited, 14 May 2021.

Pell, S & Lawler, W 1996, *Queensland Wader Survey: Wader Communities along the North-East Queensland Coast (Bowen to Cairns)*, prepared on behalf of the Queensland Ornithological Society Inc. for the Queensland Department of Environment and Heritage, February 1996.

Rogers, DI Battley, PF Piersma, T Van Gils, JA & Rogers, KG 2006, 'High-tide habitat choice: Insights from modelling root selection by shorebirds around a tropical bay', *Animal Behaviour* 72(3): 563–575.

Weston, MA, McLeod, EM, Blumstein, DT & Guay, PJ 2012, 'A review of flight-initiation distances and their application to managing disturbance to Australian birds', *Emu*, 112: 269–286.

Appendix A:
Site Plan for Channel Upgrade Project Capital Dredging Activities (Source: Port of Townsville Limited)

Figure 3: Site Plan for CU Project Capital Dredging Activities

Environmental Approval & Compliance Solutions

Cairns Office:
Level 1, 320 Sheridan Street, PO Box 5678 Cairns QLD 4870
P: 61 7 4034 5300

Townsville Office:
Suite 2A, Level 1, 41 Denham Street, PO Box 539 Townsville QLD 4810
P: 61 7 4796 9444

www.natres.com.au • nra@natres.com.au

Natural Resource Assessments Pty Ltd trading as NRA Environmental Consultants. ABN: 77 011 073 135
Certified Integrated Management System: ISO 9001:2015 (Quality), ISO 14001:2015 (Environment), ISO 45001:2018 (Safety).