VOLUME 2

Draft : Environmental Impact Statement

# Chapter B8 Terrestrial Ecology

# B8.1 Introduction

This chapter presents the results of the baseline studies and impact assessment for terrestrial ecology, carried out as part of the Cairns Shipping Development Project (the project) EIS. Further detail on this process can be seen in **Chapter A4, Project Description** and **Chapter A2, Dredge Material Placement Options**. This chapter focuses on the terrestrial ecological values in the study area as shown in **Figure B8.2.6a**.

Land-based construction and operational activities are confined to existing disturbed areas within the Port of Cairns and are limited in scope and area. For this reason, the project will not result in the direct loss of terrestrial habitat. However, there is a requirement to assess any potential impact of dredging activities on near-shore habitats (e.g mud flats), and hence, this chapter focuses on migratory and wading shorebirds that use these habitats. Emphasis is placed on the shorebird habitat associated with Trinity Inlet and the surrounding bay. **Chapter B7, Marine Ecology** describes potential impacts to the marine environment.

This chapter examines the following attributes related to terrestrial ecology within the study area:

- The policy context and legislative framework of the project in relation to terrestrial ecology issues
- The abundance and distribution of terrestrial flora and fauna across the study area
- Ecological and conservation values of species and ecosystems within the study area
- Processes known or likely to control the distribution and abundance of flora and fauna.

This chapter also includes identification and assessment of potential impacts to terrestrial flora and fauna due to the proposed project. Mitigation and management measures are subsequently recommended.

# B8.2 Methodology and Assumptions

## B8.2.1 Nomenclature and Terminology

When specifying the study area relevant to this chapter, conservative consideration was given to the likely geographical extent of potential direct and indirect impacts to terrestrial ecology. The study area refers to land within a one kilometre (km) radius of the centre of Wharves 1 to 5. This is shown in **Figure B8.2.6a** and has been modified from the project area defined in **Chapter A1, Project Introduction** due to the reduced geographical range associated with impacts to terrestrial ecology and the proximity of works to the urban environment. Where relevant, and to give a bioregional context particularly for intertidal bird habitat, areas outside the study area may be referred to on occasion.

The project area is also occasionally referred to where relevant. This area represents the land-side development footprint and is also shown in **Figure B8.2.6a**.

Within this report, the conservation status of a species is described as 'Critically Endangered', 'Endangered', 'Vulnerable', 'Near Threatened', 'Least Concern' 'Migratory' and 'Marine', in line with the provisions of the ***Native Conservation Act 1992*** (Qld) (NC Act) and/or the ***Environment Protection and Biodiversity Conservation Act 1999*** (Cth) (EPBC Act). The term 'marine plant' includes species of plants that normally grow on or adjacent to tidal lands, and is used in this chapter pursuant to the definition in section 8 of the ***Fisheries Act 1994*** (Qld).

Vegetation type descriptions used (e.g woodland and low open heath) are based on the structural types described by Neldner et al. (2012). Names of flora follow the Census of Queensland Flora (Bostock and Holland 2013) whilst names of fauna follow listings as per the NC Act, EPBC Act and Pizzey and Knight (2003).

As there are both terrestrial and marine ecological values between the highest and lowest tide marks (i.e intertidal and subtidal areas), there is some overlap between this chapter and **Chapter B7, Marine Ecology**. For this chapter, 'terrestrial habitat' is defined as land above the lowest tide mark. This chapter therefore includes terrestrial fauna that inhabit intertidal and subtidal zones during low tide. Mangrove and estuarine wetland communities are also considered within this chapter as they have potential to support terrestrial fauna (e.g birds), though seagrass communities are dealt with in **Chapter B7, Marine Ecology**.

'Non-aquatic EPBC Act migratory species' are defined in this chapter as those EPBC Act listed migratory species that do not live in water. Migratory birds are an example of non-aquatic migratory species, even though many of these species live and use marine or riverine areas. Conversely, turtles and whales are an example of aquatic EPBC Act Migratory species. These and other aquatic migratory species are discussed in **Chapter B7, Marine Ecology**.

Within this chapter, the term 'database search results' refers to results from the Protected Matters Search Tool results, Wildlife Online Search results and Atlas of Living Australia Search results.

## B8.2.2 Desktop Assessment

The desktop study involved review of Geographical Information System (GIS) mapping, database information, reports and literature relevant to flora and fauna values in the study area. This included the following sources:

- Regional Ecosystem (RE) and remnant vegetation mapping version 6.1 (Department of Environmental and Resource Management (DERM) 2011)
- High value regrowth vegetation mapping version 2.1 (DERM 2011)
- Wetland Management Area mapping and classification (DERM 2011)
- Directory of Important Wetlands mapping (Australian Department of Environment and Heritage 2005)
- Coastal Plan Mapping (Department of Environment and Heritage Protection (DEHP) 2012)
- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) Protected Matters Search Tool (PMST) for the study area (accessed 5th September 2013)
- DERM Wildlife Online (WO) database search (accessed 19th August 2013)
- Atlas of Living Australia (ALA) (accessed 5th September 2013).

## B8.2.3 Field Surveys

Following from the desktop assessment of existing information and outcomes of the gap analysis against the project requirements and respective TORs, the need for a field survey to better understand certain components of terrestrial ecology of the project area was identified. As part of this study, a site visit was undertaken on foot and by boat to collect notes on terrestrial habitat values within the study area (see **Figure B8.2.6a**). This included a walk over of parts of the terrestrial project area as well as a voyage around Trinity Inlet and Bay areas. The site visit aimed at giving perspective of the study area and does not constitute a detailed abundance and diversity survey or detailed habitat assessment.

The site visit occurred over three days between 30 October and 1 November 2013 and involved one ecologist and two representatives from Ports North.

## B8.2.4 Detailed Assessment of Coastal Bird Habitat Values

Detailed assessment of coastal bird habitat values within the study was also undertaken. Major sources of information used in this report include:

- Published data and analysis in journals, previous environmental reports on shorebirds and web based sources
- Data from various bird surveys completed in Trinity Inlet area, which includes Wildlife Online, Birdata and Australian Atlas, and privately owned bird lists and counts
- Advice and observations from local bird watchers including shorebird and raptor specialists.

The assessment was largely based on desktop research and collation of relevant information; however, targeted field surveys were also completed to assess the current condition of known habitats and to investigate gaps in knowledge. This involved visiting known and suspected habitat areas via foot and via boat.

The area subject to the detailed assessment of bird habitat values includes the coastal and intertidal areas within approximately 100m of coastline from Yarrabah township, around Trinity Inlet and north of Ellis Beach.

The work was undertaken by Paul Fisk, a qualified Ornithologist, in December 2013 and the associated report is included in **Appendix D5, Terrestrial Ecology Supporting Information**.

## B8.2.5 Impact Assessment Methodology

The impact significance criteria used for the assessment of the impacts of the project on terrestrial ecology is provided in **Table B8.2.5a**. After mitigation is applied, the residual impact significance is then combined with an assessment of likelihood to give the level of residual risk, as per **Table B8.2.5b**.

**Table B8.2.5a Impact Significance Criteria**

| Impact Significance / Consequence | Description of Significance |
|---|---|
| Very High | Fauna, flora, communities or ecosystems have a high sensitivity to impact (e.g national significance – the loss or removal of populations which reduced the extent or range of target species at the regional level, with the potential to adversely impact on EPBC listing status). |
| High | Fauna, flora, communities or ecosystems have a high to moderate sensitivity to impact (e.g fragmentation or partial loss of populations of EPBC listed species or communities). |
| Moderate | Fauna, flora, communities or ecosystems have a moderate sensitivity to impact (e.g removal or significant reduction in the extent of suitable habitat assessed as 'high suitability' for EPBC listed threatened species across the site). |
| Minor | Impacts tend to be short term or temporary and/or occur at a local scale (e.g a reduction in the extent of suitable habitat assessed as 'high suitability' for EPBC listed threatened species across the site). |
| Negligible | Minimal change to the existing situation. This could include, for example, impacts which are beneath levels of detection, impacts that are within the normal bounds of natural variation or impacts that are within the margin of forecasting error. |
| Beneficial | An improvement in the condition or value of fauna, flora, ecological communities or ecosystems. |

**Table B8.2.5b Risk Matrix Table**

| Likelihood | Significance | | | | |
|---|---|---|---|---|---|
| | Negligible | Minor | Moderate | High | Very High |
| **Highly Unlikely/ Rare** | Negligible | Negligible | Low | Medium | High |
| **Unlikely** | Negligible | Low | Low | Medium | High |
| **Possible** | Negligible | Low | Medium | Medium | High |
| **Likely** | Negligible | Medium | Medium | High | Extreme |
| **Almost Certain** | Low | Medium | High | Extreme | Extreme |

**Table B8.2.5c Risk Rating Legend**

| | |
|---|---|
| **Extreme Risk** | An issue requiring change in project scope; almost certain to result in a 'significant' impact on a Matter of National or State Environmental Significance |
| **High Risk** | An issue requiring further detailed investigation and planning to manage and reduce risk; likely to result in a 'significant' impact on a Matter of National or State Environmental Significance |
| **Medium Risk** | An issue requiring project specific controls and procedures to manage |
| **Low Risk** | Manageable by standard mitigation and similar operating procedures |
| **Negligible Risk** | No additional management required |

## B8.2.6 Limitations

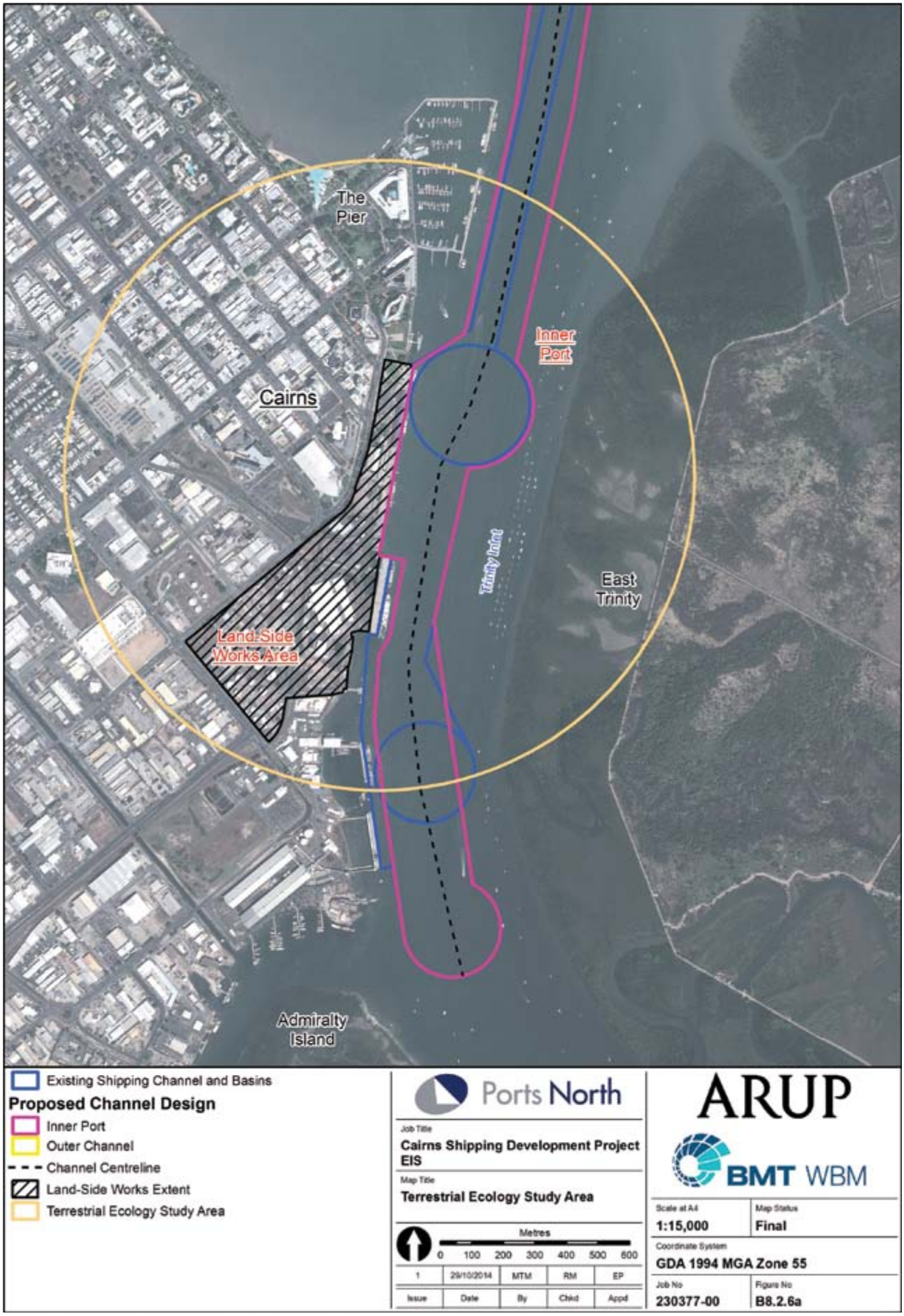
The WO database, ALA database and PMST have been used to obtain preliminary information on the fauna and flora species likely to be present in the study area.

The WO and ALA databases do not contain a comprehensive record of all plant species in an area. The database contains known records of species that have been observed or collected. There are likely to be species present that have not been recorded on the database, due to insufficient historical survey effort and detectability of certain species.

The ALA is also an amalgamation of several databases. As such, its data accuracy and the rigour of survey methodologies associated with the data and source verification would be varying. Despite this, many of the data sources are considered to be highly credible and of a quality suitable for use here. For instance, main sources include data from Eremaea, Birdlife Australia and Australian Museums. A full list of sources is listed in **Appendix D5, Terrestrial Ecology Supporting Information**.

The PMST uses predictive modelling of the potential distribution of threatened species based on historical observations, and each species habitat requirements and known ranges. The tool does not rely on recent observation and may be subject to an amount of error due to the specific on-ground features at a site. As such, the species within the results of the PSMT may not actually exist within the search area. The limitations inherent in the PMST have been mitigated by assessing the habitat suitability for each species listed in the search results.

**Figure B8.2.6a Terrestrial Ecology Study Area**



# B8.3 Legislative Framework

The following is a summary of Commonwealth and Queensland legislation that is most relevant to terrestrial ecology aspects of the project. **Chapter B1, Land** provides further discussion regarding the legislative framework and associated permits and approvals.

## B8.3.1 Environment Protection and Biodiversity Conservation Act 1999 (Cth)

The Commonwealth Government subsequently designated the project a controlled action to be assessed via an EIS due to the potential impact of the project on the following Matters of National Environmental Significance (MNES) pursuant to the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act):

- World Heritage Properties
- National Heritage Places
- The Great Barrier Reef Marine Park
- Listed threatened species and ecological communities
- Listed migratory species
- Commonwealth marine areas
- Commonwealth land.

**Chapter A1, Project Introduction** details the referral, assessment and bilateral agreement relevant to the project.

Each of the relevant MNES is briefly described below and in **Section B8.4.2**; however, detailed descriptions are also contained in Chapter B2, Nature Conservation Values.

The World Heritage Properties and National Heritage Places relevant to this chapter include the Great Barrier Reef World Heritage Area and Great Barrier Reef National Heritage Place (GBRWHA and GBRNHP). The boundaries of these two areas are the same within the study area. These areas primarily cover marine areas though they do include intertidal zones within Trinity Inlet and Trinity Bay. For this reason, these are relevant to this chapter.

The Great Barrier Reef Marine Park (GBRMP) is listed as a separate MNES, and the boundaries of the marine park area are also different to the GRBWHA and GBRNHP. As the GBRMP Zoning covers terrestrial areas, it has been considered in this chapter.

Listed threatened species and ecological communities (TECs) as well as listed migratory species are also relevant to this chapter. Listed threatened flora and fauna species are discussed in **Section B8.5.3** and **B8.6.3**, listed TECs are discussed in **Section B8.5.2**, and listed migratory (and marine) species are discussed in **Section B8.6.4**.

Commonwealth marine areas are not relevant to this chapter as they include marine areas, seabed and airspace from three to 200 nautical miles from the coast.

Commonwealth land, as a MNES, is not directly related to terrestrial ecology, however, terrestrial ecology values do exist on areas of Commonwealth land. Commonwealth land is identified in **Chapter B1, Land**.

## B8.3.2 Nature Conservation Act 1992 (Qld)

The *Nature Conservation Act 1992* (NC Act) provides for the identification, protection and management of Queensland's protected flora and fauna, as well as regulating the use and disturbance of all wildlife. The management and regulations within the NC Act are administered by DEHP.

Threatened species are listed under the NC Act as 'Extinct in the wild', 'Endangered' and 'Vulnerable'. Species can also be classed as 'Near Threatened', if they are at risk of becoming threatened in the near future. Approval from DEHP is required if terrestrial species are under threat of harm due to construction or operation of the project.

## B8.3.3 Vegetation Management Act 1999 (Qld)

The *Vegetation Management Act 1999* (VM Act) regulates the clearing of remnant vegetation, essential habitat and regrowth vegetation within Queensland. The Act was introduced to halt broad-scale clearing in Queensland. The objectives of the VM Act are to:

- Preserve remnant regional ecosystems that are endangered, of concern or of least concern
- Preserve vegetation in areas of high nature conservation
- Preserve areas vulnerable to land degradation
- Ensure clearing does not cause land degradation
- Maintain or increase biodiversity
- Maintain ecological processes and encourage ecologically sustainable land use
- Regulate vegetation clearing.

The vegetation management framework within the VM Act is supported by Regional Ecosystem (RE) mapping, which is further described in **Section B8.5.1** of this Chapter.

## B8.3.4 Fisheries Act 1994 (Qld)

The *Fisheries Act 1994* established a regime for managing fishing, development in fisheries areas and damage to marine plants in Queensland. It is relevant to this chapter as marine plants exist above the low water mark of the project area. In the act, a 'marine plant' is defined as a plant (or its material) that is usually grown on, or adjacent to, tidal land, where it is living, dead, or standing or fallen. It does not include declared pests under the *Land Protection (Pest and Stock Route Management) Act 2002*. Permits are usually required to remove marine plants.

The *Fisheries Act 1994* also establishes and manages Fish Habitat Areas. These are further discussed in **Chapter B2, Nature Conservation Areas** and **Chapter B7, Marine Ecology**.

## B8.3.5 Land Protection (Pest and Stock Route Management) Act 2002 (Qld)

The *Land Protection (Pest and Stock Route Management) Act 2002* provides a framework and powers for improved management of weeds, pest animals and the stock route network.

Under the Act, landholders have responsibilities for the management of declared pests. There are three classes of declared pests; Classes 1, 2 and 3, with different management requirements under the act.

Declared pests that are located within the study area are discussed in **Section B8.5.4** and **B8.6.5**.

## B8.3.6 Coastal Protection and Management Act 1995 (Qld)

The *Coastal Protection and Management Act 1995* regulates development and management practices within the coastal zone and coastal management districts. Ecological values of the area are considered as part of development assessment, and as such, the provisions of the Act have been considered in this chapter. Further information is provided in **Chapter B1, Land**.

## B8.3.7 Other Relevant Legislation and Policy

The relevance of other statutes is described in **Chapter B1, Land**. With consideration of terrestrial ecology issues, these include:

- Cairns City Masterplan
- *Environmental Protection Regulation 2008*
- *Far North Queensland Regional Plan 2009-31 (FNQRP)*
- *State Development Assessment Provisions (SDAP)*
- *State Planning Policies (SPP)*
- *State Planning Regulatory Provisions (SPRP).*
- *Sustainable Planning Act 2009*
- *Sustainable Planning and Other Legislation (SPOLA) Act*

# B8.4 Existing Environment

## B8.4.1 Regional Terrestrial Ecology

The study area exists within the Wet Tropics World Heritage Area (WHA) and the GBRWHA (CRC 2012). Both the areas are recognised as outstanding examples of biodiversity, habitat for threatened species, species endemism and intact ecological processes (SEWPaC 2013a, Wet Tropics Management Authority 2013).

On land, there is a diverse array of vegetation communities across the Cairns region, supporting a high level of faunal and floral diversity. Various types of mesophyll, notophyll and microphyll vine forest (rainforest) dominate eastern parts of the region where large remnant forests exist, whilst sclerophyll forests and woodlands dominate in the western parts across the Great Dividing Range (CRC 2012).

There are also high levels of habitat fragmentation across the Cairns region, particularly in lowland habitats due to the concentration of buildings, agriculture, forestry and transport infrastructure (CRC 2012). The area of urban development around Cairns City, and hence the project, is the most fragmented landscape in the region due to the concentration of urban development.

## B8.4.2 Protected Areas

**Chapter B2, Nature Conservation Areas** describes and maps protected areas within the study area. Protected areas relevant to this chapter are shown in **Table 8.4.2a**.

**Table B8.4.2a Protected Areas Relevant to Terrestrial Ecology Values**

| Area | Description and Terrestrial Ecology Significance |
|---|---|
| Great Barrier Reef World Heritage Area and Great Barrier Reef National Heritage Place (GBRWHA and GBRNHP) | Areas within the GBRWHA and GBRNHP relevant to this chapter are shown in **Figure B8.4.2a**. This includes parts of the estuarine wetland community on the eastern side of Trinity Inlet, as well as the intertidal zone north of the study area, across from the Cairns Esplanade. |
| State Great Barrier Reef Coast Marine Park | Parts of land relevant to this chapter are mapped as an Estuarine Conservation Zone (see **Figure B8.4.2b**). This includes the intertidal habitat across from Cairns Esplanade. |
| Ramsar Wetlands | No Ramsar Wetlands exist within the study area. |
| Wetlands of National Importance | Wetlands of National Importance are mapped in **Figure B8.4.2a**. The study area traverses the *Port of Cairns and Trinity Inlet Wetland of National Importance*. This area includes most of the project area along the wharves, the area of estuarine wetlands and mangroves on the eastern side of Trinity Inlet and parkland around the Esplanade. To the north of the study area, the intertidal area associated across the Esplanade is also mapped as part of the wetland. |
| Great Barrier Reef Wetland Protection Areas (GBRWPAs) | No GBRWPAs exist within the study area. |
| Wetland Management Areas | Wetland Management Areas are mapped within Trinity Inlet, however, do not cover terrestrial areas. |
| Protected Estate | No National Parks, Conservation Parks, Forest Reserves, Resource Reserve, State Forests or Timer Reserves exist within the study area. The closest area of protected estate is Greys Peak National Park, which lies 3.5km to the east of the Wharves. |
| Essential Habitat | No essential habitat will be impacted by the project; this assessment does not consider it further. |

**Figure B8.4.2a GBRWHA, GBRNHP and Wetlands of National Importance**

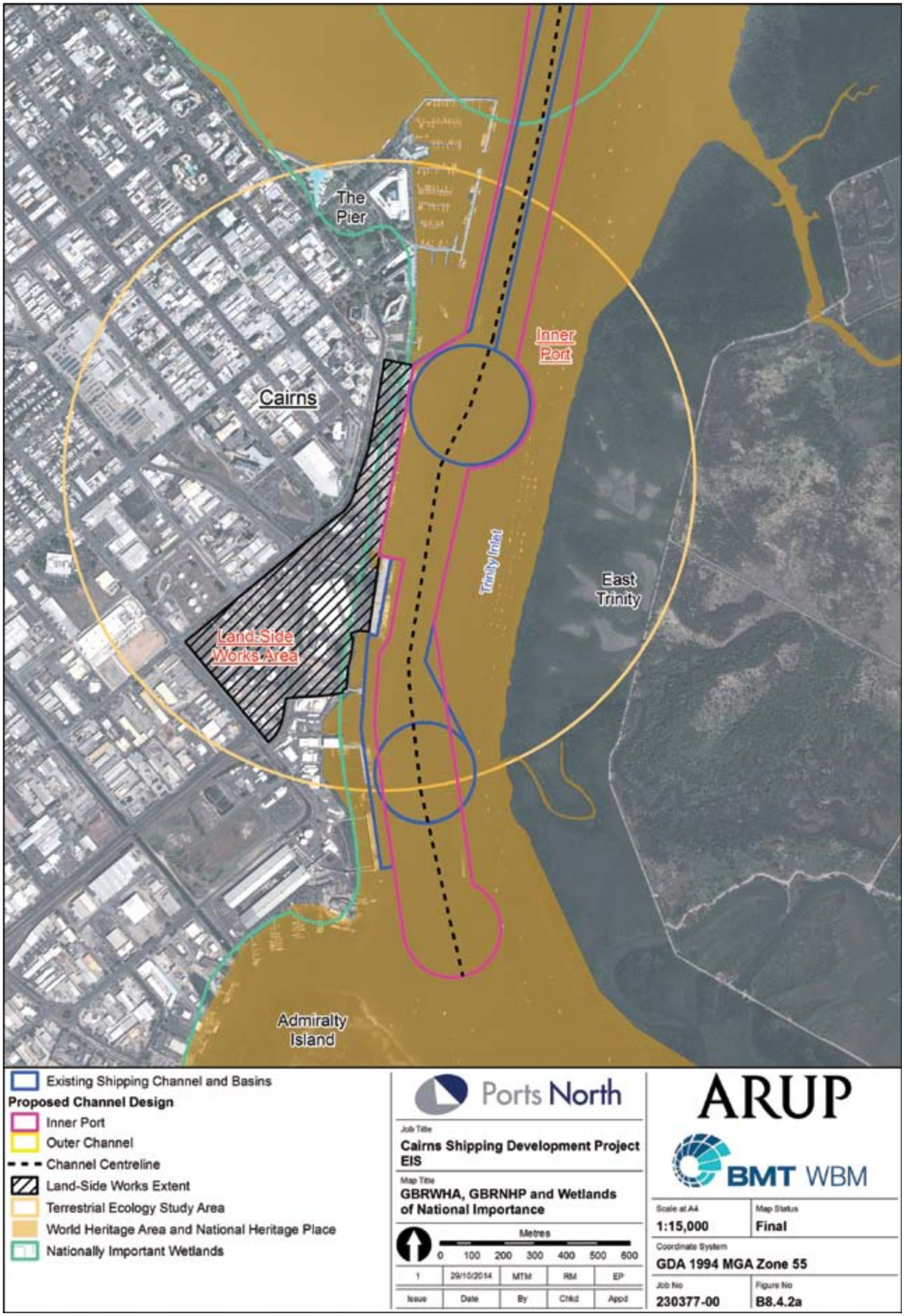
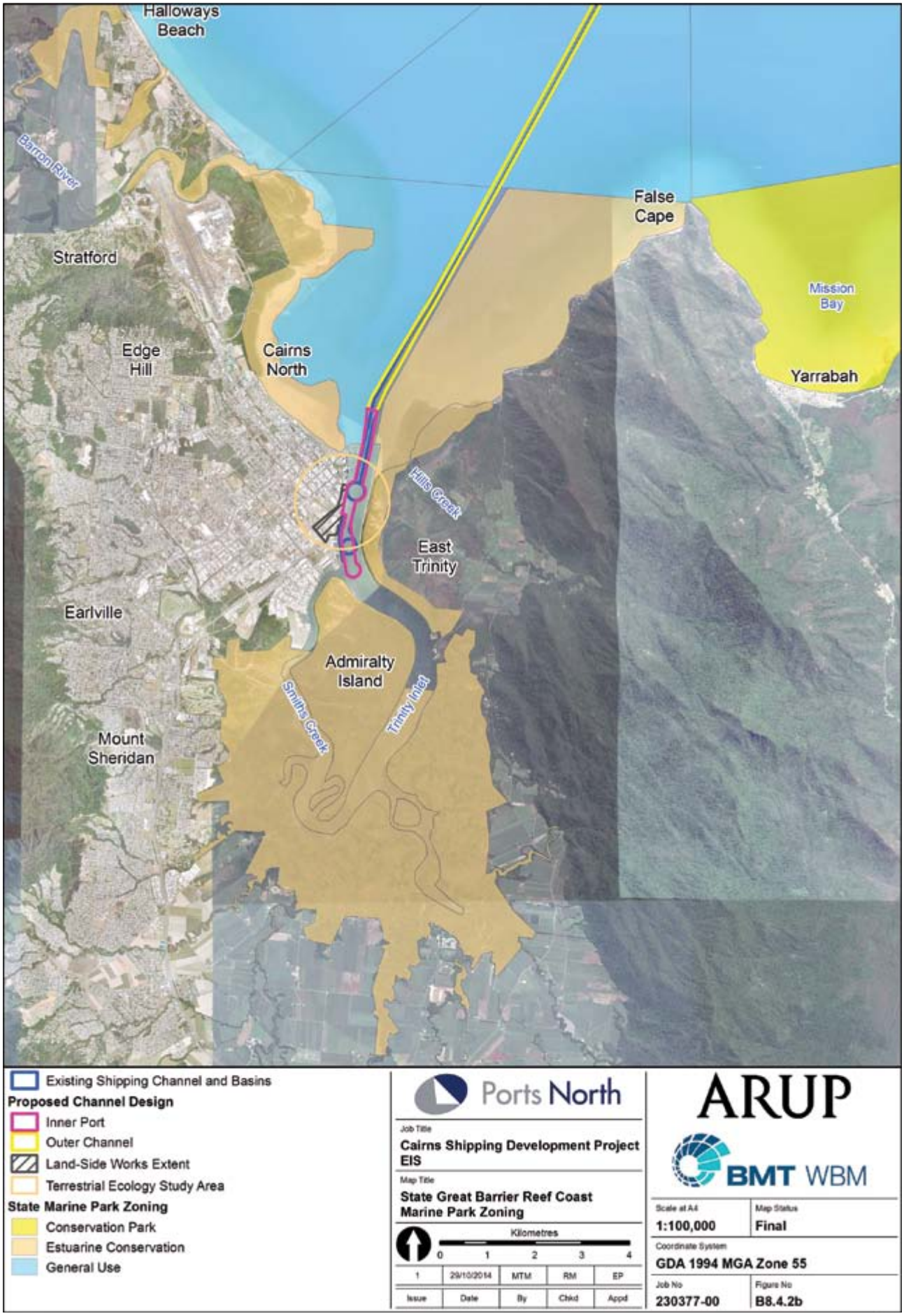


**Figure B8.4.2b State Great Barrier Reef Coast Marine Park Zoning.**



## B8.4.3 Wildlife Corridors

Wildlife corridors allow movement and dispersal of wildlife across large geographical areas. They are often made up of smaller (stepping stone) or connected linear patches of habitat that provide connectivity to large or important habitat patches throughout the landscape. They provide for both fauna movement and dispersal as well as flora dispersal.

The study area itself is not within any national, state or regional corridors recognised by the Federal Government (SEWPaC 2012; DEH 2011). There are state significant ecological corridors throughout the Cairns region which support a high to very high level of species richness (DEH, 2011).

In addition to this, the study area is within the East Asia – Australasian Flyway (EAAF). Boere and Stroud (2006) define a flyway as the geographical range associated with migratory bird movement, often travelled across on an annual basis from breeding grounds to non-breeding grounds. They usually include resting places and feeding places as well as the migratory flight path.

The EAAF extends from the Arctic Circle through Eastern and South-east Asia and then to Australia and New Zealand (see **Figure B8.4.3a**). The wetland and mudflat habitats in the Trinity Inlet and Bay area provide roosting and foraging habitat for migratory shorebirds during the Australian summer. They arrive between August and September for their non-breeding phase after having travelled south from places such as north-eastern Asia and Alaska (Environment Australia and Wetlands International 2002, Bamford et al. 2008).

The Trinity Inlet and Bay area is an important food-rich site for migratory birds, with the highest concentration of shorebirds between Townsville and Cape York. Up to 5,000 long distance migratory birds stay in the area during summer and tens of thousands more use the area on their way to and from southern Australia (BirdLife Northern Queensland, 2013).

As migratory birds rely on these habitat areas for food resources to support their long migration, the protection of shorebird habitat is considered an important conservation goal. The Commonwealth Government is part of several agreements and conservation activities to protect shorebird habitat across the EAAF. This includes the Japan-Australia Migratory Bird Agreement (JAMBA), the China-Australia Migratory Bird Agreement (CAMBA) and the Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA), as well as two multilateral agreements (Ramsar and Convention on Migratory Species) to protect migratory shorebirds and their habitat. In addition, in 2006, the ***Partnership for the Conservation of Migratory Waterbirds and the Sustainable Use of their Habitats in the East Asian – Australasian Flyway*** was launched by the Australian and Japanese Governments.

The Australian Government has also prepared the ***Wildlife Conservation Plan for Migratory Shorebirds*** (DEH and NHT, 2006) under the EPBC Act to support these international agreements and guide the associated conservation actions.

**Figure B8.4.3a The East Asian-Australasian Flyway (From Bamford et al. 2008)**

# B8.5 Terrestrial Flora

## B8.5.1 Vegetation Communities

No mapped vegetation communities occur within the project area, however,scattered individual trees do exist (see **Figure B8.5.1a**). Such areas include open-grassed park area to the north of Shed 2 and a landscaped area between Shed 3 (the CCLT) and Wharf St. These areas contain common landscaping trees such as Figs (Ficus sp), Palms (e.g. ***Cocos nuficera*** and ***Pandanus*** sp.) and Jacaranda (***Jacaranda*** sp.), amongst others.

Scattered trees (e.g Palms and ***Casuarina*** sp.) also exist in the more industrial areas in the south of the project area.

The only vegetation communities of ecological significance are located on the eastern side of Trinity Inlet. This includes a large area of mangrove forests that are mapped as remnant and regrowth Regional Ecosystems (RE). Mapped remnants include Not of Concern RE7.1.1 and Of Concern 7.1.2a. RE 7.1.1 is described as mangrove closed scrub to open forest which is subject to regular tidal inundation (DEHP, 2013). RE7.1.2a is described as estuarine wetlands comprised of Samphire flats with open forbland to sparse forbland of ***Tecticornia*** spp. (Samphire) and ***Suaeda australis*** (Sea Blite). This RE description also includes bare saltpans (DEHP, 2013).

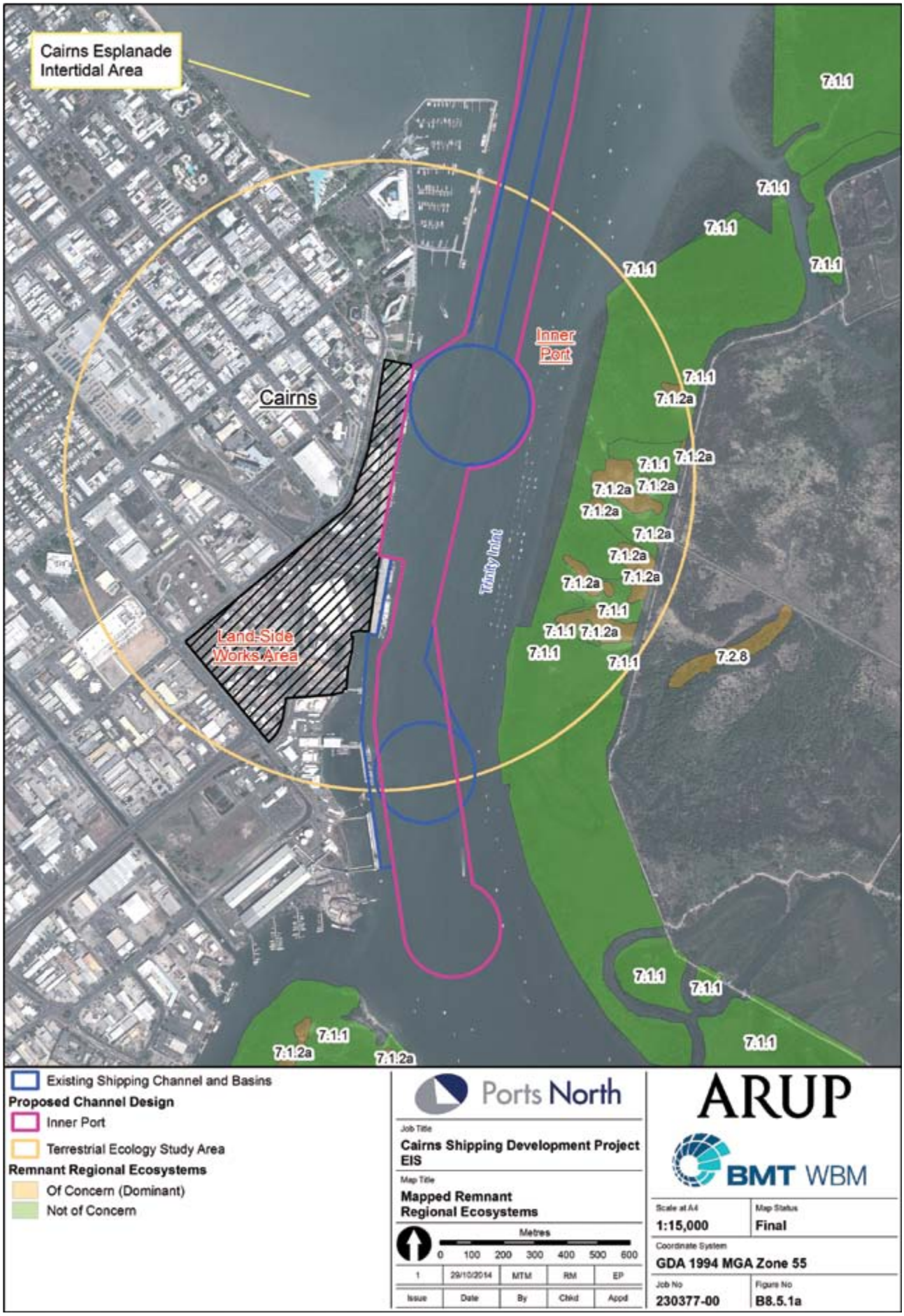
Within the VMA, the term 'Not of Concern' is also known as a least concern regional ecosystem. A least concern regional ecosystem is one where more than 30 percent or 10,000 ha of the pre-clearing extent of the regional ecosystem still exists.

The term 'Of Concern' means that:

- The area of remnant vegetation for the regional ecosystem is 10 percent to 30 percent of the pre-clearing extent of the regional ecosystem, or
- The area of remnant vegetation for the regional ecosystem is more than 30 percent of the pre-clearing extent of the regional ecosystem but is less than 10,000 ha.

Mangrove communities are also listed in the ***Great Barrier Reef Biodiversity Conservation Strategy*** (GBRMPA, 2013) (the Conservation Strategy) as being at risk due to the high degree of management concern combined with a low/moderate adequacy of information. The Conservation Strategy also outlines that mangroves are generally under threat due to the pressures associated with climate change, ports and shipping, coastal development and catchment run-off.

**Figure B8.5.1a Mapped Remnant Regional Ecosystems**



## B8.5.2 Threatened Ecological Communities

The PMST notes that no threatened ecological communities are likely to exist in the area. Mapping and aerial photography of vegetation within the study area confirms this.

## B8.5.3 Threatened and Near Threatened Terrestrial Flora

The PMST shows that two EPBC Act listed plant species (or their habitat) may occur in the study area. This includes:

- ***Dendrobium bigibbum*** (Cooktown Orchid), which is listed as vulnerable under the EPBC Act and NC Act. This species is also known as ***Vappodes bigibba***, though the Census of Queensland Flora (2013) lists the species as ***Dendrobium bigibbum***
- ***Steblus pendulinus*** (Siah's Backbone), which is listed as endangered under the EPBC Act.

***Dendrobium bigibbum*** grows on trees and rocks in a range of habitats, including coastal scrub, stream bank vegetation, monsoon thickets and gullies in fire resistant open forest and woodland (TSSC 2008). ***Steblus pendulinus*** is found in warmer well-developed rainforests, gallery forest and drier, more seasonal rainforest. It chiefly occurs along watercourses (SEWPaC 2013b).

Given the existing land uses, it is very unlikely that these species exist within the project area. It is also unlikely that these species would exist within the mangrove forests and estuarine wetlands to the east of Trinity Inlet.

An additional species, ***Myrmecodia beccarii*** (Ant Plant, vulnerable under the EPBC Act) was observed to be common in mangrove communities in Trinity Inlet. ***Myrmecodia beccarii*** is also listed as a priority plant species under the Back on ***Track Species Prioritisation Framework*** for the Wet Tropics Natural Resource Management Region (DERM 2010). The Framework identifies that habitat clearing for rural-residential development is a major threat to the species. The species is likely to exist across from the Port of Cairns in mangrove and melaleuca forest associated with East Trinity, though is unlikely to exist in the project area due to the absence of suitable habitat.

With the exception of this species, no other priority flora species listed within the Framework have been recorded within the database search results or are expected to occur in the study area.

The WO and ALA search results show that no threatened or near threatened flora species have been recorded within the study area. Further to this, no threatened or near threatened flora species were observed during the site survey.

## B8.5.4 Declared Weeds

No declared weeds were observed during the walkover of the project area.

# B8.6 Terrestrial Fauna

## B8.6.1 Fauna Habitat Values in the Project Area

Due to the urban nature of the project area and immediate surrounds (i.e. the part of the study area associated with Cairns City), habitat values would limit faunal diversity to mostly common species that have adapted well to urban settings. This includes common urban bird species (e.g Crows, Noisy Myna, Rock Pigeons), small exotic mammals such as rats (***Rattus rattus***), mice (***Mus domesticus***) and exotic amphibians (Cane Toads). Despite this, there are some threatened and near threatened species that can occasionally use urban areas for foraging, feeding and roosting (e.g flying foxes and some birds). Threatened species are more likely to occur in the areas of remnant vegetation associated with the coastal environments in the study area (see **Figure B8.5.1a**).

## B8.6.2 Fauna Habitat Values in the Coastal Region

The coastal region contains a mosaic of environs, which include mud flats, seagrass meadows, saltmarsh, mangrove forests and woodlands. Coastal environs (especially mangroves forests, which dominate the wider area) are highly productive zones and function as breeding grounds and habitat for a variety of water birds and other wildlife (Miller 2002).

Due to the potential impacts of the project, the fauna habitat values of primary concern to this assessment are those terrestrial species that exist within tidal areas in and around the study area. The types of habitat relevant to the study include mud flats, sand flats, seagrass meadows and mangrove areas.

### B8.6.2.1 Habitat Values for Birds

Mud flats, sand flats, seagrass meadows and wetlands (including large and small mangrove estuaries) provide valuable feeding, roosting and breeding (for non-migratory species) habitat for shorebirds. Raptors are also dependant on the population of shorebirds.

Past studies have identified Trinity Bay as a nationally important area for the Common Sandpiper (***Actitis hypoleucos***), Whimbrel (***Numenius phaeopus***) and Pacific Golden Plover (***Pluvialis fulva***) (Watkins, 1993), whilst other observers have outlined that it may have international significance for Whimbrels (Harrison, 1999; Bamford et al. 2008, BirdLife Northern Queensland 2013). All three of these species are listed as migratory under the EPBC Act (See **Section B8.6.3**).

Results of the detailed assessment of coastal bird habitat identified the following areas of important habitat:

- Cairns Esplanade Mud Flats (see **Figure B8.6.2.1a**)
- Barron River Delta Intertidal Sand Flats (see **Figure B8.6.2.1a**)
- Nearby Satlmarshes, Saltpans and Wetlands (see **Figure B8.6.2.1a** and **Figure B8.6.2.1b**) and
- Double Island, Haycock Island and the sand and reef flat that lies between these two islands (see **Figure B8.6.2.1b**).

Each of these is further discussed below.

**Figure B8.6.2.1a Bird Habitat Values of Trinity Inlet and Bay**

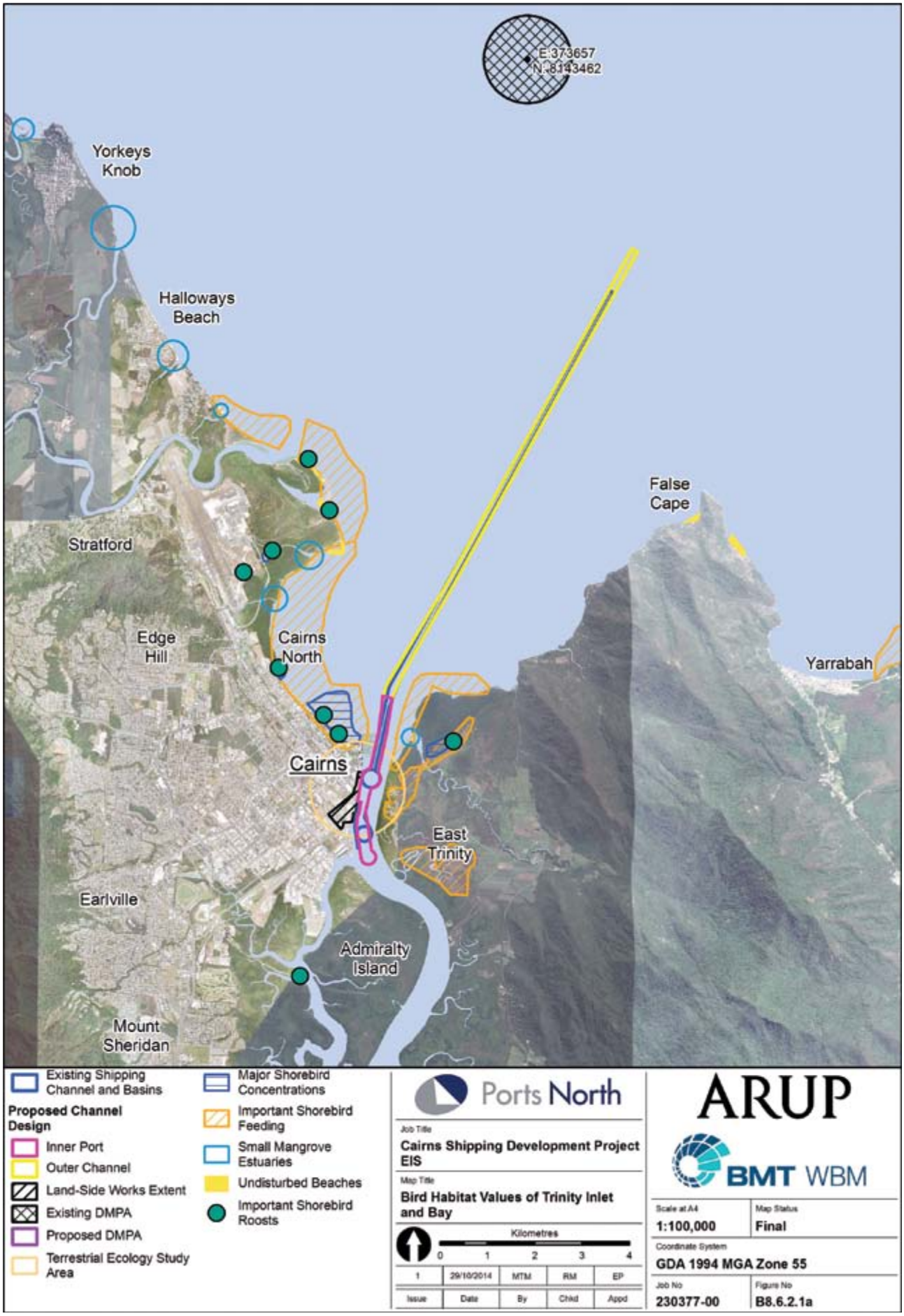
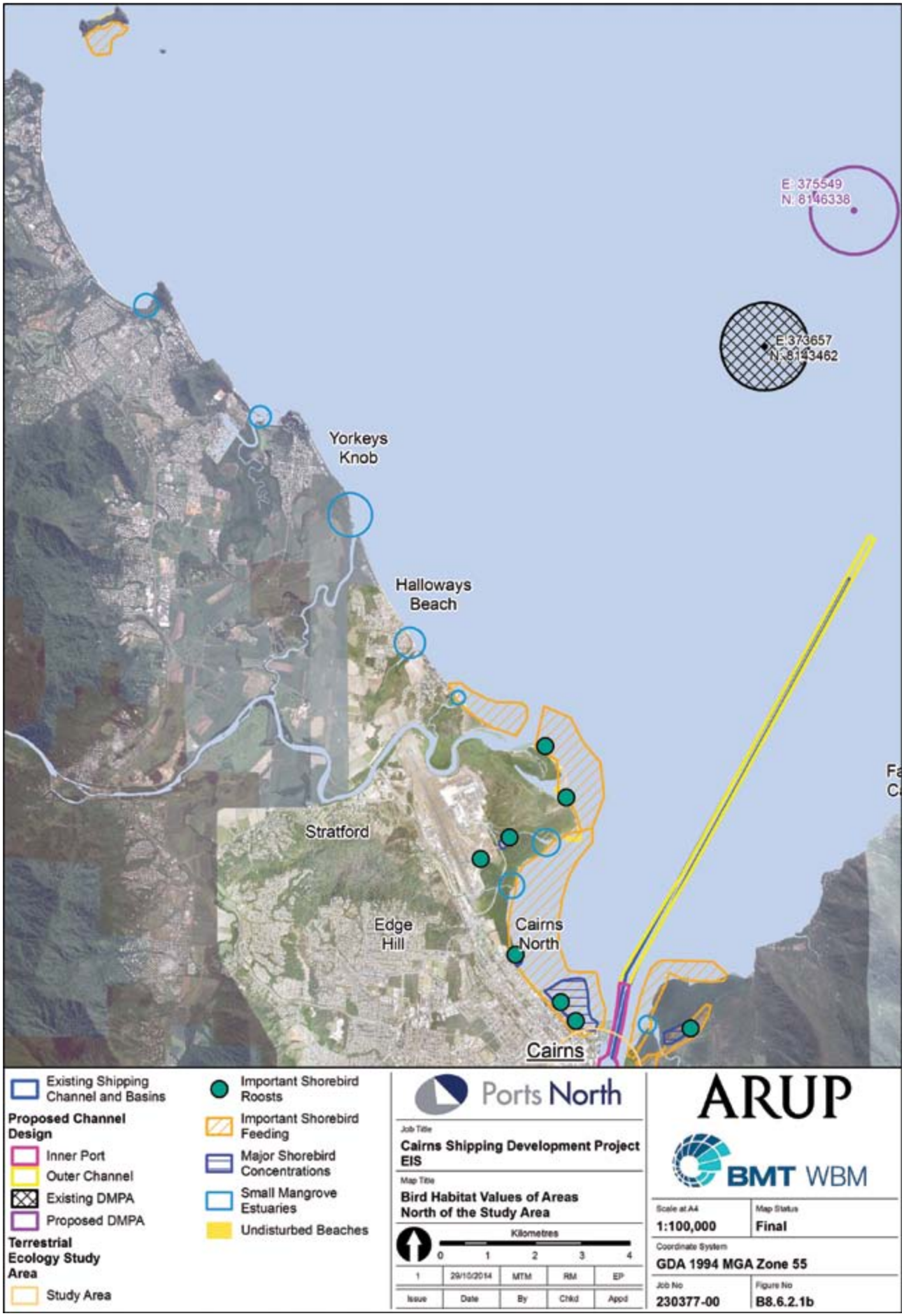


**Figure B8.6.2.1b Bird Habitat Values of Areas North of the Study Area**



## Cairns Esplanade Mud Flats

The Esplanade mud flats are the primary feeding area for migratory shorebirds and a large majority of local shorebird populations will feed on these mudflats throughout the summer months. The flats also provide the only source of food for the large migrating flocks passing through in the dry months before the wet season.

On the Cairns Esplanade, birds can begin feeding on intertidal mud at approximately the 1.8m tide level. High elevation mud that becomes exposed and available for feeding shorebirds at relatively high tide levels provides for extended periods of feeding over the tidal cycle. The early exposure of intertidal mud is important to species which need to feed for long periods of time such as the Red-necked Stint. It is also important to individuals who are starving and in need of food.

These high mud areas are limited to close inshore areas of the Esplanade (particularly around the southern end) and around the mouths of creeks entering the harbour (including Saltwater Creek, Hills Creek and Georges Creek).

Recently, large quantities of sand have been deposited along the foreshore as part of a beach nourishment program. This has resulted in a significant change to local habitat value as the sand is rapidly moving out on to the mud flats, and in so doing, changing the composition and ecology of the intertidal feeding areas. This sand is already covering considerable areas of former inshore mud and much of this is the important high elevation muds that allow for extended periods of feeding over the tidal cycle. The sand has also mixed with the mud over a much wider area, changing the composition of the intertidal flats.

Such changes are likely to impact the ecology of the prey species that the shorebirds rely on and therefore reduce the food resources available for shorebirds. However, the effect of this change in substrate ecology on shorebird feeding and the number of birds who use Trinity Inlet is unknown.

All shorebird species recorded in the study area have been observed on the Cairns mud flats. This area consistently supports a majority of all shorebirds estimated to be in Trinity Inlet. The most abundant species feeding here are the Red-necked Stint, Great Knot, Bar-tailed Godwit, Sharp-tailed Sandpiper and Lesser Sand Plover.

## Barron River Mouth Intertidal Sand Flats

This is an important diurnal and nocturnal feeding area for a significant numbers of shorebird species (including beach nesting shorebirds such as beach Stone-curlew, Sooty Oystercatcher and the Australian Pied Oystercatcher). The area extends from the southern end of Machans Beach to Ellie Point and includes large areas of intertidal sand flats with patchy occurrences of mud, sandy mud and sea grass beds throughout.

In 1990 it was estimated these flats were only available for shorebird feeding below approximately 1.25m tide level (ESS 1989). At this level there are muddy swales exposed and at lower tides, extensive areas of sea grass beds.

The largest shorebird roosts are often recorded here, particularly when the next tide will be low enough to expose feeding areas.

Whimbrels regularly gather here in large roosts at night and at appropriate tide levels, and will feed across the flats at night. It is estimated that almost the entire local population of Whimbrels will come out of the mangroves to feed here at night during the spring tides (ESS 1989).

All shorebird species known to occur in the region will feed here at some time and, as noted above, it appears to be particularly important to Whimbrels.

The predominance of intertidal sand here results in a greater abundance of the Greater Sand Plover and Lesser Sand Plover in feeding flocks. Other species such as the Great Knot, Red-necked Stint and Bar-tailed Godwits will fly in later when feeding areas become available at lower tide levels.

Undisturbed and remote beaches in this area (and across the region) are essential for beach nesting birds to breed and they provide undisturbed feeding and roosting conditions for shorebirds. The mouth of the Barron River provides suitable habitat for beach nesting birds and local records suggest there have been long-term resident pairs of birds occupying this location for many years. Observations on behaviour indicate nesting is occurring at these places.

## Nearby Saltmarshes, Saltpans and Wetlands

This habitat is a complex mix of high intertidal areas, sand ridges and freshwater wetlands. Around Trinity Inlet and Bay it is limited to:

- Patches of salt pans and sand ridges within the inlet mangrove forests
- Saltpans and wetlands around Cairns Airport
- Extensive areas of degraded wetlands, rehabilitated areas and adjoining saltpans at East Trinity.

Shorebird use of this habitat is usually as a supplementary feeding area at high tide and as a roost site. During the wet season these areas become highly productive and this is enhanced by high spring tide flushing. At this stage some species will feed for extended periods in this habitat.

The importance of these "additional" feeding areas to the survival of over-wintering migratory shorebirds is now well documented (see Betzeletos, 2012; Purnell, 2012; Sripanomyoms, 2012).

Roosts in salt pans will include species that are not recorded in significant numbers in the mixed flocks that gather on undisturbed and open beaches (such as at the mouth of the Barron River). For example, the majority of Eastern Curlews and Golden Plovers will gather in these areas rather than in mixed flocks in more open conditions.

The Airport area is used primarily as a roosting area by shorebirds with limited opportunities for feeding at high tide. Current roosting flocks are primarily Red-necked Stint and Sand Plovers who gather on a disused runway (**Figure B8.6.2.1a**). Shorebirds such as Sharp-tailed Sandpipers will also be seen foraging along the drains and low lying areas. (Ian Northcote pers. comm.).

The Boardwalk saltpan near the airport is used by roosting and feeding shorebirds – significant flocks of Sharp-tailed Sandpipers, Red-necked Stint and Golden Plovers have been recorded here (see **Figure B8.6.2.1a**).

The East Trinity Conservation Reserve (**Figure B8.6.2.1a**) is reclaimed low lying intertidal and swamp areas (the significant part is below the 2m tide level) which is currently being rehabilitated. Rehabilitation of salt marshes here has been successful between Hills Creek and Georges Creek (see NW salt marshes, **Figure B8.6.2.1a**) and this has created an important roosting and feeding area for shorebirds that was not available prior to late the 1990s. Recent surveys (November 2013) indicate the NW salt marsh on East Trinity is a major roosting and feeding area, with over 250 birds recorded. The most abundant species are the Sharp-tailed Sandpiper, Red-necked Stint and Curlew Sandpiper.

Across the region, there is evidence many former open saltpans are being encroached and covered by regrowth mangroves. This is occurring at the Boardwalk saltpan, adjoining the bund wall along the East Trinity boundary and in many places within the inlet mangroves. This change in conditions will affect their habitat value to shorebirds.

Most shorebird species will roost and feed in productive salt marsh areas and this use can be expected to increase with the increase in plant and animal growth that accompanies the wet season. Sharp-tailed Sandpipers and Red-necked Stint are often the most abundant species in roosting flocks on salt marshes and salt pans. Species such as the Greenshank, Black-tailed Godwit and Common Sandpiper will also commonly forage in these areas.

Mangrove areas in the study area provide foraging, roosting and breeding habitat for several fauna species. This includes bird species endemic to mangrove areas (e.g Collared Kingfisher, Striated Heron, Little Bronze-cuckoo, Mangrove Gerygone, et al.) that depend on intertidal invertebrates and mangrove blossoms, and those that use mangroves as secondary or seasonal habitat (e.g Rainbow Lorikeet, Honey-eaters, White-faced Heron, Intermediate Egres, Black Bitterns) (Kutt 1997). Kutt (1999) observed 47 bird species within dune-mangrove mosaics east of the Cairns Airport.

## Double Island and Haycock Island

The fourth key bird habitat location is Double Island, Haycock Island and the sand and reef flat that lies between these two islands. This area is a significant coastal bird habitat providing undisturbed, productive habitat for coastal raptors and beach nesting birds. It has the only breeding colony of seabirds identified in the study area of the coastal bird habitat assessment (**Appendix D5, Terrestrial Ecology Supporting Information**). The colony is made up of more than 20 breeding pairs of Bridled Terns on Haycock Island. Observers report two locations on the island where breeding "colonies" have formed regularly over summer (S. Foggin 2013, pers. comm.).

The value of the intertidal sand and reef flat to shorebirds has not been determined, however, small flocks of shorebirds have been observed here.

### B8.6.2.2 Habitat Values for other Fauna

During a survey of vegetation to the east of Cairns Airport, Kutt (1997) found a total of 129 terrestrial vertebrate species, which included seven amphibian species, 23 reptile species, 85 bird species, seven non-volant (non-flying) mammal species and seven bat species.

The mangrove habitat within the study area also supports reptiles that are endemic to mangrove and intertidal habitats (e.g. Little File Snake) as well as woodland species that may occasionally forage in mangrove forests (Lace monitors, Amythestine Pythons) during low tide to prey on fish, birds, and carrion (Hutchings and Saenger 1987, in Kutt 1997).

Habitat values for other fauna species within intertidal areas are described in **Chapter B7, Marine Ecology**.

## B8.6.3 Threatened and Near Threatened Fauna

The ALA and WO (**Appendix D5, Terrestrial Ecology Supporting Information**) search results show that only one EPBC Act threatened species has been recorded in the study area and 10 EVNT species under the NC Act have been recorded. These are listed below.

In addition, the PMST search results show that six bird species, two frog species and seven mammal species (or their habitat) may exist within the study area. **Appendix D5, Terrestrial Ecology Supporting Information** assesses the likelihood that these species would exist within the study area based upon database search results, habitat preferences and habitat values.

Based on the results of **Appendix D5, Terrestrial Ecology Supporting Information** and database searches, the following threatened terrestrial species are considered likely to occur in the study area or are known to occur in the study area:

- *Accipiter novaehollandiae* (Grey Goshawk) listed as near threatened under the NC Act. This species would be an occasional visitor to the study area. It has been recorded three times within the ALA search results
- *Aerodramus terraereginae* (Australian Swiflet), near threatened under the NC Act. This species is common in the study area. There has been one recorded sighting of this species in the WO search area and 65 within the ALA search results
- *Cyclopsitta diophthalma macleayana* (Macleay's Fig-parrot). The macleayana subspecies is listed as vulnerable under the NC Act. This species would be an occasional visitor to the study area. There has been two recorded sighting of Cyclopsitta diophthalma macleayana in the WO search area and 18 recorded sightings of Cyclopsitta diophthalma within the ALA search results, (ALA does not identify whether these were observations of the maclaeyana subspecies)
- *Ephippiorhynchus asiaticus* (Black-necked Stork), listed as near threatened under the NC Act and recorded four times within the ALA search results. There are three pairs of Black-necked Storks regularly seen on the East TrinityConservation Reserve
- *Esacus magnirostris* (Beach Stone-curlew), listed as vulnerable under the NC Act and recorded four times within the ALA search results. Commonly observed around Cairns Esplanade and on beaches to the northern boundary of the study area (Ellis Beach); though prefers wetlands and mangrove areas. There is a known breeding pair on the southern side of the Barron River delta and have been consistently recorded here since 1989
- *Haematopus fulignosus* (Sooty Oystercatcher), listed as near threatened under the NC Act. This has been occasionally recorded on local beaches, though it prefers rocky shores and reef flats
- *Melithreptus gularis* (Black-chinned Honeyeater), listed as near threatened under the NC Act. This species would rarely occur in the study area and has been recorded once within the ALA search results during 2012
- *Numenius madagascariensis* (Eastern Curlew), near threatened under the NC Act. This species is common in the study area; there has been seven recorded sighting of this species in the WO search area and 41 within the ALA search results. It is often recorded feeding in salt marshes and freshwater wetlands in the region
- *Pteropus conspicillatus* (Spectacled Flying-fox), listed as vulnerable under the EPBC Act. This species would rarely occur in the study area. There has been one recorded sighting of this species in the WO search area
- *Stenula albifrons* (Little Tern), listed as endangered under the NC Act. This species is an occasional visitor to the study area and has been recorded 19 times within the ALA search results. Local birds are usually in non-breeding flocks which may include migratory flocks from the north of Australia. There are no known nesting areas in study area. There is a concentration of records from the Cairns Esplanade
- *Tadorna radjah* (Radjah Shelduck), listed as near threatened under the NC Act. This species would be an occasional visitor to the study area and is recorded six times within the ALA search results.

As mentioned above, the project area is unlikely to provide core foraging, roosting or breeding habitat value for any of these species. This is due to the lack of mudflat habitat, the disturbance caused by pedestrian and maritime traffic, as well as the minimal availability of suitable trees for roosting and feeding. The core habitats where these species are expected to occur include those areas discussed in **Section B8.6.1**, as well as undisturbed beaches across the region (e.g along the coast of north Yarrabah).

Three of the fauna species listed above are priority species for the Wet Tropics NRM Region under the ***Back on Track Species Prioritisation Framework*** (DERM 2010). This includes the Beach Stone-curlew, the Little Tern and the Spectacled Flying-fox. Threat details for each are summarised in **Table B8.6.3a**. No other terrestrial fauna species listed as priority species under the ***Back on Track Species Prioritisation Framework*** have been observed in the database search results or are expected to occur in the study area.

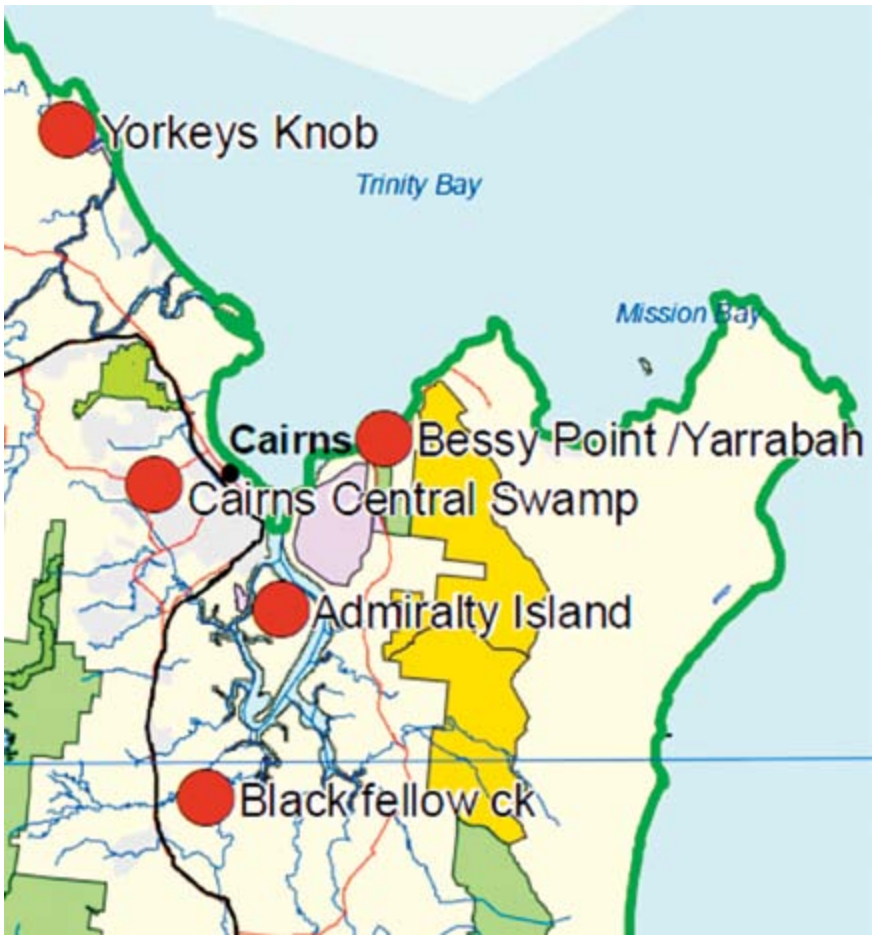
Shorebirds and seabirds are also listed in the ***Great Barrier Reef Biodiversity Conservation Strategy*** (GBRMPA 2013) as being potentially at risk of extinction due to the declines in populations that have occurred in the last century.

**Table B8.6.3a Threats to Wet Tropics NRM (adapted from DERM 2010)**

| Species | Threat | Priority | Threat Details |
|---|---|---|---|
| *Esacus magnirostris* (Beach Stone-curlew) | Recreation / Tourism | Major | Beach stone-curlews are sensitive to the recreational activities of people such as walking dogs on beaches (on and off leash), beach-combing, boating and off-road vehicles. These activities disrupt their breeding and/or resting. |
| | Urban Development | Major | Coastal development impacts the beach stone-curlew, particularly where it occurs at the interface near rocks and sandy beaches. |
| *Pteropus conspicillatus* (Spectacled Flying-fox) | Deliberate disturbance by people | Major | Urban populations are under constant pressure from disturbance by people who try to move them away because of the noise/smell of the colonies. |
| | Barbed wire | Minor | The top strand of barbed-wire on barbed-wire fences can snag the wings of bats, causing injury or slow death. The numbers of spectacled flying-foxes killed on barbed-wire fences is unknown. |
| *Stenula albifrons* (Little Tern) | Recreation / Tourism | Major | This species is found on sandy beaches and in sheltered inlets and estuaries, especially where exposed sandbanks occur. Nests are usually a scrape in the sand between the high tide mark and shore vegetation. They are therefore very vulnerable to accidental damage through 4WD traffic and human activity around dunes, including people walking dogs (on or off leash). Breeding success is reduced by direct crushing of chicks and eggs, and disturbances that cause birds to desert their eggs or eventually desert the colony altogether. |
| | Erosion | Major | The habitat of the little tern becomes eroded from changes to hydrology due to coastal development and natural processes, i.e. storms and sea level rise. Movement and deposition of sand, like spits, leads to a possibility of habitat loss due to change in beach structure. |
| | Urban Development | Minor | The little tern nests and breeds on beaches. Coastal development, which increases the use of beaches and therefore human disturbance, can have a negative impact on the little tern. |

**Figure 8.6.3a Flying-fox Roosts in the Study Area, Shown as Orange Dots (from DEHP 2013b).**

Although not shown on this map, another roost exists outside Cairns Library within the large figs on Aplin Street.




## B8.6.4 EPBC Act Migratory and Marine Birds

Results of the database searches (**Appendix D5, Terrestrial Ecology Supporting Information**) show 108 EPBC Act migratory marine, terrestrial or wetland species as well as marine species that may potentially occur in the study area, as illustrated in **Table B8.6.3a**. The majority are shorebirds, waders or raptors that would have a preference for the intertidal zone across from Cairns Esplanade, the estuarine wetland area on the eastern side of Trinity Inlet or surrounding marine and non-marine areas. These species may occasionally occur within the project area, though it is not considered to be core foraging, roosting or breeding habitat.

These species are protected under the EPBC Act, but are not necessarily considered to be threatened or near threatened.

The most commonly observed EPBC bird species within the study area as recorded in various databases are described in **Table B8.6.3a**. All these species are listed as both migratory and marine under the EPBC Act.

- *Actitis hypoleucos* (Common Sandpiper)
- *Calidris acuminata* (Sharp-tailed Sandpiper)
- *Calidris ferruginea* (Curlew Sandpiper)
- *Calidris ruficollis* (Red-necked Stint)
- *Calidris tenuirostris* (Great Knot)
- *Charadrius mongolus* (Lesser Sand Plover)
- *Limosa lapponica* (Bar-tailed Godwit)
- *Numenius phaeopus* (Whimbrel)

- *Pluvialis fulva* (Pacific Golden Plover)
- *Rhipidura rufifrons* (Rufous Fantail)
- *Sterna albifrons* (Little Tern)
- *Symposiachrus trivirgatus* (Monarcha trivirgatus) (Spectacled Monarch)
- *Tringa brevipes* (Grey-tailed Tatler)
- *Tringa nebularia* (Common Greenshank)
- *Xenus cinereus* (Terek Sandpiper)

### B8.6.5 Exotic Fauna

The EPBC Act PMST, WO Search results and Kutt (1997) lists invasive fauna that have been observed or may occur in the study area. With reference to these sources, there is suitable habitat for the following invasive fauna within the study area:

- *Acridotheres (Sturnis) tristis* (Common/Indian Myna)
- *Anas platyrhynchos* (Mallard)
- *Canis familiaris* (Dog – possibly eastern parts of the study area only)
- *Columba livia* (Rock Pigeon)
- *Felis catus* (Domestic Cat)
- *Hemidactylus frenatus* (Asian House Gecko)
- *Lepidodactylus lugubris* (Mourning Gecko)
- *Lonchura punctulata* (Nutmeg Mannikin)
- *Mus musculus* (House Mouse)
- *Passer domesticus* (House Sparrow)
- *Ramphotyphlops braminus* (Brahminy Blind Snake)
- *Rattus norvegicus* (Brown Rat, Norway Rat)
- *Rattus rattus* (Black Rat, Ship Rat)
- *Streptopelia chinensis* (Spotted Turtle-Dove)
- *Sturnus vulgaris* (Common Starling)

All of these species, except for Canis familiaris (Dog) have potential to occur within the project study area also.

## B8.7 Impact Assessment

Details on each of the components of the project are given in **Chapter A4, Project Description**. Seven components of the project are relevant to the assessment of impacts to terrestrial ecology values. These include:

- Direct impacts to terrestrial habitat values due to landside construction works
- Predicted sedimentation impact to shorebird foraging habitat values within intertidal areas due to capital and maintenance dredging
- Impacts to avifauna due to the potential for contaminants to be mobilised by dredging
- Impacts to shorebird foraging habitat within intertidal areas due to vessel wash during construction and operations
- Noise impacts to terrestrial ecology values due to construction (landside works and capital dredging) and operations (including maintenance dredging)
- Light impacts to terrestrial ecology values due to construction (landside works and capital dredging) and operations (including maintenance dredging)
- Impacts to terrestrial ecology due to decommissioning of the project.

Each of these processes and the associated affects are discussed below in the context of the terrestrial ecology values identified in **Section B8.4**.

The following additional impacts are discussed in **Chapter B7, Marine Ecology**, though are also relevant to this chapter:

- The introduction of marine debris during construction and operations
- The risk of toxic spills.

See **Chapter B7, Marine Ecology** for assessment of these impacts.

## B8.7.1 Direct Impacts on Terrestrial Habitat Values

### B8.7.1.1 Protected Areas

Land-side construction works and subsequent operations will occur within the fringe of the mapped P*ort of Cairns and Trinity Inlet Wetland of National Importance*; however, as no significant wetland habitat value (e.g mangrove forest) exists within the project area, the project will result in a negligible direct impact during construction and operations.

No other protected areas will be directly impacted by the project.

### B8.7.1.2 Wildlife Corridors

No terrestrial wildlife corridors will be impacted by the project during construction or operations.

### B8.7.1.3 Terrestrial Flora

#### Vegetation Communities

Non-tidal vegetation communities will not be impacted by the project during construction or operations. Despite this, several planted street trees may be impacted due to trenching activities associated with the IFO pipeline. Construction and operations of the project will have a negligible impact upon non-tidal vegetation communities.

#### Threatened Ecological Communities, and Threatened and Near Threatened Terrestrial Flora

No Threatened Ecological Communities will be impacted by the project during construction or operations.

As no clearing of terrestrial vegetation communities (e.g mangrove or melaleuca forest) will occur due to the project, no threatened or near threatened species are expected to be directly impacted by the project.

#### Exotic Flora

The upgrade of the landside infrastructure will result in some minor weed removal during construction due to earthworks.

Construction may also create suitable habitat for weed species in areas where disturbed ground will be left unsealed (e.g areas of pipeline trenching). During operations, a small number of weeds are also likely to colonise the project area; though this will be due to natural processes and will not be as a result of the project itself.

With implementation of standard mitigation weed management measures during construction and operation weed impacts due to the project are likely to be negligible.

### B8.7.1.4 Terrestrial Fauna

No terrestrial habitat will be directly removed as part of the project. During construction and operations, the project area will continue to provide limited habitat value for threatened and near threatened terrestrial fauna and non-aquatic EPBC Act migratory and marine species.

Exotic and invasive fauna in the area are considered more or less widespread in urban areas. The project will not result in the introduction or expansion of populations of declared pest fauna.

## B8.7.2 Predicted sedimentation impact to shorebird foraging habitat values within intertidal areas due to dredging

Both the dredging campaign and the placement of dredged material at the Dredge Material Placement Area (DMPA) will create turbid plumes that will extend over marine areas outside of the project footprint. In this chapter, predicted deposition of sediment entrained in the water column due to dredging and dredge placement is based primarily on information within **Chapter B3, Coastal Processes, Chapter B5, Marine Water Quality and Chapter B7, Marine Ecology**.

Potential turbidity plumes and sedimentation have been numerically modelled based on the various dredging scenarios assessed in this EIS. These modelled outputs are presented and discussed in full in **Chapter B5, Marine Water Quality** and **Appendix D4, Water Quality Model Development and Calibration Report**. It is worth noting that the sedimentation model does not attempt to resolve the details of the hydrodynamics of sediment transport in intertidal areas. This is because sediment transport in the intertidal zone occurs on very different spatial and temporal scales and is influenced by other processes not considered by the model (e.g interaction with groundwater table, wave action, and natural sedimentation resuspension). As such, predictions of sedimentation are based on spatial extrapolation of the modelling results, noting that levels of sedimentation reduce with increased distance from the dredging footprint and DMPA.

Deposition of suspended solids from dredging plumes associated with both the dredge footprint and the DMPA are predicted to occur as shown in **Chapter B7, Marine Ecology** for:

a) the predicted cumulative sediment disposition over the duration of the capital dredging base case; and

b) for the cumulative sediment deposition occurring during 12 months of resuspension after the completion of capital dredging (base case) works.

Note that the Base Case scenario assumes no overflow from the trailing suction hopper dredge (TSHD), as per **Chapter A1, Project Introduction**. Realistically, the extent, location and magnitude of turbidity plumes will ultimately depend on where a dredge vessel is operating at any given time, what type of dredger is operating, and the meteorological/sea conditions at the time of dredging and placement activities.

In intertidal areas, potential impacts to flora (mangrove and seagrass communities) due to sedimentation from the capital and maintenance dredging campaign are described in **Chapter B7, Marine Ecology**. As mentioned in **Section B8.2.1**, this chapter is primarily concerned with the impacts of dredging on intertidal habitat for shorebirds (including threatened, near threatened, marine and migratory species).

Modelling results in **Chapter B7, Marine Ecology** show that there are two areas of intertidal shorebird habitat that will experience differing levels of cumulative sedimentation during and after the dredge campaign. This includes a pocket of intertidal mudflat to north west of Marlin Marina and mudflats associated with East Trinity to the east of the proposed dredge footprint.

The model predicts sedimentation that occurs within intertidal shorebird habitat will be due to dredging only, with re-suspended sediment from the DMPA unlikely to result in detectable sedimentation to intertidal shorebird habitats.

The level of deposition predicted to occur as a result of dredging and dredge placement is considered minimal compared to the existing background sediment deposition occurring in the area (see assessment in **Chapter B3, Coastal Processes**). As discussed in **Chapter B3, Coastal Processes**, most of the study area is largely a depositional environment, with ambient deposition rates in the intertidal areas at least an order of magnitude higher than the predicted dredge sediment deposition rates. This is particularly the case for Trinity Inlet and Cairns Harbour as these areas do not experience major fluvial (riverine) flows and the associated sediment scour. These areas are also partially protected from wave action, limiting erosion.

**Chapter B7, Marine Ecology** has assessed no detectable impacts are expected to occur to shorebird prey (intertidal benthic fauna communities) in Area 1 due to the levels of deposition resulting from the dredging campaign. As such, it is predicted that a negligible impact will occur to intertidal shorebird habitat.

In addition to the quantities of deposited sediment, it has been demonstrated that changes to substrate composition due to deposition can influence shorebird feeding times and abundance. For instance, Quammen (1982; 1984) shows that the increased presence of sand grains on a mud flat can reduce time spent feeding in an area, suggesting that there is reduced success and prey detection where additional sand is present in the substrate.

Sampling of sediment that will be dredged as part of the project (see **Chapter B4, Marine Sediment Quality**) shows that it is characterised by high proportions of silt and clay, with sand and gravelly sediments contributing approximately 10.1 percent in the inner port and 1.3 percent in the outer channel. It is likely the sand and gravel components of the dredge material will settle out closer to the dredge footprint and the DMPA, with any sediment deposited in intertidal areas likely to be comprised of silt and clay (mud).

For this reason, it is predicted that there will be a negligible impact to shorebird habitat due to the quality of sediment that deposits due to capital dredging and dredge placement.

As the impacts of the capital dredge campaign are predicted to be negligible to minor, the impacts of maintenance dredging are predicted to be negligible due to the significantly lower dredge volumes and timeframes associated with the maintenance dredging (see **Chapter A4, Project Description** for a description of current and predicted maintenance dredging quantities and timeframes).

The potential for capital and maintenance dredging associated with the project to indirectly affect intertidal habitat values in protected areas (e.g the GBRMP) is further described in **Chapter B7, Marine Ecology and Chapter B2, Nature Conservation Areas**.

## B8.7.3 Impacts to avifauna due to the potential for contaminants to be mobilised by dredging

Disturbance and mobilisation of marine sediments may occur through dredging, dredged material placement and construction activities such as pile driving, which could release contaminants (including acid sulfates) within the sediments. As discussed in **Chapter B4, Marine Sediment Quality**, marine sediments in the proposed dredging and pile driving areas contain potential contaminants at concentrations (95 percent UCL) that are below NAGD screening levels, and therefore do not pose a toxicity threat. Therefore, dredging of sediment is also not expected to result in toxic effects to shorebirds or their prey due to acid sulfate soils or sediment contaminants. See **Chapter B7, Marine Ecology** for more information. The impact is therefore predicted to be negligible.

## B8.7.4 Impacts to shorebird foraging habitat within intertidal areas due to vessel wash during construction and operations

Wash generated by cruise ships, dredgers and construction vessels could lead to the disturbance of intertidal habitats due to increased wave energy. In intertidal areas in close proximity to vessel routes (Trinity Inlet), the wash created by moving vessels could scour intertidal banks and littoral soft sediments, potentially causing adverse alterations to associated flora and fauna communities (e.g mangroves, benthic invertebrates). The impact of this is further assessed in **Chapter B7, Marine Ecology**. With reference to **Chapter B7, Marine Ecology**, the impact to intertidal shorebird habitat is predicted to be minor.

## B8.7.5 Noise impacts to terrestrial ecology values due to construction and operations

Noise impacts described in this section relate solely to fauna as there will be no noise impacts to protected areas, wildlife corridors or flora due to construction, operations or maintenance dredging.

Noise from construction and operations and the associated impacts upon fauna has been assessed as part of **Chapter B10, Noise and Vibration**. In summary, the activities that generate the most noise during construction (dredging and piling) will not result in disturbance or harm to terrestrial fauna that shelter, roost, breed or forage within key habitat areas shown in **Figure 8.6.2.1.a**. Despite this, birds and pest fauna species in the immediate vicinity of piling may be disturbed and avoid the wharf area during piling operations. The impact of piling in and around the wharves is not expected to significantly affect Threatened or Near Threatened fauna or non-aquatic EPBC Act Migratory and Marine fauna, as these species are not common in this area and the area does not represent key habitat. The impact of piling noise on terrestrial fauna is assessed as being minor and temporary in nature.

In addition, and as per **Chapter B10, Noise and Vibration**, during operations, noise associated with ship loading/ unloading, berthing and entering /leaving the port will not disturb or harm fauna that shelter, roost, breed or forage in key habitat areas or urban habitat areas.

Overall, the project is expected to result in a negligible impact to current terrestrial habitat values during construction and operations, and terrestrial fauna identified in **Section B8.6.1** and **Section B8.6.2** is expected to persist unaffected, except, temporarily, within the immediate vicinity of piling works during construction (as mentioned above).

No Threatened, Near Threatened or non-aquatic EPBC Act Migratory and Marine fauna species will be impacted by construction or operations within the project area.

### B8.7.6 Light impacts to Terrestrial Ecology Values Due to Construction and Operations

Habitats within the study area, as well as shorebird habitats in the wider bay area are subject to a high levels of artificial light exposure (compared to undeveloped areas) due to their proximity to brightly lit coastal development. **Chapter B12, Landscape and Visual** describes changes to the light environment due to construction and operations of the project. Broadly speaking, terrestrial fauna that inhabit the study area and surrounds (particularly shorebirds) have adapted behaviourally to the impacts of artificial light. Any associated impacts due to changes to lighting during construction or operation are expected to result in a negligible impact to bird life (e.g nesting or orientation). The DMP identifies strategies for further limiting disturbance.

### B8.7.7 Impacts During Decommissioning

It is assumed that the channel and associated landside infrastructure will be utilised indefinitely into the future, unless it is no longer required, or there is no longer capacity to maintain the channel. As such, active decommissioning of the channel is not expected to occur in the timeframe of the project.

Decommissioning of land-side infrastructure and the wharf structure will be assessed in the future, when it is required. It is not expected that decommissioning will result in significant impacts greater than that during construction, nor cause significant impacts to terrestrial ecology values.

## B8.8 Mitigation

The following mitigation measures will be employed to manage impacts to terrestrial ecology:

- The Construction EMP covering terrestrial vegetation clearing, protection and fauna management is to be applied during construction. Relevant measures are contained in the Construction EMP in **Appendix C: Legislation and Approvals**
- A Weed Management Plan (see **Appendix C**) will be implemented during construction and operations to avoid the spread of weed to and from the project area
- A Waste Management Plan (see **Appendix C**) is to be implemented during construction and operations to reduce the attraction and occurrence of pest species (mosquitos, mice, rats and feral cats)
- A Dredge Management Plan (see **Chapter C2, Dredge Management Plan**) will be implemented during the capital dredge campaign. The DMP contains numerous mitigation measures design to reduce the extent and magnitude of turbid plumes and sedimentation. Relevant strategies of the DMP include the following:
  - Dredging will not be carried out in the summer (November to February). Although light and noise impacts to terrestrial fauna are predicted to be negligible during construction and capital dredging, this mitigation measure will further reduce noise and light disturbance to migratory shorebirds, which arrive between August and September and inhabit Trinity Bay and inlet during summer months. This mitigation measure is unlikely to affect the cumulative deposition discussed in **Section B8.7.2**, however, as deposition will accumulate over the dredge campaign
  - An environmental valve ('green valve') will be used in overflow pipes of the TSHD to reduce sediment dispersion during dredging
  - A reactive water quality monitoring program will be developed and implemented. Dredging activities will be modified or suspended in the event that monitoring detects exceedance/s of trigger values, which will illicit various management responses
  - A soft-sediment benthos and seagrass monitoring program will be developed and implemented to identify any changes to communities as a result of the dredging program. This will include sampling at multiple times before and dredging at putative impact sites located adjacent to the nearshore project footprint and DMPA, and at suitable control sites
  - Dredged material to remain waterlogged and not to remain in TSHD hopper or dump barge for periods exceeding 24 hours to avoid oxidation of potential acid sulfate soils.

- Maintenance dredging will be conducted in accordance with the Long Term Dredge Spoil Disposal Management Plan (LTDSDMP), which has been approved as part of the Sea Dumping Permit issued by Great Barrier Reef Marine Park Authority (see **Chapter A1, Project Introduction**)
- To reduce the impact of vessel wash on intertidal areas:
  - Vessels will be required to operate in designated shipping channels.
  - Go slow zones will be implemented to minimise wash.
- To manage the impacts of noise:
  - Soft piling starts will occur to reduce noise impacts to fauna.
  - Construction activity will not be conducted during the night-time period, unless "sufficient grounds" exist to obtain approval for out-of-hours' work from the DEHP/local authority.
  - All works to be undertaken with regard to AS 2436-2010 - Guide to noise and vibration control on construction, maintenance and demolition sites.
  - General site activities to follow the principles of Best Management Practice (BMP) and Best Available Technology Economically Achievable (BATEA).
  - During construction, a Noise Mitigation Plan will be prepared for operation of the cruise terminal providing administrative measures to reduce noise emission during the night time period (this is mainly for noise impacts to the community, though will also reduce noise impacts to fauna).
- To manage the impacts of light:
  - A Light Management Plan will be prepared for construction and operational activities. This will limit light impacts to that necessary for port operations and security.
  - During construction and operations, lighting of compounds and works sites would be restricted to agreed hours and security needs and in accordance with the relevant Environmental Management Plan.
  - Cut off and directed lighting would be used at wharf construction sites to ensure glare and light spill is minimised.

## B8.9 Residual Impacts and Assessment Summary

A summary of the outcomes of the risk-based assessment for activities that have the potential to impact on the terrestrial ecology values of the study area, during either the construction and/or operational phases of the project, are summarised in **Table B8.9a**.

**Table 8.9a Assessment Summary Table**

| Terrestrial Ecology | Initial Assessment with Standard Mitigation in Place | | | | Residual Assessment with Additional Mitigation in Place | | | |
|---|---|---|---|---|---|---|---|---|
| **Primary Impacting Processes** | **Standard Mitigation Measures** | **Significance of impact** | **Likelihood of impact** | **Risk Rating** | **Additional Mitigation Measures Proposed** | **Significance of impact** | **Likelihood of impact** | **Residual Risk rating** |
| **Construction Phase** | | | | | | | | |
| Direct impact to terrestrial habitat values due to Landside construction works | • Project design minimises area of terrestrial habitat affected by proposal.<br>• Implementation of Construction Environmental Management Plan (see **Chapter C1, Environmental Management Plan [Construction and Operation]**). | Negligible | Likely | Negligible | None identified | Negligible | Likely | Negligible |
| Predicted sedimentation impact to shorebird foraging habitat values within intertidal areas due to capital dredging | • Project design minimises the extent (volume) of dredging.<br>• Ensure TSHD and Backhoe operates within the approved dredge footprint at all times. | Negligible | Unlikely | Negligible | Implementation of DMP (see **Chapter C2, Dredge Management Plan**), including:<br>• avoidance of summer months for dredging,<br>• sailing routes optimised to minimise propeller wash. | Negligible | Unlikely | Negligible |

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| | • Overflow dredging by the TSHD is not undertaken, unless dictated as required by and in accordance with the worst case (limited dredging) scenario.<br>• Dredge hopper compartment is to be kept water tight during all dredging activities, except placement at the DMPA.<br>• Ensure the top of overflow valves are not lowered during the transport component of the dredging cycle.<br>• No high pressure jets to be used on drag heads outside of DMPA.<br>• Dredge to be fitted with a 'green valve'. | | | | • Implementation of a reactive water quality monitoring program, with management / corrective actions implemented if trigger levels are exceeded (as outlined in the **Chapter C2, Dredge Management Plan**).<br>• Implementation of soft sediment benthos and seagrass monitoring program. | | | |
| Impacts to avifauna due to the potential for contaminants to be mobilised by capital dredging | • Preparation and implementation of a sediment sampling and analysis plan (SAP) to determine suitability of sediment for marine placement. | Negligible | Unlikely | Negligible | Implementation of DMP (see **Chapter C2, Dredge Management Plan**), including:<br>• Reactive water quality monitoring program and relevant adaptive management strategies. | Negligible | Unlikely | Negligible |

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| | • Dredge material has been assessed as being suitable for at sea placement (as described in **Chapter B4, Sediment Quality**). | | | | • Dredged material to remain waterlogged and not to remain in TSHD hopper or dump barge for periods exceeding 24 hours. | | | |
| Impacts to shorebird foraging habitat within intertidal areas due to vessel wash during construction | Non identified | Minor | Likely | Medium | Implementation of construction EMP(see **Chapter C1, Environmental Mangement Plan [Construction and Operation]**),, including:<br>• Ensuring construction activities are restricted to the project footprint.<br>• Ensure vessels operate in designated shipping channels.<br>• Implementation of go slow zones to minimise wash. | Minor | Unlikely | Low |
| Noise impacts to terrestrial ecology values due to construction (landside works and capital dredging) | Non identified | Minor | Likely | Medium | • Construction activity will not be conducted during the night-time period, unless "sufficient grounds" exist to obtain approval for out-of-hours' work from the DEHP/local authority.<br>• All works to be undertaken with regard to AS 2436-2010 - Guide to noise and vibration control on construction, maintenance and demolition sites.<br>• General site activities to follow the principles of Best Management Practice (BMP) and Best Available Technology Economically Achievable (BATEA).<br>• Soft piling starts will occur to reduce impact to fauna | Negligible | Likely | Negligible |

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|---|---|---|---|---|---|---|---|---|
| Light impacts to terrestrial ecology values due to landside works and capital dredging | Non identified | Negligible | Unlikely | Negligible | • Lighting of compounds and works sites would be restricted to agreed hours and security needs and in accordance with a Construction Environmental Management Plan (see **Chapter C1, Environmental Mangement Plan [Construction and Operation]**),.<br>• Cut off and directed lighting would be used at wharf construction sites to ensure glare and light spill is minimised.<br>• Preparation of a Light Management Plan for construction activities | Negligible | Unlikely | Negligible |
| **Operational Phase** | | | | | | | | |
| Predicted sedimentation impact to shorebird foraging habitat values within intertidal areas due to maintenance dredging | • Existing maintenance dredging operations occur in accordance with an approved LTDSDMP which contains management measures to reduce impacts on water quality from dredging and placement. | Negligible | Unlikely | Negligible | • Update the LTDSDMP to address the additional volumes and duration of maintenance dredging required by the wider channel. | Negligible | Unlikely | Negligible |

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|---|---|---|---|---|---|---|---|---|
| Impacts to avifauna due to the potential for contaminants to be mobilised by maintenance dredging | • Preparation and implementation of a sediment sampling and analysis plan (SAP) to determine suitability of future maintenance dredge material for marine placement (noting maintenance material at Port of Cairns has always been suitable for at sea placement).<br>• Any contaminated material detected in future testing will not be permitted to be placed at sea under the NAGD and sea dumping permit process. | Negligible | Unlikely | Negligible | Non identified | Negligible | Unlikely | Negligible |
| Noise impacts top terrestrial ecology values due operations (maintenance dredging, increased shipping, port operations) | None identified | Negligible | Unlikely | Negligible | • A Noise Mitigation Plan will be prepared for operation of the cruise terminal providing administrative measures to reduce noise emission during the night time period (this is mainly for noise impacts to the community, though will also reduce noise impacts to wildlife). | Negligible | Possible | Negligible |

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| Light impacts to terrestrial ecology values due to operations (maintenance dredging, increased shipping, port operations | None identified | Negligible | Unlikely | Negligible | • Preparation of a Light Management Plan for operational activities.<br>• Lighting of compounds and sites would be restricted to agreed hours and security/ safety needs and in accordance with a Environmental Management Plan (see **Chapter C1, Environmental Mangement Plan [Construction and Operation]**),<br>• Cut off and directed lighting would be used at wharf sites to ensure glare and light spill is minimised. | Negligible | Unlikely | Negligible |

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