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Gladstone Ports Corporation

Report for Western Basin Dredging and Disposal Project

Terrestrial Ecology Report

August 2009

INFRASTRUCTURE | MINING & INDUSTRY | DEFENCE | PROPERTY & BUILDINGS | ENVIRONMENT

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Executive Summary

This terrestrial ecology impact assessment has been prepared for Gladstone Ports Corporation (GPC) as a technical component of the Environmental Impact Statement (EIS) for the Western Basin Dredging and Disposal Project (the “Project”).

The Project seeks to accommodate the long term dredging and dredged material disposal that is required to provide safe and efficient access to the existing and proposed Port facilities in the harbour over the foreseeable future. Dredged material will be placed in a bunded reclamation which will create a land reserve to be used to service the new port facilities.

The proposed reclamation will be set back from the foreshore to assist with conveying overland flows and stormwater discharges from Queensland Energy Resources (QER) and Cement Australia. The width of this setback will be approximately 40 m from the seaward fringe of a mangrove community. The study area for the assessment includes the proposed Project footprint and the adjacent terrestrial environment.

This report details the ecological values of the study area through a combination of literature reviews and field surveys and identifies potential impacts and mitigation measures for terrestrial flora, fauna and sensitive areas.

The study area lies at the northern extent of the South East Queensland bioregion and eastern extent of the Brigalow Belt bioregion, both of which support a diverse range of flora and fauna.

The Regional Ecosystem (RE) mapping over the study area is generally correct and identifies nine REs (eight Not of Concern and one Endangered listed under the VM Act). The mapping of the endangered RE 12.3.3 (Queensland blue gum woodland to open-forest on broad alluvial plains) is incorrect. High quality regrowth for this RE type exists (i.e. vegetation in a non-remnant state), however other areas mapped as containing this RE actually contain RE 11.3.29 (VMA Status: Not of Concern).

The vegetation communities range from eucalypt woodland and open-forests communities to tidally influenced mudflats and mangroves. Condition assessments identified that the majority of the vegetation communities were in good condition. Seven fauna habitat types are represented in the study area and these generally correspond to the delineated vegetation communities. In general, the habitats identified within the study area provide a range of resources for fauna. Variation in the complexity of the vegetation strata provides for differences in habitat values. The woodland areas demonstrate increased complexity relative to the grasslands and are considered to support a greater number of fauna species. Disturbed areas, mainly the grassland habitats, exhibited reduced species richness though retain important foraging habitat values for a range of fauna species.

The intertidal and coastline habitats, such as those with tidal influences or estuarine vegetation complexes, provide a distinctly different fauna assemblage, as do the freshwater areas. The exposure to coastal processes (winds, saline water, tides and wave action) result in an ecotone between estuarine and inland habitats. This ecotone displays characteristics of both marine and terrestrial landscapes and is similarly expected to provide habitat for species common to both landscapes.

Desktop assessments indicated that 16 flora species of conservation significance occur or had the potential to occur within the study area. Of these 14 species are listed under the Queensland NC Act and seven listed under the EPBC Act. Fourteen of these species do not have their specific habitat requirements met in the study area and its immediate vicinity. Three species may possibly occur in the

study area: *Cycas megacarpa*, *Indigofera baileyi* (Bailey's indigo) and *Quassia bidwillii* (quassia). However, none of these species were recorded during the field investigation.

Based on desktop assessments and field surveys, 27 fauna species of conservation significance are considered likely to occur in the study area. The majority of these species are considered to inhabit the dryland terrestrial environment adjacent to the reclamation footprint. This area has potential for indirect impacts only. In addition, the reclamation footprint boundary includes marine tidal flats used for foraging and roosting by a number of EPBC Act-listed migratory shorebirds. Mudflats in the north of the study area are considered important habitat for shorebirds within the Gladstone region. A number of pest and weed species were also detected during the assessment.

Impacts and risks associated with the project to the terrestrial ecosystems are generally linked to the loss and potential degradation of marine plant communities and intertidal habitats. The change in coastal processes as a result of the reclamation is likely to reduce the extent and suitability of foraging habitat for shorebirds in the area. How shorebirds will respond to these changes is uncertain. For some shorebird species the predicted changes in hydrology may be beneficial, at least in the short term. For others (and perhaps the majority of species currently utilising habitat in this area) these changes are more likely to be detrimental. Impacts on the marine plant vegetation communities in the intertidal area may also occur as a result of changes in coastal processes. As a result, marine plant offsets will be negotiated in accordance with relevant legislation including the EPBC and Queensland Government offset policies.

In addition to expected offset requirements, mitigation measures proposed include: the use of low wattage, directional lighting, minimising construction of the northern bund wall during critical bird migratory periods, widening the retained channel entrance, establishing speed limits on access roads, installing rubbish disposal facilities and managing tailwater decant. Monitoring of marine plant and migratory shorebird communities should also be considered to allow for adaptive management of impacts during the construction and operation of the Project.

1. Introduction

1.1 Background

This terrestrial ecology impact assessment has been prepared for Gladstone Ports Corporation as a component of the Environmental Impact Statement (EIS) for the Western Basin Strategic Dredging and Disposal Project (the Project).

The Project seeks to accommodate the long term dredging and dredged material disposal that is required to provide safe and efficient access to the existing and proposed Port facilities in the harbour over the foreseeable future.

Two areas of development are required for the long-term strategic development of the Port:

- The Western Basin dredging and reclamation works are required for access to proposed wharf facilities located in the Western Basin area of the Port and for the disposal of dredged material; and
- The outer harbour works are associated with the duplication of channels to account for increased traffic through the port. This will be investigated at a later stage.

The proposed reclamation will provide both a dredged material disposal location and will also provide land adjacent to the wharves necessary for efficient loading and unloading of vessels and temporary storage of cargoes and products prior to transport to the Gladstone State Development Area (GSDA) or loading onto ships for export. The proximity of the Materials Transportation Corridor linking the Fisherman's Landing facility to the GSDA and the rail link from Cement Australia to the main North Coast Rail line makes the current Fisherman's Landing and proposed Western Basin development ideal for the transfer of product between the Port and the GSDA and the hinterland of Central Queensland.

The Project area is immediately adjacent to the existing Fisherman's Landing reclamation and proposed 153 ha Fisherman's Landing reclamation expansion (Figure 1-1). The development of the Western Basin will incorporate dredging associated with the deepening and widening of existing channels and swing basins, and the creation of new channels, swing basins and berth pockets. Dredged material will be placed in a bunded reclamation, which will create a land reserve to be used to service the new port facilities. The reclamation will have a capacity of approximately 55,000,000 m^3 of dredged material. To allow the reclamation to accommodate this volume of material, it is intended to shape the material into a 50 – 70 m high hill at the back of the reclamation.

The reclamation will be set back from the foreshore to assist with conveying overland flows and stormwater discharges from Queensland Energy Resources (QER) and Cement Australia. The width of this setback will be approximately 40 m from the seaward fringe of a mangrove community. It will be necessary to install a temporary at grade crossing through this channel for road access during the construction of the bund walls.

During filling of the reclamation, a series of decant ponds will be constructed internal to the outer bund wall to allow the fine material to settle from the tailwaters. Initially, the final decant pond will be in the north-eastern corner of the reclamation, moving to the north-western corner as the reclamation is filled over time. The final decant pond will also capture stormwater discharges. Once the reclamation is completed, the final decant pond will be maintained and all stormwater discharges will be directed to this point.

This report provides a description of the ecological values of the study area and identifies potential impacts and mitigation measures for terrestrial flora, fauna and sensitive areas. Given this focus, the reclamation footprint and associated processes are of core interest to this assessment. The study area for the assessment includes the terrestrial ecosystems adjacent to the proposed Project location. Figure 1-1 shows the proposed reclamation footprint and investigation area.

Plate 1-1 Proposed Project Location

LEGEND

- Terrestrial Flora and Fauna Study Area Boundary
- Western Basin Reclamation Area
- Fishermans Landing Northern Expansion
- Parcel Boundary
- Road
- Easement

1:50,000 (at A4)

0 250 500 750 1,000

Metres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 56

N

Port of Gladstone
Western Basin Dredging and Disposal Project

Study Area

Job Number	42-15386
Revision	A
Date	16 Sept 2009

Figure 1-1

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1.2 Purpose and Scope of this Report

This report provides a description of the ecological values of the study area, and identifies potential impacts and mitigation measures for terrestrial flora and fauna, and sensitive areas. To appropriately identify, describe and assess the potential impacts of the Project at regional, state and local scales the ecological assessment investigated both the Project footprint as well as a broader study area.

The specific objectives of the terrestrial ecological assessments were as follows. The specific aspects of each to be considered are summarised in Table 1-1.

- Describe the existing environmental values for nature conservation that may be affected by the Project;
- Describe and map terrestrial vegetation;
- Describe terrestrial fauna present or likely to be present in the area;
- Identify and discuss issues relevant to sensitive areas;
- Identify, assess and discuss direct and indirect impacts of the Project on terrestrial flora, fauna and sensitive areas; and
- Outline strategies and management recommendations to mitigate potential impacts identified.

Table 1-1 Assessment Objectives

Objective	Key Components Considered
Describe the existing environmental values for nature conservation that may be affected by the Project	◗ integrity of ecological processes, including habitats of rare and threatened species; ◗ conservation of resources; ◗ biological diversity, including habitats of rare and threatened species; ◗ integrity of landscapes and places including wilderness and similar natural places; ◗ terrestrial ecosystems; and ◗ coastal values identified in *State of the Coastal Zone R*eports and environmental values as defined by the *Environmental Protection Act 1994* and environmental protection policies.
Describe and map terrestrial vegetation	◗ location, extent, biodiversity status and conservation status of vegetation types using the Department of Environment and Resource Management (DERM) Regional Ecosystem (RE) descriptions in accordance with the Queensland Herbarium (2003), Regional Ecosystems Description Database (Version 4.2, March 2005) and The Conservation Status of Queensland's Bioregional Ecosystems (Sattler & Williams, 1999) or other more recent updates; ◗ location of vegetation types of conservation significance based on DERM's RE descriptions and occurrence of species listed as protected plants under the Nature Conservation (Wildlife) Regulation 2006 and subsequent amendments, as well as areas subject to the Vegetation Management Act 1999 (VM Act);

Objective	Key Components Considered
	◗ the current extent (bioregional and catchment) of protected vegetation types of conservation significance within the protected areas such as the National Reserve System and other protected areas under the Nature Conservation Act 1992 (NC Act) (e.g. national parks, conservation parks, resource reserves, nature refuges etc.); ◗ the distribution and abundance of significant exotic and weed species; and ◗ any plant communities of cultural, commercial or recreational significance.
Describe terrestrial fauna present or likely to be present in the area	◗ species diversity (i.e. a species list) and relative abundance of animals, including birds, reptiles and mammals (including bats); ◗ any species which are poorly known but suspected of being rare or threatened; ◗ habitat requirements and sensitivity to changes; including movement corridors and barriers to movement; ◗ existence of any rare, threatened or otherwise noteworthy species/communities in the study area, including discussion of range, habitat, breeding, recruitment, feeding and movement requirements, and current level of protection (e.g. any requirements of protected area management plans); ◗ use of the area by migratory birds, nomadic birds, fish and terrestrial fauna; and ◗ the existence of feral or exotic animals with reference to the Land Protection (Pest and Stock Route Management) Regulation 2003.
Identify and discuss issues relevant to sensitive areas with respect to flora and fauna	◗ important habitats of species listed under the NC Act and/or Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) as presumed extinct, critically endangered, endangered, vulnerable or rare; ◗ REs recognised by DERM as ‘endangered’ or ‘of concern’ or ‘not of concern’ but where permits are no longer granted due to being at threshold levels, and/or ecosystems listed as ‘presumed extinct’, ‘critically endangered’ ‘ endangered’ or ‘vulnerable’ under the EPBC Act; ◗ ecosystems that provide important ecological functions, such as riparian vegetation, important buffer to a protected area, refugia or important habitat corridor between areas; and ◗ protected areas which have been proclaimed under the NC Act or are under consideration for proclamation.
Outline strategies and management recommendations to mitigate potential impacts identified	

2. Methodology

2.1 Overview

A combination of literature reviews and field surveys were conducted to describe the existing environmental values of the study area. A literature review, or desktop assessment, was conducted to identify species and communities supported within the study area and to identify any conservation significant flora and fauna species that have been historically recorded or are predicted to occur within the local area. Species of conservation significance are considered to be those listed as near threatened, rare, vulnerable, endangered, critically endangered, extinct in the wild or extinct under either the NC Act or the EPBC Act. The literature review involved a review of relevant scientific and grey literature, database searches and previously prepared technical reports.

Using the background information, field surveys were undertaken to verify the presence, and provide site specific descriptions of REs, vegetation communities, habitats and species. The field surveys were conducted between 22nd and 26th June 2009 and involved systemic, non-systemic and targeted flora and fauna surveys.

The terrestrial flora field survey aimed to verify the certified RE mapping, identify and map vegetation communities, and document the species present in the study area. In particular, surveys targeted habitats in which species of conservation significance were likely to be present. They involved conducting detailed secondary level assessments of the main vegetation communities present, and ground truthing RE mapping using quaternary assessment techniques. Vegetation and flora assessment were conducted using the Queensland Herbarium CORVEG methodology as detailed in Neldner et al. (2005).

In conjunction, the fauna surveys were conducted to identify terrestrial fauna habitats and communities of amphibians, reptiles, mammals and birds within the study area. The survey methods adopted for the terrestrial fauna assessment comprised habitat assessments, systematic surveys (Elliott traps, hair traps, funnel traps and Anabat™ bat detectors) and non-systematic surveys (spotlighting and active searches for herpetofauna). Surveys targeting the key listed fauna groups/species (microchiropteran bats, migratory and marine birds and *Xeromys myoides* (water mouse)) were also conducted.

Ecologically sensitive areas protected under Commonwealth and State legislations were identified and the likely occurrence of conservation significant flora and fauna species was assessed based on the presence of suitable habitat, previous recordings and results of the field investigations.

A risk rating matrix was used to assess the magnitude of impacts that may result from this project. Risks were assessed before and after mitigation and were rated by considering the likelihood of occurrence and relative severity of the resulting consequence.

2.2 Desktop Review

Prior to the commencement of field surveys, a literature review of existing information on the environment within the study area was undertaken to identify any listed flora and fauna species that have been historically recorded or have potential to occur within the local area. This review included a review of relevant scientific and grey literature, database searches and previously prepared technical reports. Specifically, the literature review included searches of:

- The Australian Government Department of Environment Water Heritage and the Arts (DEWHA) Environmental Reporting Tool (ERT) to identify species (and/or their habitat) listed under the Commonwealth EPBC Act that are predicted to occur within the study area and to identify invasive flora and fauna species of national significance. The search area was defined as a point (-23° 46' 11.9994"S, 151° 08' 30.8394"E) with a 5 km buffer;
- DERM's Wildlife Online database to identify flora and fauna species that have been historically recorded in or surrounding the study area, including threatened species list under the Queensland NC Act. Records were returned for a search area within a 5 km radius of the study area (23° 46' 11.9994"S, 151° 08' 30.8394"E) except where otherwise mentioned;
- Queensland Herbarium's (DERM) HERBRECS specimen database to identify any flora species previously collected from within the study area (search area);
- DERM's RE and Essential Habitat mapping (Version 5.0, 2005) to determine the type and extent of remnant vegetation as well as areas recognised as Essential Habitat within the study area;
- DERM's on-line Moratorium mapping facility to determine if the study area contains regrowth vegetation protected under the *Vegetation Management (Regrowth Clearing Moratorium) Act 2009*;
- Queensland Museum's specimen database to obtain a record of terrestrial vertebrates previously recorded in the study area. Data is stored for discrete regions on the Queensland Museum database, and as such, one "search rectangle" encompassing the study area and surrounds was queried for fauna species records. The coordinates of the search rectangle were: 23° 44'S 151° 08'E and 23° 48'S 151° 12'E;
- The Birds Australia Atlas database. This database lists all bird species previously recorded from the study area during official Birds Australia censuses. Records were returned for a search area within a 20 km radius of the study area (-23° 46' 11.9994"S, 151° 08' 30.8394"E);
- Threatened species profiles and field guides; and
- Previous studies and reports conducted in the region including:
- Gladstone Liquefied Natural Gas (GLNG) Project Environmental Impact Assessment. Prepared for Santos Ltd by URS March 2009;
- Fisherman's Landing Northern Expansion Environmental Impact Statement. Prepared for Gladstone Ports Corporation by GHD, June 2009. Including Rock Quarry Site: Flora and Fauna Investigation, Technical Report, October 2008;
- Wiggins Island Coal Terminal Environmental Impact Statement: Chapter 15 Terrestrial Flora and Fauna. Prepared for Central Queensland Ports Authority and Queensland Rail by ConnellHatch November 2006, Supp July 2007;
- Environmental Studies Literature Review and Gap Analysis Inner Harbour Dredging and Reclamation EIS. Report prepared by Gladstone Ports Corporation, 28 January 2009;
- Curtis Island Water Mouse, Powerful Owl and Wading Bird Investigation. Report prepared for URS Australia by Biodiversity Assessment and Management Pty Ltd. Gladstone LNG Plant and Pipeline, Curtis Island; and
- EPA mapping of key shorebird and sea turtle habitat areas within the Gladstone region.

The results of the desktop assessments are provided in Appendix A.

2.3 Field Surveys

Field surveys were conducted to identify species and communities supported within the study area and verify the likely occurrence of EPBC Act and NC Act listed flora and fauna species considered to have the potential to occur in the study area. The field surveys were conducted between the 22nd and 26th of June 2009 and involved systemic, non-systemic and targeted flora and fauna surveys.

2.3.1 Climatic Conditions

Conditions during the field survey were generally mild and dry. Temperature ranged between 14.7 and 27.9°C with an average minimum and maximum temperature of 15.66 and 25.62°C, respectively. Days were generally clear and sunny with moderate relative humidity (average 62.6% recorded at 3:00 pm). Rainfall recorded during the field surveys was highest on 22nd June (7.2 mm), with 0.2 mm/day recorded between the 23rd and 26th of June. No rainfall was recorded in the two week period prior to the field survey while a total of 94.8 mm was recorded in the previous three months. Wind speed during the surveys was generally low in the mornings (5 km/h) increasing to 10-15 km/h in the afternoons (3:00 pm).

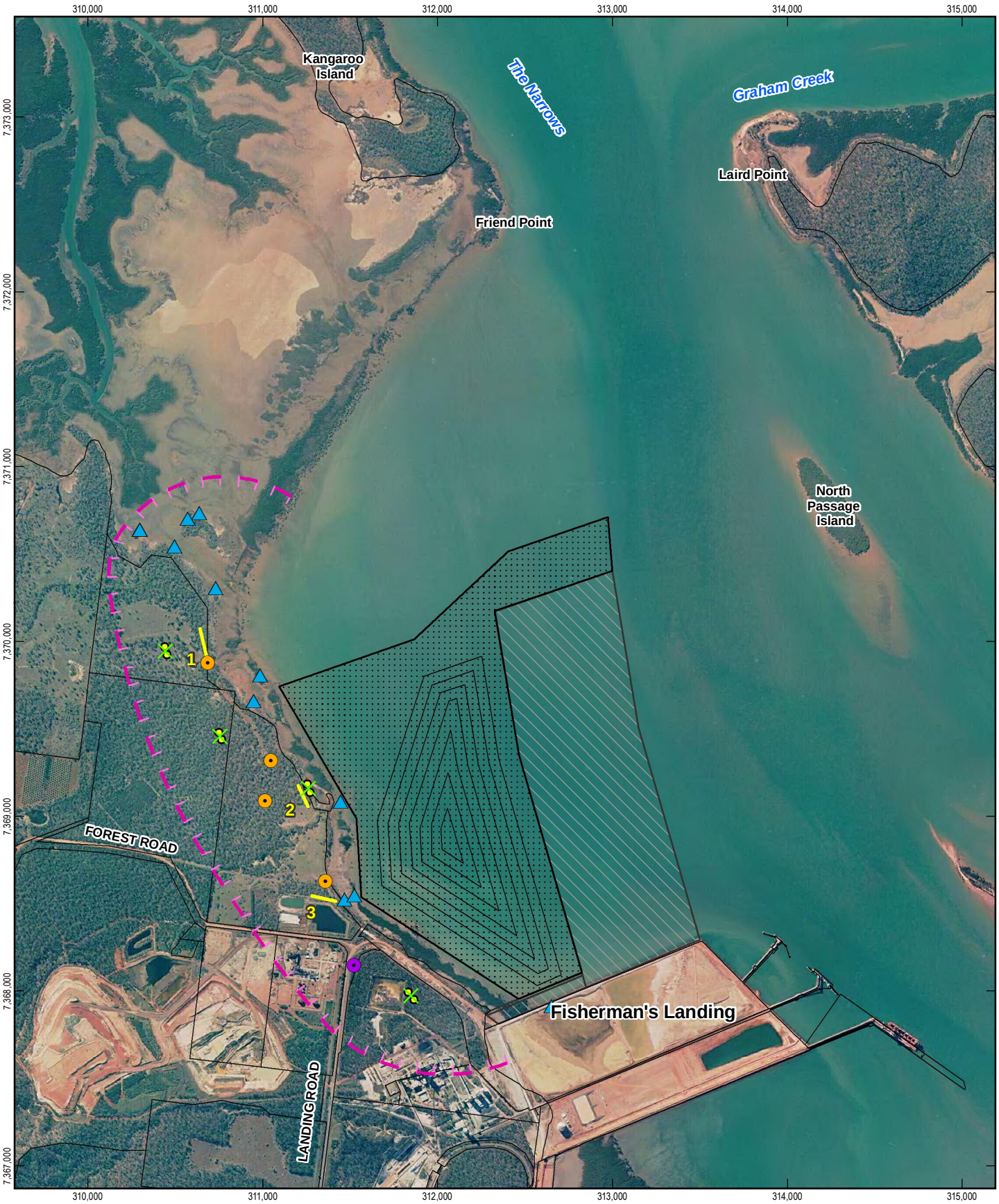
All climatic data has been sourced from the Australian Bureau of Meteorology, recorded at the Gladstone weather station (039123).

2.3.2 Flora Survey Techniques

The main objectives of this survey were to document the flora species and vegetation communities present in the study area, the landforms on which they occurred, the condition of the vegetation and the level of incursion of exotic pest plants. Initially, the study area was traversed by vehicle and foot so as to gain an appreciation of the vegetation communities present and their spatial characteristics. CORVEG quaternary level survey techniques (as described in Neldner et al. 2005) were used to identify trends and changes in the vegetation communities present.

A CORVEG secondary site assessment was then undertaken in each major vegetation community type (a total of four sites). This involves the detailed description of a 500 m^2 area (50 x 10 m), including observations on the abundance of each species present and the condition of the vegetation including the presence of weeds. The location of these transects is shown in Figure 2-1. Condition was determined using the Vegetation Assets, States and Transitions (VAST) methodology (Thackway and Leslie 2005). The spatial extent of vegetation communities was then mapped using ground traverses and aerial photo interpretation.

Desktop review of available information on species of conservation significance listed for this area were conducted. The results indicated that the main habitat type for rare and threatened species in the Gladstone region is dry rainforest/semi-evergreen vine thicket. This habitat type was to be targeted for detailed searches to determine if any species of conservation significance are present in the project area. However, this habitat type was not present in the project area. Riparian sclerophyll vegetation in association with watercourses and waterbodies was recorded as potential habitat for *Quassia bidwillii* (quassia). Searches were conducted in suitable habitat for this species.



LEGEND

Survey Locations
- Anabat
- Additional Hairtubes
- Bird Census Location

- Field Assessment Area of Interest
- Fauna trapping transect
- Flora transect

- Western Basin Reclamation Footprint
- Cadastre
- Fishermans Landing Northern Expansion

1:30,000 (at A4)

0 250 500 750 1,000

Metres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 56

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Port of Gladstone
Western Basin Dredging and Disposal Project

Terrestrial Flora and Fauna Survey Locations

Job Number	42-15386
Revision	A
Date	16 Sept 2009

Figure 2-1

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2.3.3 Fauna Survey Techniques

In accordance with DERM's Draft Flora and Fauna Survey Methodology guidelines, fauna surveys were conducted over five days. Survey techniques combined the following to assess the faunal values of the study area along with the potential for conservation significant species:

Habitat assessment of the study area;

Systematic techniques (trapping transects and timed searches); and

Non-systematic techniques (diurnal searches ad opportunistic records).

Habitat Assessments

Habitat assessments were conducted to determine the extent and types of fauna habitats represented in the study area. Habitat assessments were undertaken at each survey site and at additional sites throughout the study area. The following parameters were considered during the habitat assessments:

- Structural complexity of vegetation (i.e. tree density, canopy cover, vertical structural complexity, ground cover, leaf litter);
- Complexity of ground-level microhabitats (i.e. substrate type, vegetation cover, leaf litter, woody debris, presence of rocks);
- Habitat resources (i.e. hollows, fallen logs, rock outcrops, nests, waterbodies);
- Presence of habitat trees and the proportion that contained scratches;
- Sources of disturbance (i.e. adjacent land-use, feral animal evidence, predation, weed infestation);
- Species opportunistically recorded; and
- Wider landscape features (movement corridors, barriers etc).

Systematic Surveys

Three fauna trapping sites were chosen following a review of aerial photography, RE mapping and a reconnaissance of the study area. These sites were selected to ensure fauna trapping sites:

- Were representative of major fauna habitats within the study area;
- Covered the geographical range of habitats;
- Corresponded with potential impact area; and
- Were accessible by vehicle (to maximise survey effort without compromising animal welfare).

The systematic survey comprised a variety of trap types used to target the fauna groups identified in desktop assessments.

Systematic methods were employed to provide an overall catalogue of the presence, distribution and abundance of amphibians, birds, reptiles and mammals, while the non-systematic searches focussed on opportunistic recordings of species, with particular attention on listed fauna. Surveys targeting the key listed fauna groups/species (microchiropteran bats, migratory and marine birds and *Xeromys myoides* (water mouse)) were also conducted. Liaison with DERM prior to field assessment determined the approaches to be adopted. A summary of survey techniques employed at each survey site is provided in Table 2-1 and locations of trapping sites are shown in Figure 2-1.

Table 2-1 Summary of Fauna Survey Techniques and Locations

Habitat	Site Number	Systematic					Non-systematic	
		Funnel Line	Elliot Trap	Hair Tube	Bird Survey	Anabat	Day	Night
Mixed open woodland with grassy understorey	1/2/3	□	□	□	□	□	□	□
Mixed open woodland with vine understorey							□	
Intertidal zone	1	□	□	□	□	□	□	□
Estuarine inlet					□	□	□	□
Grassland	2	□	□	□	□		□	□
Freshwater dam					□	□	□	□
Freshwater creek with riparian zone					□		□	□

Terrestrial Amphibians, Reptiles and Mammals

Trapping for terrestrial amphibians, reptiles and mammals was undertaken using a combination of Elliot traps, funnel traps and hair tubes. At each site, traps were set in a single linear transect (approximately 200 m in length) consisted of 20 Elliot traps and five hair tubes. Four funnel and drift fence complexes (Plate 2-1) were placed in areas with suitable microhabitat adjacent to the transect. Traps were set and checked each morning for four consecutive nights. The trap configuration comprised:

- Funnel traps and drift fence: each funnel trap complex consisted of a 6 m long (30 cm high) flywire drift fence intersected with two funnel traps Plate 2-1. Funnel traps were shaded with vegetation and wet sponges placed within each trap to prevent fauna dehydration. Eight funnel traps were established at each site;
- Elliot traps: twenty Elliot traps baited with universal bait (a mixture of peanut butter, rolled oats and honey) were set at each site. Traps were placed in shady areas or covered with vegetation to minimise heat exposure to animals;
- Hair tubes: five hair tubes were placed at each site and baited with universal bait. The hair tubes were fixed onto tree trunks to specifically target arboreal mammals.

Plate 2-1 Layout of funnel traps with drift fence

Microchiropteran Bats

Anabat™ II bat detectors were used to survey microchiropteran (insectivorous) bats by recording their echolocation calls. Detectors were placed on the ground with the microphone orientated upwards at a 45° angle from the ground. Anabat units were placed in potential bat 'flyways' just before dusk and left to record calls overnight. Anabat units were set at each site for two nights. All bat calls recorded were sent to a qualified bat-call analyst (Greg Ford) for identification. Only bat calls with definite (one or more calls where absolutely no doubt exists on the species recorded) or probable (most likely the species named, low probability of confusion with species that use similar calls) were included in results.

Birds

The ecological value of the site for migratory wetland and shorebird species was assessed on the basis of existing information (i.e. from database and literature searches) and surveys of marine tidal wetlands and adjacent habitat within the study area. Marine tidal flats within the study area were surveyed at high and low tide using binoculars and a tripod-mounted spotting scope (16 - 48x magnification). Birds were counted along transects through the upper intertidal zone and at census points on tidal flats in the east of the study area. A total of 7.5 person hours were spent surveying birds in this part of the study area. Use of the reclamation area south of the study area as a high tide roost was also investigated during surveys with birds counted from census points around the perimeter of reclamation paddocks. The location of transect and census point counts are illustrated in Figure 2-1.

In addition to the migratory and shorebird surveys, opportunistic bird observations were conducted at each of the systematic survey sites and a number of other locations throughout the study area (including a freshwater creek and dams).

Non-systematic Surveys

All opportunistic observations of terrestrial vertebrates or signs of their presence (i.e. scats, tracks, diggings, nests or dreys, feathers, bones, pellets) were recorded while conducting activities in the study area. Opportunistic observations increased the likelihood of detecting rare or threatened species, which have unique habitat requirements and may not be captured/detected using systematic techniques.

Non-systematic sampling was undertaken at each of the systematic sites noted above and comprised the following:

- Diurnal searching – two person hours were expended at each systematic site searching for all amphibians, reptiles, birds and mammals. Surveys comprised searching the ground layer (overturning logs and leaf litter) and low vegetation (under bark and in tree stumps) and recording all individuals observed. Species presence was also determined via secondary evidence, in the form of scats, tracks, burrows and remains; and
- Nocturnal searching – two person hours were expended at each systematic site as well as other areas within the study area, using a combination of high-powered spotlights and head torches. Effort was made during nocturnal searches to detect the presence of listed threatened species that may inhabit the study area or adjacent land.

Targeted Surveys for Fauna of Conservation Significant and Migratory Species

The literature review indicated the occurrence or potential occurrence of 27 threatened fauna species within the study area. The primary target fauna groups/species identified include microchiropteran bats and *Xeromys myoides* (water mouse). A number of migratory and/or marine bird species were also identified to potentially utilise the study area for foraging, roosting and/or breeding.

Microchiropteran Bats – the presence of microchiropteran bats within the study area was assessed via Anabat II bat detectors. See systematic survey methodology above for a complete description of the methods.

***Xeromys myoides* (water mouse)** - tidal flats and adjacent habitat in the east of the study area were surveyed at low tide for signs of *Xeromys myoides* (water mouse). Potential water mouse habitat within the upper intertidal zone was searched for prey remains (disarticulated graspid crab remains in middens); termitaria-like nest mounds amongst mangroves and adjoining salt marsh; mud ramps and slurry trails incorporating crab remains at the base of living and dead mangroves; burrows within earth banks and rock walls near or adjacent mangroves; and tracks in wet mud. Survey effort was concentrated in intertidal areas with low *Ceriops tagal*/*Avicennia marina* mangrove forest, low *Ceriops tagal* mangrove woodland, and salt marsh and grassland habitat adjoining mangrove areas. A total of 5.83 person hours where expended across three intertidal areas within the study area.

Migratory and/or Marine Birds – in order to determine the presence of migratory and/or marine bird species within the study area, transect and census point surveys were undertaken. Additionally, an assessment was undertaken to determine the suitability of the study area to support these species and the importance of habitats for breeding and/or roosting. See systematic survey methodology above for a complete description of the methods.

Targeted field survey methodology adopted for each potential listed species is provided in Table 2-2.

Table 2-2 Targeted Survey Methodology for Conservation Significant Species

Species	NC Act status	EPBC status	Survey Technique
Reptiles			
Crocodylus porosus saltwater crocodile	V	MI/MA	Targeted spotlighting searches in estuaries, mangroves and mud flats.
Egernia rugosa yakka skink	V	V	Elliot and funnel trapping. Targeted surveys for scat piles and individuals in woodland habitat.
Paradelma orientalis brigalow scaly-foot	V	V	Elliot and funnel trapping. Opportunistic herpetofauna searches.
Varanus semiremex rusty monitor	R	-	Elliot and funnel trapping. Targeted surveys of mangroves and margins of freshwater creeks.
Mammals			
Chalinolobus dwyeri large-eared pied bat	R	V	Anabat recording throughout the study area.
Chalinolobus picatus little pied bat	R	-	Anabat recording throughout the study area.
Dasyurus hallucatus northern quoll	-	E	Elliot trapping, spotlighting, diurnal scat searches in open woodland habitat.
Pteropus poliocephalus grey-headed flying fox	-	V	Targeted nocturnal searches of suitable foraging habitats with blossoms.
Taphozous australis coastal sheathtail bat	V	-	Anabat recording throughout the study area.
Xeromys myoides water mouse	V	V	Targeted searches of upper intertidal zone for water mouse mounds/burrows, feeding middens, tracks and scats.
Birds			
Accipiter novaehollandiae grey goshawk	R	-	Surveys of freshwater and woodland habitat (including low mangrove forest on tidal flats in the east of the study area).
Calyptorhynchus lathami glossy black-cockatoo	V	-	Ground searches for chewed cones beneath casuarina trees. Surveys of woodland areas.
Ephippiorhynchus australis black-necked stork	R	-	Surveys of freshwater dams and saline flats within the study area.
Epthianura crocea macgregori yellow chat - Dawson subspecies	E	CE	Surveys of the intertidal zone habitat in the north-east of the study area.
Esacus magnirostris beach stone-curlew	V	MA	Surveys of marine tidal flats and adjacent habitat in the east of the study area.
Erythrotriorchis radiatus red goshawk	E	V	Targeted surveys of woodland habitat for individuals and nesting sites.

Species	NC Act status	EPBC status	Survey Technique
Geophaps scripta scripta squatter pigeon (southern)	V	V	Targeted surveys of woodlands, grasslands, freshwater creeks and dams.
Haematopus fuliginosus sooty oystercatcher	R	-	Surveys of marine tidal flats in the east of the study area and reclamation paddocks adjacent the study area.
Lophoictinia isura square-tailed kite	R	-	Targeted surveys of woodland and grassland habitats.
Macronectes giganteus southern giant- petrel	E	E/MI/MA	Targeted surveys of open water areas adjacent to study area.
Melithreptus gularis black-chinned honeyeater	R	-	Targeted surveys of woodland habitat near freshwater creeks and dams.
Nettapus coromandelianus cotton pygmy-goose	R	MA	Targeted surveys of the freshwater dams.
Ninox strenua powerful owl	V	-	Targeted surveys of the woodland and freshwater creek habitats.
Numenius madagascariensis eastern curlew	R	MI/MA	Targeted surveys of estuaries and tidal mudflats.
Pterodroma neglecta neglecta Kermadec petrel (western)	-	V	Targeted surveys of open water areas adjacent to study area.
Rallus pectoralis pectoralis Lewin's rail	R	-	Targeted surveys of the freshwater creeks and drainage lines.
Rostratula australis Australian painted snipe	-	V/MI/MA	Targeted surveys of freshwater creeks.
Sternula albifrons little tern	E	MI/MA	Surveys of marine tidal flats in the east of the study area and reclamation paddocks adjacent the study area.
Tadorna radjah Radjah shelduck	R	MA	Targeted surveys of the freshwater dams.
Turnix melanogaster black-breasted button-quail	V	V	Targeted searches of woodland habitat for individuals and foraging depressions.

NC Act Status: E = Endangered; V = Vulnerable; R = Rare. EPBC status: E = Endangered; V = Vulnerable; MI = Migratory; MA = Marine.

Nomenclature

Scientific and common names for terrestrial flora and fauna are consistent with those used in the following sources:

- Census of the Queensland Flora 2007 (Bostock and Holland, 2007) and botanical binomials presently accepted by the Queensland Herbarium, DERM;
- Handbook of Australian, New Zealand and Antarctic Birds (HANZAB) Book Series (Oxford University Press);
- Field Guide to Mammals of Australia (Menkhorst and Knight, 2001);

- A Field Guide to Reptiles of Queensland (Wilson, 2005);
- A Complete Guide to Reptiles of Australia (Wilson and Swan, 2008); and
- A Field Guide to Australian Frogs (Barker and Grigg, 1995).

Permits

The terrestrial fauna surveys were conducted under Section 52 of the Queensland *Animal Care and Protection Act 2001* (Scientific Purposes Permit – WISP-02740805, Registration No. 132) and supported by the DEEDI animal ethics committee (formally Department of Primary Industries and Fisheries) (CA 2006/11/159).

Limitations to Study

Surveys were conducted during June. It is acknowledged that June is not the optimal survey period for some fauna groups, in particular bird species that may be listed on migratory bird agreements.

The migratory and wader bird values of the site were assessed using a combination of habitat assessment and existing information. Collation and analysis of existing and regional information on bird distributions was undertaken.

2.4 Impact and Risk Assessment

A risk-rating matrix was used to assess the magnitude of impacts that may result from this project. Risks were assessed before and after mitigation and were rated by considering the likelihood of occurrence and relative severity of the resulting consequence. The risk rating methodology is outlined in Appendix B.

3. Results

3.1 Overview

The study area and Gladstone region falls within the northern extent of the South East Queensland bioregion (SEQ) and the eastern extent of the Brigalow Belt bioregion (BRB). Both bioregions support a diverse range of flora and fauna including a number of rare and threatened species and communities. The interaction with the coastal environment, as experienced at the Project site, provides for an environment with dynamic and complex ecosystems.

The Great Barrier Reef World Heritage area, a dugong protection area and wetlands of national importance are represented within local area in conjunction with a number of industrial and port developments. These important habitats provide for marine plant communities as well as migratory birds, with important terrestrial habitats adjacent.

3.2 Regional and Local Environmental Values

3.2.1 Bioregions and Subregions

The project area is located at northern extremity of the SEQ, with a small part of the western extremity located in the BRB. Within SEQ, the study area is located in the Burnett-Curtis Hills and Ranges subregion (SEQ 10). This subregion consists of hills and ranges of granite and metamorphic rock in the eastern, coastal section, and low, gently sloping hills of ancient sedimentary rock in the west (Sattler and Williams 1999). It includes 'islands' of high species diversity such as Mount Larcom (located just four kilometres to the west of the study area) and Kroombit Tops. Characteristic vegetation communities include *Corymbia citriodora* (lemon-scented gum) woodland/open forest, *Eucalyptus crebra* (narrow-leaved ironbark) woodland on hills and lowlands with skeletal soils derived from metamorphic rock and *E. tereticornis* (Queensland blue gum) open forest/woodland on broad alluvial plains (Sattler and Williams 1999).

Within the BRB the project area is located in the Marlborough Plains subregion (BRB 14). This subregion is characterised by large areas of low relief with a complex geological history that includes bedrock of sedimentary and igneous origins formed over a number of geological periods. The vegetation in this subregion ranges from broad alluvial plains covered in woodland of *E. platyphylla* (poplar gum), *C. dallachiana* (ghost gum) and *E. tereticornis* (Queensland blue gum) to low rises with woodland of *E. crebra* (narrow-leaved ironbark). This subregion also contains large areas of salt marsh and mangrove shrubland.

Along the bioregional boundary it is not uncommon to encounter outlying REs of the neighbouring bioregion on the certified RE maps. Where a vegetation community mapped as an RE in a particular bioregion has areas greater than 1, 000 ha located outside the bioregion, or where there are numerous occurrences located within 50 km of the bioregion boundary, and the vegetation does not match any RE description in the neighbouring bioregion, the Queensland Herbarium will map an outlier (Neldner et al. 2005). A number of outliers are present within the project area.

3.2.2 Regional Ecosystems

There are nine REs mapped over the land immediately adjacent to the Project site (see Figure 3-1). These REs are summarised in Table 3-1. Five are BRB REs and four belong to SEQ. In addition, much of the study area is mapped as non-remnant vegetation, comprising cleared open country, dams and roads. These REs and the vegetation communities in which they occur are discussed below. One RE not mapped within the study area is also included, RE 12.3.6 (VMA Status: Not of Concern). This RE is discussed later in the report.

Table 3-1 Regional Ecosystems within the Study Area

RE	VMA status	Biodiversity status	Land form	Short description	Long description and comments
11.1.2	NoC	NCaP	Occurs on supratidal flats with deep saline clay soils and formed from Quaternary estuarine sediments. Occurs along the landward edge of the intertidal zone in a hypersaline environment that is only inundated by the highest spring tides. Soils are grey mottled clays with a crusting surface, and are highly saline.	Samphire forbland on marine clay plains	Samphire forbland or bare mud-flats on Quaternary estuarine deposits. Mainly saltpans and mudflats with clumps of saltbush including one or several of the following species; *Halosarcia* spp. (e.g. *Halosarcia indica* subsp. *julacea, Halosarcia indica* subsp. *leiostachya*), *Sesuvium portulacastrum, Sarcocornia quinqueflora* subsp. *quinqueflora, Suaeda australis, S. arbusculoides, Tecticornia australasica, Salsola kali*, algal crusts and the grass *Sporobolus virginicus*. Sedges are also common. Major vegetation communities include: 11.1.2a: Bare mud flats on Quaternary estuarine deposits, with very isolated individual stunted mangroves such as *Avicennia marina* and/or *Ceriops tagal*. 11.1.2b: Samphire forbland on Quaternary estuarine deposits. Mainly saltpans and mudflats with clumps of saltbush including one or several of the following species; *Halosarcia* spp. (e.g. *Halosarcia indica* subsp. *julacea, Halosarcia indica* subsp. *leiostachya*), *Sesuvium portulacastrum, Sarcocornia quinqueflora* subsp. *quinqueflora, Suaeda australis, S. arbusculoides, Tecticornia australasica, Scleria ciliaris, Marsilea mutica, Salsola kali*, algal crusts and the grass *Sporobolus virginicus*.

RE	VMA status	Biodiversity status	Land form	Short description	Long description and comments
11.1.4	NoC	NCaP	Occurs on intertidal flats which are often dissected by tidal streams. Soils are usually deep saline clays.	Mangrove forest/woodland on marine clay plains	Mangrove low forest on Quaternary estuarine deposits. Low open-shrubland to closed forest of mangrove species forming a variety of associations, depending on position in relation to salt water inundation. *Avicennia marina* is the most common dominant but also other trees such as *Aegiceras corniculatum, Rhizophora* spp. and *Ceriops tagal* dominate often in pure stands. There is often a shrub layer consisting of juvenile plants of the above species. Other species such as *Excoecaria agallocha, Bruguiera* spp., *Lumnitzera racemosa* and *Alchornea ilicifolia* may also occur. Major vegetation communities include: 11.1.4a: *Rhizophora* spp. open-forest on Quaternary estuarine deposits 11.1.4b: *Avicennia marina* low open-shrubland to closed forest on Quaternary estuarine deposits 11.1.4c: *Ceriops tagal* +/- *Avicennia marina* open forest on Quaternary estuarine deposits 11.1.4d: Dominated by a range of species from genera such as from *Avicennia* sp., *Ceriops* sp., *Rhizophora* sp. and *Bruguiera* sp. which form a closed forest 11.1.4e: *Avicennia marina* usually dominates the canopy which forms an open-forest although may vary from a low open-forest to a woodland or shrubland

RE	VMA status	Biodiversity status	Land form	Short description	Long description and comments
11.3.29	NoC	NCaP	Occurs on broad plains and fans formed from Quaternary alluvium. Usually associated with bleached sodic duplex soils.	*Eucalyptus crebra, E. exserta, Melaleuca* spp. woodland on alluvial plains	*Eucalyptus crebra, E. exserta, Corymbia dallachiana, C. intermedia* woodland usually with a low tree understorey of *Melaleuca viridiflora* and *M. nervosa*. Major vegetation communities include: 11.3.29a: *Eucalyptus crebra* + *Corymbia dallachiana* ± *C. erythrophloia, E. moluccana* woodland.
11.5.8	NoC	NCaP	Occurs on gently undulating plains and rises formed from unconsolidated course and medium textured Cainozoic sediments. Associated soils are yellow and brown duplex or yellow and red gradational.	*Melaleuca* spp., *Eucalyptus crebra, Corymbia intermedia* woodland on Cainozoic sand plains/remnant surfaces	Mosaic of *Melaleuca viridiflora* and/or *M. nervosa* woodland and *Eucalyptus crebra, Corymbia intermedia, E. latisinensis* and *Lophostemon suaveolens* woodland. Major vegetation communities include: 11.5.8a: *Eucalyptus platyphylla, Corymbia intermedia, Lophostemon suaveolens* ± *Eucalyptus tereticornis* woodland. Occurs on rises and low hills. 11.5.8b: *Corymbia clarksoniana, Eucalyptus exserta, E. crebra, E. tereticornis, E. platyphylla* woodland with low tree layer dominated by *Melaleuca viridiflora, M. nervosa, Allocasuarina littoralis, Grevillea banksii, Acacia flavescens* + *Acacia leiocalyx*. 11.5.8c: Woodland of pure *Eucalyptus platyphylla* on white-yellow weathered sands, with grassy groundlayer. Occurs on Quaternary sediments.

RE	VMA status	Biodiversity status	Land form	Short description	Long description and comments
11.11.15	NoC	NCaP	Occurs on undulating rises and low hills, often with distinct strike pattern formed on moderately to strongly deformed and metamorphosed sediments and interbedded volcanics and Permian sediments.	*Eucalyptus crebra* woodland on deformed and metamorphosed sediments and interbedded volcanics	*Eucalyptus crebra* ± *Corymbia erythrophloia* ± *E. populnea* ± *E. melanophloia* ± *C. tessellaris* ± *C. clarksoniana* woodland often with a shrubby layer. *Eucalyptus exserta* and *E. platyphylla* present in central coastal part of bioregion. Occurs on undulating rises and low hills, often with distinct strike pattern formed on moderately to strongly deformed and metamorphosed sediments and interbedded volcanics and Permian sediments. Major vegetation communities include: 11.11.15a: *Eucalyptus crebra, E. exserta* woodland. 11.11.15b: *Eucalyptus drepanophylla* and/or *E. platyphylla* woodland ± vine thicket species. 11.11.15c: Woodland with *Corymbia setosa* present to dominant, usually with *Corymbia clarksoniana, Eucalyptus melanophloia, Corymbia dallachiana* and *Eucalyptus crebra*, with occasional shrubs of *Petalostigma pubescens* and *Alphitonia excelsa*. 11.11.15d: Woodland with *Corymbia setosa* present to dominant, usually with *Corymbia clarksoniana, Eucalyptus melanophloia, Corymbia dallachiana* and *Eucalyptus crebra,* with occasional shrubs of *Petalostigma pubescens* and *Alphitonia excelsa*. Occurs on low rises and short hills derived from Devonian-Carboniferous sediments (mainly conglomerates in Beresford Stn). Associated soils are hard gravelly to stony.

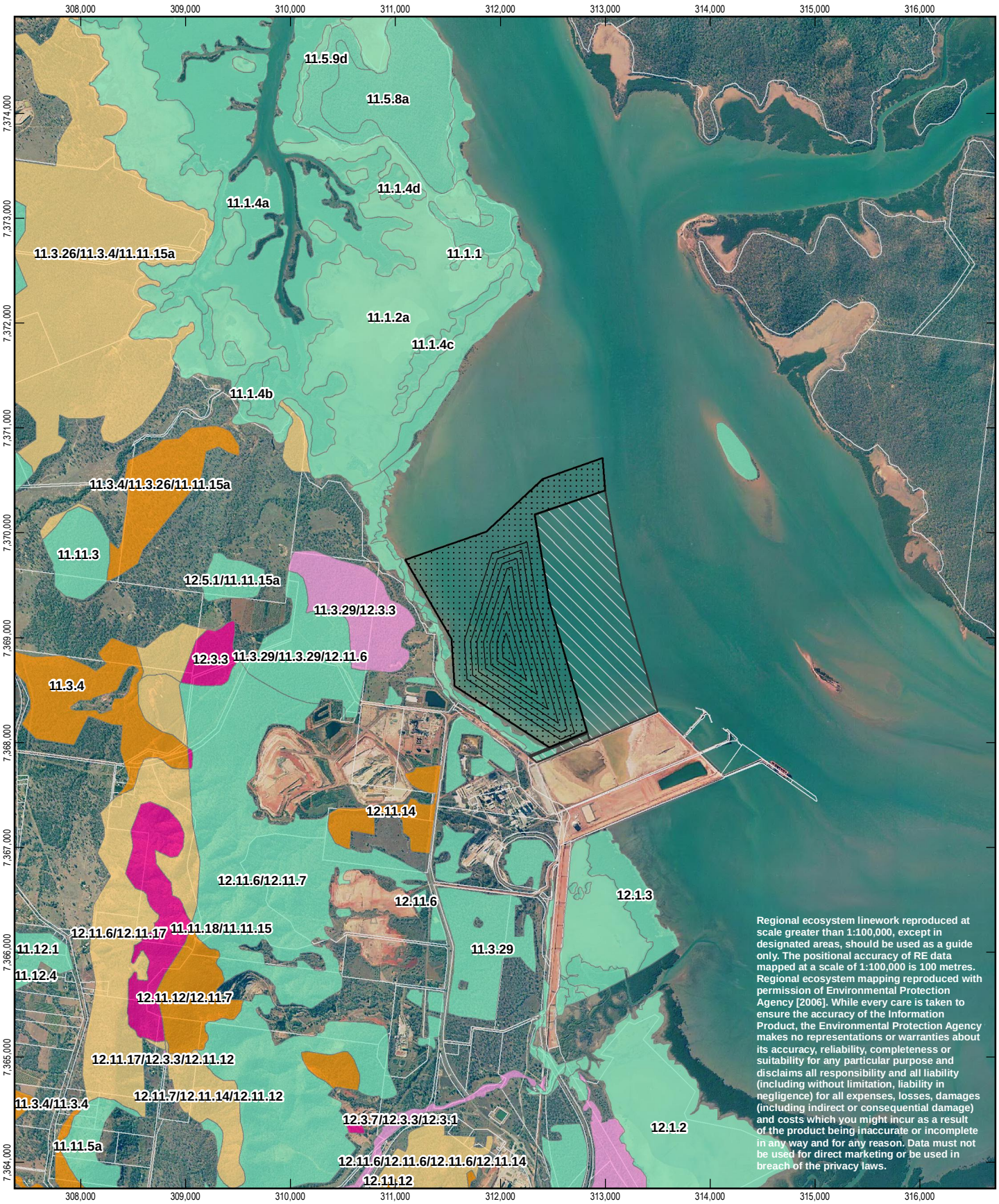
RE	VMA status	Biodiversity status	Land form	Short description	Long description and comments
12.1.2	NoC	NCaP	Occurs on Quaternary estuarine deposits. Marine plains/tidal flats.	Saltpan vegetation including grassland, herbland and sedgeland on marine clay plains	Saltpan vegetation comprising *Sporobolus virginicus* grassland and samphire herbland. Grasses including *Zoysia macrantha* subsp. *macrantha* sometimes present in upper portions of tidal flats. Includes saline or brackish sedgelands.
12.1.3	NoC	NCaP	Occurs on Quaternary estuarine deposits.	Mangrove shrubland to low closed forest on marine clay plains and estuaries	Mangrove shrubland to low closed forest.

RE	VMA status	Biodiversity status	Land form	Short description	Long description and comments
12.3.3	E	E	Occurs on broad Quaternary alluvial plains where rainfall is usually less than 1000mm/y. 12.3.3a: Occurs on high level alluvial plains and fans where rainfall is usually less than 1000mm/y. 12.3.3b: Occurs on margins of Quaternary alluvial plains. 12.3.3c: Occurs on Quaternary alluvial plains.	*Eucalyptus tereticornis* woodland to open forest on alluvial plains	*Eucalyptus tereticornis* open-forest to woodland. *E. crebra* and *E. moluccana* are sometimes present and may be relatively abundant in places, especially on edges of plains and higher level alluvium. Other species that may be present as scattered individuals or clumps include *Angophora subvelutina* or *A. floribunda, Corymbia clarksoniana, C. intermedia, C. tessellaris* and *E. melanophloia*. Major vegetation communities include: 12.3.3a: *E. crebra, C. clarksoniana, C. tessellaris* woodland to open-forest. Other species that may be present as scattered individuals or clumps include *Eucalyptus melanophloia* and *E. tereticornis*. Occurs on high level alluvial plains and fans where rainfall is usually less than 1000 mm/y. 12.3.3b: *E. moluccana* open-forest to woodland. Other frequently occurring species include *E. tereticornis, E. crebra, E. siderophloia and C. intermedia*. Occurs on margins of Quaternary alluvial plains. 12.3.3c: *Melaleuca irbyana* low open-forest or thicket. Emergent trees may be present e.g. *E. moluccana, E. crebra, E. tereticornis* and *C. citriodora. Casuarina glauca* or *Acacia harpophylla* occasionally present. Occurs on Quaternary alluvial plains.

RE	VMA status	Biodiversity status	Land form	Short description	Long description and comments
12.3.6	NoC	NCaP	Occurs on Quaternary floodplains and fringing drainage lines in coastal areas.	*Melaleuca quinquenervia, Eucalyptus tereticornis, Lophostemon suaveolens* woodland on coastal alluvial plains	*Melaleuca quinquenervia, Eucalyptus tereticornis, Lophostemon suaveolens* ± *Corymbia intermedia* open-forest to woodland with a grassy ground layer dominated by species such as *Imperata cylindrica*.
12.11.6	NoC	NCaP	Occurs on Paleozoic and older moderately to strongly deformed and metamorphosed sediments and interbedded volcanics. Drier habitats than RE 12.11.5.	*Corymbia citriodora, Eucalyptus crebra* open forest on metamorphics ± interbedded volcanics	Open-forest to woodland of *Corymbia citriodora* generally with *Eucalyptus crebra*. Other species such as *Eucalyptus fibrosa* subsp. *fibrosa, E. exserta, E. tereticornis, E. moluccana, E. melanophloia, Angophora leiocarpa* may be present in scattered patches or in low densities. Understorey grassy or shrubby.

[1] *Vegetation Management Act 1999*: E= Endangered; NoC= Not of concern.

[2] E= Endangered; NCaP= No concern at present. All descriptions from REDD (Regional Ecosystem Description Database EPA 2007)



LEGEND

- Western Basin Reclamation Footprint
- Fisherman's Landing Northern Expansion
- Cadastre

Regional Ecosystem

- Endangered - Dominant
- Endangered - Sub-dominant
- Of Concern - Dominant
- Of Concern - Sub-dominant
- Not Of Concern
- Non-remnant / regrowth

1:50,000 (at A4)

0 250 500 750 1,000

Metres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 56

N

Port of Gladstone
Western Basin Dredging and Disposal Project

Regional Ecosystem Mapping within the Study Area

Job Number	42-15386
Revision	A
Date	09 Sept 2009

Figure 3-1

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3.2.3 Vegetation Communities

The vegetation communities within and adjacent to the study area are shown in Figure 3-2 and described below.

1a *Eucalyptus Crebra* Woodland to Open-Forest (on Alluvium)

The predominant dryland vegetation community in the study area is grassy sclerophyll woodland and open-forest dominated by *Eucalyptus crebra* (narrow-leaved ironbark), *E. exserta* with *E. tereticornis* (Queensland blue gum) and *Lophostemon suaveolens* (swamp mahogany) also common in the understorey. This vegetation community is located on at least three different substrates within the study area, giving rise to three different REs and habitat mapping units. Where *E. crebra* (narrow-leaved ironbark) dominated woodland/open-forest is located on an alluvial substrate (such as immediately adjacent to the salt marsh/salt couch grassland in the heart of the study area) it corresponds to RE 11.3.29 (VMA Status: Not of Concern) (see Figure 3-1 and the RE description in Table 3-1), and has been mapped as the unit 1a in Figure 3-2. Where RE 11.3.29 has been mapped within the project area it has been included in a heterogenous polygon with RE 12.3.3 (VMA Status: Endangered). This latter RE is discussed below, and has been mapped in Figure 3-2 and identified as the units 2a and 2r.

1sed/1m *Eucalyptus Crebra* Woodland to Open-Forest

Another area of *E. crebra* (narrow-leaved ironbark) woodland to open forest is located in the far north of the study area on Kangaroo Island and adjacent areas. This vegetation is located on a low, relatively level rise formed from Tertiary period sediment and is mapped as the RE 11.5.8 (see Figure 3-1 and the RE description in Table 3-1). It has been mapped as the unit 1sed in Figure 3-2. The third variation of *E. crebra* (narrow-leaved ironbark) woodland/open forest is located in the south of the study area within the Cement Australia lot. The vegetation in this area is located on a low, gently undulating rise of metamorphic rock. Although it appears on the extract of the certified RE map as RE 11.3.29 (VMA Status: Not of Concern) it should be mapped as RE 11.11.15 (VMA Status: Not of Concern) which is mapped over much of the country adjoining the study area. This vegetation community has been mapped as the unit 1m in Figure 3-2.

2a/2r *Eucalyptus Tereticornis* Woodland to Open-Forest

The alluvial plain in the south and centre of the study area contains another sclerophyll vegetation unit; grassy woodland and open-woodland dominated by *E. tereticornis* (Queensland blue gum). This vegetation type appears to have been targeted for clearing in the past and was most likely open-forest (rather than woodland or open-woodland) in its original state. Where *E. tereticornis* (Queensland blue gum) dominated woodland to open-woodland is present on an alluvial plain within the study area it has been mapped as the unit 2a (Figure 3-2). This unit is analogous with RE 12.3.3 (VMA Status: Endangered). Where *E. tereticornis* forms a narrow riparian woodland fringing small drainage lines and creeks it has been mapped as the unit 2r. Although the species composition is similar to unit 2a, this RE is not a riparian fringing vegetation community and does not approximate the unit 2r. Instead, the unit 2r is analogous with RE 12.3.6 (VMA Status: Not of Concern).

3 Mangrove Shrubland

A narrow band of mangrove shrubland fringes the seaward side of the salt marsh and *Sporobolus virginicus* (salt couch) grassland. This community is generally less than 50 m wide, and stretches along the coastline for the full length of the study area. The species dominating the seaward edge of this shrubland was *Rhizophora stylosa* (red mangrove); the landward edge was dominated by *Ceriops tagal* (yellow mangrove) and *Avicennia marina* (grey mangrove), with *Excoecaria agallocha* (milky mangrove), *Lumnitzera racemosa* (white-flowered black mangrove) and *Aegialitis annulata* (club mangrove) also present. This vegetation community corresponds with REs 11.1.4 (VMA Status: Not of Concern) and 12.1.3 (VMA Status: Not of Concern) (see Figure 3-1 and descriptions in Table 3-1), and is mapped as unit 3 (Figure 3-2). This vegetation has been described as tall shrubland because it is less than 10 m tall in all places within the study area and does not reach the complexity of closed forest. This description follows the vegetation community categories established by Specht (1970).

4f Rarely Tidally Inundated Foreshore Vegetation

The interface between the sclerophyll woodland and the mangroves and mudflat was generally too narrow to map as a separate community. The vegetation in these areas is characterised as grassland of *Sporobolus virginicus* (salt couch), with *Acacia disparrima* (hickory wattle), *Melaleuca nervosa* (narrow-leaved tea-tree), *Petalostigma pubescens* (quinine bush) and *Pleiogynium timorense* (Burdekin plum) dominating the ecotone with the sclerophyll woodland. This vegetation appears to be mostly above the level of most high tides throughout the year but may be partly inundated at the highest spring tides. Therefore, although the substrate is sandy (indicating Land Zone 2), this area is most appropriately mapped as Land Zone 1, and the vegetation corresponds broadly to RE 11.1.1 (VMA Status: Not of Concern) and to a lesser degree RE 12.1.2 (VMA Status: Not of Concern). This vegetation community has been mapped as unit 4f (Figure 3-2).

4mu Tidally Inundated Bare Mudflats and Succulent-Dominated Saltmarsh

The majority of land in the study area is located on Land Zone 1: lands subject to tidal inundation. This section of the study area is characterised by a large expanse of estuarine mud flats, most of which is naturally bare of vegetation. The vegetated sections of mud flats were dominated by clumps of *Halosarcia* sp. (glass wort) and *Sarcocornia* sp. (beadweed) in sparse groupings. Other succulents and salt-adapted foreshore species were also present, including *Portulaca bicolor* (pigweed), *Enchylaena tomentosa* (ruby saltbush), *Limonium solanderi* (sea lavender), *Ipomoea pes-caprae* (beach morning glory), *Myoporum acuminatum* (boobialla) and *Fimbristylis ferruginea* (rusty sedge). The class three declared weed *Opuntia stricta* (prickly pear) was also commonly present. Small clumps of mangroves, mainly *Ceriops tagal* (yellow mangrove) *Avicennia marina* (grey mangrove) and *Lumnitzera racemosa* (white-flowered black mangrove) were also present. This vegetation has been mapped as the unit 4mu (Figure 3-2) and corresponds to RE 11.1.2 (VMA Status: Not of Concern). This RE is described in Table 3-1 and mapped in Figure 3-1.

5 *Corymbia Citriodora* Woodland on Undulating Metamorphic Landforms

Vegetation within the western fringe of the study area is characterised as woodland to open-forest dominated by *Corymbia citriodora* (lemon-scented gum) on a substrate of metamorphic rock. This has been mapped as unit 5 in Figure 3-2, and is analogous with RE 12.11.6 (VMA Status: Not of Concern), a common RE in the Gladstone-Calliope area.

6 Cleared landscapes

A number of open, cleared areas are located within the study area. These areas are now grasslands dominated by *Heteropogon contortus* (black speargrass), with weeds such as *Megathyrsus maximus* (Guinea grass) and *Hyptis suaveolens* (hyptis) also conspicuous. Cleared areas are generally located on level alluvium and it is likely were once characterised by a mixture of *E. crebra* (narrow-leaved ironbark) woodland and *E. tereticornis* (Queensland blue gum) woodland to open-forest (vegetation units 1a and 2a in Figure 3-2). These areas are now non-remnant vegetation and have been mapped as unit 6 in Figure 3-2 (note that this unit also contains the industrial land situated to the south of the study area).

Vegetation Condition

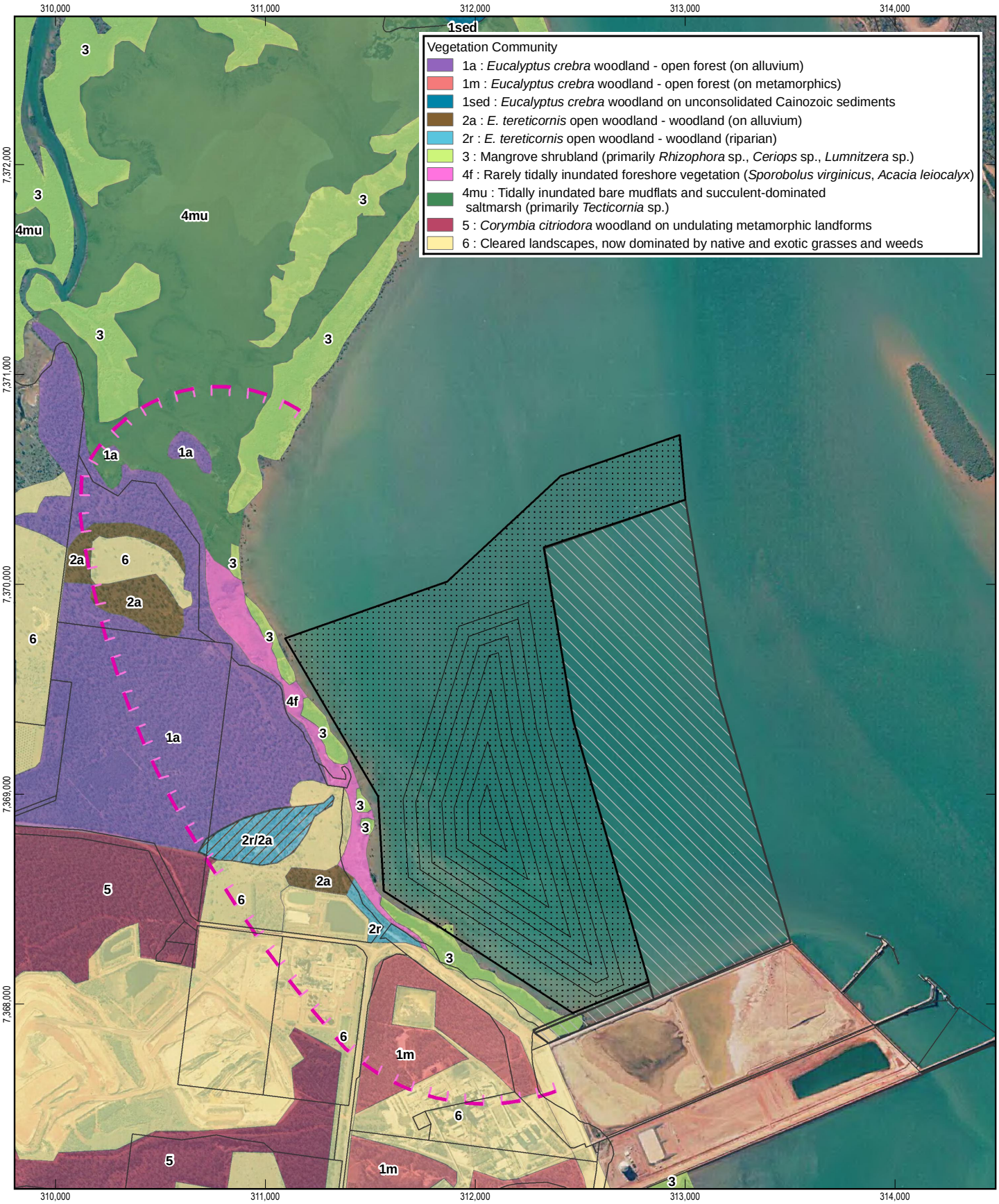
Condition assessments were conducted using the Vegetation Assets, States and Transitions (VAST) methodology (Thackway and Lesslie 2005). This method is preferred to the methodology outlined in BioCondition (Eyre et al. 2008) because the BioCondition methodology is restricted to remnant vegetation and relies on comparison with benchmarks that do not yet exist for any REs in this area. The VAST methodology is being utilised at a national level to assess condition in environments ranging from native woodlands to wasteland (i.e. it can be used to assess the condition of non-remnant vegetation) and is particularly useful in assessing the impacts of land management on ecosystem services among other things (Thackway and Lesslie 2005).

Under the VAST framework, the majority of the vegetation communities in the study area can be classified as being in a good condition. The *E. crebra* (narrow-leaved ironbark) woodland mapped as units 1a and 1sed were assessed as 'modified' (Type II). There is remarkably little weed incursion and little evidence of past or present land management practices with the natural structure and function of the vegetation community largely intact. However, this vegetation is no longer subject to the natural frequency and intensity of bushfire, evident by the build-up of woody material, height and dominance of black speargrass, and the lack of charred trunks. This vegetation type is subject to grazing, which has an effect on the species composition of the ground layer (the preponderance of stylo (*Stylosanthes* sp.) is but one example). The unit 1m contained a high degree of weed incursion which has resulted in significant structural alteration. This unit was categorised as 'transformed' (Type III) under the VAST framework. *Lantana camara* (lantana) and *Passiflora suberosa* (corky passionflower) were common with large areas having been cleared for Cement Australia plant and infrastructure.

The salt marsh vegetation (unit 4mu) was in pre-clear condition and was assessed as 'residual' (Type I) as was the salt couch grassland (4f). These vegetation communities contained litter brought by the tide, but were otherwise in original condition. The mangrove shrublands were also considered to be in residual condition. The mangroves in these areas were all less than 10 m tall and present in a relatively narrow strip of less than 50 m in most locations. The structural complexity and species diversity of mangrove closed forest was not evident. However, there was no evidence of recent dieback and this appears to be the natural state of this vegetation.

The *Corymbia citriodora* (lemon-scented gum) woodland and open-forest to the west of the study area (unit 6) was in good condition and was assessed as residual (Type II). Being located on poorer soils (derived from metamorphic rock) than the ironbark woodlands (1a and 1sed), this vegetation community is not grassy, does not appear to have been grazed and as a consequence is in a more or less original condition. The sclerophyll community that demonstrates the greatest modification is the *E. tereticornis* (Queensland blue gum) grassy woodland to open-woodland (2a and 2r). This vegetation community has

been extensively thinned, with ringbarked stags and fallen trunks present, and large open areas. The riparian unit (2r) was more intact, however the declared weeds *Lantana camara* (lantana) and *Cryptostegia grandiflora* (rubber vine) were present in low densities. These vegetation communities were assessed as modified (Type III).



LEGEND

- Western Basin Reclamation Footprint
- Fisherman's Landing Northern Expansion
- Field Assessment Area of Interest

1:25,000 (at A4)

0 250 500 750 1,000

Metres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 56

N

Port of Gladstone
Western Basin Dredging and Disposal Project

Vegetation Community Mapping

Job Number 42-15386
Revision A
Date 09 Sept 2009

Figure 3-2

G:\42\15386\GIS\WesternBasinProjects\MXDs\42-15386_WB_201_rev_a.mxd Level 4 201 Charlotte Street Brisbane QLD 4000 Australia T +61 7 3316 3000 F +61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

3.2.4 Fauna Habitat Types

A total of seven fauna habitat types (excluding marine habitats - refer to the Marine Benthic and Marine Megafauna ecological technical reports) were identified within the study area. The habitats generally correspond with the vegetation communities identified in Section 3.2.3 and can be discussed in terms of those associated with the marine/tidal environment and those associated with dryland/terrestrial areas. Vegetation communities can vary in their ecological value as habitat for fauna due to differences in the structural complexity of vegetation and substrate. These factors influence diversity and abundance of microhabitats and resources available to fauna.

In general, the habitats identified within the study area provide a range of resources for fauna. Some areas exhibit greater complexity in vegetation strata (for example the woodland areas display increased complexity relative to the grassland areas) and are considered to support a greater number of fauna species. Disturbed areas, mainly the grassland habitats, exhibited reduced species richness though retain important foraging habitat values for raptors, snakes, small ground mammals, macropods and other birds.

Coastal habitats such as those with tidal influences or estuarine vegetation complexes provide a distinctly different fauna assemblage, as do the freshwater areas. The exposure to coastal processes (winds, saline water, tides and wave action) results in an ecotone between estuarine and inland habitats. This ecotone displays characteristics of both terrestrial and marine landscapes and is similarly expected to provide habitat for species common to both landscapes.

The fauna habitat types in the study area are described in Table 3-2.

Habitat Dynamics

Fauna habitats within the study area are highly dynamic with daily and seasonal variations in environmental conditions influencing the type, distribution and quantity of ecological value for fauna.

The intertidal zone of the study area consists of mangroves, mudflats and salt marsh areas that span across the shallow embayment of the Western Basin. These areas are exposed to coastal processes and experience daily changes due to tidal influences and changes in wind speed and direction. Fauna species that occur within this habitat are specifically adapted to these conditions.

The greatest variation in local ecosystem value occurs on a seasonal scale. During the wet season, the study area receives freshwater input from the surrounding areas resulting in the expansion of the freshwater habitats. During this season, increased plant growth provides foraging and breeding habitat for a range of fauna. As the dry season commences and rainfall and runoff from the surrounding area decreases, annual plants senesce and fauna species disperse. During the dry season the permanent freshwater habitats provide an important resource for many fauna species.

Additional variation in fauna values relate to changes in forage resources. Flowering and seeding vegetation provides food resources for birds, arboreal mammals and flying foxes. Seasonal variations in flowering and seeding vegetation results in a corresponding resource availability fluctuation.

Wildlife Corridors and Connectivity

Small and large scale movement of fauna throughout the study area is dependent upon the spatial and temporal connectivity of fauna habitats. The intertidal zone habitat within the study area provides continuous habitat connectivity from Fisherman’s Landing in the south to the upper reaches of The

Narrows in the north. As the intertidal zone habitat within the study area is limited, the connectivity of this habitat to larger areas of marine habitat surrounding Targinie Creek and The Narrows is especially important for maintaining local populations of intertidal species.

Within the terrestrial environment, the open woodland habitat facilitates local movement of fauna from the costal margins to inland habitats in the north and west. Habitats in south of the study area are largely fragmented by industry and associated infrastructure and as such fauna movement is unlikely to occur through this area.

The open woodland habitat within the study area is also likely to support large scale movement of terrestrial fauna such as population dispersal and immigration. This habitat within the study area forms part of a band of connected remnant vegetation that runs north-south along the coastal margin. The connected band of vegetation acts as an important wildlife corridor connecting terrestrial fauna within the study area to important habitat areas in the north such as the area encompassing Rundle Ranges National Park, Rundle Ranges Resource Reserve and Rundle Ranges State Forest. During the dry season, movement of fauna through this corridor may be dependent upon freshwater resource availability and as such the vegetation that occurs along the freshwater creeks and dams will be the primary wildlife corridor during this period.

Table 3-2 Fauna Habitats within the Study Area

Habitat Type	Characteristics	Value for Wildlife	Photo
Mixed open-woodland with grassy understorey	◗ Variable substrate including some soft substrates ◗ Patchy shrub layer ◗ Some mature eucalypts and iron barks ◗ Grassy understorey, generally dense and tall ◗ Woody debris often covered with long grasses **Corresponding vegetation communities:** 1a, 2a, 2r, 2a/2r	Habitat for: ◗ Canopy, shrub and grass birds ◗ Raptors ◗ Arboreal mammals, macropods, rabbits, rodents and echidnas ◗ Snakes, skinks, dragons and geckos **Potential listed species:** squatter pigeon, black-chinned honeyeater, large-eared pied bat, coastal sheathtail-bat, little pied bat, grey-headed flying fox, grey goshawk, square-tailed kite, powerful owl, migratory birds	
Mixed open woodland with vine thicket understorey	◗ Some mature eucalypts and iron barks ◗ Lantana and vine dominated understorey with some grassy patches ◗ Relatively dense midstorey ◗ Some woody debris **Corresponding vegetation communities:** 1m	Habitat for: ◗ Canopy, shrub and grass birds ◗ Arboreal mammals, macropods, rabbits, rodents and echidnas ◗ Snakes, skinks, dragons and geckos **Potential listed species:** squatter pigeon, black-chinned honeyeater, large-eared pied bat, coastal sheathtail-bat, little pied bat, grey-headed flying fox, grey goshawk, square-tailed kite, powerful owl, migratory birds	

Habitat Type	Characteristics	Value for Wildlife	Photo
Intertidal zone	◗ Mangrove patches ◗ Open mudflat patches ◗ Salt march ◗ Tidally inundated ◗ Fine sediments **Corresponding vegetation communities:** 3, 4mu	Habitat for: ◗ Shorebirds ◗ Mangrove dwelling fauna including small birds, reptiles and mammals ◗ Benthic invertebrates ◗ Small fish including mudskippers Foraging habitat for: ◗ Shore- and waderbirds ◗ Other marine life ◗ Small mammals and invertebrates **Potential listed species:** migratory and marine birds, eastern curlew, beach stone-curlew, sooty oystercatcher, little tern, yellow chat, water mouse, estuarine crocodile, rusty monitor, coastal sheathtail bat	 

Habitat Type	Characteristics	Value for Wildlife	Photo
Estuarine inlet	◗ Mangrove patches ◗ Open muddy areas ◗ Salt marsh ◗ Tidally inundated during higher tides ◗ Fine sediments ◗ Abundant woody debris ◗ Isolated pools **Corresponding vegetation communities:** 4f	Habitat for: ◗ Mangrove dwelling fauna including small birds, reptiles and mammals ◗ Benthic invertebrates ◗ Small fish including mudskippers **Potential listed species:** rusty monitor, Radjah shelduck, marine and migratory birds	 
Grassland	◗ Very few canopy trees/shrubs ◗ Dense grassy understorey ◗ Cattle trampling impact **Corresponding vegetation communities:** 6	Habitat for: ◗ Grassland birds ◗ Snakes and rodents ◗ Foraging habitat for raptors **Potential listed species:** squatter pigeon	

Habitat Type	Characteristics	Value for Wildlife	Photo
Freshwater dam	◗ Aquatic plants (reeds and sedges) and variation in depth providing for variety of aquatic microhabitats ◗ Cattle trampling impact at banks ◗ Expected to be relatively permanent water source and freshwater aquatic habitat ◗ Turbid waters, some algae ◗ Some steep banks exhibit erosion scars and erosive potential however most banks vegetated ◗ Varying riparian widths though generally limited **Corresponding vegetation communities:** N/A – at least 3 impoundments located in the study area	Habitat for: ◗ Forest birds ◗ Wetland birds ◗ Snakes and rodents ◗ Amphibians and turtles ◗ Fish and aquatic macroinvertebrates Foraging habitat for: ◗ Raptors ◗ Wetland and forest birds ◗ Aquatic species (fish, turtles, invertebrates) **Potential listed species:** cotton pygmy-goose, Radjah shelduck, black-necked stork, squatter pigeon, little pied bat,	 

Habitat Type	Characteristics	Value for Wildlife	Photo
Freshwater creek and riparian zone	◗ Aquatic plants (reeds and sedges) in deeper reaches ◗ Grasses within waterbody suggests temporary nature of flow ◗ Variety of water depths, substrate, bends, runs and pools ◗ Trickle flows ◗ Varying riparian widths ◗ Cattle trampling impact at banks ◗ Some evidence of scouring in areas with higher, steeper banks **Corresponding vegetation communities:** 2r/2a	Habitat for: ◗ Snakes, skinks, dragons, monitors, geckos ◗ Freshwater turtles and frogs ◗ Small fish and aquatic invertebrates ◗ Macropods, rodents, echidnas and possums and microbats **Potential listed species:** little pied bat, grey goshawk, Lewin's rail, squatter pigeon	 

3.3 Species Diversity and Abundance

3.3.1 Flora Species

The floristic composition of the study area was defined by undertaking detailed CORVEG secondary sites in the three main vegetation communities recorded within the study area. These were: ironbark-dominated woodland (two sites), *E. tereticornis* (Queensland blue gum) dominated woodland, and the foreshore salt couch grassland (see Figure 3-2). In addition, numerous site traverses and targeted habitat searches were conducted to confirm vegetation patterns and search for species of conservation significance.

The plant species identified during site traverses and detailed site investigations are outlined in Appendix C. A total of 90 species were recorded from 41 families, of which Poaceae (at least 13 species), Myrtaceae (9 species) and Fabaceae (at least 8 species) were the most commonly encountered. Twenty-two families had only one representative species. However, at the time of reporting specimens lodged with the Queensland Herbarium for positive identification have not yet been identified (most of these were from the Poaceae and Cyperaceae families), and so the final figure will likely be greater than reported above.

No species of conservation significance were detected or suspected and only three species of declared pest plants were recorded from the study area. The class two declared weed *Cryptostegia grandiflora* (rubber vine) was present in very low densities at scattered locations throughout the study area, chiefly along the foreshore and in the mouth of the small creeks. *Opuntia stricta* (prickly pear), another class two declared weed, was present as scattered individuals on the salt marsh and in the sclerophyll vegetation. Small patches of *Lantana camara* (lantana) were also located in the sclerophyll vegetation. All infestations were minor and too small to be significant. However, there is potential for the *Cryptostegia grandiflora* (rubber vine) and *Lantana camara* (lantana) infestations to increase in area, in particular given the location of one clump of *Cryptostegia grandiflora* (rubber vine) immediately adjacent to the public entrance to the northern half of Targinie Landing Road.

3.3.2 Fauna Species

Terrestrial fauna diversity, including a number of threatened species, migratory and/or marine species and introduced species, was assessed from literature reviews and field surveys. Table 3-3 summarises the number of amphibians, reptiles, mammals and birds recorded according to survey method. The diversity of fauna recorded during the current field survey was generally lower than database results, with 125 fauna species recorded across the study area. A full species list of fauna recorded within the study area is presented in Appendix D, while a summary is provided below.

Table 3-3 Total Number of Fauna Species Predicted to Occur or Recorded from the Study Area

	Environmental Reporting Tool - Protected Matters (Predicted to occur)	Wildlife Online (Historically recorded)	Queensland Museum (Historically recorded)	Birds Australia Atlas (Historically recorded)	Field Surveys (Confirmed within study area)
Species Diversity		20 amphibians 48 reptiles 46 mammals 130 birds	14 amphibians 18 reptiles 7 mammals	238 birds	9 amphibians 10 reptiles 27 mammals 77 birds
Threatened Species	2 reptiles 4 mammals 6 birds	1 reptile 2 mammals 4 birds		10 birds	1 bird 2 mammals
Migratory and/or Marine Species	1 reptile 19 birds	36 birds		85 birds	20 birds
Introduced/Pest Species	4 mammals	1 amphibian 8 mammals	1 amphibian	4 birds	1 amphibian 7 mammals

Amphibians

Nine species of amphibians were recorded within the study area, including the introduced *Rhinella marina* (cane toad). *Limnodynastes terraereginae* (scarlet-sided pobblebonk) (Plate 3-1) was the most widely distributed species, with individuals captured throughout the study area during systematic surveys. *Litoria caerulea* (green treefrog), *Litoria fallax* (eastern sedgefrog), *Limnodynastes peronii* (striped marsh frog) and *Litoria nasuta* (striped rocketfrog) were recorded around the freshwater creek and dams during spotlighting. Overall the abundance of all amphibian species within the study area was low.

Plate 3-1 ***Limnodynastes terraereginae*** **(scarlet-sided pobblebonk) recorded throughout the study area**

Plate 3-2 ***Litoria rubella*** **(naked treefrog) captured adjacent to the estuarine inlet at Site 1**

Reptiles

Reptile diversity was generally low (10 species) within the study area reflecting the mild temperatures during the field survey. Skinks were the most diverse family with five species recorded from five genera. *Carlia vivax* (lively skink) was the most abundant skink species with individuals frequently captured in the funnel traps.

Four species of gecko were recorded within the study area including *Diplodactylus vittatus* (stone gecko), *Gehyra dubia* (dubious dtella), *Oedura rhombifer* (zigzag velvet gecko) (Plate 3-3) and *Heteronotia binoei* (Bynoe's gecko). Geckos were most commonly observed sheltering under tree bark or fallen logs within the mixed open woodland habitats. *Diporiphora australis* (tommy roundhead dragon) (Plate 3-4) was recorded in the grassy woodland habitat and was the only species recorded from the family Agamidae.

Plate 3-3 ***Oedura rhombifer*** **(zigzag velvet gecko) recorded during diurnal non-systematic surveys at Site 1**

Plate 3-4 ***Diporiphora australis*** **(tommy roundhead dragon) captured during systematic surveys at Site 3**

Mammals

Twenty-two species of native mammal were recorded within the study area. Microchiropteran bats were the most abundant mammalian group within the study area with 13 species recorded on the Anabat II bat detector, including two species of conservation significance. *Chalinolobus picatus* (little pied bat) listed as rare under the NC Act, was recorded within the mixed open woodland habitat while *Taphozous troughtoni* (Troughton's sheath-tail bat) was recorded from the estuarine inlet habitat at Site 1. *Taphozous troughtoni* (Troughton's sheath-tail bat) is currently listed as endangered under the NC Act however recent investigations suggest this species maybe more widespread and common in Queensland than previously recognised (Churchill 2008). Two flying-fox species, *Pteropus alecto* (black flying-fox) and *Pteropus scapulatus* (little red flying-fox) were observed feeding on the eucalypt and melaleuca flowers within the mixed open woodland habitats.

Arboreal mammals recorded within the study area included, *Trichosurus vulpecula* (common brushtail possum), *Petaurus norfolcensis* (squirrel glider) and *Petauroides volans* (greater glider). *Petauroides volans* was the most abundant mammal species with four individuals observed within the grassy woodland habitat.

Macropods were represented by only two species, *Macropus giganteus* (eastern grey kangaroo) and *Aepyprymnus rufescens* (rufous bettong). *Macropus giganteus* (eastern grey kangaroo) was the most widely distributed mammal species with individuals and tracks observed across all habitat types within the study area. Dirt diggings potentially made by *Aepyprymnus rufescens* (rufous bettong) (Plate 3-5) were commonly observed throughout the mixed open-woodland habitats. Other mammalian diggings within the study were those of *Tachyglossus aculeatus* (short-beaked echidna) (Plate 3-6).

Pseudomys gracilicaudatus (eastern chestnut mouse) was captured in the grassy woodland habitat and was the only native rodent observed within the study area. A scat identified as either *Isoodon macrourus* (northern brown bandicoot) or *Perameles nasuta* (long-nosed bandicoot) confirmed the presence of bandicoots within the viney woodland habitat.

Seven species of introduced mammal were observed within the study area including, *Bos taurus* (cow), *Canis lupus* (wild dog), *Vulpes vulpes* (fox), *Felis catus* (feral cat), *Oryctolagus cuniculus* (European rabbit), *Mus musculus* (house mouse) and *Rattus rattus* (black rat). *Mus musculus* (house mouse) was the most abundant introduced mammal species with a total of 32 individuals captured during the systematic survey.

Plate 3-5 Potential *Aepyprymnus rufescens* (rufous bettong) digging

Plate 3-6 *Tachyglossus aculeatus* (short-beaked echidna) diggings

Birds

Seventy-seven bird species were recorded from the study area and adjacent habitat during surveys, the vast majority of which were forest/woodland-dependent species recorded from the woodland habitat in the west of the study area. Though honeyeaters were abundant during surveys, numbers of most forest/woodland species were low.

Relatively few species were recorded from the intertidal zone habitat in the east of the study area during surveys and most of these species (*Numenius phaeopus* (whimbrel), *Vanellus miles novaehollandiae* (masked lapwing), *Haematopus longirostris* (pied oystercatcher), *Egretta novaehollandiae* (white-faced heron), *Haliaeetus leucogaster* (white-bellied sea-eagle), *Haliastur sphenurus* (whistling kite) and *Haliastur indus* (brahminy kite)) occurred at low densities. At high tide, open water over tidal flats was also used by small numbers of foraging *Pelecanus conspicillatus* (Australian pelican), *Phalacrocorax varius* (pied cormorant), *Hydroprogne caspia* (Caspian tern) and *Haliaeetus leucogaster* (white-bellied sea-eagle).

At high tide, small numbers of *Gelochelidon nilotica* (gull-billed tern) and *Numenius phaeopus* (whimbrel) were also recorded roosting at the back of the mangroves in the north-east of the study area. Several more species (*Haematopus longirostris* (pied oyster catcher), *Recurvirostra novaehollandiae* (red-necked avocet) and *Charadrius ruficapillus* (red-capped plover)) were seen roosting in the existing reclamation area south of the study area.

Mangrove habitat within the study area was utilized by a number forest and mangrove-dependent species. Amongst the latter were *Lichenostomus fasciogularis* (mangrove honeyeater), *Gerygone levigaster* (mangrove gerygone) and *Butorides striata* (striated heron). Forest/woodland birds utilising mangrove habitat within the study area included *Myiagra rubecula* (leaden flycatcher), *Rhipidura albiscapa* (grey fantail), *Lichmera indistincta* (brown honeyeater) and *Dicaeum hirundinaceum* (mistletoebird). During high tide, mangroves in the east of the study area were also used for roosting by *Ardea modesta* (great egret) and *Haliastur indus* (brahminy kite).

Bird species recorded during surveys utilised habitat within the study area mainly for foraging and/or roosting. Though only one species (*Pardalotus striatus* (striated pardalote)) was recorded breeding

during surveys, abandoned nests of several other bird species (including a large kite nest located in a tall Queensland blue gum in the north of the study area) were located within the study area during surveys.

Conservation significant species within the study area included one threatened species and 20 migratory and/or marine species listed under the EPBC Act. *Geophaps scripta scripta* (squatter pigeon - southern race) is listed as vulnerable under the EPBC Act and NC Act. A total of eight individual *Geophaps scripta scripta* (squatter pigeon - southern race) were observed within the mixed open-woodland and grassland habitats. Surveys were conducted during winter and, as such, migratory species likely to utilise habitat within the study area during spring and summer were largely absent. Hence, despite the extent of suitable foraging and roosting habitat within the study area, few migratory shorebird species were recorded during surveys. It is therefore expected that the number of birds occurring within the study area would be considerably higher than the number recorded during winter surveys. Section 3.4.6 discusses the importance of the study area for migratory and/or marine species.

Pests

According to the DEWHA's ERT and DERM's Wildlife Online database searches the following ten pest fauna species are predicted to occur within the study area:

- *Rhinella marina* (cane toad);
- *Capra hircus* (goat);
- *Bos taurus* (cow);
- *Felis catus* (domestic cat);
- *Oryctolagus cuniculus* (European rabbit);
- *Lepus capensis* (brown hare);
- *Vulpes vulpes* (fox);
- *Mus musculus* (house mouse);
- *Rattus rattus* (black rat); and
- *Sus scrofa* (pig).

Introduced species observed within the study area during field surveys are detailed below.

Table 3-4 Introduced Fauna Species Observed within the Study Area

Species	Abundance	Location	Impact
Canis lupus wild dog	Low	Across study area	Predate on native mammals and birds Compete with native predators
Vulpes vulpes fox	Low	Mixed open woodland	Predate on native mammals and birds Compete with native predators Transmit disease to domestic livestock and humans
Felis catus feral cat	Low	Intertidal zone	Predate on native mammals and birds Compete with native predators Transmit disease to native fauna, domestic livestock and humans

Species	Abundance	Location	Impact
Oryctolagus cuniculus European rabbit	Low	Mixed open woodland and grassland	Damage vegetation Compete with native mammals
Rhinella marinus cane toad	Medium	Across study area	Compete with other insectivores Toxic to native mammals and birds May transmit disease to native fauna
Bos Taurus cow	Medium	Across study area	Erode soil and damage vegetation Pollute water Spread weeds
Rattus rattus black rat	Medium	Mixed open woodland	Destroy vegetation Compete with native rodents Transmit disease to native fauna and humans
Mus musculus house mouse	High	Mixed open woodland	Compete with native rodents Transmit disease to native fauna and humans

3.4 Sensitive Areas and Conservation Significant Species

3.4.1 Summary

Sensitive areas and conservation significant species are defined as those having Commonwealth, State, regional and/ or local ecological value. Sensitive areas and species identified within the study area are summarised in Table 3-5 and discussed in detail in this section.

Table 3-5 Summary of Sensitive Areas

Significance Classification	Summary	Discussion Section Reference
Federal		
EPBC Act		
World Heritage properties	Great Barrier Reef, QLD	Section 3.4.4 and Marine Benthic & Marine Megafauna technical reports
National Heritage places	Great Barrier Reef, QLD	
	Balaclava Island and The Narrows, QLD	
Wetlands of International Importance (Ramsar Wetlands)	None present	N/A

Significance Classification	Summary	Discussion Section Reference
Threatened species and ecological communities	7 potential threatened flora species	Section 3.4.5
	13 potential threatened fauna species	Section 3.4.5
	2 threatened ecological communities	Section 3.4.3
Migratory species	86 potential migratory species	Section 3.4.6
Commonwealth Marine Areas	None present	N/A
Nuclear actions	Not applicable to this Project	N/A
DEWHA's Directory of Important Wetlands Database		
	Port Curtis, QLD	Section 3.4.4 and Marine Benthic & Marine Megafauna technical reports
	The Narrows, QLD	
Great Barrier Reef Marine Park Authority		
	Mackay/Capricorn Marine Park, QLD	Section 3.4.4 and Marine Benthic & Marine Megafauna technical reports
	Rodds Bay Dugong Protection Area, QLD	
State		
VM Act		
Regional Ecosystems	1 Endangered RE	Section 3.4.2
Moratorium mapping	Extensive areas present	Section 3.4.2
Essential Habitat	Essential Habitat for one species (*Phascolarctos cinereus* - koala)	Section 3.4.4
NC Act		
Threatened flora species	14 potential threatened flora species	Section 3.4.5
Threatened fauna species	26 potential threatened fauna species	Section 3.4.5
Protected areas	Rodds Bay Dugong Protection Area, QLD	Section 3.4.4 and Marine Benthic & Marine Megafauna technical reports
	Targinie State Forest	Section 3.4.4

Significance Classification	Summary	Discussion Section Reference
MP Act		
Protected areas	Mackay/Capricorn Marine Park, QLD	Section 3.4.4 and Marine Benthic & Marine Megafauna technical reports
Fisheries Act		
Protected areas	Rodds Bay Dugong Protection Area, QLD	Section 3.4.4 and Marine Benthic & Marine Megafauna technical reports
Marine plants	12 marine plants species	Section 3.2.3
EPA Biodiversity Planning Assessment		
Significant areas	Areas of State significance	Section 3.4.4
Local		
EPA Gladstone Harbour Protection and Enhancement Strategy		
Significant areas	Major shorebird roost and feeding sites	Section 3.4.4

3.4.2 Endangered and Of Concern Regional Ecosystems

REs that are considered 'threatened' are those listed under the VMA as Endangered or Of Concern. Only one RE in the project area meets this criteria: RE 12.3.3 (VMA Status: Endangered). The full description for this RE is provided in Table 3-1: it consists of open-forest to woodland on alluvial soils generally dominated by *E. tereticornis* (Queensland blue gum), with *E. crebra* (narrow-leaved ironbark) and/or *E. moluccana* (gum-topped box) sometimes dominant. It occurs on broad alluvial plains. This RE also includes *M. irbyana* low open-forest to thicket with *E. tereticornis* (Queensland blue gum), *E. crebra* (narrow-leaved ironbark), *E. moluccana* (gum-topped box) and/or *Corymbia citriodora* (lemon-scented gum) as emergents. In 2005 (the most recent date for which comprehensive statistics are publicly available) RE 12.3.3 has a total extent of just over 42,000 ha within the SEQ Bioregion, of which approximately 14% is located in protected areas (national parks and other tenures forming the Queensland conservation estate) (Accad et al. 2008).

The current certified RE mapping (version 5.0) covering the study area indicates that RE 12.3.3 has been mapped as a subcomponent of a heterogenous polygon with the Not of Concern RE 11.3.29 (see Figure 3-1), which comprises the *E. crebra* (narrow-leaved ironbark) woodland/open forest community on alluvium. From the observations and data gained through the field survey, it is apparent that the mapping of this RE is not correct. The area mapped is composed entirely of RE 11.3.29 (VMA Status: Not of Concern). The vegetation immediately to the north of this polygon, mapped as non-remnant in the certified RE mapping, is the actual location of the only vegetation that meets the species composition of RE 12.3.3 in the project area. The unit 2a in Figure 3-2 is analogous with the RE 12.3.3 and provides an accurate indication of its location.

Therefore, RE 12.3.3 does not occur in the areas it is presently mapped within the study area, and it is unlikely that it ever occurred in these situations. The true location of the RE 12.3.3 is represented by the unit 2a in Figure 3-2. This area has been mapped as moratorium vegetation under the *Vegetation Management (Regrowth Clearing Moratorium) Act 2009*, and this is discussed in more detail below.

Moratorium Mapping

Under the *Vegetation Management (Regrowth Clearing Moratorium) Act 2009*, areas mapped as non-remnant vegetation currently (i.e. cleared areas) but with even a low degree of regrowth, and that is mapped as containing a pre-cleared endangered RE prior to clearing, were placed under a clearing moratorium. This means that unless the vegetation can be cleared under a 'moratorium exemption' outlined in the *Vegetation Management (Regrowth Clearing Moratorium) Act 2009*, clearing of moratorium vegetation can not occur without a permit, and no permits to clear such vegetation will be issued. This is a temporary situation put in place so that the Queensland government can liaise with the various interest groups affected and it is expected to last until October 2009. However, after October protection for moratorium vegetation is likely to be written into the VM Act and the various clearing codes and policies used by DERM to assess applications to clear native vegetation.

Within the project area, a significant area of vegetation has been placed under the moratorium. This is likely to be based on areas that have been mapped as containing the endangered RE 12.3.3 prior to clearing. Indeed, some of the moratorium area matches the areas mapped as unit 2a in Figure 3-2, a unit which is directly analogous to the RE 12.3.3 and which does contain some high quality regrowth of that RE. In addition, areas mapped as unit 6 (cleared land) in Figure 3-2 that are located north of the heterogenous polygon of REs 11.3.29/12.3.3 in the centre of the study area are also likely to be correctly designated as formerly containing the RE 12.3.3.

However, the strip of moratorium mapping located directly between the foreshore and the eastern boundary of the heterogenous polygon of REs 11.3.29/12.3.3 is incorrect. It is highly unlikely that this vegetation ever contained RE 12.3.3, as it now contains well-established narrow-leaved ironbark woodland meeting the definition of the RE 11.3.29. Indeed, this vegetation is at remnant status and could be remapped as remnant of RE 11.3.29 (VMA Status: Not of Concern).

Therefore, the moratorium mapping in the project area is only correct where it occurs over the areas mapped as units 2a in Figure 3-2. Where the moratorium mapping is over units mapped as 1a, 2r or 6 in Figure 3-2 it is not correct and could possibly be challenged if required. However, as there are no impacts predicted for this vegetation from the project a challenge is most likely unnecessary.

3.4.3 Threatened Ecological Communities

Two threatened vegetation communities were indicated in the Protected Matters Search Tool results. 'Semi-evergreen vine thicket of the Brigalow Belt (North and South) and Nandewar bioregions' ('SEVT') is an endangered ecological community under the EPBC Act. The conservation advice for this community provides a list of REs that are considered to define SEVT in Queensland (Threatened Species Scientific Committee 2001). None of these REs are present in the study area, and the characteristic vegetation of this ecological community is also absent from the project site and its vicinity, hence this TEC will not be impacted by the Project.

The second ecological community nominated in the Protected Matters Search Tool results was the endangered community 'Weeping Myall Woodlands'. This community is dominated by myall (*Acacia pendula*) and in Queensland is restricted to the REs 11.3.2 and 11.3.28 (Threatened Species Scientific

Committee 2008). Neither myall nor these REs were present in the project area or its immediate vicinity, and this Project will not impact on this ecological community.

Although it was not listed in the Protected Matters Search Tool results, the critically endangered ecological community 'Littoral rainforest and coastal vine thickets of Eastern Australia' is also present in the Curtis Coast region. In South East Queensland, this ecological community is considered to be wholly analogous with the RE 12.2.2 (Threatened Species Scientific Committee 2008). There are no REs from the Brigalow Belt listed for this ecological community. This RE does not occur in the project area or its immediate vicinity and the characteristic vegetation for this ecological community is also absent. Therefore, this project will not have an adverse impact on this ecological community.

3.4.4 Important Habitats

The desktop assessment identified a number of locally important habitat areas. These are predominantly marine environments and are discussed in further detail in the Marine Benthic and Marine Megafauna ecological technical reports. They include:

- Great Barrier Reef World Heritage property;
- Balaclava Island and The Narrows;
- Rodds Bay Dugong Protection Area;
- Port Curtis Wetland of national importance; and
- The Narrows Wetland of national importance.

The marine aspects of these are discussed in related technical reports. Those identifying with terrestrial ecosystems and migratory/marine bird species are briefly discussed below.

Balaclava Island and The Narrows

The Balaclava Island and The Narrows area is one of only five tidal estuarine passages that separate continental islands from the Australian mainland. A 27,500 ha system of mangroves, saltmarsh and mud flats have been created as a result of two different hydrological systems. Five major alliances of mangroves occur with the communities reflecting variations in salinity and tidal inundation. The mangrove forests contain a mixture of tropical and temperate species such as *Avicennia marina* and *Rhizophora* spp. The saltmarsh areas are dominated by *Sporobolus virginicus* (saltwater couch) and occur between the mixed and landward mangrove communities. Balaclava Island and The Narrows support a diverse range of estuarine fauna including *Scylla serrata* (mud crab) and *Orcaella brevirostris* (irrawaddy dolphin). Balaclava Island and The Narrows are listed as a National Heritage place under the EPBC Act (DEWHA 1999). Assessment of the potential impacts on the Balaclava Island and The Narrows will be undertaken as part of the Marine Ecology Assessment.

Port Curtis Wetland

Port Curtis wetland is a 31,232 ha wetland comprising a mixture of partially enclosed embayments, shallow estuaries, rocky islands, intertidal flats, estuarine islands and marine waters. The wetland includes extensive mangrove forests and shrublands dominated by *Avicennia*, *Rhizophora* and *Ceriops* species. The coastal saltpans include areas of bare claypan, low open halophytic shrubland and sand couch grassland. Seagrass beds of *Zostera capricornia*, *Halophila ovalis* (paddle weed) and *Halodule uninervis* (narrow-leaf seagrass) occur throughout the intertidal zone. The Port Curtis wetland provides habitat for a number of flora species at the limit of their distribution including: *Halophila tricostata*,

Acanthus ilicifolia, *Avicennia eucalyptifolia* (black mangrove), *Xylocarpus australasicus* and *Bruguiera exaristata*. Notable fauna occurring within the wetland includes: *Dugong dugon* (dugong), *Chelonia mydas* (green turtle) and *Natator depressus* (flatback turtle) which are known to forage within the seagrass beds and colonies of *Pteropus scapulatus* (little red flying-fox), *Pteropus alecto* (black flying-fox) and *Pteropus poliocephalus* (grey-headed flying-fox) which inhabit the mangrove areas. The Port Curtis wetland provides forage and roosting habitat for a range of listed migratory and/or marine bird species and conservation significant species including *Esacus neglectus* (beach stone curlew), *Ephippiorhynchus asiaticus* (black-necked stork) and *Sterna albifrons* (little tern). Port Curtis wetland qualifies as a wetland of national importance under the DIWA (DEWHA 2004a).

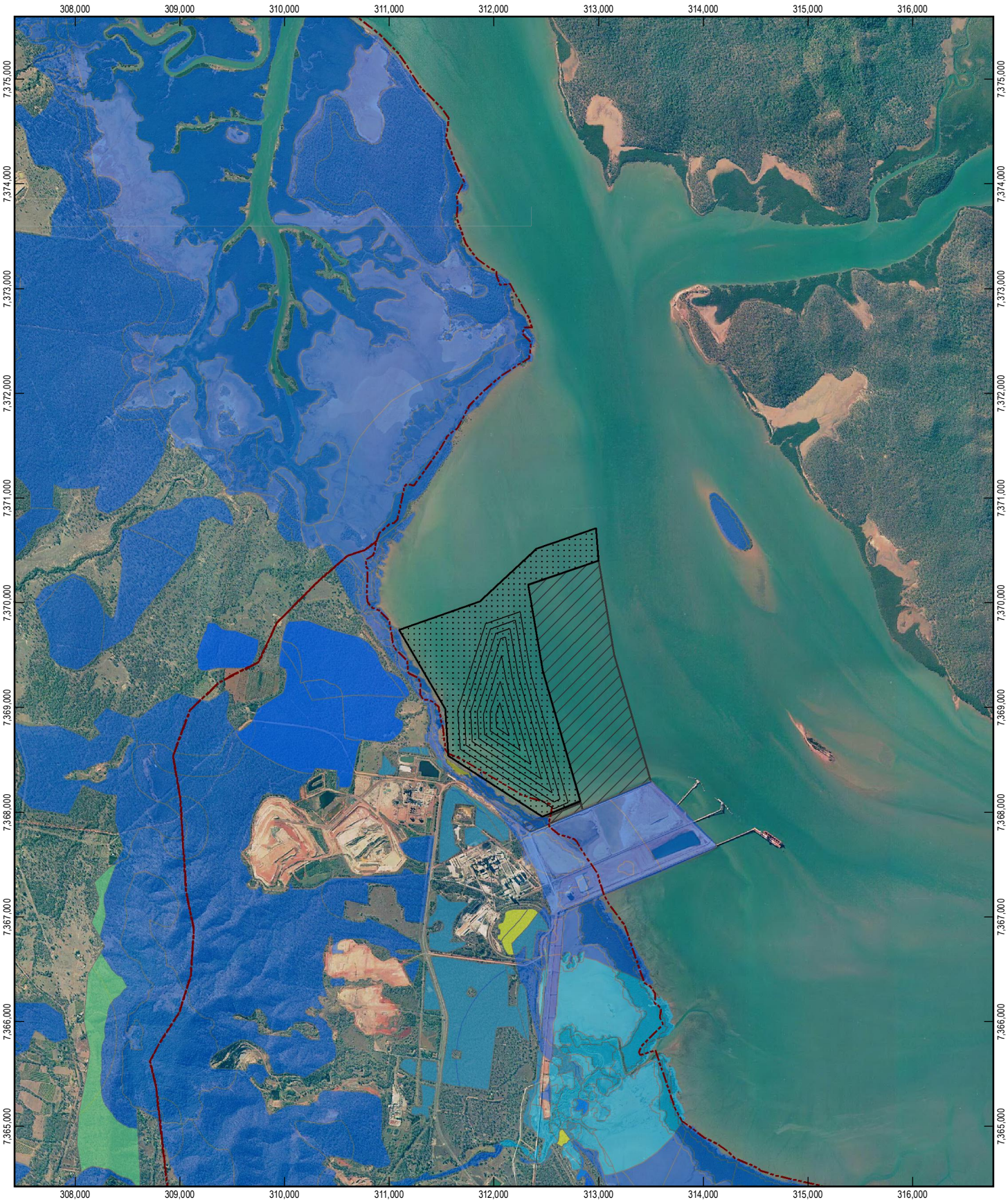
The Narrows Wetland

The Narrows is the 20,903 ha passage that separates Curtis Island from the mainland and is one of only five tidal passages within Australia. Habitat types within the wetland include saline coastal flats, mangrove forest, intertidal sand and mud flats, seagrass beds and open marine and estuarine waters. The seagrass beds provide important habitat for various fish and invertebrate species and act as a foraging ground for *Dugong dugon* (dugong) and four species of sea turtle. The Narrows also provides habitat for a number of listed marine and/or migratory bird species as well as the vulnerable *Crocodylus porosus* (estuarine crocodile) which is near its southern limit in this area. Current land use within The Narrows includes commercial and recreational fishing and crabbing, shipping transport, mineral exploration, grazing, industrial and urban development and transport. The Narrows qualifies as a wetland of national importance under the DIWA (DEWHA 2004b).

Other Important Habitats

Other important areas occurring within the study area include:

- Essential Habitat - the RE 11.3.29/12.3.3 in the east of the study area is mapped as Essential Habitat for *Phascolarctos cinereus* (koala). Whilst this area provides potential habitat for *Phascolarctos cinereus*, no evidence of this species was observed within the study areas during the field survey. Should *Phascolarctos cinereus* inhabit the study area, it would be in low densities.
- BPA significant area - DERM's Biodiversity Planning Assessment mapping identifies the remnant vegetation within the study area as being of State significance (Figure 3-3). This mapping assesses the biodiversity values at a landscape scale using Queensland Herbarium vegetation mapping data. It can be used as a tool by Agency staff, other government departments and local governments to advise planning decisions. The BPA significance value is derived from a range of criteria and expert panel. The areas within the study area are valued by a number of criteria including:
  - The significance of the area as a wetland and buffer to an important wetland;
  - The value of remnants, including their role in bioregional corridors; and
  - Some remnants have records of at least one vulnerable or rare fauna species.
- Shorebird feeding and roosting habitat - EPA mapping for the Gladstone Harbour Protection and Enhancement Strategy (EPA, date of publication unknown), shows marine tidal flats and adjacent habitat within the far north of the study area as locally important for feeding and roosting shorebirds (i.e., important within the Gladstone region).
- Targinie State Forest - the Targinie State Forest covers an area of 800 ha and occurs in the west of the study area.



LEGEND

- Bio-region Boundary
- Western Basin Reclamation Footprint
- Fishermans Landing Northern Expansion

Biodiversity Planning Assessment Significance

- State
- State Habitat for EVR taxa
- Regional
- Local or Other Values
- Non Bioregion Ecosystem

1:50,000 (at A4)

0 250 500 750 1,000

Metres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 56

N

Port of Gladstone
Western Basin Dredging and Disposal Project

Job Number 42-15386
Revision A
Date 16 Sept 2009

Biodiversity Planning Assessment Mapping

Figure 3-3

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3.4.5 Conservation Significant Flora and Fauna Species

Flora and fauna species considered rare or threatened with extinction are protected under Commonwealth (EPBC Act) and State legislation (NC Act). The literature review identified the potential presence of 16 flora and 27 fauna species listed under the EPBC Act and/or NC Act. Details of the likelihood of occurrence assessment for all conservation significant flora and fauna species identified in the literature review or recorded within the study area is are shown in Appendix E.

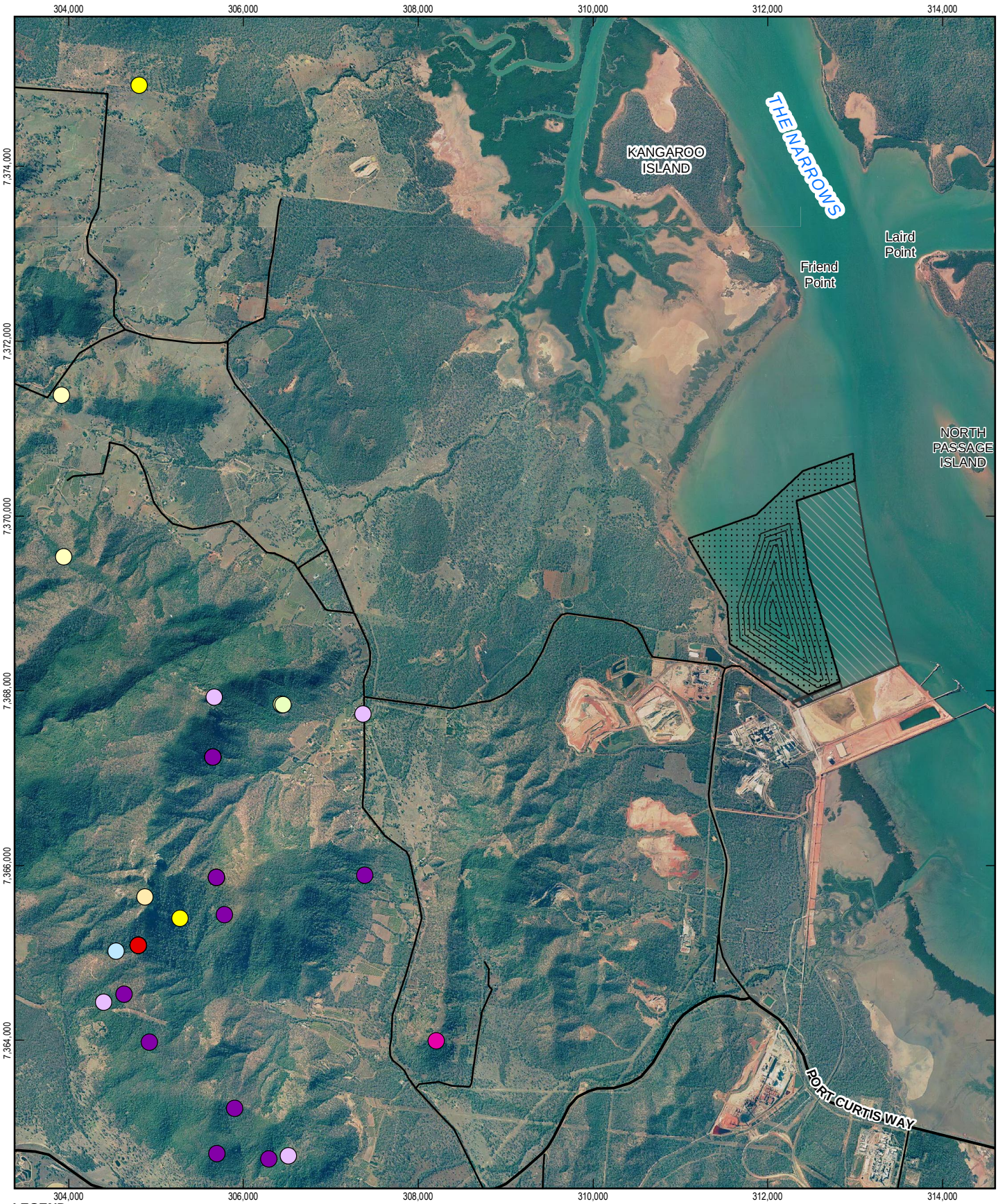
Flora

A total of 16 flora species of conservation significance at State or Commonwealth level have been recorded within five kilometres of the study area. All 16 have been listed and their habitat requirements discussed in Appendix E. Those that were recorded in Herbrecs have coordinates provided and these have been mapped in Figure 3-4.

The majority of species listed in the desktop survey results in Appendix E are found in closed forest/dry rainforest or vine thicket, and most records were from the slopes or peak of the nearby Mount Larcom. Only *Cycas megacarpa*, *Quassia bidwillii* (quassia) and *Indigofera baileyi* (Bailey's indigo) have habitat requirements that could be met in the study area. *C. megacarpa* is common on Mount Larcom but there are no records for this species in the lower lying areas in the vicinity of the study area. This species forms a conspicuous plant when mature. If present it is likely to have been observed.

Herbrecs contains a single record for *Indigofera baileyi* (Bailey's indigo) from the southern coastline of Curtis Island (dated 1958). This is one of the northern most records for this species (Australian Virtual Herbarium 2009) with the core populations of this plant are located south of Fraser Island. *Indigofera baileyi* (Bailey's indigo) is described as occurring in sclerophyll woodland and open forest on soils derived from granite and basalt (NSW Dept. Environment and Conservation 2009). Although the soils in the study area are either alluvium or derived from metamorphic rock or Tertiary sediments, the presence of this species cannot be ruled out.

Quassia bidwillii (quassia) is a shrub that is chiefly found in closed forests and vine thickets but which has been recorded from open forest and woodland, usually in association with riparian vegetation and freshwater (DEWHA 2008d). This species was not detected during targeted searches of riparian vegetation. However, its presence cannot be ruled out in association with the two creeks and two dams in the study area, although it is unlikely given the relatively poorly differentiated riparian vegetation in these areas.



LEGEND

- Western Basin Reclamation Footprint
- Fisherman's Landing Northern Expansion

QLD Herbarium Record

- *Actephila sessilifolia*
- *Alyxia magnifolia*
- *Atalaya rigida*
- *Cupaniopsis shirleyana*
- *Cycas megacarpa*
- *Graptophyllum excelsum*
- *Hernandia bivalvis*
- *Indigofera baileyi*
- *Macropteranthes leiocaulis*
- *Parsonsia larcomensis*
- *Quassia bidwillii*
- *Senna acclinis*
- *Zieria actites*

1:60,000 (at A4)

0 500 1,000 1,500 2,000

Metres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 56

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Port of Gladstone
Western Basin Dredging and Disposal Project

Previous Records of Conservation Significant Flora Species

Job Number 42-15386
Revision A
Date 16 Sept 2009

Figure 3-4

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Fauna

Of the 27 species identified during the desktop assessment, the following species were either recorded within the study area during field surveys or considered likely (≥ moderate likelihood) to occur within the study area:

- *Crocodylus porosus* (estuarine crocodile) – vulnerable (NC Act), migratory and marine (EPBC Act);
- *Varanus semiremex* (rusty monitor) – rare (NC Act);
- *Chalinolobus dwyeri* (large-eared pied bat) – rare (NC Act), vulnerable (EPBC Act);
- *Chalinolobus picatus* (little pied bat) - rare (NC Act);
- *Pteropus poliocephalus* (grey-headed flying fox) – vulnerable (EPBC Act);
- *Taphozous australis* (coastal sheathtail-bat) – vulnerable (NC Act);
- *Taphozous troughtoni* (Troughton's sheath-tail bat) – endangered (NC Act);
- *Accipiter novaehollandiae* (grey goshawk) - rare (NC Act);
- *Ephippiorhynchus asiaticus* (black-necked stork) - rare (NC Act);
- *Epthianura crocea macgregori* (yellow chat - Dawson subspecies) – critically endangered (EPBC Act), endangered (NC Act);
- *Esacus neglectus* (beach stone-curlew) – vulnerable (NC Act);
- *Geophaps scripta scripta* (squatter pigeon) – vulnerable (EPBC Act);
- *Haematopus fuliginosus* (sooty oystercatcher) - rare (NC Act);
- *Lophoictinia isura* (square-tailed kite) - rare (NC Act);
- *Melithreptus gularis* (black-chinned honeyeater) - rare (NC Act);
- *Nettapus coromandelianus* (cotton pygmy-goose) – rare (NC Act), migratory (EPBC Act);
- *Ninox strenua* (powerful owl) – vulnerable (NC Act);
- *Numenius madagascariensis* (eastern curlew) - rare (NC Act), migratory (EPBC Act);and
- *Rallus pectoralis pectoralis* (Lewin's rail) – rare (NC Act);
- *Sterna albifrons* (little tern) – endangered (NC Act), migratory and marine (EPBC Act); and
- *Tadorna radjah* (Radjah shelduck) – rare (NC Act).

The majority of these species are considered to inhabit the dryland/terrestrial environment of the study area. As discussed in Section 3.2.4, this environment is well connected to adjacent similar habitat. Furthermore, this habitat is not considered to be core habitat to any of these terrestrial species. The study area provides the characteristics suitable for breeding and foraging for many of those species however given the availability of similar habitat in the surrounds; this area is not considered of core importance.

For the other shorebird and migratory species, the intertidal habitat provides roosting and foraging area. This is further discussed in Section 3.4.6.

3.4.6 Migratory and Marine Bird Species

A number of EPBC Act-listed migratory bird species either occur or are likely to occur within the study area. The importance of habitat and occurrence of these species within the study area is discussed below.

Woodland habitat within the study area is likely to be used for foraging and/or breeding by terrestrial migratory species listed under the EPBC Act including *Cuculus saturatus* (oriental cuckoo) and *Myiagra cyanoleuca* (satin flycatcher), both of which have been recorded near the study area. Areas of dense riparian vegetation and mangrove habitat within the study area could also be used by migratory *Monarcha trivirgatus* (spectacled monarch) and *Monarcha melanopsis* (black-faced monarch) for foraging, albeit on an infrequent/seasonal basis. Habitat for these terrestrial migratory species is limited within the study area and is unlikely to support significant numbers of the species and, with the exception of *Myiagra cyanoleuca* (satin flycatcher), is unlikely to be used for breeding. As such habitat within the study area is not considered important for these species.

Migratory *Chaetura caudacuta* (white-throated needletail) and *Apus pacificus* (fork-tailed swift) are also likely to forage over the study area when visiting eastern Australia in spring and summer. Habitat within the study area, however, is not considered important for these species.

Habitat within the study area is also likely to be used by a number of migratory shorebirds. *Limosa lapponica* (bar-tailed godwit), *Calidris ruficollis* (red-necked stint) and *Numenius madagascariensis* (eastern curlew) have all been recorded near the study area and are likely to utilise mudflats in the east of the study area for foraging and/or roosting during spring and summer. Other migratory shorebird species recorded from the Gladstone region (e.g. *Limosa limosa* (black-tailed godwit), *Calidris canutus* (red knot), *Tringa nebularia* (common greenshank), *Pluvialis squatarloa* (grey plover), *Xenus cinereus* (terek sandpiper), *Calidris acuminate* (sharp-tailed sandpiper), and *Calidris ferruginea* (curlew sandpiper) could similarly utilise habitat within the study area (mangroves and/or mudflats) for roosting and/or foraging. Reclamation paddocks south of the study area could also provide roosting habitat for some of these species. The migratory and/or marine bird species recorded within the study area during the field survey are detailed in Appendix D.

While intertidal flats within the study area appear to provide suitable foraging and roosting habitat for a range of shorebirds, the Gladstone region is not recognised as an area of national or international significance for migratory shorebirds. As such, the study area is unlikely to support numbers of national or state significance. Habitat within the far north of the study area is however locally important for feeding and roosting shorebirds (i.e., important within the Gladstone area).

3.5 Results Summary

The study area lies at the northern extent of the South East Queensland bioregion and eastern extent of the Brigalow Belt bioregion, both of which support a diverse range of flora and fauna. The study area for the assessment includes the proposed Project footprint and the adjacent terrestrial environment.

In considering potential indirect impacts of reclamation activities to surrounding marine environments as well as indirect impacts of the reclaimed earth volume and structure to stormwater runoff, coastal processes and groundwater dynamics; the adjacent habitats were also assessed.

3.5.1 Vegetation Communities and Habitats

The reclamation footprint boundary includes an intertidal habitat used for foraging and roosting by migratory shorebirds. With existing data from field and desktop investigations, the value of habitat within and adjacent to the study area for migratory shorebirds is difficult to assess. The Gladstone region, however, is not recognised as an area of national or international significance for migratory shorebirds and, as such, the study area is unlikely to support numbers of national or State significance. Habitat within the study area may, nonetheless, be of some importance for migratory species at a regional/local level (see Section 3.4.6). The adjacent intertidal area display similar characteristics and values to that within the reclamation footprint boundary.

In the adjacent terrestrial environment, two ecological communities protected under the EPBC Act were predicted for the project area in the Protected Matters Search Tool results and an additional, third community is known to occur in the area. However, none of these communities were found during field survey (Section 3.4.3). The RE mapping over the study area identifies nine RE types (eight Not of Concern and one Endangered under the VM Act) (Figure 3-1) and is generally correct. However, the mapping of the endangered RE 12.3.3 (Queensland blue gum woodland to open-forest on broad alluvial plains) is incorrect. High quality regrowth for this RE type exists (i.e. vegetation in a non-remnant state), however other areas mapped as containing this RE actually contain RE 11.3.29 (VMA Status: Not of Concern). Full description of the RE types are provided in Table 3-1.

The vegetation communities range from eucalypt woodland and open-forests communities to tidally influenced mudflats and mangroves. Condition assessments identified that the majority of the vegetation communities were in good condition (using the VAST methodology) (see Section 3.2.3). Seven fauna habitat types are represented in the study area (Table 3-2) and these generally correspond to the delineated vegetation communities (Section 3.2.3 and mapped in Figure 3-2). In general, the habitats identified within the study area provide a range of resources for fauna. Variation in the complexity of the vegetation strata provides for differences in habitat values. The woodland areas demonstrate increased complexity relative to the grasslands and are considered to support a greater number of fauna species. Disturbed areas, mainly the grassland habitats, exhibited reduced species richness though retain important foraging habitat values for raptors, snakes, small ground mammals, macropods and other birds.

The intertidal and coastline habitats such as those with tidal influences or estuarine vegetation complexes provide a distinctly different fauna assemblage, as do the freshwater areas. The exposure to coastal processes (winds, saline water, tides and wave action) result in an ecotone between estuarine and inland habitats. This ecotone displays characteristics of both marine and terrestrial landscapes and is similarly expected to provide habitat for species common to both landscapes.

3.5.2 Flora and Fauna Species

A total of 16 flora species of conservation significance were detected by the desktop survey, of which 14 are listed under the Queensland NC Act and seven are listed under the EPBC Act. Of these, 14 do not have habitat requirements met in the study site and its immediate vicinity (see Appendix E). Three species may possibly occur in the study area: *Cycas megacarpa*, *Indigofera baileyi* (Bailey's indigo) and *Quassia bidwillii* (quassia). However, none of these species were detected during the field investigation.

Based on desktop assessments and field surveys, 27 fauna species of conservation significance are considered likely to occur. The majority of these species are considered to inhabit the dryland terrestrial

environment adjacent to the reclamation footprint. This area has potential for indirect impacts only. In addition, a number of EPBC Act-listed migratory bird species are either known or likely to occur within the study area. The value of the area for migratory species is discussed above.

A number of pest and weed species were also detected during the assessment.

4. Potential Impact and Risk Assessment

4.1 Summary of Potential Impacts

The study area exhibits values for a range of flora, fauna and associated habitats that have potential to be impacted, including listed EPBC migratory bird species and marine plant communities. Construction and operation of the Project has the potential to cause a number of direct and indirect impacts on these values.

The impacts and risks to terrestrial ecology are generally associated with changing the coastal processes and profile by introducing a reclaimed landmass to the marine environment with existing tidal and current regimes. There are direct and indirect consequences that have potential to disturb both the terrestrial and intertidal, ecosystems and values, assessed in this report.

4.2 Construction Impacts

Construction impacts of the Project are considered to be the activities associated with establishing the bund wall bounding the reclamation footprint and reclaiming the footprint (not including its function as a dredge disposal area). These impacts are temporary as a result of the construction activities being conducted and are restricted to the period required to conduct these activities. Construction of the bund wall will require deposition of rock material directly on the marine substrate to enclose the area. This enclosure will then be reclaimed using the dredge material. A temporary at grade crossing will be installed to cross the retained channel for access for construction of the western bund wall.

The potential impacts associated with these processes include:

- Disruption to wildlife behaviour as a result of light, noise and vibration disturbances from construction activities;
- Direct mortality of flora and fauna during construction;
- Indirect degradation of habitats due to pollution and acid sulphate soil disturbance; and
- Creation of new habitat on/within the reclamation formation.

4.2.1 Disruption to Wildlife Behaviour

Noise and vibration from activities associated with the establishment and infilling of reclamation area, for example operation of heavy earth-moving machinery and deposition of large grade rock material for the bund wall, may disturb migratory shorebirds on tidal flats in close proximity to activities.

The impacts of noise and vibration are expected to be localised in nature with animals further from the Project area minimally effected or able to habituate. Nevertheless, it must be recognised that these disturbances can have a significant impact on migratory bird species if they restrict access to a limited resource or inhibit wildlife behaviours during critical phase of the animals' life-cycle.

As discussed in Section 3.4.6, the Gladstone region is not recognised as an area of national or international significance for migratory shorebirds though it is expected that the habitat may be of some importance for migratory species at a regional/local scale. Although migratory species may be present throughout the year, greater numbers are expected to visit the area during spring and summer, when an impact would have its greatest effect on this group.

These impacts also apply during the operation of the Project.

4.2.2 Direct Mortality of Flora and Fauna

Any large construction activity in a natural environment has the potential to cause flora and fauna mortality. The increased vehicular activity associated with construction has potential to increase the incidence of terrestrial fauna mortality via collision. The activities required for the Project are predominantly marine based, however additional motor vehicles will be required to transport personnel and equipment to the Project site. As the surrounding landuses already generate heavy vehicle traffic, this impact is not considered to be substantial. The potential for the direct mortality of marine flora and fauna is addressed in Appendices Q and R of the main EIS.

4.2.3 Indirect Degradation of Habitats Due to Pollution, Weed and Pest Species, and Acid Sulphate Soils

As discussed in Section 4.2.2, construction activities will result in increased traffic volumes and greater numbers of visitors to the area. Generally with increased human presence, there is a higher incidence of general refuse in the natural environment. Rubbish and other refuse types, especially those related to construction activities, can harm the natural environment and the native flora and fauna. An increase in human activity may also result in an increase in the abundance of weed and pest species. Introduced species are known to predate, compete and destroy habitat of native species, severely disrupting the natural balance of populations. Although not considered a significant impact, all reasonable measures should be taken to limit refuse to the surrounding area and prevent the spread and/or introduction of weed and pest species.

An acid sulphate soils assessment has been undertaken as part of the Project EIS to assess the risk associated with disturbing material of this nature. Disturbance of, or any leachate from fill used to reclaim land may be harmful to marine plants or invertebrate prey (for birds and mammals) within the benthos of tidal flats adjacent to the proposed reclamation area. As a result of the modification and disturbance of marine plant communities or individuals as a result of the reclamation, marine plant offsets will be negotiated in accordance with relevant legislation including the EPBC and Queensland Government offset policies. Any reduction in prey abundance resulting from contaminated land fill may impact upon migratory and resident shorebirds foraging on tidal flats within and, potentially, adjacent to the study area.

Measures to mitigate acid sulphate soil disturbance are discussed in the Acid Sulfate Soil Assessment (Appendix I of main EIS).

4.2.4 Creation of New Habitat on/within Reclamation Formation

A potential positive outcome of the proposed development is the temporary creation of roosting habitat for migratory shorebird and tern species within reclamation area (as has occurred with Fisherman's Landing reclamation works adjoining the study area to the south, where a number of migratory and shorebird species were recorded during surveys). This is expected to be a temporary habitat benefit as the area will ultimately be filled in.

4.3 Operation Impacts

Operation of the Project is considered to be the associated activities following land reclamation for the life of the Project. This includes the disposal of dredge material, general port operation activities and public access activities.

The potential impacts associated with these processes include:

- Direct loss of habitat within the bund and reclamation footprint;
- Indirect degradation or change in intertidal habitat as a result of changes in coastal processes (scour and sediment deposition);
- Indirect degradation or change in intertidal habitat and adjacent marine plant communities as a result of changes in water quality from stormwater runoff and tailwater management;
- Indirect degradation or change in dryland/terrestrial vegetation communities and fauna habitats due to changes in groundwater dynamics as a result of reclamation;
- Indirect degradation of habitats due to pollution, weeds and pests;
- Disruption to wildlife behaviour as a result of light, noise and vibration disturbances from operational activities; and
- Creation of new habitat on/within the reclamation formation.

4.3.1 Direct Loss of Habitat

There will be a direct loss of intertidal habitat as a result of the construction of the bund wall and reclamation of its enclosure. Approximately 2.5 km of intertidal coastline will be affected by the Project footprint. This intertidal zone provides important forage resources and potential roosting habitat for a number of EPBC listed migratory bird species, including the rare NC Act listed *Numenius madagascariensis* (eastern curlew). The upper limits of this area also provides habitat for a range of marine plant communities.

As discussed in Section 3.4.6, the Gladstone region is not recognised as an area of national or international significance for migratory shorebirds though it is expected that the habitat may be of some importance for migratory species at a regional/local scale and cumulative impacts should be considered (See Section 5). The footprint of the Project will affect almost half of the available habitat within the bay.

4.3.2 Indirect Degradation or Change in Intertidal Habitat as a Result of Changes in Coastal Processes

The establishment of a new landmass in the marine environment is expected to alter existing coastal processes by creating an additional barrier to natural currents and flow paths. Predicted changes to coastal processes as a result of the reclamation include a minor shift in tide height and time, increase in scouring and ponding of water within the proposed channel (see Appendix J of main EIS).

Predicted changes to the hydrology of tidal flats north of the proposed reclamation area will reduce the area of foraging habitat available for shorebirds within the study area during low tide. Additionally, the aforementioned changes may affect the distribution and abundance of invertebrate prey in areas of remaining foraging habitat. As such, changes to coastal processes will result in further loss and potentially degradation of shorebird foraging habitat within the study area, including shorebird feeding habitat of local importance in the far north of the study area.

While affecting foraging habitat, predicted changes in hydrology associated with the proposed development are unlikely to affect shorebird roosting habitat in the north of the study area. Similarly, changes to hydrology in the north of the study area are unlikely to significantly affect habitat suitable for the critically endangered *Epthianura crocea macgregori* (yellow chat Dawson subspecies) or vulnerable EPBC Act-listed *Esacus neglectus* (beach-stone curlew). Changes to tidal habitat to the west of the reclamation area may, however, affect the suitability of potential foraging habitat for *Esacus neglectus* in the south of the study area.

Of most concern to the terrestrial environment is the potential for scouring in the intertidal area adjacent to the reclamation footprint. This intertidal area provides habitat for a range of benthic communities (Appendix Q of main EIS) that are a food resource for shorebirds, many of which are listed as marine or migratory under the EPBC Act, hence considered conservation significant. The local area, especially to the north of the study area, exhibits similar intertidal areas that provide similar values. A change in these coastal patterns has potential to reduce the quality of this foraging area for marine and migratory bird species, and place existing mangrove communities at risk. Scouring has been predicted to occur in the north-east of the basin and at the entrance of the setback channel (Chapter 8 of main EIS). In the event that these intertidal habitats are degraded (in conjunction with the loss of habitat within the footprint) the impact on the local and regional availability of suitable migratory shorebird habitat must be considered.

The reclamation will be set back from the foreshore to assist with conveying overland flows and stormwater discharges from QER and Cement Australia. The width of this setback will be approximately 40 m from the seaward fringe of a mangrove community. The reclamation will buffer the mangrove community within the proposed 40 m channel from the minor wave action experienced in the course of a typical tidal cycle. These mangroves are located in a narrow belt on the landward edge of a shallow but extensive mud flat, exposed to approximately 200 m or more seawards on most low tides. With the reduction in wave action resulting from the reclamation formation, mangrove propagules may establish more readily in this mud flat, allowing an outward expansion of this vegetation community. Alternatively the channel formation may induce an increase in tidal inflow/outflow velocities resulting in scouring and modification of these vegetation communities. Scouring is most likely to occur at the channel entrance during extreme high tides.

Modelling results indicate that the retained channel will experience changes to tidal fluxes with ebb tide velocities being greater and low tide levels higher than what is presently observed (Chapter 8 of main EIS). This change is likely to impact the retained mangrove communities. Individual mangrove species have species specific tolerances to the period of tidal inundation. As a consequence of changes in the tidal flux, the mangrove community within the proposed retained channel may experience turnover in species composition over time as a response to changes to the duration of inundation. Presently mangrove areas are in direct contact with open water and are subjected to similar periods of tidal inundation. With the formation of a channel along the western bund wall, the “upper” areas of mangroves, particularly the mangrove areas in front of the Cement Australia lot, will experience changes in the duration of tidal inundation and as such may experience a turnover from a *Rhizophora* dominated system to a more *Avicennia*/*Ceriops* dominated system. Due to the topography of the proposed channel, tidal flushing within the channel will be limited to extreme high tides and as a result, water will pool within the “upper” reaches. This pooling within the channel will result in changes to the salinity and the possible permanent inundation of the mangrove community and may also result in the mortality of some individuals.

Impacts on the marine plant vegetation communities in the foreshore area may also occur as a result of changes in coastal processes. As a result, marine plant offsets will be negotiated in accordance with relevant legislation including the EPBC and Queensland Government offset policies. In terms of the higher elevation marine plant communities (salt couch grassland), the reclamation formation may limit (or reduce to some extent) the supply of sand to the foreshore in this area. At present the foreshore has a narrow strip of level or gently sloping sand on which the salt couch grassland is located. This sandy strip is isolated from the water by the broad expanse of mudflat and the mangrove tall shrubland and is likely to be inundated only on the highest spring tides.

4.3.3 Indirect Degradation or Change in Intertidal Habitat as a Result of Changes in Water Quality

Changes in water quality as a result of the Project (including tailwater management and stormwater runoff) are described and discussed in the Water Quality Report (Appendix K of main EIS) and Chapter 8 of the main EIS. Any changes to water quality have the potential to impact upon the benthic communities (abundance and complexity) that provide the foraging resource to migratory shorebird species. Any reduction in prey abundance resulting from changes in water quality may impact upon migratory and resident shorebirds foraging on tidal flats within and, potentially, adjacent to the study area.

4.3.4 Indirect Degradation or Change in Dryland/Terrestrial Vegetation Communities and Fauna Habitats

Groundwater underlying this area is relatively shallow and saline (Appendix O of main EIS) and vegetation communities in this area appear to be adapted to this environment. Initial investigations indicate that groundwater levels are not expected to rise as a result of the Project. Similarly, given that no change in the vegetation communities is expected, there is not considered to be an impact on terrestrial fauna habitat.

The natural flow of the minor waterways draining the study area are also not expected to be affected by the project, and should be maintained in their current state. The operational activities are not expected to have any impact on dryland terrestrial vegetation in the study area.

4.3.5 Indirect Degradation of Habitats Due to Pollution

As discussed in Section 4.2.3, increased traffic volumes and greater numbers of visitors to the area has potential to result in increased amount of rubbish, weeds and pests in the area, which can harm wildlife and degrade habitat.

Although not considered a significant impact, all reasonable measures should be taken to limit refuse to the surrounding area and prevent the spread and/or introduction of weed and pest species.

4.3.6 Disruption to Wildlife Behaviour

As discussed in Section 4.2.1, noise, vibration and light associated with the Project have the potential to disrupt natural wildlife behaviours. Noise and vibration during the operation phase is expected to be less than that generated during construction and will consist of minor maintenance of the reclamation surface by GPC machinery. Future proponents wishing to establish facilities on the reclamation will be required to assess the impacts of their operations through their approvals processes.

4.3.7 Creation of New Habitat

The Project design includes a retention pond in the north-west corner of the footprint that is a permanent feature. This allocation aims to provide avenue for the management of the quality and discharge of tailwater and stormwater. This area has potential to provide habitat for migratory shorebird and tern species, though this will be dependant on conditions.

Similarly, the material used to build the bund wall will be larger rock material that provides an alternative aquatic habitat to that represented currently in the area. The potential ecological value of this habitat is discussed in the Marine Ecology technical report. Should it establish a productive habitat, the substrate has potential to provide food resources for migratory shorebirds and predatory birds.

4.4 Risk Assessment

The Gladstone Port Corporation risk assessment methodology has been used to assess the risk of the impacts identified in Section 4. The risk assessment method is shown in Appendix B. Table 4-1 summarises the results of the potential impacts, raw risk rating, mitigation recommendations and resultant residual risk rating.

Table 4-1 Risk Assessment for Terrestrial Flora and Fauna

Activity	Potential Impact	Raw Risk Rating (likelihood, consequence)	Mitigation Recommendation	Residual Risk (mitigated)
Construction Phase - Building of bund and reclamation	Disturbance to wildlife (mainly birds and bats) behaviour due to noise, light and vibration. Potential to disturb EPBC listed migratory shorebird species during critical phase of life-cycle, e.g. roosting, or limit access to food resources.	(3, 5) High	◗ If possible, minimise construction of the northern bund wall during critical migratory bird visitation periods (March- April and September-October); ◗ Employ directional lighting pointed towards Project area and away from surrounding habitat; ◗ Use low wattage lights and glare guards in vicinity of the important shorebird habitat in the north-west of the Project area; ◗ Ensure plant and equipment are maintained; ◗ Monitor abundance and diversity of avifauna species for signs of impact to allow for adaptive management where possible.	(3, 1) Low
	Direct mortality of flora and fauna associated with vehicular traffic and deposition of large rock material.	(3, 1) Low	◗ Educate employees of environmental responsibilities during inductions; ◗ Establish appropriate speed-limits to restrict incidence of wildlife road-kill; ◗ See Marine Megafauna and Marine Ecology technical reports.	(2, 1) Low

Activity	Potential Impact	Raw Risk Rating (likelihood, consequence)	Mitigation Recommendation	Residual Risk (mitigated)
	Indirect degradation of habitats due to pollution, weed and pest species, and acid sulphate soils.	(3, 4) Medium	◗ See Acid Sulfate Soils technical report; ◗ Install appropriate rubbish disposal facilities on site (including recycling option); ◗ Include a weed and pest management plan as part of the EMP for the Project. Management plan will include procedures for managing the spreading of weeds from construction vehicles.	See Acid Sulfate Soils technical report.
Operation Phase – Disposal of dredge material and general port activities	Direct loss of habitat in the footprint of the Project. The footprint will replace an area of intertidal flats considered foraging and roosting habitat for EPBC migratory shorebird species including the rare NC Act-listed *Numenius madagascariensis* (eastern curlew).	(2, 5) Medium	◗ Vegetation offsets. No ability to control impact. Habitat and communities represented elsewhere in the region.	(2, 5) Medium
	Indirect degradation or change in adjacent and surrounding intertidal habitats as a result of changes in coastal processes. This includes potential for scour and/or sediment deposition changing suitability for existing benthic (fauna forage resource) and marine plant communities and reduction in tidal flushing within proposed channel.	(4, 3) Medium	◗ Design of the reclamation area will consider widening of the entrance to the retained channel; ◗ Monitor the distribution and health of the intertidal habitats and report findings regularly; and ◗ Develop a management plan to assess cause of impacts and potential mitigation measures.	(4, 3) Medium

Activity	Potential Impact	Raw Risk Rating (likelihood, consequence)	Mitigation Recommendation	Residual Risk (mitigated)
	Indirect degradation or change in adjacent and surrounding intertidal habitats as a result of changes in water quality. This may change suitability for existing benthic (fauna forage resource) and marine plant communities.	(2, 3) Low	◗ Use appropriate construction of bund and management of tailwater outputs to reduce potential for negative water quality impacts to the adjacent area; ◗ Use geofabric in bund construction; ◗ Manage tailwater decant to maintain water quality within background levels.	(2, 2) Low
	Indirect degradation or change in dryland/terrestrial habitats as a result of groundwater dynamic changes. The reclaimed landmass has potential to impact upon groundwater conditions, flow paths and levels.	(1, 2) Very Low	◗ Monitor the health of the terrestrial habitats and report findings regularly.	(1, 2) Very Low
	Indirect degradation of habitats due to pollution and weed and pest species.	(3, 1) Low	◗ Install appropriate rubbish disposal facilities on site (including recycling option); ◗ Include a weed and pest management plan as part of the EMP for the Project. Management plan will include procedures for managing the spreading of weeds from construction vehicles.	(3, 1) Low

Activity	Potential Impact	Raw Risk Rating (likelihood, consequence)	Mitigation Recommendation	Residual Risk (mitigated)
	Disturbance to wildlife (mainly birds and bats) behaviour due to noise, vibration and light. Potential to disturb EPBC listed migratory shorebird species during critical phase of life-cycle, e.g. roosting, or limit access to food resources.	(3, 3) Medium	◗ Employ directional lighting pointed towards Project area and away from surrounding habitat; ◗ Use low wattage lights and glare guards in vicinity of the important shorebird habitat in the north-west of the Project area; ◗ Ensure plant and equipment are maintained; ◗ Monitor abundance and diversity of avifauna species for signs of impact to allow for adaptive management where possible. Monitoring should consider the need for permanent sound barriers on the north-west bund wall as ongoing protection of important shorebird habitat.	(2, 3) Low

4.5 Project Risks

Impacts and risks associated with the project to the terrestrial ecosystems are generally linked to the loss and potential degradation of marine plant communities and intertidal habitats. The change in coastal processes as a result of the reclamation is likely to reduce the extent and suitability of foraging habitat for shorebirds in the area. How shorebirds will respond to these changes is uncertain. For some shorebird species the predicted changes in hydrology may be beneficial, at least in the short term. For others (and perhaps the majority of species currently utilising habitat in this area) these changes are more likely to be detrimental. Impacts on the marine plant vegetation communities in the intertidal area may also occur as a result of changes in coastal processes. Marine plant offsets will be negotiated in accordance with relevant legislation including the EPBC and Queensland Government offset policies.

5. Cumulative Impacts and Mitigation

The Port of Gladstone has experienced ongoing development since the beginning of the twentieth century. Surveys of the region have identified a diversity of terrestrial flora and fauna assemblages and sensitive areas in close proximity to port facilities demonstrating these assemblages persist under existing port operational conditions. However, as Projects have both direct and indirect impacts on terrestrial flora and fauna and their habitats, it follows that the implementation of additional dredging and reclamation projects will have a cumulative impact on these communities.

Impacts to the marine environment, especially those experienced in intertidal areas, such as water quality changes (e.g. turbidity, salinity), benthic communities and coastal processes changing tidal and flow regimes, have potential to indirectly alter the values for terrestrial ecosystems. Cumulative impacts of multiple dredging and reclamation projects on water quality are discussed in Chapter 16 and cumulative impacts to benthic communities are also addressed in the Marine Ecology technical report.

To minimise these potential cumulative impacts on terrestrial flora, fauna and ecosystems, the design of the reclamation areas has minimised the proposed footprints and other indirect impacts and an appropriate offsets package will be negotiated under the EPBC and Queensland Government offset policies.

6. Conclusion

Surveys of the study area identified a number of conservation significant ecological values that have the potential to be impacted by the proposed Project. These included:

- Essential habitat for *Phascolarctos cinereus* (koala);
- Marine plants;
- Intertidal habitat for migratory shorebird species of local/regional significance;
- Habitat for three terrestrial flora species considered to be conservation significant; and
- Habitat for 27 conservation significant fauna species, dominated by terrestrial species.

The results of groundwater studies for the area indicate (preliminary results only) that the dryland/terrestrial environment impacts will be minor. Therefore the impact to the flora and fauna species dependant on these environments for refuge, forage and breeding resources, as well as movement corridors will not be impacted by the Project.

The intertidal environment, including the marine plant communities however may be impacted by changes in coastal processes (such as scouring or deposition) as a result of the reclamation formation, degradation of water quality and the direct loss of habitat beneath the Project footprint.

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Appendix A

Desktop Assessment Results

Environmental Reporting Tool

Wildlife Online

Queensland Museum

Birds Australia

Queensland Museum

Family	Genus	Species	Common Name	Field Habitat Description
Bufonidae	*Rhinella*	*marina*	cane toad	
Bufonidae	*Rhinella*	*marina*	cane toad	
Elapidae	*Cryptophis*	*boschmai*	carpentaria snake	
Elapidae	*Demansia*	*vestigiata*	lesser black whipsnake	
Elapidae	*Oxyuranus*	*scutellatus*	coastal taipan	*Eucalyptus* woodland
Gekkonidae	*Diplodactylus*	*vittatus*	stone gecko	
Gekkonidae	*Diplodactylus*	*vittatus*	stone gecko	*Melaleuca quinqueenervia* woodland
Gekkonidae	*Diplodactylus*	*vittatus*	stone gecko	*Melaleuca quinquenervia* open woodland with dense ground cover
Gekkonidae	*Gehyra*	*dubia*	dubious dtella	
Gekkonidae	*Gehyra*	*dubia*	dubious dtella	*Melaleuca quinqueenervia* woodland
Gekkonidae	*Gehyra*	*dubia*	dubious dtella	*M.quinquenervia* open woodland with dense ground cover
Gekkonidae	*Heteronotia*	*binoei*	Bynoe's gecko	*Melaleuca quinqueenervia* woodland
Gekkonidae	*Heteronotia*	*binoei*	Bynoe's gecko	*Melaleuca quinqueenervia* open woodland; dense ground cover (AM981)
Gekkonidae	*Heteronotia*	*binoei*	Bynoe's gecko	*Melaleuca quinqueenervia* open woodland; dense ground cover (AM980)
Gekkonidae	*Oedura*	*rhombifer*	zigzag velvet gecko	
Gekkonidae	*Oedura*	*rhombifer*	zigzag velvet gecko	
Hydrophiidae	*Hydrophis*		sea snake	
Hylidae	*Cyclorana*	*brevipes*	superb collared-frog	
Hylidae	*Litoria*	*caerulea*	green treefrog	

Family	Genus	Species	Common Name	Field Habitat Description
Hylidae	*Litoria*	*caerulea*	green treefrog	*Melaleuca quinquenervia* open woodland with dense groundcover (QCL/AM977)
Hylidae	*Litoria*	*fallax*	eastern sedgefrog	
Hylidae	*Litoria*	*fallax*	eastern sedgefrog	
Hylidae	*Litoria*	*inermis*	Peters' frog	
Hylidae	*Litoria*	*inermis*	Peters' frog	
Hylidae	*Litoria*	*latopalmata*	broad-palmed rocketfrog	
Hylidae	*Litoria*	*latopalmata*	broad-palmed rocketfrog	
Hylidae	*Litoria*	*latopalmata*	broad-palmed rocketfrog	
Hylidae	*Litoria*	*nasuta*	striped rocketfrog	
Hylidae	*Litoria*	*nasuta*	striped rocketfrog	
Hylidae	*Litoria*	*rothii*	roth's tree-frog	Small dam
Hylidae	*Litoria*	*rothii*	roth's tree-frog	
Hylidae	*Litoria*	*rubella*	naked treefrog	
Hylidae	*Litoria*	*rubella*	naked treefrog	
Limnodynastidae	*Limnodynastes*	*peronii*	striped marsh frog	*Melaleuca quinquenervia* open woodland; dense ground cover (QCL/AM989)
Limnodynastidae	*Limnodynastes*	*tasmaniensis*	spotted marshfrog	
Limnodynastidae	*Limnodynastes*	*tasmaniensis*	spotted marshfrog	
Limnodynastidae	*Limnodynastes*	*tasmaniensis*	spotted marshfrog	*Melaleuca quinquenervia* open woodland; dense ground cover (QCL/AM976)
Limnodynastidae	*Limnodynastes*	*tasmaniensis*	spotted marshfrog	*Melaleuca quinquenervia* open woodland; dense ground cover (QCL/AM988)
Limnodynastidae	*Limnodynastes*	*terraereginae*	scarlet-sided pobblebonk	

Family	Genus	Species	Common Name	Field Habitat Description
Limnodynastidae	*Limnodynastes*	*terraereginae*	scarlet-sided pobblebonk	*Melaleuca quinquenervia* open woodland/dense Poaceae spp
Limnodynastidae	*Platyplectrum*	*ornatum*	ornate burrowing frog	
Limnodynastidae	*Platyplectrum*	*ornatum*	ornate burrowing frog	
Limnodynastidae	*Platyplectrum*	*ornatum*	ornate burrowing frog	*Melaleuca quinquenervia* open woodland/dense Poaceae spp
Macropodidae	*Macropus*	*giganteus*	eastern grey kangaroo	Eucalypt open forest with very sparse understorey and grassy ground cover
Macropodidae	*Macropus*	*rufogriseus*	red-necked wallaby	Eucalypt open forest with very sparse understorey and grass ground cover
Muridae	*Melomys*	*burtoni*	grassland melomys	*Eucalyptus* open forest/moderate understorey/grassy ground cover/burnt patches
Muridae	*Melomys*	*cervinipes*	fawn-footed melomys	*Melaleuca quinquenervia* open woodland
Myobatrachidae	*Uperoleia*	*rugosa*	chubby gungan	
Phalangeridae	*Trichosurus*	*vulpecula*	common brushtail possum	Eucalypt open forest with very sparse understorey
Pteropodidae	*Pteropus*		flying fox	
Pteropodidae	*Pteropus*	*scapulatus*	little red flying-fox	Eucalypt open forest with very sparse understorey and grass ground cover
Scincidae	*Lygisaurus*	*foliorum*	Burnett's skink	
Scincidae	*Lygisaurus*	*foliorum*	Burnett's skink	
Scincidae	*Lygisaurus*	*foliorum*	Burnett's skink	*Melaleuca quinquenervia* woodland
Scincidae	*Lygisaurus*	*foliorum*	Burnett's skink	*Melaleuca quinquenervia* open woodland/dense grassy ground stratum
Scincidae	*Lygisaurus*	*foliorum*	Burnett's skink	*Melaleuca quinquenervia* open woodland/dense Poaceae spp

Family	Genus	Species	Common Name	Field Habitat Description
Scincidae	*Lygisaurus*	*foliorum*	Burnett's skink	*Melaleuca quinquenervia* open woodland; dense ground cover (AM983)
Scincidae	*Carlia*	*pectoralis*	open-litter rainbow skink	
Scincidae	*Carlia*	*pectoralis*	open-litter rainbow skink	
Scincidae	*Carlia*	*pectoralis*	open-litter rainbow skink	
Scincidae	*Carlia*	*pectoralis*	open-litter rainbow skink	
Scincidae	*Carlia*	*pectoralis*	open-litter rainbow skink	
Scincidae	*Carlia*	*pectoralis*	open-litter rainbow skink	
Scincidae	*Carlia*	*pectoralis*	open-litter rainbow skink	*Melaleuca quinquenervia* open woodland/dense Poaceae spp.
Scincidae	*Carlia*	*vivax*	lively skink	
Scincidae	*Carlia*	*vivax*	lively skink	
Scincidae	*Carlia*	*vivax*	lively skink	Eucalypt woodland
Scincidae	*Carlia*	*vivax*	lively skink	*Melaleuca quinquenervia* woodland
Scincidae	*Carlia*	*vivax*	lively skink	*Melaleuca quinquenervia* open woodland/dense *Poaceae spp/herbaceous* ground cover
Scincidae	*Cryptoblepharus*	*virgatus*	wall skink	
Scincidae	*Cryptoblepharus*	*virgatus*	wall skink	*Melaleuca quinquenervia* woodland
Scincidae	*Cryptoblepharus*	*virgatus*	wall skink	*Melaleuca quinquenervia* woodland
Scincidae	*Cryptoblepharus*	*virgatus*	wall skink	*Melaleuca quinquenervia* open woodland/dense Poaceae spp/herbaceous ground cover
Scincidae	*Ctenotus*	*taeniolatus*	copper-tailed skink	

Family	Genus	Species	Common Name	Field Habitat Description
Scincidae	*Ctenotus*	*taeniolatus*	copper-tailed skink	*Melaleuca quinquenervia* woodland
Scincidae	*Eulamprus*	*tenuis*	bar-sided skink	
Scincidae	*Lerista*	*fragilis*	eastern mulch-slider	
Scincidae	*Lerista*	*fragilis*	eastern mulch-slider	*Melaleuca quinquenervia* woodland
Scincidae	*Lerista*	*fragilis*	eastern mulch-slider	*Melaleuca quinquenervia* open woodland/dense grassy ground stratum
Scincidae	*Lerista*	*fragilis*	eastern mulch-slider	*Melaleuca quinquenervia* open woodland with dense ground cover
Scincidae	*Menetia*	*greyii*	common dwarf skink	
Scincidae	*Menetia*	*greyii*	common dwarf skink	*Melaleuca quinquenervia* open woodland/dense Poaceae spp.
Scincidae	*Morethia*	*taeniopleura*	north-eastern firetail skink	
Scincidae	*Morethia*	*taeniopleura*	north-eastern firetail skink	*Melaleuca quinquenervia* open woodland/dense Poaceae spp/herbaceous ground cover
Varanidae	*Varanus*	*tristis*	black-headed monitor	

Birds Australia

Scientific Name	Common Name	NC Act Status	EPBC Act Status
Acanthagenys rufogularis	spiny-cheeked honeyeater		
Acanthiza pusilla	brown thornbill		
Accipiter cirrocephalus	collared sparrowhawk		
Accipiter fasciatus	brown goshawk		MA
Accipiter novaehollandiae	grey goshawk	R	
Acrocephalus australis	Australian reed-warbler		MA
Actitis hypoleucos	common sandpiper		MA/MI
Alectura lathami	Australian brush-turkey		
Alisterus scapularis	Australian king-parrot		
Anas castanea	chestnut teal		
Anas gracilis	grey teal		
Anas rhynchotis	Australasian shoveler		
Anas superciliosa	Pacific black duck		
Anhinga novaehollandiae	Australasian darter		
Anseranas semipalmata	magpie goose		MA
Anthus novaeseelandiae	Australasian pipit		MA
Aprosmictus erythropterus	red-winged parrot		
Apus pacificus	fork-tailed swift		MA/MI
Aquila audax	wedge-tailed eagle		
Ardea ibis	cattle egret		MA/MI
Ardea intermedia	intermediate egret		MA
Ardea modesta	eastern great egret		MA/MI
Ardea pacifica	white-necked heron		
Ardeotis australis	Australian bustard		
Arenaria interpres	ruddy turnstone		MA/MI
Artamus cinereus	black-faced woodswallow		
Artamus cyanopterus	dusky woodswallow		
Artamus leucorynchus	white-breasted woodswallow		

Scientific Name	Common Name	NC Act Status	EPBC Act Status
Artamus minor	little woodswallow		
Aviceda subcristata	Pacific baza		
Aythya australis	hardhead		
Burhinus grallarius	bush stone-curlew		
Butorides striata	striated heron		
Cacatua galerita	sulphur-crested cockatoo		
Cacomantis flabelliformis	fan-tailed cuckoo		MA
Cacomantis pallidus	pallid cuckoo		MA
Cacomantis variolosus	brush cuckoo		
Calidris acuminata	sharp-tailed sandpiper		MA/MI
Calidris alba	sanderling		MA/MI
Calidris canutus	red knot		MA/MI
Calidris ferruginea	curlew sandpiper		MA/MI
Calidris ruficollis	red-necked stint		MA/MI
Calidris tenuirostris	great knot		MA/MI
Calyptorhynchus banksii	red-tailed black-cockatoo		
Calyptorhynchus funereus	yellow-tailed black-cockatoo		
Calyptorhynchus lathami	glossy black-cockatoo	V	
Caprimulgus macrurus	large-tailed nightjar		
Carternornis leucotis	white-eared monarch		
Centropus phasianinus	pheasant coucal		
Ceyx azureus	azure kingfisher		
Chalcites basalis	Horsfield's bronze-cuckoo		MA
Chalcites lucidus	shining bronze-cuckoo		MA
Chalcites minutillus	little bronze-cuckoo		MA
Chalcophaps indica	emerald dove		
Charadrius bicinctus	double-banded plover		MA/MI
Charadrius leschenaultii	greater sand plover		MA/MI
Charadrius mongolus	lesser sand plover		MA/MI

Scientific Name	Common Name	NC Act Status	EPBC Act Status
Charadrius ruficapillus	red-capped plover		MA
Chenonetta jubata	Australian wood duck		
Chlidonias hybrida	whiskered tern		MA
Chlidonias leucopterus	white-winged black tern		MA/MI
Chroicocephalus novaehollandiae	silver gull		MA
Cisticola exilis	golden-headed cisticola		
Climacteris picumnus	brown treecreeper		
Colluricincla megarhyncha	little shrike-thrush		
Columba livia	rock dove	I	
Conopophila rufogularis	rufous-throated honeyeater		
Coracina novaehollandiae	black-faced cuckoo-shrike		MA
Coracina papuensis	white-bellied cuckoo-shrike		MA
Coracina tenuirostris	cicadabird		MA
Corcorax melanorhamphos	white-winged chough		
Corvus coronoides	Australian raven		
Corvus orru	Torresian crow		
Coturnix pectoralis	stubble quail		MA
Coturnix ypsilophora	brown quail		
Cracticus nigrogularis	pied butcherbird		
Cracticus tibicen	Australian magpie		
Cracticus torquatus	grey butcherbird		
Cygnus atratus	black swan		
Dacelo leachii	blue-winged kookaburra		
Dacelo novaeguineae	laughing kookaburra		
Daphoenositta chrysoptera	varied sittella		
Dendrocygna arcuata	wandering whistling-duck		MA
Dendrocygna eytoni	plumed whistling-duck		
Dicaeum hirundinaceum	mistletoebird		
Dicrurus bracteatus	spangled drongo		MA

Scientific Name	Common Name	NC Act Status	EPBC Act Status
Egretta garzetta	little egret		MA
Egretta novaehollandiae	white-faced heron		
Egretta sacra	eastern reef egret		MA/MI
Elanus axillaris	black-shouldered kite		
Elseyornis melanops	black-fronted dotterel		
Entomyzon cyanotis	blue-faced honeyeater		
Eolophus roseicapillus	galah		
Ephippiorhynchus asiaticus	black-necked stork	R	
Esacus magnirostris	beach stone-curlew	V	MA
Eudynamys orientalis	eastern koel		
Eurystomus orientalis	dollarbird		MA
Falco berigora	brown falcon		
Falco cenchroides	nankeen kestrel		MA
Falco longipennis	Australian hobby		
Falco peregrinus	peregrine falcon		
Fulica atra	Eurasian coot		
Gallinula tenebrosa	dusky moorhen		
Gelochelidon nilotica	gull-billed tern		MA
Geopelia humeralis	bar-shouldered dove		
Geopelia striata	peaceful dove		
Geophaps scripta	squatter pigeon	V	
Gerygone albogularis	white-throated gerygone		
Gerygone levigaster	mangrove gerygone		
Gerygone palpebrosa	fairy gerygone		
Glossopsitta pusilla	little lorikeet		
Grallina cyanoleuca	magpie-lark		
Grus rubicunda	brolga		
Haematopus fuliginosus	sooty oystercatcher	R	
Haematopus longirostris	Australian pied oystercatcher		

Scientific Name	Common Name	NC Act Status	EPBC Act Status
Haliaeetus leucogaster	white-bellied sea-eagle		MA/MI
Haliastur indus	brahminy kite		MA
Haliastur sphenurus	whistling kite		MA
Hieraaetus morphnoides	little eagle		
Himantopus himantopus	black-winged stilt		MA
Hirundapus caudacutus	white-throated needletail		MA/MI
Hirundo neoxena	welcome swallow		
Hydroprogne caspia	Caspian tern		MA/MI
Irediparra gallinacea	comb-crested jacana		
Ixobrychus dubius	Australian little bittern		
Ixobrychus flavicollis	black bittern		
Lalage leucomela	varied triller		
Lalage sueurii	white-winged triller		
Leucosarcia picata	wonga pigeon		
Lewinia pectoralis	Lewin's rail		
Lichenostomus chrysops	yellow-faced honeyeater		
Lichenostomus fasciogularis	mangrove honeyeater		
Lichenostomus fuscus	fuscous honeyeater		
Lichenostomus leucotis	white-eared honeyeater		
Lichenostomus virescens	singing honeyeater		
Lichmera indistincta	brown honeyeater		
Limicola falcinellus	broad-billed sandpiper		MA/MI
Limosa lapponica	bar-tailed godwit		MA/MI
Limosa limosa	black-tailed godwit		MA/MI
Lonchura castaneothorax	chestnut-breasted mannikin		
Lonchura punctulata	nutmeg mannikin		
Lophoictinia isura	square-tailed kite	R	
Lopholaimus antarcticus	topknot pigeon		
Malurus lamberti	variegated fairy-wren		

Scientific Name	Common Name	NC Act Status	EPBC Act Status
Malurus melanocephalus	red-backed fairy-wren		
Manorina melanocephala	noisy miner		
Megalurus timoriensis	tawny grassbird		
Meliphaga lewinii	Lewin's honeyeater		
Melithreptus lunatus	white-naped honeyeater		
Merops ornatus	rainbow bee-eater		MA/MI
Microcarbo melanoleucos	little pied cormorant		
Microeca fascinans	Jacky winter		
Milvus migrans	black kite		
Mirafra javanica	Horsfield's bushlark		
Monarcha melanopsis	black-faced monarch		
Morus serrator	Australasian gannet		MA
Myiagra alecto	shining flycatcher		
Myiagra cyanoleuca	satin flycatcher		MA/MI
Myiagra inquieta	restless flycatcher		
Myiagra rubecula	leaden flycatcher		
Myzomela obscura	dusky honeyeater		
Myzomela sanguinolenta	scarlet honeyeater		
Nectarinia jugularis	olive-backed sunbird		
Neochmia modesta	plum-headed finch		
Nettapus coromandelianus	cotton pygmy-goose	R	MA
Nettapus pulchellus	green pygmy-goose		MA
Ninox connivens	barking owl		
Ninox novaeseelandiae	southern boobook		MA
Numenius madagascariensis	eastern curlew		MA/MI
Numenius phaeopus	whimbrel		MA/MI
Nycticorax caledonicus	nankeen night-heron		MA
Ocyphaps lophotes	crested pigeon		
Onychoprion anaethetus	bridled tern		MA/MI

Scientific Name	Common Name	NC Act Status	EPBC Act Status
Oriolus sagittatus	olive-backed oriole		
Pachycephala pectoralis	golden whistler		
Pachycephala rufiventris	rufous whistler		
Pandion cristatus	eastern osprey		MA/MI
Pardalotus punctatus	spotted pardalote		
Pardalotus striatus	striated pardalote		
Passer domesticus	house sparrow	I	
Pelecanus conspicillatus	Australian pelican		MA
Petrochelidon ariel	fairy martin		
Petrochelidon nigricans	tree martin		MA
Phalacrocorax carbo	great cormorant		
Phalacrocorax sulcirostris	little black cormorant		
Phalacrocorax varius	pied cormorant		
Phaps chalcoptera	common bronzewing		
Philemon citreogularis	little friarbird		
Philemon corniculatus	noisy friarbird		
Phylidonyris niger	white-cheeked honeyeater		
Platalea flavipes	yellow-billed spoonbill		
Platalea regia	royal spoonbill		
Platycercus adscitus	pale-headed rosella		
Plectorhyncha lanceolata	striped honeyeater		
Plegadis falcinellus	glossy ibis		MA/MI
Pluvialis fulva	Pacific golden plover		MA/MI
Pluvialis squatarola	grey plover		MA/MI
Podargus strigoides	tawny frogmouth		
Poliocephalus poliocephalus	hoary-headed grebe		
Pomatostomus temporalis	grey-crowned babbler		
Porphyrio porphyrio	purple swamphen		
Porzana pusilla	Baillon's crake		MA

Scientific Name	Common Name	NC Act Status	EPBC Act Status
Ptilinopus regina	rose-crowned fruit-dove		
Recurvirostra novaehollandiae	red-necked avocet		MA
Rhipidura albiscapa	grey fantail		
Rhipidura leucophrys	willie wagtail		
Rhipidura rufifrons	rufous fantail		MA/MI
Scythrops novaehollandiae	channel-billed cuckoo		MA
Sericornis frontalis	white-browed scrubwren		
Sphecotheres vieilloti	Australasian figbird		
Sterna hirundo	common tern		MA/MI
Sternula albifrons	little tern	E	MA/MI
Strepera graculina	pied currawong		
Streptopelia chinensis	spotted dove		
Sturnus tristis	common myna	I	
Sturnus vulgaris	common starling	I	
Sula leucogaster	brown booby		MA/MI
Symposiarchus trivirgatus	spectacled monarch		MA/MI
Tachybaptus novaehollandiae	Australasian grebe		
Tadorna radjah	Radjah shelduck	R	MA
Taeniopygia bichenovii	double-barred finch		
Thalasseus bengalensis	lesser crested tern		MA/MI
Thalasseus bergii	crested tern		MA/MI
Threskiornis molucca	Australian white ibis		MA
Threskiornis spinicollis	straw-necked Ibis		MA
Todiramphus chloris	collared kingfisher		
Todiramphus macleayii	forest kingfisher		MA
Todiramphus sanctus	sacred kingfisher		MA
Tribonyx ventralis	black-tailed native-hen		
Trichoglossus chlorolepidotus	scaly-breasted lorikeet		
Trichoglossus haematodus	rainbow lorikeet		

Scientific Name	Common Name	NC Act Status	EPBC Act Status
Tringa brevipes	grey-tailed tattler		MA/MI
Tringa nebularia	common greenshank		MA/MI
Tringa stagnatilis	marsh sandpiper		MA/MI
Turnix maculosus	red-backed button-quail		
Vanellus miles	masked lapwing		
Xenus cinereus	Terek sandpiper		MA/MI
Zosterops lateralis	silvereye		MA

Appendix B

Risk Rating Methodology

Risk Assessment Methodology

The objective of a risk assessment is to filter the minor acceptable risks from the major non-acceptable risks. It involves consideration of the sources of risk, the consequences and the likelihood that those consequences may occur.

Risk analysis may be undertaken to various degrees of refinement depending upon the risk information and data available. Analysis techniques include:

- Qualitative assessment;
- Semi-Quantitative assessment; and
- Quantitative assessment.

In practice, a qualitative analysis is often used to first obtain a general indication of the level of risk and then a more quantitative analysis is applied to refine the risk.

A quantitative risk assessment can be undertaken based on statistical analysis for various consequences and probabilities. In the absence of statistical data, an estimate may be made of the degree of the consequence and frequency (refer to section 4.3 of the Standard).

The risk assessment methodology for this EIS uses a semi-quantitative process for determining risk. The semi-quantitative process estimates the degree of the consequence and probability and assigns a score to each. The assigned scores for consequence and probably are not linearly related to each other or to the level of environmental impact but are weighted descriptors (refer to Section 4.3.4 of the Standard). The risk and impact assessment process used here to assess and weight potential project risks was undertaken using an Environmental Risk and Likely Impact ("ERLI") approach. For each possible impact aspect, two key areas were addressed:

Environmental Risk

This essentially considers the risk of irreversible change to natural ecological processes and community interaction. Assessment addresses:

- Conservation significance of environmental, social and cultural values and regional context of these values;
- Current level of integrity of natural ecosystem processes;
- Known sensitivity of ecosystem processes/natural values to human induced change;
- Natural change and resilience of relevant ecosystem processes/natural values;
- Potential for cumulative social and environmental impacts; and
- Level of scientific certainty of the above factors.

Likely Impact

This considered the likely impact of the project, as modified and undertaken in accordance with mitigation strategies (including any environmental management plans or conditions from licensing/approval agencies) and includes:

- Geographic extent of the activities;
- Duration of the activities;
- Magnitude of potential environmental change;

- Confidence in prediction of impact;
- Confidence in mitigation strategies to minimise ecological and social risks; and
- Ability to monitor the impacts and detect change before irreversible change to system processes occurs.

The approach considered direct and indirect impacts, short and long term, cumulative, temporary and irreversible, and adverse and beneficial impacts.

The relative importance of each impact was examined to provide context and an ability to justifiably determine the impact's significance. In particular, the duration of the impact (temporary v permanent) and reversibility were considered. The ability of natural systems (including population, communities and ecosystems) to accept or assimilate impacts was also considered.

The above approach is used to provide the essential information that is used in the formal Risk Assessment as based on the Australian/New Zealand Standard 4360:2004. This methodology is outlined below.

Stage 1: Identification of Risk

This included identification of all relevant risks, addresses all known activities and related environmental aspects of the project.

Stage 2: Risk Analysis

An important feature is recognition of the fact that an event's consequence extends beyond the immediate impact. This methodology ensures that the full consequences of events are visible to risk owners and managers and that the effects on the project are all understood and treated. Each class of consequence is rated a score of 1 - 5, where "1" is minor consequence to "5" is critical.

An analysis of each risk is undertaken to determine an environmental event's likelihood of occurrence and its consequences. A five-level qualitative description of the likelihood and consequences for each risk enables a semi-quantitative method to be used to calculate a 'score' for each risk.

Definitions and scales for Consequences and definitions and scales for Likelihood are shown in the tables below.

Threat criteria and consequence scales

Category	Workplace Health & Safety	Environment	Financial Impact on Earnings before Interest and Tax	Community or Customer Reputation	Legal	Process Interruption
1 Minor	Near miss/no injury	On site release of pollutant contained without external assistance	Losses less than $100,000	Isolated complaint	Court action with small fine – less than $10,000	Less than 1 hour

Category	Workplace Health & Safety	Environment	Financial Impact on Earnings before Interest and Tax	Community or Customer Reputation	Legal	Process Interruption
2 Moderate	First Aid Treatment	On site release of pollutants contained with external assistance	Losses of $100,000 to $1million	Multiple community or customer complaints	Court action with moderate fine - $10,000 to $75,000	1 hour to 1 shift
3 Significant	Medical treatment	Significant on or off site release and detrimental impacts	Losses of $1 million to $2.5 million	Community action with possible delays to project	Court action with significant fine - $75,000 to $250,000	1 shift to 1 day
4 Major	Serious injury/lost time injury	Major offsite release and detrimental impacts	Losses of $2.5 million to $5 million	Community action severely delays project	Court action with major fine - Greater than $250,000	1 day to 1 week
5 Critical	Major extensive injury (permanent disablement) or fatality	EPA ordered shutdown of major part of process	Losses of greater than $5 million	Community or customer outrage prevents projects or results in severe damage to Corporate image which limits future options	Court action with jail sentence	More than 1 week

Likelihood rating

Likelihood	Rating	Likelihood Calculator
Rare	1	The risk may occur only in exceptional circumstances (The risk is not likely to occur in the next 25 years)
Unlikely	2	The risk could occur at some time (The risk is likely to occur once in the next 5-25 years)
Possible	3	The risk might occur at some time (This risk is likely to occur in the next 2-5 years)
Likely	4	The risk will probably occur in most circumstances (The risk is likely to occur in 1-2 years)
Almost Certain	5	The risk is expected to occur in most circumstances (The risk is likely to occur within the next 12 months)

Stage 3: Calculation of Risk Level

Two levels of risk are used:

The **Primary Risk Level (PRL)** is a conservative measure of risk, based on the most severe consequences across all the relevant criteria. PRL is calculated according to the equation:

Primary Risk Level (PRL) = Likelihood Rating X Maximum Consequence Rating

The **Secondary Risk Level (SRL)** is a less conservative measure of risk, which incorporates all relevant criteria, not just the most severe ones. SRL is calculated according to the equation:

Secondary Risk Level (SRL) = Likelihood Rating X Average Consequence Rating

In most circumstances PRL should be the preferred measure, as it is more conservative. Risk scores are banded into risk levels which provide a "plain English" view of the risk. Scores will always be visible to enable prioritisation within bands.

The table below show the bands, their threshold values and indicative management action.

Stage 4: Determination of Options for Treatment of Risks

Following the analysis of a risk it is necessary to investigate the options available for risk treatment and then determine the option or options that provide the greatest cost benefit.

Risks may be treated in one or a combination of ways[1]:

- Avoiding a risk by preventing the activity that leads to the risk eventuating;
- Reducing the likelihood of the risk eventuating;
- Reducing the consequences if the risk does eventuate;
- Transfer the risk; and

[1] After AS/NZS 4360:2004

- Retaining the risk.

Risk assessment matrix

	Consequence				
Likelihood	**Critical (5)**	**Major (4)**	**Significant (3)**	**Moderate (2)**	**Minor (1)**
Almost Certain (5)	High	High	High	Medium	Medium
Likely (4)	High	High	Medium	Medium	Low
Possible (3)	High	Medium	Medium	Low	Low
Unlikely (2)	Medium	Medium	Low	Low	Very Low
Rare (1)	Medium	Low	Low	Very Low	Very Low

Appendix C

Flora Species Records

Flora species list

Species[1](declared status)	Common name	Location (abundance[2])
Aizoaceae		
Sesuvium portulacastrum	sea purslane	4mu (F); 4f (O)
Amaranthaceae		
Achyranthes aspera	chaff flower	4f (O)
*Alternanthera pungens**	khaki weed	2a (R)
Anacardiaceae		
Pleiogynium timorense	Burdekin plum	4f (O)
Apocynaceae		
Alstonia constricta	bitter bark	1a (O)
*Cryptostegia grandiflora**[C2]	rubber vine	2r, 4f (O)
*Gomphocarpus physocarpus**	balloon cotton	1a, 1m, 2a, 2r, 4f (O)
Parsonsia straminea	monkey rope vine	2a, 2r (O)
Asteraceae		
*Ageratum houstonianum**	blue billygoat's grass	1a, 1m (O); 2a, 2r (F)
*Bidens pilosa**	cobbler's pegs	1a, 2a (F)
Cyanthillium cinereum	vernonia	1a, 1m, 2a (F)
*Emilia sonchifolia**	emilia	1a, 1m, 2a (O)
Pterocaulon redolens		1a, 1m, 2a (O)
Avicenniaceae		
Avicennia marina	grey mangrove	3 (A); 4mu (O)
Boraginaceae		
*Heliotropium amplexicaule**	blue heliotrope	1a, 1m, 2a (O)
Cactaceae		
*Opuntia stricta**[C2]	prickly pear	1a, 1m, 4f, 4mu (O)
Capparaceae		
Capparis canescens	wild orange	1a, 2a (R)
Chenopodiaceae		
Enchylaena tomentosa	ruby saltbush	4mu (F); 4f (O)

Species[1](declared status)	Common name	Location (abundance[2])
Halosarcia sp.	glasswort	4mu (D); 4f (O)
Sarcocornia quinqueflora	bead weed	4mu (A); 4f (R)
Combretaceae		
Lumnitzera racemosa	black mangrove	3 (A)
Convolvulaceae		
Ipomoea pes-caprae	beach morning glory	4f (F)
Cyperaceae		
Fimbristylis sp.	sedge	4mu, 4f (A)
Euphorbiaceae		
Excoecaria agallocha	milky mangrove	3 (O); 4mu (O)
Petalostigma pubescens	quinine bush	1a, 1m, 2a (O); 4f (F)
Fabaceae		
Crotalaria linifolia	rattlepod	1a, 1m, 2a (O)
Erythrina vespertilio	bat's-wing coral tree	1a (O)
Flemingia parvifolia		1a (O)
Glycine tomentella	woolly glycine	1a, 1m, 2a (F)
*Macroptilium atropurpureum**	siratro	1a, 1m, 2a, 2r, 4f (F)
Rhynchosia minima	rhynchosia	1a, 1m, 2a (F)
Sesbania sp.	sesbania pea	4f (O), 6 (A)
Stylosanthes sp.*	stylo	1a, 1m, 2a (F), 4f (O)
Hemerocallidaceae		
Dianella sp.	flax lilly	1a, 1m, 2a (R)
Geitonoplesium cymosum	scrambling lily	1a, 1m, 2a (O)
Lamiaceae		
Clerodendrum floribundum	lolly bush	1a, 4f (O)
Vitex trifolia	blue vitex	4f (F)
Laxmanniaceae		
Lomandra longifolia	mat rush	1a, 1m (O), 2r (F)
Lomandra multiflora	many-flowered mat rush	1a, 1m (O)
Lecythidaceae		

Species[1](declared status)	Common name	Location (abundance[2])
Planchonia careya	cocky apple	1a, 4f (O)
Malvaceae		
*Sida cordifolia**	flannel weed	1a, 1m (F); 2a (O)
Sida hackettiana	spiked sida	1a, 1m (A); 2a, 4f (F)
Meliaceae		
Melia azedarach	white cedar	1a, 1m (R)
Mimosaceae		
Acacia disparrima	hickory wattle	1a, 1m, 2r, 4f (A); 2a (O)
Acacia fasciculifera	scrub ironbark	4f (O)
Acacia leiocalyx	black wattle	1a (O)
Moraceae		
Ficus coronata	sandpaper fig	1a, 1m (O)
Myoporaceae		
Myoporum acuminatum	boobialla	4f (F)
Myrtaceae		
Corymbia citriodora	lemon-scented gum	5 (D)
Corymbia intermedia	pink bloodwood	1a, 1m, 5 (O)
Corymbia tessellaris	Moreton Bay ash	1a, 1m (R); 2a (O); 2r (A)
Eucalyptus crebra	narrow-leaved ironbark	1a, 1m, 1sed (D); 2a, 2r (O)
Eucalyptus exserta	peppermint gum	1a, 1m (F)
Eucalyptus tereticornis	Queensland blue gum	1a, 1m (O); 2a, 2r (D)
Lophostemon suaveolens	swamp mahogany	1a, 1m, 2a, 2r (F)
Melaleuca nervosa	narrow-leaved tea tree	1a, 1m (A); 4f (F)
Onagraceae		
Ludwigia sp.		2a (O)
Passifloraceae		
*Passiflora suberosa**	corky passion flower	1a, 1m, 2r (A); 2a (O)
Pentapetaceae		
Melhania oblongifolia		1a, 1m, 2a (F); 4f (O)
Phyllanthaceae		

Species[1](declared status)	Common name	Location (abundance[2])
Breynia oblongifolia	coffee bush	1a, 1m, 2r (O)
Plumbaginaceae		
Aegialitis annulata	club mangrove	3 (O)
Limonium solanderi	native sea lavender	4mu, 4f (O)
Poaceae		
Aristida sp.	wire grass	1a, 1mu (F)
Arundinella nepalensis	reed grass	1a, 1mu, 2a, 2r (F)
*Chloris inflata**	purpletop chloris	1a, 1mu, 2a, 2r (O); 4f (F)
Cymbopogon refractus	barbed wire grass	1a, 1mu, 2a (O)
Eragrostis sp.		1a, 1mu, 2a (O)
Heteropogon contortus	black spear grass	1a, 1mu, 2a, 6 (D ground layer); 4f (F)
*Hyparrhenia rufa**	thatch grass	2r (O); 6 (A)
Panicum sp.		1a, 1mu, 2a (O)
Paspalidium sp.		1a, 1mu, 2a (O)
Oplismenus sp.		1mu (O)
Sporobolus virginicus	salt couch	4f (D), 4mu (F)
*Themeda quadrivalvis**	grader grass	6 (F)
Themeda triandra	kangaroo grass	1a, 1mu, 2a (F)
Polygonaceae		
Persicaria attenuata		2a (in dam) (O)
Portulacaceae		
Portulaca bicolor	pigweed	4mu, 4f (F)
Rhamnaceae		
Alphitonia excelsa	red ash	1a, 1mu, 4f (O)
Rhizophoraceae		
Ceriops tagal	yellow mangrove	3 (A); 4mu (O)
Rhizophora stylosa	red mangrove	3 (D)
Rubiaceae		
Pogonolobus reticulatus	medicine bush	1a, 1mu (F)

Species[1](declared status)	Common name	Location (abundance[2])
Psydrax attenuata	psydrax	1a (O)
Rutaceae		
Geijera salicifolia	brush wilga	1a, 1m (O)
Sapindaceae		
Cupaniopsis anacardioides	tuckeroo	1a, 1mu, 4f (O)
Dodonaea viscosa	sticky hop bush	2r, 4f (O)
Solanaceae		
Physalis sp.		2a (O)
Sparrmanniaceae		
Grewia latifolia	dog's balls	1a, 1mu, 2a, 2r (F)
Typhaceae		
Typha sp.	cumbungi	2a (in dam), 2r (O)
Verbenaceae		
*Lantana camara**[C3]	lantana	1a, 2r, 4f (O), 1mu (F)
*Stachytarpheta jamaicensis**	snake weed	1a, 1mu (O), 2a (F)

[1] As listed in Bostock and Holland (2007). * = exotic. C2 = Class two pest plant, C3 = Class three pest plant, as declared under *Land Protection (Pest and Stock Route Management) Act 2002.*

[2] Abundance is estimated based on observations made during field traverses and measured using the DAFOR scale (D= dominant; A = abundant; F= frequent; O= occasional; R= rare).

Appendix D

Fauna Species Records

GHD Field Survey June 2009

Family	Scientific Name	Common Name	EPBC Status	NCA Status	Habitat
Amphibians					
Bufonidae	*Rhinella marina*	cane toad	-	I	WG/WV/G/FC/D
Hylidae	*Litoria caerulea*	green treefrog	-	-	FC/D
Hylidae	*Litoria fallax*	eastern sedgefrog	-	-	FC/D
Hylidae	*Litoria nasuta*	striped rocketfrog	-	-	WG/FC/D
Hylidae	*Litoria rubella*	naked treefrog	-	-	WG/E
Limnodynastidae	*Limnodynastes peronii*	striped marsh frog	-	-	FC/D
Limnodynastidae	*Limnodynastes tasmaniensis*	spotted marsh frog	-	-	WG/FC/D
Limnodynastidae	*Limnodynastes terraereginae*	scarlet-sided pobblebonk	-	-	WG/G/FC/D
Myobatrachidae	*Platyplectrum ornatum*	ornate burrowing frog	-	-	WG/IZ
Reptiles					
Agamidae	*Diporiphora australis*	tommy roundhead dragon	-	-	WG
Gekkonidae	*Diplodactylus vittatus*	stone gecko	-	-	WG
Gekkonidae	*Gehyra dubia*	dubious dtella	-	-	WG
Gekkonidae	*Oedura rhombifer*	zigzag velvet gecko	-	-	WG/WV
Gekkonidae	*Heteronotia binoei*	Bynoe's gecko	-	-	IZ
Scincidae	*Carlia vivax*	lively skink	-	-	WG/G
Scincidae	*Crytoblepharus virgatus* sensu lato	wall skink	-	-	IZ
Scincidae	*Ctenotus taeniolatus*	copper-tailed skink	-	-	WG/IZ

Family	Scientific Name	Common Name	EPBC Status	NCA Status	Habitat
Scincidae	*Lygisaurus foliorum*	Burnett's skink	-	-	WG
Scincidae	*Morethia taeniopleura*	north-eastern firetail skink	-	-	IZ
Mammals					
Bovidae	*Bos taurus*	cattle	-	I	WG/G/IZ/E/FC/D
Canidae	*Canis lupus*	wild dog	-	I	WG/G/IZ/E/FC/D
Canidae	*Vulpes vulpes*	fox	-	I	WG/G/IZ/E/FC/D
Emballonuridae	*Taphozous troughtoni*	Troughton's sheathtail bat	-	E	E
Felidae	*Felis catus*	feral cat	-	I	IZ
Leporidae	*Oryctolagus cuniculus*	European rabbit	-	I	WG/G
Macropodidae	*Macropus giganteus*	eastern grey kangaroo	-	-	WG/WV/G/IZ/E/FC/D
Miniopteridae	*Miniopterus australis*	little bent-winged bat	-	-	WG/E/D
Miniopteridae	*Miniopterus orianae ocenensis*	eastern bent-winged bat	-	-	WG/E/D
Molossidae	*Chaerephon jobensis*	northern free-tail bat	-	-	E/D
Molossidae	*Mormopterus beccarii*	Beccari's free-tail bat	-	-	E
Molossidae	*Mormopterus* species 2	free-tail bat	-	-	E/D
Molossidae	*Tadarida australis*	white-striped free-tailed bat	-	-	E
Muridae	*Mus musculus*	house mouse	-	I	WG/G/IZ
Muridae	*Pseudomys gracilicaudatus*	eastern chestnut mouse	-	-	WG
Muridae	*Rattus rattus*	black rat	-	I	WG

Family	Scientific Name	Common Name	EPBC Status	NCA Status	Habitat
Peramelidae	*Isoodon macrourus* or *Perameles nasuta*	Bandicoot sp	-	-	WV
Petauridae	*Petaurus norfolcensis*	squirrel glider	-	-	WG
Phalangeridae	*Trichosurus vulpecula*	common brushail possum	-	-	WG/WV
Potoroidae	*Aepyprymnus rufescens*	rufous bettong	-	-	WG/WV/G
Pseudocheiridae	*Petauroides volans*	greater glider	-	-	WG
Pteropodidae	*Pteropus scapulatus*	little red flying fox	-	-	WG/FH
Pteropodidae	*Pteropus alecto*	black flying-fox	-	-	WG/FH
Rhinolophidae	*Rhinolophus megaphyllus*	eastern horseshoe bat	-	-	WG
Vespertilionidae	*Chalinolobus gouldii*	Gould's wattled bat	-	-	E/D
Vespertilionidae	*Chalinolobus nigrogriseus*	hoary wattled bat	-	-	WG/E/D
Vespertilionidae	*Chalinolobus picatus*	little pied bat	-	R	WG
Vespertilionidae	*Nyctophilus species*	unknown long-eared bat	-	-	E
Vespertilionidae	*Scotorepens greyii*	little broad-nosed bat	-	-	WG/E/D
Birds					
Acanthizidae	*Gerygone albogularis*	white-throated gerygone	-	-	WG
Acanthizidae	*Gerygone levigaster*	mangrove gerygone	-	-	E/IZ
Accipitridae	*Haliaeetus leucogaster*	white-bellied sea-eagle	MA/MI	-	WG/WV/IZ
Accipitridae	*Haliastur indus*	brahminy kite	MA	-	IZ
Accipitridae	*Haliastur sphenurus*	whistling kite	MA	-	WG/WV/IZ

Family	Scientific Name	Common Name	EPBC Status	NCA Status	Habitat
Accipitridae	*Pandion cristatus*	osprey	MA/MI	-	IZ
Anatidae	*Anas superciliosa*	Pacific black duck		-	D
Anseranatida	*Anseranas semipalmata*	magpie goose	MA	-	D
Ardeidae	*Ardea modesta*	great egret	MA/MI	-	IZ
Ardeidae	*Butorides striata*	striated heron	-	-	IZ
Ardeidae	*Egretta garzetta*	little egret	MA	-	IZ
Ardeidae	*Egretta novaehollandiae*	white-faced heron	-		IZ
Artamidae	*Artamus leucorynchus*	white-breasted woodswallow	-	-	IZ
Artamidae	*Cracticus nigrogularis*	pied butcherbird	-	-	WG/WV
Artamidae	*Cracticus tibicen*	Australian magpie	-	-	WG/WV/IZ/D
Artamidae	*Strepera graculina graculina*	pied currawong (eastern Australia)	-	-	WG
Campephagidae	*Coracina novaehollandiae*	black-faced cuckoo-shrike	MA	-	WG
Campephagidae	*Coracina papuensis*	white-bellied cuckoo-shrike	MA	-	WG
Campephagidae	*Lalage leucomela*	varied triller	-	-	WG
Charadriidae	*Elseyornis melanops*	black-fronted dotterel		-	IZ
Charadriidae	*Vanellus miles novaehollandiae*	masked lapwing (southern subspecies)		-	IZ
Cisticolidae	*Cisticola exilis*	golden-headed cisticola	-	-	G
Climacteridae	*Charadrius ruficapillus*	red-capped plover	MA	-	RA

Family	Scientific Name	Common Name	EPBC Status	NCA Status	Habitat
Columbidae	*Geopelia humeralis*	bar-shouldered dove	-	-	WG/IZ
Columbidae	*Geopelia striata*	peaceful dove	-	-	WG
Columbidae	*Geophaps scripta scripta*	squatter pigeon (southern subspecies)	V	V	WG/G
Columbidae	*Ocyphaps lophotes*	crested pigeon	-	-	WG
Corcoracidae	*Corcorax melanorhamphos*	white-winged chough	-	-	WG
Corvidae	*Corvus orru*	Torresian crow	-	-	WG/WV
Cuculidae	*Centropus phasianinus*	pheasant coucal	-	-	WG
Cuculidae	*Chalcites minutillus minutillus*	little bronze-cuckoo	MA	-	WG/IZ
Dicruridae	*Dicrurus bracteatus*	spangled drongo	MA	-	WG
Estrildidae	*Taeniopygia bichenovii*	double-barred finch	-	-	WG/G
Haematopodidae	*Haematopus longirostris*	pied oystercatcher	-	-	IZ/RA
Halcyonidae	*Dacelo leachii*	blue-winged kookaburra	-	-	WG
Halcyonidae	*Dacelo novaeguineae*	laughing kookaburra	-	-	WG
Halcyonidae	*Todiramphus sanctus*	sacred kingfisher	MA	-	WG/IZ
Hirundinidae	*Hirundo neoxena*	welcome swallow		-	WG/WV/G/D/IZ/RA
Laridae	*Gelochelidon nilotica*	gull-billed tern	MA	-	IZ
Laridae	*Hydroprogne caspia*	Caspian tern	MA/MI	-	IZ
Lonchura	*Lonchura castaneothorax*	chestnut-breasted mannikin	-	-	WG
Maluridae	*Malurus melanocephalus*	red-backed fairy-wren	-	-	WG/WV/G

Family	Scientific Name	Common Name	EPBC Status	NCA Status	Habitat
Megaluridae	*Megalurus timoriensis*	tawny grassbird	-	-	G
Meliphagidae	*Entomyzon cyanotis*	blue-faced honeyeater	-	-	WG/WV
Meliphagidae	*Lichenostomus fasciogularis*	mangrove honeyeater	-	-	WG/IZ
Meliphagidae	*Lichmera indistincta*	brown honeyeater	-	-	WG/WV/IZ
Meliphagidae	*Melithreptus albogularis*	white-throated honeyeater	-	-	WG
Meliphagidae	*Myzomela sanguinolenta*	scarlet honeyeater	-	-	WG
Meliphagidae	*Philemon citreogularis*	little friarbird	-	-	WG/WV
Meliphagidae	*Philemon corniculatus*	noisy friarbird	-	-	WG/WV
Meropidae	*Merops ornatus*	rainbow bee-eater	MA/MI	-	WG
Monarchidae	*Grallina cyanoleuca*	magpie-lark		-	IZ/D/RA
Monarchidae	*Myiagra inquieta*	restless flycatcher	-	-	RA
Monarchidae	*Myiagra rubecula*	leaden flycatcher	-	-	WG/WV/IZ
Nectariniidae	*Dicaeum hirundinaceum*	mistletoebird	-	-	WG/IZ
Oriolidae	*Sphecotheres vieilloti*	figbird	-	-	WG
Pachycephalidae	*Colluricincla harmonica*	grey shrike-thrush	-	-	WG/IZ
Pachycephalidae	*Pachycephala rufiventris*	rufous whistler	-	-	WG
Pardalotidae	*Pardalotus punctatus*	spotted pardalote	-	-	WG
Pardalotidae	*Pardalotus striatus*	striated pardalote	-	-	WG/WV
Pelecanidae	*Pelecanus conspicillatus*	Australian pelican	MA	-	IZ/RA/D

Family	Scientific Name	Common Name	EPBC Status	NCA Status	Habitat
Phalacrocoracidae	*Phalacrocorax varius*	pied cormorant	-	-	IZ
Phasianidae	*Coturnix ypsilophora*	brown quail	-	-	WG
Podargidae	*Podargus strigoides*	tawny frogmouth	-	-	WG
Pomatostomidae	*Pomatostomus temporalis temporalis*	grey-crowned babbler (eastern)	-	-	WG
Psittacidae	*Aprosmictus erythropterus*	red-winged parrot	-	-	WG
Psittacidae	*Nymphicus hollandicus*	cockatiel	-	-	WG
Psittacidae	*Platycercus adscitus palliceps*	pale-headed rosella (southern form)	-	-	WG
Psittacidae	*Trichoglossus chlorolepidotus*	scaly-breasted lorikeet	-	-	WG
Psittacidae	*Trichoglossus haematodus moluccanus*	rainbow lorikeet	-	-	WG/WV
Rallidae	*Gallinula tenebrosa*	dusky moorhen	-	-	D
Recurvirostridae	*Recurvirostra novaehollandiae*	red-necked avocet	MA	-	RA
Rhipiduridae	*Rhipidura albiscapa*	grey fantail	-	-	WG/WV/IZ
Rhipiduridae	*Rhipidura leucophrys picata*	willie wagtail (northern)	-	-	WG/WV/IZ/RA
Scolopacidae	*Numenius phaeopus*	whimbrel	MA/MI	-	IZ
Strigidae	*Ninox connivens*	barking owl	-	-	WG
Threskiornithidae	*Threskiornis molucca*	Australian white ibis	MA	-	IZ

NC Act Status: E = Endangered; V = Vulnerable; R = Rare. EPBC status:; E = Endangered; V = Vulnerable; MI = Migratory; MA = Marine. Habitat: WG = mixed open woodland with grassy understorey; WV = mixed open woodland with viney understorey; G = grassland; E = estuarine inlet; D = freshwater dam; IZ = intertidal zone; D = freshwater dam.

Appendix E

Likelihood of Occurrence of Conservation Significant Species and Vegetation Communities

Species	NCA Status	EPBC Act Status	Habitat Preference	Likely Presence within the Project Area
Vegetation Communities				
Semi-evergreen vine thickets of the Brigalow Belt and Nandewar bioregions	-	E	In Queensland this community is considered to be analogous with the REs 11.2.3, 11.3.11, 11.4.1, 11.5.15, 11.8.3, 11.8.6, 11.8.13, 11.9.4, 11.9.8, 11.11.18 (Threatened Species Scientific Committee 2001).	Low EPBC Protected Matters search tool-predicted but not found in study area
Weeping myall woodlands	-	E	Woodland to open woodland in which *Acacia pendula* is the dominant or main overstorey species. Occurs on raised alluvial plains in REs 11.3.2 and 11.3.28 (Threatened Species Scientific Committee 2008).	Low EPBC Protected Matters search tool-predicted but not found in study area
Flora				
Actephila sessilifolia broad leaved actephila	R	-	Found in dry rainforest and vine thicket (Harden et al. 2006). This species is usually found beside creeks and is commonly associated with soils derived from serpentinite, granite or acid volcanic rock (Calvert et al. 2005).	Low Herbrecs record for 2 km NW of project area in 'rainforest'; also nominated in Wildlife Online. Not found in study area and unlikely to be present given lack of suitable habitat.
Alyxia magnifolia large-leaved alyxia	R	-	A shrub present in subtropical and dry rainforests on poorer soils (Harden et al. 2006).	Low Two Herbrecs records within 2 km of project area, from dry rainforest ('scrub'); also nominated in Wildlife Online. Not found in study area and unlikely to be present given lack of suitable habitat.

Species	NCA Status	EPBC Act Status	Habitat Preference	Likely Presence within the Project Area
Atalaya rigida veiny whitewood	R	-	A small tree of vine thickets and dry rainforests (Harden et al. 2006).	Low Seven Herbrecs records within 5 km of project area, mostly on Mount Larcom, all in 'vine thicket/microphyll rainforest'; also nominated in Wildlife Online. Not found in study area and unlikely to be present given lack of suitable habitat.
Bosistoa transversa (includes *B. selwynii*) three-leaved bosistoa	-	V	Known to occur up to 300 m altitude in rainforest and vine thicket (DEWHA 2008a).	Low EPBC Protected Matters search tool-predicted; Wildlife Online-listed. Known to occur on Mount Larcom but not likely to be found within project area due to lack of suitable habitat.
Bulbophyllum globuliforme miniature moss orchid	R	V	This species grows as an epiphyte on the upper branches of mature Hoop pines (*Araucaria cunninghamii*) in rainforest, and known from the Calliope Range (DEWHA 2008b).	Low EPBC Protected Matters search tool-predicted only – highly unlikely to be located in project area due to lack of suitable habitat.
Cupaniopsis shirleyana wedge-leaved tuckeroo	V	V	A shrub or small tree found in dry rainforest (Harden et al. 2006).	Low EPBC Protected Matters search tool-predicted; numerous Herbrecs records from the slopes of Mount Larcom, 2 km west of project area, in vine thicket/closed forest; also nominated in Wildlife Online. Not found in study area and unlikely to be present given lack of suitable habitat.

Species	NCA Status	EPBC Act Status	Habitat Preference	Likely Presence within the Project Area
Cycas megacarpa	E	E	A conspicuous cycad when mature growing to three metres (and up to six metres) tall, usually found on sloping country in wet sclerophyll open forest or rainforest (Royal Botanic Gardens 2009).	Low-moderate EPBC Protected Matters search tool-predicted; two Herbrecs record from the slopes and summit of Mount Larcom, where it is common in open sclerophyll forest. Not observed within the project area. Could potentially be present but unlikely.
Graptophyllum excelsum scarlet fuschia	R	-	A dense, prickly shrub to three metres tall found in vine thickets and dry rainforests (Calvert et al. 2005; Harden et al. 2006).	Low One record from Herbrecs on the north east of Mount Larcom slopes, with no associated habitat details recorded. Unlikely to be present on site given the lack of suitable habitat.
Hernandia bivalvis grease nut tree	R	-	◗ A small tree found in dry rainforest (Harden et al. 2006).	Low Four Herbrecs records from dry rainforest/vine thicket on Mount Larcom; also recorded in Wildlife Online. Unlikely to be present in study area due to lack of suitable habitat
Indigofera baileyi Bailey's indigo	R	-	An upright perennial herb to 40 cm. Occurs in open woodland on granite or basalt soils (NSW Dept. Environment and Conservation 2009a).	Moderate One Herbrecs record from Curtis Island with no associated habitat information. This is the most northerly record for this species, which can be found as far south as northern NSW. May be present in project area.

Species	NCA Status	EPBC Act Status	Habitat Preference	Likely Presence within the Project Area
Macropteranthes leiocaulis southern bonewood	R	-	Tree found in vine thickets and dry rainforest (Harden et al. 2006), often on steep, rocky terrain (Calvert et al. 2005).	Low Four Herbrecs records from Mount Larcom range to the west of the project area, all in closed forest/vine thicket. Given the lack of suitable habitat this species is unlikely to occur in the project area.
Parsonsia larcomensis Mt Larcom silkpod	R	V	A creeping plant found above 350 m altitude in montane heathland and shrublands on serpentinites and acid volcanic rocks (DEWHA 2008c).	Low Four Herbrecs records, all from Mount Larcom on steep slopes in rocky areas, cliffs, scree slopes. Given the lack of suitable habitat this species is unlikely to be present in the project area.
Quassia bidwillii quassia	V	V	Quassia is a shrub chiefly found in rainforest and rainforest margins, but can also be found in sclerophyll woodland and open forest, primarily beside temporary or permanent freshwater sources. It is known to occur in association with a number of eucalypts, including *C. citriodora* and *E. tereticornis* (found within the project area) (DEWHA 2008d).	Moderate EPBC Protected Matters search tool-predicted only – no records from the project vicinity and not located during the field surveys. Quassia could be present in sclerophyll vegetation near the watercourses and dams in the project area.
Senna acclinis rainforest cassia	R	-	A shrub known from subtropical and dry rainforest and its margins (NSW Dept. Environment and Conservation 2009b).	Low A single Herbrecs record west of the project area within 5 km. No habitat information was recorded. Given the lack of suitable habitat this species is unlikely to occur in the project area.

Species	NCA Status	EPBC Act Status	Habitat Preference	Likely Presence within the Project Area
Taeniophyllum muelleri[1]	-	V	A widespread and common species found on shrubs and trees in rainforest and open forest, gullies and in riparian vegetation from Cape York Peninsula to Wauchope, New South Wales, at 50 to 1, 200 m elevation (Jones 2006).	Low EPBC Protected Matters search tool-predicted – no records for the project area were located. Given the low altitude of this project, this species is unlikely to be present.
Zieria actites Mt Larcom zieria	V	-	A shrub to one metre tall found only above 600 m altitude on Mount Larcom, in cliff lines and in exposed situations in open woodland and shrubland (Duretto and Forster 2007).	Low Four Herbrecs records from the peak and upper slopes of Mount Larcom. Given the low altitude of this project this species will not be present.
Fauna				
Reptiles				
Crocodylus porosus estuarine crocodile	V	MI/MA	This species inhabits coastal rivers, swamps, estuaries and open seas generally north of Rockhampton. The study area is the southern distribution limit for this species (Wilson 2005).	Moderate Though not recorded during surveys, the estuarine crocodile has been previously recorded near the study area in the Fitzroy and Calliope Rivers. The intertidal habitat within the study area may provide marginal habitat for transient individuals however the area is unlikely to support permanent residents.
Egernia rugosa yakka skink	V	V	Occurs in dry open forests, woodlands and rocky areas, living in communal burrow complexes under heaped dead timber, deep rock crevices or abandoned rabbit warrens (Wilson 2005).	Low No records from or near study area. Little or no suitable habitat within or adjacent study area.

Species	NCA Status	EPBC Act Status	Habitat Preference	Likely Presence within the Project Area
Paradelma orientalis brigalow scaly-foot	V	V	This species inhabits sandstone ridges, woodlands and vine thickets. Often found in association with brigalow (Wilson 2005).	Low No records from or near study area. Little or no suitable habitat within or adjacent study area.
Varanus semiremex rusty monitor	R	-	This species inhabits hollow limbs and trucks in mangroves, swamp margins and freshwater creeks (Wilson 2005).	High Though not recorded during the field survey, the rusty monitor has been previously recorded in the area. The
Mammals				
Chalinolobus dwyeri large-eared pied bat	R	V	Prefers dry sclerophyll forests and woodlands however may also inhabit rainforest edges and moist eucalypt forest. Roosting occurs in caves, mine tunnels and abandoned fairy martin mud nests (Van Dyck and Strahan 2008).	Low-moderate This species was not identified during the field survey however it has been historically recorded within the Rockhampton area. No roosting habitat occurs within the study area. The woodland habitats may provide foraging habitat for this species however due to the abundance of this habitat within the general area, the study area is not considered important for this species.
Chalinolobus picatus little pied bat	R	-	Is thought to inhabit dry areas of southern Queensland, New South Wales and South Australia. Roots in dry caves or mine shafts (Van Dyck and Strahan 2008).	Present The little pied bat was recorded from the open woodland habitat within the study area. The open woodland habitats provides foraging habitat for this species while the freshwater creeks and dams provide an important water resource. There are no roosting sites for this species within the study area.

Species	NCA Status	EPBC Act Status	Habitat Preference	Likely Presence within the Project Area
Dasyurus hallucatus northern quoll	-	E	Most abundant in rocky eucalypt woodland, but occurs in a range of vegetation types, usually within 200 km of coast (Menkhorst and Knight 2004).	Low There are no records of this species from or near the study area. Little to no suitable habitat within or adjacent study area.
Pteropus poliocephalus grey-headed flying fox	-	V	This species occurs along the coast from Rockhampton to Melbourne. Colonies typically camp in gullies that have a dense canopy and are in close proximity to water. Feeds on a wide variety of flowering and fruiting plants (Van Dyck and Strahan 2008).	Moderate No roosting colonies occur within the nearby area however this species has been historically recorded from the general Rockhampton area. As individuals can travel up to 50 km from roosting sites for feeding, the study area provides potential foraging habitat.
Taphozous australis coastal sheathtail-bat	V	-	Prefers coastal roosts within about one kilometre of the ocean, including sand dune scrub, mangroves, *Melaleuca* swamps, coastal heathlands, open eucalypt forest, and grasslands. Cape Hillsborough forms the southernmost point of its range. The species has been found to roost in large numbers in sea caves or rocky clefts (Van Dyck and Strahan 2008).	High Though not recorded during the field survey, this species has been previously recorded in the nearby area. The intertidal zone, woodland and grassland habitats provided potential foraging habitat for this species. No roosting habitat occurs within the study area.

Species	NCA Status	EPBC Act Status	Habitat Preference	Likely Presence within the Project Area
Taphozous troughtoni Troughton's sheath-tail bat	E	-	This species is currently known only from a small area around Mount Isa. Recent studies however suggest that the Troughton's sheath-tail bat may be widespread throughout Queensland. Very little information is known about the habitat requirements however the species has been recorded in hilly areas with rocky outcrops and dry drainage channels dominated by river red gums (*Eucalyptus camaldulensis*). Roosting is thought to occur in caves, rocky outcrops, abandoned hard rock mines and vertical rock walls (Van Dyck and Strahan 2008).	Present This species was recorded within the estuarine inlet habitat adjacent to Site 1.
Xeromys myoides water mouse, false water rat	V	V	Lives near shallow water habitats close to the coast. Also found in coastal wetlands, lagoons, swamps and sedged lakes close to fore dunes (Van Dyck and Strahan 2008).	Low Despite the presence of potentially suitable habitat, no evidence was found of water mice occurring within the study area. Given the absence of records from the Gladstone area, the failure to detect water mice during surveys and the limited extent of suitable breeding/nesting habitat within the study area, it is unlikely that the water mouse occurs within the study area.

Species	NCA Status	EPBC Act Status	Habitat Preference	Likely Presence within the Project Area
Birds				
Accipiter novaehollandiae grey goshawk	R	-	Inhabits rainforests, forests, gullies, valleys, tall woodlands, watercourses and open areas. Nests high in live trees (Pizzey and Knight 2007).	Low-moderate Though not recorded during surveys, the grey goshawk has been recorded from the Gladstone area and, as such, may occur within the study area. Grey goshawks could utilise woodland habitat within the study area when foraging. Shaded creeklines within the study area could also be used for roosting by this species. Overall, habitat within and adjacent the study area appears marginal for the grey goshawk and with very few records from the Gladstone area, habitat within the study area is not considered important for the species.
Calyptorhynchus lathami glossy black-cockatoo	V	-	This species inhabits she-oak forests, woodlands, timbered watercourses, rocky ridges and eucalypt, native cypress and brigalow scrub. Nests in large hollows (Pizzey and Knight 2007)	Low No records from or near study area. Little or no suitable habitat within or adjacent study area.
Ephippiorhynchus asiaticus black-necked stork	R	-	Uncommon nomad over most of range from Broome, WA to Newcastle, NSW. A rare vagrant further south (Slater et al, 2008).The black-necked stork forages in fresh or saline waters up to 0.5 m depth. The bird favours ephemeral wetlands in monsoonal areas, but retreat to permanent waters in dry season. Nests are built in secluded places, often in tops of tall trees with wide views; usually, but not always, in wetlands (Marchant and Higgins 1990).	Low-moderate Though not recorded during surveys, the black-necked stork has been recorded from the Gladstone area and may therefore utilise habitat within the study area. Habitat suitable for this species is limited largely to dams in woodland habitat in the west of the study area. Overall, habitat within the study area is considered marginal for black-necked storks. And, with more suitable habitat elsewhere in the Gladstone region, habitat within the study area is unlikely to be important for the species.

Species	NCA Status	EPBC Act Status	Habitat Preference	Likely Presence within the Project Area
Epthianura crocea macgregori yellow chat - Dawson subspecies	E	CE	This species inhabits bullrushes, pencil-rush, sedges, swamp cane-grass, lignum on season wetlands, artesian bore drains, saltbush and bluebush on plains (Pizzey and Knight 2007).	Low-moderate Though not recorded within the study area, the yellow chat (Dawson subspecies) is known from nearby Curtis Island and the Fitzroy River delta flood plain. Given uncertainty regarding the movement and local distribution of yellow chats in this region, the species could potentially occur within the study area. There is habitat suitable for yellow chats (salt marsh dominated by marine couch *Sporobolus virginicus* and samphire) in the north-east of the study area. The extent of this habitat within the study area is, however, limited and is unlikely to support significant numbers of this species. As such salt marsh habitat within the study area is most likely not important for yellow chats.
Erythrotriorchis radiatus red goshawk	E	V	This bird occupies a range of habitats in northern and eastern Australia, including coastal and subcoastal tall open forests and woodlands. The red goshawk has an enormous home range covering between 50 and 220 km^2. It prefers a mix of vegetation types with its habitat including tall open forest, woodland, lightly treed savannah and the edge of rainforest (Marchant and Higgins 1993).	Low Very rare in coastal parts of south-east Queensland. Not recorded during surveys. No records from Gladstone area. Habitat within and adjacent study area marginal for species.

Species	NCA Status	EPBC Act Status	Habitat Preference	Likely Presence within the Project Area
Esacus neglectus beach stone-curlew	V	-	Found on northern beaches and reefs. Usually rests near driftwood during the day and feeds later in afternoon on beaches or when tide is out on reefs (Slater et al. 2008).	Low-moderate Though not recorded during surveys, the beach stone-curlew could utilise mudflats, mangroves and adjacent habitat in the north-east of the study area for roosting and/or foraging. Habitat in the south-east of the study area is most likely unsuitable for this species due to vehicular traffic, the presence of cattle and frequent human visitation. The presence of cats and dogs, particularly in the south- east of the study area, may limit the suitability of habitat within the study area for breeding.
Geophaps scripta scripta squatter pigeon (southern subspecies)	-	V	Occurs never far from water in grassed woodlands, foothills, watercourses, river flats, grassy plains, and environs of homesteads (Pizzey and Knight 2007).	Present During surveys, *Geophaps scripta scripta* were recorded from the open woodland and grassland habitats in the west of the study area. The woodland and grassland habitat throughout the study area provide foraging and potentially breeding habitat for this species. The freshwater dams and creeks within the study area are also important for this species, providing much-needed drinking water. These freshwater resources may be especially important for *Geophaps scripta scripta* in dry times when drinking water is scarce. The coastal grassy woodlands between Gladstone and Rockhampton (including those of the study area) support significant numbers of *Geophaps scripta scripta* and, as such, these habitats may be considered important for the species.

Species	NCA Status	EPBC Act Status	Habitat Preference	Likely Presence within the Project Area
Haematopus fuliginosus sooty oystercatcher	R	-	Prefers rocky intertidal shorelines, coral reefs, sandy beaches near intertidal mudflats. Breeds and roots on offshore islands (Marchant and Higgins 1993).	Moderate Though not recorded from the study area, the sooty oystercatcher has been recorded near Gladstone. Tidal flats in the east of the study area may therefore provide foraging habitat for this species, albeit on an irregular/occasional basis. Since tidal mudflats are not the preferred habitat of the sooty oystercatcher, habitat within the study area is not considered important for the species.
Lophoictinia isura square-tailed kite	R	-	Typically inhabits coastal and subcoastal habitats including open forests, woodlands with grassy understorey, coastal healthlands, grasslands, pasture crops, road verges and urban areas (Marchant and Higgins 1993).	High While not recorded during surveys, the square-tailed kite has been recorded nearby and is likely to occur within the study area. Passerine-rich woodlands within the study area are likely to provide suitable foraging habitat for this species. Large eucalypt trees near water within the study area could also be used by nesting by square-tailed kites. With similar suitable woodland habitat nearby, habitat within the study area would only be considered important for the species if it were used for breeding.
Macronectes giganteus southern giant- petrel	E	E/MI/MA	The southern giant-petrel inhabits Antarctic to subtropical waters. Uncommon winter-spring migrant to Australian coast (Marchant and Higgins 2004).	Low No records form Gladstone area. No suitable habitat within or adjacent study area.

Species	NCA Status	EPBC Act Status	Habitat Preference	Likely Presence within the Project Area
Melithreptus gularis black-chinned honeyeater	R	-	This species inhabits eucalypt and *Melaleuca* forests and woodlands. Vegetated watercourses are a critical habitat within arid areas (Slater et al. 2008).	Moderate While not recorded from the study area, the black-chinned honeyeater has been recorded nearby. Woodland habitat within the study area could therefore provide foraging and, potentially, breeding habitat for this species. With extensive areas of potentially suitable habitat nearby, woodland habitat within the study area is unlikely to be important for the species.
Nettapus coromandelianus cotton pygmy-goose	R	MI	Most commonly found in freshwater lakes, swamps and large water impoundments of coastal and sub-coastal environments. Preference for deep permanent waters with abundant aquatic vegetation. They are a predominantly aquatic species (Marchant and Higgins 1990).	Low-moderate The cotton pygmy-goose has occasionally been recorded from the Gladstone area and could, on occasion, utilise dams within the study area for foraging. If occurring on site, habitat within the study area would most likely be utilised by small numbers of cotton-pygmy goose on an infrequent basis. As such, habitat within the study area is unlikely to be important for the species.
Ninox strenua powerful owl	V	-	This species primarily inhabits mountain forests, forest margins, coastal forests, gullies, woodlands, scrubs, pine plantations and urban areas generally within 200 km of the coast (Pizzey and Knight 2007).	Moderate Though not recorded during surveys, the powerful owl has been recorded from the Gladstone area and, as such, may occur within the study area. Woodland habitat within the study area may provide foraging habitat for this species. Shaded creeklines within the study area could also be used for roosting by powerful owls. Large hollow-baring forest red gums (*E. tereticornis*) in the north of the study area could

Species	NCA Status	EPBC Act Status	Habitat Preference	Likely Presence within the Project Area
				potentially be used for breeding by this species. With similar suitable habitat nearby, habitat within the study area is unlikely to be important for the species, unless breeding on site.
Numenius madagascariensis eastern curlew	R	MI	Common migrant from eastern Asia to coastal mudflats, mangroves, islands, estuaries and sandpits around mainland Australia and Tasmania; many over winter (Slater et al. 2008). Preferred habitats include sheltered coastal areas with large intertidal mudflats or sandflats, often with beds of seagrass (Higgins and Davies 1996). Foraging areas are mainly sheltered intertidal mudflats, which are open and without vegetation or covered with seagrass and often near mangroves (Higgins and Davies 1996).	High Though not recorded during winter surveys, the eastern curlew (a summer visitor to Australia) has been recorded near the study area and is likely to utilise habitat within the study area (intertidal flats and mud flats at the back of mangroves) for foraging and/or roosting. With similar or otherwise suitable habitat south of the study area, habitat within the study area is not considered important for the species.
Pterodroma neglecta neglecta Kermadec petrel (western)	-	V	The Kermadec petrel is a marine, pelagic species that inhabits the subtropical and tropical waters of the South Pacific Ocean. Rare summer-autumn-winter visitor to eastern Australia (Marchant and Higgins 2004).	Low Not recorded during surveys. No records in Gladstone area. No suitable habitat within or adjacent study area.
Rallus pectoralis pectoralis Lewin's rail	R	-	This species inhabits swamps, swamp woodlands, creeks, wet heaths and saltmarshes. Nesting occurs near or over water (Pizzey and Knight 2007).	Low-moderate While not recorded within the study area, the Lewin's rail has been recorded nearby. Well-vegetated creeks and drainage lines in the east of the study area may therefore provide habitat for this species. The extent of suitable habitat for this species within the study

Species	NCA Status	EPBC Act Status	Habitat Preference	Likely Presence within the Project Area
				area is limited however and, with similar habitat nearby, habitat within the study area is unlikely to be important for the species.
Rostratula australis Australian painted snipe	V	V/MI	This species inhabits well vegetated shallows and margins of wetlands, lakes, swamps, inundated or waterlogged grasslands, dams and other freshwater to brackish habitats. Also use modified habitats e.g. low-lying woodlands that have been converted to grazing land, dams, sewage farms or irrigated crops. Nests are found among tall grass tussocks, reeds and rushes and also on small, nuddy islands or swamp shores (Pizzey and Knight 2007).	Low Not recorded from Gladstone area. Little or no suitable habitat within study area. Not recorded from study area during surveys.
Sterna albifrons little tern	E	MI/MA	Commonly found in sheltered coastal environments, including lagoons, lakes and estuaries, especially where there are exposed sandbanks or sand spits. They are rarely found on rocky or muddy shores. This bird uses sheltered coastal environments for breeding and are often found nesting on artificial banks or raised banks within 150 m of the tideline. The shallow waters of estuaries are used for foraging (Higgins and Davies 1996).	Low-moderate The little tern has been recorded in the Gladstone area and could utilise open water in the east of the study area for foraging. Reclamation paddocks south of the study area could also be used for roosting by this species. With extensive areas of open water suitable for foraging nearby, habitat within the study area is not considered important for the species. The reclamation area adjacent the study area could, occasionally at least, be used by little terns for roosting. Just how many birds might utilise this area for roosting is unknown, as is the importance of this reclamation area to the species.

Species	NCA Status	EPBC Act Status	Habitat Preference	Likely Presence within the Project Area
Tadorna radjah Radjah shelduck	R	-	During the wet season, this species inhabits shallow freshwater, salt and brackish swamps, mangrove-lined coastal creeks and shallow river margins. During the dry season, permanent lagoons, paperbark swamps, man-made wetlands, mangroves, tidal mudflats and estuaries are preferred (Pizzey and Knight 2007).	Low-moderate Though rare south of Rockhampton, the radjah shelduck has been recorded from the Gladstone area. The species may therefore occasionally utilise wet areas (in particular dams and mangrove-lined creeks) within or adjacent the study area for foraging. Nesting opportunities within and adjacent the study area appear limited and breeding is considered unlikely. With few records from the Gladstone area and similar suitable habitat nearby, habitat within the study area is unlikely to be important for the species.
Turnix melanogaster black-breasted button-quail	V	V	This species prefers habitats with extensive leaf litter including dry rainforests, vine thickets, scrubby woodlands, lantana thickets and hoop pine plantations (Pizzey and Knight 2007).	Low No records near study area. Little or no suitable habitat within study area. Not recorded during surveys.

NC Status: E = Endangered; V = Vulnerable; R = Rare. EPBC status: CE = Critically Endangered; E = Endangered; V = Vulnerable; MI = Migratory; MA = Marine.

[1] *Taeniophyllum muelleri* is erroneously listed under the EPBC Act. This species should only be listed as Vulnerable Norfolk Island Flora Species and not be listed as vulnerable on the Australian mainland.

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