



# Report

## GLNG Curtis Island Marine Facilities Migratory Shorebirds Environmental Management Plan

17 MARCH 2011

Prepared for  
GLNG Operations Pty Ltd  
Level 22 Santos Place  
32 Turbot Street  
Brisbane Qld 4000

42626727

**URS**

Project Manager:



Angus McLeod  
Senior Ecologist

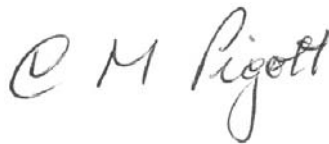
**URS Australia Pty Ltd**

**Level 16, 240 Queen Street  
Brisbane, QLD 4000  
GPO Box 302, QLD 4001  
Australia**

**T: 61 7 3243 2111**

**F: 61 7 3243 2199**

Principal-In-Charge:



Chris Pigott  
Senior Principal

Author:



Angus McLeod  
Senior Ecologist

Reviewer:



Chris Pratt  
Principal Environmental  
Scientist

Date:

**17 March 2011**

Reference:

**42626727/01/03**

Status:

**Final**

---

## Table of Contents

Abbreviations.....	iii
Executive Summary.....	iv
<b>1 Introduction .....</b>	<b>1</b>
1.1 Project Background .....	1
1.2 Purpose of the Migratory Shorebirds Environment Management Plan .....	1
1.3 Aims and Objectives .....	3
1.4 Study Area .....	3
1.4.1 Regional Context.....	3
1.4.2 GLNG LNG Facility Site.....	6
1.5 Intertidal Habitats of China Bay and Environs .....	6
1.5.1 Soft Mudflats .....	6
1.5.2 Mangrove Communities.....	6
1.5.3 Rocky Shores .....	7
1.5.4 Salt flats and Saltmarshes .....	7
1.5.5 Sandy Beaches.....	7
<b>2 Migratory Shorebirds.....</b>	<b>9</b>
2.1 Shorebird Species.....	9
2.2 Migration along the East Asian-Australasian flyway .....	10
2.3 Migratory Shorebird Sites of International Importance in Australia.....	10
2.4 Port Curtis as a Migratory Shorebird Site.....	11
2.5 Feeding and Roosting Requirements .....	16
2.5.1 Food Resources and Suitable Foraging Habitat.....	16
2.5.2 Suitable Roost Areas .....	16
2.6 Threats to Shorebirds and their Habitat .....	16
<b>3 Migratory Shorebird Surveys .....</b>	<b>18</b>
3.1 Introduction .....	18
3.1.1 Background.....	18
3.1.2 Aims and Objectives .....	18
3.1.3 Target Species.....	18
3.2 Methods .....	19

3.3	Results .....	22
3.4	Discussion .....	22
4	<b>Potential Impacts and Mitigation Strategies .....</b>	<b>24</b>
4.1	Proposed Activities .....	24
4.2	Existing Management Plans .....	24
4.3	Potential Impacts to Migratory Shorebirds.....	24
4.4	Management of Potential Impacts to Migratory Shorebirds.....	27
5	References.....	32
6	Limitations .....	34

## Tables

Table 2-1	The 36 international migratory shorebird species.....	9
Table 2-2	Migratory shorebird records from Port Curtis and Environs .....	12
Table 3-1	Location of the low and high tide survey observation points.....	19
Table 4-1	Summary of impact mitigation strategies.....	29

## Figures

Figure 1	Location of LNG Facility.....	5
Figure 2	Intertidal & Subtidal Substrate Type.....	8
Figure 3	Marine Intertidal and Subtidal Substrate Type.....	14
Figure 4	Shorebird Roosts.....	15
Figure 5	GLNG LNG Surveyed Shorebird Roosts.....	21

---

## Abbreviations

APLNG	Australia Pacific LNG
CEMP	Construction Environment Management Plan
CSG	Coal Seam Gas
DEWHA	Department of Environment, Water, Heritage and the Arts
DMP	Dredge Management Plan
EIS	Environmental Impact Statement
EMP	Environment Management Plan
EPBC Act	Environment Protection and Biodiversity Conservation Act
GLNG OPL	Gladstone LNG Operations Pty Ltd
GPC	Gladstone Ports Corporation
GTP	Gas Transmission Pipeline
LNG	Liquefied Natural Gas
MOF	Materials Offloading Facility
MSEMP	Migratory Shorebirds Environmental Management Plan
PBRF	Pioneer Barge Ramp Facility
PLF	Product Loading Facility
QCLNG	Queensland Curtis LNG
SDPWO Act	State Development and Public Works Organisation Act
SEIS	Supplementary Environmental Impact Statement
Total E&P	Total Exploration and Production

---

## Executive Summary

This Migratory Shorebirds Environmental Management Plan (MSEMP) has been developed to fulfil:

- Condition 19 of the Commonwealth EPBC Approval No. 2008/4058 (GLNG LNG Marine Facilities) granted under the EPBC Act; and
- Condition 22 of the Commonwealth EPBC Approval No. 2008/4057 (GLNG LNG Facility Site).

A migratory shorebird survey was conducted between 18 and 20 January 2011 inclusive (48 observation man-hours) in accordance with the conditions of EPBC Approval No. 2008/4058. The survey methodology, results, and discussion of the results are presented in this MSEMP.

This MSEMP details the potential impact to migratory shorebirds from the proposed construction of the LNG facility and associated marine facilities at China Bay, south-west Curtis Island. It also provides mitigation measures to reduce impacts to migratory shorebirds. Background information on shorebird migration, ecology and species potentially present in Port Curtis are provided for context.

---

## Introduction

### 1.1 Project Background

GLNG Operations Pty Ltd (GLNG OPL) on behalf of the joint venture partners Santos GLNG Pty Ltd (Santos), PETRONAS Australia Pty Limited (PETRONAS) and Total E&P Australia (Total) are proposing to develop coal seam gas (CSG) resources in the Bowen and Surat Basins in the area between Roma and Emerald, Queensland. These CSG resources are proposed to be used as feed gas for a liquefied natural gas (LNG) liquefaction and export facility on Curtis Island, near Gladstone, Queensland.

The GLNG Project comprises the following major components:

- Coal seam gas fields;
- Gas transmission pipeline (GTP); and
- LNG liquefaction and export facility (LNG facility).

The CSG fields will be developed over a period of approximately 25 years to provide CSG to the LNG facility. The gas transmission pipeline will transport the gas from the CSG fields to the LNG facility.

The construction of the marine facilities, which include the Materials Offloading Facility (MOF) and the Product Loading Facility (PLF), will involve disturbance to marine and intertidal habitat. In order to construct the MOF, a temporary Pioneer Barge Ramp Facility (PBRF), will be required to unload bulk aggregate material and equipment onto Curtis Island. Within this report the term 'marine facilities' will include the MOF, the PLF and the Pioneer Barge Ramp Facility.

The GLNG LNG facility site and proposed marine facilities are depicted on Figure 1.

### 1.2 Purpose of the Migratory Shorebirds Environment Management Plan

On 16 July 2007, the Coordinator-General declared the Project to be a 'significant project' for which an Environmental Impact Statement (EIS) is required under the *State Development and Public Works Organisation Act 1971* (SDPWO Act). On 31 March 2008, the GLNG Project was declared a 'Controlled Action' under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act).

During 2008 and 2009, an EIS and a supplementary EIS were prepared for the GLNG Project under the State-Federal bilateral agreement. On 28 May 2010, the Coordinator-General issued a report under the SDPWO Act. On 22 October 2010, the project was granted federal approval under the EPBC Act.

Condition 19 of EPBC Approval No. 2008/4058 requires the preparation of a Migratory Shorebirds Environment Management Plan (MSEMP). Condition 19 requires the MSEMP to include measures for:

- Managing the impacts of the action on listed migratory shorebirds including but not limited to the whimbrel (*Numenius phaeopus*) and the Terek Sandpiper (*Xenus cinereus*);
- Determining baseline population densities and habitat utilisation for migratory shorebirds on or contiguous to the proponent's LNG facility site including, at a minimum, undertaking annual/twice annual surveys during northwards and southwards migrations;
- Minimising impacts from noise and light on the feeding and roosting sites of listed migratory seabirds; and

---

## 1 Introduction

- Monitoring the effect of the construction of the marine facilities on the shorebirds, including but not limited to and to the extent relevant pile driving, construction dredging, noise impulse levels, light spill, water quality reduction, decreased access to intertidal foreshore habitat, increased sedimentation and displacement.

The purpose of the MSEMP is to address the requirement of condition 19 and to specify actions to manage impacts to migratory shorebirds during the construction of the marine facilities, including the MOF and PLF, and associated activities.

In association with the preparation of the MSEMP, one targeted migratory shorebird field survey was undertaken during January 2011. The results of this survey have been incorporated into this MSEMP as an initial part of the process for determination of baseline population densities and habitat utilisation for migratory shorebirds and to assist in refining shorebird impact management strategies. An additional two shorebird surveys are scheduled for February and November 2011 to meet the requirements for surveys to refine the determination of baseline population densities as required by condition 19(b) of the Marine Facilities EPBC Approval No 2008/4058.

GLNG will consult with Gladstone Ports Corporation Limited (GPC), to conduct future surveys as part of the wider GPC monitoring program as per the Gladstone Western Basin Dredging and Disposal Project Referral EPBC No 2009/4904, provided the surveying satisfies GLNG's conditions under EPBC No 2008/4058.

A brief summary of shorebird migration, shorebird ecology and species potentially present is provided as background to place the MSEMP in context.

This MSEMP has also been prepared to fulfil Conditions 20 and 22 of the Commonwealth EPBC Approval No. 2008/4057 for the LNG facility.

Condition 20 relates to the undertaking of pre-clearance surveys to verify the presence or absence of listed ecological communities, listed threatened species, listed migratory species, their habitat and species identified as contributing to the World Heritage and National Heritage values of the Great Barrier Reef World Heritage Area.

Condition 22 relates to the provision of a management plan for each of the species identified during the pre-clearance surveys required under Condition 20. Pre-clearance surveys were undertaken in January 2011 within the GLNG LNG facility site to fulfil Condition 20. The survey did not detect the presence of any:

- Ecological communities;
- Threatened species;
- Migratory species;
- Habitat for threatened and migratory species; and
- Species contributing to the World Heritage and National Heritage values of the Great Barrier Reef World Heritage Area

However, as the migratory shorebird survey recorded the presence of listed migratory species immediately adjacent to the GLNG LNG facility site, this MSEMP serves to fulfil Condition 22 for migratory shorebirds using intertidal habitat.

The pre-clearance surveys also confirmed the presence of a small community of the EPBC-listed *Littoral Rainforest and Coastal Vine Thickets of Eastern Australia* Ecological Community (critically



---

## 1 Introduction

endangered) in close proximity to the GLNG Site. Best practices methods will be employed to protect this community during construction and operation of the GLNG LNG facility.

### 1.3 Aims and Objectives

The aim of this MSEMP is to specify measures to minimise potential impacts to migratory shorebirds from construction and operation of the marine facilities at the GLNG LNG facility on Curtis Island. In meeting this aim, the objectives (as per Condition 19 of EPBC Approval No. 2008/4058) are to:

- Manage the impacts of the action on listed Migratory Shorebirds including but not limited to the whimbrel (*Numenius phaeopus*) and the Terek sandpiper (*Xenus cinereus*);
- Determine baseline population densities and habitat utilisation for migratory shorebirds on or adjacent to the GLNG LNG facility site including, at a minimum, undertaking annual/twice annual surveys during northwards and southwards migration;
- Minimise impacts from noise and light on the feeding and roosting sites of listed migratory shorebirds; and
- Monitor the effect of the construction of the marine facilities on shorebirds, including but not limited to and to the extent relevant:
  - a) Pile driving;
  - b) Construction dredging;
  - c) Noise impulse levels;
  - d) Light spill
  - e) Water quality reduction;
  - f) Decreased access to intertidal foreshore habitat
  - g) Increased sedimentation; and
  - h) Displacement.

In addition, the MSEMP aims to minimise impacts to migratory shorebirds to fulfil Condition 22(b) of the EPBC Approval No. 2008/4057 for the LNG facility.

For the purposes of this report, the term 'Migratory Shorebirds' refers to those shorebirds that migrate from breeding grounds in the northern hemisphere to Australia via the East Asian-Australasian flyway each year (DEWHA, 2009). However, it is anticipated that the strategies proposed in the MSEMP will contribute to the management of impacts for all bird species that potentially utilise intertidal habitat in the vicinity of the GLNG LNG facility site.

### 1.4 Study Area

#### 1.4.1 Regional Context

##### *Location*

Curtis Island is located off the coast of central Queensland near Gladstone forming part of the eastern rim of Port Curtis. It is approximately 40 km long and 20 km across at its widest point. Typical landforms on the island include moderate to steep wooded slopes, wooded alluvial plains, intermittent and semi-permanent watercourses, estuarine systems and fresh and saltwater wetlands.

---

## 1 Introduction

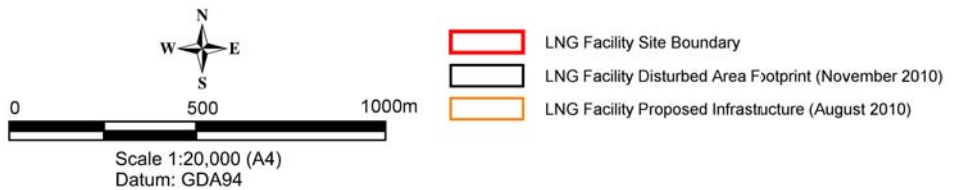
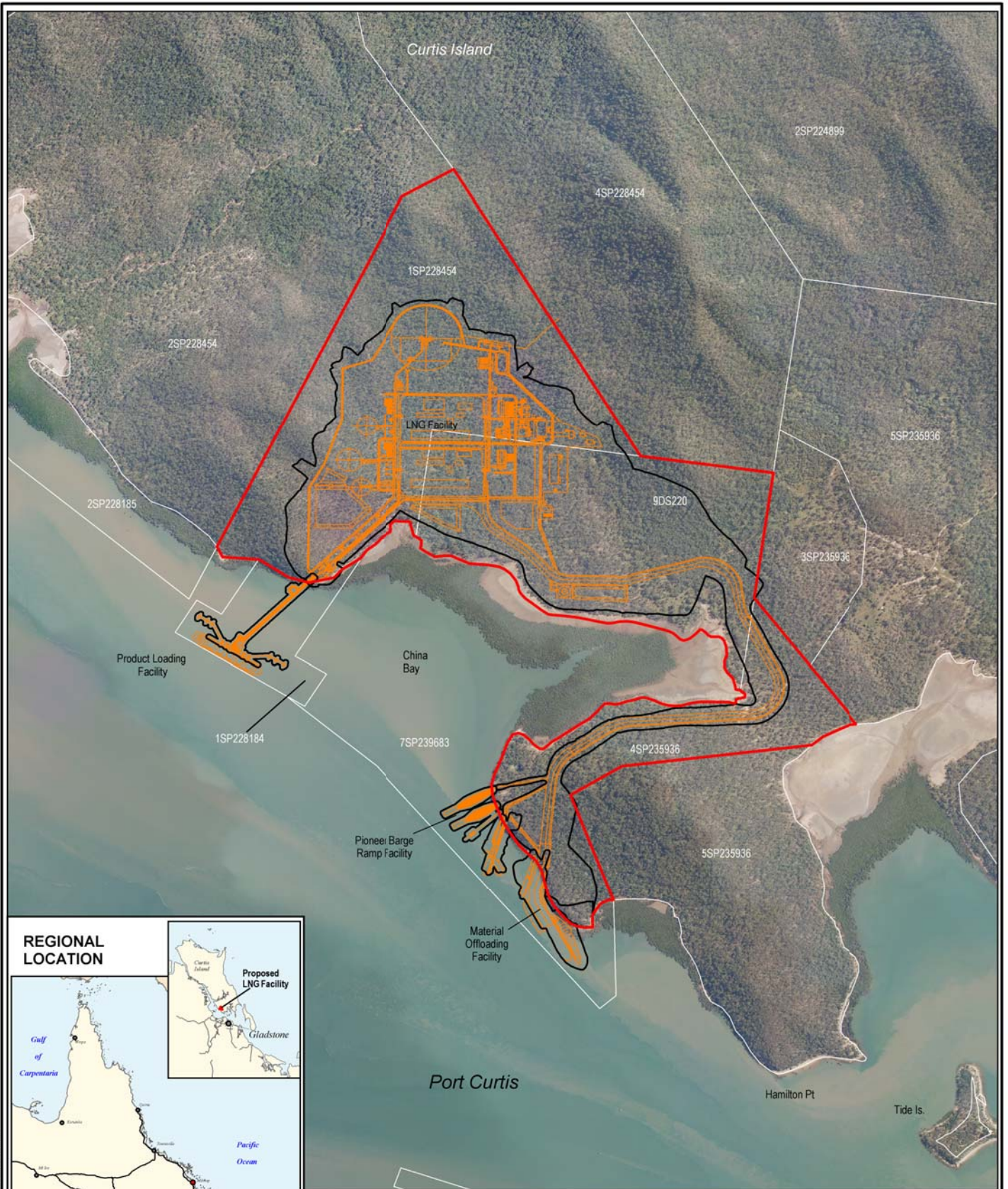
### *Port Curtis*

Port Curtis is a major industrial centre that supports aluminium refineries and smelters, cement production works, chemical plants and Queensland's largest power station. The area of state-owned industrial land measures over 10,000 hectares (Duke *et al.*, 2003). The port is a major international and multi-commodity facility. Issues in the region include harbour dredging, port development, industrial development, discharge of effluent and extensive reclamation of intertidal wetlands, including mudflats, mangroves, saltflats and marshes. Although intertidal wetlands are still prevalent along the Port Curtis coastline, they have been extensively cleared, filled or modified around Gladstone City and Auckland Inlet (Duke *et al.*, 2003). Intertidal areas along the south-west coastline of Curtis Island in the vicinity of the proposed LNG site are largely undisturbed.



Habitats potentially affected by the proposed LNG infrastructure are widely represented within Port Curtis (and broader regional areas) and it is considered unlikely that any particular intertidal habitat or individual species would be solely restricted to areas that would be directly cleared or modified by the project given the broad extent of habitat available in the locality and broader region. In the context of significant historical impacts to intertidal habitats in the Port Curtis area from land reclamation projects, the potential direct habitat loss from the LNG project is likely to be small. In Port Curtis, there was a regional loss of mangrove (1470 ha or 38%) and saltmarsh (1340 ha or 34.8%) habitats between 1941 and 1999 (Duke *et al.*, 2003).

Construction of the GLNG LNG facility, the MOF, PLF and pioneer barge facility will involve the removal of 0.18 ha of Regional Ecosystem (RE) 12.1.2 (Saltpan vegetation comprising *Sporobolus virginicus* grassland and samphire herbland on Quaternary estuarine deposits) and 0.92 ha of RE 12.1.3 (Mangrove shrubland to low closed forest on Quaternary estuarine deposits). This equates to 0.001 % and 0.006 % of RE 12.1.2 and RE 12.1.3 respectively within the Burnett-Curtis Hills and Ranges subregion of the Southeast Queensland Bioregion (URS, 2011).





Source: This map may contain data which is sourced and Copyright. Refer to Section 18.2 of the EIS for Ownership and Copyright. DCDB correct as at January 2011

<p>Client</p> 	<p>Project</p> <p><b>GLNG MARINE FACILITIES MIGRATORY SHOREBIRD ENVIRONMENTAL MANAGEMENT PLAN</b></p>	<p>Title</p> <p><b>LOCATION OF GLNG LNG FACILITY AND SITE INFRASTRUCTURE LAYOUT</b></p>
	<p>Drawn: CA    Approved: DS    Date: 17-02-2011</p> <p>Job No: <b>4262 6727</b>    File No: 42626727-g-001.wor</p>	<p>Figure: 1</p> <p>Rev: C A4</p>

This drawing is subject to COPYRIGHT. It remains the property of URS Australia Pty Ltd.

---

## 1 Introduction

### 1.4.2 GLNG LNG Facility Site

The GLNG LNG facility site is located on the south-western coast of Curtis Island on the landward flank of China Bay. The site is dominated by *Eucalyptus* and *Corymbia* woodlands on moderate to low slopes and alluvial plains. Mangrove and saltmarsh communities are present within intertidal areas. The study site displays impacts consistent with a long history of use that includes grazing, clearing, cropping, and selected timber felling. The presence of agricultural and environmental weeds and a sub-optimal history of fire have also impacted upon the ecological values of the site. It appears that much of the woodland is regrowth, however some mature trees are scattered throughout. A number of ephemeral streams that only flow following sustained rain, drain into China Bay.

The proposed marine facilities will be constructed at the northern and southern extents of China Bay. The MOF will be constructed at Hamilton Point to the south of China Bay. The PLF is located on the northern side of China Bay. The location of the GLNG LNG facility on Curtis Island and in the region is depicted on Figure 1.

## 1.5 Intertidal Habitats of China Bay and Environs

A range of intertidal habitat types within and adjacent to China Bay provide foraging and/or roosting resources for migratory shorebirds. The main intertidal habitats in the area of China Bay include:

- Soft mudflats;
- Mangrove communities;
- Rocky shores;
- Saltflats and salt marshes; and
- Sandy beaches (URS, 2009a).

These habitat types are described in further detail below. The values of each habitat type for migratory shorebirds are discussed in Section 2.5.

### 1.5.1 Soft Mudflats

On the GLNG site extensive areas of mudflats with very fine mud dominate the lower intertidal zones. Soft mudflats up to 300 m wide are exposed at low tide in areas seaward of the mangroves. Such mudflats are usually devoid of vegetation (URS, 2009a).

### 1.5.2 Mangrove Communities

On the GLNG site mangrove habitats are dominated by low forests and dense thickets of *Rhizophora stylosa* (stilt mangrove) which occur across almost the entire mangrove zone from the seaward edge to its landward margin. In locations where the mangrove zone abuts salt flats, a landward mangrove margin consists of a narrow zone of shrubland communities dominated by *Ceriops australis* (smooth-fruited yellow mangrove) and *Avicennia marina* (grey mangrove). In locations where the mangrove zone abuts terrestrial habitat (usually at the ecotone with eucalypt woodland), a narrow band approximately 2 to 3 trees wide of mixed species such as *Excoecaria agallocha* (milky mangrove), *Aegiceras corniculatum* (river mangrove), *Lumnitzera racemosa* (white-flowered black mangrove), *Bruguiera gymnorhiza* (large-leafed orange mangrove), *Osbornia octodonta* (myrtle mangrove), *Xylocarpus moluccensis* (cedar mangrove), *Ceriops australis* and *Avicennia marina* occurs (URS, 2009a).



---

## 1 Introduction

### 1.5.3 Rocky Shores

On the GLNG site, in between the mangrove embayments, rocky shores with a high silt content occur at the mid to upper intertidal zone (e.g. at Hamilton Point). The shores are mostly composed of small boulders and rubble that are oyster encrusted at mid-tide levels. A low mangrove shrubland community composed mostly of *Aegiceras corniculatum* (with minor contributions by *Avicennia marina* and *Aegialitis annulata* (club mangrove)) also occur at mid to high tide levels (URS, 2009a).

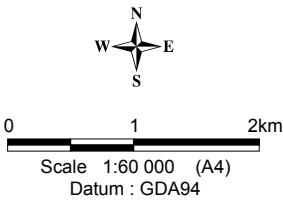
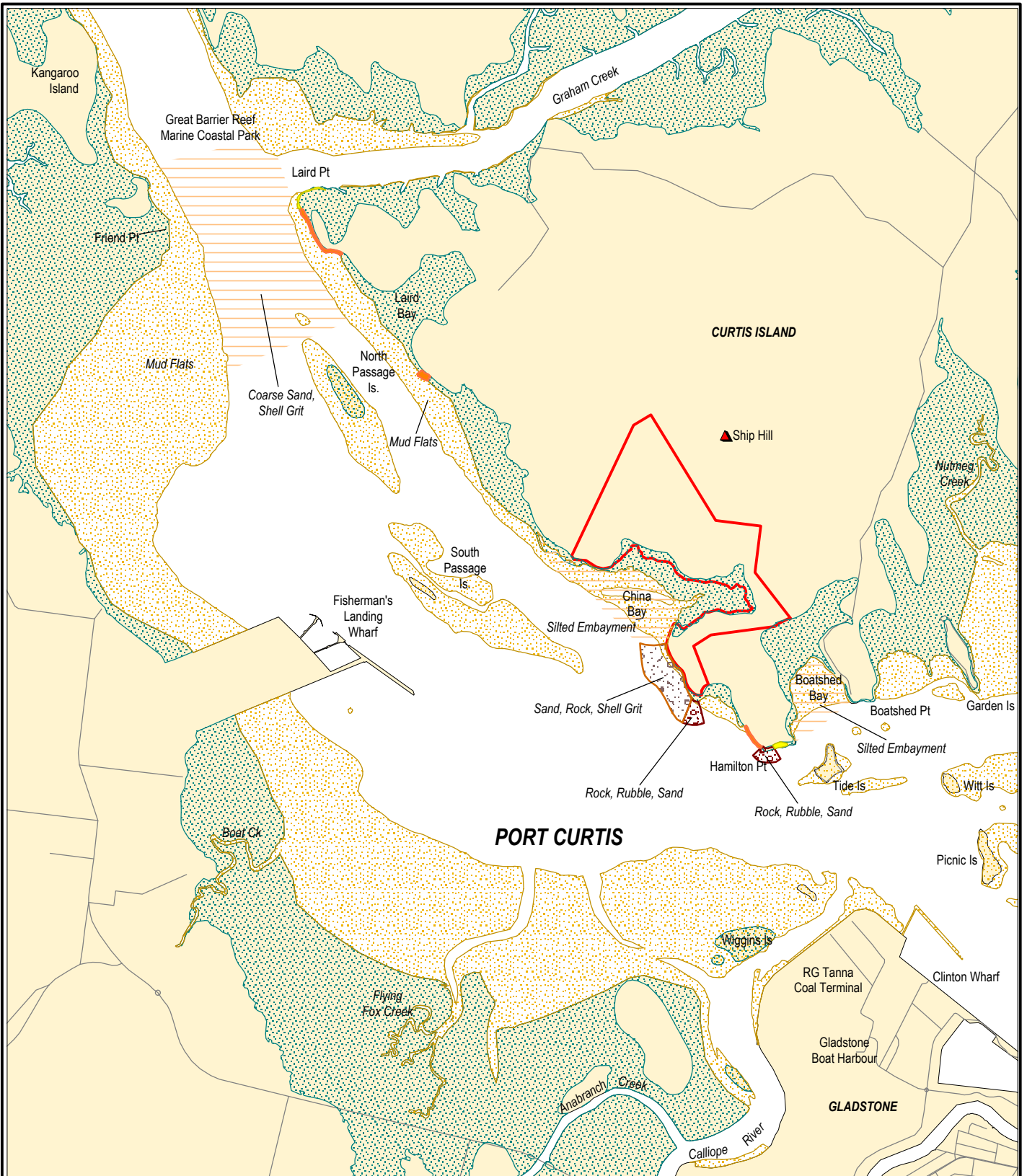
### 1.5.4 Salt flats and Saltmarshes

On the GLNG site salt flats occur on tidal flats landward of the mangrove zone in areas that only receive tidal inundation during spring tides. High evaporation rates and extreme soil salinities largely preclude macrobiota from living in this habitat except in some shallow drainage lines. While salt flats are largely devoid of vegetation there are sparse areas of halophytic shrubs and grasses (e.g. *Sporobolus virginicus* (salt couch)) growing on the salt flats. In some areas the surface is covered with algal mats (cyanobacterial mats) that are in various degrees of desiccation depending upon location and extent of tidal wetting received. The algal mat combines with the top layer of clay to form a leathery surface which peels back and cracks as the salt flat dries (URS, 2009a).

### 1.5.5 Sandy Beaches

Due to the predominance of muddy substrates along the south-west coastline of Curtis Island, sandy beaches are limited to small areas at Hamilton Point and Laird Point in the vicinity of the GLNG site. As these sites can experience extensive wave action that moves the sand rapidly, colonisation by plants is rare (URS, 2009a).

The location of each habitat type is shown on Figure 2.



- |  |                   |  |                            |
|--|-------------------|--|----------------------------|
|  | Sandy Beaches     |  | Low Tidal Mud Flats        |
|  | Silted Embayments |  | Low Tidal Sand Flats       |
|  | Rocky Shores      |  | LNG Facility Site Boundary |
|  | Coarse Sand       |  |                            |
|  | Rubble Slope      |  |                            |
|  | Rocky Headland    |  |                            |

Source: This map may contain data which is sourced and Copyright. Refer to Section 18.2 of the EIS for Ownership and Copyright.

Client  	Project GLNG MARINE FACILITIES MIGRATORY SHOREBIRD ENVIRONMENTAL MANAGEMENT PLAN		Title <b>PORT CURTIS          INTERTIDAL &amp; SUBTIDAL          SUBSTRATE TYPE</b>	
	Drawn: LL/CA Job No: <b>4262 6727</b>	Approved: DS File No: 42626727-g-002.wor	Date: 17-02-2011	Figure: <b>2</b>

This drawing is subject to COPYRIGHT. It remains the property of URS Australia Pty Ltd.

## Migratory Shorebirds

### 2.1 Shorebird Species

Migratory Shorebirds are those shorebirds that migrate from breeding grounds in the northern hemisphere to Australia via the East Asian-Australasian flyway each year. Thirty-six species are recognised under the EPBC Act (DEWHA, 2009). These are listed in Table 2-1, below.

**Table 2-1 The 36 international migratory shorebird species**

Number	Species	Common Name
	<b>Scolopacidae</b>	<b>Sandpipers and related birds</b>
1.	<i>Gallinago hardwickii</i>	Latham's snipe
2.	<i>Gallinago stenura</i>	pin-tailed snipe
3.	<i>Gallinago megala</i>	Swinhoe's snipe
4.	<i>Limosa limosa</i>	black-tailed godwit
5.	<i>Limosa lapponica</i>	bar-tailed godwit
6.	<i>Numenius minutus</i>	little curlew
7.	<i>Numenius phaeopus</i>	whimbrel
8.	<i>Numenius madagascariensis</i>	eastern curlew
9.	<i>Tringa totanus</i>	common redshank
10.	<i>Tringa stagnatilis</i>	marsh sandpiper
11.	<i>Tringa nebularia</i>	common greenshank
12.	<i>Tringa glareola</i>	wood sandpiper
13.	<i>Xenus cinereus</i>	Terek sandpiper
14.	<i>Actitis hypoleucos</i>	common sandpiper
15.	<i>Heteroscelus brevipes</i>	grey-tailed tattler
16.	<i>Heteroscelus incanus</i>	wandering tattler
17.	<i>Arenaria interpres</i>	ruddy turnstone
18.	<i>Limnodromus semipalmatus</i>	Asian dowitcher
19.	<i>Calidris tenuirostris</i>	great knot
20.	<i>Calidris canutus</i>	red knot
21.	<i>Calidris alba</i>	sanderling
22.	<i>Calidris ruficollis</i>	red-necked stint
23.	<i>Calidris subminuta</i>	long-toed stint
24.	<i>Calidris melanotos</i>	pectoral sandpiper
25.	<i>Calidris acuminata</i>	sharp-tailed sandpiper
26.	<i>Calidris ferruginea</i>	curlew sandpiper
27.	<i>Limicola falcinellus</i>	broad-billed sandpiper
28.	<i>Philomachus pugnax</i>	ruff
29.	<i>Phalaropus lobatus</i>	red-necked phalarope
	<b>Charadriidae</b>	<b>Plovers and lapwings</b>
30.	<i>Pluvialis fulva</i>	golden plover
31.	<i>Pluvialis squatarola</i>	grey plover
32.	<i>Charadrius bicinctus</i>	double-banded plover

## 2 Migratory Shorebirds

Number	Species	Common Name
33.	<i>Charadrius mongolus</i>	lesser sand plover
34.	<i>Charadrius leschenaultii</i>	greater sand plover
35.	<i>Charadrius veredus</i>	Oriental plover
	<b>Glareolidae</b>	<b>Pratincoles</b>
36.	<i>Glareola maldivarum</i>	Oriental pratincole

A number of other resident shorebirds are also known from Port Curtis and may be potentially impacted by the proposed construction of the GLNG LNG facility and associated marine infrastructure. These species include (but are not restricted to):

- beach stone-curlew (*Esacus magnirostris*)
- pied oystercatcher (*Haemotopus longirostris*)
- sooty oystercatcher (*Haemotopus fuliginosus*)
- red-capped plover (*Charadrius ruficapillus*)
- masked lapwing (*Vanellus miles*)

This report focuses on the international migratory shorebirds. However, it can be assumed that any impact management strategies proposed for the international migrants will also benefit resident shorebird species utilising habitat in the vicinity of the project site.

### 2.2 Migration along the East Asian-Australasian flyway

Migratory shorebirds migrate to Australia along the East Asian-Australasian flyway from their breeding grounds in the northern hemisphere. The flyway stretches from the breeding grounds of Siberia and Alaska, southwards through east and south-east Asia, to Australia and New Zealand. Migratory shorebirds depart from their breeding grounds from July to October. Birds begin arriving in Australia in late August, with most birds commonly present from October to March each year (DEWHA, 2009).

Migration can involve a 25,000 km round trip each year. The ability of migratory shorebirds to complete these flights depends on the availability of suitable rest and feeding sites across the flyway. During their migration, migratory shorebirds move through networks of wetland sites, known as staging areas, where they feed intensively to build up fat and protein reserves. Australia provides migratory shorebirds with essential non-breeding habitats to feed and rest (DEWHA, 2009).

### 2.3 Migratory Shorebird Sites of International Importance in Australia

Migratory shorebirds utilise a range of sites within the southern hemisphere for rest and feeding prior to returning to the northern hemisphere. A number of these sites are recognised as having international importance for these species due to the food and refuge values.

For sites to qualify as internationally important for migratory shorebirds they must meet the following criteria:

- Areas where 20,000 or more shorebirds have been recorded (includes migratory and resident species); and/or



---

## 2 Migratory Shorebirds

- Areas where 1% or more of the individuals of the East Asian-Australasian Flyway population of one species or sub-species of shorebird have been recorded (Shorebirds 2020, 2009a)

This approach is consistent with that used to identify wetlands of international importance under the "Convention on Wetlands of International Importance, especially as Waterfowl Habitat" (Ramsar Convention) (Watkins, 1993).

Australia has the largest number of important sites (118) identified of any country in the Flyway. Ten internationally important sites are located on the eastern Queensland coastline (Bamford *et al.*, 2008). These are (from south to north):

- Moreton Bay;
- Great Sandy Strait;
- Shoalwater Bay and Broadsound;
- Notch Point;
- Pioneer River – McEwan’s Beach;
- Burdekin River delta;
- Cape Bowling Green;
- Cairns foreshore;
- Pelican Island and nearby islands; and
- Islands off False Orford Ness.

### 2.4 Port Curtis as a Migratory Shorebird Site

Whilst Port Curtis is not recognised as an internationally important migratory shorebird site (Bamford *et al.*, 2008), it has been recognised as one of 234 ‘Shorebird Areas’ by the Shorebirds 2020 organisation. Shorebird Areas in Australia have been identified as areas of important habitat for both resident and migratory shorebirds. Based on the values for migratory shorebirds, Port Curtis has been targeted for ongoing shorebird surveys (Shorebirds 2020, 2009b).

In addition, recent studies for the various LNG projects report the presence of shorebird species within Port Curtis (Sandpiper Ecological Surveys, 2008, 2009; APLNG, 2010; BAAM, 2009; and URS, 2009a). Other reports not publicly available may contain data on the presence of other species.

A range of reports and online data was reviewed to ascertain species of international migratory shorebirds recorded from Port Curtis and environs. This information is presented in Table 2-2 below. This table shows that 25 of the 36 recognised international migratory shorebirds (as listed in Table 2-1) have been recorded from Port Curtis and environs. The various locations of shorebird sightings in Port Curtis are depicted on Figure 4 except for records derived from the EPBC Act Protected Matters report and Wildlife Online which do not specify location data; these are referred to generally as “Port Curtis environs”. In addition, specific locations for the shorebird survey sites at the APLNG and QCLNG facility sites on Curtis Island have not been specified and therefore generic locations for these records are given in Table 2-2.

Reports reviewed include:

- Sandpiper Ecological Surveys (for the QCLNG EIS), 2008, 2009a, 2009b;
- BAAM, 2009;
- URS, 2009a;
- APLNG, 2010; and

## 2 Migratory Shorebirds

- GHD, 2009<sup>1</sup>.

Database search areas used were:

- EPBC Act Protected Matters report: 10 km buffer centred on Latitude -23.6294, Longitude: 151.1678;
- Wildlife Online: 10 km buffer centred on Latitude -23.6294, Longitude: 151.1678; and
- Queensland Museum<sup>2</sup>: Rectangle formed by the points Latitude 23° 43', Longitude 151° 05' to Latitude 23° 51', Longitude 151° 19'.

**Table 2-2 Migratory shorebird records from Port Curtis and Environs**

Common Name	Species	Location <sup>A</sup>	Source <sup>B</sup>
Latham's snipe	<i>Gallinago hardwickii</i>	<ul style="list-style-type: none"> <li>• Port Curtis environs</li> </ul>	3, 4,
pin-tailed snipe	<i>Gallinago stenura</i>	<ul style="list-style-type: none"> <li>• Port Curtis environs</li> </ul>	3
Swinhoe's snipe	<i>Gallinago megala</i>	<ul style="list-style-type: none"> <li>• Port Curtis environs</li> </ul>	3
black-tailed godwit	<i>Limosa limosa</i>	<ul style="list-style-type: none"> <li>• Port Curtis environs</li> </ul>	3
bar-tailed godwit	<i>Limosa lapponica</i>	<ul style="list-style-type: none"> <li>• Friend Point Roost<sup>1</sup></li> <li>• Mainland Claypan<sup>1 8</sup></li> <li>• QCLNG LNG facility<sup>8</sup></li> </ul>	1, 3, 8
little curlew	<i>Numenius minutus</i>	<ul style="list-style-type: none"> <li>• Port Curtis environs</li> </ul>	3
whimbrel	<i>Numenius phaeopus</i>	<ul style="list-style-type: none"> <li>• Friend Point Roost<sup>1</sup></li> <li>• Laird Point roost<sup>1</sup></li> <li>• GLNG LNG facility<sup>2, 6</sup></li> <li>• APLNG LNG facility<sup>7</sup></li> <li>• Mainland Claypan<sup>9</sup></li> <li>• QCLNG LNG facility<sup>1 7 8</sup></li> </ul>	1, 2, 3, 4, 5, 6, 7, 8
eastern curlew	<i>Numenius madagascariensis</i>	<ul style="list-style-type: none"> <li>• Friend Point Roost<sup>1</sup></li> <li>• Laird Point roost<sup>1</sup></li> <li>• GLNG LNG facility<sup>2</sup></li> <li>• Mainland Claypan<sup>8</sup></li> <li>• QCLNG LNG facility<sup>1 7 8</sup></li> </ul>	1, 2, 3, 4, 7, 8
marsh sandpiper	<i>Tringa stagnatilis</i>	<ul style="list-style-type: none"> <li>• Port Curtis environs</li> </ul>	3, 4,
common greenshank	<i>Tringa nebularia</i>	<ul style="list-style-type: none"> <li>• GLNG LNG facility<sup>1</sup></li> <li>• Mainland Claypan<sup>1 8</sup></li> </ul>	1, 2, 4, 8

<sup>1</sup> The GHD survey was conducted in June when migratory shorebirds are typically absent from Australia. As a result no migratory shorebirds were recorded.

<sup>2</sup> The Queensland Museum database search did not return any records of migratory shorebirds.

## 2 Migratory Shorebirds

Common Name	Species	Location <sup>A</sup>	Source <sup>B</sup>
Terek sandpiper	<i>Xenus cinereus</i>	<ul style="list-style-type: none"> <li>• South Passage Island<sup>1 8</sup></li> <li>• GLNG LNG facility<sup>2</sup></li> <li>• Mainland Claypan<sup>8</sup></li> </ul>	1, 2, 3, 8
common sandpiper	<i>Actitis hypoleucos</i>	<ul style="list-style-type: none"> <li>• GLNG LNG facility<sup>2</sup></li> </ul>	1, 3, 4
grey-tailed tattler	<i>Heteroscelus brevipes</i>	<ul style="list-style-type: none"> <li>• Friend Point Roost<sup>1</sup></li> <li>• GLNG LNG facility<sup>2</sup></li> <li>• Mainland Claypan<sup>1 8</sup></li> <li>• South Passage Island<sup>8</sup></li> </ul>	1, 2, 3, 8
ruddy turnstone	<i>Arenaria interpres</i>	<ul style="list-style-type: none"> <li>• Port Curtis environs</li> </ul>	3
great knot	<i>Calidris tenuirostris</i>	<ul style="list-style-type: none"> <li>• Friend Point Roost<sup>1</sup></li> <li>• South Passage Island<sup>1</sup></li> <li>• Mainland Claypan<sup>1 8</sup></li> </ul>	1, 3, 8
red knot	<i>Calidris canutus</i>	<ul style="list-style-type: none"> <li>• Port Curtis environs</li> </ul>	3, 4
red-necked stint	<i>Calidris ruficollis</i>	<ul style="list-style-type: none"> <li>• Mainland Claypan<sup>1 8</sup></li> <li>• GLNG LNG facility<sup>2</sup></li> </ul>	1, 2, 3, 8
sharp-tailed sandpiper	<i>Calidris acuminata</i>	<ul style="list-style-type: none"> <li>• Mainland Claypan<sup>1 8</sup></li> </ul>	1, 3, 4, 8
curlew sandpiper	<i>Calidris ferruginea</i>	<ul style="list-style-type: none"> <li>• Port Curtis environs</li> </ul>	3
broad-billed sandpiper	<i>Limicola falcinellus</i>	<ul style="list-style-type: none"> <li>• Port Curtis environs</li> </ul>	3
pacific golden plover	<i>Pluvialis fulva</i>	<ul style="list-style-type: none"> <li>• Mainland Claypan<sup>1 8</sup></li> <li>• APLNG LNG facility<sup>6</sup></li> </ul>	1, 3, 6, 8
grey plover	<i>Pluvialis squatarola</i>	<ul style="list-style-type: none"> <li>• Port Curtis environs</li> </ul>	3
double-banded plover	<i>Charadrius bicinctus</i>	<ul style="list-style-type: none"> <li>• Port Curtis environs</li> </ul>	3
lesser sand plover	<i>Charadrius mongolus</i>	<ul style="list-style-type: none"> <li>• Mainland Claypan<sup>1 8</sup></li> </ul>	1, 3, 8
greater sand plover	<i>Charadrius leschenaultii</i>	<ul style="list-style-type: none"> <li>• Port Curtis environs</li> </ul>	3

A: Locations are depicted on Figure 3, except for records derived from the EPBC Act Protected Matters report (3) and Wildlife Online (4) which do not specify location data

– these are referred to generally as "Port Curtis environs". Superscript numbering in this column refers to source (below).

B: sources:

1: Sandpiper Ecological Surveys, 2009b

2: BAAM, 2009

3: EPBC Act Protected Matters report

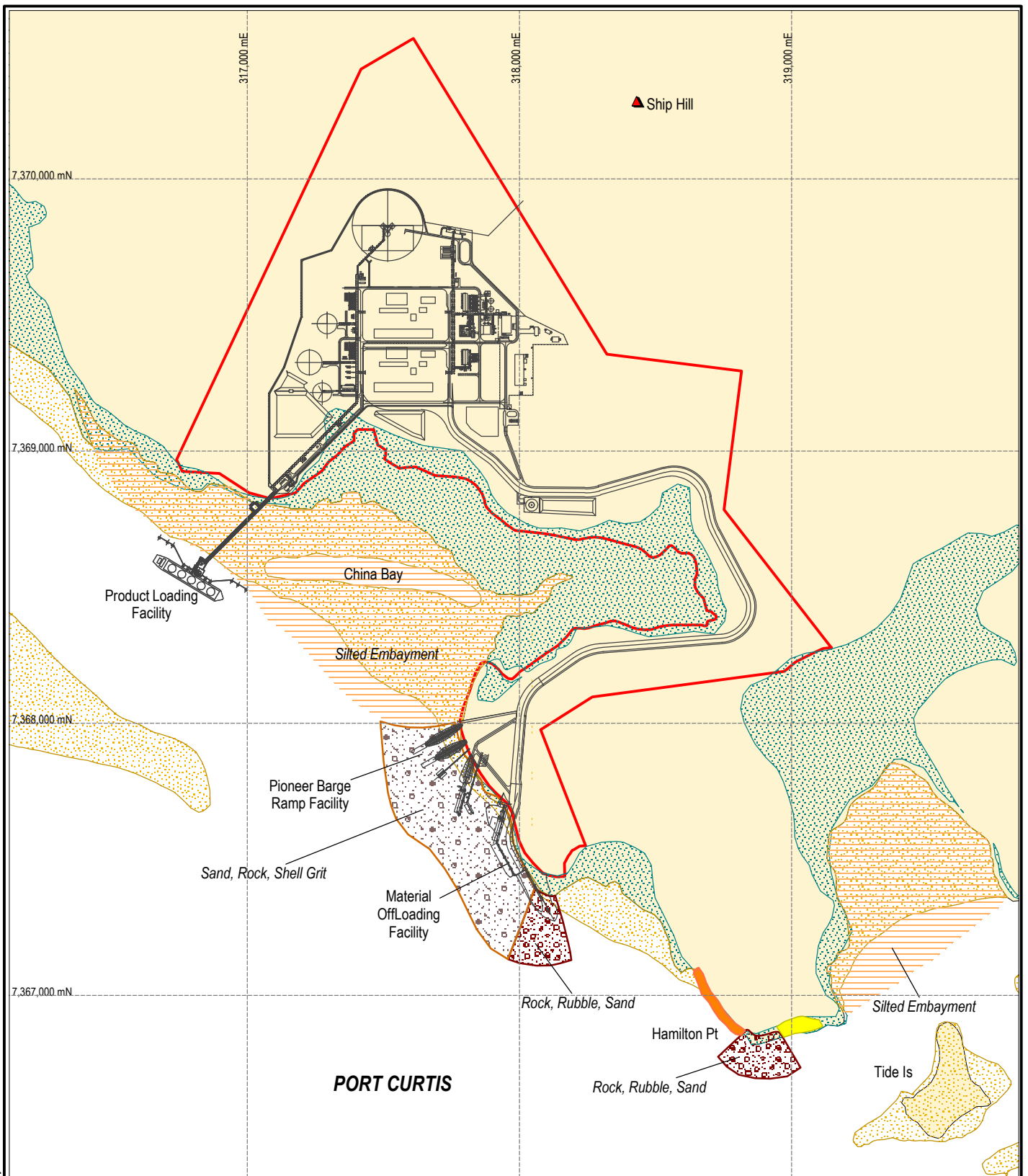
4: Wildlife Online

5: URS, 2009a

6: APLNG, 2010

7: Sandpiper Ecological Surveys, 2008

8: Sandpiper Ecological Surveys, 2009a



Scale 1:20 000 (A4)  
Datum : GDA94

- Sandy Beaches
- Silted Embayments
- Rocky Shores
- Coarse Sand
- Rubble Slope
- Rocky Headland
- Low Tidal Mud Flats
- Low Tidal Sand Flats
- LNG Facility Site Boundary

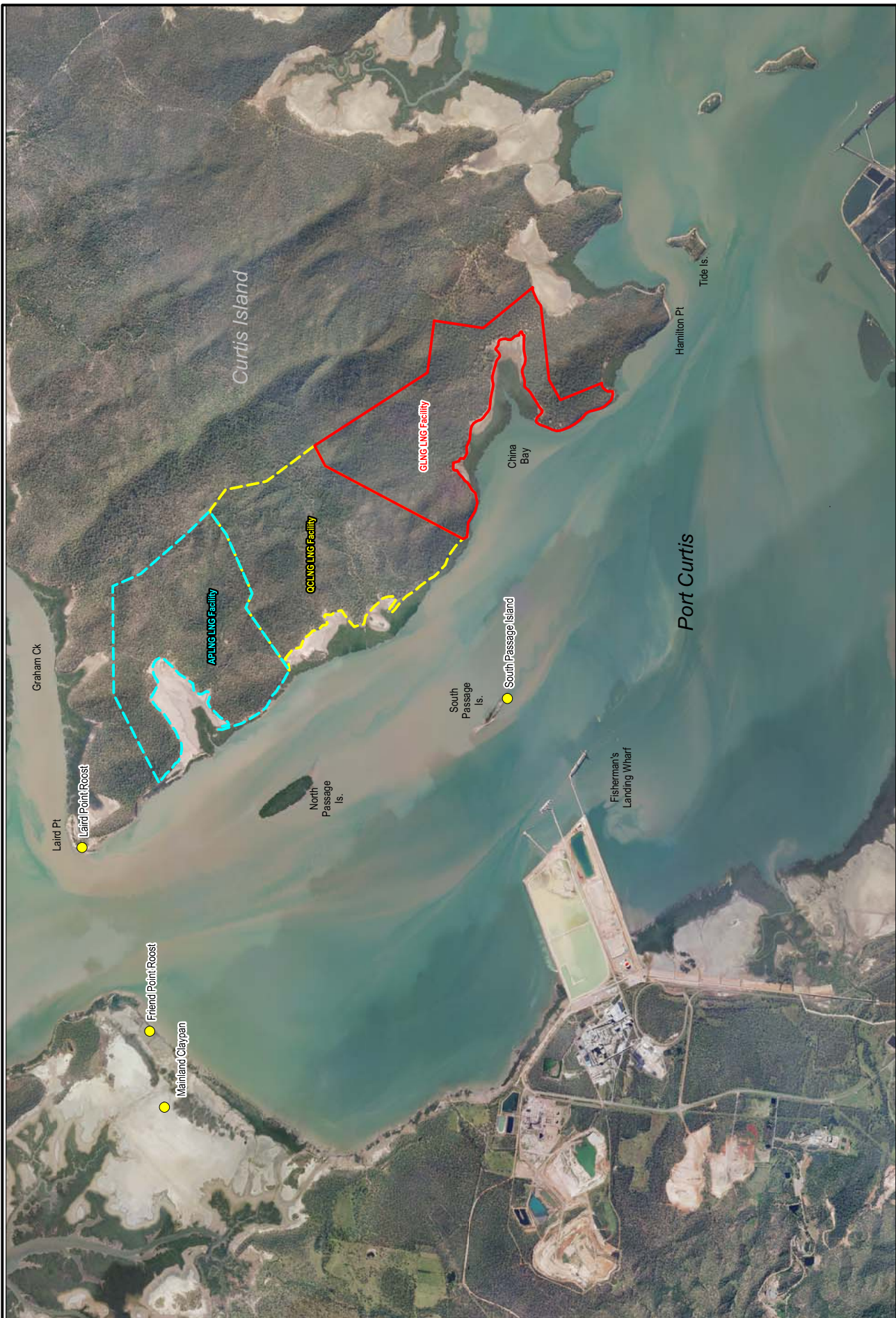
Source: This map may contain data which is sourced and Copyright. Refer to Section 18.2 of the EIS for Ownership and Copyright.

Client   	Project <p style="text-align: center;"><b>GLNG MARINE FACILITIES MIGRATORY SHOREBIRD MANAGEMENT PLAN</b></p>	Title <p style="text-align: center;"><b>MARINE FACILITIES INTERTIDAL &amp; SUBTIDAL SUBSTRATE TYPE</b></p>	
Drawn: LL/CA    Approved: DS    Date: 07-02-2011		Figure: 3	Rev:A
Job No: 4262 6727    File No: 42626727-g-003.wor			<b>A4</b>

This drawing is subject to COPYRIGHT. It remains the property of URS Australia Pty Ltd.





This drawing is subject to COPYRIGHT. It remains the property of URS Australia Pty Ltd.



● Shorebird Observation Locations

Source: This map may contain data which is sourced and Copyright. Refer to Section 18.2 of the EIS for Ownership and Copyright.

	<p>Client</p> <p>Project</p> <p>GLNG MARINE FACILITIES MIGRATORY SHOREBIRD ENVIRONMENTAL MANAGEMENT PLAN</p>	<p>Title</p> <p>LOCATION OF SURVEYED SHOREBIRD SITES IN PORT CURTIS</p>
	<p>Drawn: CA/RG   Approved: DS   Date: 17-02-2011</p> <p>Job No: <b>4262 6727</b>   File No: 42626727-g-004.wor</p>	<p>Figure: <b>4</b></p> <p>Rev:C <b>A4</b></p>

---

## 2 Migratory Shorebirds

### 2.5 Feeding and Roosting Requirements

Migratory shorebirds rely on intertidal habitat for food and resting whilst in Australia to ensure they are fit for the return journey to the northern hemisphere.

#### 2.5.1 Food Resources and Suitable Foraging Habitat

Intertidal mudflats are recognised as an important habitat with a high biodiversity and biomass of benthic invertebrates that provide important feeding grounds for migratory shorebirds (Erftemeijer and Lewis 1999 in Connelly *et. al*, 2006). Typically, migratory shorebirds forage on intertidal mudflats at low tide, seeking a range of invertebrate prey species. Many migratory shorebirds have specialised feeding techniques that enable them to feed at specific foraging habitat (DEWHA, 2009).

Within the China Bay area, the soft mudflats seaward of the mangrove zone will traditionally be favoured for foraging by shorebirds if there is suitable presence of invertebrate prey populations. The saltflats on the landward side of the mangrove zone would not act as high value foraging habitat because high soil salinities preclude macrobiota from living in this habitat except in some shallow drainage lines. Minor use of rocky shores, mangroves and sandy beaches for foraging would be expected, however these features would be of higher value as roost habitat.

#### 2.5.2 Suitable Roost Areas

Migratory shorebirds gather at favoured roost areas during high tide when foraging opportunities are limited. Use of roost areas is dependent upon a number of factors including proximity to foraging areas and security from predators. Good visibility of surrounding areas is important as shorebirds are generally more settled when there is a greater chance of detecting predators or other disturbances.

In the vicinity of the GLNG LNG facility, habitats above high tide levels could be used for roosting. These habitats include mangroves, saltflats and saltmarsh, rocky shores and sandy beaches. The rocky shores and sandy beaches present are not particularly suitable for roosting due to their narrow width and high tide, and the poor visibility to the landward side. The saltflats and saltmarsh habitat would be a preferred roosting habitat adjacent to the GLNG LNG facility. In northern Australia, mangroves can be important roost sites for migratory shorebird species such as whimbrel, grey-tailed tattler and Terek sandpiper.

### 2.6 Threats to Shorebirds and their Habitat

Worldwide, threats to migratory shorebirds include loss of habitat, degradation of habitat, introduced and exotic species, traditional harvesting of shorebirds and their eggs and the potential effects of climate change (Asia-Pacific Migratory Waterbird Conservation Committee, 2001).

The physiological effects of such disturbance on migratory shorebirds can include:

- Increased energy expenditure affecting the ability of birds to build fat reserves to satisfy their annual cycle (e.g., moult, migration, breeding);
- Reduced food intake, affecting the ability of birds to fulfil their annual cycle (e.g. moult, migration, breeding);
- Nest abandonment;
- Increased predation of unattended eggs or chicks;

---

## 2 Migratory Shorebirds

- Thermal stress to chicks; and
- Increased vigilance among parents resulting in reduced time spent foraging and /or in allocation of less food to chicks (Shorebirds 2020, 2009c).

International migrants do not breed in Australia and therefore there will be no impacts to breeding international migrants, their eggs or their chicks from construction activities. Potential impacts specific to the GLNG LNG marine facility construction, and the proposed mitigation measures are detailed in Section 4.

## Migratory Shorebird Surveys

### 3.1 Introduction

#### 3.1.1 Background

It is a Condition 19(b) of the EPBC Approval No. 2008/4058 for development of the GLNG LNG marine facilities that migratory shorebird surveys be undertaken to determine baseline population densities and habitat utilisation for migratory birds on or contiguous to the GLNG LNG facility site. This is to include as a minimum undertaking annual/twice annual surveys during northwards and southwards migrations. This section details the methodology used and results of the shorebird survey conducted in January 2011 which forms the initial part of the surveys to establish baseline population densities and habitat utilisation. An additional two shorebird surveys are scheduled for April and November 2011 to assess habitat utilisation during northward (on the neap tide) and southward migration events respectively to complete the determination of baseline population densities as required by condition 19(b). This will also contribute to an increase in the rigour of the survey results.

#### 3.1.2 Aims and Objectives

The aim of the shorebird survey is to determine baseline population densities and habitat utilisation for migratory shorebirds. In meeting this aim, the survey's objectives are to:

- Undertake annual or twice annual surveys during the northwards and southwards migrations;
- Identify usage of roost and foraging habitat by migratory shorebirds;
- Determine impacts on migratory shorebirds from current disturbance sources in the China Bay area; and
- Develop and implement protection and mitigation measures to protect Migratory Shorebirds from impacts generated from the construction, operation and decommissioning of Marine and LNG facilities on Curtis Island.

#### 3.1.3 Target Species

Condition 19 (a) of the EPBC Approval states the Migratory Shorebirds Environment Management Plan (MSEMP) must include measures for "...managing the impacts of the action on listed Migratory Shorebirds including but not limited to the whimbrel (*Numenius phaeopus*) and the Terek sandpiper (*Xenus cinereus*)".

The literature review for the MSEMP (Section 2.4) has determined that at least 25 species of international migrants utilise Port Curtis. The shorebird surveys will target these species (listed below), along with resident shorebirds and Australian migratory species. The 25 species are:

- Latham's snipe
- pin-tailed snipe
- Swinhoe's snipe
- black-tailed godwit
- bar-tailed godwit
- little curlew
- whimbrel
- common greenshank
- Terek sandpiper
- common sandpiper
- grey-tailed tattler
- ruddy turnstone
- great knot
- red knot
- sharp-tailed sandpiper
- curlew sandpiper
- broad-billed sandpiper
- pacific golden plover
- grey plover
- double-banded plover
- lesser sand plover



### 3 Migratory Shorebird Surveys

- eastern curlew
- red-necked stint
- greater sand plover
- marsh sandpiper

#### 3.2 Methods

Migratory shorebird foraging and roost surveys were conducted over three days between 18 and 20 January 2011 inclusive. The survey was timed to occur around the spring tide event on the full moon of 20 January. Observations were conducted over a four-hour period that included two hours on either side of the high and low tides. Survey events on spring and neap tides are recommended to ensure sampling of the various tidal conditions. The survey effort totalled 48 observation man hours.

Observation sites were established adjacent to potential migratory shorebird foraging and roost habitat areas to conduct surveys for shorebirds at low and high tide respectively. The observation point for the foraging surveys was established at Hamilton Point on the north-west facing beach ridge. This site allowed for a virtually uninterrupted view to the northern extent of China Bay of the soft mudflats that form foraging habitat seaward of the mangrove zone. Establishment of a survey point on the northern side of China Bay was impractical due to mangroves blocking views from that side.

For the roost surveys, an observation site was set up on the southern fringe of the major expanse of saltflats within China Bay. The sinuous nature of the China Bay coastline landward of the mangroves made it impossible to observe all high tide roost habitat from the one point. However, it was reasoned that this area was more attractive to roosting shorebirds due to the size, security and visibility at this site. The majority of the remaining potential roost habitat along the northern coastline of China Bay was assessed for usage by shorebirds during vehicle or foot traverses of the area. The observation sites and areas assessed are depicted on Figure 5. Coordinates of each observation point are given in, below.

**Table 3-1 Location of the low and high tide survey observation points**

Observation Point	Eastings	Northings	Latitude	Longitude
Foraging (low tide)	317,810.92	7,368,087.00	-23.788095	151.211872
Roosting (high tide)	318,657.18	7,368,350.17	-23.785815	151.220207

A high tide survey of the rocky shore habitat between southern Hamilton Point and the headland at the northern extent of China Bay was conducted by boat to assess the roosting values for shorebirds in these locations.

During each survey period, the foraging and roost areas were continually scanned for shorebirds from the observation points using the naked eye and binoculars. Where the distance was too great for identification using binoculars, a spotting scope was employed. Where shorebirds departed the observation zone, the direction of travel was noted in an attempt to reduce the opportunity for repeat counting. Identifications were confirmed using Morecombe (2004) and Birds Australia Australian Shorebirds Identification Sheets. Data was collated using the standard Shorebirds 2020 data sheet. Data recorded included:

---

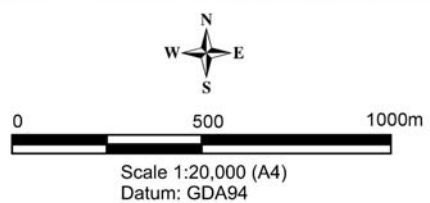
### 3 Migratory Shorebird Surveys

- Observer details;
- Time and date;
- Survey location;
- Wind speed;
- Disturbance from human activity;
- Shorebird species utilising the area;
- Other bird species observed; and
- An estimation of numbers of each species present.

The Shorebirds 2020 data sheet used during the survey is included in Appendix A.



Observation Point	Easting	Northing	Latitude	Longitude
Low Tide Foraging Survey Base	317 810.92	7 368 087.99	-23.788095	151.211872
High Tide Roost Survey Base	318 657.19	7 368 350.17	-23.785815	151.220207



- Shorebird Survey Locations
- Vehicle and Foot Surveys of High Tide Roost Habitat
- Areas in which eastern curlew and whimbrel were observed
- LNG Facility Site Boundary
- LNG Facility Disturbed Area Footprint (November 2010)
- LNG Facility Proposed Infrastructure (August 2010)

Source: This map may contain data which is sourced and Copyright. Refer to Section 18.2 of the EIS for Ownership and Copyright. DCDB correct as at January 2011

  	<b>Client</b> Project <b>GLNG MARINE FACILITIES MIGRATORY SHOREBIRD ENVIRONMENTAL MANAGEMENT PLAN</b>	<b>Title</b> <b>GLNG LNG FACILITY LOCATION OF SURVEYED SHOREBIRD HABITATS</b>
	Drawn: LL    Approved: DS    Date: 17-02-2011 Job No: <b>4262 6727</b> File No: 42626727-g-005.wor	<b>Figure: 5</b>

This drawing is subject to COPYRIGHT. It remains the property of URS Australia Pty Ltd.



## 3 Migratory Shorebird Surveys

### 3.3 Results

Two species of international migrants were observed using foraging and roost habitat at China Bay; eastern curlew (*Numenius madagascariensis*) and whimbrel (*Numenius phaeopus*).

Very low numbers of each species were observed using available habitat during the surveys as detailed in Table 3-2, below. Also included in this table are observations and counts of resident shorebirds and other birds observed using intertidal habitat.

**Table 3-2 Shorebird counts at China Bay roost and foraging habitat sites**

Survey Period	International migrants observed (count)	Other species observed (count)
18/1/11 Roost (high tide)	eastern curlew (2) whimbrel (10)	Australian pied oystercatcher (2) masked lapwing (2) Australian magpie (1) whistling kite (1)
18/1/11 Forage (low tide)	eastern curlew (7) whimbrel (3)	Australian pied oystercatcher (2) striated heron (1) rainbow bee-eater (5) little egret (1)
19/1/11 Roost	eastern curlew (3) whimbrel (8)	masked lapwing (2) little egret (1) striated heron (1)
19/1/11 Forage	eastern curlew (2) whimbrel (5)	nil
20/1/11 Roost*	eastern curlew (4)	masked lapwing (4) brahminy kite (1)
20/1/11 Forage	whimbrel (4)	masked lapwing (1) little egret (4) striated heron (2) Brahminy kite (1) crested tern (5)

\* Includes results of vehicular and foot traverse of the northern China Bay coastline and boat survey of high tide roost habitat.

### 3.4 Discussion

As shown in Table 3-2, two species of international migratory shorebirds were observed utilising intertidal habitat within China Bay; eastern curlew (*Numenius madagascariensis*) and whimbrel (*Numenius phaeopus*). This is a very low diversity when compared to the overall diversity of international migrants (25 species) known from Port Curtis.

The low diversity and abundance of international migrants recorded during the survey can probably be attributed to poor quality foraging resources on the exposed mudflats at low tide and inferior roost habitat landward of the mangroves within China Bay. Sandpiper Ecological Surveys (2008) noted during surveys for the QCLNG project conducted between 29 September 2008 and 9 October 2008 species diversities and counts that were almost identical to that of the current survey. In addition, they noted at that time that “By way of comparison, high tide counts conducted at a roost site immediately

---

### 3 Migratory Shorebird Surveys

to the west of South End recorded a minimum of 1600 individuals of 16 species, including large flocks of Eastern Curlew, Whimbrel and Grey-tailed Tattler". It is evident therefore that superior roosting habitat is present elsewhere in Port Curtis and that China Bay and environs do not support a large diversity and abundance of migratory shorebirds. Surveys of the rocky coast of Curtis Island to the south and north of China Bay did not detect roosting birds at this habitat type at all, thereby indicating that rocky shores in this area do not significantly contribute to roost habitat in Port Curtis.

As the results of this survey are not dissimilar to earlier surveys (e.g. Sandpiper Ecological Surveys, 2008) conducted prior to elevated levels of disturbance, it is unlikely that current disturbance levels are deterring usage of habitat in the area. Sources of disturbance noted during the survey in the vicinity of China Bay were few and of low impact. Vehicular movement along the intertidal/terrestrial ecotone generally did not disturb roosting eastern curlews enough to make them take flight. Pile-driving at the nearby QCLNG site did not disturb shorebirds at high or low tide at all.

---

## Potential Impacts and Mitigation Strategies

### 4.1 Proposed Activities

GLNG OPL is proposing to construct an LNG facility on the south-west coast of Curtis Island at China Bay. The GLNG LNG facility will consist of the following key elements:

- A liquefaction facility which includes the on-shore gas liquefaction and storage facilities;
- Marine facilities which will include:
  - A PLF for loading LNG into ships for export,
  - A temporary Pioneer Barge Ramp to support the construction of the MOF; and
  - A MOF; and
- A haul road linking the MOF with the LNG facility.

Due to the proximity of the GLNG LNG facility to intertidal habitat, there is potential for the construction and operation of all aspects of the GLNG LNG facility to have a direct or indirect impact on shorebirds.

### 4.2 Existing Management Plans

The GLNG EIS included preliminary Environmental Management Plans (EMPs) for the various aspects of the GLNG Project. The purpose of these preliminary EMPs was to propose environmental protection commitments to protect the environmental values that may be affected by the development of the project and to assist the administering authorities to decide the appropriate approval conditions for the project (URS, 2009b).

With respect to the management of impacts on fauna at the GLNG LNG facility, EMPs were prepared for:

- Clearing and Grading;
- Marine Flora and Fauna Management; and
- Fauna Management.

The EMPs were finalised as part of the GLNG Supplementary EIS (SEIS) (URS, 2009c).

A Construction EMP (CEMP) has been developed for the GLNG LNG facility site (which includes the Marine Facilities). The CEMP includes a range of sub-plans including a Wildlife and Habitat Management Plan (Bechtel, 2010).

This MSEMP applies in addition to the mitigation measures detailed within the above EMPs.

### 4.3 Potential Impacts to Migratory Shorebirds

The construction and operation of the marine facilities has the potential to impact on migratory shorebirds. Whilst discrete events on their own are often sufficient to disrupt foraging and roosting activities, it is likely that construction will result in a combination of disruptive actions that will disturb shorebirds and their habitats. Potential impacts could include:

- Mortality;
- Loss of intertidal feeding habitat through clearing and construction activities;
- Loss and fragmentation of roosting areas;
- Interruption to feeding and roosting activities from adjacent disturbance;

---

## 4 Potential Impacts and Mitigation Strategies

- Impacts from light sources;
- Impacts from noise;
- Increased susceptibility to predation;
- Reduction in water quality; and
- Increased sedimentation.

### *Mortality*

As migratory shorebirds are easily disturbed and are mobile, there is a negligible chance of direct mortality through construction activities.

### *Loss of Intertidal Feeding Habitat*

The construction of the GLNG marine facilities (PLF, MOF and pioneer barge ramp) will involve clearing of intertidal habitat at the northern extent of China Bay and at Hamilton Point respectively. The areas impacted feature rocky shores with scattered low mangroves. This habitat type has limited value as foraging habitat for shorebirds, and possesses greater importance as potential roosting habitat. Therefore, the area of important feeding habitat removed through clearing for construction is minimal.

### *Direct loss and Fragmentation of Roosting Areas*

The PLF, MOF and pioneer barge ramp will be constructed on rocky headlands to the north and south of China Bay. These areas feature a shelving beach of rubble-strewn exposed rock with scattered stunted mangroves. At high tide the available roosting habitat is limited to a narrow strip approximately 3 to 10 m wide. Given that shorebirds favour roosting areas with good visibility to enhance the ability to detect predators, the areas impacted are not considered to be critical for roosting shorebirds. However, certain species or individuals may utilise these areas during particular climatic conditions (e.g. storms) as they would be protected from the wind by the scarps and terrestrial woodlands to the immediate east.

### *Interruption to Feeding and Roosting Activities*

Construction activities within intertidal and adjacent terrestrial habitat have the potential to impact on shorebird feeding and roosting activities. Movement of vehicles, boats and personnel and sudden noise can cause shorebirds to take to the air. Disturbance can reduce effective feeding and roosting effort which can lead to a lower fitness for the return journey to northern hemisphere breeding grounds. This may affect the ability to safely complete the return trip and subsequent breeding cycle. Sustained disturbances can prevent shorebirds from using parts of the habitat, which can lead to displacement.

Dredging for ship access to the MOF may in itself not have a significant impact on shorebirds as the dredge vessels are stationary for periods and noise levels will generally be constant operational noises such as engine drone. However, sudden noises such as caused by anchor drop, and the movement of barges may result in disturbance to shorebirds.

The displacement of shorebird species to other feeding and roosting sites within Port Curtis and elsewhere may increase competition amongst shorebirds for these resources thus further impacting on their fitness for northward migration.

---

## 4 Potential Impacts and Mitigation Strategies

### *Impacts from Light*

Excessive light spilling onto night time roosts can disturb roosting birds during construction and operational phases. The presence of excessive light for prolonged periods may result in birds abandoning the roost for less secure sites, which may increase the opportunity for further disturbance or predation. These factors may contribute to a reduction in fitness for the northward migration.

### *Impacts from Noise*

Unpredictable discrete disturbances such as loud noises have the capacity to disturb roosting and foraging birds. Blasting and pile-driving activities are examples of construction-related noises that can cause shorebirds to take flight. Ongoing disturbance to shorebirds during roosting and feeding can place undue stress on the animals leading to a reduction in fitness. Operation-related noises can also cause stress on feeding and roosting birds.

### *Increased Susceptibility to Predation*

The south-west coast of Curtis Island currently supports populations of feral pigs, feral cats and wild dogs (URS 2009d). Red foxes are also present. Therefore there are existing pressures on shorebirds from feral predators. Whilst the internationally migratory species are not at risk from losses of chicks and eggs during the breeding season, the mere presence of feral predators in the vicinity of roost sites in particular is enough to disturb the birds into flight, with potential impacts on fitness for the northward migration leg.

Displacement of roosting shorebirds to inferior roosting sites during construction may put the displaced birds at risk from predation at the new roost sites.

### *Reduction in Water Quality*

Water quality in intertidal habitat can be affected by releases of contaminants. These can potentially fall into three categories:

- Disturbance to potential acid sulfate soils (PASS) and subsequent runoff;
- Accidental spills including hydrocarbons and other substances; and
- Stormwater discharges from the site carrying high levels of sediments.

The GLNG EIS reports that low-lying areas of the GLNG LNG facility site have been mapped as containing PASS. The disturbance of PASS may result in mobilisation of acidic solutions into intertidal areas. This could potentially impact upon invertebrate prey populations and cause harm to shorebirds that wade through acid-affected water.

Spills of hydrocarbons (diesel, petrol, etc.) and other toxic substances have the potential to be mobilised into intertidal areas if not properly managed. Hydrocarbons and other chemicals can harm shorebirds and their prey if ingested. In addition, diesel can affect shorebirds' natural waterproofing and impact on their ability to fly.

If not properly managed, high rainfall events within the China Bay catchments can result in the mobilisation of sediments into intertidal areas.

GLNG will implement appropriate management measures which are documented in the EIS EMPs to prepare for these potential events.



---

## 4 Potential Impacts and Mitigation Strategies

### *Increased Sedimentation*

Dredging for ship access has the capacity to mobilise sediments which may be transported by currents and tides onto intertidal habitat. Whilst sediment transportation is a naturally occurring event, and one that assists in the formation of intertidal habitat, large-scale releases of sediment can smother habitat for invertebrate biota and reduce foraging opportunities for shorebirds.

Dredging by GLNG is restricted to the berth pocket (for the MOF) with disposal of material at the existing Fisherman's Landing reclamation area or offshore disposal. All other dredging related to the GLNG project is being conducted by Gladstone Ports Corporation.

Given that a Dredge Management Plan (DMP) has been prepared for the MOF berth pocket, and that the quantity of mobilised sediment is likely to be small, there is a low probability of this scenario eventuating.

### **4.4 Management of Potential Impacts to Migratory Shorebirds**

A range of mitigation strategies are available to minimise impacts to migratory shorebirds within intertidal habitat adjacent to the GLNG LNG facility.

The primary strategy available to minimise impacts to shorebirds is to avoid undertaking works during the period in which international shorebirds are in Australia. However, the construction period will most likely encompass multiple migration periods and so avoidance is not viable. In addition, resident shorebirds will be susceptible to impacts all year round.

The mitigation strategies are summarised in Table 4-1, along with monitoring, auditing and reporting requirements.

### *Mortality*

As previously noted, the potential for direct shorebird mortality from construction activities is low, and therefore there is little need to prescribe mitigation strategies for this eventuality.

### *Loss of intertidal feeding habitat and roosting areas*

To minimise impacts to intertidal feeding and roosting habitat, the following strategies will be employed:

- Areas of vegetation to be cleared during construction will be restricted to the minimum area required and will be clearly delineated;
- All clearing boundaries will be illustrated on construction drawings and clearly marked in the field;
- Access to the site will be restricted to prohibit unauthorised access to the surrounding undisturbed areas. Access restrictions will be implemented to prevent unauthorised clearing, recreational driving, unmanaged fire regimes, and the spread of introduced weed species;
- Bushland and habitat surrounding the site will be managed to prohibit any unauthorised disturbance so as to maintain the area's habitat values. and
- Inductions will include environmental awareness.

### *Interruption to feeding and roosting activities*

The following strategies will be employed to minimise disturbance to shorebirds from construction activities:

---

## 4 Potential Impacts and Mitigation Strategies

- All clearing boundaries will be illustrated on construction drawings and clearly marked in the field;
- As per the GLNG Project Curtis Island Environmental Protection Code of Conduct, no pets will be brought to Curtis island; and
- All personnel, as part of the site environmental inductions, will be given information on the site's ecological values including intertidal habitat and migratory shorebirds. .

### *Impacts from light sources*

To reduce impacts to fauna from excessive light spill, a number of strategies will be employed, including:

- Where practicable, lights will be turned inwards to face the facility;
- Ensuring lights facing towards intertidal habitat are at the lowest practicable output for their intended purpose; and
- Lights, including those on the marine facilities, will be shielded to reduce light spill where they face intertidal habitat.

### *Impacts from noise*

Impacts from construction noise on migratory shorebirds will be reduced through the implementation of strategies as specified within the existing Noise and Vibration EMP (13.6.11, GLNG EIS). Such strategies will include (but are not restricted to):

- Use of the quietest plant and equipment that can economically undertake the work;
- Regular maintenance of equipment in order to keep it in good working order;
- Construction work will occur, wherever possible, within the daytime period;
- Operators of construction equipment will be made aware of the potential noise problems and of techniques to minimise noise emission through a continuous process of operator education;
- Best available work practices will be employed on-site to minimise occupational noise levels; and
- High efficiency mufflers will be fitted to appropriate construction equipment.

### *Increased susceptibility to predation*

Whilst the construction of the marine facilities alone is unlikely to cause an increase in predation, the following strategies will assist in reducing predation throughout the GLNG LNG facility construction and operation period:

- Enforcement of the “no pets” policy in the GLNG Project Curtis Island Environmental Protection Code of Conduct; and
- Regular inspections will be conducted and inspectors shall be trained to identify major pests, such as lantana and fire ants.

### *Reduction in water quality and increase in sedimentation*

Impacts on migratory shorebirds from a reduction in water quality and an increase in sedimentation will be minimised through the implementation of strategies as specified within the existing Surface Water Management EMP (13.16.6, GLNG EIS). Such strategies will include (but are not restricted to):

- Implementation of a site-specific construction erosion and sediment control plan in accordance with the Institution of Engineers Australia – Erosion and Sediment Control Guidelines (1996);

## 4 Potential Impacts and Mitigation Strategies

- Installation of temporary drainage works (channels and bunds) in areas required for sediment and erosion control and around storage areas for construction materials;
- Installation of temporary sediment basins to capture sediment-laden runoff from site;
- Stabilise cleared areas not used for plant infrastructure with vegetation or appropriate surface treatments as soon as practicable following earthworks, to minimise erosion;
- Provision of appropriate storage areas for fuels and dangerous goods with bunding and spill cleanup kits, and ensuring that relevant construction personnel are trained in appropriate handling of such materials and spill prevention;
- Restricting vegetation clearance to the smallest area necessary;
- Diversion channels and silt fences will be constructed around the topsoil stockpiles to prevent erosion and loss of topsoil. Seeding of long-term topsoil stockpiles will be carried out with an appropriately designed seed mix to limit stockpile erosion. The topsoil will be respread prior to revegetation of areas to be rehabilitated at completion of construction; and
- Topsoil stockpiles will be located in areas outside drainage lines, and will be protected from erosion. Prior to the re-spreading of topsoil, the ground surface will be ripped to assist with binding of the soil layers, water penetration, and revegetation.

**Table 4-1 Summary of impact mitigation strategies**

Element/Issue	Management of impacts to Shorebirds
Management Objective	To minimise and manage impacts to migratory shorebirds during construction and operation of the GLNG LNG facility marine facilities.
Performance criteria	<ul style="list-style-type: none"> <li>• No significant reduction in baseline numbers of migratory shorebirds during the construction and operation of the GLNG marine facilities;</li> <li>• Minimal disturbance of shorebirds during construction and operation of the marine facilities; and</li> <li>• Minimal impact on roosting and foraging habitat.</li> </ul>
Implementation Strategy	<p><b>Loss and fragmentation of habitat</b></p> <ul style="list-style-type: none"> <li>• Areas of vegetation to be cleared during construction will be restricted to the minimum area required and will be clearly delineated;</li> <li>• All clearing boundaries will be illustrated on construction drawings and clearly marked in the field;</li> <li>• Access to the site will be restricted to prohibit unauthorised access to the surrounding undisturbed areas. Access restrictions will be implemented to prevent unauthorised clearing, recreational driving, unmanaged fire regimes, and the spread of introduced weed species;</li> <li>• Bushland and habitat surrounding the site will be managed to prohibit any unauthorised disturbance so as to maintain the area's habitat values; and</li> <li>• Inductions will include environmental awareness.</li> </ul> <p><b>Disturbance to Shorebird Roosting and Feeding</b></p> <ul style="list-style-type: none"> <li>• All clearing boundaries will be illustrated on construction drawings and clearly marked in</li> </ul>

## 4 Potential Impacts and Mitigation Strategies

Element/Issue	Management of impacts to Shorebirds
	<p>the field;</p> <ul style="list-style-type: none"> <li>• As per the GLNG Project Curtis Island Environmental Protection Code of Conduct, no pets will be brought to Curtis island; and</li> <li>• All personnel, as part of the site environmental inductions, will be given information on the site's ecological values including intertidal habitat and migratory shorebirds.</li> </ul> <p><b>Light Impacts</b></p> <ul style="list-style-type: none"> <li>• Where practicable, lights will be turned inwards to face the facility;</li> <li>• Ensuring lights facing towards intertidal habitat are at the lowest practicable output for their intended purpose; and</li> <li>• Lights, including those on the marine facilities, will be shielded to reduce light spill where they face intertidal habitat.</li> </ul> <p><b>Noise Impacts</b></p> <ul style="list-style-type: none"> <li>• Use of the quietest plant and equipment that can economically undertake the work;</li> <li>• Regular maintenance of equipment in order to keep it in good working order;</li> <li>• Construction work will occur, wherever possible, within the daytime period;</li> <li>• Operators of construction equipment will be made aware of the potential noise problems and of techniques to minimise noise emission through a continuous process of operator education;</li> <li>• Best available work practices will be employed on-site to minimise occupational noise levels; and</li> <li>• High efficiency mufflers will be fitted to appropriate construction equipment.</li> </ul> <p><b>Predation</b></p> <ul style="list-style-type: none"> <li>• Enforcement of the “no pets” policy in the GLNG Project Curtis Island Environmental Protection Code of Conduct; and</li> <li>• Regular inspections will be conducted and inspectors shall be trained to identify major pests, such as lantana and fire ants.</li> </ul> <p><b>Water Quality and Sedimentation</b></p> <ul style="list-style-type: none"> <li>• Implementation of a site-specific construction erosion and sediment control plan in accordance with the Institution of Engineers Australia – Erosion and Sediment Control Guidelines (1996);</li> <li>• Installation of temporary drainage works (channels and bunds) in areas required for sediment and erosion control and around storage areas for construction materials;</li> <li>• Installation of temporary sediment basins to capture sediment-laden runoff from site;</li> <li>• Stabilise cleared areas not used for plant infrastructure with vegetation or appropriate surface treatments as soon as practicable following earthworks, to minimise erosion;</li> <li>• Provision of appropriate storage areas for fuels and dangerous goods with bunding and spill cleanup kits, and ensuring that relevant construction personnel are trained in</li> </ul>

## 4 Potential Impacts and Mitigation Strategies

Element/Issue	Management of impacts to Shorebirds
	<p>appropriate handling of such materials and spill prevention;</p> <ul style="list-style-type: none"> <li>• Restricting vegetation clearance to the smallest area necessary;</li> <li>• Diversion channels and silt fences will be constructed around the topsoil stockpiles to prevent erosion and loss of topsoil. Seeding of long-term topsoil stockpiles will be carried out with an appropriately designed seed mix to limit stockpile erosion. The topsoil will be respread prior to revegetation of areas to be rehabilitated at completion of construction; and</li> <li>• Topsoil stockpiles will be located in areas outside drainage lines, and will be protected from erosion. Prior to the re-spreading of topsoil, the ground surface will be ripped to assist with binding of the soil layers, water penetration, and revegetation.</li> </ul>
Monitoring and Auditing	<p>Monitoring will comprise of twice annual shorebird monitoring surveys during northward and southward migration periods over 5 years during the construction and operational phases. The monitoring events will be conducted as per the existing shorebird survey methodology as employed during the January 2011 survey event undertaken as part of this MSEMP. The results of each monitoring survey will be compared to the baseline survey results to determine if construction and operation of the GLNG LNG facility and marine facilities is having a significant impact on shorebird usage of intertidal habitat adjacent to the facilities. The monitoring of shorebirds will also consider the results of monitoring for noise, water quality, erosion and sedimentation and feral animal control to assess the role these aspects may have on shorebird use of intertidal habitats.</p> <p>Routine inspections of undisturbed areas by the contractor's environmental representative (during construction) and the GLNG LNG Facility Environmental Manager (during operations) will be undertaken to identify any evidence of unauthorized intertidal habitat disturbance or shorebird mortality.</p> <p>GLNG will consult with GPC, to conduct future surveys as part of the wider GPC monitoring program as per the Gladstone Western Basin Dredging and Disposal Project Referral EPBC No 2009/4904, provided the surveying satisfies GLNG's conditions under EPBC No 2008/4058.</p>
Reporting and Corrective Action	<p>Reporting of environmental performance data will be conducted in accordance with the Project CEMP (Construction) and EMP (Operations).</p> <p>Reporting, investigation and management of corrective actions associated with environmental events (including incidents, hazards, near misses, non-compliance events and third party complaints) will be conducted in accordance with the CEMP (Construction) and Project EMP (Operations)</p> <p>Non-compliance and incident reports will be closed out by senior management.</p> <p>Any third party complaints will be recorded in a complaints register and appropriate corrective actions will be implemented and closed out by the GLNG LNG Facility Environmental Manager.</p> <p>The GLNG LNG Facility Environmental Manager will report any incidents of unauthorised intertidal habitat disturbance or shorebird mortality to the Construction Manager or the GLNG LNG Facility Manager as necessary.</p> <p>In the event of a failure to comply, investigations will be undertaken into the cause of the incident or failure to comply and the appropriate corrective actions taken to overcome the problem and prevent recurrence.</p>

## References

- APLNG (2010) Australia Pacific LNG EIS LNG Facility Terrestrial Ecology Technical Report.
- Asia-Pacific Migratory Waterbird Conservation Committee. 2001. *Asia-Pacific Migratory Waterbird Conservation Strategy: 2001-2005*. Wetlands International - Asia Pacific. Kuala Lumpur, Malaysia. <http://www.environment.gov.au/biodiversity/migratory/publications/asia-pacific/pubs/strategy.pdf>
- BAAM (2009) *Curtis Island Water Mouse, Powerful Owl and Wading Bird Investigations*. Report prepared for URS Australia.
- Bamford, M, D. Watkins, W. Bancroft, G. Tischler and J. Wahl (2008) *Migratory Shorebirds of the East Asian - Australasian Flyway; Population Estimates and Internationally Important Sites*. Wetlands International - Oceania. Canberra, Australia.
- Bechtel (2010) *GLNG LNG Facility Construction Environmental Management Plan*. Prepared for GLNG Operations Pty Ltd.
- Connolly RM, Currie DR, Danaher KF, Dunning M, Melzer A, Platten JR, Shearer D, Stratford PJ, Teasdale PR & Vandergragt M (2006) *Intertidal wetlands of Port Curtis: ecological patterns and processes, and their implications. Technical Report No. 43*, CRC for Coastal Zone, Estuary and Waterway Management, Brisbane.
- DERM (2010a) Wildnet Database. Queensland Department of Environment and Resource Management, Brisbane. Retrieved 13 December 2010. [https://www.epa.qld.gov.au/nature\\_conservation/wildlife/wildlife\\_online/](https://www.epa.qld.gov.au/nature_conservation/wildlife/wildlife_online/)
- DEWHA (2009). *Draft Background Paper to EPBC Act Policy Statement 3.21 – Significant Impact Guidelines for 36 Migratory Shorebird Species*. Commonwealth Department of Environment, Water, Heritage and the Arts, Canberra.
- DEWHA (2010) EPBC Act Protected Matters Report. Retrieved 13 December 2010. <http://www.environment.gov.au/erin/ert/epbc/index.html>
- Duke, NC, Lawn, PT, Roelfsema, CM, Zahmel, KN, Pedersen, DK, Harris, C, Steggles, N & Tack, C. 2003. *Assessing Historical Change in Coastal Environments – Port Curtis, Fitzroy River Estuary and Moreton Bay Regions*. Report to the CRC for Coastal Zone, Estuary & Waterway Management. July 2003. Marine Botany Group, Centre for Marine Studies, University of Queensland.
- GHD (2009). *Report for Western Basin Dredging and Disposal Project – Terrestrial Ecology Report*. Report prepared for Gladstone Ports Corporation.
- Morecombe, M. (2004) *Field Guide to Australian Birds*. Steve Parish Publishing, Brisbane.
- Queensland Museum (2010) *Queensland Museum Fauna Database*. Data retrieved 21 December 2010. <http://www.qm.qld.gov.au/Research/Biodiversity/Studying+biodiversity/Zoology+Data+Search4>

---

## 5 References

- Sandpiper Ecological Surveys (2008) *British Gas Liquid Natural Gas Project, Curtis Island - Targeted Bird Survey*. Report prepared for British Gas.
- Sandpiper Ecological Surveys (2009a) *QGC Queensland Curtis LNG Project, Curtis Island - Supplementary Targeted Bird Survey*. Report prepared for Queensland Gas Company, March 2009.
- Sandpiper Ecological Surveys (2009b) *Supplementary Survey for Powerful Owl and Migratory Shorebirds – QGC LNG Facility, Curtis Island*. Report prepared for Queensland Gas Company, November 2009.
- Shorebirds 2020 (2009a). *Internationally Significant Migratory Shorebird Sites*. <http://www.shorebirds.org.au/shorebird-conservation/internationally-significant-sites/>
- Shorebirds 2020 (2009b). *Methods and Site Selection*. <http://www.shorebirds.org.au/about/methods-site-selection/>
- Shorebirds 2020 (2009c). *Human Disturbance*. <http://www.shorebirds.org.au/shorebird-conservation/management/human-disturbance/>
- URS (2009a). *GLNG EIS Marine Ecology Technical Report*. Report prepared for Santos Ltd.
- URS (2009b) *GLNG EIS LNG Facility Environment Management Plans*. Report prepared for Santos Ltd.
- URS (2009c). *GLNG SEIS LNG Facility Environment Management Plans*. Report prepared for Santos Ltd.
- URS (2009d). *GLNG EIS Terrestrial Ecology Technical Report*. Report prepared for Santos Ltd.
- URS (2011). *Draft Application to Disturb Marine Plants - GLNG Project (Materials Offloading Facility, Pioneer MOF and Haul Road)*. Report prepared for Santos Ltd.
- Watkins, D. 1993. *A National Plan for Shorebird Conservation in Australia*. Australasian Wader Studies Group. RAOU Report No.90.



---

## Limitations

Subject to any agreement between URS Australia Pty Ltd (URS) and Santos Limited, to the contrary, the following limitations apply to this report.

URS Australia Pty Ltd (URS) has prepared this report in accordance with the usual care and thoroughness of the consulting profession for the use of GLNG and only those third parties who have been authorised in writing by URS to rely on the report. It is based on generally accepted practices and standards at the time it was prepared. No other warranty, expressed or implied, is made as to the professional advice included in this report. It is prepared in accordance with the scope of work and for the purpose outlined in the Proposal dated 2 December 2010.

The methodology adopted and sources of information used by URS are outlined in this report. URS has made no independent verification of this information beyond the agreed scope of works and URS assumes no responsibility for any inaccuracies or omissions. No indications were found during our investigations that information contained in this report as provided to URS was false.

This report was prepared between 6 December 2010 and 2 February 2011 and is based on the conditions encountered and information reviewed at the time of preparation. URS disclaims responsibility for any changes that may have occurred after this time.

This report should be read in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties. This report does not purport to give legal advice. Legal advice can only be given by qualified legal practitioners.



## Appendix A Shorebirds 2020 Data Sheet

# SHOREBIRD COUNT FORM



CARING  
FOR  
OUR  
COUNTRY

OFFICE USE			
VISIT ID:			
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

OBSERVER DETAILS		<i>For detailed instructions on how to fill out this form refer to "Count Form Instructions"</i>	
FULL NAME:	<input type="text"/>	PHONE NUMBER:	<input type="text"/>
<i>If more than one observer, only name the count leader or main contact</i>			
EMAIL:	<input type="text"/>	TOTAL NO. OBSERVERS	<input type="text"/> YEARS OF COUNTING EXPERIENCE OF MOST EXP. COUNTER <input type="text"/>

TIME & DATE	DAY	MONTH	YEAR	HOUR	MINS	HOUR	MINS
SURVEY DATE:	<input type="text"/>	<input type="text"/>	<input type="text"/>	TIME STARTED: (24 hour clock)	<input type="text"/>	TIME FINISHED: (24 hour clock)	<input type="text"/>

SURVEY DETAILS		IF COUNT <b>WAS</b> CONDUCTED IN A SHOREBIRDS 2020 COUNT AREA (count area names and maps available at <a href="http://www.shorebirds.org.au">www.shorebirds.org.au</a> )		YES or NO
SHOREBIRD AREA	<input type="text"/>	COUNT AREA	<input type="text"/>	COMPLETE COVERAGE OF MAPPED COUNT AREA? <input type="text"/>
<b>OR</b>				
IF COUNT WAS <b>NOT</b> CONDUCTED IN A SHOREBIRDS 2020 COUNT AREA:				
SITE NAME	<input type="text"/>		LAT/ LONG	<input type="text"/>
STATE	<input type="text"/>	SURVEY TYPE (land, boat, air)	L.B.A. <input type="text"/>	TIDE HEIGHT
		<i>Height in metres or rising, high, falling or low</i>		<input type="text"/>
		AREA UNDER WATER (wetlands only)	<input type="text"/>	WIND DIRECTION
		<i>%</i>		<input type="text"/>
WIND SPEED	<input type="radio"/> 0 - 5 kph (flat to ripples / wind not felt on face)	<input type="radio"/> 6 - 11 kph (small wavelets, crests not breaking / wind felt on face)	<input type="radio"/> 12 - 19 kph (large wavelets, crests begin to break / leaves in motion)	<input type="radio"/> 20 - 28 kph (small waves / dust, small)
	<input type="radio"/> 29 - 38 kph (moderate waves, some foam & spray / small trees sway)	<input type="radio"/> 39 - 49 kph (large waves with foam, crests and spray / large branches in motion)	<input type="radio"/> >50 kph (sea heaps up, foam begins to streak / strong resistance while walking)	

HUMAN ACTIVITY		<i>Write down the number of times the following were observed during the count within the count area:</i>			
PEOPLE MOVING	<input type="text"/>	BOATS - AT ANCHOR	<input type="text"/>	JET SKI	<input type="text"/>
PEOPLE FISHING	<input type="text"/>	BOATS - MOVING	<input type="text"/>	ATV/MOTORCYCLE	<input type="text"/>
DOGS - OFF LEAD	<input type="text"/>	BOATS - WATERSKIING	<input type="text"/>	CARS/TRUCKS	<input type="text"/>
DOGS - ON LEAD	<input type="text"/>	BOATS - VERY LOUD/FAST	<input type="text"/>	OTHER (specify)	<input type="text"/>
NUMBER OF FLIGHTS CAUSED BY DISTURBANCE:		<input type="text"/>			

THREATS		<i>Add timing, scale and severity scores to obtain a total threat score for each threat type</i>				
	TIMING		SEVERITY		SCALE	TOTAL THREAT SCORES
	3 = Occurring now		3 = Will persist for >10 years		3 = >90% population decline	0-5 = Low threat
	2 = Likely to occur within 1-3 years		2 = Will persist for 3-10 years		2 = 50-90% population decline	6-7 = Medium threat
	1 = Likely to occur in >3 years		1 = Will persist for 0-3 years		1 = 10-49% population decline	8-9 = High threat
	0 = Not occurring, not likely to in future		0 = Will not persist		0 = 0-9 % population decline	
HABITAT LOSS	<input type="text"/>	+	<input type="text"/>	+	<input type="text"/>	= <input type="text"/>
HUMAN DISTURBANCE	<input type="text"/>	+	<input type="text"/>	+	<input type="text"/>	= <input type="text"/>
INVASIVE SPECIES	<input type="text"/>	+	<input type="text"/>	+	<input type="text"/>	= <input type="text"/>
POLLUTION	<input type="text"/>	+	<input type="text"/>	+	<input type="text"/>	= <input type="text"/>
WATER LEVEL	<input type="text"/>	+	<input type="text"/>	+	<input type="text"/>	= <input type="text"/>

HABITAT CHANGE		YES or NO	AREA AFFECTED BY HABITAT CHANGE: (area used by shorebirds only)	%
HAS HABITAT CHANGED SINCE LAST COUNT?:		<input type="text"/>	<input type="text"/>	<input type="text"/>
TYPE OF HABITAT CHANGE: (mark all that apply)		URBAN DEVELOPMENT (within 200m) <input type="radio"/>	RECLAMATION <input type="radio"/>	HARVESTING/FISHING <input type="radio"/>
FISH FARMING/AQUACULTURE <input type="radio"/>		CHANGE IN WATER LEVELS <input type="radio"/>	EROSION <input type="radio"/>	POLLUTION <input type="radio"/>
ENCROACHMENT FROM NATIVE VEGETATION <input type="radio"/>		INVASIVE SPECIES/INTRODUCED PESTS <input type="radio"/>	ALGAL BLOOMS <input type="radio"/>	

Count forms, count area maps, instructions at [www.shorebirds.org.au](http://www.shorebirds.org.au). Return form to Shorebirds 2020, Birds Australia, 60 Leicester Street, Carlton, Victoria, 3053. Ph (03) 9347 0757. Email: [shorebirds@birdsaustralia.com.au](mailto:shorebirds@birdsaustralia.com.au).  
Online data entry form at <http://data.shorebirds.org.au/>

**SHOREBIRDS**

**B**= breeding; please enter comments below

Enter 'P' for present in box where a species was present but not counted

**STONE-CURLEWS**

- Bush Stone-curlew
- Beach Stone-curlew

**OYSTERCATCHERS, STILTS**

- Aust. Pied Oystercatcher
- Sooty Oystercatcher
- Black-winged Stilt
- Red-necked Avocet
- Banded Stilt

**PLOVERS, DOTTERELS, LAPWINGS**

- Pacific Golden Plover
- Grey Plover
- Little Ringed Plover
- Red-capped Plover
- Double-banded Plover
- Lesser Sand Plover
- Greater Sand Plover
- Oriental Plover
- Black-fronted Dotterel
- Hooded Plover
- Red-kneed Dotterel
- Banded Lapwing
- Masked Lapwing

**JACANA, PAINTED SNIPE, SNIPE**

- Comb-crested Jacana
- Australian Painted Snipe
- Latham's Snipe
- Other *Gallinago* sp.

**GODWITS, CURLEWS, SANDPIPERS, ALLIES**

- Black-tailed Godwit
- Bar-tailed Godwit

Little Curlew

Whimbrel

Eastern Curlew

Terek Sandpiper

Common Sandpiper

Grey-tailed Tattler

Wandering Tattler

Common Greenshank

Marsh Sandpiper

Common Redshank

Wood Sandpiper

Ruddy Turnstone

Asian Dowitcher

Great Knot

Red Knot

Sanderling

Red-necked Stint

Long-toed Stint

Pectoral Sandpiper

Sharp-tailed Sandpiper

Curlew Sandpiper

Broad-billed Sandpiper

Ruff

Red-necked Phalarope

**PRATINCOLES**

Oriental Pratincole

- Australian Pratincole

**UNIDENTIFIED**

*Unident. small wader*

*Unident. med. wader*

*Unident. large wader*

**GEESE, DUCKS, SWANS, GREBES**

Magpie Goose

Plumed Whistling-duck

Musk Duck

Cape Barren Goose

Black Swan

Australian Shelduck

Australian Wood Duck

Pink-eared Duck

Australasian Shoveler

Grey Teal

Chestnut Teal

Northern Mallard

Pacific Black Duck

Hardhead

Blue-billed Duck

Australasian Grebe

Hoary-headed Grebe

Great Crested Grebe

**GANNETS, CORMORANTS**

Australasian Gannet

Australasian Darter

Little Pied Cormorant

Great Cormorant

Little Black Cormorant

Pied Cormorant

Black-faced Cormorant

**PELICAN, HERONS, ALLIES**

Australian Pelican

White-necked Heron

Eastern Great Egret

Intermediate Egret

Cattle Egret

White-faced Heron

Little Egret

Nankeen Night Heron

Glossy Ibis

Australian White Ibis

Straw-necked Ibis

Royal Spoonbill

Yellow-billed Spoonbill

Purple Swamphen

Dusky Moorhen

Eurasian Coot

**GULLS, TERNS**

Little Tern

Fairy Tern

Caspian Tern

Whiskered Tern

White-fronted Tern

Common Tern

Crested Tern

Pacific Gull

Kelp Gull

Silver Gull

**EXTRA BIRDS NOT LISTED ABOVE**

**TOTAL BIRDS**

Total shorebirds

Total other birds

**COMMENTS**

Enter comments, extra species counts, presence of dead birds, details of habitat change, disturbances and threats here. Attach additional pages if necessary.

YES or NO

WERE ALL VISIBLE  
SHOREBIRDS COUNTED?

YES or NO

WERE ALL WATER-  
BIRDS COUNTED?



**URS**

URS Australia Pty Ltd  
Level 16, 240 Queen Street  
Brisbane, QLD 4000  
GPO Box 302, QLD 4001  
Australia

T: 61 7 3243 2111

F: 61 7 3243 2199

[www.ap.urscorp.com](http://www.ap.urscorp.com)