

EASTERN CURLEW AND OTHER SHOREBIRD MONITORING PLAN, NORTHERN LAND EXPANSION PROJECT STAGE 1 (CO22000089)

PORT OF GLADSTONE

Prepared for
Gladstone Ports Corporation Limited



Biodiversity Assessment and Management Pty Ltd
PO Box 1376
CLEVELAND 4163

 **BAAM**
ECOLOGICAL CONSULTANTS

Specialised ecological knowledge that reduces your risk

Cover Page and Declaration of Accuracy (Proponent)

EPBC number: 2012/6558

Project name: Port of Gladstone Gatcombe and Golding Cutting Channel Duplication Project (CD Project) Stage 1 (Project Stage 1 means any aspect of the construction of the barge unloading facility and the southern reclamation area), Gladstone, Queensland

Approval holder and ABN: Gladstone Ports Corporation Limited, ABN: 96 263 788 242

Approved action: To duplicate the existing Gatcombe and Golding Cutting shipping channel, disposal of capital dredge spoil to land reclamation, and upgrade associated infrastructure in the Port of Gladstone, Queensland (see EPBC Act referral 2012/6558 approved by the Minister on December 2020).

Location of the action: Port of Gladstone, Queensland

Declaration of accuracy

In making this declaration, I am aware that section 491 of the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) makes it an offence in certain circumstances to knowingly provide false or misleading information or documents to specified persons who are known to be performing a duty or carrying out a function under the EPBC Act or the *Environment Protection and Biodiversity Conservation Regulations 2000* (Cth). The offence is punishable on conviction by imprisonment or a fine, or both. I am authorised to bind the approval holder to this declaration and that I have no knowledge of that authorisation being revoked at the time of making this declaration.

Signed



Full name (please print)

Richard Haward

Organisation (please print)

Gladstone Ports Corporation Limited ACN131 965 896

Date

24/07/2024

Document Version Control

File Number: 0570-004

Project Manager/s: Dr Penn Lloyd

Client: Gladstone Ports Corporation Limited

Project Title: Eastern Curlew and Other Shorebird Monitoring Plan, Northern Land Expansion Project (Stage 1), Port of Gladstone (CO22000089)

This report should be cited as: Lloyd, P. (2024). Eastern Curlew and Other Shorebird Monitoring Plan, Northern Land Expansion Project (Stage 1), Port of Gladstone. Report for Gladstone Ports Corporation Limited by Biodiversity Assessment and Management Pty Ltd, April 2024, 36 pp.

Draft Preparation History:

Draft No.	Date draft completed	Reviewed by	Issued by
0570-004 Draft A	16/04/2024	Paulette Jones	Dr Penn Lloyd

Revision/ Checking History Track:

Version	Date of Issue	Checked by	Issued by
0570-004 Version 0	17/04/2024	Paulette Jones	Dr Penn Lloyd
0570-004 Version 1	13/05/2024	Paulette Jones	Dr Penn Lloyd

Document Distribution:

Destination	Revision							
	1	Date Dispatched	2	Date Dispatched	3	Date Dispatched	4	Date Dispatched
Client Copy 1 - digital	A	16/04/2024	0	17/04/2024	1	13/05/2024		
Client Copy 1- hard copy								
Project file cloud storage	A	16/04/2024	0	17/04/2024	1	13/05/2024		

NOTICE TO USERS OF THIS REPORT

Purpose of Report

Biodiversity Assessment and Management Pty Ltd has produced this report in its capacity as {consultants} for and on the request of Gladstone Ports Corporation Limited (the "Client") for the sole purpose of providing an Eastern Curlew and Other Shorebird Monitoring Plan to meet the requirements of Conditions 14(a) and 17 of EPBC 2012/6558 (the "Specified Purpose"). This information and any recommendations in this report are particular to the Specified Purpose and are based on facts, matters and circumstances particular to the subject matter of the report and the Specified Purpose at the time of production. This report is not to be used, nor is it suitable, for any purpose other than the Specified Purpose. Biodiversity Assessment and Management Pty Ltd disclaims all liability for any loss and/or damage whatsoever arising either directly or indirectly as a result of any application, use or reliance upon the report for any purpose other than the Specified Purpose.

This report has been produced solely for the benefit of the Client. Biodiversity Assessment and Management Pty Ltd does not accept that a duty of care is owed to any party other than the Client. This report is not to be used by any third party other than as authorised in writing by Biodiversity Assessment and Management Pty Ltd and any such use shall continue to be limited to the Specified Purpose. Further, Biodiversity Assessment and Management Pty Ltd does not make any warranty, express or implied, or assume any legal liability or responsibility for any third party's use in whole or in part of the report or application or use of any other information or process disclosed in this report and to the full extent allowed by law excludes liability in contract, tort or otherwise, for any loss or damage sustained by any person or body corporate arising from or in connection with the supply or use of the whole part of the report through any cause whatsoever.

Biodiversity Assessment and Management Pty Ltd has used information provided to it by the Client and governmental registers, databases, departments and agencies in the preparation of this report. Biodiversity Assessment and Management Pty Ltd does not know, nor does it have any reason to suspect, that the information provided to it was false, inaccurate, incomplete or misleading at the time of its receipt. This report is supplied on the basis that while Biodiversity Assessment and Management Pty Ltd believes all the information in it is deemed reliable at the time of publication, it does not warrant its accuracy or completeness and to the full extent allowed by law excludes liability in contract, tort or otherwise, for any loss or damage sustained by any person or body corporate arising from or in connection with the supply or use of the whole or any part of the information in this report through any cause whatsoever.

Copyright and reproduction

This report and all indexes, schedules, annexures or appendices are subject to copyright pursuant to the Copyright Act 1968 (Cth). Subject to statutory defences, no third party may reproduce, publish, adapt or communicate to the public, in whole or in part, the content of this report without the express written consent of Biodiversity Assessment and Management Pty Ltd.

Signed on behalf of
Biodiversity Assessment and Management Pty Ltd

Date: 13/05/2024



Dr Penn Lloyd
Principal Ecologist and Director

DECLARATION OF ACCURACY (AUTHOR)

I declare that:

1. To the best of my knowledge, all the information contained in, or accompanying this Eastern Curlew and Other Shorebird Monitoring Plan is complete, current and correct.

2. I am aware that:

a. Section 490 of the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) makes it an offence for an approval holder to provide information in response to an approval condition where the person is reckless as to whether the information is false or misleading.

b. Section 491 of the EPBC Act makes it an offence for a person to provide information or documents to specified persons who are known by the person to be performing a duty or carrying out a function under the EPBC Act or the *Environment Protection and Biodiversity Conservation Regulations 2000* (Cth) where the person knows the information or document is false or misleading.

c. The above offences are punishable on conviction by imprisonment, a fine or both.

Signed



Full name (please print)

Penn Lloyd

Organisation (please print)

Biodiversity Assessment and Management Pty Ltd

Date: 13/05/2024

Glossary

BAAM	Biodiversity Assessment and Management Pty Ltd
CEMP	Construction Environmental Management Plan
EPBC Act	Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i>
ERMP	Ecosystem Research and Monitoring Program
GLM	Generalised linear model
GPC	Gladstone Ports Corporation Limited
NLEP-SRA	Northern Land Expansion Project - Southern Reclamation Area
REMP	Receiving Environment Monitoring Program
WBRA	Western Basin Reclamation Area

EXECUTIVE SUMMARY

BACKGROUND

In 2020, Gladstone Ports Corporation Limited (GPC) received conditions of approval (EPBC 2012/6558) under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) for the Port of Gladstone Gatcombe and Golding Cutting Channel Duplication Project (CD Project). This project will be conducted in stages, with Stage 1 currently scheduled to commence construction in October 2024. Stage 1 is named as the Northern Land Expansion Project Southern Reclamation Area (NLEP-SRA). The EPBC approval (EPBC 2012/6558) defines Project Stage 1 as meaning any aspect of the construction of the barge unloading facility and the southern reclamation area. However, the construction of the barge unloading facility is not being envisaged at this stage. Consequently, Project Stage 1 for the purposes of this Eastern Curlew and Other Shorebird Monitoring Plan is taken to mean any aspect of the construction of the southern reclamation area. A revised plan will be submitted for approval before any aspect of the construction of the barge unloading facility or Stage 3 can commence. Construction of the southern reclamation area involves the construction of a bund wall to create a new 111.12 ha reclamation area that will tie in west of the current Western Basin Reclamation Area (WBRA) for long-term placement of dredged material to the north of Fisherman's Landing. Construction of the barge unloading facility will occur at a later date and is not considered under this Eastern Curlew and Other Shorebird Monitoring Plan.

The EPBC Act approval for the Project requires GPC to comply with several conditions with regards to Eastern Curlew (*Numenius madagascariensis*), which is listed as a critically endangered species under the EPBC Act. These conditions include a requirement to implement an Eastern Curlew monitoring program.

PURPOSE

This monitoring plan sets out the monitoring methods, data analysis and reporting framework to ensure the monitoring program is capable of accurately monitoring any effects of Project Stage 1 on the population and behaviour of Eastern Curlew in Eastern Curlew habitat utilised by the species within the shorebird area that includes Friend Point, the WBRA and South Passage Island until two years following completion of construction of Project Stage 1.

MONITORING PROGRAM

To meet the approval conditions, the monitoring program incorporates the following three components based on a technical memorandum of advice provided by Professor Richard Fuller:

- **Acute phase monitoring-** Monitoring of direct and indirect project impacts in the vicinity of the project area that has been assessed as being exposed to impacts from project activities, based on monthly counts and disturbance observations of migratory shorebirds and Beach Stone-curlews at high tide roost sites (encompassing Friend Point, the Passage Islands, the WBRA and any suitable roosting habitat that emerges during the works in the NLEP-SRA) from one month prior to construction to one month post construction.
- **Long-term monitoring-** A broader and longer-term assessment of any changes in roost site usage by shorebirds in Port Curtis, based on surveys of high tide roost sites twice annually (summer, winter), covering high tide roosts at Friend Point, the Passage Islands, the WBRA, southern Curtis Island and Facing Island, following exactly the methods used in previous surveys under the Ecosystem Research and Monitoring Program (ERMP) to achieve maximum comparability with previous data. The monitoring will continue for at least five years post construction to ensure sufficient time to detect any changes in bird numbers or distribution.
- **Eastern Curlew behavioural monitoring-** Monitoring the number and density of foraging Eastern Curlews, their behavioural time budget (including responses to disturbance),

position on the tidal flats between the NLEP-SRA and Friend Point, how this changes over the tidal cycle, and where they fly to roost.

DATA ANALYSIS FRAMEWORK

The approach to analysing the monitoring data to test whether the Project Stage 1 results in impacts on the population and behaviour of the Eastern Curlew is summarised in the Table 1 below.

Table 1. Summary of the monitoring data analysis framework.

Objective	Monitoring indicator	Trigger for investigation	Frequency
Test for an impact of the Project on the Eastern Curlew population	Counts of Eastern Curlew at roost sites in the vicinity of the NLEP-SRA ('impact' area) and across the rest of Port Curtis ('control' area) within the period October-February.	A significant difference ($p < 0.05$) in Eastern Curlew roost counts in the before-after, control-impact (BACI) design tested using a generalised linear model (GLM).	Once, at the completion of the long-term monitoring program.
	Counts of Eastern Curlew at roost sites in the vicinity of the NLEP-SRA ('impact' area) within the period October-February.	A significant difference ($p < 0.05$) in Eastern Curlew roost counts in the impact area between time periods (before, after impact) tested using a GLM.	Annually during the construction phase.
Test for an impact of the Project on Eastern Curlew behaviour	Proportion of time Eastern Curlews spend on activities such as foraging, resting/preening and responding to anthropogenic disturbance	A significant difference ($p < 0.05$) in the time spent on the relevant activity between time periods (before, after impact), controlling for the potential influence of tide (neap, intermediate, spring) using a GLM.	Annually during the construction phase and once post-construction.
	Eastern Curlew feeding rates	A significant difference ($p < 0.05$) in feeding rate between time periods (before, after impact), controlling for the potential influence of tide (neap, intermediate, spring) using a GLM.	Annually during the construction phase and once post-construction.
	Count of Eastern Curlews feeding in the behavioural monitoring area at low tide	A significant difference ($p < 0.05$) in Eastern Curlew counts at low tide between time periods (before, after impact) using a GLM.	Annually during the construction phase and once post-construction.

REPORTING

An annual monitoring report will be prepared to report the results of monitoring for the reporting year, comparison with previous results, review of the effectiveness and appropriateness of the monitoring program in meeting the monitoring program objectives, recommendations to inform relevant management plans to adaptively manage and mitigate impacts to Eastern Curlew, where new or increased impacts as a result of the action have been identified, and recommendations to inform the development and delivery of environmental offsets for any significant residual impacts on Eastern Curlew, where relevant. At the end of the final year of monitoring, the annual monitoring report shall be prepared as a completion report that will be submitted to the Department within 6 months following the completion of the monitoring program.

Any incidents of disturbance to Eastern Curlew because of Project activities will be reported to GPC within 24 hours of the incident(s) to inform adaptive management measures.

EASTERN CURLEW AND OTHER SHOREBIRD MONITORING PLAN

NORTHERN LAND EXPANSION PROJECT (STAGE 1), PORT OF GLADSTONE

Table of Contents

1.0	INTRODUCTION	1
1.1	Background	1
1.2	Project Description	1
1.3	Legislative Requirements	2
2.0	MONITORING PROGRAM	3
2.1	Objectives.....	3
2.2	Suitably Qualified Ecologists	3
2.3	Monitoring Program Components	3
2.4	Monitoring Methods	4
2.4.1	<i>General</i>	4
2.4.2	<i>Acute phase monitoring</i>	4
2.4.3	<i>Long-term monitoring</i>	6
2.4.4	<i>Eastern Curlew behavioural monitoring</i>	6
2.5	Monitoring Data Analysis Framework	9
3.0	REPORTING	10
4.0	LINKAGES WITH OTHER PLANS	11
5.0	REFERENCES	12

Table of Figures

- Figure 2.1: Acute phase roost monitoring sites
Figure 2.2: Long-term roost monitoring sites
Figure 2.3: Eastern Curlew behavioural monitoring area

Table of Appendices

- Appendix 1: Technical Advice for development of Eastern Curlew Monitoring
Appendix 2: Monitoring Schedule
Appendix 3: Baseline data summary

1.0 INTRODUCTION

1.1 BACKGROUND

In 2020, Gladstone Ports Corporation Limited (GPC) received conditions of approval (EPBC 2012/6558) under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) for the Port of Gladstone Gatcombe and Golding Cutting Channel Duplication Project (CD Project). This project will be conducted in stages, with Stage 1 currently scheduled to commence construction in October 2024. Stage 1 is named as the Northern Land Expansion Project Southern Reclamation Area (NLEP-SRA) but was referred to in the EPBC Act approval as the Western Basin Expansion Southern Reclamation Area.

1.2 PROJECT DESCRIPTION

The EPBC approval (EPBC 2012/6558) defines Project Stage 1 as meaning any aspect of the construction of the barge unloading facility and the southern reclamation area. However, the construction of the barge unloading facility is not being envisaged at this stage. Consequently, Project Stage 1 for the purposes of this Eastern Curlew and Other Shorebird Monitoring Plan is taken to mean any aspect of the construction of the southern reclamation area. A revised plan will be submitted for approval before any aspect of the construction of the barge unloading facility or Stage 3 can commence. Construction of the southern reclamation area involves the construction of a bund wall to create a new 111.12 ha reclamation area that will tie in west of the current Western Basin Reclamation Area (WBRA; see **Figure 1.1** for location) for long-term placement of dredged material to the north of Fisherman's Landing. The NLEP-SRA will provide additional long-term storage capacity for future capital and maintenance (if required) dredging programs in the Port of Gladstone (e.g. Targinnie Channel, Gatcombe and Golding Cutting Channels).



Figure 1.1: Location of the proposed NLEP-SRA.

The proposed NLEP-SRA outer bund wall has been designed as a rock filled embankment structure comprising the following key elements:

- an inner bund comprising of hard, durable rock (core material) suitable for use in a marine environment;
- an outer, ocean-side face that will consist of a filter rock layer and armour rock (rip rap revetment) on the face and toe;
- an inner, reclamation-side face that will consist of geotextile layers and a filter sand layer as well as a reshaping rock berm on the face and toe; and
- a compacted (unsealed) surface on the crest of the bund wall composed of wearing course material.

1.3 LEGISLATIVE REQUIREMENTS

The EPBC Act approval for the construction of the NLEP associated with the Port of Gladstone Gatcombe and Golding Cutting Channel Duplication Project (EPBC 2012/6558) requires GPC to comply with several conditions with regards to Eastern Curlew (*Numenius madagascariensis*), which is listed as a critically endangered species under the EPBC Act. The relevant conditions are outlined in **Table 1.1**, together with a reference to which sections of the Monitoring Plan each approval condition is addressed in.

Table 1.1. Outline of the Project conditions of approval (EPBC 2012/6558) relevant to the Eastern Curlew Monitoring Plan together with a reference to which sections of the plan each approval condition is addressed in.

Approval condition	Plan reference
(14) The approval holder must implement, commencing prior to the commencement of each relevant Project Stage , the following monitoring programs in respect of Project Stage 1 and Project Stage 3 :	
a. a program capable of accurately monitoring any effects of Project Stage 1 and Project Stage 3 on the population and behaviour of the Eastern Curlew within Eastern Curlew habitat utilised by the species within the shorebird area including at Friend Point, the WB reclamation area and South Passage Island until 2 years following completion of construction of Project Stage 1 and Project Stage 3;	This plan
(17) All monitoring plans and programs required under conditions 14, 15 and 16 must:	
a. be designed and undertaken by a person suitably qualified to design and/or implement the specific plan or program and who is a suitably qualified person , such as a suitably qualified field ecologist , or a marine sediment expert ;	Sections 2.2 and 2.4.1
b. be submitted for the Minister's approval prior to the commencement of the relevant Project Stage ;	Stage 1 has not yet commenced
c. include commitments for reporting to the Department the relevant findings and outcomes of monitoring, including performance against specified monitoring objectives, and procedures for undertaking periodic reviews of the effectiveness and appropriateness of the monitoring plan/program;	Section 3
d. commit to submit completion reports to the Department within 6 months following the completion of each monitoring program (i.e. the completion of the monitoring in respect of the particular Project Stage which is the subject of the monitoring plan or program);	Section 3
e. inform relevant management plans required by this approval to adaptively manage and mitigate impacts to protected matters ; and	Sections 3 and 4
f. be used to inform the development and delivery of environmental offsets for protected matters .	Sections 3 and 4

2.0 MONITORING PROGRAM

2.1 OBJECTIVES

This monitoring plan sets out the monitoring methods, data analysis and reporting framework to ensure the monitoring program is capable of accurately monitoring any effects of Project Stage 1 on the population and behaviour of Eastern Curlew in Eastern Curlew habitat utilised by the species within the shorebird area that includes Friend Point, the Western Basin Reclamation Area and South Passage Island until two years following completion of construction of Project Stage 1.

2.2 SUITABLY QUALIFIED ECOLOGISTS

This monitoring plan has been prepared by Dr Penn Lloyd and is based on a technical memorandum of advice provided by Professor Richard Fuller (**Appendix 1**). Both Professor Fuller and Dr Lloyd are Eastern Curlew and other shorebird experts. Professor Fuller holds a Doctor of Philosophy and is a Professor in the School of the Environment, Faculty of Science at the University of Queensland. His considerable research expertise includes the ecology and conservation of migratory shorebirds (including Eastern Curlew) and strategies for designing efficient conservation plans. Professor Fuller has provided extensive advice on migratory species conservation to the Australian Government and other agencies, including as part of the official Australian delegation in bilateral talks on migratory species conservation with the Chinese, Japanese and Korean governments. Dr Lloyd holds a PhD in Ornithology, has worked as an academic researcher on the conservation ecology of birds for 17 years, as a consultant for the past 14 years, and is a Certified Environmental Practitioner (CEnvP) Ecology Specialist of the Environment Institute of Australia & New Zealand (EIANZ). Over the past 14 years he has led baseline assessments and monitoring surveys for 35 different projects that have included survey and assessment for Eastern Curlew.

2.3 MONITORING PROGRAM COMPONENTS

To address the conditions of approval outlined in **Section 1.3**, the monitoring program has been designed to incorporate the following three components:

- **Acute phase monitoring-** Monitoring of direct and indirect project impacts in the vicinity of the project area that has been assessed as being exposed to impacts from project activities, based on monthly counts and disturbance observations of migratory shorebirds and Beach Stone-curlews at high tide roost sites (encompassing Friend Point, the Passage Islands, the WBRA and any suitable roosting habitat that emerges during the works in the NLEP-SRA) from one month prior to construction to one month post construction.
- **Long-term monitoring-** A broader and longer-term assessment of any changes in roost site usage by shorebirds in Port Curtis, based on surveys of high tide roost sites twice annually (summer, winter), covering high tide roosts at Friend Point, the Passage Islands, the WBRA, southern Curtis Island and Facing Island, following exactly the methods used in previous surveys under the Ecosystem Research and Monitoring Program (ERMP) to achieve maximum comparability with previous data. The monitoring will continue for at least five years post construction to ensure sufficient time to detect any changes in bird numbers or distribution.
- **Eastern Curlew behavioural monitoring-** Monitoring the number and density of foraging Eastern Curlews, their behavioural time budget (including responses to disturbance), position on the tidal flats between the NLEP-SRA and Friend Point, how this changes over the tidal cycle, and where they fly to roost.

The detailed rationale for including these three components is provided in **Appendix 1**.

2.4 MONITORING METHODS

2.4.1 General

Although the conditions of approval of EPBC 2012/6558 are specific to Eastern Curlew, the acute-phase and long-term monitoring components will count all migratory shorebird species (including Eastern Curlew), resident shorebird species and other waterbird species present at roost sites. Surveys will focus on the existing known roost sites surveyed by the ERMP (shown by the green icons in **Figure 2.2** that reproduces the roost site map (Appendix A) of Prof. Fuller's technical memorandum attached as **Appendix 1**) to ensure comparability with the long-term ERMP data (Wildlife Unlimited 2020). Efforts will also be made to identify any emerging alternative new roost sites that may be used within the monitoring area to meet the intent of the ERMP and long-term monitoring to monitor potential changes to shorebird use of roost sites and population sizes in Port Curtis over time.

The shorebird surveys of high tide roost sites will follow the survey guidelines outlined in the EPBC Act *Policy Statement 3.21: Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species* (Commonwealth of Australia 2015). Specifically:

- surveys for roosting shorebirds will be conducted as close to the time of high tide as practicable and at a maximum of no more than two hours either side of high tide;
- surveys will not be undertaken during periods of high rainfall or strong winds;
- surveys will determine the total number of individuals of each shorebird species present, to enable assessment of site and habitat importance; and
- surveys will collect spatial data of the area used by shorebirds for roosting.

To ensure further alignment with Shorebird 2020 (BirdLife Australia, undated) shorebird survey data capture, information collected at each site will include survey type (land or boat-based), site name and co-ordinates, observer names, date, start and finish time, high tide height and time, wind direction and speed, sources of potential disturbance and details of any incidents of actual disturbance.

Shorebird surveys will be conducted by suitably qualified field ecologists¹ experienced in the identification and counting of migratory shorebirds, including in large, mixed-species aggregations using spotting telescopes mounted on sturdy tripods (land-based) or binoculars (boat-based). Habitat areas will be surveyed from suitable vantage points that provide an unobstructed view of the entire area or will be circumnavigated on foot where required.

2.4.2 Acute phase monitoring

Acute phase monitoring surveys will be conducted once per month, starting from one month prior to construction and finishing one month after the end of construction of the NLEP-SRA outer bund wall; construction is expected to last 18 months (see **Appendix 2** for indicative schedule). Each acute phase monthly monitoring event will survey the roost sites shown in **Figure 2.1** (and any suitable roosting habitat that emerges during the works in the NLEP-SRA) within a 4-hour period, two hours either side of high tide.

¹ A suitable qualified ecologist is defined by EPBC 2012/6558 as a person who has professional qualifications and at least three (3) years of work experience designing and implementing surveys for the protected matter and their habitat, and can give authoritative assessment and advice on the presence and habitat requirements for the protected matter using relevant protocols, standards, methods and/or literature.



310000 315000

Data Sources:
 Long-term monitoring roost sites:
 BAAM - March 2024
 Baseline Roads and Tracks - Queensland, Published 01/07/2022
 Rail Network - Queensland, Published 17/05/2022
 State of Queensland (Department of Resources) 2023

© State of Queensland 2024
 © Biodiversity Assessment and Management P/L
 While every care is taken to ensure the accuracy of this data, BAAM Ecology makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaims all responsibility and all liability (including without limitation liability in negligence) for all expenses, losses, damages (including indirect consequential damage) and costs which might be incurred as a result of the data being inaccurate or incomplete in any way and for any reason.
 Drawn By: MapLass - KM Reviewed by: PL Date: 12/04/2024

310000 315000

Figure: 2.1

Title: Acute phase roost monitoring sites

Project: CO2200089 Eastern Curlew and Other Shorebird Monitoring Plan

Client: Gladstone Ports Corporation Ltd



2.4.3 Long-term monitoring

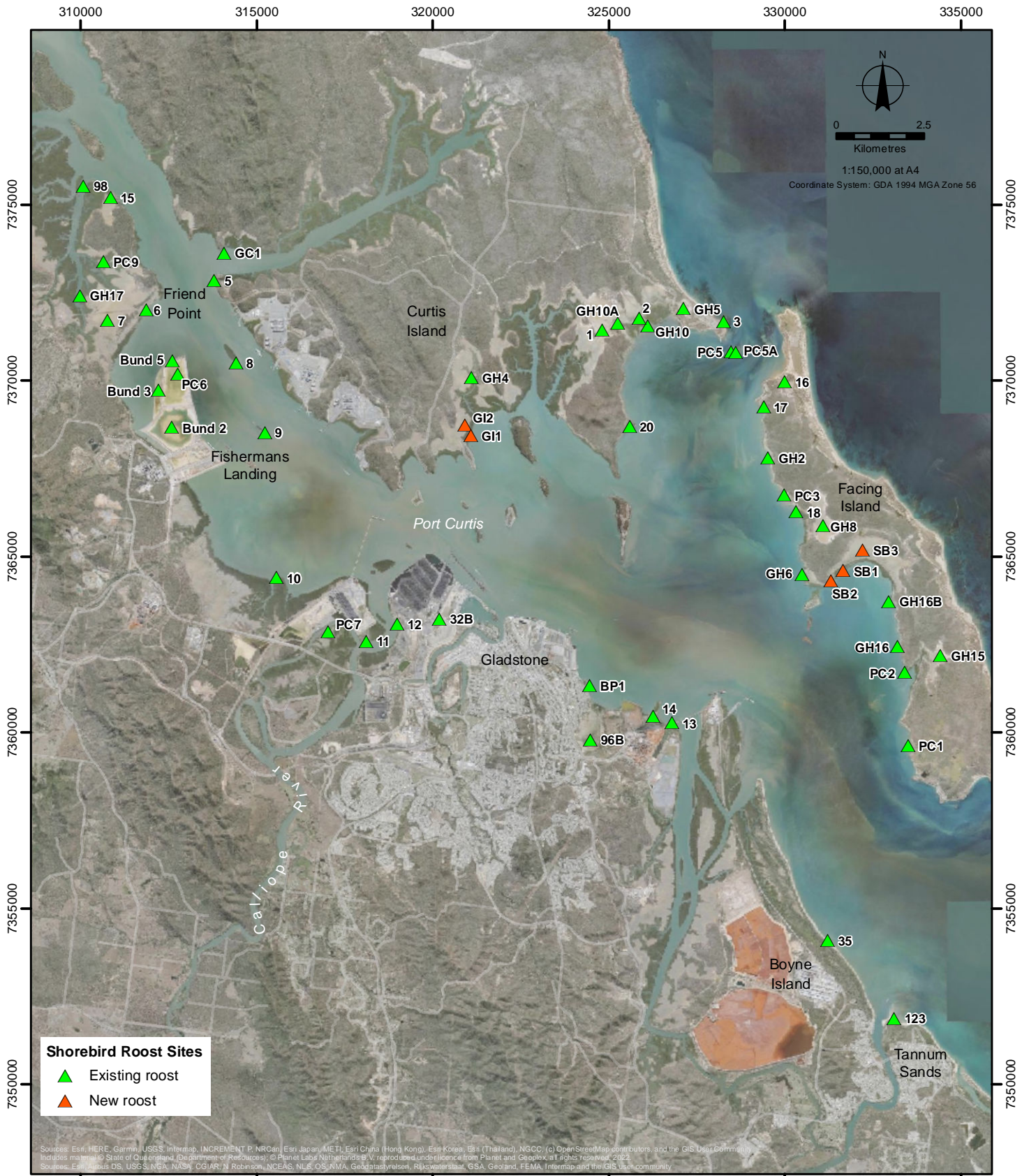
Long-term monitoring surveys will be conducted twice per year (summer, winter), starting once construction starts and continuing for at least five years after the end of construction of the NLEP-SRA outer bund wall (see **Appendix 2** for indicative schedule). An additional pre-construction summer survey was conducted in February 2024 to supplement the existing long-term monitoring data collected annually from 2011 to 2020 by the ERMP (Lloyd and Trainor 2024). The extent of the baseline data that have already been collected is summarised in **Appendix 3**. Each long-term monitoring event will survey the roost sites shown in **Figure 2.2** (and any suitable roosting habitat that emerges during the works in the NLEP-SRA) within a 4-hour period, two hours either side of high tide. Summer surveys will be conducted within the period mid-November to the end of February, preferably in February to align with most previously conducted ERMP surveys, and winter surveys will be conducted within the period mid-May to mid-August.

2.4.4 Eastern Curlew behavioural monitoring

Eastern Curlew behavioural monitoring will be conducted over two consecutive summer seasons prior to the start of construction (pre-impact baseline) and then repeated every summer and winter during construction of the NLEP-SRA outer bund wall (see **Appendix 2** for indicative schedule). The two pre-impact baseline surveys prior to the start of construction were completed in early March 2023 and January-February 2024 (Lloyd and Trainor 2023, 2024). Each behavioural monitoring event will be undertaken over a full tide cycle (spring tide, neap tide, intermediate tide) on three separate days. Each behavioural monitoring event during the construction phase will be timed to coincide with intense construction activities wherever possible. In addition, the behavioural monitoring will be supplemented by having an observer stationed to monitor any impacts during the period of most intense construction activity that GPC expects to occur at the time of bund closure.

The behavioural monitoring will focus on the full extent of the tidal flat between the NLEP-SRA construction site and Friend Point, as shown in **Figure 2.3**. Each day of observations shall start before the birds first fly in from the roosting grounds to the tidal flat, and end after they have departed the foraging area to fly back to the roost site. Observers shall be positioned on the shoreline edge of the bund wall or suitable vantage points on the mainland shoreline and monitor Eastern Curlews using high-powered spotting telescopes (mounted on sturdy tripods) that permit monitoring of Eastern Curlew at distances up to 1-2 km.

The behavioural time budget shall be quantified using the focal individual sampling technique (Altmann 1974) that is widely used in quantifying the time budgets of shorebirds, including Eastern Curlew (e.g. Finn and Catterall 2023). The behaviour of birds present on the tidal mudflat shall be monitored from the time the first bird flies in from the roosting grounds to the tidal flat, and end after the last bird has departed the foraging area to fly back to the roost site. Each individual Eastern Curlew present on the tidal mudflat shall be monitored for 15 minutes at a time, split into three 5-minute intervals, whereafter the observer shall switch to monitoring the next closest Eastern Curlew, proceeding in this manner to monitor all individuals present on the mudflat. Once all individuals have been monitored once, the observer shall repeat the process for the duration of the available monitoring time. During each 5-minute interval, the time spent engaged in the following different behavioural categories shall be recorded: foraging; resting/preening; aggressive interaction; alert; walking away from disturbance; in flight. The causes for the birds engaging in the last three behaviours listed above shall be established on each occasion. At the same time, the observer shall be alert to potential sources of disturbance present in the area, including presence and movement of vehicles and people and loud noises from the project area, potential sources of disturbance outside the project area (e.g. aircraft, boats) and presence of natural sources of disturbance such as raptors. The total number of prey items consumed by each bird during each 5-minute interval shall also be recorded when birds are close enough to monitor foraging success. Foraging success rates shall be calculated as the number of items consumed per unit of time spent foraging. During each monitoring event, the total number and positions of Eastern Curlew present on the tidal mudflat at low tide shall be recorded to establish the density of feeding birds.



Data Sources:
 Long-term monitoring roost sites:
 BAAM - March 2024
 Baseline Roads and Tracks - Queensland, Published 01/07/2022
 Rail Network - Queensland, Published 17/05/2022
 State of Queensland (Department of Resources) 2023

© State of Queensland 2024
 © Biodiversity Assessment and Management P/L
 While every care is taken to ensure the accuracy of this data, BAAM Ecology makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaims all responsibility and all liability (including without limitation liability in negligence) for all expenses, losses, damages (including indirect consequential damage) and costs which might be incurred as a result of the data being inaccurate or incomplete in any way and for any reason.
 Drawn By: MapLass - KM Reviewed by: PL Date: 12/04/2024

Figure: 2.2
Title: Long-term roost monitoring sites
Project: CO22000089 Eastern Curlew and Other Shorebird Monitoring Plan
Client: Gladstone Ports Corporation Ltd





Data Sources:
 Eastern Curlew Foraging Sites 2024:
 BAAM - Jan 17, Feb 2 and Feb 22 2024
 Baseline Roads and Tracks - Queensland, Published 01/07/2022
 Rail Network - Queensland, Published 17/05/2022
 State of Queensland (Department of Resources) 2023

© State of Queensland 2024
 © Biodiversity Assessment and Management P/L
 While every care is taken to ensure the accuracy of this data, BAAM Ecology makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaims all responsibility and all liability (including without limitation liability in negligence) for all expenses, losses, damages (including indirect consequential damage) and costs which might be incurred as a result of the data being inaccurate or incomplete in any way and for any reason.
Drawn By: MapLass - KM Reviewed by: PL Date: 12/04/2024

Figure:	2.3
Title:	Eastern Curlew behavioural monitoring area
Project:	CO2200089 Eastern Curlew and Other Shorebird Monitoring Plan
Client:	Gladstone Ports Corporation Ltd



At the start and end of each survey, the directions from which birds fly to the tidal flats at the start of the low tide and the directions in which birds fly off to roost at the end of the low tide shall be noted, and, if possible, identifying which roost sites they arrive from or go to.

2.5 MONITORING DATA ANALYSIS FRAMEWORK

This section outlines the approach to analysing the monitoring data to test whether the Project Stage 1 results in impacts on the population and behaviour of the Eastern Curlew, summarised in **Table 2.1**.

Table 2.1. Summary of the monitoring data analysis framework.

Objective	Monitoring indicator	Trigger for investigation	Frequency
Test for an impact of the Project on the Eastern Curlew population	Counts of Eastern Curlew at roost sites in the vicinity of the NLEP-SRA ('impact' area) and across the rest of Port Curtis ('control' area) within the period October-February.	A significant difference ($p < 0.05$) in Eastern Curlew roost counts in the before-after, control-impact (BACI) design tested using a generalised linear model (GLM).	Once, at the completion of the long-term monitoring program.
	Counts of Eastern Curlew at roost sites in the vicinity of the NLEP-SRA ('impact' area) within the period October-February.	A significant difference ($p < 0.05$) in Eastern Curlew roost counts in the impact area between time periods (before, after impact) tested using a GLM.	Annually during the construction phase.
Test for an impact of the Project on Eastern Curlew behaviour	Proportion of time Eastern Curlews spend on activities such as foraging, resting/preening and responding to anthropogenic disturbance	A significant difference ($p < 0.05$) in the time spent on the relevant activity between time periods (before, after impact), controlling for the potential influence of tide (neap, intermediate, spring) using a GLM.	Annually during the construction phase and once post-construction.
	Eastern Curlew feeding rates	A significant difference ($p < 0.05$) in feeding rate between time periods (before, after impact), controlling for the potential influence of tide (neap, intermediate, spring) using a GLM.	Annually during the construction phase and once post-construction.
	Count of Eastern Curlews feeding in the behavioural monitoring area at low tide	A significant difference ($p < 0.05$) in Eastern Curlew counts at low tide between time periods (before, after impact) using a GLM.	Annually during the construction phase and once post-construction.

To test for a long-term impact of the Project on the Eastern Curlew population, the total Eastern Curlew count across roost sites included in the acute phase monitoring area ('impact' area) will be compared to the total Eastern Curlew count across the remainder of the long-term monitoring area in Port Curtis ('control' area). If the Project results in negative impacts on Eastern Curlew, causing them to be displaced from roost sites in the 'impact' area, then the total count in the 'impact' area is expected to reduce and the total count in the 'control' area is expected to increase when comparing count data from before construction starts to count data after construction is completed. This equates to a before-after, control-impact (BACI) testing framework that is considered a suitable design for testing environmental impact (Stewart-Oaten and Bence 2001, Smokorowski and Randall 2017), which will be tested using a generalised linear model (GLM) for analysing count data. Only counts that fall within the period October to February inclusive, the period that numbers of Eastern Curlew are most stable in south-east Queensland (Lloyd *et al.* in review) will be included

in the analysis. This analysis will be conducted at the completion of the long-term monitoring program, five years after the completion of construction.

To test for a short-term impact of the Project on the Eastern Curlew population, the total Eastern Curlew counts across roost sites included in the acute phase monitoring area ('impact' area) during the summer period (October-February) will be compared between baseline surveys (before impact) and acute phase monitoring surveys during construction (after impact). This analysis will be conducted annually during the construction phase.

To test for an impact of the Project on Eastern Curlew behaviour, three analyses will be reported annually during the construction phase and once post-construction:

- Test for impact on time budget;
- Test for impact on feeding rates; and
- Test for impact on foraging density on the tidal flat adjoining the Project footprint.

The test for impact on time budget will compare the proportion of time (per 15-minute focal observation) Eastern Curlews spend on activities such as foraging, resting/preening and responding to anthropogenic disturbance before construction starts (baseline) versus: (a) during construction; or (b) after construction ends. A GLM will be used to test for a significant difference ($p < 0.05$) between time periods, controlling for the potential influence of tide (neap, intermediate, spring).

The test for impact on feeding rates will compare the number of food items caught during the period spent foraging (per 15-minute focal observation) before construction starts (baseline) versus: (a) during construction; or (b) after construction ends. A GLM will be used to test for a significant difference ($p < 0.05$) between time periods, controlling for the potential influence of tide (neap, intermediate, spring).

The test for impact on foraging density will compare the number of Eastern Curlew recorded within the behavioural monitoring area at low tide before construction starts (baseline) versus: (a) during construction; or (b) after construction ends. A GLM will be used to test for a significant difference ($p < 0.05$) between time periods.

Should any of these statistical tests find a significant difference ($p < 0.05$) between the before and after impact time periods or between the impact and control areas, it identifies that the Project has had a significant impact on Eastern Curlew unless a subsequent investigation determines that the change is not caused by Project activities.

The NLEP-SRA is expected to have a significant residual impact on 121.24 ha of Eastern Curlew tidal mudflat feeding habitat (BAAM 2024). Localised, temporary displacement of Eastern Curlew is expected to occur during the period of construction in the immediate vicinity of the construction area (Gladstone Ports Corporation Limited 2013).

3.0 REPORTING

An annual monitoring report will be prepared, which will include the following information at a minimum:

- EPBC approval number;
- results of monitoring for the reporting year;
- comparison of the monitoring results for the current year of reporting with the monitoring results from the previous years of reporting, including comparison with the pre-construction (baseline) monitoring results;

- review of the effectiveness and appropriateness of the monitoring program in meeting the monitoring program objectives outlined in Section 2.1;
- recommendations to inform relevant management plans required by EPBC 2012/6558 to adaptively manage and mitigate impacts to Eastern Curlew, where relevant (see Section 4); and
- recommendations to inform the development and delivery of environmental offsets for any significant residual impacts on Eastern Curlew, where relevant (see Section 4).

At the end of the final year of monitoring, the annual monitoring report shall be prepared as a completion report that will be submitted to the Department within 6 months following the completion of the monitoring program.

Any incidents of disturbance to Eastern Curlew because of Project activities will be reported to GPC within 24 hours of the incident(s) to inform adaptive management measures.

4.0 LINKAGES WITH OTHER PLANS

GPC is required to develop and implement several other management and monitoring plans to address the full requirements of approval conditions under both Commonwealth and Queensland legislation. The interaction between the Eastern Curlew and Other Shorebird Monitoring Plan and these other plans is summarised in **Table 4.1**.

Table 4.1 Description of other management plans and linkages with the Eastern Curlew and Other Shorebird Monitoring Plan.

Management Plan	Purpose	Link to legislation or approval	Link to Eastern Curlew and Other Shorebird Monitoring Plan
Construction Environmental Management Plan (CEMP)	Systems and controls for minimising the risk of environmental impacts associated with the construction of the NLEP-SRA outer bund wall.	EPBC approval Condition 20 Development Permit DA2022/10/01 Condition 27 Environmental Authority PA-EA-100261837	Informs interpretation of ecological triggers, monitoring and management through adaptive processes set out in the CEMP.
Receiving Environment Monitoring Program (REMP)	Describes the receiving environment attributes, environmental monitoring and related adaptive management actions designed for the NLEP-SRA.	EPBC approval Conditions 14-17 Development Permit DA2022/10/01 Condition 27 Environmental Authority PA-EA-100261837	Links with the overarching REMP and informs interpretation of ecological triggers, monitoring and management through adaptive processes set out in the REMP.
Eastern Curlew Offset Strategy	To deliver an environmental offset to compensate for significant residual impacts of the NLEP-SRA on the habitat of Eastern Curlew	EPBC approval Conditions 31-33	Will inform revisions to the Eastern Curlew Offset Strategy to offset any significant residual impacts to Eastern Curlew.

5.0 REFERENCES

- Altmann, J. (1974).** Observational study of behaviour: sampling methods. *Behaviour* 49: 227-267.
- BAAM (2024).** Eastern Curlew Offset Strategy, Northern Land Expansion Project - Southern Reclamation Area, Port of Gladstone Gatcombe and Golding Cutting Channel Duplication Project (CO22000089). Report prepared for Gladstone Ports Corporation Limited by Biodiversity Assessment and Management Pty Ltd.
- BirdLife Australia (undated).** The Shorebirds 2020 Count Form. Available at: <https://direct.birdlife.org.au/documents/SB-instructionscountform.pdf>
- Finn, P. G., & Catterall, C. P. (2023).** Towards an efficient indicator of habitat quality for Eastern Curlews on their intertidal feeding areas. *Australasian Journal of Environmental Management* 30: 26–47. <https://doi.org/10.1080/14486563.2022.2084166>.
- Gladstone Ports Corporation Limited (2013).** Construction Environmental Management Plan for the Northern Land Expansion Project (NLEP) - Southern Reclamation Area.
- Lloyd, P. and Trainor, C. (2023).** CO22000089 Shorebird Monitoring Services: Monitoring the behaviour of Eastern Curlew, before construction. Report for Gladstone Ports Corporation Limited by Biodiversity Assessment and Management Pty Ltd, May 2023, 14 pp.
- Lloyd, P. and Trainor, C. (2024).** CO22000089 Shorebird Monitoring Services: NLEP Shorebird Summer Count and Eastern Curlew Behavioural Monitoring 2024, Before Construction. Report for Gladstone Ports Corporation Limited by Biodiversity Assessment and Management Pty Ltd, April 2024, 23 pp.
- Lloyd, P., Driscoll, P.V., Coleman, J.T., Cross, L. & Rothlisberg, P.C. (in review).** Shorebird use of the Port of Brisbane, Queensland: insights from 30 years of monitoring. *Corella*.
- Smokorowski, K.E. and Randall, R.G. (2017).** Cautions on using the Before-After-Control-Impact design in environmental effects monitoring programs. *Facets* 2: 212–232.
- Stewart-Oaten, A., and Bence, J. R. (2001).** Temporal and spatial variation in environmental impact assessment. *Ecological monographs* 71: 305-339.
- Wildlife Unlimited (2020).** Gladstone Ports Corporation Report for Migratory Shorebird Monitoring, Port Curtis and the Curtis Coast, Annual Report – 2019. Report produced for the Ecosystem Research and Monitoring Program Advisory Panel as part of Gladstone Ports Corporation's Ecosystem Research and Monitoring Program. pp. 115.

APPENDIX 1

Technical Advice for development of Eastern Curlew Monitoring

TECHNICAL MEMORANDUM VERSION 2

To: Gladstone Ports Corporation

From: Professor Richard Fuller, University of Queensland

Version 1 Date: 27th November 2020

Version 2 Update: 21st October 2022

Version 3 Update: 3rd November 2022

Subject: Technical Advice for development of Eastern Curlew Monitoring for EPBC2012/6558

This technical memorandum develops scientific reasoning for the design and implementation of a shorebird monitoring programme that will enable GPC to meet the shorebird monitoring requirements for Conditions 7 and 14. Importantly, *this advice only covers Stage 1, additional monitoring may be required to meet the conditions for Stage 3*. It makes the following three recommendations:

Recommendation 1 - Acute phase monitoring: Direct and indirect project impacts need to be monitored in the vicinity of the project area that has been assessed as being exposed to impacts from project activities. This should comprise monthly counts of migratory shorebirds and beach stone-curlews at high tide roost sites from one month prior to construction to one month post construction at Friend Point, South Passage Island, the Western Basin wetland and any suitable roosting habitat that emerges during the works in the Southern Reclamation Areas. This acute phase monitoring should be supplemented by having observers stationed to watch for any impacts around any particularly intense scheduled activities during construction. Provision needs to be made for analysing and reporting on the results of the acute phase monitoring.

Recommendation 2 – Long term monitoring: A broader and longer-term assessment of any changes in habitat usage by shorebirds in Port Curtis is also needed. To achieve this, all shorebirds (migratory and non-migratory) should be counted at high tide roosts twice annually, with a summer count occurring between mid-November and mid-February, and a winter count occurring between mid-May and mid-August. This broad scale monitoring should cover high tide roosts at Friend Point, the Passage Islands, southern Curtis Island and Facing Island. The monitoring should occur during the high tide period, following exactly the methods used in previous surveys under the ERMP program to achieve maximum comparability with previous data. The monitoring should continue for at least five years post construction to ensure sufficient time to detect any changes in bird numbers or distribution. No low tide counts are required as part of the long term monitoring programme – changes in roost site use will index changes in foraging habitat use. To meet Condition 14, the first survey will occur before mid-February 2022. Provision needs to be made for analysing and reporting on the results of the long term monitoring, including the monitoring data collected through the ERMP between 2011 and 2020. Data needs to be collated and stored in the same format as the previous monitoring data.

Recommendation 3 – Eastern curlew behavioural monitoring: Behaviour of foraging eastern curlews on the intertidal flats should be monitored by stationing observers at strategic vantage points from which foraging curlews can be watched through the full low tide cycle in the between the Southern Reclamation Area construction site and Friend Point. The observations should monitor the number and density of feeding birds, their behavioural time budget, position on the tidal flats, how this changes over the tidal cycle, directions in which birds fly off to roost, and if possible identifying which roost sites they go to. Provision needs to be made for analysing and reporting on the results of the behavioural monitoring.

Development of Recommendations

1. Existing shorebird monitoring activities in the Gladstone region

Migratory shorebird monitoring in the Gladstone region was sporadic and patchy prior to 2010 (Driscoll 2013), but since then, regular monitoring has occurred as part of the Western Basin Dredging Project, overseen by the Ecosystem Research and Monitoring Program (ERMP; Figure 1).

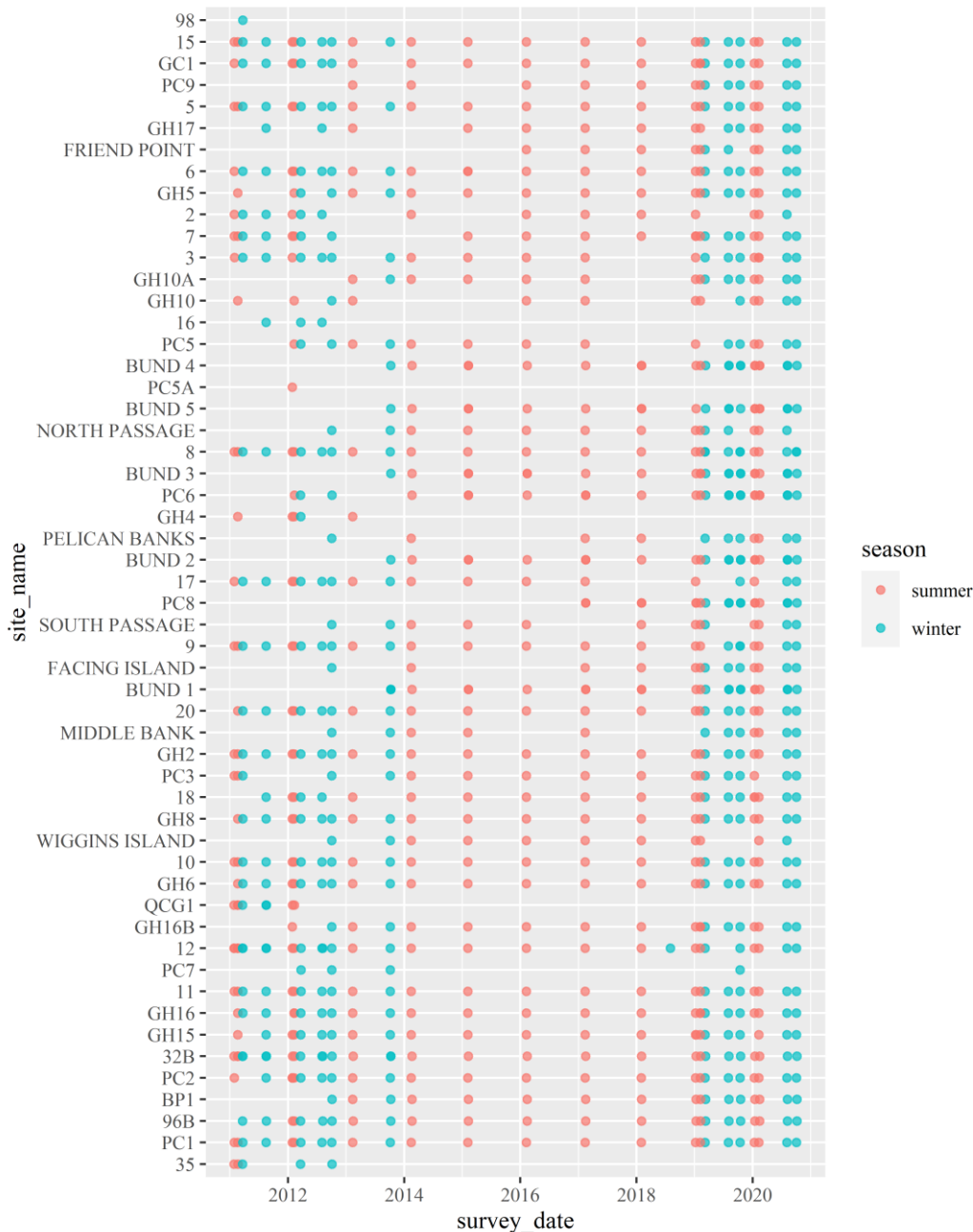


Figure 1 Shorebird monitoring surveys in the Gladstone Harbour region, between Kangaroo Island in the north and Tannum Sands in the south. Sites are listed in latitudinal order from north to south – see Appendix A for a map of the survey locations. A summer count is defined as November – February, and a winter count as May-August.

Analysis of this shorebird monitoring data by Fuller et al. (2022) detected rapid declines of three species (Whimbrel, Eastern Curlew, Bar-tailed Godwit), and provisional declines of two species (Great Knot, Sanderling) in the ERMP Survey Area. The Eastern Curlew decline in the ERMP Survey Area averaged an annual percent change between 2011 and 2020 of -6.49% [95% BCI = -11%, -1.56%]. This is much steeper than the national decline of this species, suggesting a possible role for local threats. The declines in abundance for Eastern Curlew and several other shorebird species in the ERMP Survey Area suggests that monitoring the impact of ongoing developments is critically important in this region. Moreover, plots of the monitoring dataset for the Gladstone Harbour region between Kangaroo Island and Tannum Sands suggest that migratory shorebird numbers have approximately halved between 2010 and 2020, and declines in Eastern Curlew numbers might be even steeper than that (Figure 2). Beach stone-curlew numbers are very low in this region, and arguably not well monitored by the ERMP survey methodology, which was designed for aggregating migratory shorebirds.

The monitoring data show that there is relatively low availability of high quality roosting sites on the mainland coast of the Gladstone Port area (compare left column with right column in Figure 2), and thus avoiding and monitoring impacts to the Friend Point roost is of paramount importance.

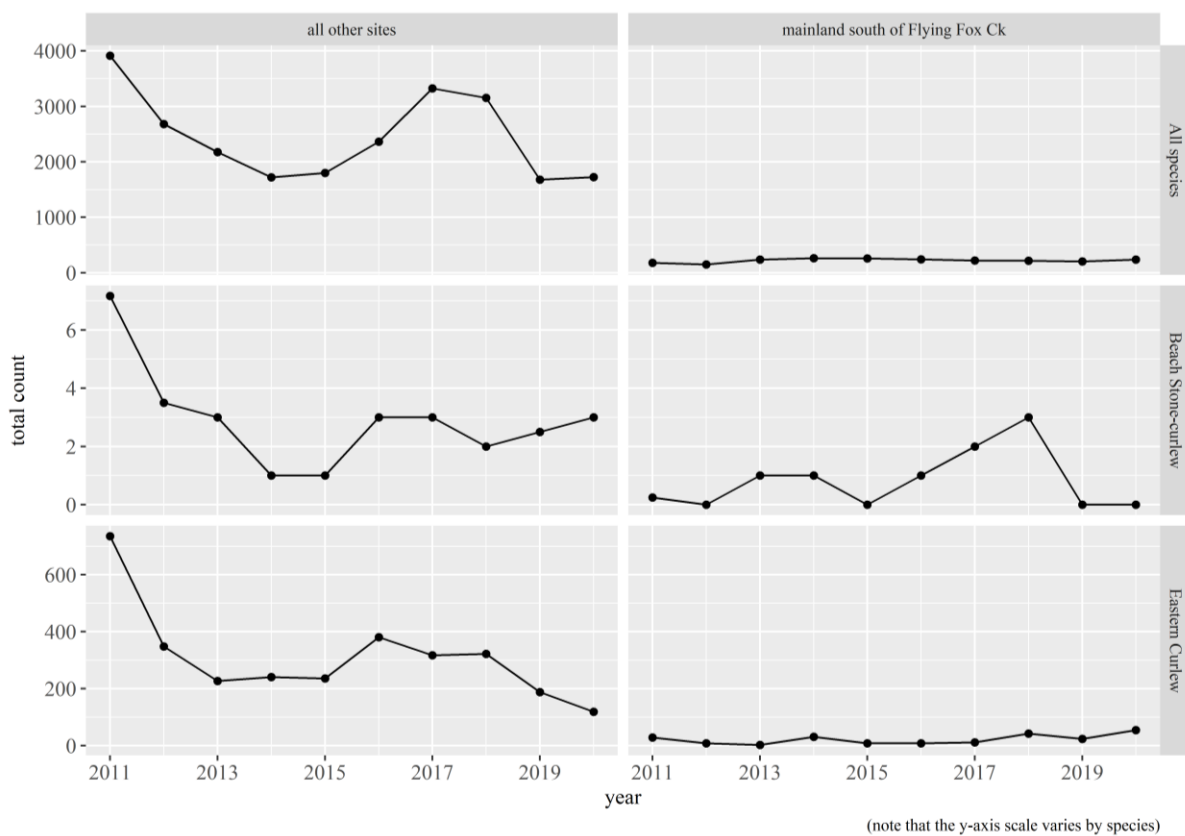


Figure 2 Total shorebird counts in the Gladstone Harbour region (Kangaroo Island to Tannum Sands) each summer between 2011 and 2020. A mean was used for a site in cases where multiple counts were conducted within a summer season (November – February). Note this is not an analysis, but simply a representation of the raw monitoring data.

2. Design of shorebird population monitoring

2.1 Spatial extent of monitoring

Condition 14 calls for effects on Eastern Curlew abundance to be “accurately monitored”, with three roost sites being specifically named (Friend Point, the Western Basin Reclamation Area, and South Passage Island). It also stipulates monitoring in Eastern Curlew habitat in the “shorebird area”.

For monitoring the immediate impact of project activities, the sites specifically named above constitute a reasonable area for intensive monitoring to check for acute impacts.

The correct definition of the broader area that could be impacted by the project as a whole depends on projecting how extensive the impact might be. Here I use four interlinked lines of reasoning to determine the extent of the area that should be monitored for Eastern Curlews and other migratory shorebirds.

First, the site of the Southern Reclamation Area is within 3 km of the Western Basin Reclamation Area, Friend Point, South Passage Island and North Passage Island roost, and thus the monitoring must necessarily include this group of sites, which might be directly impacted by project activities, and among which birds might redistribute in response to acute impacts of the project activities.

Second, substantial commuting movements of Eastern Curlews have been documented in this region. Radio-tracking of Eastern Curlews and several other shorebird species along the south coast of Curtis Island revealed that commuting movements of 5-10 km occurred between feeding and roosting sites, and also among roosting sites (Figure 3; Choi *et al.* 2017). In Moreton Bay, movements of up to 15 km between feeding and roosting sites have been detected in satellite-tagged Eastern Curlews (B. Woodworth, University of Queensland, personal communication). There are no direct data on Eastern Curlew movements between the Friend Point roost and other roosts in the region, it seems highly likely that at least some birds will be moving between Friend Point and other roost sites at southern Curtis Island and Facing Island. While much of Facing Island is more than 15 km in a direct line from Friend Point, the Southern Curtis Island / Facing Island system of roosts operates as a tightly connected network (Figure 3), and so both Curtis Island and Facing Island need to be part of the monitoring. The Southern Curtis Island / Facing Island roosts can all be surveyed comfortably in a day.

Third, if impacts to Friend Point or the other roost proximal to the Southern Reclamation Area do occur, ensuring that monitoring is ongoing across all sites likely to receive any displaced curlews will ensure that any impact can be fully understood. For example, if Eastern Curlews are displaced from the Friend Point roost and relocate to the Southern Curtis Island Clapyan roost, GPC will be able to monitor the long term fate of those displaced birds.

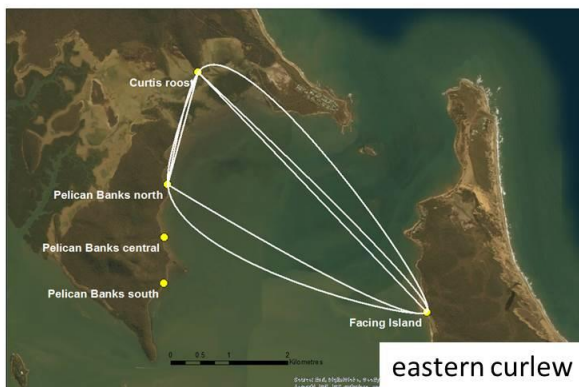


Figure 3 Commuting movements in the Pelican Banks/Facing Island area by eight radio-tagged Eastern Curlews. Automated receiver stations were located at each of the yellow dots, and are joined by a line when a bird was detected by both stations. Figure from Choi *et al.* (2017).

Fourth, the number of Eastern Curlews using the mainland roost sites at Flying Fox Creek and south is so low that continued monitoring of those sites is extremely unlikely to be valuable (Figure 2, 4). Those roosts are mostly unsuitable for Eastern Curlews, and are considered very unlikely to be recipient sites for any displaced birds from Friend Point (J. Reside, Wildlife Unlimited, personal communication).

On the basis of these four pieces of evidence, I conclude that the area monitored for acute impacts should be the roosts at Friend Point, the Western Basin wetland, any emerging wetlands in the Southern Reclamation Area, and South Passage Island (North Passage Island does not really function as a roost site). Over the longer term, broader monitoring would include this area plus the southern coast of Curtis Island and the west coast of Facing Island.

2.2 Design of monitoring

2.2.1 Acute phase monitoring for possible impacts

Shorebird sites local to the project precinct should be frequently monitored during the period when active works are underway. High tide roost counts should be conducted monthly during the period of intense project activity, and should cover the sites local to the project precinct, i.e. the roosts at Friend Point, the Western Basin wetland, any emerging wetlands in the Southern Reclamation Area, and South Passage Island (North Passage Island does not really function as a roost site). This monitoring could be conducted by local observers, using a similar methodology to the monitoring that has been done at the Western Basin during 2020. If there are any acutely disturbing actions planned, such as extremely loud noises, it might be a good idea to have observers watching for shorebird impacts, and to time these events to occur at low tide if possible.

To monitor any impacts on shorebirds foraging at low tide, I propose stationing observers to watch periodically, and especially during periods of intense construction activity, for any impacts to the behaviour and distribution of foraging Eastern Curlews, or evidence of disturbance such as birds taking flight, or shifting their distribution away from the construction area. Provision for analysis of these data would need to be made.

Thus, I make the following recommendation for acute-phase monitoring:

Recommendation 1 - Acute phase monitoring: Direct and indirect project impacts need to be monitored in the vicinity of the project area that has been assessed as being exposed to impacts from project activities. This should comprise monthly counts of migratory shorebirds and beach stone-curlews at high tide roost sites from one month prior to construction to one month post construction at Friend Point, South Passage Island, the Western Basin wetland and any suitable roosting habitat that emerges during the works in the Southern Reclamation Areas. This acute phase monitoring should be supplemented by having observers stationed to watch for any impacts around any particularly intense scheduled activities during construction. Provision needs to be made for analysing and reporting on the results of the acute phase monitoring.

2.2.2 Long term monitoring for possible impacts

Eastern Curlews and other migratory shorebirds spend only the non-breeding season in Australia, and typically the period November – February is considered the stable non-breeding period when large scale migratory movements of individuals do not occur (Wilson *et al.* 2010). Clearly, a key focus for any monitoring programme is this summer period. There is some evidence of fluctuations in numbers in the Gladstone region in early November and late February, and so my conclusion is that monitoring should occur between mid-November and mid-February.

Some individual shorebirds remain in Australia over the austral winter, comprising some non-migrating adults and a larger number of young birds, which don't begin migrating until several years into their life (Figure 4). Eastern Curlews often don't commence migration until they are 3-4 years old. These first few years that are spent in Australia are crucially important because (i) they are inexperienced foragers and perhaps more vulnerable to predation, (ii) they are continuously exposed to any local threats for that entire developmental period, and (iii) monitoring data has shown that over 10 birds can be present in the winter surveys at Friend Point, and up to 100 birds across the broader Gladstone Harbour region (Figure 4). This presents a clear case for winter monitoring, to look for any changes in the numbers and distribution of non-migrating Eastern Curlews over the period of the project impact.

Shorebird counts are highly variable, and high variability in the numbers of shorebirds observed can complicate analysis and weaken their ability to detect trends (Wilson *et al.* 2011). Thus, I considered recommending that a second summer count be undertaken each year. However, because this new monitoring activity will build directly on the long term monitoring that has been ongoing at these sites since 2010, it is my view that measurement errors can already be accurately estimated and that an additional summer count is not necessary. Thus, I make the following recommendation.

Recommendation 2 – Long term monitoring: A broader and longer-term assessment of any changes in habitat usage by shorebirds in Port Curtis is also needed. To achieve this, all shorebirds (migratory and non-migratory) should be counted at high tide roosts twice annually, with a summer count occurring between mid-November and mid-February, and a winter count occurring between mid-May and mid-August. This broad scale monitoring should cover high tide roosts at Friend Point, the Passage Islands, southern Curtis Island and Facing Island. The monitoring should occur during the high tide period, following exactly the methods used in previous surveys under the ERMP program to achieve maximum comparability with previous data. No low tide counts are required – changes in roost site use will index changes in foraging habitat use. To meet Condition 14, the first survey will need to

occur before mid-February 2021. Provision needs to be made for analysing and reporting on the results of the long term monitoring, including the monitoring data collected through the ERMP between 2011 and 2020. Data needs to be collated and stored in the same format as the previous monitoring data.

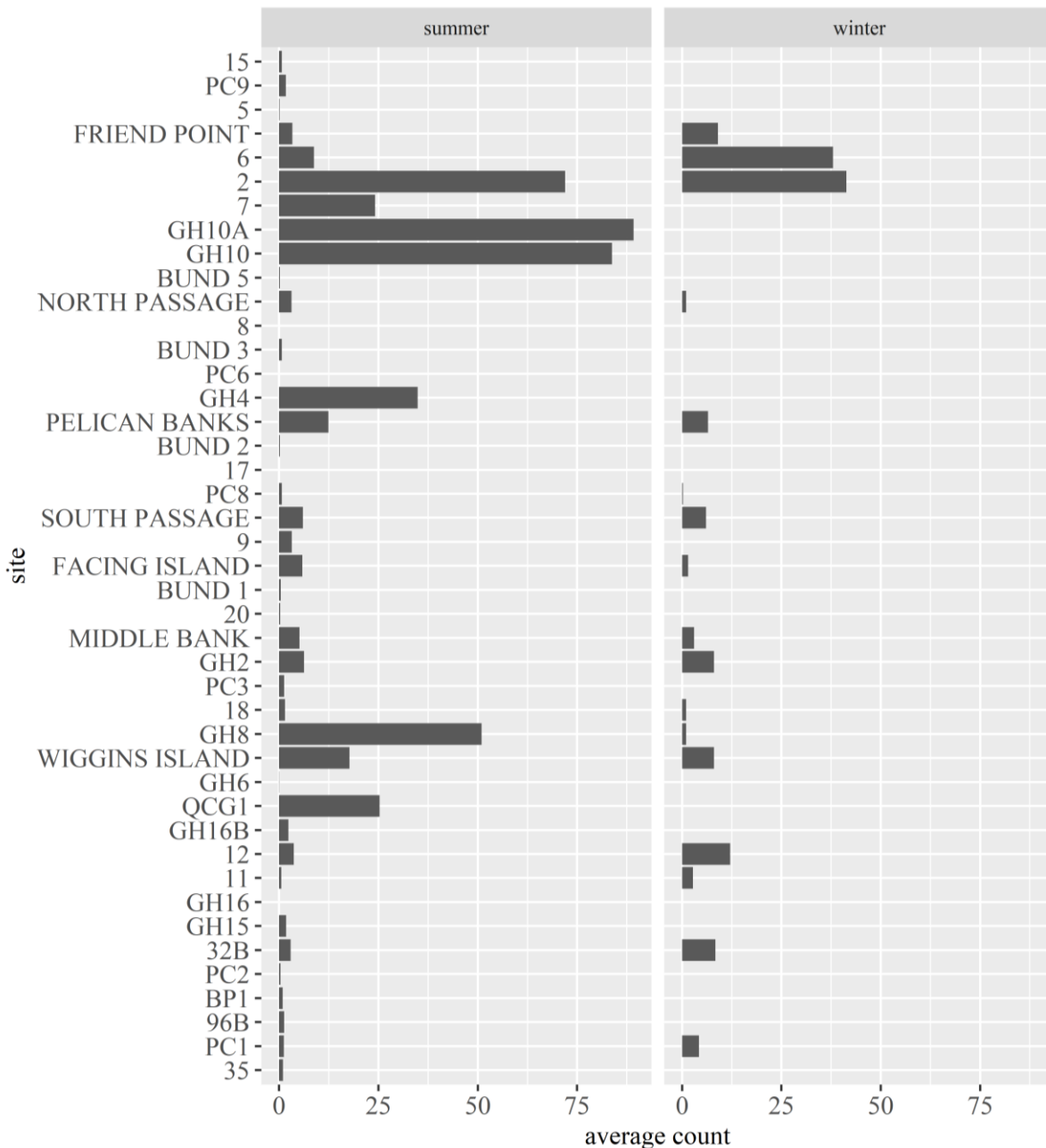


Figure 4 Average summer (Nov-Feb) and winter (Mar-Oct) abundance of Eastern Curlews at roost sites in the Gladstone Harbour region. See Appendix A for locations of sites.

2.3 Method of monitoring

2.3.1 Abundance of migratory shorebirds, including Eastern Curlews

The existence of a long term highly structured monitoring programme set up to fulfil the EPBC Act approval conditions for the Western Basin Port Development Project has created a solid foundation on which any impacts caused by the further reclamation works can be assessed. Given the existence of this long term shorebird monitoring in the region between 2011 and 2020, it is most logical for the new monitoring to continue using exactly the same methodology as the previous monitoring, which is compliant with national monitoring standards (see, e.g. GHD 2011; Wildlife Unlimited 2020 and intervening report). Basing any new monitoring work on the existing foundation of shorebird survey data and methodology that spans the previous decade will deliver the most scientifically robust comparison with existing data, and thus be the strongest possible design for measuring impact. It will enable (i) more rapid detection of any deviations in abundance from the long term numbers of birds present at each of the key roosts in and near the impact site, and (ii) the detection of any impact-driven movements away from the Friend Point roost, including identifying which sites are receiving any displaced birds.

The conditions specifically mention Eastern Curlews, but given the substantial investment needed in transporting surveyors to the roost sites (often by boat), and the fact that many other migratory shorebirds are also matters of national environmental significance, it seems logical for surveyors to count all shorebirds present at the roost, including non-migratory species such as Beach Stone-curlew.

Previous long term monitoring surveys under the ERMP have also included low tide counts at selected tidal flats, indicating that direct monitoring of foraging birds when the tide is out is achievable. The acute-phase monitoring will contribute some data on low tide abundance and distribution of shorebirds through the observer-based surveys, and I suggest extending these intertidal bird surveys for longer-term behavioural monitoring.

Thus I conclude that shorebird monitoring should entail counting all shorebirds (migratory and non-migratory) present at known roosting sites during the high tide period, following exactly the methods used in previous surveys under the ERMP program. No low tide counts are required for the long term monitoring programme.

2.3.2 Monitoring the behaviour of Eastern Curlews

Condition 14 includes the requirement to monitor the behaviour of Eastern Curlews. There are many ways to consider approaching this, from satellite tagging or leg-flagging birds to direct field observations of focal roosting or foraging birds, and repeated counts of birds in low tide foraging areas. Capture and tagging is possible, and has yielded worthwhile results elsewhere in Australia for Eastern Curlews (Lilleyman et al. 2020; Morricks et al. 2022), but is a high risk exercise because Eastern Curlews are very difficult to catch, and there are very limited potential catching sites near to the project area (Choi et al. 2017). This leaves direct observation of foraging birds as the most achievable way of gathering data on the behaviour of Eastern Curlews proximal to the project area.

To achieve behavioural monitoring, observers would need to be stationed in the field (either at a land-based vantage point or in a boat) to observe Eastern Curlews and study their distribution and behaviour across the tidal and annual cycle. To detect any impact on Eastern Curlew behaviour, I suggest surveys are carried out before and during the construction, but they only need to be continued after construction if impacts are detected. I suggest that each behavioural survey consists of three days in the field, at different stages of the tidal cycle (e.g. spring tide, neap tide, intermediate tide) to get a clear picture of Eastern Curlew behaviour. Each day of observations

should start before the birds first fly in from the roosting grounds to the tidal flat, and end after they have departed the foraging area to fly back to the roost site. Particular attention should be given to signs of disturbance to the birds, changes to their behavioural time budget, foraging success rate, the spatial distribution of foraging birds, and the timing of movements to and from roost sites. Surveys should commence in summer 2022/2023 prior to the construction project starting, and be repeated every subsequent winter and summer until the construction is finished. I make the following recommendation:

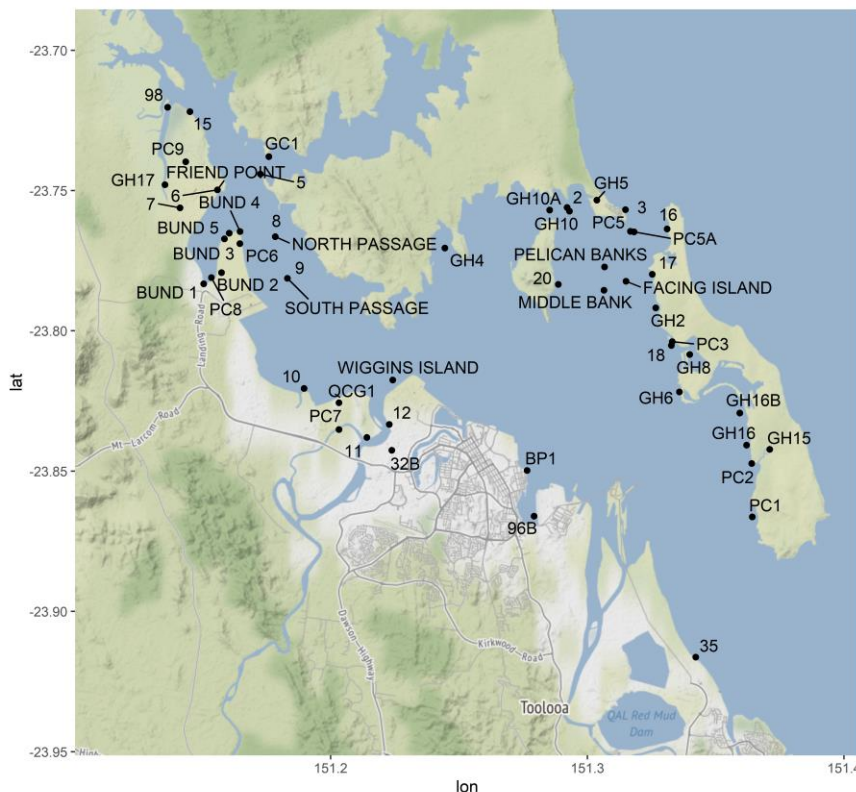
Recommendation 3 – Eastern curlew behavioural monitoring: Behaviour of foraging eastern curlews on the intertidal flats should be monitored by stationing observers at strategic vantage points from which foraging curlews can be watched through the full low tide cycle in the between the Southern Reclamation Area construction site and Friend Point. The observations should monitor the number and density of feeding birds, their behavioural time budget, position on the tidal flats, how this changes over the tidal cycle, directions in which birds fly off to roost, and if possible identifying which roost sites they go to. Provision needs to be made for analysing and reporting on the results of the behavioural monitoring.

2.4 Breakdown of the Conditions and how they will be met:

Condition 7	
<i>The approval holder must not cause any impact from to the Friend Point Eastern Curlew roost site for the duration of the effect of the approval</i>	The recommendations herein cannot prevent impact, but they do provide GPC with a mechanism for detecting impact, through (i) direct behavioural observations during periods of extremely intense project activity, (ii) frequent shorebird monitoring local to the project precinct during the active construction phase, and (iii) longer term shorebird monitoring across the full Gladstone Harbour ecosystem before, during, and for several years after, the project activities.
Condition 14	
<i>The approval holder must implement, commencing prior to the commencement of each relevant Project Stage, the following monitoring programs in respect of Project Stage 1 and Project Stage 3: a. a program capable of accurately monitoring any effects of Project Stage 1 and Project Stage 2 on the population and behaviour of</i>	Population monitoring is achieved by longer term shorebird monitoring across the full Gladstone Harbour ecosystem before, during, and for several years after, the project activities. The extent of this monitoring region has been chosen on the basis that the monitored sites are potentially connected with the roost sites local to the project precinct, and thus might receive any displaced birds. Behavioural monitoring is achieved by on-ground observations of foraging birds on the tidal flats proximal to the project area, indicating how they are using foraging

<p><i>the Eastern Curlew within Eastern Curlew habitat utilised by the species within the shorebird area including at Friend Point, the WB Reclamation area and South Passage Island until 2 years following completion of construction of Project Stage 1 and Project Stage 3.</i></p>	<p>and roosting habitats in the habitats local to the project precinct over the full tidal, diurnal, and seasonal cycles. Any changes in behaviour during and after the project activities will be apparent from the behavioural time budget data.</p>
---	--

Appendix A Map of sites included in count data summaries.



REFERENCES

- Choi C-Y, Coleman J, Klaassen M, Moffitt DJ, Rogers D, Skilleter G, & Fuller RA (2017) *Final Report: Migratory Shorebird Monitoring – Understanding Ecological Impact (CA12000284)*. Report produced for the Ecosystem Research and Monitoring Program Advisory Panel as part of GPC's Ecosystem Research and Monitoring Program. 133 pp.
- Driscoll P (2013) *Migratory shorebird monitoring review: Consultancy Agreement CA120022*. Report produced for the Ecosystem Research and Monitoring Program Advisory Panel as part of GPC's Ecosystem Research and Monitoring Program. Brisbane. 83 pp.
- GHD (2011) *Report for Migratory Shorebird Monitoring - Port Curtis to Port Alma, Survey 3, March 2011*. Report produced for the Ecosystem Research and Monitoring Program Advisory Panel as part of Gladstone Ports Corporation's Ecosystem Research and Monitoring Program. 71 pp.
- Lilleyman A, Rogers DI, Jackson MV, Fuller RA, O'Brien G & Garnett ST (2020) An artificial site provides valuable additional habitat to migratory shorebirds in a tropical harbour. *Pacific Conservation Biology*, 26, 249-257.
- Morrisk ZN, Lilleyman A, Fuller RA, Bush R, Coleman JT, Garnett ST, Gerasimov YN, Jessop R, Ma Z, Maglio G, Minton CDT, Syroechkovskiy E & Woodward BK (2022) Differential population trends align with migratory connectivity in an endangered shorebird. *Conservation Science and Practice*, 4, e594.
- Wildlife Unlimited (2020) *Gladstone Ports Corporation Report for Migratory Shorebird Monitoring, Port Curtis and the Curtis Coast, Annual Report – 2019*. Report produced for the

Ecosystem Research and Monitoring Program Advisory Panel as part of Gladstone Ports Corporation's Ecosystem Research and Monitoring Program. pp. 115.

Wilson HB, Kendall BE, Fuller RA, Milton DA & Possingham HP (2011) Analyzing variability and the rate of decline of migratory shorebirds in Moreton Bay, Australia. *Conservation Biology*, 25, 758-766.

APPENDIX 2

Monitoring Schedule

Table A2.1. Monitoring survey schedule. Pre-construction surveys shaded orange, surveys during construction shaded blue, post-construction surveys shaded green.

Survey	Length	Mar 23	Jan 24	Feb 24	Sep 24	Oct 24	Nov 24	Dec 24	Jan 25	Feb 25	Mar 25	Apr 25	May 25	Jun 25	Jul 25	Aug 25	Sep 25	Oct 25	Nov 25	Dec 25		
Monitoring the behaviour of Eastern Curlew Survey Event 1A (summer Pre- construction)	3 days																					
Monitoring the behaviour of Eastern Curlew Survey Event 1B (summer Pre- construction)	3 days																					
Long Term Monitoring Survey (summer- Preconstruction)	4 days																					
Acute Phase Monthly Monitoring Survey 1 (1 month before construction)	2 days																					
Acute Phase Monthly Monitoring Survey 2	2 days																					
Acute Phase Monthly Monitoring Survey 3	2 days																					
Acute Phase Monthly Monitoring Survey 4	2 days																					
Acute Phase Monthly Monitoring Survey 5	2 days																					
Monitoring the behaviour of Eastern Curlew Survey Event 2 (summer construction)	3 days																					
Acute Phase Monthly Monitoring Survey 6	2 days																					
Long Term Monitoring Survey 1 (Summer Year 1)	2 days																					
Acute Phase Monthly Monitoring Survey 7	2 days																					
Acute Phase Monthly Monitoring Survey 8	2 days																					
Acute Phase Monthly Monitoring Survey 9	2 days																					
Acute Phase Monthly Monitoring Survey 10	2 days																					
Long Term Monitoring Survey 2 (Winter Year 1)	2 days																					
Monitoring the behaviour of Eastern Curlew Survey Event 3 (winter construction)	3 days																					
Acute Phase Monthly Monitoring Survey 11	2 days																					
Acute Phase Monthly Monitoring Survey 12	2 days																					
Acute Phase Monthly Monitoring Survey 13	2 days																					
Acute Phase Monthly Monitoring Survey 14	2 days																					
Acute Phase Monthly Monitoring Survey 15	2 days																					
Acute Phase Monthly Monitoring Survey 16	2 days																					

Survey	Length	Jan 26	Feb 26	Mar 26	Apr 26	May 26	Jun 26	Jul 26	Feb 27	Jun 27	Feb 28	Jun 28	Feb 29	Jun 29	Feb 30	Jun 30	Feb 31	Jun 31
Acute Phase Monthly Monitoring Survey 17	2 days																	
Monitoring the behaviour of Eastern Curlew Survey Event 4 (summer construction)	3 days																	
Acute Phase Monthly Monitoring Survey 18	2 days																	
Long Term Monitoring Survey 3 (Summer Year 2)	2 days																	
Acute Phase Monthly Monitoring Survey 19	2 days																	
Acute Phase Monthly Monitoring Survey 20	2 days																	
Acute Phase Monthly Monitoring Survey 21	2 days																	
Acute Phase Monthly Monitoring Survey 22	2 days																	
Long Term Monitoring Survey 4 (Winter Year 2)	2 days																	
Acute Phase Monthly Monitoring Survey 23 (post construction)	2 days																	
Long Term Monitoring Survey 5 (Summer Year 3)	4 days																	
Long Term Monitoring Survey 6 (Winter Year 3)	4 days																	
Long Term Monitoring Survey 7 (Summer Year 4)	4 days																	
Long Term Monitoring Survey 8 (Winter Year 4)	4 days																	
Long Term Monitoring Survey 9 (Summer Year 5)	4 days																	
Long Term Monitoring Survey 10 (Winter Year 5)	4 days																	
Long Term Monitoring Survey 11 (Summer Year 6)	4 days																	
Long Term Monitoring Survey 12 (Winter Year 6)	4 days																	
Long Term Monitoring Survey 13 (Summer Year 7)	4 days																	
Long Term Monitoring Survey 14 (Winter Year 7)	4 days																	

APPENDIX 3

Baseline Data Summary

This appendix summarises the baseline data that have been collected prior to Project Stage 1 impacts. These data will be used as the pre-impact dataset when testing to assess whether the Project has had a significant impact on the population or foraging behaviour of Eastern Curlew as per the data analysis framework outlined in Table 2.1 of the Eastern Curlew and Other Shorebird Monitoring Plan (the Plan).

Eastern Curlew Population Baseline Data

The Ecosystem Research and Monitoring Program (ERMP; Wildlife Unlimited 2020) and several subsequent surveys have surveyed the population of Eastern Curlew using roost sites within the Port Curtis shorebird area. Each survey established the population size of Eastern Curlew by surveying all known shorebird roost sites within Port Curtis. For the purposes of the data analysis framework, these roost sites are grouped into roosts within the ‘impact’ area (all roosts shown in Figure 2.1 of the Plan), and roosts within the ‘control’ area (all remaining roosts shown in Figure 2.2 of the Plan). **Table A3.1** summarises the timing of the surveys that have been undertaken to date; only the surveys falling within the ‘summer’ season for Eastern Curlew (October-February), a total of 18 surveys will comprise the baseline dataset for the data analysis framework outlined in Table 2.1 of the Plan.

Table A3.1. Timing of baseline surveys of Eastern Curlew population size in Port Curtis.

Survey number	Year-Month	Season
1	2011-01	Summer
2	2011-02	Summer
3	2011-03	Migration
4	2011-08	Migration
5	2012-01	Summer
6	2012-02	Summer
7	2012-03	Migration
8	2012-08	Migration
9	2012-10	Summer
10	2013-02	Summer
11	2014-02	Summer
12	2015-02	Summer
13	2016-02	Summer
14	2017-02	Summer
15	2018-01	Summer
16	2019-01	Summer
17	2019-02	Summer
18	2019-03	Migration
19	2019-08	Migration
20	2019-10	Summer
21	2020-01	Summer
22	2020-02	Summer
23	2020-08	Migration
34	2020-10	Summer
25	2021-03	Migration
26	2024-02	Summer

Eastern Curlew Foraging Behaviour Baseline Data

Whereas Prof. Fuller recommended one pre-construction survey of Eastern Curlew foraging behaviour at low tide, two pre-construction surveys have been completed, the first in early March 2023 and the second in January-February 2024. **Table A3.2** summarises the timing and sample size of observations for each relevant variable. **Table A3.3** summarizes the behavioural categories used to categorize Eastern Curlew behavioural time budgets.

Table A3.2. Summary of baseline data of Eastern Curlew foraging behaviour.

Survey	Date	Tide	Data summary
1	01/03/2023	Neap	<ul style="list-style-type: none"> Total Eastern Curlew in the behavioural monitoring area Time budget: 15 15-minute observations Feeding rates: 8 15-minute observations
1	02/03/2023	Intermediate	<ul style="list-style-type: none"> Total Eastern Curlew in the behavioural monitoring area Time budget: 24 15-minute observations Feeding rates: 11 15-minute observations
1	07/03/2023	Spring	<ul style="list-style-type: none"> Total Eastern Curlew in the behavioural monitoring area Time budget: 5 15-minute observations Feeding rates: nil observations
2	17/01/2024	Intermediate	<ul style="list-style-type: none"> Total Eastern Curlew in the behavioural monitoring area Time budget: 17 15-minute observations Feeding rates: 11 15-minute observations
2	02/02/2024	Neap	<ul style="list-style-type: none"> Total Eastern Curlew in the behavioural monitoring area Time budget: 18 15-minute observations Feeding rates: 9 15-minute observations
2	22/02/2024	Spring	<ul style="list-style-type: none"> Total Eastern Curlew in the behavioural monitoring area Time budget: 25 15-minute observations Feeding rates: 14 15-minute observations

Table A3.3. Summary of behaviour categories used in the categorisation of Eastern Curlew foraging behaviour time budgets.

Behaviour	Code
Foraging	F
Resting/Preening	R/P
Aggressive interaction	Ag
Flight-Natural	F-N
Disturbance - Alert-Natural	D-A-N
Disturbance - Walking away-Natural	D-W-N
Disturbance - Flight-Natural	D-F-N
Disturbance - Alert-Construction	D-A-C
Disturbance - Walking away-Construction	D-W-C
Disturbance - Flight-Construction	D-F-C
Disturbance - Alert-Other Anthropogenic	D-A-A
Disturbance - Walking away-Other Anthropogenic	D-W-A
Disturbance - Flight-Other Anthropogenic	D-F-A






DOCSCQPA-#1937308-v4B-Env_NLEP_CO22000089_NLEP_Eastern_Curlew_and_Other_Shorebird_Monitoring_Plan_Draft_A_pdf

Final Audit Report

2024-07-24

Created:	2024-07-24
By:	Helen Marsh (MarshH@GPCL.COM.AU)
Status:	Signed
Transaction ID:	CBJCHBCAABAAXJUmOv03KufZsY6XCDqghphI0KnUUL-L

"DOCSCQPA-#1937308-v4B-Env_NLEP_CO22000089_NLEP_Eastern_Curlew_and_Other_Shorebird_Monitoring_Plan_Draft_A_pdf" History

-  Document created by Helen Marsh (MarshH@GPCL.COM.AU)
2024-07-24 - 2:26:55 AM GMT- IP address: 165.225.232.91
-  Document emailed to Richard Haward (HawardR@gpcl.com.au) for signature
2024-07-24 - 2:27:35 AM GMT
-  Email viewed by Richard Haward (HawardR@gpcl.com.au)
2024-07-24 - 2:57:35 AM GMT- IP address: 52.102.12.181
-  Document e-signed by Richard Haward (HawardR@gpcl.com.au)
Signature Date: 2024-07-24 - 4:08:19 AM GMT - Time Source: server- IP address: 165.225.232.121
-  Agreement completed.
2024-07-24 - 4:08:19 AM GMT