Priority port master planning

Evidence base documentation

Priority Port of Townsville

Queensland | Australia | 2018

Included in this set:

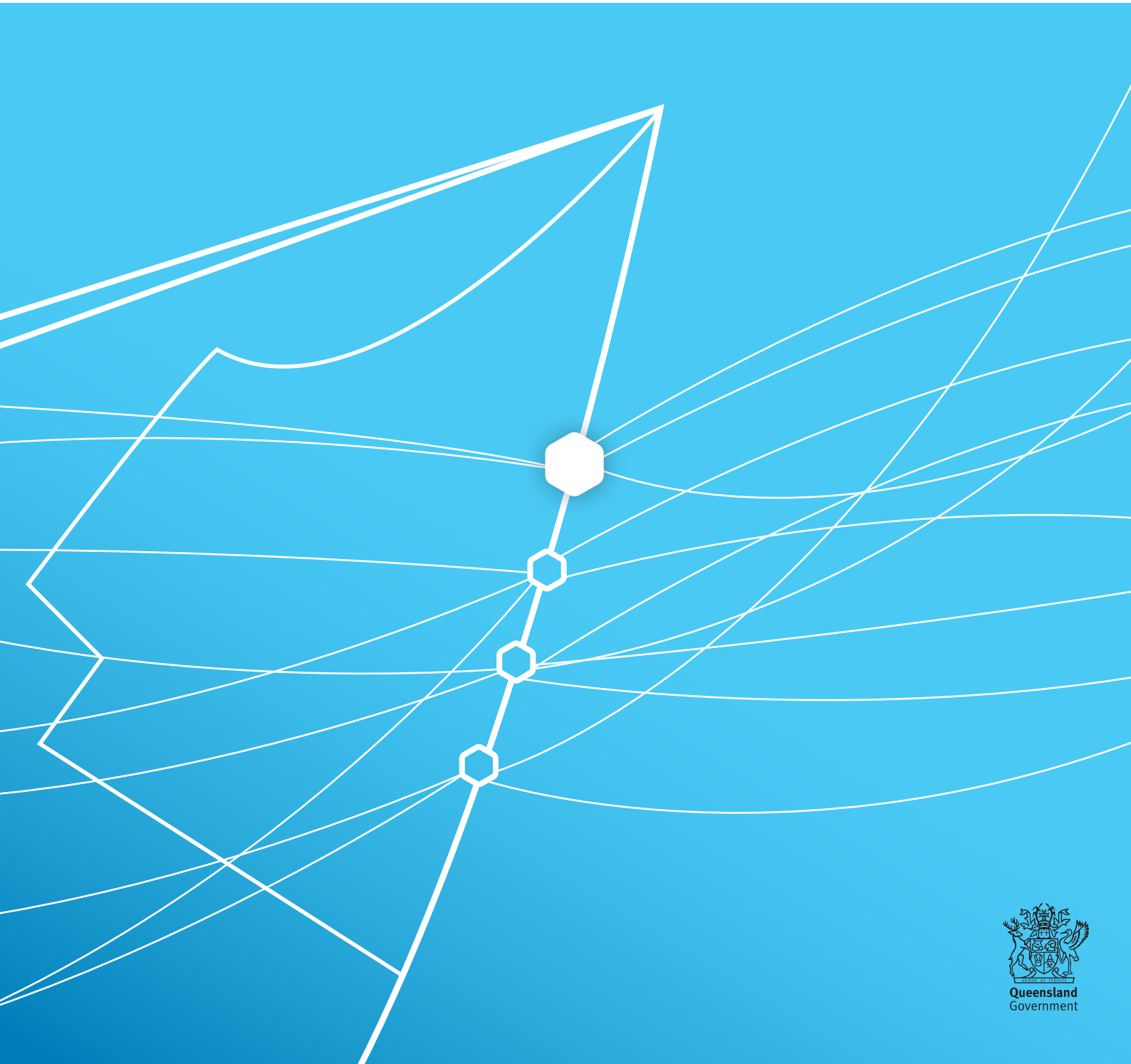
- Evidence base report
- Infrastructure and supply chain analysis
- Risk assessment

Queensland Government

Priority port master planning

Evidence base report
Priority Port of Townsville

Queensland | Australia | 2018



Queensland Government

Priority Port of Townsville

Evidence Base Report

02 December 2016

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Table of Contents

Table List

Figures

Appendix List

Executive Summary

The *Sustainable Ports Development Act* 2015 (Ports Act) sets a legislative framework to implement a number of Queensland's port-related *Reef 2050 Long Term Sustainability Plan* (Reef 2050 Plan) actions and responds to the United Nations Educational, Scientific and Cultural Organization (UNESCO) World Heritage Committee recommendations on the reef. The Ports Act mandates master planning for the priority ports of Gladstone, Mackay/Hay Point, Abbot Point and Townsville at which future port development will be concentrated. A key purpose of the master planning is to optimise use of existing infrastructure and address operational, economic, environmental and social relationships, as well as supply chains and surrounding land uses.

The Port of Townsville is located 1360 kilometres north of Brisbane. The port was established in 1864 and initiated and facilitated the development of the city of Townsville. It is situated east of Townsville's city centre in North Queensland and is Queensland's third largest commercial port. The port is located in the southwest of Cleveland Bay, between Ross River and Ross Creek. Magnetic Island, a continental island located approximately eight kilometres offshore, lies at the northern entrance to the bay. The Port of Townsville is located adjacent to and within the Great Barrier Reef World Heritage Area (GBRWHA) which was listed as a world heritage site in 1981.

This report represents the first of three stages in preparation of the master plan for the Priority Port of Townsville: an evidence base report to support targeted consultation, informing development of the master plan and providing recommendations and rationales for a proposed master planned area and precincts.

Stage two will include the development of growth scenarios for the port, assessment of the supply chain and infrastructure to identify potential issues and solutions to better support management and productivity. Stage three includes an environmental risk assessment of impacts of future development on the proposed master planned area and affected surrounding areas and the development of management measures to address these impacts.

This report has been prepared through completion of the following activities:

- An initial review of background information
- Targeted consultation with key stakeholders
- Review and analysis of available data for a large study area including:
  - Legislation and policy
  - Existing and proposed land uses
  - Existing and proposed infrastructure
  - Environmental, social and cultural values
  - World Heritage – Outstanding Universal Value (OUV) expression
- Determination of locations of interest with respect to the study area
- Identification of a proposed master planned area (boundary) based on areas of interest and the application of high level screening criteria over the study area

- Identification of proposed master plan precincts based on agreed precinct definitions.

The Port of Townsville is well situated to support the regional mineral and agricultural industries and as a regional trade hub for North Queensland. It is strategically situated to serve the North and North West Queensland region, and is the terminus for the Mount Isa rail line. It is also strategically situated to serve the activities of the Townsville State Development Area (TSDA), which was declared in 2003 and is located to the port's south-east. The port is managed and operated by a government-owned corporation, the Port of Townsville Limited (POTL).

The Port of Townsville supports a diverse range of trade products including containers, bulk minerals and liquids, live cattle, sugar, molasses and general cargo. A comprehensive review of environmental, social, cultural heritage, OUV expression, existing policy and legislation, land uses and infrastructure in the region supporting the port, assisted the development of areas of interest, which then informed the proposed boundary for the future port master planned area.

A series of high level screening criteria were developed to help identify land and infrastructure for inclusion in the master planned area. These criteria considered the relevance of existing and future land uses and infrastructure to the port, existing boundaries (physical and administrative) and existing ownership arrangements, environmental, social, cultural heritage and OUV expression.

Immediately adjacent to the port is the Townsville City Waterfront Priority Development Area (TCWPDA). This significant project will see redevelopment of a significant tract of land enhancing Townsville's status as an important regional centre in the state's north.

The Port Expansion Project (PEP) currently proposed by POTL, which includes channel widening and creation of several new berths to be developed as required was considered the maximum growth footprint for the port. The PEP influenced the identification of future land requirements for the port.

The following areas of interest were considered relevant for potential inclusion in the proposed master planned area.

Location	Relevance
Port of Townsville (Land side)	This area encompasses all land side operations of the port from the berth face to port boundary including areas identified for future expansion in the Port Expansion Project.
Port of Townsville (Marine side)	This area includes all marine infrastructure and areas from the berth face to the boundary of the port limits marine area excluding the Great Barrier Reef Marine Park.
Townsville Eastern Area Rail Corridor	The TEARC corridor as identified through the TEARC corridor study.

Location	Relevance
Townsville State Development Area	The TSDA is land preserved for industrial development of regional, state and national significance. The TSDA is strategically located to support medium to large-scale industrial development with direct connection with the Port of Townsville via the Port Access Road and has access to the Bruce and Flinders Highways, and both the Mount Isa and North Coast rail lines. The TSDA and immediately surrounding areas, which may be considered for future expansion, or that may restrict future expansion are included. This includes interface land uses in Cluden in close proximity to the TSDA.
Bohle Industrial Estate	The existing Bohle industrial estate (including all vacant and occupied land) which may potentially accommodate port related industry.
Yabulu	The Yabulu heavy industry area and surrounding areas. Irrespective of the future of Queensland Nickel and existing infrastructure on the site, this location is important as a home for future heavy industry in the region.
Oonoonba Priority Development Area	The Oonoonba PDA is located along the (NCL/MIRL) corridor and as such urban development in this location may influence the future operation of this corridor.
Townsville City Waterfront Priority Development Area	This area extends south from the port boundary and forms part of a broader interface precinct between the port and city. Development in this precinct will directly influence the future port operations. Future port operations will also impact on future land uses/activities in this precinct.
Port of Townsville Quarry	This is a new quarry proposal located in the Pinnacles region of Townsville that will be a source of rock armour and other materials required for the Port Expansion Project. As part of this proposal, the port will construct a private road to haul the rock from the quarry onto Riverway Drive and then to the port via the Ring Road to avoid using Granitevale Road.
Elliot Springs Urban Development	The Elliot Springs Development is located to the south of Townsville and will potentially have a significant impact on the transport network in the southern part of the study area.
Boundary Street / Archer Street Precinct	This precinct is located immediately to the south of the port and together with the Waterfront PDA forms an important interface between the port and the city.

Location	Relevance
Rail Corridor – North Coast Line (Brisbane to Cairns)	This is the primary rail freight corridor between Brisbane and Cairns with a connection to the port.
Rail corridor – Mount Isa Rail Line (Mount Isa to Townsville)	This rail connection provides access to the wider region and in particular resource projects in the Mount Isa region.
Road Corridor – Townsville Ring Road (Deeragun to Cluden)	This is an important road for freight vehicles with origins to the north/south of Townsville accessing the port.
Road Corridor – Bruce Highway (North of Townsville)	This road connects the port to industry and freight generators/users in the north of Queensland.
Road Corridor – Bruce Highway (South of Townsville)	This road connects the port to industry and freight generators/users in the south of Queensland.
Road Corridor – Bruce Highway (Woolcock Street to Ring Road)	This section of Bruce Highway connects existing industrial uses on Woolcock Street to the Ring Road and the port.
Road Corridor – Woolcock Street	Prior to the construction of the Ring Road this road provided access to the port from the Bruce Highway (North).
Road corridor – Southern Port Road	This is an important road corridor providing access to the port from the Ring Road and areas to the south of Townsville.
Road Corridor – Abbott Street	The Abbott Street corridor connects from Woolcock Street through to the Ring Road. Although it is not the main heavy vehicle corridor forentering the port, together with Boundary Street it provides alternative access to the port.
Road Corridor - Flinders Highway	The Flinders Highway provides an important road link from the port to agricultural and resources activities located to the west of Townsville.
Road Corridor – Boundary Street	In conjunction with Abbott Street, Boundary Street provides an important alternative road connection to the port.

Location	Relevance
Magnetic Island (land)	Magnetic Island is located within Townsville Port Limits and within the GBRWHA. The waters surrounding the island are included in the Great Barrier Reef Marine Park (GBRMP) however the land side is not. The land side of Magnetic Island is included as an area of interest due to its proximity to the Port of Townsville and its environmental values.
Bohle Plains Industrial Land Investigation Area	This land is under investigation by the Department of Infrastructure, Local Government and Planning (DILGP) / Townsville City Council (TCC) for potential future industrial use. Development of this precinct may create opportunities for port related uses in the future. Townsville City Plan suggests that subject to detailed planning and investigations, future land uses may include manufacturing, transport, storage and other uses which require larger sites in locations separated from sensitive land.
Woodstock Industrial Land Investigation Area	The land of Lansdown Station at Woodstock is under investigation by the Queensland Government and TCC for potential future industrial use. Development of this precinct may create opportunities for port related uses in the future. Townsville City Plan suggests that future land uses that may occur include heavy industry uses including concrete batching plants, boiler making, engineering and metal foundry, subject to detailed planning and investigations. The use of that area for feedlots to support live cattle export from the port is also being investigated.

The study area was screened for it's environmental, cultural and heritage values. The report appendix describes such values in detail. Where values may be impacted by existing or future port related development, relevant locations containing the values have been included in the proposed master planned area.

The Port of Townsville is located within the GBRWHA. The concept of OUV underpins the basis for listing properties on the World Heritage List. For a World Heritage property to be listed and considered to have OUV, it must meet one or more of 10 World Heritage criteria. The Great Barrier Reef meets four World Heritage criteria, in particular the criteria relating to natural world heritage.

The report presents a method and results for identifying the local presence of OUV within the GBRWHA surrounding the Port of Townsville. The process for determining the local presence of OUV is based around understanding of which attributes are present and how important those attributes are within the context of the wider World Heritage Area.

Analysis of key attributes expressed within the Priority Port of Townsville study area determined that there are several environmental attributes with moderate or significant presence:

Significant presence

- Important populations of migratory shorebirds occurring in wetland and intertidal roosting locations primarily within the Bowling Green Bay Ramsar wetland and areas east of the Ross River as well as the Townsville Town Common Conservation Park
- Substantial mangrove stands occur in Cleveland Bay and around Magnetic Island that provide nursery habitat for many fish and invertebrate species as well as nesting habitat for birds and animals. A total of 12 species of mangrove have been recorded
- Cleveland Bay contains some of the most extensive and diverse seagrass meadows in north Queensland. Eight species of seagrass have been recorded in Cleveland Bay
- Cleveland Bay is recognised as dugong habitat and is a declared Dugong Protection Area.

Moderate presence

- The broader areas of Cleveland Bay, Magnetic Island and Cape Cleveland provide a contribution to the superlative natural beauty of the World Heritage Area
- Magnetic Island is a notable example of a green vegetated island
- The reef communities comprised of hard corals around Magnetic Island, at Middle Reef and at Virago Shoal contribute to OUV as do the intertidal areas, which are a key habitat for many species of invertebrates (e.g. crabs, shell fish, worms).

Land-side areas within the study area also support areas of environmental, social and cultural heritage values, particularly in the vicinity of the Townsville State Development Area which abuts important wetland areas and contains areas of Indigenous cultural heritage value. High value national park areas are scattered at the extremities of the study area, and on Magnetic Island which contains significant areas of vegetation designated as 'Endangered' and 'Of Concern' Regional Ecosystems.

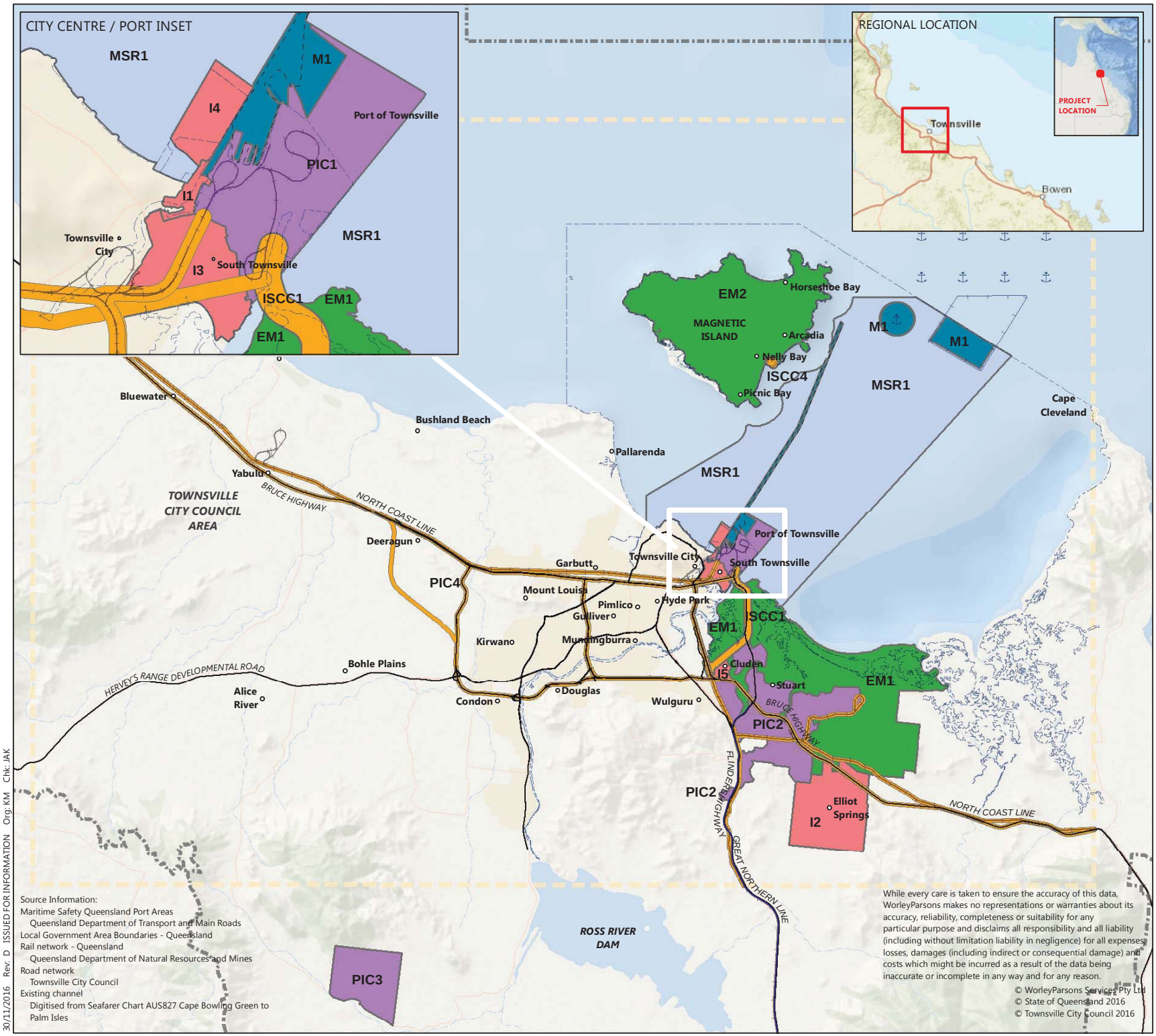
The proposed master planned area is not a single contiguous land area but a series of areas relating to land uses and infrastructure. Following stakeholder consultation, the areas of interest were refined resulting in the identification of precincts to make up the proposed master planned area. Precincts are grouped into six types, each with a unique definition relating to its form and function. The following precincts have been identified through the study and are shown Figure E-1:

Precinct Classification	Precinct Name	Boundary Description
Marine	Port of Townsville (Marine Side - Port Operations)	This boundary is aligned with the marine boundary identified in the PEP excluding the area allocated to the Great Barrier Reef Marine Park (GBRMP). It also includes the offshore dredge material placement area and anchorage area that lies within the port limits but outside the GBRMP.

Precinct Classification	Precinct Name	Boundary Description
Marine Services and Recreation	Port of Townsville (Marine Side - excluding port operations)	This precinct includes all marine activities outside of those areas identified in the marine precinct and the area designated as the GBRMP. It includes the Breakwater Marina.
Port Industry and Commerce	Port of Townsville (Land Side)	This boundary is aligned with the boundary of the port as proposed by the PEP and includes all land currently owned/occupied by the port.
Environmental Management	Townsville State Development Area (Environmental Management)	This precinct occupies both environmentally and culturally sensitive areas within and adjacent to the TSDA. Environmental areas largely relate to tidal and drainage areas and include a declared Fish Habitat Area. Cultural areas relate to areas of Indigenous cultural heritage.
Environmental Management	Magnetic Island - Land (Environmental Management)	Magnetic Island is a continental island located within the GBRWHA. The land side of Magnetic Island contributes to the superlative natural beauty of the WHA, containing forested areas of high environmental value. The proposed master planned area cannot include the waters surrounding the island as these are within the boundary of the GBRMP, however the master plan must consider the impacts on this surrounding area. Magnetic Island also includes several residential and commercial areas, including Nelly Bay, Horseshoe Bay, Arcadia and Picnic Bay. These have been included in this precinct for the purposes of master planning.
Port Industry and Commerce	Townsville State Development Area	This precinct reflects the area of the TSDA and adjacent industrial area (Stuart Industrial Estate) outside the TSDA Environmental Management precinct.
Infrastructure and Supply Chain Corridor	Townsville Eastern Access Rail Corridor	This precinct is defined as a 400m corridor offset from the centreline of the stage 1 and stage 2 TEARC alignments as proposed in the TEARC Study.

Precinct Classification	Precinct Name	Boundary Description
Infrastructure and Supply Chain Corridor	Rail Corridors	All rail corridors have been defined as a 220m corridor based on the centreline of the existing rail reserve. This is aligned with the rail corridors identified in the TCC's Infrastructure Noise Corridors Overlay. Corridors include parts of the: ▪ North Coast Line ▪ Mount Isa Rail Line.
Infrastructure and Supply Chain Corridor	Road Corridors	All road corridors have been defined as a 220m corridor based on the centreline of the existing road reserve. This is aligned with the road corridors identified in the TCC's Infrastructure Noise Corridors Overlay. Road corridors include: ▪ Townsville Ring Road ▪ Bruce Highway (north and south of Townsville) ▪ Woolcock Street ▪ Southern Port Access Road ▪ Abbott Street ▪ Flinders Highway ▪ Boundary Street.
Infrastructure and Supply Chain Corridor	Magnetic Island Ferry Terminal	Ferry terminal and ancillary infrastructure.
Port Industry and Commerce	Port of Townsville Quarry	This precinct is defined as the two lots currently owned by POTL for the purpose of quarrying materials required for the future Port Expansion Project.
Interface	Townsville Waterfront Priority Development Area	This precinct boundary is aligned with the current boundary of the PDA incorporating only precincts five, six and seven.
Interface	Elliot Springs Urban Development	This precinct is defined by the boundary for the Elliot Springs urban development as outlined in the TCC City Plan.
Interface	Boundary Street/Archer Street Precinct	This precinct occupies the area immediately south of the port precinct. Its northern and eastern boundaries are defined by the port precinct whilst its southern boundary follows the peninsula created by Ross River. Its western boundary is located along Davidson Street.

Precinct Classification	Precinct Name	Boundary Description
Interface	Casino and Breakwater Precinct	This precinct boundary incorporates the existing casino and area of the now expired Townsville Ocean Terminal project.
Interface	Cluden	This urban precinct is immediately adjacent to the TSDA. It is bounded by the proposed TEARC infrastructure and supply chain coridor, and the TSDA Environmental Management and Port Industry and Commerce precincts.



Townsville Evidence Base Report

Figure E-1: Proposed Master Plan Precinct Boundaries

- Existing rail network
- State controlled road
- Existing port anchorage
- Existing channel
- Existing dredge material placement area
- Port bounds
- Townsville City Council LGA boundary
- Project area of interest

Precinct Classifications

- Marine
- Marine Services and Recreation
- Environmental Management Area
- Infrastructure and Supply Chain Corridors
- Port Industry and Commerce
- Interface

Precinct Name

- M1 - Port of Townsville (Marine Side - Port Operations)
- MSR1 - Port of Townsville (Marine Side - excluding port operations)
- EM1 - Townsville State Development Area (Environmental Management)
- EM2 - Magnetic Island Environmental Management Area
- ISCC1 - Townsville Eastern Access Rail Corridor
- ISCC2 - Rail Corridors
- ISCC3 - Road Corridors
- ISCC4 - Magnetic Island Ferry Terminal
- PIC1 - Port of Townsville (Land Side)
- PIC2 - Townsville State Development Area
- PIC3 - Port of Townsville Quarry
- I1 - Townsville City Waterfront Priority Development Area
- I2 - Elliot Springs Urban Development
- I3 - Boundary Street / Archer Street Precinct
- I4 - Casino and Breakwater Precinct
- I5 - Cluden

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Kilometres

Coordinate System: GCS GDA 1994
Datum: GDA 1994
Scale at A3 - 1:200,000

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Source Information:
Maritime Safety Queensland Port Areas
Queensland Department of Transport and Main Roads
Local Government Area Boundaries - Queensland
Rail network - Queensland
Queensland Department of Natural Resources and Mines
Road network
Townsville City Council
Existing channel
Digitised from Seafarer Chart AUS827 Cape Bowling Green to Palm Isles

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1 Introduction

The Port of Townsville is one of 11 commercial trading ports operating within the Great Barrier Reef World Heritage Area (GBRWHA) along Queensland's eastern coast line. These ports primarily service the export demands of the Queensland agricultural, gas and mineral provinces as well as supporting general cargo imports and exports for a range of domestic and industrial commodities (such as fuels, food, vehicles, commercial machinery and manufactured items). Being located along the Great Barrier Reef coastline, these ports operate adjacent to and within the GBRWHA, which extends from the top of Cape York to just north of Bundaberg, and was inscribed on the World Heritage List in 1981.

The Port of Townsville is the northern-most of four Priority Ports identified under the Queensland *Sustainable Ports Development Act* 2015 (Ports Act), which was enacted in November 2015. Among other things the Ports Act:

- restricts new port development in and adjoining the GBRWHA to within current port limits and outside Commonwealth and State marine parks
- prohibits major capital dredging for the development of new or expansion of existing port facilities in the GBRWHA outside the priority ports of Gladstone, Abbot Point, Townsville and Hay Point/Mackay
- prohibits the sea-based disposal of port-related capital dredge material within the GBRWHA (DSD, 2016)
- mandates that capital dredge material generated at the priority ports be beneficially reused.

Through the Ports Act, the Queensland Government seeks to strike a balance between environmental considerations and the protection of the state's priority ports which are critical elements of the economic infrastructure of Queensland. To achieve this, the Ports Act introduces a strategic planning process for priority ports. The master planning process considers aspects beyond the priority port boundary and assists with the optimisation of infrastructure and addresses operational, environmental, social and economic relationships. Key considerations beyond the port boundary include supply chains and surrounding land uses. Each priority port master plan will contain an Environmental Management Framework (EMF) which will provide for consistent and structured management, monitoring and reporting on environmental, social and cultural heritage values relevant to the priority port.

1.1 Purpose

This Evidence Based Report collates, analyses and synthesises information that will support the master planning process being led by the Department of State Development* regarding the Priority Port of Townsville. This report presents a basis upon which a master planned area and associated precincts are proposed, for subsequent refining in later phases of the process. The collection, analysis and synthesis of information and development of a proposed master planned area and associated precincts are designed to:

* now being led by the Department of Transport and Main Roads.

- consider land use and infrastructure, environmental, economic, social and cultural heritage information and constraints
- consider Commonwealth, state and local environmental interests both on land and in marine areas in a development context
- seek to minimise the social and environmental impacts of development and address the importance of preserving cultural heritage concerns.

This report presents information based around four key elements:

- Identify the regulatory context relevant to port development and operations
- Identification of land use, environmental, social, and cultural heritage values and key constraints
- Assessment of the local presence of Outstanding Universal Value (OUV) within the GBRWHA
- Mapping of a proposed master planned area and precincts.

1.2 Methodology

This report has been prepared through application of the following high-level methodology which was developed in response to the project objectives/purpose as identified by DSD.

- An initial review of background information was undertaken in preparation for consultation with key stakeholders
- Targeted consultation through meetings and follow up correspondence with key stakeholders including:
  - Townsville City Council
  - Port of Townsville
  - Department of Transport and Main Roads
  - Queensland Rail
  - Aurizon
  - Port User Group (Glencore, South 32, Incitec Pivot Fertilisers, Queensland Sugar, Northern Stevedoring Services, Townsville Bulk Storage and Handling Services)
- Review and analysis of available data/documentation including:
  - Legislation and policy relating to planning and infrastructure
  - Existing and proposed land uses
  - Existing and proposed infrastructure
  - Environmental, social and cultural values
- Development of high level assessment criteria for determining areas of interest from a master planning perspective
- Determination of general locations/features/infrastructure of interest with respect to the master plan
- Identification of the boundary for the master planned area based on areas of interest.

Identification of master plan precincts based on agreed precinct definitions.

2 Location Context

The Port of Townsville is located 1360 kilometres north of Brisbane and is situated and east of Townsville's city centre in tropical North Queensland. The port is situated in the southwest of Cleveland Bay, between Ross River and Ross Creek. Magnetic Island a continental island located approximately eight kilometres offshore, lies at the northern entrance to the bay (Figure 3-1).

The Townsville region includes the Local Government Area of Townsville. It encompasses a major urban coastal area, a restricted rural area, mountain ranges, a major offshore island and a number of smaller islands and rock shoals (Townsville City Council, 2011a). It has a spatial area of 3736 square kilometres and shares its boundaries with the Shires of Burdekin to the south, Charters Towers Regional Council to the east and Hinchinbrook to the North. The Palm Island Aboriginal Shire Council is also an important neighbouring council, responsible for the administration of Palm Island located 65 kilometres north-west of Townsville.

The Port of Townsville is well situated to support the regional mineral and agricultural industries and as a regional trade hub for North Queensland. It is strategically situated to serve the North West Queensland region, and is the terminus for the Mount Isa rail line (MIRL). It is also strategically situated to serve the activities of the Townsville State Development Area (TSDA), which was declared in 2003 and is located to the port's south-east.

Significant redevelopment of the urban core is planned through the Townsville City Waterfront PDA. This significant project will see redevelopment of a significant tract of land enhancing Townsville's status as an important regional centre in the state's north.

3 Port Overview

The Port of Townsville was established in 1864 to serve hinterland pastoral properties in the region. Since then, the Port of Townsville has grown to be a major import and export node in North Queensland.

The port served as a major supply port during World War II, with more than one million tonnes of war supplies and some 300,000 tonnes (t) of fuel passing through the port up to 1943. The defence heritage of Townsville remains today with Townsville maintaining Army and Air Force bases, and hence being recognised as Australia's largest garrison city, with over 15,000 defence force personnel and dependents living in the region.

Wool and subsequently coal and ore were the dominant exports through the 1920s and 1930s. A bulk sugar terminal was developed in 1959. In 1967 reclamation works provided an additional 170 hectares of land that would support oil facilities, an LPG terminal, bulk steel store and enabled the development of prawn and fish processing works. Imports of vehicles and containers commenced in 1969. Imports of nickel ore commenced in 1974.

Further reclamation works in the 1980's enabled new container and LPG terminals to be developed, as well as a fertiliser terminal. During the 1980's a new breakwater was built and the commercial fishing fleet was relocated to Ross Creek. Broken Hill Proprietary Company (BHP, now BHP Billiton) constructed a new berth in 1997 that provided for export of mineral concentrates from the Cannington Mine. In 2013, an upgrade of Berth 10 and Quayside Terminal were completed.

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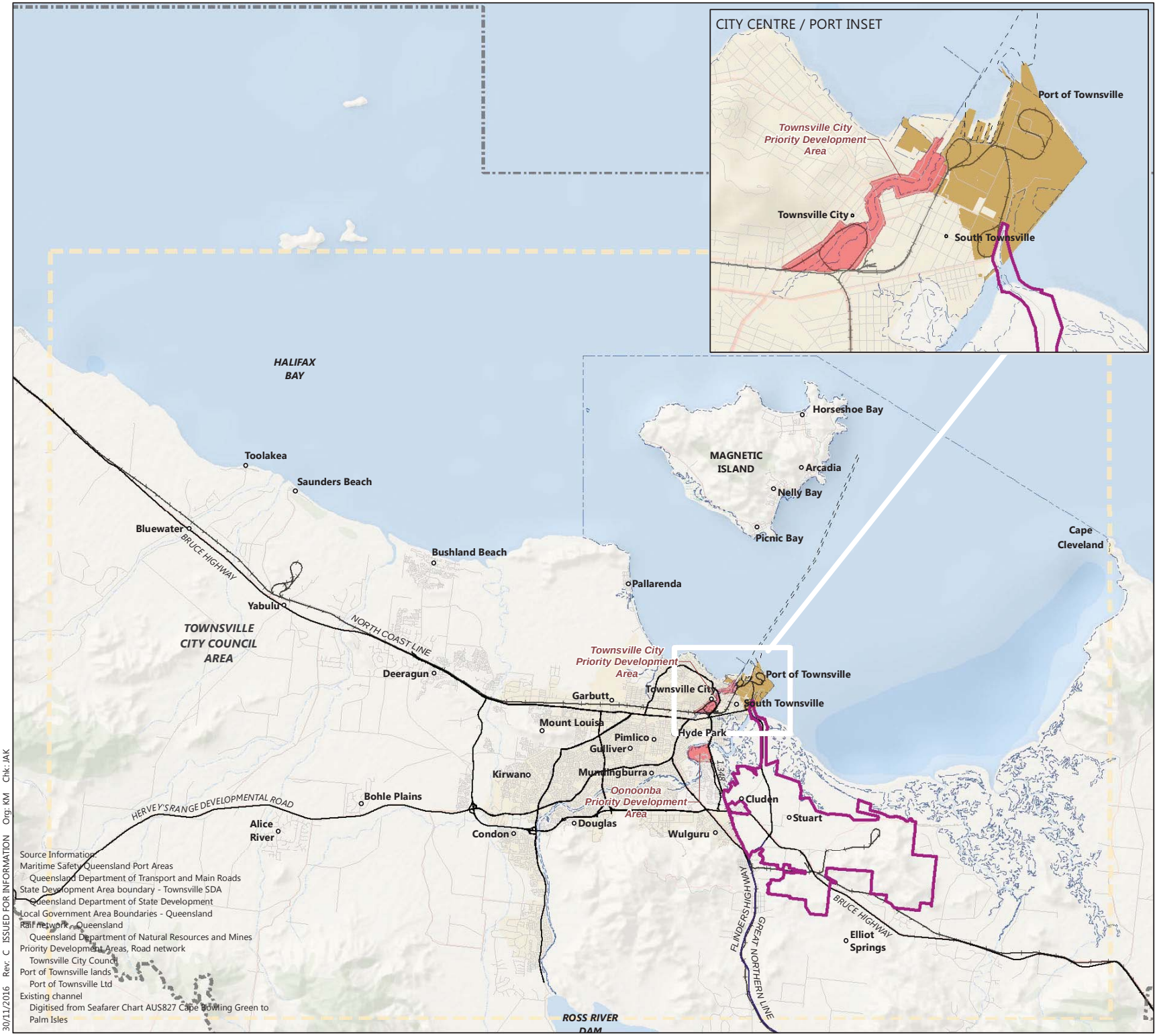
Figure 3-1:
Location of Port of Townsville and Master Plan Study Area



- Existing state controlled road
- Existing road network
- Existing rail network
- Existing channel
- Port bounds
- Gazetted State Development Area - Townsville
- Priority development areas (Townsville City Council City Plan)
- Port of Townsville
- Townsville City Council LGA boundary
- Project area of interest

Source Information:
Maritime Safety Queensland Port Areas
Queensland Department of Transport and Main Roads
State Development Area boundary - Townsville SDA
Queensland Department of State Development
Local Government Area Boundaries - Queensland
Rail network - Queensland
Queensland Department of Natural Resources and Mines
Priority Development Areas, Road network
Townsville City Council
Port of Townsville lands
Port of Townsville Ltd
Existing channel
Digitised from Seafarer Chart AUS827 Cape Bowling Green to Palm Isles

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4 Current Port Function

Today, the Port of Townsville remains one of Queensland's most strategic economic assets, playing a significant role in the local, regional and state economy. The port is managed and operated by a government-owned corporation, the Port of Townsville Limited (POTL).

The port is located at the mouth of the Ross Creek near the centre of Townsville. The port serves Townsville's expansive hinterland with road and rail connections providing access to the port for a variety of mineral projects and agricultural activities.

As a multi-commodity port, it now handles about 14 per cent of the total international export trade by earned value, yet only 4 to 5 per cent of the total tonnage emanating from Queensland seaports. A significant expansion of sea-borne trade is expected in North Queensland in the next few decades and beyond as a result of Free Trade Agreements and emerging Asian markets. Further development is expected in the next 30 years.

In the 2015/16 financial year, the port's throughput decreased overall from approximately 10.5 million tonnes (mt) in 2014/15 to approximately 9.2 (mt). This decrease was primarily driven by a decrease in bulk nickel through Berth 2 and decommissioning of Berth 7. The decrease was partially offset by increased throughput the bulk material and multi-purpose Berth 8 and bulk liquids through Berth 1. Low commodity prices and the closure of Queensland Nickel in Yabulu are the likely cause of the reduction of commodity throughput volumes. Vessel calls decreased accordingly.

The current operational conditions of the various berths within the port are provided in Table 4-1.

At present the Port of Townsville caters for an extensive range of import and exports with a focus on the following five trade sectors (POTL, 2016).

Mining and Resource Hub

The Port of Townsville's principal catchment area encompasses the towns and hinterlands of Townsville, Cairns, Mackay, Charters Towers, Mount Isa, the Burdekin and the Whitsundays, with a population in excess of 700,000. The port is linked by road and rail to one of the world's largest base metals provinces. The North West and North East Minerals Provinces surround the Mount Isa and Cloncurry region and are rich in commodities such as copper, silver, lead, zinc, gold, phosphate, magnetite and thermal coal.

Agriculture Hub

Townsville Port is the largest sugar export facility in Australia and one of the most efficient exporters of live cattle. Demand for agricultural products such as sugar, molasses, biofuels, beef, fertilizers, rice, chick pea, mung bean and grain sourced from northern Australia is expected to increase as Asia continues to grow and experiences difficulty in meeting demand with local resources. In 2015/2016 around 261,000 head of cattle were exported through the Port of

Townsville, with Indonesia accounting for 60 per cent of the destination market with the remainder to Vietnam.

Fuel Import Hub

The demand for fuel imports through Townsville is directly linked to new mining projects in the northern Australia region, as well as population growth. POTL has recently invested in the fuel pipeline infrastructure on Berths 9 and 10 to enable Navy vessel refuelling (bunkering), further increasing the demand for the import of fuel via Berth 1.

General Cargo Hub

The northern Queensland region is projected to grow over the life of the master plan which will drive growth in containerised cargo imports. Increased agricultural exports driven by the Asian demand for grain, and beef, will provide further growth opportunities for POTL in the containerised cargo sector. Container import and export numbers totalled 58,711 Twenty Foot Equivalent Unit (TEU) containers for 2015/2016.

General cargo is the predominant component of container imports while refined metals make up the major proportion of exports. There is an increasing trend to containerise refined metals due to the proliferation of Asian container ports which facilitate logistical efficiencies and therefore cost savings for customers. The potential to develop coal resources in the Galilee Basin may provide additional growth opportunities in project cargo imports due to new mining projects and the construction of infrastructure associated with newly developed resource regions. These opportunities are dependent on market conditions and commodity prices strengthening. The completion of a $40.7 million upgrade and refurbishment of Berth 4 (due for completion end of 2017) will significantly improve Port of Townsville's ability to increase container trade.

Defence and Tourism Hub

Townsville is home to Australia's largest defence base, Lavarack Barracks, as well as a base for the Royal Australian Air Force. Recent investment into Berth 10 at the Townsville Port has enhanced Defence's amphibious mounting base capacity, making Townsville a more strategic asset for Defence deployment capabilities. The port also has a new cruise ship terminal (Quayside Terminal) and berth facilities at the port.

Table 4-1 Existing Berth Use

Berth	Existing Product/Berth Infrastructure Capability	2015/2016 Utilisation (%)	2015/2016 Throughput (T)
1	Bulk liquids	27.65%	1,120,038
2	Bulk nickel	32.77%	1,638,690
3	Multi-purpose (incl. containers)	79.88%	1,702,694

Berth	Existing Product/Berth Infrastructure Capability	2015/2016 Utilisation (%)	2015/2016 Throughput (t)
4	Multi-purpose. Currently being upgraded with heavy crane beams	43.65%	645,898
8	Bulk material/multi-purpose	44.26%	1,884,841
9	Sugar, molasses, motor vehicles, bulk, general cargo	29.59%	1,545,664
10	Navy/cruise/multi-purpose (incl cattle)	43.77%	288,718
11	Bulk mineral export	16.93%	403,025

Source: Port of Townsville Ltd

The sea channel that leads to the harbour berths is currently 92m wide on average, which is considered undersized for the projected future vessel sizes, and narrow compared to the sea channels of other major port channels in Queensland.

4.1 Port Expansion Project

POTL currently proposes an expansion of the Port of Townsville to accommodate future trade growth over the planning horizon to 2040. To be able to accommodate future trade growth and to remain a competitive global port, the Port of Townsville proposes to widen the channel entrance to the harbour to accommodate larger vessels and build new berths in the outer harbour.

This Port Expansion Project (PEP) is being assessed under separate Commonwealth and State approval processes. Invitation for public comment on the draft Environmental Impact Statement for the PEP was issued in March 2013, and the period for public comment closed in May 2013.

Since that time, the PEP has undergone design changes. The Additional information to the EIS submitted to the Office of the Coordinator-General in May 2016 (AECOM, 2016) (AEIS) includes all dredged material from channel deepening and widening now being placed on shore in an expanded proposed reclaim area.

The PEP is proposed to be developed progressively to match the demand for additional port facilities. The staging comprises 3 primary stages of development as follows:

- Stage 1 – Initial outer harbour reclamation, channel widening and development of Berth 12
- Stage 2 – Ultimate outer harbour reclamation and development of Berths 14, 15 and 16
- Stage 3 – Channel deepening, and development of Berths 17 and 18.

Key features of the revised PEP dredging include:

- Dredging to extend the channel length to 14.9 kilometre length and increase the channel widths of the Platypus and Sea channels. The narrow channel currently is approximately 80 m wide.
  - Platypus Channel will increase to a maximum width of 180 m and taper to 135 m width
  - Sea Channel will increase to a maximum of 135m and taper to 120 m width
- Reclamation area of 152 ha will beneficially re-use approximately 11.4 million m^3 of dredged material
- Dredging duration of approximately 10.5 years.

5 Regulatory and policy context

A suite of overlapping and primarily complementary International Conventions, Australian and Queensland legislation, government planning schemes, and supporting policy has relevance to the Port of Townsville and surrounding areas. The suite of instruments is designed to manage land use and development, protect the environment, cultural and Indigenous values of the area, while allowing multiple-use activities to continue in a sustainable manner. Notably, port activities are amongst the most highly regulated sectors in the country, partly this reflects the complexity and risks associated with port operations but also the overlap and intersection with Australian, state/territory and local laws and policies; as well as the overlap of land based and maritime regulation. Added to this are a number of international conventions that apply to port-related activities or the coastal zone in which ports are located.

The key instruments are summarised in the following subsections. Key areas of regulatory and policy context are shown on Figure 5-1.

5.1 International Conventions

A number of international Conventions are relevant to the management of land, ocean and activities in and surrounding the Port of Townsville.

5.1.1 Convention for the Protection of the World Cultural and Natural Heritage, 1972, (the World Heritage Convention)

The World Heritage Convention (WHC) administered by the UNESCO is a pillar of the international environmental legal system. The convention establishes a list of properties that have outstanding universal value, called the World Heritage List. These properties are part of the cultural and natural heritage of states that are parties to the Convention. Located within and adjacent to Townsville, the GBRWHA is such a property on the World Heritage List. The GBRWHA commences at the mainland low watermark and extends eastwards to the outer limits of the Reef; the area includes all islands, reefs and cays within this area.

5.1.2 Convention on Biological Diversity, 1992 (the Biodiversity Convention)

The Biodiversity Convention imposes a general obligation on the Commonwealth of Australia to conserve biodiversity in both terrestrial and marine ecosystems. Article 8 is of particular relevance in terms of Australia's obligation to 'promote environmentally sound and sustainable development in areas adjacent to protected areas with a view to furthering protection of these areas'. The principles of the Convention are given effect through various environmental and planning laws that relate to port development (e.g. the *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act)).

5.1.3 International Convention for the Prevention of Pollution from Ships, 1973 (the MARPOL Convention)

The MARPOL Convention was adopted in 1973 and is the primary international tool responsible for regulating pollution of marine environments by vessels resulting from accidents or operational waste. Regulations to prevent pollution from ships in Australian waters are based on the MARPOL Convention and are implemented by both the Australian and Queensland Governments.

The Australian Maritime Safety Authority (AMSA) is responsible for the application and enforcement of MARPOL in areas of Commonwealth jurisdiction (i.e. to the limit of the 200 nautical mile exclusive economic zone). Maritime Safety Queensland (MSQ) is responsible for the application and enforcement of MARPOL in areas of state jurisdiction (i.e. to the three nautical mile limit). Maritime Safety Queensland (MSQ) is responsible for enforcement activity in respect of illegal discharges from smaller vessels in the GBRMP.

The legislation giving effect to MARPOL in Australia is the *Pollution Protection of the Sea (Prevention of Pollution from Ships) Act* 1983 and the *Navigation Act* 1912, and in Queensland, the *Transport Operations (Marine Pollution) Act* 1995.

5.1.4 The Protocol to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972 (The London Protocol)

The Protocol to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972, known as the London Protocol, is one of the first global conventions to protect the marine environment from human activities and has been in force since 1975. The aims of the London Protocol are to protect and preserve the marine environment from all sources of pollution and to prevent, reduce and eliminate pollution by controlling the dumping of wastes and other materials at sea. Internationally, guidelines have been developed under the London Protocol for the assessment of dredged material, specific guidelines for other waste that may be disposed of at sea, and guidance on action lists and action levels to assist regulators. In Australia, the London Protocol is administered through the *Environment Protection (Sea Dumping) Act 1981*. The Protocol has specific relevance to both capital and maintenance dredging activities undertaken by ports, particularly if offshore placement of dredge material is proposed.

5.2 National and Queensland Policy

5.2.1 Reef 2050 Long Term Sustainability Plan

The Australian and Queensland Governments released the Reef 2050 Plan for the GBRWHA in March 2015. The Reef 2050 Plan builds on the findings of the Great Barrier Reef Strategic Assessment and guides the sustainable management of the Great Barrier Reef for the next 35 years.

The Reef 2050 Plan incorporates the following four elements:

- A vision for the GBRWHA that reflects the diversity of use and interest in the property, protects the outstanding universal value of the reef, sustains its integrity and integrates the three pillars of sustainability (environmental, social and economic)
- An outcomes framework that includes desired outcomes and targets for protection of the property's outstanding universal value (OUV)
- Adaptive management actions to deliver outcomes and targets (primarily drawn from the two strategic assessments and with a focus on critical areas of new work)
- Integrated monitoring and reporting programs to measure the success of the plan.

The Reef 2050 Plan commits to limiting port-related capital dredging in the GBRWHA to the ports of Abbot Point, Gladstone, Hay Point/Mackay, and Townsville. Additionally, the Reef 2050 Plan supports the disposal of dredged material on land rather than at sea.

The Reef 2050 Plan also requires that port master planning be undertaken for the ports of Gladstone, Hay Point/Mackay, Abbot Point and Townsville that optimise infrastructure and considers operational, economic, environmental and social relationships as well as supply chains and surrounding land uses.

5.2.2 GBR Strategic Assessment

The Australian Government and the Queensland Government completed a comprehensive strategic assessment of the GBRWHA and adjacent coastal zone in accordance with section 146 of the EPBC Act. The strategic assessment:

- Investigated the adequacy of the existing management arrangements for the GBRWHA
- Assessed current and future development policies and planning in the GBRWHA and the adjacent coastal zone and analysed likely direct, indirect and cumulative impacts.

The strategic assessment had two key components: a marine component and a coastal component. The Great Barrier Reef Marine Park Authority (GBRMPA) led the marine component and the Queensland Government led the coastal component.

The assessment examined whether the appropriate planning processes and management arrangements are in place to ensure development occurs sustainably and does not impact unacceptably on matters of national environmental significance, including the OUV of the GBRWHA.

The strategic assessment examined the effects of impacts arising from activities conducted within and adjacent to the Region, including the legacy effects of historical activities. Of the 40 impacts examined, 25 were assessed as having high or very high effects on the region's values including increased sea temperature, cyclone activity, sediments from catchment run-off, nutrients from catchment run-off and their link to crown-of-thorns starfish outbreaks, modifying supporting

terrestrial habitats, and several impacts of direct use, such as death of discarded species, dredging, dumping and resuspension of dredge material, illegal fishing and poaching.

The assessment found several of the most significant impacts (for example those related to catchment run-off and extreme weather) operate at broad scales affecting large areas of the Reef. For almost all the major impacts considered, the intensity of effect is greatest in inshore areas in the southern two-thirds of the region.

The assessment found, while the (OUV) of the World Heritage Area remains largely intact, the overall health of the Reef ecosystem, especially inshore in the southern two-thirds of the region has declined significantly and critical habitats such as coral reefs and seagrass meadows are in poor condition. Habitats in the north, further offshore and in deeper waters, have been subject to fewer impacts and are believed to remain in good condition and are able to support dependent species.

The findings of the GBR strategic assessment informed the development of the Reef 2050 Plan (5.2.1).

5.2.3 National Ports Strategy

The National Ports Strategy (NPS) was published by Infrastructure Australia in 2011 and endorsed by the Council of Australian Governments (COAG). The NPS sees 'ports and related land-side logistics chains [as being] critical to the competitiveness of Australian businesses, which rely on them to deliver business imports and to take exports to the global market'. The overarching purpose of the NPS is 'to drive the development of efficient, sustainable ports and related freight logistics that together support the needs of a growing Australian community and economy and the quality of life aspirations of the Australian people'.

The NPS provides a nationally coordinated approach to the future development and planning of Australia's port and freight infrastructure. It provides a national action plan and a number of recommended actions, which include:

- Governments to recognise the central role of ports and related freight supply chains to trade and thus to Australia's future
- State governments to prepare state plans that recognise key maritime spaces and landside access routes of strategic importance
- Ports to prepare precinct plans that reflect the challenges of a port and demonstrate how the port capacity will be provided to meet forecast needs with an outlook horizon of a minimum of 15 to 30 years.

5.2.4 National Land Freight Strategy

As it states: "the National Land Freight Strategy is a partnership between the Commonwealth, State, Territory, local governments and industry to drive efficient and sustainable freight logistics, balancing the needs of a growing Australian economy, with the quality of life aspirations of the Australian people."

The objective of this strategy is to improve the efficiency of freight movements across infrastructure networks, minimise the negative impacts associated with such freight movements and influence policy-making relevant to the movement of freight. The strategy's long-term outcomes are to ensure: an efficient, productive and competitive national land freight system; a sustainable land freight system that responds to growth and change; and that policies affecting land freight are aligned and coherent across governments.

The physical, planning and policy links between land freight initiatives and ports cannot be understated.

5.2.5 State of Queensland: Moving Freight

In 2013, the Queensland Government released the 'Moving Freight' Strategy aimed at highlighting the importance and significance of freight movement throughout the state. Moving Freight outlined the Government's 10-year strategy to develop a multi-modal freight network that was sustainable and productive. The strategy is aiming to align and inform a range of state government initiatives such as:

- statutory regional plans
- Queensland's Agriculture Strategy
- the Bruce Highway Action Plan
- future rail and road developments.

5.2.6 White Paper on Developing Northern Australia

The White Paper on Developing Northern Australia (Australian Government, 2015) is the Australian Government's plan for building a strong, prosperous economy in northern Australia, and providing a safe and secure country. It sets our policy ideas for the next 20 years to 2035.

The White Paper includes measures to unlock the north's potential across six key areas: simpler land arrangements to support investment; developing the north's water resources; growing the north as a business, trade and investment gateway; investing in infrastructure to lower business and household costs; reducing barriers to employing people; and improving governance. Primary White Paper enablers are:

- fix roads and telecommunications
- build dams to deliver certainty to landholders and water users
- drive down the costs of operating in the north for business, making it a more attractive place to invest and work
- make regulations and infrastructure investments that encourage jobs and tackle the costs of living far from major cities.

Infrastructure is recognised as playing an integral role in unlocking economic opportunities, globally, nationally and especially in the north. The White Paper identifies that the Commonwealth

Government will focus on funding high priority infrastructure that include the following amongst other things:

- The $5 billion Northern Australia Infrastructure Facility, providing concessional loans for major infrastructure in the north and supporting projects prioritised on the new infrastructure pipeline
- Investing $5 million in rail freight analyses — starting with a pre-feasibility analysis of a Mount Isa to Tennant Creek railway.

5.2.7 The Burra Charter

The Burra Charter, adopted by the Australian International Council on Monuments and Sites in 1979, is a set of principles that provide a best practice standard for managing and conserving cultural heritage places in Australia. The Charter was initially designed for the conservation and management of historic heritage. However, after the addition of further guidelines that defined cultural significance and conservation policy, use of the charter was extended to include Indigenous and non-Indigenous places of cultural significance.

Under the Charter conservation is defined as 'the process of looking after a place so as to retain its cultural significance'. A 'place' is considered significant if it possesses aesthetic historic, scientific or social value for past, present or future generations. All four stated values are reflected in the criteria used to determine the cultural heritage significance under the *Queensland Heritage Act* 2003. The Charter is periodically updated to reflect developing understanding on the theory and practice relating to cultural heritage management and conservation.

5.2.8 North Queensland Regional Plan

The North Queensland Regional Plan is currently being developed by the Department of Infrastructure, Local Government and Planning. The regional plan will cover five local councils including Burdekin, Charters Towers, Hinchinbrook, Palm Island and Townsville. The regional plan will set the vision for North Queensland and develop a blueprint for the region's future. The plan will focus on addressing and resolving competing state interests on a regional scale. The plan is currently being developed, with statutory consultation planned for mid-2017.

Strategic outcomes and policy recommendations from the Townsville Port Master Planning process should be reflected in the final Regional Plan.

5.3 Australian Government Legislation

5.3.1 Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act) is the Australian Government's central environmental law. The EPBC Act provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage

places which are defined in the EPBC Act as matters of national environmental significance (MNES). The Great Barrier Reef is listed as a particular MNES.

The EPBC Act is triggered when a development proposal has the potential to have a significant impact on MNES. The provisions of the EPBC Act transcend state, regional and local planning instruments. If a development is likely to have a significant impact on MNES, it triggers referral to the Commonwealth Minister for assessment as a Controlled Action.

Port of Townsville's current port expansion project is the subject of an environmental impact assessment under the EPBC Act.

5.3.2 Great Barrier Reef Marine Park Act 1975

The *Great Barrier Reef Marine Park Act* 1975 (GBRMP Act) is the primary legislation relating to the protection of the Great Barrier Reef and is administered by the GBRMPA. The GBRMP Act provides a framework for the management and protection of the GBRMP) (Figure 5-1) and prohibits particular activities including mining exploration and extraction within the park. A key aspect of the GBRMP Act is the designation of shipping routes and compulsory pilotage areas for large vessels navigating through the GBRMP.

5.3.3 Native Title Act 1993

The *Native Title Act* 1993 (NT Act) recognises the rights and interests of Indigenous people in respect of land on which they historically resided. The NT Act provides for the determination of Native Title claims, the treatment of future acts that may impact Native Title rights and the requirement for consultation and/or notification to relevant claimants where future acts are involved. The main objects of the NT Act are:

- to provide for the recognition and protection of Native Title
- to establish ways in which future dealings affecting Native Title may proceed and to set standards for those dealings
- to establish a mechanism for determining claims to Native Title
- to provide for, or permit, the validation of past acts, and intermediate period acts, invalidated because of the existence of Native Title.

5.3.4 Aboriginal and Torres Strait Islander Heritage Protection Act 1984

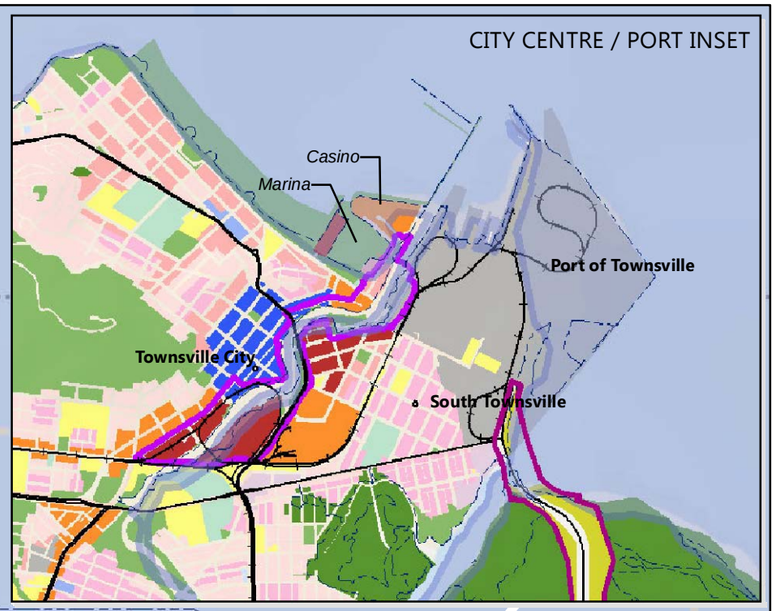
The purpose of the *Aboriginal and Torres Strait Islander Heritage Protection Act 1984* is the preservation and protection from injury or desecration of areas and objects that are of particular significance to Aboriginal and Torres Strait Islander people in accordance with their traditions in Australia and in Australian waters.

5.3.5 Historic Shipwrecks Act 1976

The *Historic Shipwrecks Act 1976* protects all shipwrecks and associated relics that are at least 75 years old, regardless of whether their physical location is known. The *Historic Shipwrecks Act* aims to ensure historic shipwrecks are protected for their heritage values and maintained for recreational and educational purposes. It also regulates activities that may result in the damage, interference, removal or destruction of an historic shipwreck or associated relics. The *Historic Shipwrecks Act* also provides for protected zones (which can cover up to 200 hectares) to be declared in order to protect historic shipwrecks and relics, which are of special significance or sensitivity or at risk of interference. Permits are required to enter protected zones. Currently in Queensland there are 10 shipwrecks located in nine protected zones.

Townsville Evidence Base Report

Figure 5-1:
Key areas of regulatory context



0 2.5 5 7.5 10
Kilometres
Coordinate System: GCS GDA 1994
Datum: GDA 1994
Scale at A3 - 1:200,000

RATTLESNAKE ISLAND
Halifax Bay
MAGNETIC ISLAND
Horseshoe Bay
Arcadia
Nelly Bay
Picnic Bay
Cape Cleveland
Toolakea
Saunders Beach
Bluewater
BRUCE HIGHWAY
Yabulu
Bushland Beach
Pallarenda
NORTH COA
ST LINE
TOWNSVILLE CITY COUNCIL AREA
Deeragun
Bohle Industrial Area
Garbutt
Townsville City
Port of Townsville
South Townsville
Mount Louisa
Pimlico
Gulliver
Hyde Park
Kirwan
Mundingburra
Oonoonba PDA
Cluden
Stuart
Townsville SDA
Bohle Plains
Douglas
Alice River
Condon
Wulguru
Stuart Industrial Estate
Elliot Springs
Port of Townsville Quarry
HWAY

Source Information:
Maritime Safety Queensland Port Areas
Queensland Department of Transport and Main Roads
State Development Area boundary - Townsville SDA
Queensland Department of State Development
Local Government Area Boundaries - Queensland
Rail network - Queensland
Queensland Department of Natural Resources and Mines
Road network, Townsville City Plan Zoning
Townsville City Council
Great Barrier Reef coast marine park
Queensland Department of National Parks, Sport and Racing
Great Barrier Reef Marine Park boundary
Great Barrier Reef Marine Park Authority
Great Barrier Reef World Heritage Area
Department of Sustainability, Environment, Water, Population and Communities
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© Australian Government 2016
© State of Queensland 2016
© Townsville City Council 2016

- Existing rail network
- State-controlled road
- Port bounds
- World heritage area
- Great Barrier Reef Marine Park boundary
- Great Barrier Reef Coast Marine Park
- Gazetted State Development Area - Townsville
- Townsville City Waterfront Priority Development Area (PDA)
- Townsville City Council LGA boundary
- Study area

Townsville City Council - Townsville City Plan Zoning

Residential zones category
- Low density residential
- Medium density residential
- High density residential
- Rural residential
- Character residential

Centre zones category
- Neighbourhood centre
- Local centre
- District centre
- Major centre
- Principal centre (CBD)
- Specialised centre
- Mixed use

Community facilities and open space zones category
- Sport and recreation
- Open space
- Community facilities
- Environmental management and conservation

Industry zones category
- Low impact industry
- Medium impact industry
- High impact industry

Rural zones category
- Rural

Other zones category
- Emerging community
- Special purpose

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30/11/2016 Rev: D ISSUED FOR INFORMATION Org: KM Chk: JAK

5.3.6 Environment Protection (Sea Dumping) Act 1981

Dumping of waste or incineration at sea of radioactive material, wastes and other material from any vessel, aircraft or platform in Australian waters is prohibited under the *Environment Protection (Sea Dumping) Act* 1981, unless a permit has been issued. Permits are most commonly issued for dredging operations and the creation of artificial reefs. Permits have also been issued for dumping of vessels, platforms or other man-made structures and for burials at sea. The Act also fulfils Australia's international obligations under the London Protocol (to prevent marine pollution by controlling dumping of wastes and other matter). The Sea Dumping Act applies to all vessels, aircraft and platforms in Australian waters and Australian vessels, aircraft and platforms in international waters. The Act is administered by the Department of Environment or GBRMPA if sea dumping takes place within the GBRMP.

5.3.7 Protection of the Sea (Prevention of Pollution from Ships) Act 1983

The discharge into the ocean of oil, noxious substances, packaged harmful substances, sewerage and garbage from ships (including aircraft) is prohibited by this Act. It implements the MARPOL Convention and applies to all vessels within Australian Waters but allows state and territory legislation to be accredited for coastal waters.

5.4 Queensland Legislation

5.4.1 Sustainable Ports Development Act 2015

The *Sustainable Ports Development Act 2015 (Ports Act)* sets a legislative framework to implement a number of Queensland's port-related Reef 2050 actions and responds to UNESCO World Heritage Committee recommendations on the reef.

The Ports Act will:

- protect greenfield sites by restricting new port development in and adjoining the GBRWHA to within current port limits and outside Commonwealth and state marine parks
- prohibit major capital dredging for the development of new or expansion of existing port facilities in the GBRWHA outside the priority ports of Gladstone, Abbot Point, Townsville and Hay Point/Mackay
- prohibit the sea-based disposal of port-related capital dredge material within the GBRWHA
- mandate that capital dredge material generated at the priority ports be beneficially reused.

The Ports Act also mandates master planning for priority ports—Gladstone, Abbot Point, Townsville and Mackay/Hay Point—to optimise use of existing infrastructure and address operational, economic, environmental and community relationships, as well as supply chains and surrounding land uses.

Following extensive stakeholder consultation, the port master planning process will determine: a long term sustainable port growth scenario; appropriate environmental, social and heritage

outcomes; and measures to manage the various interface issues between port-related uses and other land/maritime uses.

State Interests for each priority port will be defined in the master plan along with any priority management measures (PMMs) identified in a master plan's environmental management framework. Both State Interests and PMMs will be:

- implemented through the statutory port overlay
- developed with reference to the OUV of the GBRWHA
- consistent with the GBRMP Act, the Queensland Marine Parks Act, their regulations and zoning plans.

The Ports Act stipulates that master plans cannot extend over the GBRMP.

5.4.2 Transport Infrastructure Act 1994

The *Transport Infrastructure Act 1994* (TIA) establishes the regime under which port authorities plan for future development of strategic port land and for the identification of port marine operational areas.

Land use plans prepared under the TIA are required to:

- contain details of strategic port land
- coordinate and integrate the 'core matters' relevant to the Land Use Plan (LUP)
- identify Desired Environmental Outcomes (DEOs) for the strategic port land and
- include measures to achieve the DEOs.

As part of the formal approval process established under the TIA for LUPs the Minister for Transport must also be satisfied that State interests will not be adversely affected.

Port authorities' are the assessment manager for all assessable development on strategic port land (SPL) and the LUPs are the principal tool for assessing any development. Development within SPL is not regulated under local government planning schemes. The area of strategic port land at the Port of Townsville is shown in Figure 3-1. As the LUP is the principal regulatory instrument for managing land development, it may be necessary to amend the plan to reflect the outcomes of the master plan in the future.

5.4.3 State Development and Public Works Organisation Act 1971

The *State Development and Public Works Organisation Act 1971* (SDPWO Act) facilitates timely, coordinated and environmentally responsible infrastructure planning and development to support Queensland's economic and social progress. The SDPWO Act provides for the appointment of a Coordinator-General. The SDPWO Act gives the Coordinator-General the power to implement and manage state development areas.

A State Development Area (SDA) is a clearly defined area of land that clusters economic activity together in order to facilitate greater economic development. SDAs are managed through a development scheme. The scheme is prepared and administered by the Office of the Coordinator-General and ensures development in an SDA is well planned and managed. The Coordinator-General assesses and approves all development applications that relate to the scheme and may compulsorily acquire land.

The 4900 hectare TSDA was declared in 2003 and is located about six kilometres south-east of the Townsville CBD and is adjacent to the Port of Townsville (Figure 5-1). The TSDA is intended to be the preferred location in the region for the establishment of industrial development of regional, state and national significance. The area is of particular strategic importance for rail and road connections. The Townsville SDA lends itself to industrial development due to its proximity to:

- Port of Townsville
- road and rail routes running north, south and west
- key infrastructure corridors
- large workforce and support services.

Land within the TSDA is mostly privately owned and only a small portion of the 4900 hectares declared area is available for development due to a range of environmental constraints including topography, flood risk and prohibitive development costs.

Planning and development in the TSDA is controlled by the Development Scheme for the Townsville State Development Area, which was first approved in 2005 and was most recently amended in July 2013 following a series of detailed investigations, including environmental, economic and infrastructure studies. The development scheme controls land-use and infrastructure planning and development within the SDA and sets out the processes and procedure for the assessment of applications for the use of land in the SDA.

5.4.4 Sustainable Planning Act 2009

The *Sustainable Planning Act* 2009 (SP Act) forms the overarching framework for Queensland's planning and development system and sets out categories of assessable development. The SP Act gives effect to a range of planning instruments such as State Planning Regulatory Provisions, the State Planning Policy, regional plans and local government planning schemes. The SP Act is supported by the *Sustainable Planning Regulation* 2009 (SP Reg) that provides detailed guidance regarding the application of the SP Act purpose. Key matters identified in the Regulation include exempt and assessable types of development and matters requiring referral to state agencies.

The SP Act will be replaced in mid-2017 when the new *Planning Act* 2016 comes into effect.

5.4.5 Coastal Protection and Management Act 1995

The *Coastal Protection and Management Act* 1995 (Coastal Act) provides for the protection, conservation, rehabilitation and management of the coastal zone, including its resources and

biological diversity. The Coastal Act provides regulatory provisions for assessment of development for the purposes of the SP Act when development is located within a Coastal Management District declared under the *Coastal Protection and Management (Coastal Management Districts) Regulation* 2003 and for work within a tidal area (the area below the high-water mark. The Coastal Management Plan is the primary statutory instrument under the Coastal Act.

5.4.6 Economic Development Act 2012

The *Economic Development Act 2012* (came into effect on 1 February 2013 and repealed the *Urban Land Development Authority Act 2007* and the *Industrial Development Act 1963)*. The Act establishes the Minister for Economic Development Queensland (MEDQ) who has responsibility for the government agency of Economic Development Queensland (EDQ).

EDQ's role is to identify and drive economic development and development for community purposes in consultation and partnership with local government. The aim is to provide a greater emphasis on supporting, facilitating and fast-tracking economic development in Queensland by refining and improving existing processes.

EDQ plan, develop and manage declared priority development areas to:

- respond to a gap in the market
- drive economic development
- undertake a joint venture with a partner such as a local government
- facilitate development in complex large sites
- undertake a special purpose, for example the Commonwealth Games Village.

The Townsville City Waterfront Priority Development Area PDA was declared at the request of Townsville City Council on 5 September 2014. The Townsville City Waterfront PDA Development Scheme was approved in October 2015. The PDA includes approximately 97 hectares of land located on both sides of Ross Creek directly adjacent to Townsville's Central Business District (CBD) and is envisaged to accommodate a portion of the additional 30,000 people planned to live and work in the wider CBD by 2030.

The Townsville City Waterfront PDA will provide for mixed use development in the CBD, pedestrian and cycle paths along the banks of Ross Creek, a variety of public open spaces and includes measures designed to protect the Port of Townsville's activities from incompatible uses.

The Oonoonba Priority Development Area was declared on 23 April 2010. The Oonoonba UDA covers 83 hectares of land in the suburb of Oonoonba, about 3.5 kilometres south of the Townsville City Centre. The Oonoonba PDA is a promontory bounded by the Ross River to the west and north, a rail corridor and Abbott Street road corridor to the east, and the suburb of Idalia to the south. The site was formerly used as a Queensland Government cattle and research station.

The Oonoonba Urban Development Area Development Scheme was approved by the state government on 15 April 2011. Development on the site is for the purpose of providing a range of

housing choices to cater for the diverse needs of the Townsville community through a mix of densities, types, designs, price points and home ownership and rental options.

The locations of the PDAs are shown in Figure 3-1. All development within the PDAs will now be assessed against their respective PDA Development Schemes. Development within the Townsville City Waterfront PDA that is located within strategic port land will need to also be assessed against the Port of Townsville Land Use Plan.

5.4.7 Environmental Protection Act 1994

The *Environmental Protection Act 1994* (EP Act) is administered by the Department of Environment and Heritage (DEHP) and is Queensland's key environmental legislation. The EP Act is focused on fostering ecologically sustainable development through the maintenance of an integrated management program that develops and implements effective environmental strategies. The EP Act establishes an assessment regime for the consideration and approval of environmentally relevant activities (ERA).

5.4.8 Regional Interests Planning Act 2014

The *Regional Interests Planning Act* (RPI Act) identifies and protects areas of Queensland that are of regional interest. In doing this, the RPI Act seeks to manage the impact and support coexistence of resource activities and other regulated activities in areas of regional interest. It protects Priority Living Areas, Priority Agricultural Areas, Strategic Cropping Areas (formerly known as Strategic Cropping Land), and Strategic Environmental Areas. The RPI Act is supported by the RPI Regulation. A regional interests development approval (RIDA) may be required when a resource or regulated activity is proposed to be located in an area of regional interest.

Within the study area, there only scattered areas of Strategic Cropping Area (refer Appendix 1 Detailed Environmental Values Figure 2-5 for map).

5.4.9 Queensland Heritage Act 1992

The *Queensland Heritage Act 1992* (QH Act) provides the framework for assessing the significance of items and places of cultural heritage value in Queensland, and is administered by the DEHP. It makes provision for the conservation of Queensland's cultural heritage by protecting all places and areas listed on the Queensland Heritage Register (QHR).

5.4.10 Aboriginal Cultural Heritage Act 2003

Section 4 of the *Aboriginal Cultural Heritage Act* 2003 (ACH Act) defines its main purpose as providing effective recognition, protection and conservation of Aboriginal cultural heritage. The ACH Act defines Aboriginal cultural heritage as anything that is either: a significant Aboriginal area in Queensland; a significant Aboriginal object; or significant archaeological or historical evidence of Aboriginal occupation of an area of Queensland. The ACH Act also imposes requirements for development under the *Sustainable Planning Act* 2009 (s. 89).

5.4.11 Marine Parks Act 2004

The *Marine Parks Act* 2004 provides a framework for the creation of marine parks and the protection of marine species. Three marine parks have been created under the Act: Great Barrier Reef (GBR) Coast Marine Park; Great Sandy Marine Park; and Moreton Bay Marine Park. The GBR Coast Marine Park complements (in adjacent state waters) the GBR Marine Park created under the *Great Barrier Reef Marine Park Act* 1975. The Act creates zoning plans for multiple-use management and a permit system for activities within marine parks such as collecting marine products or commercial whale watching.

5.4.12 Nature Conservation Act 1992

The *Nature Conservation Act* 1992 is the terrestrial equivalent of the *Marine Parks Act* 2004 and establishes a framework for the creation and management of protected areas, for example national parks, and the protection and management of native flora and fauna. Under the Act there are 13 classes of protected areas and flora and fauna are listed as being one of the following five classifications: extinct in the wild, endangered, vulnerable, near threatened and least concern.

5.4.13 Vegetation Management Act 1999

The clearing and protection of native vegetation in Queensland is regulated by the *Vegetation Management Act* 1999 and associated policies and codes. The Act establishes the vegetation management framework for Queensland which applies to all vegetation other than state forests, national parks, forest reserves and certain other tenures defined under the *Forestry Act* 1959 and the *Nature Conservation Act* 1992.

The framework uses a series of maps to determine what vegetation is regulated and where clearing may not take place. The Act contains provisions relating to:

- Clearing exemptions for a range of routine property management activities
- Self-assessable codes that apply to a range of activities such as fodder harvesting and weed control
- Area management plans which can be prepared by landholders or organisations and apply to certain clearing activities
- Development approvals for the clearing of vegetation.

Generally, the clearing of vegetation to which the Vegetation Management Act applies is "assessable development" under the Sustainable Planning Act 2009 and will require a development approval in accordance with that Act.

5.4.14 Transport Operations (Marine Pollution) Act 1995

Marine pollution from ships in Queensland's coastal waters is regulated under the *Transport Operations (Marine Pollution) Act 1995*. The Act is administered by Maritime Safety Queensland (MSQ) and complements the *Protection of the Sea (Prevention of Pollution from Ships) Act 1983*, which regulates marine pollution in Australian waters.

5.4.15 Fisheries Act 1994

The *Fisheries Act 1994* sets out the responsibilities for the economically viable, socially acceptable and ecologically sustainable development of Queensland's fisheries resources. The Act and the supporting *Fisheries Regulation 2008* defines specific regulatory rights and allocation requirements for people and/or entities wishing to disturb or remove Queensland's fisheries resources. The Act enables the implementation of fisheries management measures, including fish habitat protection areas, limits and quotas, licensing and the enforcement of legal provisions.

5.4.16 Land Protection (Pest and Stock Route Management) Act 2003

The management of the state's stock route network is undertaken by Local Government in accordance with the *Land Protection (Pest and Stock Route Management) Act 2002*. This Act is the primary legislative mechanism for the control and management of travelling stock and the short-term agistment of stock on the stock route network and local government roads.

The Act charges local government with the responsibility of controlling and maintaining stock routes, reserves for travelling stock and all network infrastructure, such as water facilities.

5.4.17 Breakwater Island Casino Act 1984

The Queensland Government entered into an agreement with Breakwater Island Limited and other parties to allow the establishment and operation of two casinos. This was enabled by the passing of the *Breakwater Island Casino Act* 1984 (BICA Act).

The BICA Act oversaw the reclamation and construction of the existing land peninsulas that contain now contains The Ville Resort – Casino complex (previously Townville Hotel and Casino Complex), the Townsville Entertainment and Convention Centre and the Mariner's North Holiday Apartments and marina facilities. Under the original BICA Act, rights were also provided to the Breakwater Island Trust to obtain a further development lease, to later reclaim the area for development. Various further developments have been proposed, including most recently the Townsville Ocean Terminal.

5.5 Local Planning Instrument

5.5.1 Townsville City Plan

Under the SP Act the state government accepted and gazetted a new planning scheme for the City of Townsville in October 2014. The Townsville City Plan (Townsville City Council, 2014) superseded the old schemes of the former Townsville and Thuringowa councils and is the first approved planning scheme for the combined council. The Townsville City Plan (planning scheme) sets out Townsville City Council's intention for the future development in the planning scheme area, over the next 25 years. Figure 5-1 provides an overview of the zoning and areas covered by the Townsville City Plan.

The planning scheme seeks to advance state and regional strategies, including state planning policies, through more detailed local responses, taking into account the local context. The Port of Townsville is identified as a 'Specialised Centre' within Townsville City Plan. A key stated outcome of the Townsville City Plan is that:

> *"Sensitive uses are prevented from encroaching on the city's freight routes, special purpose areas, industrial areas and specialised centres, particularly Townsville Airport, Port of Townsville, the Townsville State Development Area and the Department of Defence landholdings, to ensure their ongoing efficient operation, minimise risks and avoid conflicts."*

Of particular significance to this study is the support/protection of infrastructure corridors (freight routes etc) and industrial uses from urban encroachment/impacts through the continual update overlays (Noise Corridors) provided by the scheme.

The port is also identified as a key productive precinct needed to accommodate growth within the region. The City Plan states:

> *"Townsville is the major economic and service centre for North Queensland. It is the primary port and freight hub, particularly for the agricultural areas of the surrounding region and for the North West minerals province. Townsville has a diverse and healthy economy. This is driven by population growth, by the traditionally strong defence, port and transport sectors and by Townsville's regional position as the capital of North Queensland and transport hub for the North West minerals province and North Queensland agricultural sector".*

There is a clear recognition within the Townsville City Plan to enable the port to grow and operate and the need to manage the interface between port and city.

5.5.2 Port of Townsville Land Use Plan

The Port of Townsville Land Use Plan (LUP) is prepared in accordance with the provisions of the Queensland *Transport Infrastructure Act* 1994, as a framework for the assessment of development on Strategic Port Land. The current LUP was adopted by the Minister for Transport on 9 August 2010 and commenced on 20 August 2010. The LUP is to be reviewed at a minimum of every 8 years to ensure that the port is planned, developed and managed to meet the Port of Townsville Limited's intentions for future development. It applies to all Strategic Port Land, including all ramps and waterways within the Strategic Port Land boundaries (POTL, 2013).

6 Land Use and Infrastructure

This section provides an overview of existing and proposed land uses and infrastructure within Townsville and the surrounding hinterlands (tourism to the north, minerals to the north west and agriculture in the east/south east).

Understanding existing and proposed land uses and infrastructure networks throughout the study area is critical to determining the spatial boundaries of the master plan. Understanding these networks and land uses assisted planners to develop a picture of how the port currently operates and its relationship with these external uses/activities.

This information is used to identify potential constraints and opportunities for the future operation of the port and through this appropriate boundaries and precincts for the master plan.

6.1 Land Uses

The Port of Townsville is located adjacent to the heart of the city. Shipping activities initially commenced in 1864 with the Townsville Harbour Board established in 1896. The city has grown around the port with transport corridors (road and rail) now permeating through the broader urban area.

Planning for the Townsville Local Government Area is advanced. Existing zoning plans reflect future population projections for the area of up to approximately 300,000 people by 2031. Current growth is slower than initial projections and as such existing urban areas should prove sufficient in excess of the 25 year planning horizon.

Figure 3-1 provides a general overview of the Townsville urban area identifying the existing boundaries of the port, major roads, railways and the TSDA.

6.1.1 Existing Port Layout and Activities

The existing layout of the Townsville Port is illustrated Figure 6-1. Key features of the existing port layout include:

- A significant area of land is currently utilised for dredge spoil management. Other land uses/activities reflect the current significant trade volumes in the port including sugar, dry bulk and bulk liquids. Several existing land uses/activities are accommodated in multiple locations rather than in a consolidated manner.
- 8 existing berths for various product types as allocated in Table 4-1
- Freight rail access is currently provided from the south of the site with two loops and multiple spurs provided within the site
- Road access to the public network is provided via Benwell Road and Archer Street. Security check points are located at Benwell Road and on Lennon Drive.

Townsville Evidence Base Report

Figure 6-1: Marine Infrastructure and Existing Port Layout

- Existing rail network
- Existing channel
- Existing shipping berth
- Berth number

Port Land Use

- Marine Industries
- Port Industry
- Port Operations
- Special Use
- Environmental Park/Buffer

Source Information:
Rail network - Queensland
Queensland Department of Natural Resources and Mines
Port of Townsville infrastructure
OTB Spatial for Port of Townsville Ltd 2016
Existing channel
Digitised from Seafarer Chart AUS827 Cape Bowling Green to Palm Isles
Seafarer Chart Seafarer Chart AUS827
Australian Hydrographic Office

While every care is taken to ensure the accuracy of this data, WorleyParsons makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaims all responsibility and all liability (including without limitation liability in negligence) for all expenses, losses, damages (including indirect or consequential damage) and costs which might be incurred as a result of the data being inaccurate or incomplete in any way and for any reason.

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1:100,000

Scale at A3 -

Coordinate System: GCS GDA1994
Datum: GDA1994

0 1 2 3 4
Kilometres

REGIONAL LOCATION

Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), MapmyIndia, © OpenStreetMap contributors, and the GIS User

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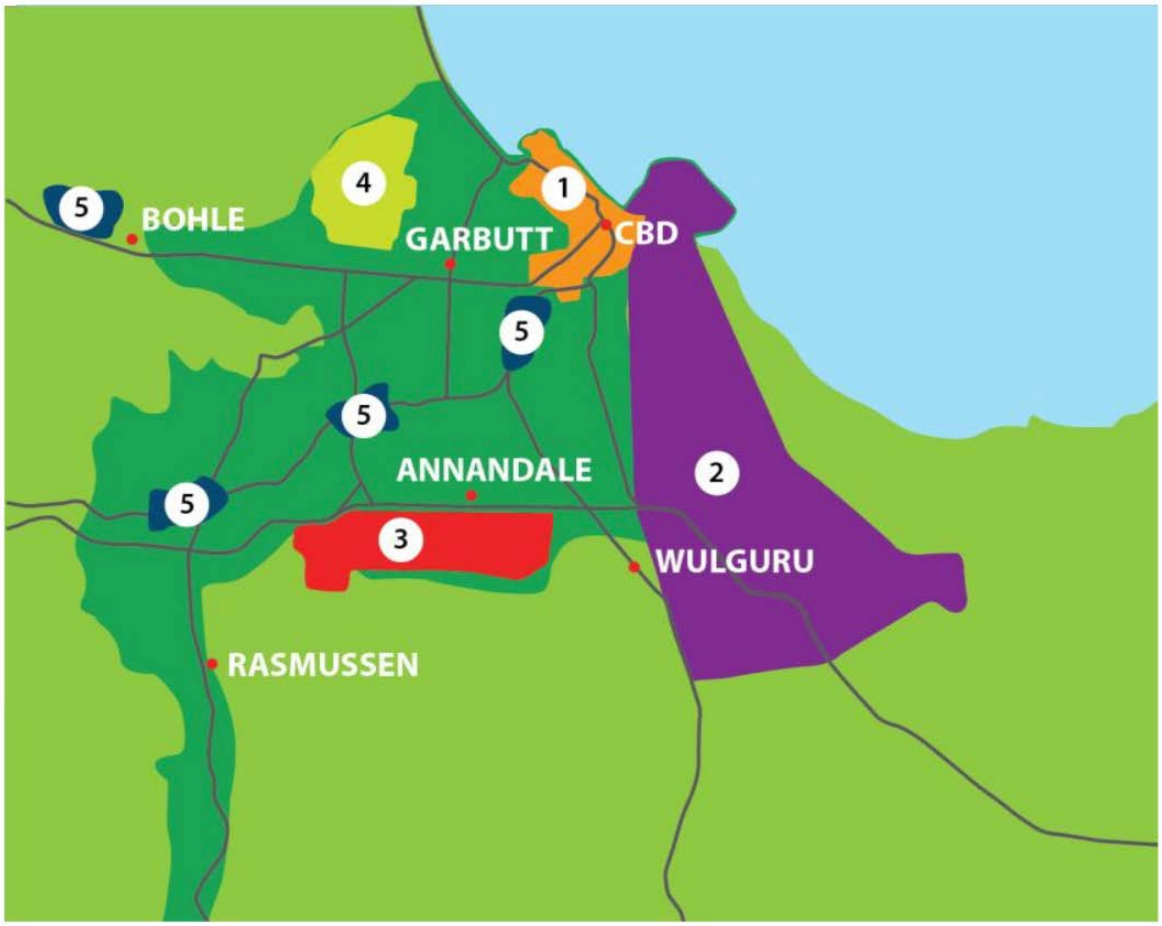
28/09/2016 Rev: B ISSUED FOR INFORMATION Org: KM Chk: JAK

6.1.2 External Land Uses

The Townsville City Economic Development Plan (2013-2017) identifies five key economic or 'productive' precincts within the City. The precincts are illustrated in Figure 6-2 and summarised in Table 6-1. The Port of Townsville and TSDA both fall within the Wulguru Precinct.



Source: Townsville Economic Development Plan 2013-2017

Figure 6-2 Townsville Productive Precincts

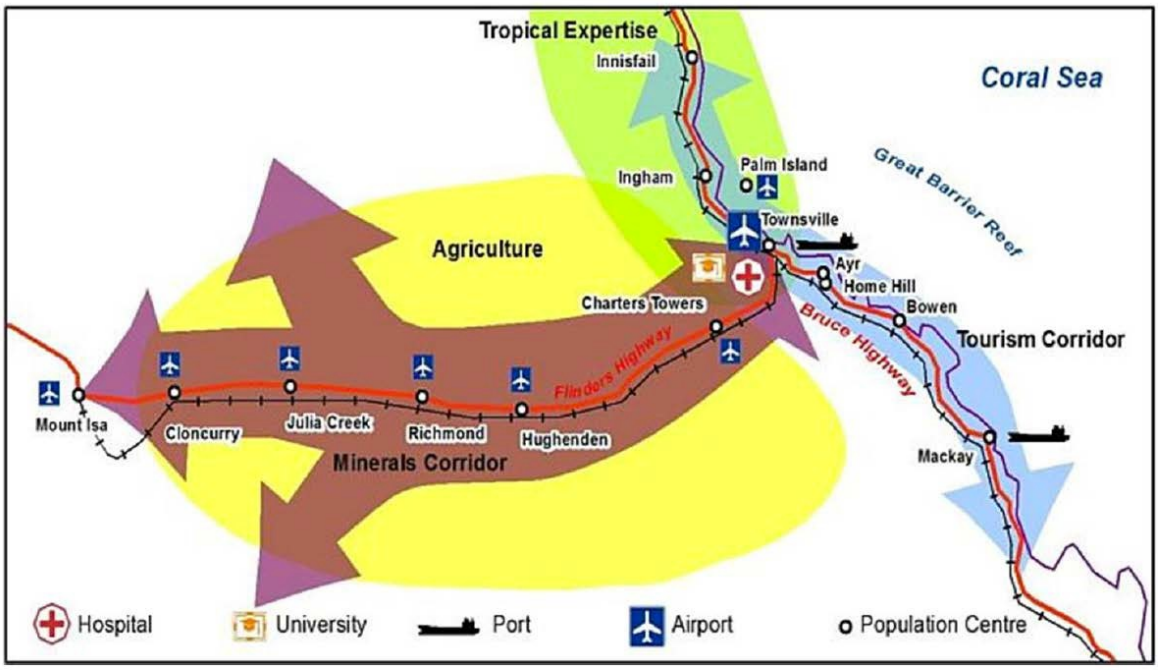
Table 6-1 Townsville Productive Precincts

Productive Precinct	Location in Figure 6-2	Locality	Existing Functions and Industries	Current Employment*
Townsville CBD Area	(1)	Townsville's CBD, North Ward / The Strand, Sturt Street leading to West End, Reid Park	Services, offices, retail, accommodation, residential, recreational, food services	10% - 15%
Port of Townsville and Stuart Industrial Area Corridor	(2)	Port of Townsville, South Townsville commercial area, Ross River marine precinct, TSDA and Stuart Industrial Area	Transport and storage, heavy industrial, light industrial, commercial retail, manufacturing, water services	4% - 6%
James Cook University, The Townsville Hospital and Lavarack Barracks Precinct	(3)	Lavarack Barracks, The Townsville Hospital, James Cook University, Australian Technical College, Scientific research clusters	Education and training, services, scientific and technical, health, social assistance, defence, recreation, food services	8.5% - 12%
Townsville airport precinct	(4)	Civil aviation master plan precinct and adjoining Queensland Government lands	Airport, RAAF Base Townsville, aviation and Defence related activities	2% - 4%
Major Activity Centres	(5)	Hyde Park, Aitkenvale, Thuringowa Central, North Shore	Recreational, foods services, retail, commercial, residential	5% - 7%

* approximate percentage of the total region's employment.

The region surrounding Townsville is represented in Figure 6-3. To the north and north-west of the city is an important agricultural and minerals corridor connected to the port via the Mount Isa Rail Line (MIRL). Activities in this corridor include cattle grazing, crop farming and wide range of mining projects.

Review of the Department of State Development (DSD) map of coordinated projects reveals that current or completed assessment of major projects in the region are typically resource related.



Source: Townsville City Plan (Strategic Framework – Figure 3.1 Regional context plan – October 2014)

Figure 6-3 Regional Context

6.1.2.1 Resource Projects

World class minerals and coal resource regions are located in close proximity to North Queensland.

The North Queensland Regional Economic Development Plan 2014-2031 (NQROC, 2014) identifies that the North West Minerals Province (NWMP) is the largest producer of lead, silver and zinc in Australia and ranks second in national copper production. There are substantial deposits of other important minerals such as gold, phosphate, rare earths and other industrial minerals.

Lead/Silver-Zinc/Copper-Gold

The Mount Isa Minerals Province which extends over the majority of the NWMP has significantly contributed to the port of Townsville throughput with its mines being ranked amongst the most productive mines globally. In particular, Glencore's Ernest Henry, Mount Isa Copper and Zinc mines and South 32's Cannington mine provide the majority of production in the region. All of these mines have an expected mine life of between six and 14 years.

A review of industry databases and DNRM's MapsOnline indicate there are around 140 projects identified in the area. However, of these only 17 are new projects that are advanced enough and capable of reaching production within the next 10 years. The larger deposits include:

- Dugald River project, zinc-lead-silver deposits, (MMG)
- Capricorn Mt Gordon, copper deposit (Lighthouse Minerals)
- Mt Elliott and Mt Dore, copper- gold (Chinova)
- Rocklands, copper-gold (Cudeco)
- Roseby (Little Eva), copper-gold (Altona)
- Walford Creek zinc-lead-silver, cobalt-copper (Aeon Metals).

The ore, metal and grades contained within all of the new projects combined remain significantly smaller than current production levels at Glencore's and South 32's operating mines. It is expected beyond the next five years there is likely to be a reduction in the output of metal ore, metal concentrate, smelted and refined metal should these operating mines enter their care and maintenance phases.

There are opportunities for Glencore and South 32 to extend their mine life through two brownfield projects: the Mount Isa open pit project and the Cannington extension project.

Figure 6-4 illustrates the location of significant mineral mines and throughout Queensland, and includes their current status regarding whether they are in operations, in development, or under care and maintenance. Of particular interest to this study are the clusters of mines around Mount Isa/Cloncurry and Charters Towers/Collinsville. These projects have the potential to access the Port of Townsville either by road or rail for the import and export of materials associated with their operations.

Figure 6-5 illustrates 'advanced' mining projects throughout Queensland. The Department of Natural Resources and Mines defines these projects as '*one for which the proponent has identified a resource and is carrying out investigations and seeking approvals to develop that identified mineral, coal, petroleum, gas or geothermal resource to commercial production*'. In the context of this study, projects in the Mount Isa/Cloncurry/Townsville corridor and other projects in close proximity to Townsville could potentially rely on the port in the future for the import and export of materials.

The Mount Isa Rail Infrastructure Master Plan (Queensland Rail) analyses different growth scenarios and identifies improvements necessary to meet mining throughput projections to capitalise on the resource opportunities. Analysis is continuing and the Port of Townsville is a key stakeholder for this work.

Coal

Historically, there was no coal exploration along the MIRL until late 2011 when three companies had received permission to explore coal mines near Hughenden. Projects are proposed in the Northern Galilee near Hughenden and Pentland. Should these projects be advanced a choice will be made on which port to use to access export markets. Coal could be sent to the Port of Abbot

Point near Bowen, although diverting a portion of coal through the Townsville Eastern Access Rail Corridor (TEARC) to the Port of Townsville could be an option. The development of TEARC would enable coal trains to access the Port of Townsville and reduce social or political pressure to stop the export due to coal dust and noise pollution. However, currently the mines have not been developed and the coal price appears to remain low. Therefore, coal mining may not take off around Townsville without a change in the coal price.

The Bureau of Resources and Energy Economics (BREE, 2014) projects that black coal, which includes both thermal and metallurgical coal, is projected to remain Australia's dominant energy export, increasing by around 54 per cent to approximately 650mtpa from 2014-15 to 2049-50. The projected annual growth rate of 1.2 per cent is built on expectations that global demand for coal will continue to increase in the period to 2049-50 as a result of increased demand for electricity and steel-making raw materials, particularly in emerging market economies in Asia. Continued export of coal from Australia to Asia over the long term is similarly predicted by the US Energy Information Administration's International Energy Outlook 2016 (IEO, 2016), which reflect an increase from 394.3 mt (short) in 2013, to 428.1 mt in 2020 and 479.8 mt in 2040.

Nickel Ore

For the past few years, nickel ore was the single largest import product in terms of its quantity in 2012-13 accounting for 35 per cent of all imports through the Port of Townsville. However, in January 2016, the nickel refinery at Yabulu was shut down which will produce large spare capacity for Berth 2 of Townsville Port.

Magnetite

Magnetite is a resource that is expected to increase in the future, however the only two mines (Ernest Henry and Mount Moss Mine) that are related to the Townsville rail and port have ceased operation due to the low iron ore price, which is not forecast to increase in the near term according to the Department of Industry, Innovation and Science (DIIS) (DIIS, 2015).

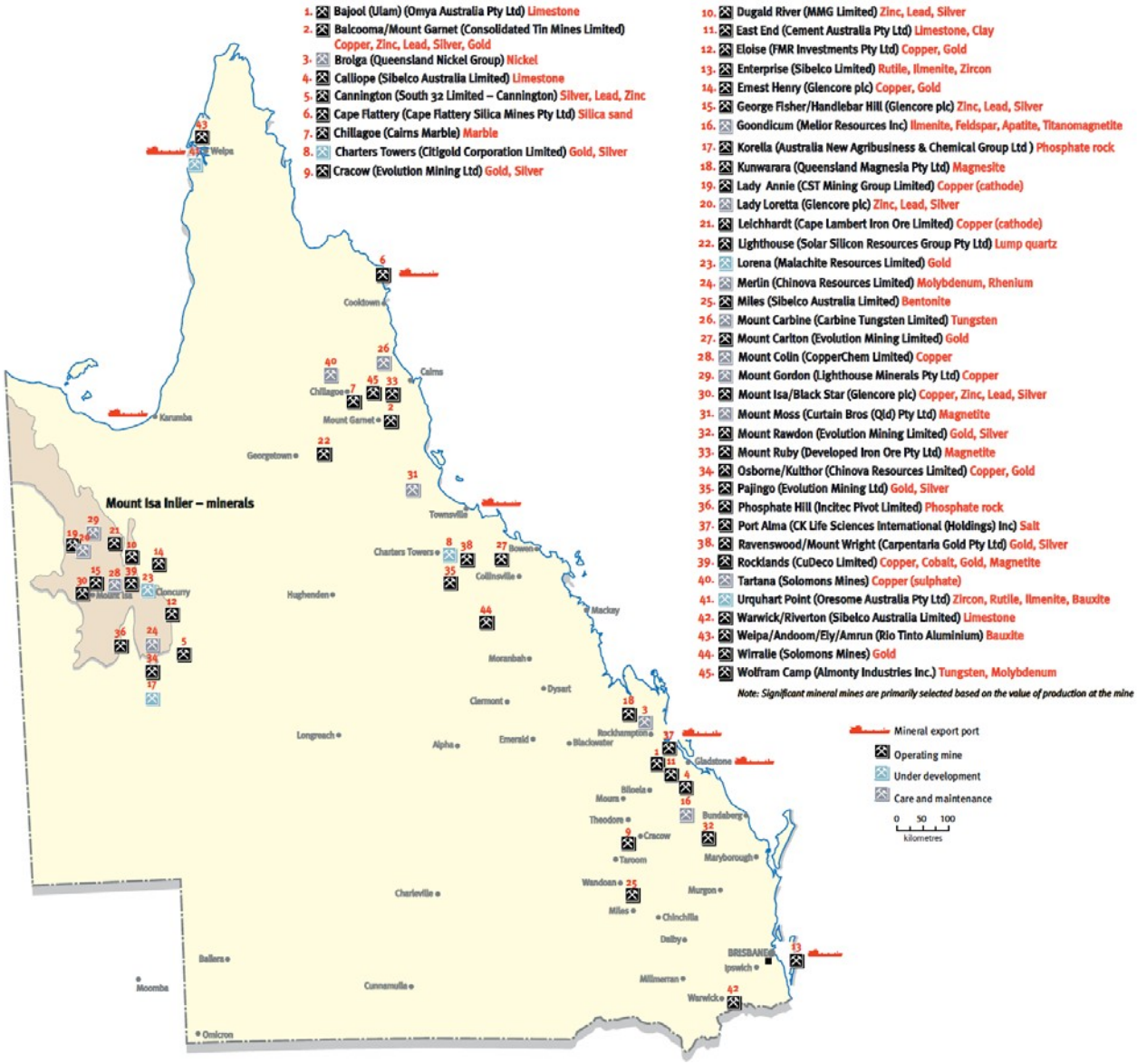
Lithium

Lithium is an alkali metal and is used in the production of batteries. Lithium-ion batteries are critical to the development of electric cars in order to make them competitive with petrol engine vehicles. The production of lithium carbonate (the compound used in lithium-ion batteries) is predicted to increase significantly as demand for electric vehicles grows. Significant quantities of lithium have been found in Queensland at Buchanan's Creek and the adjacent Grants Gully of Georgetown which is located north-west or Townsville. Exploration of this deposit is continuing and drilling to define a resource is expected later this year (DNRM, 2015).

Phosphate

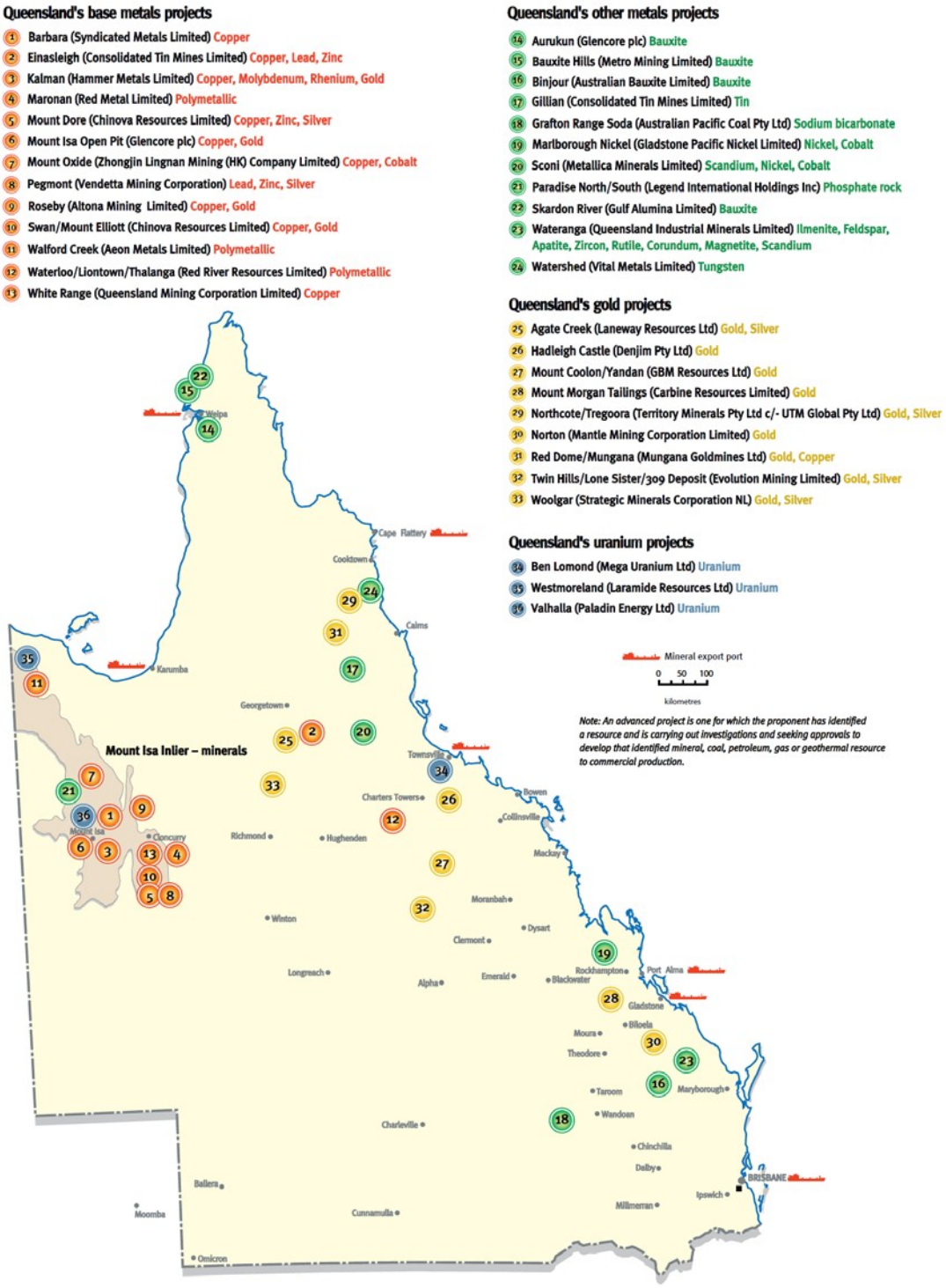
Incitec Pivots Phosphate Hill near Mount Isa manufactures ammonium phosphate fertilisers. In addition to its beneficiation, ammonia, phosphoric acid and granulation plants, Phosphate Hill has its own mine and ore processing capacity. BHP Billiton acquired Phosphate Hill in 2005 from WMC Fertilisers and onsold it to Incitec Pivot Ltd in August 2006. Incitec Pivot Ltd, although a publically

listed company on the Australian Securities Exchange (ASX), has not published resource figures. The last publically available JORC compliant resource for Phosphate Hill dates from BHP Billiton's Annual Report 2006 and quotes a proved reserve of 29 Mt at 24.6 per cent P2O5 and a probable reserve of 52 Mt at 24.3 per cent P2O5. (DNRM, 2014). Approximately 2.1 Mt of phosphate rock is mined annually and used to manufacture di-ammonium phosphate fertiliser (DAP) and mono-ammonium phosphate (MAP). The fertiliser plant has the capacity to produce 970,000 tpa of DAP and MAP. The products are railed 900 kilometres to the port of Townsville.



Source: DNRM, July 2016

Figure 6-4 Queensland's Significant Mineral Mines Locality Map

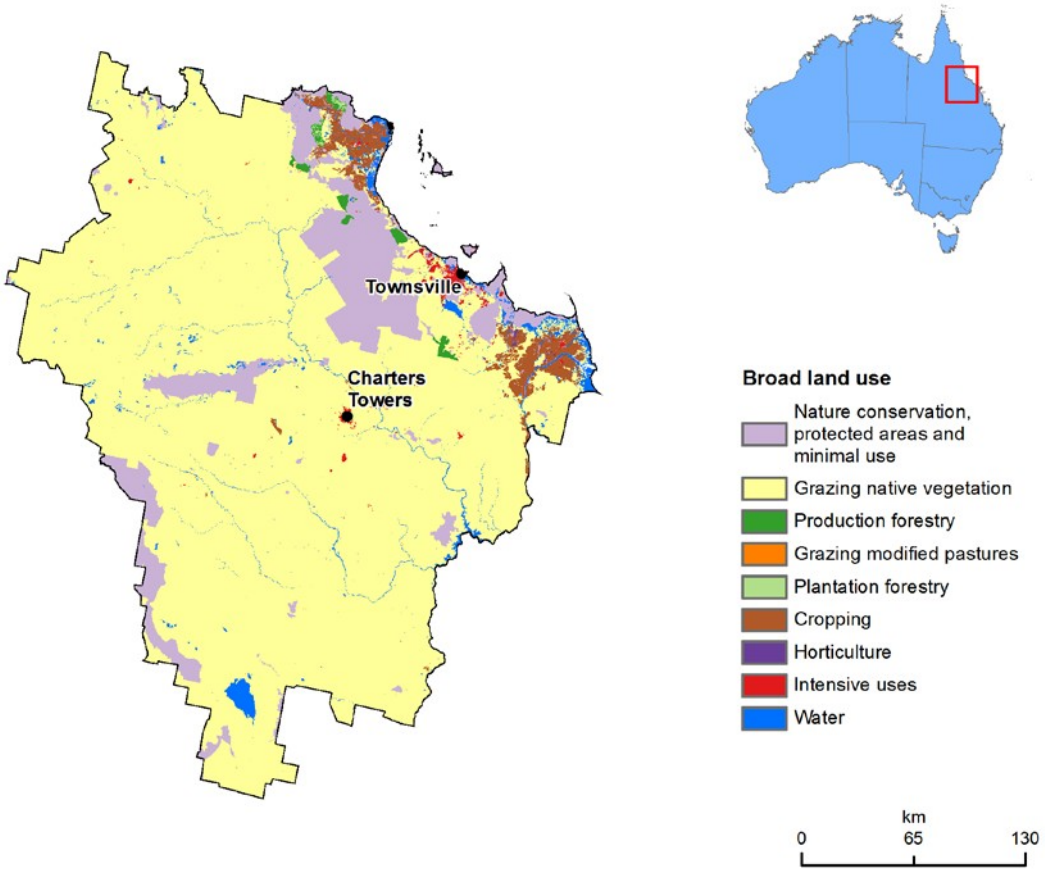


Source: DNRM, July 2016

Figure 6-5 Queensland Advanced Base Metals, Other Minerals, Gold and Uranium Projects (DNRM, July 2016)

6.1.2.2 Agriculture

Agriculture plays an important role in the wider Townsville region and is a key user of the port. The region is home to a diverse range of agricultural activities as illustrated in Figure 6-6.

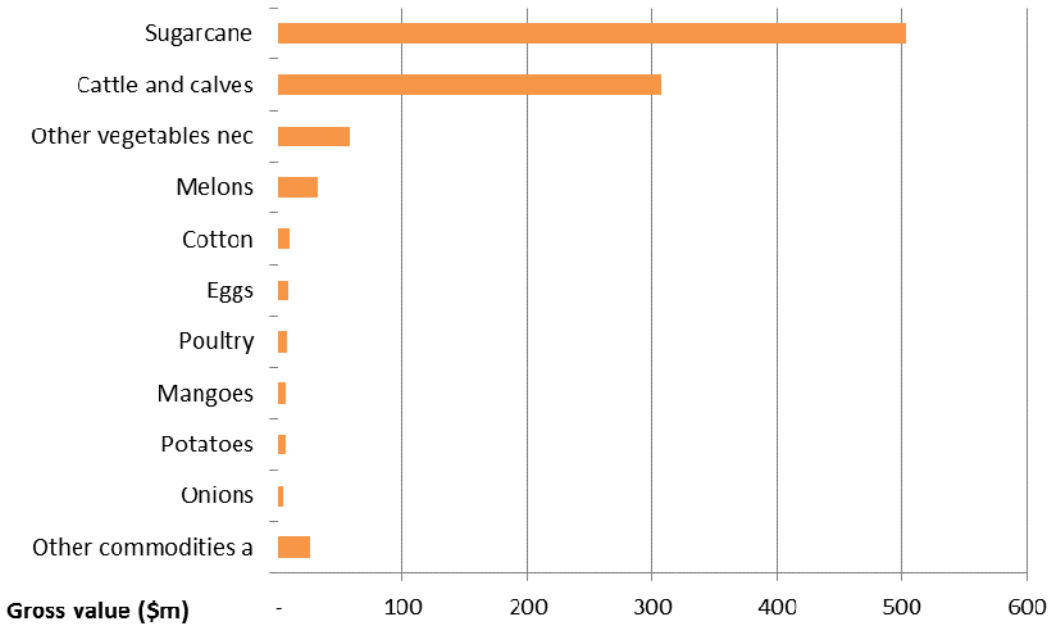


Source: ABARES, 2015

Figure 6-6 Broad Agriculture Activities in the Townsville Region

Although the largest area of the region is utilised for cattle grazing, the highest value agricultural activity, as indicated in Figure 6-7, is sugar cane. The Burdekin region, is one of Australia's most productive agricultural districts in Australia. Increased exports particularly due to the Asian demand for sugar, rice and grains provides a further opportunity for increased containerised trade. The region boasts strong rice, grain pulses and horticulture in addition to its established sugar industry.

Cattle and calves are the second highest value activity with other activities being significantly lower in value. The port plays an important role in supporting the agriculture industry with both the sugar and cattle industry heavily reliant on the port for import (fertiliser/materials/equipment) and export activities (sugar, cattle and meat).



Note: The graph shows aggregated values for published data. In some cases data are not included at the commodity level to ensure confidentiality. Some data have not been published to ensure confidentiality (refer to tabular data). The missing data results in under reporting for some groups of commodities.
a the "Other commodities" classification includes totals for commodities not shown elsewhere plus total for the unpublished values.
nec "not elsewhere classified".

Source: ABS, 2016.

Figure 6-7 Summary of Agricultural Production by Value

The North Queensland Regional Economic Development Plan 2014-2031 (NQROC, 2014) identifies that North Queensland has significant opportunity to build on its established strengths in agriculture. It identifies there are opportunities to significantly expand and diversify irrigated cropping in the region. Existing infrastructure and conditions have supported a substantial level of cattle grazing and cropping within the Burdekin catchment. However if further work is undertaken in relation to land availability, water infrastructure and policy, and soil suitability, then output could be significantly enhanced for expanded and diversified cropping (including in horticulture, grains and fibre).

A new dam, the Hells Gate Dam, is currently being investigated to provide an optimal water storage dam within the region to enable supply for irrigated agriculture. However, preliminary studies revealed potential impacts on existing downstream users of the Burdekin Falls Dam. Investigations will continue. The Hells Gate Dam would be located 100 kilometres west-northwest of Townsville, in Hervey's Range.

The potential for irrigated agriculture further west (outside of the North Queensland region) in the Flinders River Agricultural precinct may also present opportunities for the region. Other projects

such as the North Queensland Bio Energy Corporation (NQBEC), the Etheridge Integrated Agricultural Project/Integrated Food and Energy Developments Pty Ltd (EIA/IFED) and the CJ ACT Cassava project if come to fruition will increase agricultural exports from the region. Building on the existing capacity, proximity to the Port of Townsville and current supply chain processes could result in a diversified agribusiness economy for the region.

6.1.2.3 Industrial

The Townsville region operates as a primary support centre and transport hub for the mining, tourism and agricultural sectors. Mining and manufacturing are significant industries in North Queensland. Townville hosts three heavy industry plants focussed on producing refined products for the export market:

- Glencore Copper refinery at the Townsville State Development Area (TSDA). The copper refinery is part of Glencore's broader operations in the region and is expected to continue operations until at least 2022.
- Sun Metals Corporation zinc refinery also at the TSDA. Expansion plans for the plant in Townsville have been discussed in the past however there are currently no firm dates for this available.
- Queensland Nickel Industries Ltd nickel and cobalt refinery at Yabulu. This operation is currently closed while administrators decide on its future. Figure 6-8 illustrates the location of existing industrial land throughout the City of Townsville. It is difficult to determine the exact relationship of each industrial precinct to the Port without a detailed land use/activity survey mapping industry/service types and product movements. Even light industrial areas may have a connection to the port through, for example, the servicing or maintenance of equipment or small-scale importers/exporters. At a broad level, all industry within Townsville will have some connection to the port, although in many cases this connection may not be direct.

The TCC is responsible for the planning of the Bohle, Stuart and Roseneath industrial areas. As such it is their responsibility to ensure that development applications conform to all relevant planning requirements. It is also the council's responsibility to manage any potential conflicts between these areas and surrounding non-industrial land uses.

Aurizon is currently completing construction of its new Stuart Intermodal Facility Project. The facility is due to commence operations in late 2016. The facility will include:

- A freight distribution centre
- Container terminal
- Three rail sidings for intermodal operations
- Direct road access to the Stuart Bypass Road
- Access to the North Coast Line (NCL) and MIRL.

The Stuart Industrial Area is ideally located with regard to land transport connections (Flinders Highway / Stuart Bypass connection to Bruce Highway and the NCL) and also has strong

connections to the Port. The TSDA is also immediately adjacent to the Stuart Industrial Area further strengthening its position as a key transport and logistics node.

Townsville State Development Area (TSDA)

The TSDA was declared in 2003, a Development Scheme initially approved in 2005 and amended as recently as 2013 governs planning and development. The TSDA Development Scheme does not govern all development within the SDA, only land use changes.
Reconfiguration of operational works to existing uses is regulated by the Townsville City Council through their City Plan.

The 4900 hectares industrial area is located approximately six kilometres south-east of the Townsville City Centre. It has good access to the Port of Townsville via road, rail and infrastructure corridors (Flinders Highway / Stuart Bypass connection to Bruce Highway and the NCL).

The TSDA is intended to be the preferred location for industrial development of regional and state significance. Target industry includes:

- Manufacturing
- Minerals processing
- Intermodal freight and logistics
- Bulk storage.

The Department of State Development is currently undertaking a review of the TSDA. At present Sun Metals operates its Zinc refinery from within the high impact industry precinct of the TSDA. Glencore also operates its refinery from the medium-high impact precinct.

The TSDA Development Scheme includes two precinct types that constrain development: 1) Ecological Corridors and Priority Offset Precinct and; 2) Environmental Conservation Precinct. Both precincts recognise and protect various environmental and cultural values while providing for limited development including: the development of conveyor infrastructure with a minimized footprint and; conveyor infrastructure in order to support development of the high impact industry precinct or medium-high port related industry precinct.

The Townsville City Plan provides mapping of coastal hazard areas, which identify high and medium hazard areas that could be subject to storm-tide inundation from sea level rise. Storm surge mapping is provided in the Detailed Environmental Assessment (refer Appendix A Section 4.1). This mapping identifies that the TSDA and South Townsville area lies within the high hazard area making development of land in these low lying areas costly. The TSDA Development Scheme identifies general requirements for development within the TSDA, including expectations that the development minimises its emissions of greenhouse gases and identify how the use will adapt to projected climate change conditions.

Although the TSDA is zoned "Special Purpose" under the TCC City Plan there is the potential for conflicts between proposed industrial uses and surrounding existing zones. In particular the Elliot Springs development, zoned "Emerging Community" to the south and existing rural residential

communities zoned to the south-east. These uses may potentially create conflicts relating to amenity, safety and traffic issues in the future, although planning for the TSDA has considered these issues.

Yabulu Heavy Industrial Area (Queensland Nickel)

The Yabulu Heavy Industrial Area is located to the north west of Townsville on the Bruce Highway. This is the site of Queensland Nickel which ceased operations in January 2016. The site has access to the port via the Northern Rail line (Brisbane to Cairns) and direct road access to the Bruce Highway.

It is currently unclear what the future of this site will be. Continued operation as a Nickel refinery is uncertain given current commodity prices and the expensive nature of the technology applied at the refinery. Having originally been constructed in 1970's the technology applied is more energy and chemical intensive than other more modern refineries located elsewhere in Australia and overseas.

Use of the area for other heavy industry may be possible in the future. Suitable industry would include various mineral processing plants or other heavy industry requiring access to heavy haul rail. Rehabilitation of the site for alternative uses will take many years and will likely be an expensive undertaking.

Bohle Industrial Estate

The Bohle Industrial Area is located approximately 10 kilometres to the west of the Townsville CBD on Ingham Road close to the Bruce Highway. It is home to a range of medium and light industrial uses. Land is still available for development.

Stuart Industrial Estate

The Stuart Industrial Estate is a privately held industrial area located to the south of Townsville. It has medium-high impact industries as well as light industrial activities including transportation and logistics hub.

Roseneath Medium Impact Industry Precinct

The Roseneath Medium Impact Industry precinct is located to the south of Townsville on the Flinders Highway. The area is transitioning from previously rural land uses to the intended future focus on transport related industry. This area is adjacent to the Townsville State Development Area.

Bohle Plains Industrial Investigation Area

The Department of Infrastructure and Local Government and Planning (DILGP) and TCC are currently investigating a large area of land to the north and south of the final section of the Townsville Ring Road for potential re-zoning for industrial uses.

The developable area of the site covers an area of approximately 400ha and would accommodate light to medium industry. The Bohle Plains may offer the opportunity for medium industry that could accommodate a large amount of transport / logistic-focused uses and presents an opportunity for heavier industries central to the area. Manufacturing, transport, storage and other uses which require larger sites in locations separated from sensitive land uses may be supported in this area, subject to detailed planning and investigations. However, the majority of the investigation area is heavily influenced by various natural constraints including Black Throated Finch habitat, waterways and neighbouring urban development limiting its suitability for industrial land use.

Preliminary planning for the site has also found the site may not be suitable for heavy industry as other sites are considered more favourable. At present there has not been a revised market study for the project, however the study suggests that the project would have a 20-30 year development horizon based on the proposed area to be developed.

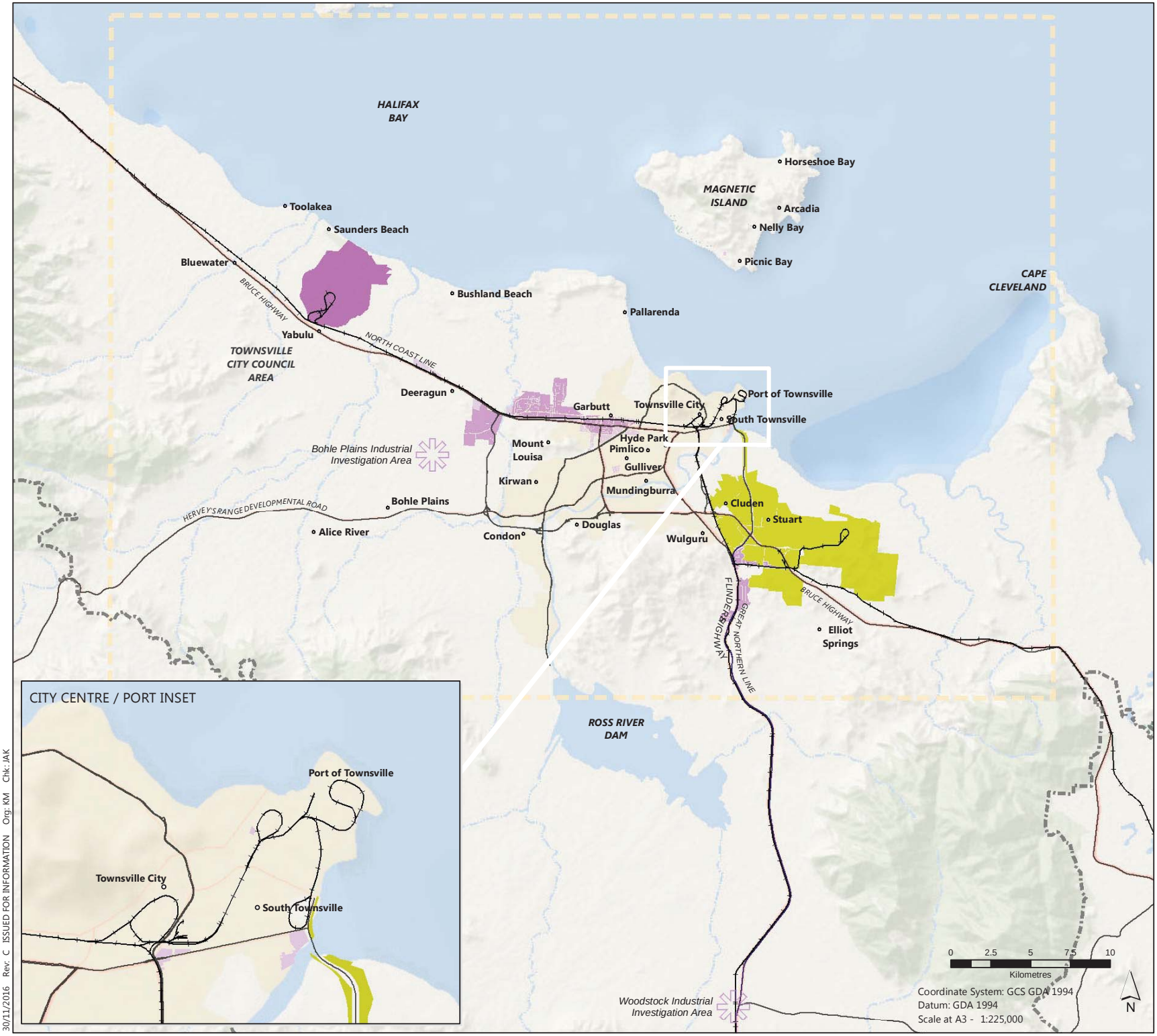
Investigations are ongoing and no decision as to the area's future has currently been made. Although the land is currently zoned rural it is protected by the TCC through identification in the City Plan as an Industrial Investigation Area. Ultimately, responsibility for rezoning of this land lies with the TCC, however state agencies Economic Development Queensland (EDQ) division and Department of Natural Resources and Mines (DNRM) would also be closely involved in further planning for the site.

Woodstock Industrial Land Investigation Area

Similar to the Bohle Plains Industrial Investigation Area, Woodstock has been identified within the Townsville City Plan's Strategic Framework as an 'industrial investigation area', highlighting that within the next 25 years it may be utilised for medium to high-impact industries. The site under investigation is the TCC-owned Lansdown Station ("Lansdown") site at Woodstock. Investigation progress includes the Lansdown Opportunities Assessment, master plan and Infrastructure Strategy project, which is a joint initiative between the TCC and Queensland Government. That assessment aims to identify priority business and investment opportunities and deliver a master plan and infrastructure strategy for the investigation area.

Townsville Evidence Base Report

Figure 6-8:
Existing Industrial Land



- Existing state controlled road
- Existing rail network
- Townsville City Council LGA boundary
- Study area

Townsville City Council - Townsville City Plan Zoning

Industry zones category

- Low impact industry
- Medium impact industry
- High impact industry

Other zones category

- Special purpose

Source Information:
Local Government Area Boundaries - Queensland
Rail network - Queensland
Queensland Department of Natural Resources and Mines
Townsville City Council - Townsville City Plan Zoning
Townsville City Council - July 2016

While every care is taken to ensure the accuracy of this data, WorleyParsons makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaims all responsibility and all liability (including without limitation liability in negligence) for all expenses, losses, damages (including indirect or consequential damage) and costs which might be incurred as a result of the data being inaccurate or incomplete in any way and for any reason.

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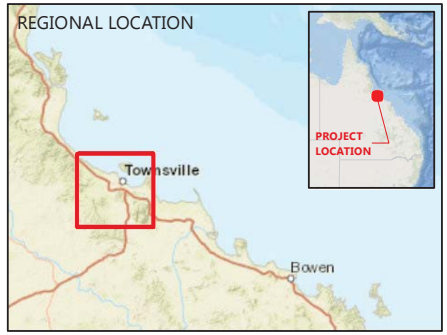

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30/11/2016 Rev: C ISSUED FOR INFORMATION Org: KM Chk: JAK

6.1.2.4 Sensitive Land Uses

The Townsville Land Use Proposal Overview 2011-2036 (Townsville City Council, 2011b) predicts an increase in population from 190,000 people to 300,000 people by 2036. This is a significant population growth and will result in increased demand for infrastructure and employment in the region. Existing planning for the city identifies all land necessary to accommodate this predicted future growth. Figure 5-1 identifies the location of land currently zoned residential within the City of Townsville.

More recently, population growth in Townsville has slowed (the ABS indicated a growth rate of 1 per cent p.a). This means it will take significantly longer to reach the population of 300,000 identified in the Land Use Proposal Overview. In effect this means that the planning horizon for the city to achieve this population is much greater than 2036 and that existing planning for land uses and infrastructure will be sufficient well into the future.

Elliot Springs

While all future development will generally have an impact on the port operations (in particular road corridors) the Elliot Springs (formerly Rocky Springs) residential development (refer Figure 5-1) will potentially have a more direct impact due to its location (traffic will likely seek to access the city using the Port Access Road). The development site occupies 1609 hectares and is located to the south of Townsville on the Bruce Highway, adjacent to the Townsville State Development Area.

The development timeframe for Elliot Springs is currently unclear; however, at build out it is predicted to accommodate a total population of up to 26,000 residents (10,600 dwellings). Although planning for the development is aiming for a high level of employment self-sufficiency this does not mean that the project will not have a significant impact on the external road network. In particular this project is likely to contribute traffic to the Port Access Road potentially resulting in congestion along this corridor to the port. The type and extent of impact will be influenced by the project ability to meet employment self-sustainability targets and background traffic volumes on the external road network.

The Environmental Impact Statement Assessment Report submitted in 2008 proposes the following mitigation measures (relating specifically to transportation) as part of the Environmental Management Plan:

- Design allowances for public transport connections and integration to Townsville
- CBD and other major destinations within Townsville are provided for within the master planning of Elliot Springs
- Design allowances for public transport connections to employment generators and education facilities are provided for in the master planning of Elliot Springs
- Planning applications must address connection to Townsville
- Noise impacts from the Bruce Highway meet the requirements of the Queensland Department of Transport and Main Roads Road Traffic Noise Management: Code of Practice

- Noise impacts from state-controlled roads meet the requirements of the EPP Noise
- Road design and connectivity will be addressed as part of any precinct plan with public transport connection to be addressed as part of infrastructure agreements or the like.

Even with these measures in place there is still concern among Port of Townsville stakeholders that this project will increase traffic volumes and congestion on the Southern Port Road and the Ring Road interchanges, negatively impacting on the efficient operation of this road corridor into the port.

An initial preliminary approval for the project was issued in 2010 and then extended to 2018. Approval for Precinct 1 of the development is currently pending and will remain pending until an Infrastructure Agreement is signed with Council. Negotiations regarding the Infrastructure Agreement are expected to be finalised by the end of 2016. Construction is now anticipated to commence in March 2017 pending all necessary approvals/agreements.

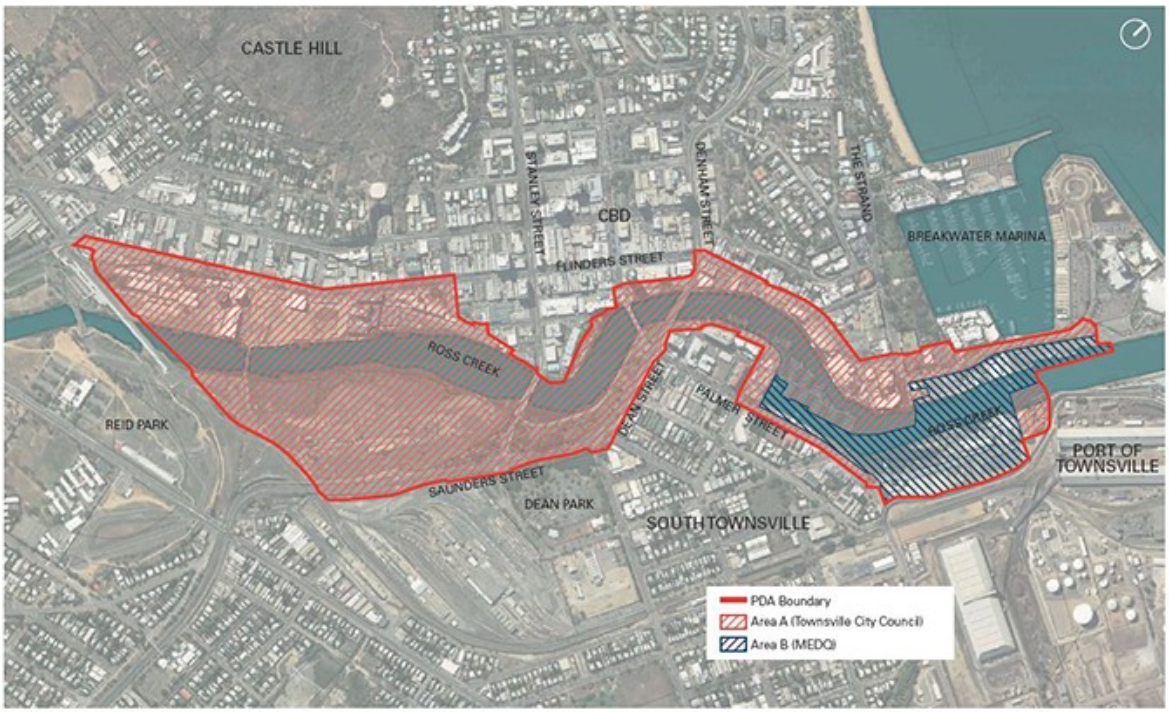
Townsville City Waterfront PDA

The Townsville City Waterfront PDA stretches along Ross Creek from the boundary of the Port/Marina inland covering an area of approximately 97 hectares. The PDA is divided into seven precincts with three of them in close proximity to the port.

The Development Scheme for the Townsville City Waterfront PDA was created in 2015 following consultation throughout its development with the community and stakeholders. The PDA Development Scheme includes a broad set of development criteria encompassing urban design, the public realm, sustainability, movement networks, the natural environment, public safety and infrastructure. The criteria address the need to integrate the proposed precincts with adjacent existing land uses.

Within the PDA all development must be assessed against the Development Scheme. All development applications must consider the Land Use Plan, Infrastructure Plan, Implementation Strategy and State Government Guidelines to the extent that they are relevant. Where there is any inconsistency with the local planning scheme the Development Scheme prevails.

The precinct is divided into two areas where applications for development will be assessed by either the TCC or the Minister for Economic Development Queensland (MEDQ). These two areas are identified in Figure 6-9.



Source: EDQ, 2015

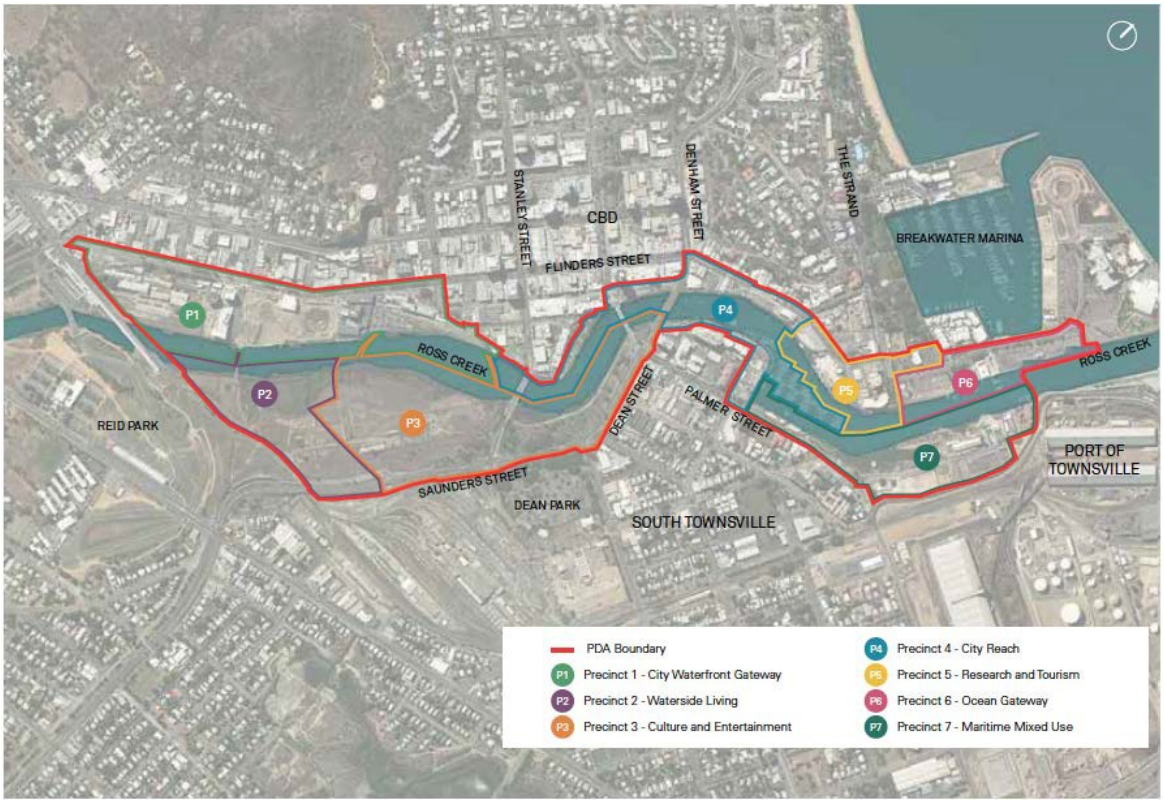
Figure 6-9 Townsville City Waterfront PDA Boundary and Assessment Precincts

The two assessment precincts outlined in Figure 6-9 do not align exactly with the precincts outlined in the PDA Development Scheme although they mostly affect precincts six and seven.

The PDA is divided into a number of precincts for future development; these are illustrated in Figure 6-10. Of most relevance to the port are precincts five, six and seven as they provide for land uses which could potentially result in future conflict with port operations. These precincts are immediately adjacent to the port. Precinct 5 includes tourism, research, residential, short term accommodation and small scale commercial uses. Precinct 6 includes commercial, residential and short term accommodation uses whilst Precinct 7 includes port services, marine oriented business activities, research and education and allied tourism activities. In these precincts the built form is required to be responsive to noise and other potential impacts from the port.

Precincts 6 and 7 include Port of Townsville Strategic Port Land (SPL) that is designated as Special Use zone under the Port of Townsville Land Use Plan (LUP). The LUP states that the purpose of the Special Use zone is that this area incorporates waterfront activities that have evolved over time, including community facilities, marinas, tourism facilities, and industrial marine uses. It is envisaged that industrial activities will gradually be relocated out of these areas, with redevelopment to take place which recognises the unique location of these areas within a vibrant and growing CBD. Future development will need to be sensitive to the adjoining land uses and will integrate the community with the port. These objectives are broadly compatible with the uses and intent of the precincts identified in the PDA Development Scheme.

Development on SPL will require consent from Port of Townsville Limited for applications lodged in relation to the PDA and an approval from the Port of Townsville for development on SPL would be required.



Source: EDQ, 2015

Figure 6-10 Townsville City Waterfront PDA Development Precincts

Within the Townsville City Waterfront PDA there is an infrastructure corridor crossing Ross Creek at the end of The Strand. The Townsville Coastal Hazard Adaptation Strategy (GHD, 2012a) has identified this corridor as a potential storm tide barrier to provide defence for the CBD area.

The Strand

The Strand is an important tourist and recreation hub extending from the Townsville Sailing Club/The Ville Casino-Resort to the Jezzine Barracks. The precinct features a 2.2 kilometres beachfront promenade with a range of recreation activities including public pools and beaches, walking/cycling paths and landscaped areas. Adjacent to the promenade are a range of commercial land uses including cafes, restaurants and accommodation.

The Strand is located in close proximity to the port and has the potential to be adversely impacted by activities in the port (noise, odour and dust). The severity of these impacts will vary depending on wind direction, wind speed and the intensification of land uses.

The critical importance of this precinct to Townsville is acknowledged and it is recommended that it is further considered in subsequent project phases through inclusion in the environmental risk assessment task.

Oonoonba PDA

The Oonoonba PDA was declared in 2010 over an 83ha area located to the south of central Townsville. The development is primarily residential in nature and is of interest to this study as it currently borders Abbott Street and the NCL (Brisbane to Cairns).

The proposed structure and zoning plan for the area will result in an increased population being located in close proximity to an important rail access corridor for the port. Implementation of the TEARC corridor may remove freight rail operations from this section of the railway, however as there is no fixed date for implementation of the corridor there may be increased pressure regarding rail noise from the community in this development in the future.

Figure 6-11 Oonoonba PDA Structure and Zoning Plan

Boundary Street Precinct

This precinct sits immediately to the south of the port within a network of important port access roads (Benwell Road/Southern Port Road, Perkins Street, Boundary Street and Archer Street).

Land uses within this precinct have traditionally been residential in nature (originally port workers would have occupied this area) which has created ongoing issues with regard to traffic management along Boundary Street and interface issues with the port. This has resulted in modifications to intersections along Boundary Street to manage traffic congestion and restrict vehicle access. Major roads within this precinct carry heavy goods vehicles to and from the port which can potentially create conflicts with general traffic and can have noise impacts on adjacent residential areas.

Much of this precinct is currently zoned as a residential character area to ensure that existing heritage buildings are preserved into the future. This means that the population of this area is unlikely to increase significantly in the future. However, the population of this precinct may still be impacted by port operations (within the port and along transport corridors).

In the future it will be important to ensure that port operations are not adversely impacted by land uses within this precinct and additionally that the impacts of port operations do not adversely impact these land uses. Impacts including road safety (the interaction of heavy vehicles and general traffic) congestion, noise and vibration must all be considered through future planning.

Despite the addition of the Port Access Road, Boundary Street remains a significant access route into the port for many vehicles travelling from Bohle/Garbutt or other northern areas. The continuing use of Boundary Street for this traffic is a significant cause of concern for some residents. Master planning should consider preserving this alternative access route to the port into the future while managing interface issues with the surrounding residential communities.

Townsville Airport

Townsville Airport is located to the east of the Townsville City Centre. Its runway is shared with the RAAF. The airport provides services to ten domestic/regional (including fly-in/fly-out services to mining operations) locations and one international. The airport predominantly serves passenger transportation however it also handles freight. The freight handled by the airport is most likely high value in comparison to that handled by the port and hence there is little overlap in terms of their roles as part of the freight network.

Australian Defence Force (ADF) Installations

Townsville is home to several significant military installations. The military is a major employer in the region. Three main ADF facilities operate within the study area:

- Townsville RAAF Base – located at the Townsville International Airport
- Lavarack Army Barracks – located to the south of Townsville on the Bruce Highway near James Cook University

- Ross Island Defence Barracks – located on the Ross River to the south of the Port
- Navy – The Port of Townsville incorporates various facilities for the Royal Australian Navy including berthing facilities (Berth 10) and staging areas within the port boundary.

Townsville Ocean Terminal Project

Although this project is no longer active it has been included in this section of the report as it was located immediately next to the port. Any future proposal in this location would require careful consideration with regard to its potential impact on existing/future port uses and the impact of ongoing port operations on any proposed land uses. According to the project Environmental Impact Statement prepared in 2009:

The project comprises the development of approximately 80 hectares of land under tidal water seaward of the existing Townsville Casino and Entertainment Centre, including:

- *a dedicated cruise terminal and wharf to receive cruise ships and naval vessels*
- *reclamation of land under tidal water for a residential canal development*
- *development of approximately 200 detached and 500 multistorey dwellings*
- *marina facilities for general recreational vessels and visiting superyachts*
- *new foreshore public open space areas.*

There are currently no active approvals for development of the site. However, development of this site with sensitive land uses (residential, tourism or recreation) could potentially create significant conflicts with future port operations.

6.2 Shipping and Marine Infrastructure

6.2.1 Shipping Channels, Navigation Aids, Anchorages and Dredge Material Placement Areas.

The development and maintenance of appropriate infrastructure that can facilitate trade is a primary element of port planning and operations. The establishment and ongoing management of waterside infrastructure, including shipping channels, ship berths and swing basins, is as important as the development and maintenance of landside infrastructure such as roads, railways and port terminals (Ports Australia, 2016).

The protection of sea channels is critical to port planning and programs as they are the critical link to all land-based infrastructure supply chain.

The extent of the ports marine boundary and entrance channel are illustrated in Figure 3-1. Currently the Port of Townsville's entrance channel measures -11.7 mLAT and 92 m wide on average, making it around half the size of most other comparable ports in Australia. Both channels are single lane with no passing lanes and cater for up to Panamax size vessels. The use of tugs and pilotage are mandatory within the channels.

The entrance channel (Platypus and Sea Channels) currently meets shipping demand however there are plans to widen and deepen the channels progressively in accordance with the Port Expansion Project, which is yet to be approved. To generate capacity required for future trade growth, it is critical that the existing channels are widened to cater for post-Panamax class vessels.

The emerging trade that a wider channel at the Port of Townsville will cater for include:

- Expansion of the containerised cargo (supported by a larger regional base, as well as expansion in the range of project being containerised)
- Fuels driven by loss of Australian refineries and a need to cater for the longer range vessels (i.e. via Long Range 1 (LR1) and Long Range 2 (LR2) class ships out of Asia)
- Car vessels
- Opportunistic use by the leisure cruise industry.

Key features of the PEP relating to the channels include:

- Dredging to extend the channel length to 14.9 kilometre length and increase the channel widths of the Platypus Channel and Sea Channel. Based on simulation of likely future vessels, and working in conjunction with pilots and the Regional Harbour Master, the following channel widening is proposed:
  - Platypus Channel: Widening will be on the west side of the channel with the eastern edge remaining. The width between toe-lines will be 180 m at the outer harbour and reducing to 135 m at the junction with the Sea Channel
  - Sea Channel: Widening will be on the east side of the channel (opposite side from Magnetic Island) with the western edge remaining. The width between toe-lines will be 135m at the junction with the Platypus Channel reducing to 120m at the sea end.

This will allow vessels to access the port (up to Panamax size).

The entrance channels are critical to the operation of the port. Maintaining their width and depth to accommodate appropriate vessel sizes in the future will be critical to maintaining the Port of Townsville as a competitive international port.

There are 13 Port of Townsville Anchorage positions identified in the Port Procedures and Information for Shipping – Port of Townsville (MSQ, 2016). One of these anchorages is located within the port limits, while the remaining twelve are located in a cluster immediately outside the port limits.

The Port of Townsville has a range of associated navigation aids including a lighthouse at Cape Cleveland, channel leads, buoys and beacons. Further detail regarding these navigation aids can be found in the Port Procedures and Information for Shipping – Port of Townsville (MSQ, 2016). In August 2016, Ports Australia released the Environmental Code of Practice (CoP) for Dredging and Dredged Material Management. The CoP was developed by Ports Australia in consultation with members (including the Port of Townsville Ltd), port customers, regulators and associated industry representatives. Ports Australia members have endorsed the principles contained in the CoP and

are committed to conducting activities consistent with the Code when Planning and undertaking dredging programs. These principles reflect the principles of ecologically sustainable development as outlined in the Commonwealth's *Environment Protection and Biodiversity Conservation Act* 1999. The expression of these principles are expressed through various elements relevant to dredging, including: environmental awareness; environmental risk assessment and management; avoidance, mitigation and offsets; dredged material relocation; dredging operations; monitoring; consultation; compliance; transparency and accountability; and research and innovation.

The principles are applicable to all ports and dredging operations, however, the manner and scale in which they may be delivered will vary to suit the specific port, the scale of the dredging program and the environmental risks that are relevant.

The Port of Townsville's approved offshore Dredged Material Placement Area (DMPA) is located to the east of Magnetic Island and north-west of Cape Cleveland, outside of the GBRMP. The offshore dredge material placement area will continue to be used for maintenance dredge spoil disposal as part of the ongoing operations of the Port of Townsville subject to Commonwealth and State approvals.

6.2.2 Existing Berth Layout and Infrastructure

Figure 6-12 illustrates the location of existing berth infrastructure within the port and their current uses.

Existing Berth Uses

1. Bulk liquids
2. Bulk Nickel
3. Multi-purpose (incl. containers)
4. Multi-purpose. Currently being upgraded with heavy crane beams
8. Bulk material/multi-purpose
9. Sugar, molasses, motor vehicles, bulk, general cargo
10. Navy/Cruise/Multi-purpose
11. Bulk Mineral Export

Figure 6-12 Existing Berth Layout

6.3 Supply Chain Networks and Supporting Infrastructure

An efficient network of roads and railways supporting the port is critical to the long term future of the port. This includes intermodal facilities outside of the port. This infrastructure is planned, implemented, maintained and operated by a mixture of state government, local government and private sector entities. Additionally, this infrastructure also has the potential for conflict with adjacent land uses (due to noise, light and vibration) as well as traffic generated by these uses impacting on their efficiency. The TCC has taken steps to manage the impacts of these networks through the application of a Transport Noise Corridor Overlay. This is discussed later in this section.

Planning for future land uses must also consider how these transport corridors will be used in the future, their impact on land uses and how changes to land use might impact the corridors. Increased traffic volumes, train lengths or frequency can have a significant impact on network performance and sensitive communities. It is therefore critical that these corridors are managed as part of the broader infrastructure network, which supports the port's efficient operation.

Figure 6-13 Existing and proposed road and rail infrastructure

6.3.1 Roads

Roads play a critical role in the successful operation of the port. All products not utilising the rail network to access the port rely on an efficient road network. Figure 6-14 identifies the road network surrounding the port. The road network in Townsville is made up of both state and local roads. Local roads are planned, implemented and maintained by the TCC while state roads are

planned, implemented and maintained by the DTMR. The TCC and the DTMR work closely together in Townsville to manage the transport network. This includes land uses planning, traffic forecasting and overall network management.

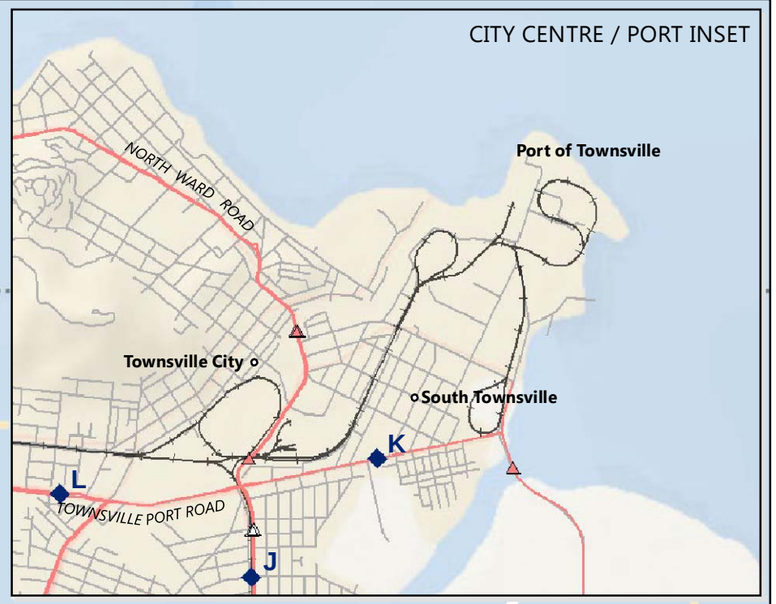
Table 6-2 summarises the landside transport modes of existing and proposed products that utilise the port (refer to Section 6.5 for trade forecasts). It indicates a diverse range of products with many relying on both road and rail infrastructure. Smaller producers/industry tend to utilise road whilst larger volumes tend to utilise rail.

Figure 6-14 also provides existing and future traffic volumes (vehicles per day) on the road network throughout Townsville based on TCC/DTMR data and modelling. The DTMR and TCC have ongoing upgrade programs across the network to help manage congestion across the network. These upgrades are identified in the Townsville City Council Assessment Management Plan for local government roads and Queensland Transport and Investment Program (QTRIPS) for state- controlled roads.

Table 6-2 Existing Landside Product Transport Modes

Product Type	Transport Mode
Bulk liquids	Road/Rail
Vehicles	Road
Livestock	Road
Sugar	Road/Rail
Dry bulk imports	Road/Rail
Dry bulk exports (excluding coal)	Road/Rail
Coal	Rail
Containers	Road/Rail
Break bulk	Road/Rail
Cement	Road/Rail
Molasses	Road

Location ID	2011 Volume	2016 Volume	2021 Volume	2026 Volume	2031 Volume	2036 Volume
A	5381	5916	6555	7292	7969	8679
B	38462	36537	38090	46991	53534	60711
C	11843	11022	15563	11145	14218	17977
D	6217	12213	15112	16582	18942	21649
E	29318	34344	36269	39284	44343	50012
F	NA	2422	3005	3586	6408	10518
G	10132	11904	13671	15395	31396	47123
H	2385	5561	6173	6826	7530	8264
I	33842	40996	52825	61560	68951	77120
J	25333	27301	30118	33985	38598	44260
K	7039	6964	7304	7584	7597	13214
L	32983	40871	52483	61295	66404	73985
M	9675	10493	11944	13477	14934	16222
N	21961	23781	25426	23802	25070	26085



Halifax Bay
Horseshoe Bay
MAGNETIC ISLAND
Arcadia
Nelly Bay
Picnic Bay
Cape Cleveland
HIGHWAY
NORTH COAST LINE
A
Toolakea
Saunders Beach
Bluewater
BRUCE
Bushland Beach
Pallarenda
Yabulu
TOWNSVILLE
CITY COUNCIL AREA
Deeragun
Port of Townsville
B
Garbutt
Townsville City
South Townsville
Mount Louisa
Hyde Park
I
L
K
J
F
C
Gulliver
Pimlico
RAILROAD
Kirwan
PDR
Mundingburra
Cluden
Stuart
TT-LINE
HERVEY'S RANGE DEVELOPMENTAL ROAD
M
Bohle Plains
Alice River
D
E
Douglas
Wulguru
Condon
N
H
G
Elliot Springs
GREAT NORTHERN WAY
NORTH COAST LINE HIGHWAY
ROSS RIVER DAM

Source Information:
Local Government Area Boundaries - Queensland
Rail network - Queensland
Queensland Department of Natural Resources and Mines
Local road network
Townsville City Council - July 2016
State-controlled roads and bridges
Queensland Department of Transport and Main Roads 2016
Traffic volumes (Existing and future)
Traffic Transport Planning Section, Strategic Planning Branch
Townsville City Council - August 2016

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0 2.5 5 7.5 10
Kilometres

Coordinate System: GCS GDA 1994
Datum: GDA 1994
Scale at A3 - 1:200,000

REGIONAL LOCATION
PROJECT LOCATION
Townsville
Bowen

Townsville Evidence Base Report

Figure 6-14: Road and Rail Network Map

- Traffic volume locations
- State controlled on-road bridge
- State controlled over-road bridge
- State-controlled road
- Existing local road network
- Existing rail network
- Townsville City Council LGA boundary
- Project area of interest

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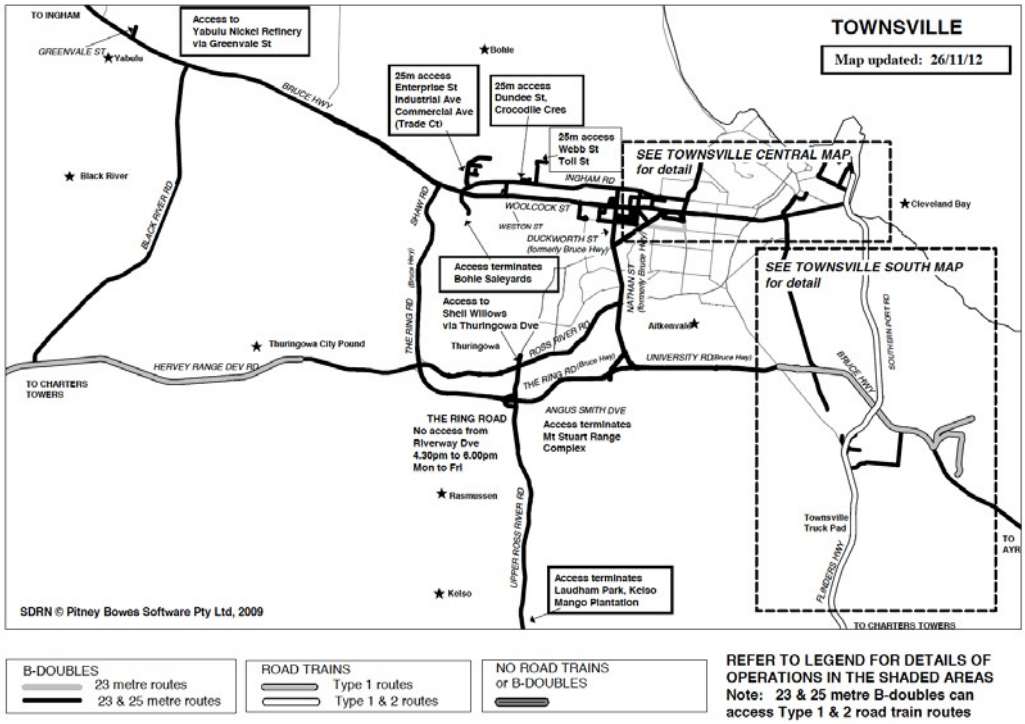
30/11/2016 Rev: C ISSUED FOR INFORMATION Org: KM Chk: JAK

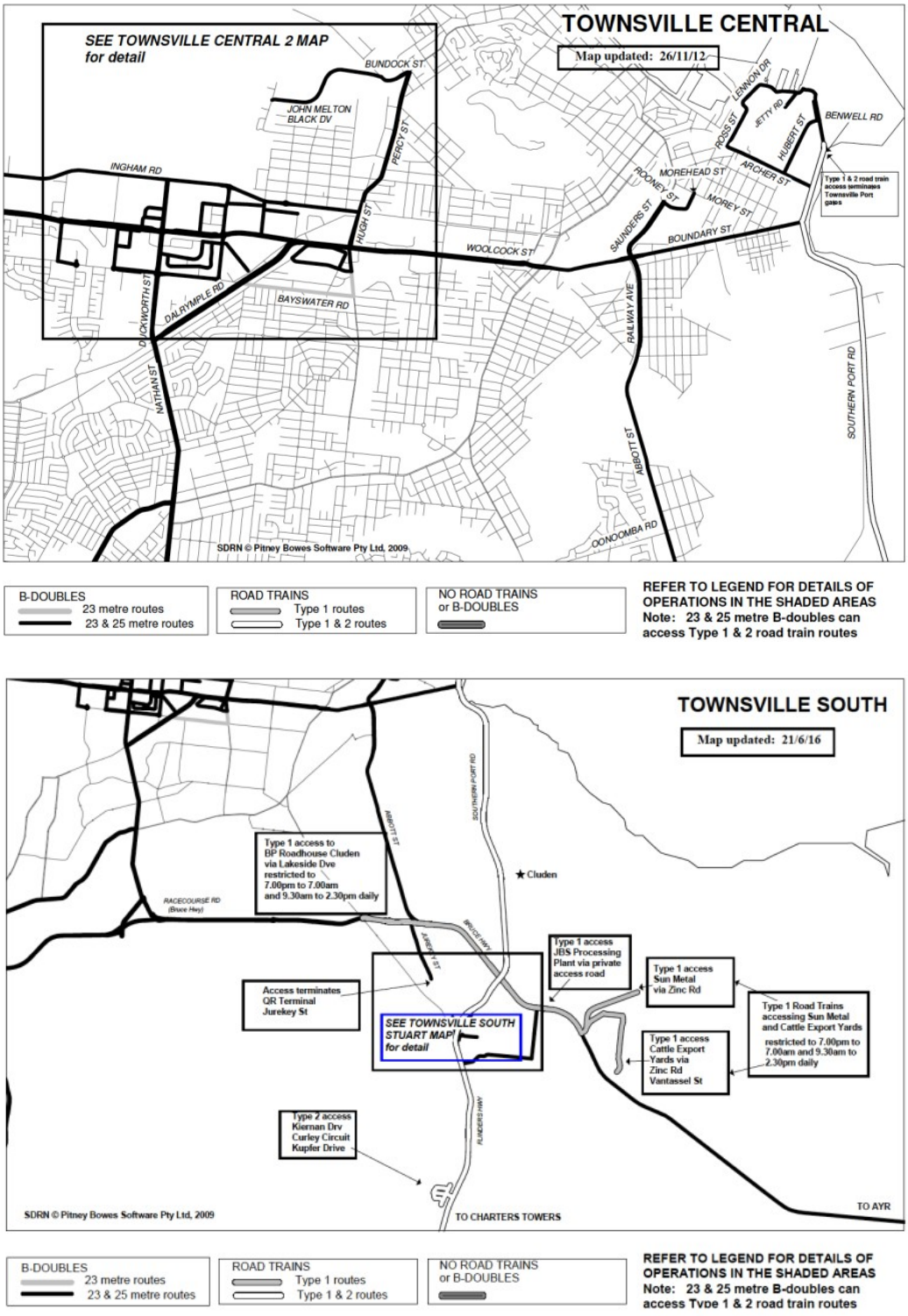
Freight activities are concentrated on higher order roads in the network as illustrated in Figure 6-15a-c. These roads are designed to cater for heavy goods vehicles including high and wide loads. Intersection geometries are designed to accommodate the turning requirements of these vehicles and additional clearance to structures on these roads is provided. These roads, including the Hervey Range Development Road, Bruce Highway, Flinders Highway and Southern Port Road are of particular importance to the efficient operation of the port. These roads can accommodate road train vehicles (in the case of the Southern Port Road providing direct access to the port) and provide road freight connections to the wider region. Both the Flinders Highway and the Bruce Highway are also part of the National Land Transport Network.

The City of Townsville's Transport Noise Corridor Overlay identifies a number of important transport corridors throughout the City. All land identified in this overlay must be developed in accordance with Queensland Development Code Part 4.4 – Buildings in a Transport Noise Corridor. At present this overlay only identifies state-controlled roads however this will be updated to include local government roads in the near future.



Source: www.tmr.qld.gov.au

Figure 6-15 a Designated Road Freight Routes

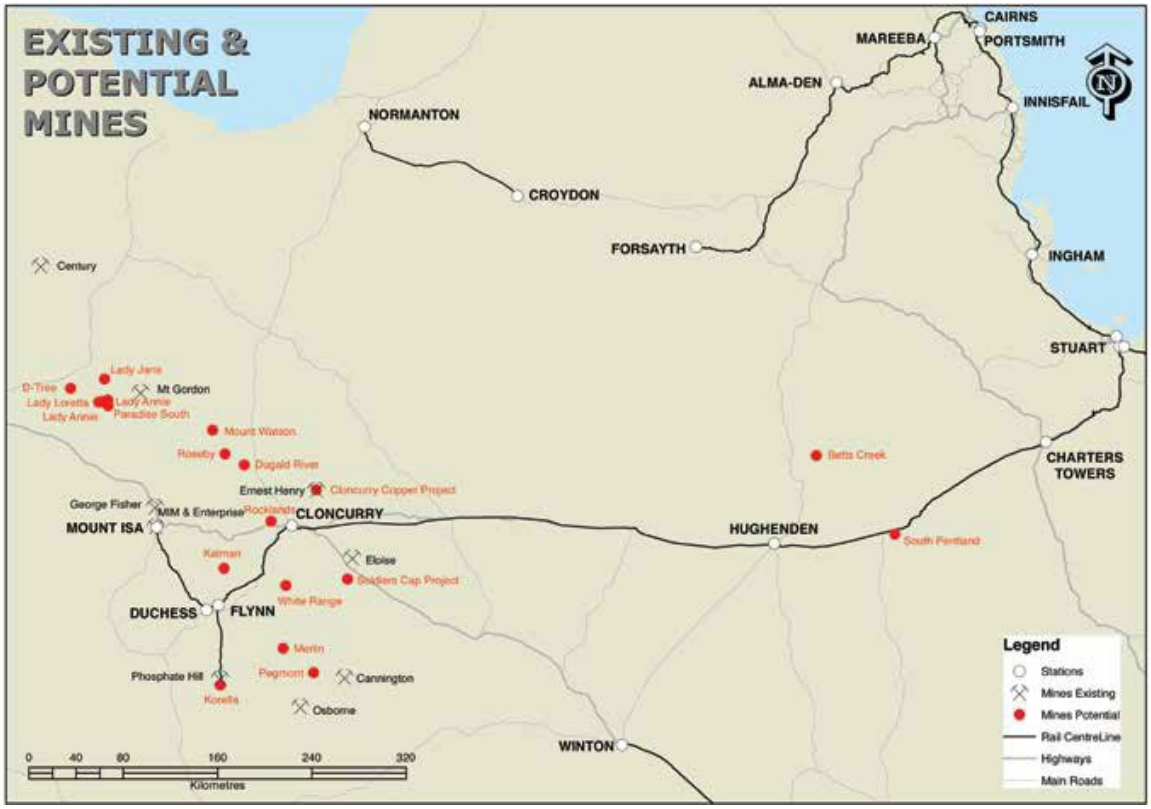


Source: www.tmr.qld.gov.au

Figure 6-15 b,c Designated Road Freight Routes

6.3.2 Railways

Townsville is located at the intersection of the NCL (Brisbane to Cairns) and the MIRL (Mount Isa to Stuart). The location of rail lines within the study area is shown in Figure 6-14. The wider context of freight rail network in the wider region is provided in Figure 6-16.



Source: Mount Isa Rail Line Infrastructure Master Plan (Queensland Rail, 2012)

Figure 6-16 Regional Freight Rail Network

The NCL and the MIRL are owned and managed by Queensland Rail (QR). QR manages access to the infrastructure and provides maintenance services.

North Coast Line

The NCL is the principal regional freight and passenger line within the Queensland Rail (QR) network. The line extends approximately 1400 kilometres between Brisbane and Cairns excluding sections of the Aurizon network. It enters Townsville from the south along the Bruce Highway and travels west through the city along the general alignment of Ingham Road until re-joining the Bruce Highway.

The NCL carries a variety of freight products including containers, sugar, bulk minerals, liquids and fertilisers. Additionally, the NCL also provides passenger services from the south of Queensland as far north as Cairns.

Mount Isa Rail Line

The MIRL extends over 1000 kilometres from Mount Isa in the states west to Stuart where it joins the NCL and enters the Port of Townville. The MIRL services a number of existing and potential future mining operations, communities and agriculture in the Mount Isa/Duchess/Flynn/Cloncurry area. The TEARC project will significantly improve access between the MIRL and the port by providing a direct connection from Stuart into the port in the future. The TEARC will mean that freight trains on the MIRL will no longer have to travel through urban areas prior to entering the port.

Current transport activities include:

- minerals concentrates
- fertiliser
- acid
- fuel
- refined metals
- cattle
- general freight
- passenger transport.

Table 6-3 MIRL Summary

Aspect	Detail
Length	1032 km – single track with passing loops
Rail	Mix of 41, 47, 50 and 60 kg/m
Axle load	20 tonne limit
Maximum line speed	80 km/hr
Safeworking system	Direct traffic control
Gauge	Narrow – 1067mm
Sleepers	75% concrete; 25% steel
Maximum train length	1000 m
Seasonal conditions	Extreme heat and monsoonal rains in summer months
Product railed	Copper, lead, zinc, magnetite, sulphuric acid, cement, livestock, fuel, sulphur, fertiliser, passengers and general / intermodal freight

Source: Queensland Rail, 2012

The QR *Mount Isa Line Rail Infrastructure Master Plan* (2012) identified a number of different growth scenarios for the future development and operation of the line. At present the rail line provides sufficient capacity to cater for existing operations. Under the base case scenario (7.8mtpa), only minor improvements to infrastructure are required, however under the medium and high growth scenarios more significant upgrades would be required. The medium case of (20Mtpa) includes TEARC development but does not include coal transportation. The high growth scenario assumes development of mines in the Galilee Basin and initial railing of 10mtpa between Hughenden and Stuart. The high growth scenario assumes 30+mtpa of coal from the Hughenden region.

Mount Isa to Tennant Creek Rail Investigation

The Commonwealth, Northern Territory and Queensland Governments are currently investigating strategic options for a rail line that links Mount Isa to Tennant Creek, creating a direct rail connection between Queensland and Northern Territory. The investigation considers the prospective benefits of completing a rail link between Darwin and Townsville which could foreseeably link Northern Australia with the East Coast of Australia and the Adelaide to Darwin railway. This rail link has the potential to provide transport access to enable previously unrealised mineral resources, agricultural, container, and general freight opportunities access to the major ports of Darwin and Townsville and provide a catalyst for northern Australia's economic development as detailed in the White Paper on Developing Northern Australia (Australian Government, 2015).

Growth scenarios	Corridor				
	Stuart–Hughenden	Hughenden–Cloncurry	Cloncurry–Flynn	Flynn–Mount Isa	Flynn–Phosphate Hill
Base case					
Tonnes (mtpa)	7.8	7.8	5	2.5	3
Capital enhancements required	2 crossing loops; 2 holding roads	2 holding roads	-	-	-
Indicative capital cost	$22m	$11m	-	-	-
Construction timeframe	18 months	18 months	-	-	-
Maintenance requirements	Resleepering/ rerailing; bridge upgrades	Resleepering/ rerailing; bridge upgrades	Resleepering/rerailing	Resleepering/rerailing	-
Indicative cost	$67m	$354m	$27m	$6m	-
Construction timeframe	2 years	5 years	18 months	12 months	-
Total cost	**$89m**	**$365m**	**$27m**	**$6m**	-
Medium growth (includes costs from the base case) All access to the Port of Townsville is through the Eastern Access Corridor.					
Tonnes (mtpa)	20.9	10.9	7.8	5.3	3
Capital enhancements required	Duplicate 60km 4 holding roads Extend all crossing loops	2 crossing loops 2 holding roads Extend all crossing loops	Extend all crossing loops	Extend all crossing loops	Extend all crossing loops
Indicative capital cost	$395m	$55m	$6m	$4m	$2m
Construction timeframe	3 years	3 years	18 months	18 months	18 months
Maintenance requirements	Resleepering/rerailing	Resleepering/rerailing; Bridge upgrades	Resleepering/rerailing	Resleepering/rerailing	Safety improvements
Indicative cost	$236m	$463m	$119m	$11m	$8m
Construction timeframe	3 years	5 years	2 years	12 months	12 months
Total cost	**$631m**	**$518m**	$125m	$15m	$8m
High growth (includes costs from the medium growth and base case)					
Tonnes (mtpa)	49.2	19.2	11.1	5.3	3
Capital enhancements required	To be determined by customer requirements	To be determined by customer requirements	2 crossing loops	-	-
Indicative capital cost			$17m	$4m	$2m
Construction timeframe			18 months	-	-
Maintenance requirements			Resleepering/ rerailing	Resleepering/ rerailing	Safety improvements
Indicative cost			$137m	$34m	$9m
Construction timeframe			2 years	12 months	12 months
Total cost	**TBD**	**TBD**	**$153m**	**$38m**	**$11m**

Information provided in the growth scenario table does not constitute a commitment by Queensland Rail to complete these works. The suggested improvements are based on detailed capacity analysis with set operating assumptions undertaken by Queensland Rail. Any infrastructure alterations will be determined with customers once all requirements and operating parameters are confirmed for any tonnage increase. Queensland Rail will design, construct, maintain and/or manage any network configuration, built to satisfy customer requirements and maximise the efficient tonnage throughput of the line. We encourage open and transparent dialogue with our customers to ensure this is achieved.

Source: Queensland Rail, 2012

Table 6-4 Summary of Development Scenarios and Investment Requirements

Townsville Eastern Access Rail Corridor

The proposed Townsville Eastern Access Rail Corridor (TEARC) project is a new rail link designed to connect the NCL and the MIRL directly in to the Port of Townsville (refer to Figure 6-17). The proposed seven kilometre rail freight line connecting the NCL and the MIRL will branch off from the NCL at Cluden (south of Townsville) and run parallel to the Port Access Road to the Port.

The intention of the TEARC is to provide a more efficient alternative alignment of the MIRL into the port. The TEARC will allow for 1.4 kilometre trains, increasing capacity and future proofing for when the feeder lines are upgraded. Upgrades to the MIRL may also be required for TEARC's efficiency to be realised as train lengths are currently limited to 1000 m on the MIRL (and 650 m on the NCL).

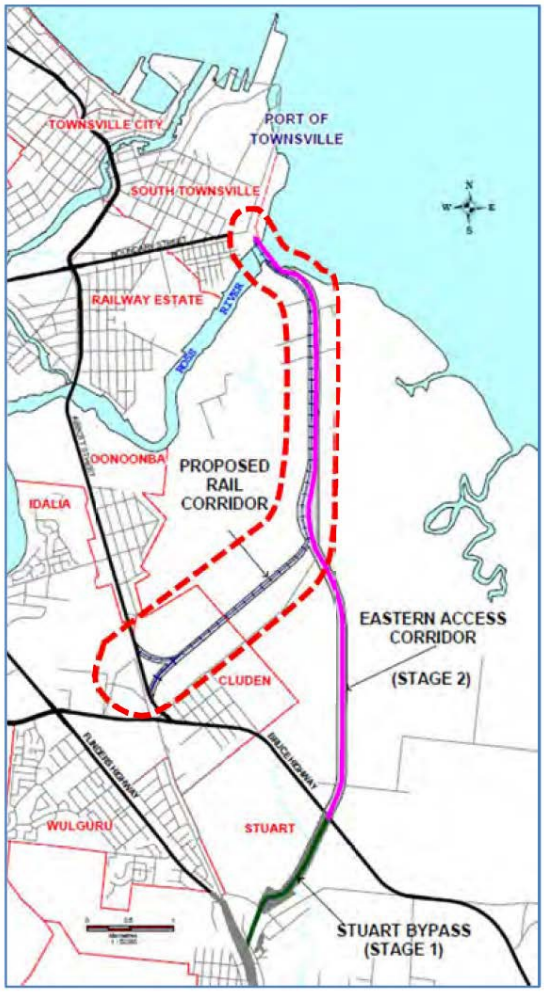
The construction of the TEARC will also improve (vehicular) traffic flow and safety by redirecting significant quantities of freight travelling by rail to the Port of Townsville away from multiple at grade road crossings through the CBD (POTL, 2016).

Key benefits of the project include:

- meeting future growth in rail freight
- providing the ability for increased train length (up to 1,400 m)
- reduced bottle necks at the Port of Townsville
- improvements to urban amenity within the City of Townsville
- Improved road safety.

The existing railway would potentially be retained (as it still forms part of the NCL), however train volumes along this section of track would be reduced. Road crossings along the proposed corridor will be grade separated to reduce impacts on the road network.

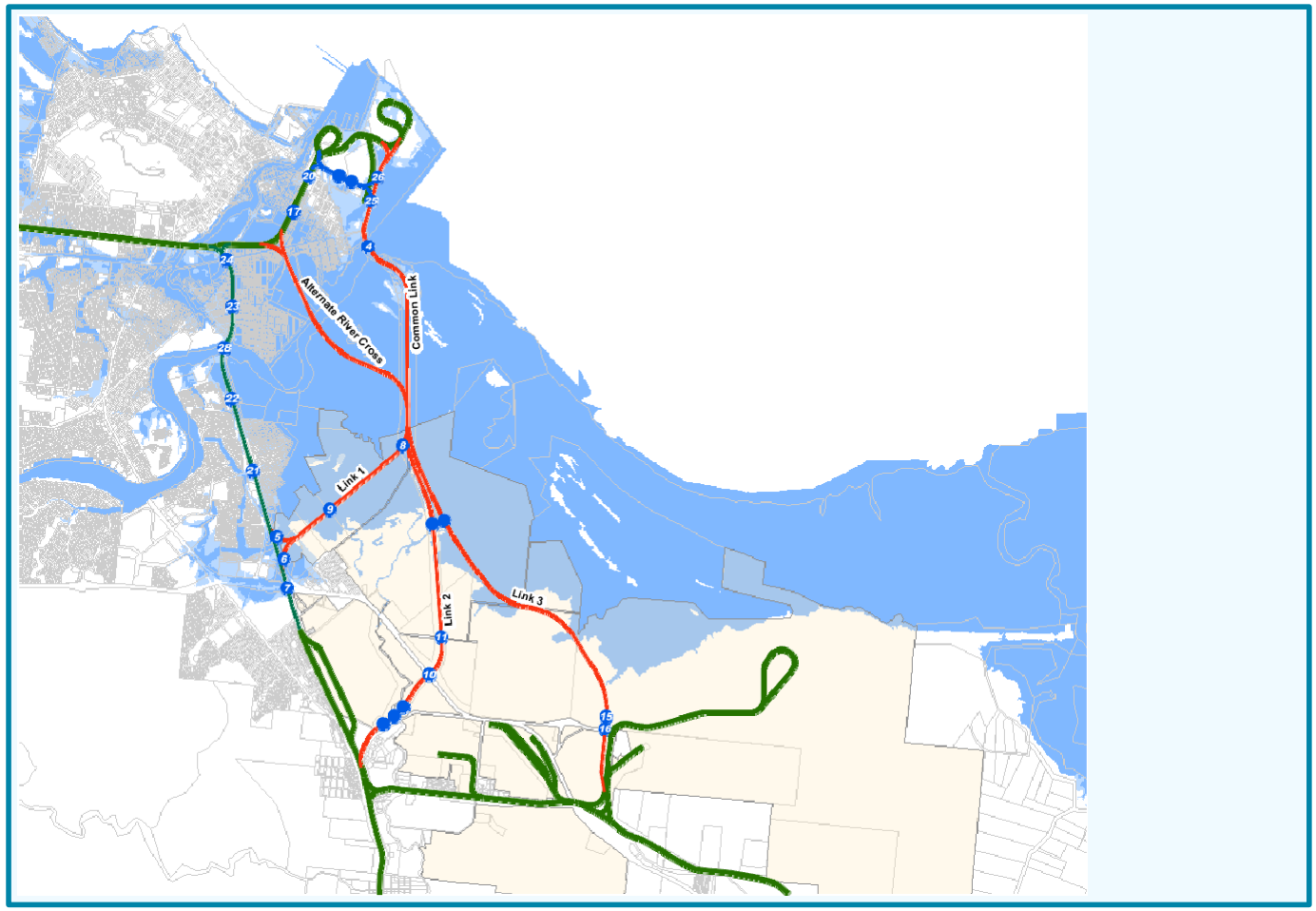
The TEARC feasibility study was completed in 2012, the Queensland and Commonwealth Governments have recently partnered to progress the business case for the TEARC project.



Source: GHD, 2012b.

Figure 6-17 TEARC Corridor Alignment

The Townsville City Council has also prepared several alignment options for discussion in addition to those presented above in Figure 6-17. These options are illustrated in Figure 6-18. Included on the figure are locations of rail conflicts, where at grade crossings occur, within the South Townsville area in particular.



Source: Townsville City Council 2011b

Figure 6-18 Townsville City Council Alternative Rail Alignment Options

The alternative river crossing alignment provides the following potential benefits from the perspective of Council:

- Lower bridge clearance required above Ross River as it is upstream of Ross Island Barracks
- Removes the need for the common future rail link near Archer Street to bypass port facilities
- Connection with existing line allows for large radius curves to improve rail efficiency
- Ability to co-locate storm tide defence measures for the broader city through elevated embankment and storm tide barrier under the bridge crossing
- Opportunity to provide a rail siding at Ross Island Barracks if desirable
- Shorter length of rail compared to Common Link.

All options for the railway alignment have the same objectives of improving the ports efficiency and ability to move freight, whilst also improving amenity and safety for the community by reducing at grade crossings. Further detailed investigations are required to determine the best alignment option for the future. Building Queensland will be preparing a business case for the TEARC corridor in the near future which will address these issues. The preferred alignment should consider impacts on port needs, the Townsville City Waterfront PDA, the TSDA and the South Townsville community.

Greenvale to Townsville Disused Rail Corridor

A disused rail corridor is located between Greenvale and Townsville. From 1974 – 1993 nickel was mined at Greenvale and transported via rail to the Yabulu Nickel Refinery at Townsville. The rail infrastructure has since been removed but the corridor and some tunnels remain.

6.3.3 Utilities

Figure 6-19 illustrates the location of major utility infrastructure within the study area.

Power

North Queensland is connected to the national power grid via a 1,000 MW transmission line from Central Queensland. Local power generation capabilities include (peaking and industry):

- Yabulu Power Station – 234 MW Gas Fired Power Station owned/operated by RATCH Australia Corporation. The Power Station was installed in 1998 and waste heat recovery section added in 2005. In 2013, the operating mode for this plant changed from base load to 'on demand' (intermittent or cycling) operation). The projected lifespan is predicted to be another 18 years (2034).
- Mt Stuart Power Station – 414MW owned/operated by Origin Energy. Constructed in 1999, it was upgraded to its current capacity in 2010 with the addition of a third 126MW turbine. This power station is designed to provide power during peak demand periods. Following the overhaul of the plant, it is anticipated that its lifespan would extend to 2035 to 2040; however there are a range of factors that influence this.

Power within the Townsville region is generally expensive due to transmission costs and charges from generators.

Water

Drinking water for Townsville is supplied from the Ross River and Paluma Dams. The Burdekin Dam is also available as a back-up supply if required. The TCC is responsible for the management and distribution of water supply networks within Townsville.

The Ross River Dam, Townsville's main supply is located to the south of Townsville. The Ross River Dam holds water prior to releasing it to the Douglas Water Treatment Plant. The Ross River Dam has a catchment of 750 square kilometre and a capacity of 233,187 ML. The TCC has an annual entitlement of 75,000ML.

The Paluma Dam/Crystal Creek System is located to the north of Townsville and has a catchment of approximately 9.8 km^2 and a capacity of 11,400 ML. Water is transported via the Mount Spec pipeline to the Northern Water Treatment Plant prior to being made available to Townsville. TCC currently holds an entitlement for 21,571 ML/annum of water from the Paluma Dam.

Water from the Burdekin Haughton Water Supply Scheme can also be accessed during times of extended drought. Should the Ross River Dam fall below 10 per cent capacity, TCC can access an additional 130ML/day via the Haughton Pipeline, discharged upstream of the dam. TCC has an entitlement for
10,000 ML/annum of high priority water and access to a further 110,000 ML/annum of medium priority water to 2020 should this be required.

Additional water is available in the region, with Sun Water currently holding approximately 44,000 ML of uncommitted High Priority/Medium Priority water available for lease.

Telecommunications

The Townsville region already has access to high quality/speed telecommunication services. A significant proportion of the City already has access to the National Broadband Network (NBN) which is extremely important for businesses with national and overseas clients.

Townsville Evidence Base Report

Figure 6-19:
Major Utility Infrastructure

REGIONAL LOCATION

PROJECT LOCATION

Townsville

Bowen

HALIFAX BAY

TOWNSVILLE CITY COUNCIL AREA

MAGNETIC ISLAND

BRUCE HIGH WAY

RANGE DEVELOPMENTAL ROA

HERVEY'S

FLINDERS HIGHWAY

ROSS RIVER DAM

Toolakea

Saunders Beach

Bluewater

Yabulu

Bushland Beach

Deeragun

Horseshoe Bay

Arcadia

Nelly Bay

Picnic Bay

Pallarenda

Cape Cleveland

Garbutt

Townsville City

South Townsville

Mount Louisa

Pimlico

Hyde Park

Gulliver

Kirwan

Mundingburra

Bohle Plains

Alice River

Condon

Douglas

Cluden

Stuart

Wulguru

Elliot Springs

- Existing local road network
- Townsville City Council LGA boundary
- Project area of interest
- High voltage transmission line
- Water Supply Pipeline (Mt Spec)
- Regional gas pipeline

Townsville City Water Network

- Reservoir
- Tank
- Treatment Plant
- Reticulation Main
- Distribution Main
- Trunk Main
- Raw Water Main

Source Information:
Local Government Area Boundaries - Queensland
Rail network - Queensland
Queensland Department of Natural Resources and Mines
Local road network, Townsville City water network assets,
Townsville City Council - July 2016
High voltage transmission lines, Water supply pipeline (Mt Spec),
Regional gas pipeline
Townsville City Plan - Strategic Framework map
SFM-004 - Sustaining economic growth
Townsville City Council - July 2016

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6.4 Environmental Areas and Separation Precincts

Figure 6-20 identifies areas of significant public open space throughout the City of Townsville. This includes regional, state and national parks, rivers and waterways, public open space and environmental management and conservation areas. Townsville City Plan mapping identifies areas considered important from an environmental and conservation perspective. The inclusion of these areas was informed by an environment and biodiversity study by Chenoweth (2011).

Protected areas and environmental management and conservation areas:

- protect areas of environmental significance, and the ecological processes and biodiversity values of terrestrial and aquatic ecosystems
- maintain ecosystem services and other functions performed by Townsville's natural areas
- protect water quality, ecosystem health and the natural hydrological functioning of waterways, wetlands and their riparian areas.

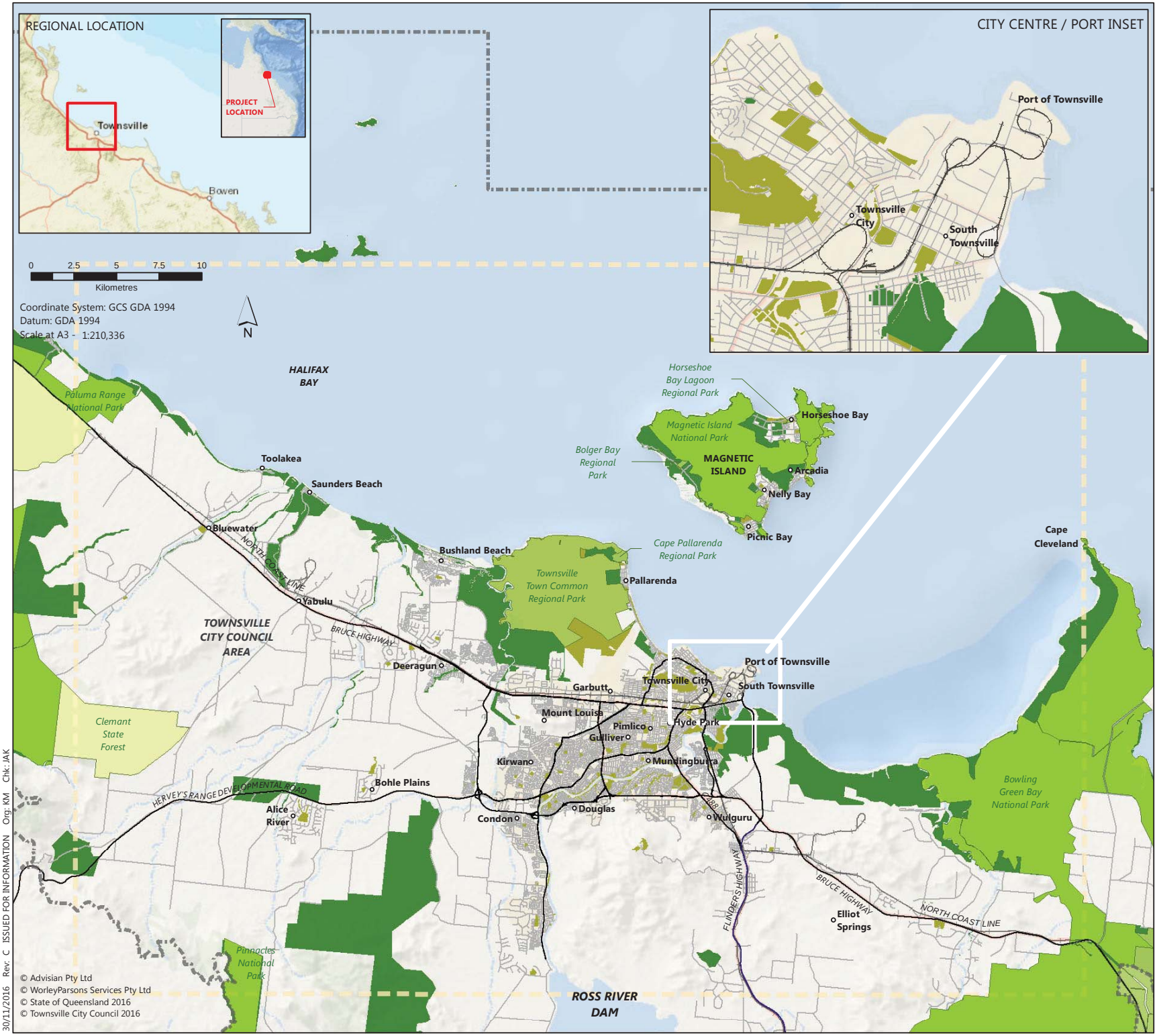
Public open space areas:

- Provide open space for informal recreation where for informal recreation where the built form is not essential to the enjoyment of the space.

Further detail regarding environmental features in the study area is provided in Section 7.2

Townsville Evidence Base Report

Figure 6-20:
Environmental Areas and Separation Precincts



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- Existing state controlled road
- Existing local road network
- Existing rail network
- Townsville City Council LGA boundary
- Project area of interest

Protected areas

- National Park
- Regional Park
- State Forest

Townsville City Council - Parks

- Public open space

Townsville City Council - Townsville City Plan Zoning

Community facilities and open space zones category

- Environmental management and conservation

Source Information:
Local Government Area Boundaries - Queensland
Rail network - Queensland
Protected areas of Queensland
Queensland Department of Natural Resources and Mines
Local road network, Townsville City Plan Zoning, Parks
Townsville City Council - July 2016

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6.5 Economic Influences on Port Development

The global economy is currently experiencing reduced levels of growth. Commodity prices remain low however the Australian dollar has devalued against the currencies of some of our key trading partners (China, USA and Japan) making our exporters more competitive on the global market. This has also made Australia more attractive as a destination for tourists, with this sector of the market expected to continue to grow steadily in the future.

Although the recent downturn in commodities prices and mining activities in the Townsville Region have had a significant impact on the economy, the long term prospects for the region remain positive. The Townsville Region has a highly diversified economy with strong agriculture, defence, government and tourism sectors also making an important contribution to the regional economy. In June 2016, the Queensland Government announced the Advancing North Queensland plan to further diversify and advance the North Queensland economy, identifying five priority areas for investment. Increased and continued government investment in key infrastructure will influence future growth.

Although commodities prices are currently low there is an expectation that trade volumes through ports such as Townsville will continue to grow, albeit at a reduced rate, into the future as a result of increasing demand from Asia, population growth and new free trade agreements. Growth is expected to be slower than previous estimates as global economic growth has slowed significantly in recent years. However, the ultimate capacity planned for the port is expected to be sufficient to cater for future growth and can be implemented progressively as required.

Forecast Shipping Volumes

Considering the "30 year Medium+ North Queensland Hub" forecasts provided by the POTL, Advisian combined products into 11 main types based on the infrastructure required at the berths, storage facilities and material handling equipment required to load/unload the product. For each of these types, the forecast volume for 2015/16, 2030/31 and 2043/44 were developed and are presented in Figure 6-21.

When reviewing the export figures, some that could be considered dry or liquid bulk were determined as requiring individual handling outside of the bulk liquid and bulk exports categories. These include:

- Sugar due to:
  - The food grade requirement for material handling equipment means that shared equipment would need to be thoroughly cleaned after handling other dry bulk products such as metal concentrates or fertiliser
  - The long term lease the sugar industry currently has over its storage and berth facilities.
- New large volume dry bulk product due to:
  - The large increase in this single product skewed the expected infrastructure for bulk export (there are three coal mines located near Pentland on the MIRL with the potential to export product through Townsville Port)
  - The specific requirements for an effective single product terminal (e.g. multiple blend storage, larger and deeper draft ships), it was felt that handling this product on its own would provide a more efficient port operation than handling with the other bulk export materials.
- Cement and molasses could be considered as dry bulk import and bulk liquid respectively, however were considered separately due to:

- The specialised nature of on berth material handling,
- The storage and material handling on port land.

- Nickel is retained within these forecasts. At the time of their preparation the future of Queensland Nickel was unclear and as such Nickel was included within estimates for completeness. If operations at Queensland Nickel are not resumed in the future this will reduce the volume of dry bulk exports/imports through the port by approximately 2.9Mtpa and create additional berth capacity at the port.

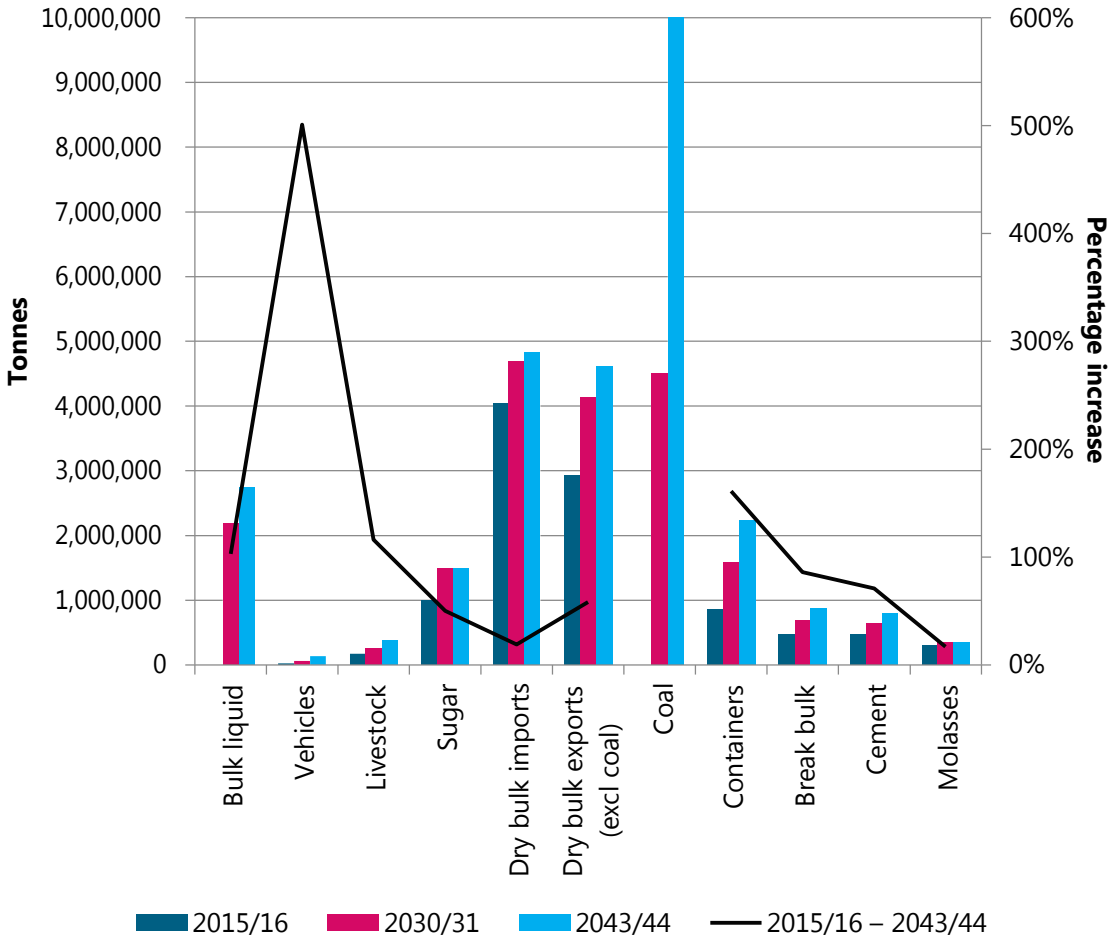


Figure 6-21 Forecast Product Volumes

Ship Visits

Based on the forecast volumes, Advisian estimated the number of ship visits per annum. The number of ships per annum is important as combined with an understanding of the average time at berth for particular product type ships, it is used to determine the number of berths required for each product type, as well as the volume of on land storage required. These values are required to determine infrastructure layout and land allocation.

A number of assumptions were made in order to develop the estimated number of ships/annum. These assumptions were based on information provided by POTL and Advisian's experience of other comparable port operations, and included:

- For most product types, the existing ship sizes would be maintained as the berth sizes were not expected to increase
- For bulk liquids, future ships would include partially laden LR1
- A conservative assumption has been made that in the future a similar number of container TEU would be handled per container ship. It is noted that with a continuous quay line from Berth 2 to 4, larger containerships could be handled at the port, reducing ship numbers
- The proportion of dry bulk material exported by container will remain constant (based on stakeholder discussion and information provided by POTL, some bulk material is exported in containers to locations such as Papua New Guinea) throughout the planning horizon
- Average coal parcels will be 50,000 t per shipment.

Based on the assumptions made, the estimates of ship numbers are presented in Figure 6-22. This estimate was compared to the number of ships during July 2014 to May 2015 as provided by POTL and found to provide a reasonable match.

Figure 6-22 Forecast Ship Visits

Estimated Berth Requirements

Estimated future berth requirements based on:

- The estimated number of ship visits/annum/product type
- Expected average time at berth for a ship transporting a particular product type.

The number of berths/product type in an optimum port layout have been developed and are contained in Table 6-5. It has been assumed that higher productivity material handling equipment is installed on the berths by 2043/44.

Note that with a berth utilisation figure of 70%, depending on product type, ships may need to wait for a berth to become available as other ships may already be at suitable berths (PIANC, 2014).

The estimated number of future berths should be considered an estimate only and may differ depending on forecasting figures. Economic forecasting should be regularly reviewed to enable more accurate planning into the future particularly due to commodity volatility.

Table 6-5 Future Berth Requirements

Product Type	2015/16	2030/31	2043/44
Bulk liquids	1	1	1
Vehicles	0.2	0.2	0.4
Livestock	0.25	0.5	1
Sugar	0.25	0.25	0.25
Dry bulk imports	1	1	1
Dry bulk exports (excluding coal)	1	2	2
Coal	---	0.5	1
Containers	1	2	2
Break bulk	Use MPBs	Use MPBs	Use MPBs
Cement	Use MPBs	Use MPBs	Use MPBs
Molasses	Use MPBs	Use MPBs	Use MPBs
Total	7	9	11

Legend: MPB = Multi Purpose Berth

6.6 Areas of Interest

The following areas have been identified as locations of interest to the master planning process for inclusion within the proposed master planned area. These areas have been identified based on their relationship to the port. They are locations where:

- Existing or future conflicts may require management

- Port operations may adversely impact existing or proposed land uses
- Proposed land uses or activities may adversely impact on the future operation of the port
- Efficient operation of the port is directly linked to their planning and operation
- Port related activities or businesses occur.

These general areas are developed further into the proposed Master Planned area boundary and associated precincts in Section 9. The general location of these precincts is illustrated in Figure 6-23. Note, rail and road corridors are not referenced in Figure 6-23, but are shown in Figure 9-1 and Figure 9-2.

Table 6-6 Master plan areas of interest

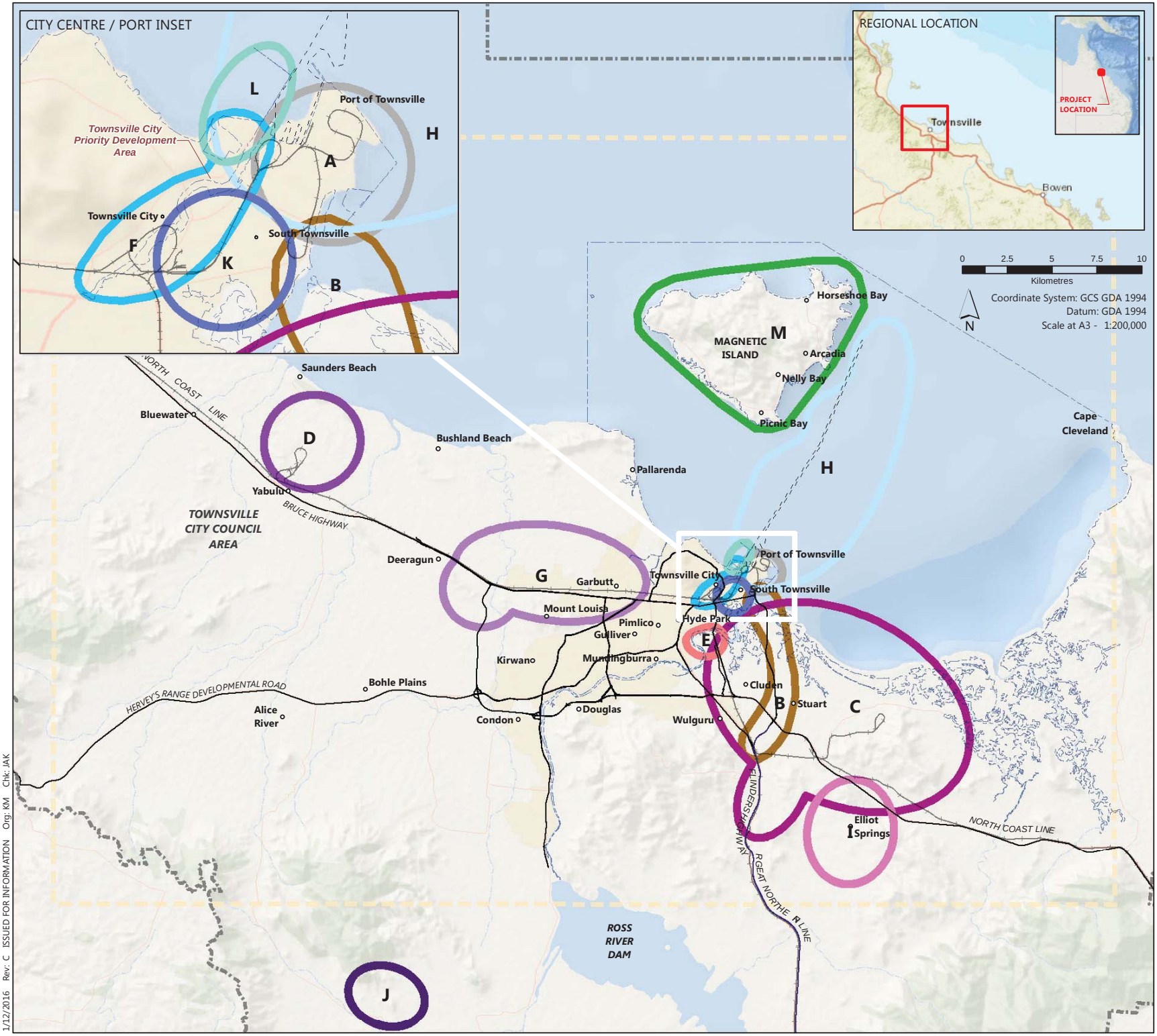
Location	Relevance
Port of Townsville (Land side)	This area encompasses all land side operations of the port from the berth face to port boundary including areas identified for future expansion in the Port Expansion Project.
Port of Townsville (Marine side)	This area includes all marine infrastructure and areas from the berth face to the boundary of the port limits marine area excluding the GBRMP.
Townsville Eastern Area Rail Corridor	The TEARC corridor as identified through the TEARC corridor study.
Townsville State Development Area	The TSDA is land preserved for industrial development of regional, State and national significance. The TSDA is strategically located to support medium to large-scale industrial development with direct connection with the Port of Townsville via the Port Access Road and has access to the Bruce and Flinders Highways, and both the Mount Isa and North Coast rail lines. The TSDA and immediately surrounding areas, which may be considered for future expansion, or that may restrict future expansion are included. This includes interface land uses in Cluden in close proximity to the TSDA.
Bohle Industrial Area	The existing Bohle industrial area (including all vacant and occupied land and adjacent environmental management areas may potentially accommodate port related industry.
Yabulu	The Yabulu heavy industry area and surrounding areas. Irrespective of the future of Queensland Nickel and existing infrastructure on the site, this location is important as a home for future heavy industry in the region.
Oonoonba Priority Development Area	The Oonoonba PDA is located along the NCL corridor and as such urban development in this location may influence the future operation of this corridor.

Location	Relevance
Townsville City Waterfront Priority Development Area	This area extends south from the port boundary and forms part of a broader interface precinct between the port and city. Development in this precinct will directly influence the future port operations. Future port operations will also impact on future land uses/activities in this precinct.
Bohle Plains Industrial Land Investigation Area	This land is under investigation by the DILGP/TCC for potential future industrial use. Development of this precinct may create opportunities for port related uses in the future Townsville City Plan suggests that subject to detailed planning and investigations, future land uses may include manufacturing, transport, storage and other uses which require larger sites in locations separated from sensitive land.
Woodstock Industrial Land Investigation Area	This land is under investigation by the Queensland Government and TCC for potential future industrial use. Development of this precinct may create opportunities for port related uses in the future Townsville City Plan suggests that future land uses that may occur include heavy industry uses including concrete batching plants, boilermaking, engineering and metal foundry subject to detailed planning and investigations. The use of this area for feedlots to support live cattle export from the port is also being investigated.
Port of Townsville Quarry	This is a new quarry proposed located in the Pinnacles region of Townsville that will be a source of rock armour and other materials required for the port expansion project. As part of this proposal, the port will construct a private road to haul the rock from the quarry onto Riverway Drive and then to the port via the Ring Road to avoid using Granitevale Road.
Elliot Springs Urban Development	The Elliot Springs Development is located to the south of Townsville and will potentially have a significant impact on the transport network in the southern part of the study area.
Boundary Street / Archer Street Precinct	This precinct is located immediately to the south of the port and together with the Waterfront PDA forms an important interface between the port and the city.
Rail Corridor – North Coast Line (Brisbane to Cairns)	This is the primary rail freight corridor between Brisbane and Cairns with a connection to the port.
Rail Corridor – Mount Isa Rail Line (Mount Isa to Townsville)	This rail connection provides access to the wider region and in particular resource projects in the Mount Isa region.
Road Corridor – Townsville Ring Road (Deeragun to Cluden)	This is an important road for freight vehicles with origins to the north/south of Townsville accessing the port.

Location	Relevance
Road Corridor – Bruce Highway (North of Townsville)	This road connects the port to industry and freight generators/users in the north of Queensland.
Road Corridor – Bruce Highway (South of Townsville)	This road connects the port to industry and freight generators/users in the south of Queensland.
Road Corridor – Bruce Highway (Woolcock Street to Ring Road)	This section of Bruce Highway connects existing industrial uses on Woolcock Street to the Ring Road and the port.
Road Corridor – Woolcock Street	Prior to the construction of the Ring Road this road provided access to the port from the Bruce Highway (North).
Road Corridor – Southern Port Road	This is an important road corridor providing access to the port from the Ring Road and areas to the south of Townsville.
Road Corridor – Abbott Street	The Abbott Street corridor connects from Woolcock Street through to the Ring Road although it is not the main heavy vehicle corridor for entering the port. Together with Boundary Street it provides alternative access to the port.
Road Corridor - Flinders Highway	The Flinders Highway provides an important road link from the port to agricultural and resources activities located to the west of Townsville.
Magnetic Island (land)	Magnetic Island is located within Townsville Port Limits and within the GBRWHA. The waters surrounding the island are included in the GBRMP however the land side is not. The land side of Magnetic Island is included as an area of interest due to its proximity to the Port of Townsville and its environmental values.

Townsville Evidence Base Report

Figure 6-23:
Master Plan Areas of Interest



Source Information:
Maritime Safety Queensland Port Areas
Queensland Department of Transport and Main Roads
Local Government Area Boundaries - Queensland
Rail network - Queensland
Queensland Department of Natural Resources and Mines
Road network
Townsville City Council
Existing channel
Digitised from Seafarer Chart AUS827 Cape Bowling Green to Palm Isles

While every care is taken to ensure the accuracy of this data, WorleyParsons makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaims all responsibility and all liability (including without limitation liability in negligence) for all expenses, losses, damages (including indirect or consequential damage) and costs which might be incurred as a result of the data being inaccurate or incomplete in any way and for any reason.

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1/12/2016 Rev: C ISSUED FOR INFORMATION Org: KM Chk: JAK

7 Environmental, Social and Cultural Values

7.1 Methodology

The known values across the study area for the Port of Townsville Master Plan Evidence Based Report were identified and described in relation to the following broad areas:

- Environmental values
- Social values
- Indigenous and non-Indigenous cultural heritage values.

The purpose of this process is to understand what are the key values and constraints that the master planning process needs to be mindful of in defining the proposed master planned area and associated precincts.

7.1.1 Environmental Values

A primary objective of the Queensland Government with regard to port master planning is to support protection, restoration and management of coastal ecosystems that contribute to Reef health and resilience with particular regard to:

- MNES (the core environmental concept of the EPBC Act 1999
- the OUV of the GBR
- MSES as defined in the Queensland State Planning Policy (SPP) and shown where possible on the SPP interactive mapping system.

The port master planned area is to allow consideration of key MNES that may be impacted by port or port related activities. The port master planned area, particularly the marine component, must allow adequate consideration of protection of OUV of the GBRWHA that could be directly related to the port.

Environmental values relevant to the master planning process are those environmental aspects that are present at significant levels (e.g. important populations), are critical to maintaining ecosystem health and regional presence and have intact or high quality features. Importantly, these key environmental values contribute to the significant or moderate expression of OUV of the GBRWHA.

The key environmental values within the study area were identified through a review of available literature and databases including:

- Published and unpublished environmental reports relating to the Port of Townsville
- Wide array of published reports from various sources regarding environmental aspects relevant to the study area, including the Townsville State Development Area (TSDA)
- The *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act) Protected Matters Search Tool, and Species Profile and Threats (SPRAT) database
- Queensland Department of Environment and Heritage Protection (EHP), Regional Ecosystem – Regulated Vegetation Management Map

- EHP Wildlife Online Database
- Mapping obtained from a range of sources, including Townsville City Council, Port of Townsville Limited and various Queensland Government Departments.

In order to provide consistency of approach across Evidence Based Reports for other Priority Ports, a similar framework to that for Abbot Point was used. Accordingly, environmental values were grouped under the following aspects to provide a framework for understanding their significance. Summary detail is provided in 7.2, with further detail provided in Appendix 1.

- Marine and estuarine environment
- Terrestrial environment
- Air quality, noise and vibration
- Hazards.

A description of key environmental values within each aspect was provided in a tabular profile format that included its:

- Description of the environmental value presence in the study area, along with its importance and conservation significance
- Contribution to OUV
- Threats to the value.

The presence and extent of key environmental values was mapped within the study area, drawing information from mapping layers provided by TCC, POTL and various Queensland Government Departments.

7.1.2 Social Values

Social profile information was derived via desktop review of Townsville data from a range of information sources, including:

- Data sourced from the Australian Bureau of Statistics (ABS) and the Queensland Government Statisticians Office (QGSO)
- Regional profile information for the Townsville area, commonly compared against Queensland more widely
- Information contained in the Townsville City Plan 2014
- Information contained in Port of Townsville EIS documentation.

Data relating to demography, housing/accommodation, economy and labour force, education and training were sourced primarily from the ABS and QGSO. Other sources are noted where applicable.

The social profile uses data for the Townsville Statistical Area Level 3 (SA3) level where available. SA3s are geographic areas that are used to present regional data. SA3s are designed to provide a regional breakdown of Australia. They generally have a population of between 30,000 and 130,000 people. In regional areas, they represent the area serviced by regional cities with a population over 20,000 people.

There are 351 SA3s covering the whole of Australia without gaps or overlaps. They are built up of whole SA2s. Whole SA3s aggregate directly to SA4s.Townsville SA3 is comprised of 25 SA2s, and has a total area of 3,833.7 square kilometres (Figure 7-1). Information regarding social values is provided in Section 0.

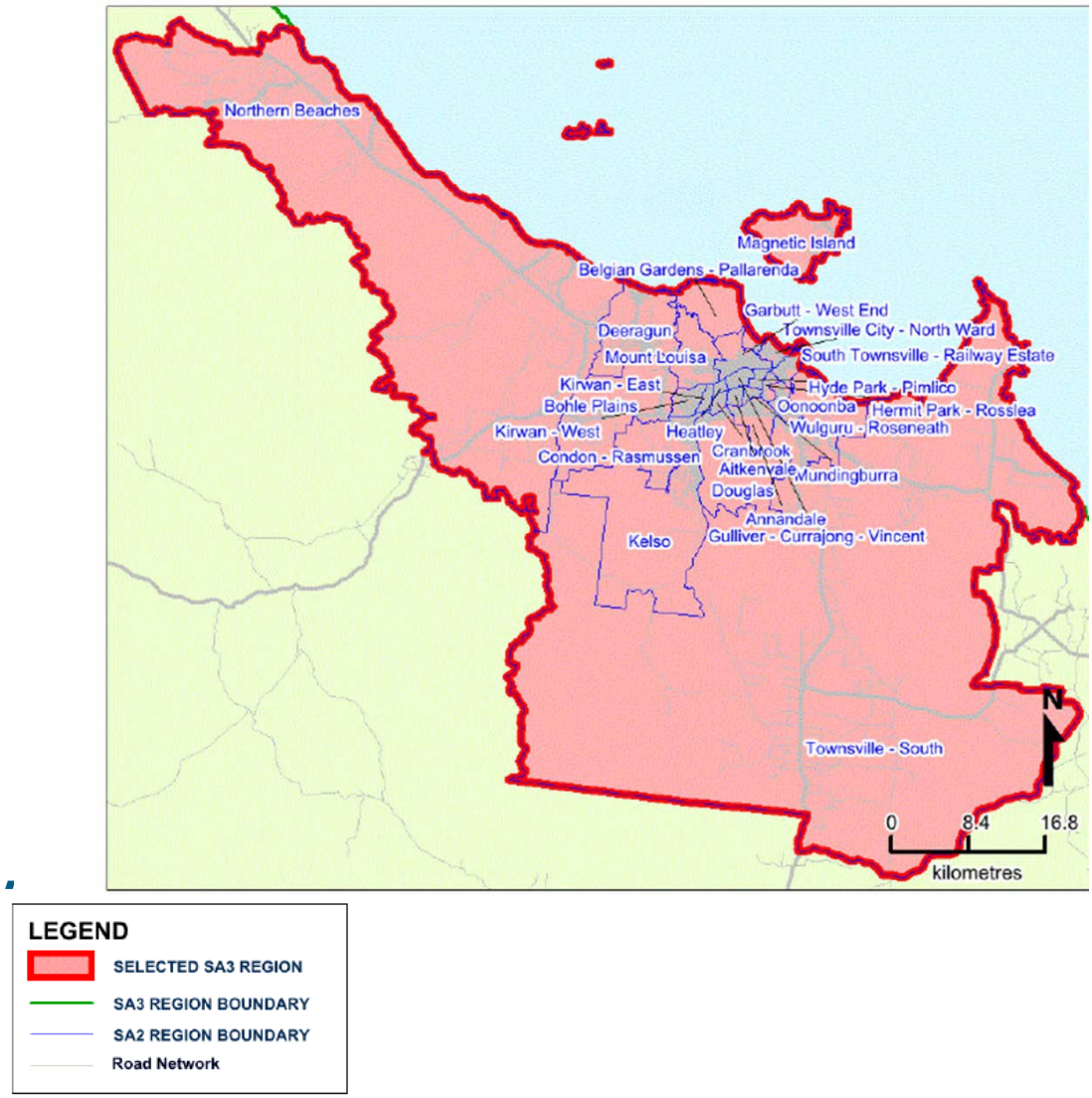


Figure 7-1 Map of Townsville SA3 (Code 31802)

7.1.3 Cultural Heritage

Previous significant cultural heritage assessment studies have been undertaken, which characterise the area in the vicinity of the Port of Townsville, TSDA and for the study area more widely. These assessments include:

- Bird & Heim (2009). 'Indigenous Cultural Heritage Report, Port of Townsville Limited (POTL), Townsville Marine Precinct and Port Expansion Projects'. Report prepared by Michele Bird (Northern Archaeological Consultants Pty Ltd) and Nicolaas Heim (Segue Pty Ltd), in conjunction with endorsed Aboriginal parties for Bindal and Wulgurukaba Traditional Owners.

- Bird (2006). 'Cultural Heritage Desktop Investigation, Townsville Industrial Land Suitability Study (Townsville State Development Area – TSDA), Stage 1'. Report prepared by Michelle Bird for Maunsell Australia.

  (Note: Specific details of the locations of significant Aboriginal cultural heritage sites are typically not published or made publically available. Accordingly, no specific details are provided in these documents).

These studies are supplemented with searches on the National Heritage List, the Commonwealth Heritage List, the Queensland Heritage Register in July 2016. Townsville City Council local heritage register GIS data was provided by the council, across the extent of the study area. That data relates to Schedule 7 Places of cultural heritage significance of the Townsville City Plan and associated Cultural Heritage overlay, which was informed by Brannock (2014). A search of the Australian National Shipwrecks Database (ANSDB) maintained under the requirements of the *Historic Shipwrecks Act 1976* was conducted.

Information regarding cultural heritage values is provided in Section 7.3.

7.1.4 Limitations and Assumptions

It is important to note the following limitations and assumptions when reading this report:

- This report provides guidance only for the Port of Townsville master planning process. It is not intended to be used for making project level decisions. The report identifies important areas within the study area and risks to those areas that may result from future development. Any future developments within the study area are required to undertake project specific environmental, social and cultural impact assessments according to their own terms of reference.
- The information contained within this report has been synthesised from a range of sources, including project specific environmental, social and cultural heritage reports. Field surveys for those reports have therefore been undertaken within their specific project study areas and not for the entirety of the Port of Townsville Master Planned study area. Results within those reports may have:
  - targeted specific species and habitats within a limited area
  - utilised varying degrees of survey effort
  - been undertaken in varying weather and seasonal conditions.

  Accordingly, more detailed studies will be required prior to any development being undertaken within the master planning study area to further refine understanding of their distribution and abundance within future development areas.
- It is not practicable to provide details of known, likely or potential habitat for all species within the study area. Detailed data is not available across the full study area. Considerable survey and study information is available for areas of proposed development and such detail has been used where available and applicable, however in most instances further surveys will need to be undertaken for future development.
- It is assumed that the information obtained from the various sources has been previously assessed for its veracity, and it is assumed to be suitable for inclusion in this evidence based report.

7.2 Environmental Values

This section provides a summary of the key terrestrial and marine environmental values present within the study area that may be impacted by the Port of Townsville or port related activities. The information in this section will be used to help guide the decision making process for the development of the boundaries of the port interest overlay, and contribute to the overall environmental vision of the master plan for the Port of Townsville.

Further detail regarding the environment and its values is provided in Appendix 1.

7.2.1 Key Environmental Studies

Numerous studies have been completed throughout the Townsville area for various industry and government projects, some of which contain environmental information pertaining to the study area. A number of these studies were reviewed to assist in the collation of environmental information relevant to this project, but due to the size of the study area, no single industry report includes its entirety. Nonetheless, some key environmental attributes from these reports have been identified and used to form the basis to assess environmental values for this project. In addition to the above, use of some older government studies (i.e. undertaken by CSIRO) completed for the region provide an informative environmental context for the study area.

The studies most relevant to the project are provided in Table 7-1. These include investigations of the terrestrial and marine environment around Townsville. A substantial amount of material was available in relation to the Port of Townsville and surrounds via the Port of Townsville PEP. Key terrestrial studies included those for the TSDA Area (TSDA). Key information sources were supplemented by information gathered from the government database searches such as those for MNES and MSES.

Table 7-1 List of Relevant Environmental Studies

Reference	Report title	Relevance
Environmental impact studies		
Saunders Havill Group, 2011	Townsville State Development Area – Environmental Constraints Analysis Report	Terrestrial – south
Port of Townsville Limited, 2014	A Description of the Existing Environment Surrounding the Port of Townsville	Marine
AECOM BMT WBM, 2012	Port of Townsville Port Expansion Project EIS	Marine
AECOM BMT WBM, 2016	Port of Townsville Port Expansion Project AEIS	Marine
Port of Townsville Limited, 2014	A description of the existing environment surrounding the Port of Townsville (Supporting information for the Long Term Monitoring and Management Plan for Maintenance Dredging)	Marine & terrestrial

Reference	Report title	Relevance
Planning		
Maunsell AECOM, 2007	Port of Townsville Master Plan Report R5 – Master Plan	
Gunn, J and Manning, C., 2010	Black Ross (Townsville) Water Quality Improvement Plan: Improving water quality from Creek to coral	Water quality
NQ Dry Tropics NRM	Burdekin Dry Tropics NRM Plan 2016-2026	Natural resources

7.2.2 Overview of the Environment

The study area (refer Figure 3-1) is located within the Burdekin Dry Tropics Region and centred on the city and Port of Townsville. The study area extends from Clement State Forest in the northwest to Lake Ross in the south to Cape Cleveland in the east and includes the Port of Townsville coastal waters along with Magnetic Island up to Rattlesnake Island.

Townsville City and the Port of Townsville lie on the shores of Cleveland Bay and Halifax Bay protected to some degree from weather that predominantly comes from the south-east. Cleveland Bay is mostly shallow inshore, with several large beaches and continually shifting sand bars. The seagrass meadows and fringing reefs are home to rare dolphins, dugongs, migratory whales and turtles. The mouth of the Bohle River and Cleveland Bay are declared Fish Habitat Areas and Cleveland Bay is covered by a Dugong Protection Area (NQ Dry Tropics NRM, 2016).

The land side of the study area forms a portion of a very distinctive landscape and natural environment characterised by the mountainous Hervey and Paluma Ranges in the west and northwest that set a backdrop to the coastal lowlands, hills and turquoise turbid waters of Cleveland Bay (Wyatt, 1968). The terrestrial portion of the study area is located within coastal lowlands that have been categorised into four broad physiographic units by Murtha in 1975 and 1982:

- Coastal sand dunes representing beach ridges north of Ross River and littoral zones mainly along the Cleveland Bay coastline to the south of Ross River consisting of shallow freshwater and coastal swamps and extensive areas of mangrove estuaries, saltpan and mudflats containing Acid Sulfate Soils (ASS)
- Low lying and elevated alluvial plains used for cattle grazing and containing numerous rivers, creeks and wetlands such as Bluewater Creek, Bohle River, Ross Creek, Ross River and Bowling Green Bay
- Piedmont slopes and gently undulating uplands (i.e. foot hills)
- Hilly and mountainous lands featuring unique landmarks such as Mt Louisa, Castle Hill, Mount Stuart and Magnetic Island. These inselbergs are the residuals of intrusive volcanics (mainly granite and granodiorite) of Upper Carboniferous to Permian age (Wyatt et al., 1986). The highest peak in the study area and on the Townsville 1:100,000 Sheet 8259 is Mt Stuart (1.223 kilometres).

These environments provide habitats for numerous Commonwealth and State listed species of birds, mammals, reptiles and plants including endangered, vulnerable and rare species.

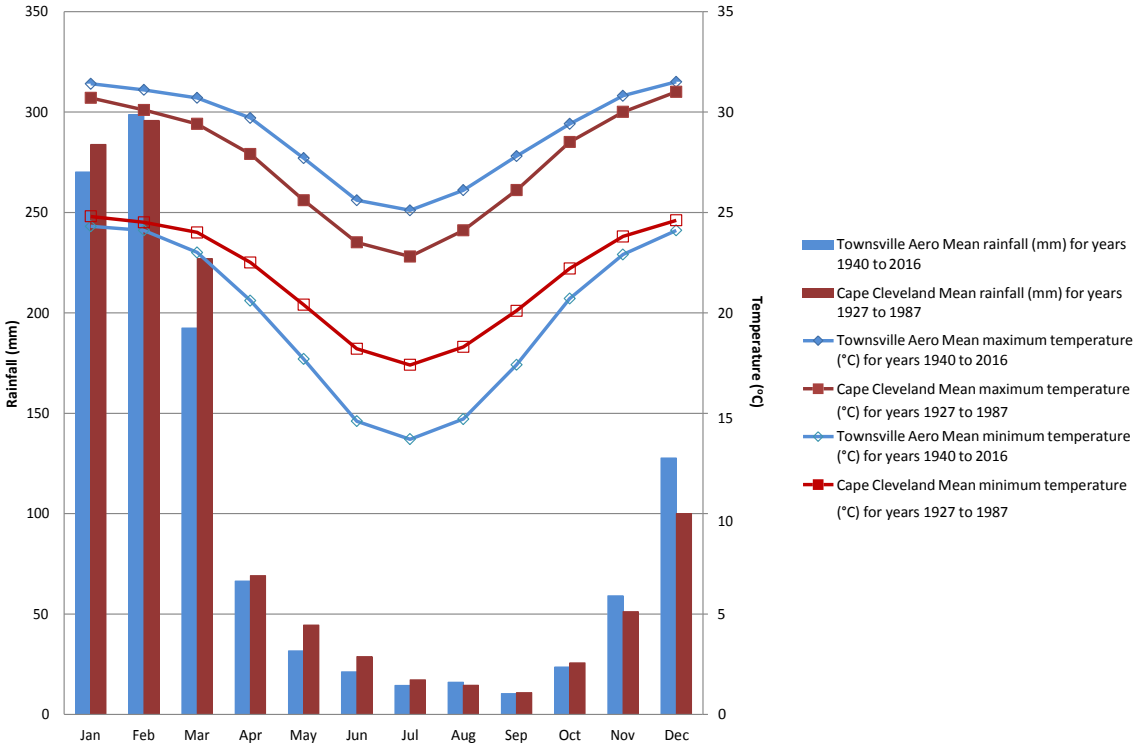
The marine component of the study area includes Halifax Bay, south of Rattlesnake Island, and the Port of Townsville marine boundary consisting of Cleveland Bay and Magnetic Island. The marine component is partly within and adjoining the GBRWHA, the GBRMP and the Queensland State Marine Park.

National parks and other reserves include Magnetic Island, Paluma Range, and Bowling Green Bay National Parks; and the Cape Pallarenda and Townsville Town Common Conservation Parks.

7.2.3 Climatic Conditions and Climate Change

The Australian Bureau of Meteorology (BOM) provides climatic classifications for Australia. According to the Koppen classification which uses native vegetation as an expression of climate, the study area is located within a tropical climate and is characterised by wet hot (and humid) summers, typically from November to April, and warm dry winters, typically from May to October (Figure 7-2) (BOM, 2012).

The average temperature ranges from 13.7 °C in July to 31.5°C in December, while the average rainfall ranges from 10.3mm in September to 298.7mm in February (Figure 7-2). The predominant source of rainfall is the south-east trade-wind, however, there are also tropical influences such as tropical cyclones and associated disturbances (Christian *et al.*, 1953). In this region, rainfall is the dominating climatic factor influencing plant growth with the amount of rainfall, distribution and intensity generally depending on distance from the coast (Christian *et al.*, 1953). Temperatures are moderate to high throughout the year (Christian *et al.*, 1953).



Source: BOM, 2016

Figure 7-2 Townsville Mean Yearly Rainfall and Max Temperature

Adaptive Strategies and Open Lines (2015) provide a synopsis of changes to climate that may occur in the northern Queensland context (as represented for nearby Abbot Point). These changes were identified as likely to influence a range of hydrological and meteorological conditions in the master planning study area with flow on effects to a range of other environmental processes, including:

- an annual increase in evaporation of 11 per cent
- mean sea level rises of 0.8 m (by 2100)
- mean temperature increases of 3.0 °C (by 2070)
- an increase in average annual days over 35 °C from one to 12 (by 2070)
- humidity decreases of 1 - 2 per cent
- an increase of drought months by up to 40 per cent
- increases in the intensity and southward distribution of tropical cyclones
- an annual decrease in rainfall of up to 10 per cent
- an increase in the number days with a high Forest Fire Danger Index
- annual increases in wind speeds of 5 - 10per cent
- sea water temperature increases of 2.2 - 2.5 °C
- ocean acidification, with a pH reduction of 0.14 to 0.35 units (by 2100)
- 5% increase in rainfall intensity with every degree Celsius of temperature rise
- an increase in storm tide inundation levels of 3 - 10 per cent

Relevant effects of climate change are introduced in Section 7.2.4 in discussion of environmental values of the study area.

7.2.4 Marine and Estuarine Environmental Values

A number of marine and estuarine environmental values (EV) have been identified within the study area and are discussed in detail within Appendix 1. Of these, mangrove and reef communities, seagrass and macroalgae, marine megafauna, fish and fisheries, MNES and MSES have been identified as key environmental considerations as they contribute to Outstanding Universal Value (OUV) (Section 8.2.6) and have also been identified as environmental constraints (Section 7.4.1).

Summary descriptions of the environmental considerations and the potential threats are discussed below.

7.2.4.1 Description

Mangrove and Saltmarsh communities

Mangroves and saltmarsh grow in the intertidal zone, typically within quiescent (calm) environments (BMT WMB, 2012) such as estuaries and bays. There are 12 species of mangrove recorded from the study area, with these communities mainly found along Ross Creek, Ross River, the eastern shoreline of Cleveland Bay, Magnetic Island, and a small patch adjacent to the esplanade. The Queensland Herbarium Regional Ecosystem (RE) Description Database (Queensland Herbarium, 2015) classifies mangrove and saltmarsh vegetation as 'of least concern'.

Mangroves and saltmarshes represent benthic primary producer habitats (BPPH) with high conservation values as they provide a nursery and shelter for fish, mud crabs and prawns, trap tide-borne sediments and help control coastal erosion and provide vital protection from strong winds, tidal surges and heavy rainfall associated with cyclones. Their ability to provide protection will become increasingly important given increases in cyclonic activity and resulting flooding and inundation predicted as a result of climate change. Mapping of storm surge provided in the Townsville City Plan takes into account sea level rise due to climate change.

Reef communities

Reef habitats in Cleveland Bay include shallow fringing reefs and rocky shores around Magnetic Island, the well-developed reef platform of Middle Reef and smaller, less developed reef areas between the mainland and Magnetic Island (e.g. Virago Shoal) (BMT WBM, 2012). Although the corals only occupy approximately 1per cent of Cleveland Bay, they are of high biodiversity significance around Magnetic Island and form part of an extensive system of nearshore reefs within the Coastal Central Reefs Bioregion (BMT WBM, 2012). Nearby nearshore reef systems include Herald Island, Bramble Rock Reef, Cordelia Rocks Reef, Acheron Reef and the Palm Island group to the northwest of Cleveland Bay, and Salamander, Bray and Bald Reefs around Point Cleveland.

Coral cover, species diversity and aesthetic quality is generally considered higher in the fringing reefs on the northern side of Magnetic Island (Horseshoe Bay) than in other fringing reefs. A large number of hard corals have been recorded in these communities, including areas of *Montipora digitata* (POTL, 2014). The distribution and abundance of coral species varies in the fringing reefs and is related to the physical characteristics of the substrate and energy environments (POTL, 2014).

Seagrass and macroalgae

Seagrass meadows occur in nearshore and deep-water of Cleveland Bay and are considered to be among the largest in the central Queensland coast (BMT WBM, 2012). They are present in approximately 10per cent of the bay and occur extensively in the eastern portion of Cleveland Bay with smaller beds occurring off the Strand, Kissing Point, Pallarenda Beach and some bays fringing Magnetic Island; however, seagrass is not known in the vicinity of the existing port infrastructure or proposed PEP area (POTL, 2014). Seagrass provides food for dugong and turtles and are also a nursery for prawns.

A recent (2015) annual seagrass survey indicated that most meadows were considered to be in a satisfactory condition with the dominant species recorded as *Halophila ovalis*, *Halodule uninervis*, *Zostera capricorni*, and *Cymodocea serrulata* in shallow waters and *Thalassia hemprichii* on reef flats surrounding Magnetic Island (Davies *et al*, 2016).

Marine megafauna

Cleveland Bay and the waters around Magnetic Island are an important habitat for sea turtles, dugongs and nearshore dolphin species with other marine megafauna such as whales favouring offshore waters.

Six turtle species have been recorded, with the green turtle being the most abundant and accounting for approximately 90per cent of turtles observed within the Bay (BMT WBM, 2012). The green turtle grazes on seagrass and macroalgae while key foraging habitats for other marine turtles in Cleveland Bay are not well known (BMT WBM, 2012). Cleveland Bay does not represent a critical turtle nesting area, with

only low densities occuring on a number of sandy beaches on Magnetic, Herald and Rattlesnake Islands, The Strand beach and the Australian Institute of Marine Science (AIMS) beach.

The Australian snubfin dolphin, Indo-Pacific humpback dolphin, common dolphin and the bottlenose dolphin are known or likely to occur within the study area. Australian snubfin dolphins and Indo-Pacific humpback dolphins occur nearshore and in shallow-water habitat opportunistically feeding on fish, with the Australian snubfin dolphin also feeding on cephalopods (BMT WBM, 2012). Little is known about the population, distribution, ecology and movement patterns of both species at a regional and national level. However, a frequented area for both species is within and adjacent to Ross River and Ross Creek.

Humpback whale adults and calves have occasionally been recorded within the coastal waters of Cleveland Bay, usually during August-September and likely when they were making their return migration to southern waters.

Dugongs are herbivores and feed selectively on dominant seagrass species (BMT WBM, 2012). As Cleveland Bay is a regionally important habitat for this species it has been designated as a Dugong Protection Area (DPA). The primary feeding areas, and where dugongs were mostly observed in the area, are the dense nearshore meadows in eastern portion of the Cleveland Bay Dugong Protection Area (DPA) (BMT WBM, 2012).

The following conservation and recovery plans are in place for whales, dolphins, dugong and marine turtles:

- Nature Conservation (Whales and Dolphins) Conservation Plan 1997
- Nature Conservation (Dugong) Conservation Plan 1999
- Recovery Plan for Marine Turtles in Australia 2003 (Environment Australia 2003).

Fish and fisheries

Fish Habitat Areas (FHA) have been established in Cleveland Bay and in the nearby Bohle River and Bowling Green Bay. They provide habitats for a wide range of fish and shellfish of direct economic significance. The main commercial fisheries operating directly in Cleveland Bay include:

- Queensland Mud Crab
- East Coast Otter Trawl
- Queensland Blue Swimmer Crab
- Queensland East Coast Spanish Mackerel
- Queensland East Coast Inshore Fin Fish
- The Queensland Spanner Crab Fishery includes waters adjacent to Cleveland Bay.

The FHAs provide protection to sustaining fish stocks while also acting as breeding grounds for target species such as barramundi, grunter, mud crabs and prawns. Once an area is declared as a FHA, it protects all habitat types (e.g. vegetation, sand bars and rocky headlands) from direct physical disturbance and coastal development from fishing disturbance.

Fishing for target species is a common practice and undertaken by traditional owner, commercial and recreational fishers within the tidal creeks and estuaries. There are no major aquaculture facilities currently operating in the Cleveland Bay area.

Matters of National Environmental Significance

A protected matters search identified MNES as potentially occurring within the study area. These are listed below. Figure 7-3 shows the MNES that have fixed boundaries.

- World Heritage Properties: Great Barrier Reef World Heritage Area
- National Heritage Places
- Wetlands of International Importance (listed under the RAMSAR Convention): Bowling Green Bay
- Great Barrier Reef Marine Park: 17 GBRMP zones. This includes most of Cleveland Bay and portions of Halifax Bay
- Commonwealth Marine Area: This is based on Australian Maritime Boundaries and includes water in the northeast of the study area and outside of Cleveland Bay. This is not considered further.
- Listed Threatened Ecological Communities: 3 listed ecological communities
- Listed Threatened Species: 12 listed threatened species
- Listed Migratory Species: 23 migratory species.

Great Barrier Reef World Heritage Area and Marine Park

The Great Barrier Reef is listed as a UNESCO World Heritage site. The GBRWHA was inscribed on the World Heritage List in 1981. It covers an area of approximately 348,000 square kilometres and extends along the Queensland coast for 2000 kilometres from Cape York to Fraser Island and up to 250 kilometres offshore from the low water mark along the mainland and down to 2000 m in depth. The GBRWHA forms the world's largest coral reef ecosystem and includes approximately 2,500 individual reefs, more than 900 islands, over 1,500 species of fish, approximately 400 species of coral, 4,000 species of mollusc, and approximately 240 species of birds including a range of sponges, anemones, marine worms, crustaceans, and other species (UNESCO, 2016). No other World Heritage property contains such biodiversity (UNESCO, 2016).

Cleveland and Halifax Bays, including the Port of Townsville, are located within the GBRWHA. The GBRWHA extent includes all waters to low water mark along the coastline. Accordingly, Port of Townsville infrastructure below the low water mark lies within the GBRWHA. It is important to note that the marine park boundary differs slightly for the GBRWHA, with the port area excluded from the marine park. The land side of continental islands, such as Magnetic Island, are also excluded from the marine park. Land-side values of Magnetic Island can therefore be included within the master planned area. While below water values of Magnetic Island cannot be included in the master planned area, these values are relevant to consider as they would form part of the surrounding area required to be considered within the Port Act.

The GBRWHA is also an Australian National Heritage Place. Due to its management as a marine park (established in 1975), the Great Barrier Reef has several designations controlled by the Commonwealth and State governments. The Great Barrier Reef Marine Park Authority (GBRMPA) is the Australian Government agency responsible for its overall management, in conjunction with Queensland's Department of National Parks, Recreation, Sport and Racing (DNPSR) which provides the day-to-day management.

As a world heritage site, the GBRWHA is a globally outstanding and significant entity with OUV. The extent to which the OUV is expressed within the study area is assessed in Section 8.2.6.

RAMSAR – Bowling Green Bay

Bowling Green Bay is a Ramsar listed wetland. Ramsar wetlands represent wetlands of international significance and are also protected nationally and listed on the Directory of Important Wetlands of Australia. Bowling Green Bay is mainly located to the east of Cape Cleveland, but extends partly along the southeast coastline of Cleveland Bay and within the study area. It is a diverse complex of coastal wetland systems that include:

- inter-tidal seagrass beds
- mangrove woodlands
- saltpan communities on the coast
- brackish to freshwater wetlands inland
- extensive areas of forest and woodland, some closed forest on the mountainous areas and the coastal dune system. (DEE, 2016).

It contains examples of the richest coastal habitats typical of north-east Australia's coastal wet-dry tropics and is home to a rich and varied birdlife.

The wetland receives a majority of its fresh water during summer. This dilutes salinity levels of the shallow inshore marine areas, the surface soils of the saltpans and the mangrove areas and recharges the two aquifers (DEE, 2016).

Listed Threatened and Migratory Species

Cleveland Bay supports habitats for migratory or transient threatened or protected marine fauna including whales, dugongs, dolphins and marine turtles. These animals have different likelihoods of occurring in the study area with only a few species having been observed. These are described above along with other listed marine species. Sharks and sawfish are described in Appendix 1. Migratory marine birds are discussed below.

A number of migratory marine birds are listed within the MNES search as likely to occur within the study area. Surveys of the Eastern Access Corridor and the site of the bridge over Ross River (NRA, 2005) identified the following migratory shore bird species as present during the survey: Redneck Stint, Great Knot, Sharp-tailed Sandpiper, Bar-tailed Godwit, Great Sand Plover and Eastern Curlew. Favoured use areas appear to be the South Bank beach and a sand bar south of the entrance channel to Ross River.

AECOM (2013) reported that the Sooty Oystercatcher, among other species, is known to use existing POTL breakwaters and revetments for roosting, while other migratory birds use the POTL eastern reclamation for foraging. It was also reported that newly reclaimed areas are likely to enhance opportunistic foraging opportunities in emplaced marine sediments and roosting along greater lengths of breakwater and revetments (AECOM, 2013).

Matters of State Environmental Significance

Matters of State Environmental Significance (MSES) refers to biodiversity within the State Planning Policy (SPP) and is comprised of:

- State Conservation Areas such as Protected Areas (*Nature Conservation Act* 1992, *Marine Parks Act* 2004, *Fisheries Act* 1994)
- wetlands and waterways (*Environmental Protection Act* 1992; *Regional Planning Interests* Act 2014)
- threatened species (*Nature Conservation Act* 1992)
- regulated vegetation (*Vegetation Management Act* 1999)
- offset areas (various acts).

A search of Wildlife Online was completed on 29 July 2016 for the study area in order to identify marine species listed under the *Nature Conservation Act* (NCA) 1992 that occur within the study area. The results identified 2000 species. This search was filtered to identify the Queensland listed endangered (E), vulnerable (V) and near threatened (NT) species. Eight vulnerable marine species were identified. These include the humpback whale, Australian snubfin dolphin, dugong, hawksbill turtle, green turtle, flatback turtle discussed above, but also the estuarine crocodile. Designated areas of MSES within the study area are presented in Figure 7-4.

7.2.4.2 Contribution to OUV

The following key expressions of OUV by the marine and estuarine environment of the study area include the following. Further detail regarding assessment of OUV is provided in Section 8.2.6.

- Superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance
  - soft bottom communities
  - substantial mangrove stands in Cleveland Bay and around Magnetic Island
  - the most extensive and diverse seagrass meadows in north Queensland
  - fringing reefs around Magnetic Island and Middle Reef containing hard and soft corals
- Examples representing major stages of earth's history, including the record of life, significant on-going geological processes in the development of landforms, or significant geomorphic or physiographic features
  - Reef communities comprised of hard corals exist around Magnetic Island, at Middle Reef and at Virago Shoal (located between Magnetic Island and Cape Pallarenda)
- Significant on-going ecological and biological processes
  - Common benthic flora and fauna are present in the marine areas
- Contain the most important and significant natural habitats for in-situ conservation of biological diversity
  - Cleveland Bay, Magnetic Island and surrounding areas including Bowling Green Bay RAMSAR wetland area
  - Coral reefs
  - Mangroves
  - Seagrass
  - Declared dugong protection area
  - Species of dolphins
  - 242 species of birds

7.2.4.3 Threats to Values

Mangrove communities

Mangrove communities occur in Cleveland Bay and around Magnetic Island. The predominant threats to mangrove ecosystems arise from land use conflicts, for instance where human activity and development encroaches into mangrove areas. Other threats include local effects on water quality, particularly through the introduction of nutrients and herbicides (BMT WBM, 2012).

Climate-induced disturbances may also create conditions that make them more susceptible to anthropogenic disturbance (POTL, 2014). The protection of the coastline offered by mangrove communities will be increasingly important in mitigating impacts to the shoreline from increased cyclonic weather events and storm surge predicted as a result of climate change.

Reef communities

Cleveland Bay coral communities are subject to a range of environmental pressures including low salinity flood waters, physical disturbance from cyclones, increase seawater temperatures leading to coral bleaching and temporary reduction of productivity and their resident prey populations due to water quality and/or sedimentation effects from dredging. The latter posing the greatest threat to reef communities from future port expansion and ongoing maintenance.

Resilience of reef communities will be important in responding to climate change effects. Increased frequency and severity of cyclonic events cause change in coral cover, with effects ranging from damaging tips or edges of coral through to severely damaging or removing coral and coral communities. After events resulting in severe damage, further changes can occur on reef structures including extensive growth of algae over injured colonies, potentially blanketing damaged reef structure.

Seagrass and macroalgae

Seagrasses are sensitive to a number of environmental factors such as climate, cyclones, flooding, decreases in water quality and increased sedimentation effects that generate low light conditions and temporary reduction of benthic seagrass productivity. The resilience of the communities is also affected by the frequency of disturbances, for instance, an increased number of disturbances will increasingly deplete energy stores, seed banks, and standing crop. Anthropogenic effects that create the low light conditions that seagrasses are most sensitive to include riverine turbid plumes (particularly from agricultural catchments) and dredging activities. It is noted though that seagrass meadows are not located within close proximity to the Port of Townsville operational area or proposed PEP area.

Marine megafauna

Threats to marine megafauna are predominately from anthropogenic factors such as incidental capture in nets set for swimmers' safety and mesh net fisheries, disturbances to habitat and feeding areas, pollution from spills or inadequate stormwater management and increased vessel traffic and noise from port development and operations or otherwise. Physical interactions with megafauna are most likely to occur with boats travelling at speed rather than large vessel movements at port where speeds are necessarily slow. It is noted that the port marine operations and proposed PEP are not located where seagrasses are found, so risk of impacting megafauna that feed on seagrasses (e.g. green turtles and

dugong) are reduced; however there is potential for these and other megafauna species to traverse the port area.

Fish and fisheries

The main threats to fish and fisheries are from anthropogenic factors such as illegal and overfishing, pollution from spills or inadequate stormwater management and loss of habitat used for feeding or breeding (i.e. seagrasses, reef and benthic habitat).

Matters of National Environmental Significance

Great Barrier Reef World Heritage Area and Marine Park

According to the Great Barrier Reef Outlook Report (GBRMPA, 2014), the northern third of the Great Barrier Reef has good water quality and its ecosystem is in good condition, while key habitats, species and ecosystem processes in central and southern inshore areas have continued to deteriorate from the cumulative effects of impacts (GBRMPA, 2014).

GBRMPA has undertaken surveys of the Great Barrier Reef to assess the extent of the coral bleaching event that occurred in 2016. GBRMPA identified findings (prior to the last survey) showing that 22 per cent of coral on the Reef has died due to the worst mass bleaching event on record. Eighty-five per cent of this mortality occurred in the 600 kilometre stretch between the tip of Cape York and just north of Lizard Island. Overall, the area below Cairns has escaped significant mortality.

The major threats to the future vitality of the GBR include (GBRMPA, 2014):

- Climate change
- Poor water quality from land-based run-off
- Impacts from coastal development (i.e. construction of revetment walls)
- Loss of soft sediment benthic habitat due to reclamation
- Temporary impacts to benthos due to dredging
- Noise generated by maritime activities such as dredging, piling and construction is also likely to result in the temporary avoidance by marine megafauna and fish
- Direct use (i.e. illegal fishing, anchorages)
- Other threats include major storms and floods, crown of thorns starfish outbreaks, marine pest introduction, marine debris and release of emissions or pollutants / waste.

These threats have the potential to work in combination to weaken the resilience of the Great Barrier Reef ecosystem and therefore its ability to recover from serious disturbances (such as major coral bleaching events) which are predicted to become more frequent in the future (GBRMPA, 2014).

RAMSAR – Bowling Green Bay

Threats to Bowling Green Bay are predominately from anthropogenic factors such as clearing / destruction of habitat, disturbances to feeding and foraging habitats, pollution from spills and/or inadequate stormwater management and turbidity plumes from dredging campaigns.

Listed Threatened and Migratory Species

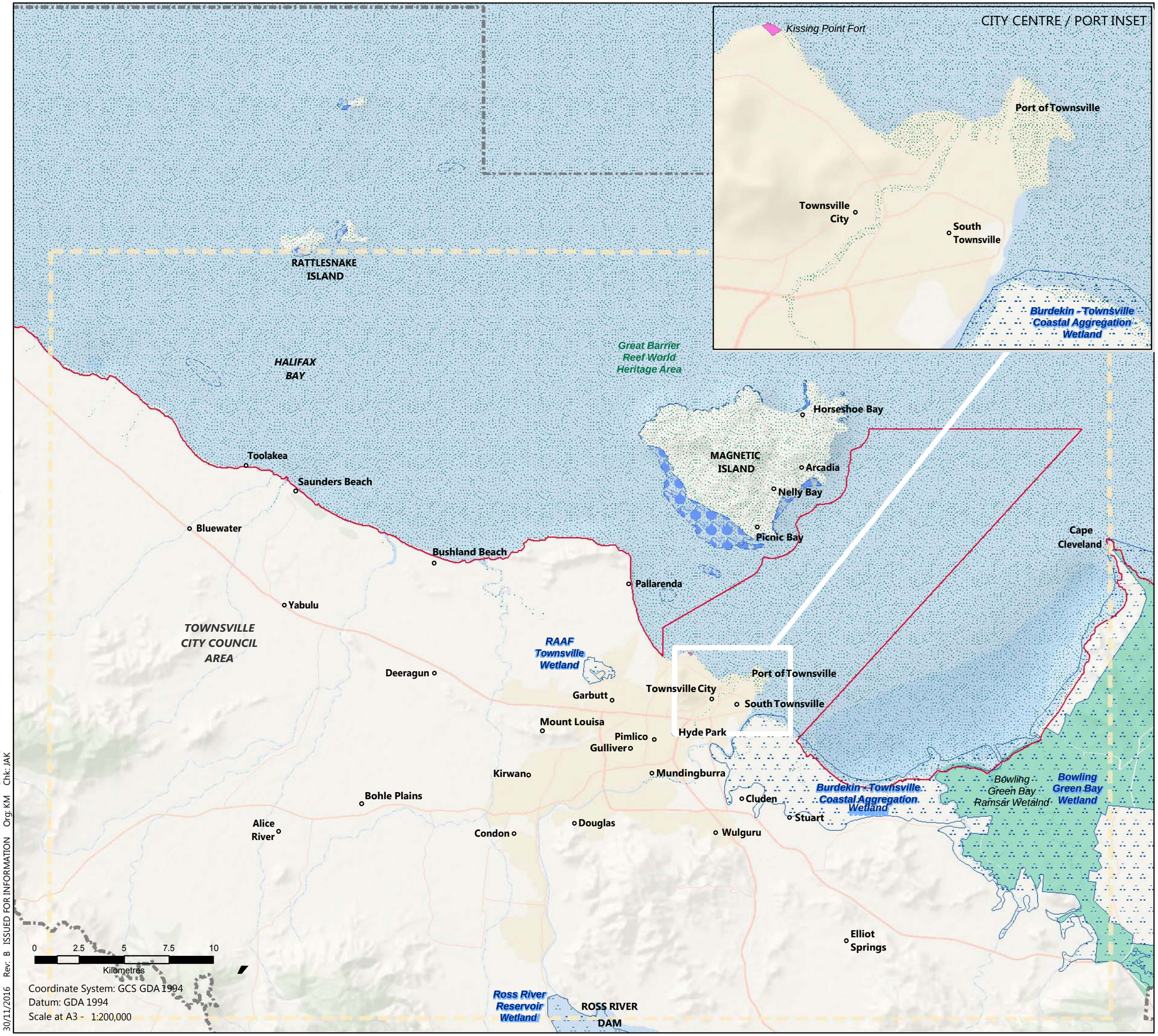
Threats to listed threatened and/or marine migratory species are predominately from anthropogenic factors such as noise and light emissions and visual disturbance resulting in modified foraging and breeding behaviours, and movement patterns. Environmental factors include animal interactions and acute climatic disturbances such as cyclones.

Matters of State Environmental Significance

Threats to MSES are similar to those values for values common with MNES.

Townsville Evidence Base Report

Figure 7-3:
Key Matters of National Environmental Significance



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- Townsville City Council LGA boundary
- Project area of interest
- Great Barrier Reef World Heritage Area
- Ramsar Wetland
- Directory of Important Wetlands - wetland area
- Commonwealth non-indigenous heritage register places
- Great Barrier Reef Marine Park boundary

Reef communities

- Indicative reef boundary
- Drying Reef

Source Information:
Local Government Area Boundaries - Queensland
Queensland Department of Natural Resources and Mines
Commonwealth Heritage List Database
Australian Government Department of the Environment, Water, Heritage and the Arts
Great Barrier Reef Marine Park boundary and Reef Communities
Great Barrier Reef Marine Park Authority
Ramsar Wetlands of Australia
Great Barrier Reef World Heritage Area
Australian Government Department of Sustainability, Environment, Water, Population and Communities
Directory of important wetlands - Queensland
Department of Environment and Heritage Protection

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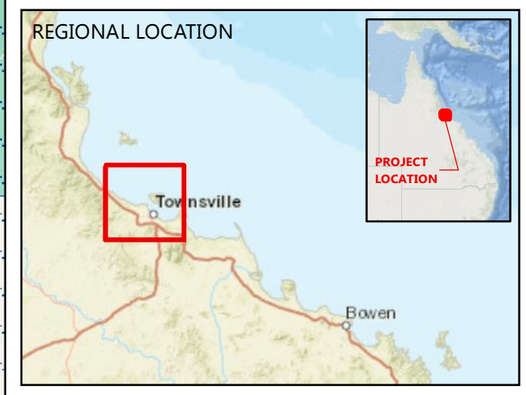

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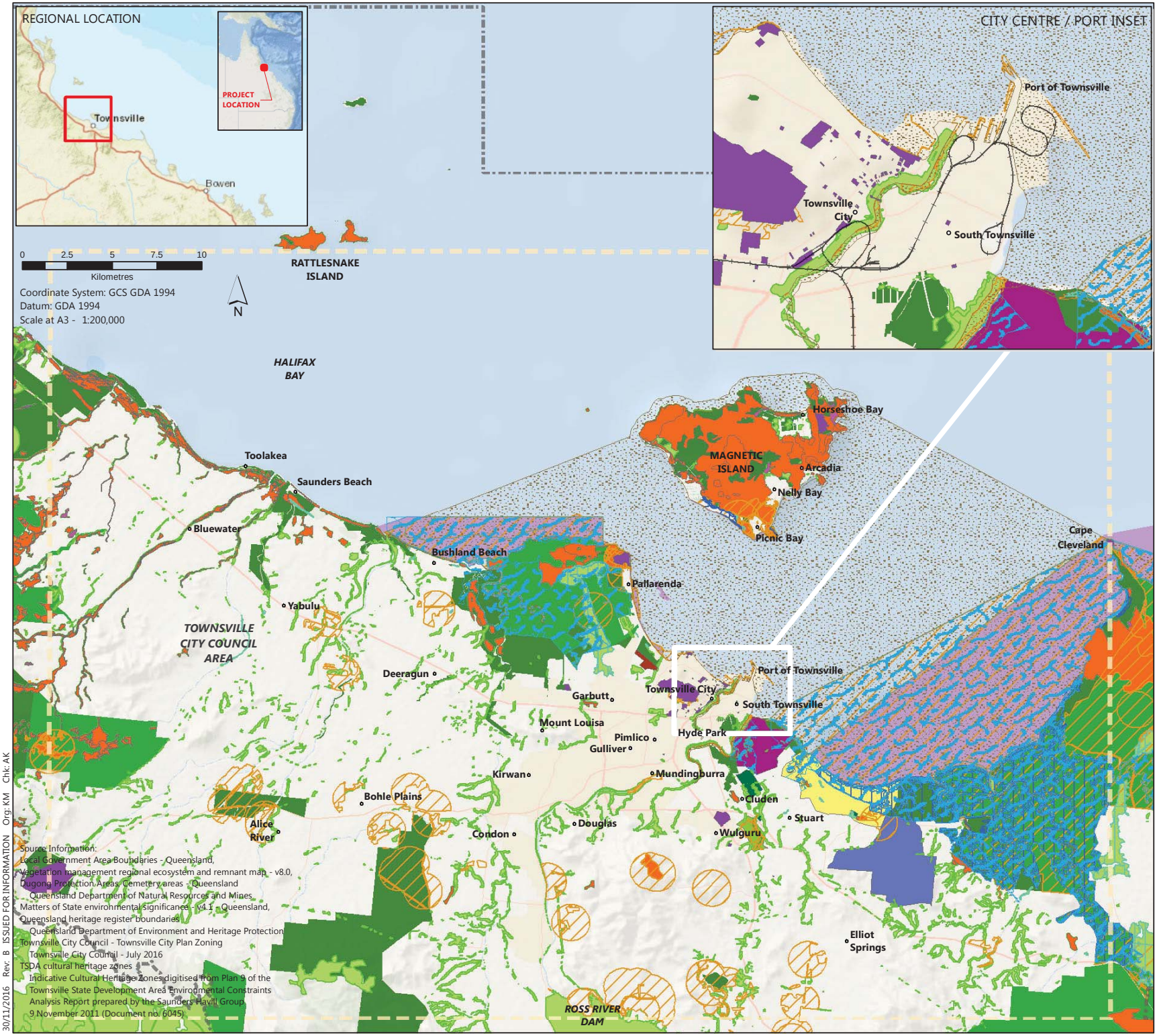
Figure 7-4:
Key Matters of State Environmental Significance



Townsville City Council LGA boundary
Project area of interest
Dugong protection area

Matters of State Environmental Significance

- MSES - High ecological value waters (wetland)
- MSES - 'High Ecological Significance' wetlands
- MSES - Wildlife habitat
- MSES - Regulated vegetation
- MSES - Protected area
- MSES - Declared fish habitat area
- MSES - Marine park

Regional Ecosystems (v8.0)

As listed under the Qld Vegetation Management

- Remnant vegetation containing endangered regional ecosytems
- Remnant vegetation containing of concern regional ecosystems

Townsville City Council - Townsville City Plan Zoning

Community facilities and open space zones category

- Environmental management and

Cultural Heritage

- Queensland non-indigenous heritage register places
- Cemetery

TSDA cultural heritage zones

- Zone 1 - Sandfly Creek Coastal Area
- Zone 2 - South Bank of Ross River
- Zone 3 - Stuart Creek and Surrounds
- Zone 4 - Muntalunga Range
- Zone 5 - Lagoons and Wetlands

Source Information:
Local Government Area Boundaries - Queensland,
Vegetation management regional ecosystem and remnant map - v8.0,
Dugong Protection Areas, Cemetery areas - Queensland
Queensland Department of Natural Resources and Mines
Matters of State environmental significance - v4.1 - Queensland,
Queensland heritage register boundaries
Queensland Department of Environment and Heritage Protection
Townsville City Council - Townsville City Plan Zoning
Townsville City Council - July 2016
TSDA cultural heritage zones
Indicative Cultural Heritage Zones digitised from Plan 9 of the Townsville State Development Area Environmental Constraints Analysis Report prepared by the Saunders Havill Group, 9 November 2011 (Document no. 6045)

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7.2.5 Terrestrial Environmental Values

The terrestrial component of the study is best described as four physiographic units: coastal sand dunes, alluvial plains, piedmont slopes and hilly and mountainous lands. Terrestrial environmental values identified within these landscapes are discussed in detail within Appendix 1. Of these, environmentally protected areas such as state and national parks and other reserves, of concern and endangered Regional Ecosystems (RE), MNES and MSES have been identified as key terrestrial environmental values as they either contribute to Outstanding Universal Value (OUV) (Section 8.2.6) and/or have also been identified as environmental constraints (Section 7.4).

7.2.5.1 Description

Vegetation

Based on communities that are mapped under the *Vegetation Management Act* (VM Act) 1999, the study area is comprised of 376 REs, of these, 55 have been identified as 'endangered' or 'of concern'. These are listed in Appendix 1 and occur largely outside of built up areas such as urban or industrial land uses and commonly within specific protected environmental areas. Specific protected environmental areas include state and national parks and other reserves including Magnetic Island, Paluma Range, and Bowling Green Bay National Parks; and the Cape Pallarenda, Townsville Town Common Conservation Park, Stuart Creek Nature Refuge, Cape Pallarenda Regional Park and Magnetic Island's Horseshoe Bay Lagoon Conservation Park.

The landside port area has been either cleared or reclaimed and is utilised for port operations and assoicated industry and does not support terrestrial flora values. Values at the port area are limited and mainly assoicated with the coastal zone inter-tidal and littoral habitats.

Fauna

The study area contains a number of habitats that support mammals, reptiles, and substantial bird populations, including the migratory birds that fly through the coastal plain on their annual journey along the East Australian Flyway. Although the landside port area does not generally support critical terrestrial fauna habitat, avifauna (birds) may visit the coastal zone and use nearby shoreline andlittoral habitats. Marine birds frequently occur at the port, while feeding, resting or overflying from one habitat to another. Nearby inter-tidal shores are known for shorebird occurrence, providing a key roosting and feeding habitat. Many of those bird species that occur are listed as threatened or migratory species. The predominant areas of bird habitation are located on the sandspit on the eastern bank of Ross River.

The study area contains several areas that provide habitat to the EPBC listed endangered Black-throated Finch (southern) (*Poephila cincta cincta*). This includes an area that coincides with the Bohle Plains Industrial Land Investigation Area. That land may provide significant potential nesting habitat and habitat for other theatened species such as the vulnerable Squatter Pigeon (southern subspecies) (*Geophaps scripta scripta*) and critially endangered Bare Rumped Sheath Tail Bat. The presence of preferred habitat for these species would limit the area's suitability for future industrial development.

Matters of National Environmental Significance

A protected matters search identified MNES as potentially occurring within the study area. These are listed below. Figure 7-3 shows the MNES that have fixed boundaries.

Ecological communities

Three ecological communities have been listed as MNES. These include:

- Broad leaf tea-tree (*Melaleuca viridiflora*) woodlands in high rainfall coastal north Queensland. This endangered and relatively small community is likely to occur within the northwest corner of the study area typically as woodland but can have a more dense forest structure in some areas.
- Littoral Rainforest and Coastal Vine Thickets of Eastern Australia. This critically endangered community occurs on Quaternary sands (beach ridges) in the northern portion of the South Eastern Queensland Bioregion. A small patch is likely to occur within the northwest corner of the study area as RE 11.2.3.
- Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions. This fragmented and endangered community is likely to occur within the northwest corner of the study area, Bowling Green Bay and Magnetic Island.

Listed threatened and migratory species

MNES search results indicated the following:

- 43 listed threatened species
- 41 migratory species

The study area supports habitats for migratory or transient threatened or protected terrestrial fauna including birds, frogs, mammals, reptiles and plants. These animals have different likelihoods of occurring in the study area with only a few species having been observed within the TSDA.

Matters of State Environmental Significance

MSES refers to biodiversity within the State Planning Policy (SPP) and is comprised of:

- State Conservation Areas such as Protected Areas (*Nature Conservation Act* 1992)
- wetlands and waterways (*Environmental Protection Act* 1992; *Regional Planning Interests Act* 2014)
- threatened species (*Nature Conservation Act* 1992)
- regulated vegetation (*Vegetation Management Act* 1999)
- offset areas (various acts).

MSES relevant to the study area are presented in Figure 7-4 and described in detailed in Appendix 1. This included the identification of seven endangered, 16 vulnerable and two near threatened species as listed in the *Nature Conservation Act* 1992. Regulated vegetation and threatened species are mentioned above as vegetation and fauna.

7.2.5.2 Contribution to OUV

The key terrestrial environmental values for the study area have been identified as they contribute to OUV (Section 8.2.6) as containing:

- Superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance
  - Magnetic Island is a continental island with rocky granite headlands, sandy bays, covered with open eucalypt woodlands and surrounded by coral reefs
  - Internationally significant numbers of shorebirds (including migratory species) frequently occur within the study area, while feeding, resting or overflying from one area to another.
- The most important and significant natural habitats for in-situ conservation of biological diversity
  - Cleveland Bay, Magnetic Island and surrounding areas provide habitat for a large range of species and ecosystems
  - 242 species of birds.

OUV is discussed in more detail in Section 8.2.6.

7.2.5.3 Threats to Values

Vegetation

Regulated vegetation occurs throughout the study area adjacent to urban and industrial areas and within environmentally protected areas. The predominant threats to vegetation arise from land use conflicts, for instance where human activity encroaches (i.e. urban or industrial / commercial development and agriculture) causing the direct removal of land forming habitat for plants and animals, increases in traffic through sensitive areas, spread of invasive pest and weed species, fire, feral animals and indirect effects from changed hydrology limiting water sources.

Fauna

The main threat to the fauna includes the direct removal of habitat for plants and animals due to urban or industrial / commercial expansion. Within the study area this includes removal of vegetation particularly where listed or threatened species have been identified (e.g. the sandspit on the eastern bank of Ross River and the northern part of Ross River Dam). Other threats include spread of invasive terrestrial species and noise, vibration and light emissions from nearby human activity resulting in modified foraging and breeding behaviours and movement patterns.

7.2.6 Air Quality, Noise and Vibration

Air quality

The DEHP rate Townsville's air quality as very good based on data from 2004. AECOM (2013) indicate that the quantity of greenhouse gas emissions or future emissions from POTL do not trigger the *National Greenhouse and Energy Reporting (NGER) Act* 2007 and are considered minimal in the context of Australian corporations (AECOM, 2013). Air quality has limited relevance to OUV, however, threats to future air quality may result from increased particulate and dust emissions from development (i.e. construction, operations, increased traffic) and odours (e.g. live cattle exports if not sited appropriately).

Noise

Receptors sensitive to noise include dwellings, libraries and educational institutions, childcare centres and kindergartens, outdoor school playground areas, medical institutions, commercial and retail activities, protected areas, marine parks and passive parks and gardens. The existing ambient acoustic environment at the port was assessed by AECOM, 2013 and is characterised by noise from both port and urban traffic from Townsville and noise from port activities. Impacts to the ambient levels may be associated from increased developed, i.e. port development including piling and rock breaking.

Vibration

The vibration information available is reported by AECOM (2013) whom conservatively estimate the existing background vibration environment at the port as a Peak Particle Velocity vibration level lower than 0.10 mm/s. At the port, vibrations sources include heavy vehicles and overhead crane movements and the impact of items being unloaded from ships onto the wharves. In the wider study area, vibrations may result from heavy vehicle movements and industrial activity such as quarrying.

7.2.7 Hazards

A number of hazards have been identified within the study area that may impact future port development. This includes flooding and inundation, contaminated land and unexploded ordnance.

Flooding and storm-tide inundation

With the exception of several residual mountains, a majority of the study area is located within a naturally low-lying coastal floodplain susceptible to inundation by a combination of heavy rainfall and/or high tides (AECOM, 2012). Heavy rainfalls during the wet seasons often coincide with high tides therefore having a significant impact on flooding extent (AECOM, 2012). Overflows from the Ross River and Ross Creeks can cause significant inundation around Port of Townsville, Townsville CBD and the suburbs of South Townsville, Railway Estate and Oonoonba (AECOM, 2012).

The Ross River catchment is the largest within the Townsville LGA while Ross Creek drains most of the urbanised area of Townsville City including the suburbs of South Townsville, Hyde Park, Mundingburra, Gulliver, Currajong, Pimlico, Mysterston, Aitkenvale, Vincent and Cranbrook (AECOM, 2012).

Three hydraulic extremes could exist to create flooding within the study area:

- Storm tide only (refers to the elevation of the storm surge in combination with the astronomical tide and wave setup)
- Stormwater only
- A combination of elevated storm tide and stormwater flow.

Flood and storm surge inundation mapping is presented in Appendix 1. This indicates that the port land area is relatively immune to flooding and storm surge, however the TSDA is particularly susceptible to being impacted. It should be noted that the mapping is taken from storm tide inundation mapping as presented in the Townsville City Plan. That mapping includes the effects of sea level rise as predicted to occur under conditions of climate change.

Contaminated land

In Queensland, contaminated land is regulated under the Queensland *Environmental Protection Act* (EP Act) 1994 which is in turn administered by DEHP. DEHP maintains two databases where contaminated land is recorded:

- Environmental Management Register (EMR) - Land presently or formerly used for a notifiable activity or land that is confirmed as being contaminated is recorded
- Contaminated Land Register (CLR) – land that is proven contaminated and has the potential to cause serious environmental harm.

A community based website, State of Environment Townsville (SoE) indicates that 447 land parcels within the Townsville LGA are listed on the EMR and of these, 19 are subject to Site Management Plans (SMPs) (SoE, 2003). AECOM (2013) completed EMR/CLR searches for the PEP. These identified 20 lots near the PEP as being listed on the EMR.

Acid sulfate soils

Littoral zones mainly along the Cleveland Bay coastline to the south of Ross River consist of shallow freshwater and coastal swamps and extensive areas of mangrove estuaries, saltpan and mudflats contain ASS. These soils generally occur below 5 m AHD.

Unexploded ordnance

Unexploded ordnance (UXO) represents a specific form of land contamination arising from any sort of military ammunition or explosive ordnance which has failed to function as intended. Explosive ordnance that has functioned yet contains residual explosive or chemical warfare agent is normally treated as UXO. Derelict or discarded explosive ordnance is also treated similarly to UXO. A search of the Australian Department of Defence (DoD) online mapping indicates several areas with "slight" and "other" UXO potential with significant potential areas located at Yabulu, Townsville Town Common Conservation Park, Bowling Green Bay National Park and smaller areas within the TSDA. A "slight" potential indicates sites with a confirmed history of military activities that have resulted in residual UXO, while the classification "other" potential confirm that the area was used for military training but do not confirm that the site was used for live firing. UXO or explosive ordnance fragments / components have not been recovered from the site.

Bushfire

The Townsville City Plan maps bushfire hazard. It identifies that the majority of the study area is classed as medium hazard. This is predominantly due to the uniform vegetation community found across much of the area combined with the generally flat terrain. High bushfire hazard areas include those around Granite Vale and Calcium, Mount Elliot and Alligator Creek, Mount Stuart and Julago, Clement and Blue Hills, The Pinnacles and Cape Cleveland. The Townsville City Plan includes a Bushfire Hazard Overlay Code to manage development in bushfire hazard areas.

Social Values

This section of the Evidence Based Report provides an overview of the social baseline and to identify the community and social values of the Port of Townsville and surrounding area. It considers demographic trends that will inform the Priority Port Master Planning and provides a context

regarding the values which may influence the growth of the Port of Townsville, and which may be influenced by the growth of the port.

7.2.8 Description of Existing Social Values

The Port of Townsville is located within the Townsville City Council Local Government Area which has an area of 3,733 km^2.

Townsville was established in 1864 as a port to support the growth of pastoral industry in North Queensland. Consistent with ports in general, changes in population have influenced trading volumes and cargo types through the port, particularly those that relate to domestic consumption and consumer products. Accordingly, the Port of Townsville has continued to play an important role in supporting the evolving economic, industrial and community development of Townsville and North Queensland, and has influenced its social characteristics in the process.

Consistent with many areas of regional Queensland, Townsville's demand for consumer goods and general household products are heavily linked to the economic health of the mineral and resource sectors due to the large amount of direct and indirect employment provided by these sectors. Similarly, the Port of Townsville throughput is linked to mineral and resources throughputs, and so are heavily exposed to broader global trends in demand from markets particularly in east and south-east Asia.

7.2.9 Social Baseline Information

Key social baseline statistics for Townsville are provided in Table 7-2. Further discussion regarding key aspects follows.

Much of the information is derived from census data, which is collected periodically as part of the census of Population and Housing in Australia. This census is the largest statistical collection undertaken by the Australian Bureau of Statistics.

The Townsville Statistical Area Level 3 (SA3) which best matches the Study Area and is most similar to the area covered by the City of Townsville. Townsville SA3 has a total area of 3,833.7 km^2 and is comprised of 25 smaller Statistical Area Level 2 (SA2) areas.

Much of the information provided in this report is derived from the 2011 census and will be superseded by the data collected and analysed from the next census in August 2016. Where more recent data for Townsville SA3 is available from the Queensland Government Statistician's Office, that information is used.

It is noted that Townsville is changing and is subject to community composition changes together with other regional areas reliant on resource and mineral commodity exports. These changes will become more evident with the release of 2016 census data.

Table 7-2 Key Social Baseline Data for Townsville SA3

Townsville – Key social baseline	
Estimated resident population	Estimated residential population of 193,992 in June 2015: ▪ 4% of Queensland's population ▪ 0.82% of Australia's population ▪ Population in 2036 is projected to be 288,663.
Average population growth rate	▪ 1.9% over 5 years ▪ 2.2% over 10 years ▪ Higher than the Queensland average
Median age	33.3 years in 2014
Aged 65 years and above	10.6% as proportion of population in 2014
Aboriginal and Torres Strait Islander	6.1 per cent as proportion of population in 2011
Born overseas	19.9 per cent in 2011
Families	Dominant family types in 2011: ▪ Couples with children – 43.5 per cent ▪ Couples without children - 37.8 per cent
Income – median	$35,100 in 2011
Main employment industries	In 2011, the top three employment industries were: ▪ Health care and social assistance – 12.5 per cent ▪ Public administration and safety – 11.9 per cent ▪ Retail trade – 10.7 per cent
Education	In 2011, education beyond school level: ▪ 42.3 per cent

7.2.9.1 Population and Demography

As at June 30 2015, Estimated Residential Population (ERP) for Townsville SA3 was 193,992.

The average annual growth rate over five and ten years is expected to be 1.9% and 2.2% respectively, which is higher than the comparative Queensland ERP growth rates of 1.6% and 2.0%.

Table 7-3: Recent Population Trends in Townsville SA3 as at June 2015

Year	Townsville SA3 population
2010	176,591
2011	180,186
2012	184,617
2013	189,087
2014	192,107
2015	193,992

Source: Queensland Government Statistician's Office, Queensland Treasury, Queensland Regional Profiles: Resident Profile for Townsville Statistical Area Level 3

The Queensland Government projection of population in 2036 is estimated to be 288,663 based on a 1.9 per cent growth rate projection. This projection is based on assumptions made about future levels of fertility, mortality, and overseas and interstate migration that are applied to a base population (split by sex and single year of age).

Table 7-4: Population Projections for Townsville SA3

Year	Townsville SA3 population projections
2016	199,428
2021	219,713
2026	241,942
2031	265,085
2036	288,663
Average annual ERP growth rate	1.9%

Source: Queensland Government Statistician's Office, Queensland Treasury, Queensland Regional Profiles: Resident Profile for Townsville Statistical Area Level 3

The breakdown of population by age group identifies that the 68.6 per cent of the SA3 ERP at June 2014 were aged between 15 and 64 years of age. The Townsville SA3 area has a comparatively greater proportion of 15-24 year age group (16.1 per cent) than for Queensland more generally (13.7 per cent). It also has proportionally fewer ERP in the 65+ years age group (10.6 per cent) compared to that for Queensland (14.0 per cent). As at June 2014, the median age for Townsville SA3 was 33.3 years.

Table 7-5: Estimated Resident Population (ERP) by Age as at June 2014

Region	0-14 Years	15-24 Years	25-44 Years	45-64 Years	65+ Years
Townsville SA3	39,944 (20.8%)	30,993 (16.1%)	56,332 (29.3%)	44,490 (23.2%)	20,348 (10.6%)
Queensland	934,862 (19.8%)	645,774 (13.7%)	1,323,000 (28.0%)	1,159,012 (24.5%)	659,799 (14.0%)

Source: Regional Statistics by ASGS, 2010-2014, Annual (2009-10 to 2013-14) Townsville 31802

7.2.9.2 Indigenous Population

The Indigenous population of Townsville SA3 is based on 2011 census of population and housing question regarding Indigenous status where each person was asked to identify whether they are of Aboriginal and/or Torres Strait Islander origin. Data for Townsville SA3 show a greater proportion of Indigenous persons (6.1 per cent) within the population compared with the proportion overall for Queensland (3.6 per cent).

Table 7-6: Indigenous Status of Townsville SA3 and Queensland, 2011

Region	Aboriginal	Torres Strait Islander	Both	Total	Non-Indigenous Persons	Total persons
Townsville SA3	7,801	1,728	1,177	10,706 (6.1%)	153,120 (87.7%)	174,531
Queensland	122,896	20,094	12,834	155,824 (3.6%)	3,952,707 (91.2)	4,332,740

Source: Queensland Government Statistician's Office, Queensland Treasury, Queensland Regional Profiles: Resident Profile for Townsville Statistical Area Level 3

7.2.9.3 Family Composition

The family composition variable distinguishes between different types of families based on the presence or absence of couple relationships, parent-child relationships, child dependency relationships or other familial relationships. As at 2011, Townsville SA3 had 45,340 families, and 43.5 per cent of total families were couple families with children. The composition of families was relatively similar to that across Queensland.

Table 7-7: Family Composition of Townsville SA3 and Queensland, 2011

Region	Couple family, no children	Couple family, with children	One-parent family	Total
Townsville SA3	17,139 (37.8%)	19,735 (43.5%)	7,648 (16.9%)	45,340
Queensland	453,102 (39.5%)	491,200 (42.8%)	184,547 (16.1%)	1,148,179

Source: Queensland Government Statistician's Office, Queensland Treasury, Queensland Regional Profiles: Resident Profile for Townsville Statistical Area Level 3

7.2.10 Economy and Labour Force

Basic measures of household economic statistics demonstrate that as at 2011, Townsville SA3 residents generally had higher incomes than Queensland more widely, while mortgage payments were generally similar.

It is acknowledged that the 2011 statistics may differ to current times following the closure of Queensland Nickel and softening of the resources and minerals sector. Unemployment is expected to trend higher in the short to medium term, with follow on negative impacts to incomes.

Table 7-8 Selected Household Medians of Townsville SA3 and Queensland, 2011

Measure	Townsville SA3	Queensland
Median total personal income per year	$35,100	$30,524
Median family personal income per year	$84,552	$75,556
Median total household income per year	$71,812	$64,220
Median mortgage repayment per month	$1,861	$1,850
Average household size	2.6	2.6

Source: Queensland Government Statistician's Office, Queensland Treasury, Queensland Regional Profiles: Resident Profile for Townsville Statistical Area Level 3

7.2.10.1 Personal Income

As at 2011, personal income statistics for Townsville SA3 demonstrated a higher proportion of people earning $52,000 to $103,000 per year compared to Queensland more widely, and a lesser proportion

of people earning less than $20,800. The overall median income for Townsville SA3 was $35,100, which is approximately 15% higher than the median for Queensland.

Table 7-9 Total Personal Income of Townsville SA3 Residents and Queensland, 2011

Measure	Townsville SA3	Queensland
Less than $20,800 per year	41,968 (30.5%)	1,195,059 (34.6%)
$20,800 to $51,999 per year	42,631 (31.0%)	1,095,509 (31.7%)
$52,000 to $103,999 per year	33,279 (24.2%)	689.495 (19.9%)
$104,000 or more per year	7,017 (5.1%)	191,236 (5.5%)
Median per year	$35,100	$30,524

Source: Queensland Government Statistician's Office, Queensland Treasury, Queensland Regional Profiles: Resident Profile for Townsville Statistical Area Level 3

7.2.10.2 Unemployment and Labour Force

The unemployment rate in Townsville SA3 at March 2016, was 7.9 per cent, which is significantly higher than the overall Queensland unemployment rate of 6.2 per cent. The unemployment rate has been trending higher than that of Queensland since about March 2013 and exceeded the Queensland unemployment rate beginning in March 2014.

Table 7-10 Unemployment and Labour Force of Townsville SA3 and Queensland, March 2016

Region	Unemployed	Labour Force	Unemployment Rate
Townsville SA3	7,479	95,071	7.9%
Queensland	154,537	2,510,876	6.2%

Source: Queensland Government Statistician's Office, Queensland Treasury, Queensland Regional Profiles: Resident Profile for Townsville Statistical Area Level 3

7.2.10.3 Employment by Industry

Based on 2011 census data, 12.5 per cent of employed people worked in the health care and social assistance industry, and 11.9 per cent of employed people worked in public administration and safety industry. In general, the percentages employed by the top industries are approximately similar and were typically

in the same rank order of percentage employment. The exception was public administration and safety, where Townsville SA3 has a higher proportion than for Queensland more widely.

Table 7-11 Top 5 Employment Industries for Townsville SA3 and Queensland, as at June 2011.

Top 5 industries in Townsville SA3	Townsville SA3 %	Queensland %
Health care and social assistance	12.1	11.9
Public administration and safety	10.8	6.7
Retail trade	10.6	10.7
Construction	9.2	9.0
Manufacturing	8.2	8.4
Education and training	8.2	7.9

Source: Queensland Government Statistician's Office, Queensland Treasury, Queensland Regional Profiles: Resident Profile for Townsville Statistical Area Level 3

7.2.10.4 Employment by Occupation

As at June 2011, the top four employment occupations were the same for both Townsville SA3 and Queensland and ranked the same by percentage. Townsville had a slightly greater proportion of technicians and trades workers and community and personal service workers than for Queensland more broadly, and lesser proportion of professionals, managers and labourers.

Table 7-12 Top 5 Employment by Occupation for Townsville SA3 and Queensland, as at June 2011.

Top 5 occupations in Townsville SA3	Townsville SA3 (%)	Queensland (%)
Professionals	17.3	18.9
Technicians and trades workers	16.7	14.9
Clerical and administrative workers	14.3	14.7
Community and personal service workers	12.2	10.0
Labourers	9.9	10.6

Source: Queensland Government Statistician's Office, Queensland Treasury, Queensland Regional Profiles: Resident Profile for Townsville Statistical Area Level 3

According to the QGSO, the top five occupations by sub-major groups of employment for Townsville SA3 were:

1. Sales assistants and sales persons (6.6 per cent)
2. Health professionals (5.1 per cent)
3. Specialist managers (4.7 per cent)
4. Automotive and engineering trades workers (4.7 per cent)
5. Carers and aides (4.1 per cent).

7.2.11 Rental market and dwelling sale prices

The weekly rent for dwellings in Townsville SA3 is significantly less than that for Queensland more broadly. This reflects lower median sale prices for dwellings compared to Queensland overall.

Table 7-13 Median Rent for Dwelling Types for Townsville SA3 and Queensland, as at June 2016

Median rent	Townsville SA3	Queensland
1 bedroom flat/unit	$230 (weekly)	$295 (weekly)
2 bedroom flat/unit	$250 (weekly)	$340 (weekly)
3 bedroom house	$300 (weekly)	$350 (weekly)
4 bedroom house	$360 (weekly)	$410 (weekly)

Source: Residential Tenancies Authority, Rental Bonds data (Queensland Government Statistician's Office derived

Table 7-14 Median Sale Price for Dwelling Types for Townsville SA3 and Queensland, as at December 2015.

Median dwelling sale price	Townsville SA3	Queensland
Attached dwelling	$290,000	$375,000
Detached dwelling	$355,000	$455,000
New house and land	$409,950	$442,000
Vacant residential land	$158,500	$225,000

Source: Department of Natural Resources and Mines, Office of the Valuer-General, Property Sales. (Queensland Government Statistician's Office derived

7.2.12 Education and Training

7.2.12.1 Highest Level of Schooling

Based on 2011 census data, the percentage of total persons in Townsville SA3 with highest level of schooling as year 11 or 12 is 55.1 per cent. This percentage is essentially the same as Queensland overall (55.3 per cent). Schooling to year 9 or 10 has similar percentages between Townsville SA3 and Queensland. There is a slightly lower percentage of Townsville SA3 persons that either did not go to school or did not extend beyond year 8 (5.7 per cent) compared to Queensland more broadly (6.6 per cent).

Table 7-15 Highest Level of Schooling Completed by Townsville SA3 and Queensland

Schooling level	Townsville SA3 (%)	Queensland (%)
Did not go to school, or Year 8 or below	7,472 (5.7%)	219,102 (6.6%)
Year 9 or 10 or equivalent	39,044 (29.6%)	977,116 (29.4%)
Year 11 or 12 or equivalent	72,686 (55.1%)	1,836,995 (55.3%)
Total	131,912	3,320,761

Source: Queensland Government Statistician's Office, Queensland Treasury, Queensland Regional Profiles: Resident Profile for Townsville Statistical Area Level 3

7.2.12.2 Non-School Qualification

The percentage of persons in Townsville SA3 with a non-school qualification was 53.8 per cent, which is very similar to that for Queensland more broadly (54.2 per cent). Townsville has lesser percentage of people who have Bachelor degree or higher and Advanced diploma or diploma compared to those for Queensland. Conversely, Townsville SA3 has a greater percentage of people with a certificate as their highest non- school qualification.

Table 7-16 Non-school Qualifications by Level of Education, Townsville SA3 and Queensland

Non-school qualification	Townsville SA3 (%)	Queensland (%)
Bachelor degree or higher	19,343 (14.0%)	548,894 (15.9%)
Advanced diploma or diploma	9,001 (6.5%)	260,778 (7.5%)

Non-school qualification	Townsville SA3 (%)	Queensland (%)
Certificate	29,829 (21.7%)	686,993 (19.9%)
Persons with qualification	74,028 (53.8%)	1,875,323 (54.2%)
Total	137,695	3,456,875

Source: Queensland Government Statistician's Office, Queensland Treasury, Queensland Regional Profiles: Resident Profile for Townsville Statistical Area Level 3)

7.2.13 Social Amenity Sites and Uses

Townsville City is located within the low lying coastal plain of the Ross River and Bohle River and between two wetland landscapes (Townsville Town Common National Park to the north and Bowling Green National Park to the south). The landscape in and around Townsville includes several prominent rugged outcrops of granite rock, notably Castle Hill, Mount Louisa, Mount Stuart, and Mount Cook at Magnetic Island (AECOM, 2016). These areas provide a distinctive natural backdrop to the city and are valuable recreational assets enjoyed by residents and both domestic and international tourists.

The scenic amenity of Townsville was assessed in 2011 (GHD, 2011) to inform the development of the Townsville City Plan 2014. The assessment methodology was based upon the South East Queensland Regional Plan, Implementation Guideline No. 8 (Queensland Government, 2007). That methodology determines amenity on the basis of visual exposure[1] and scenic preference[2]. Scenic preference ratings were defined between 0 (least preferred) and 10 (most preferred).

Townsville City has developed in close association with the Port of Townsville, which was established in 1864 to support the growth of agricultural exports products from the hinterland area. While the port is located close to the city centre, it is separated from the city centre, recreational areas such as the marina and entertainment centre by Ross Creek.

The Port of Townsville is located at the very downstream end of the Townsville City Waterfront Priority Development Area, beyond the Maritime Mixed Use Precinct and opposite the Ocean Gateway Precinct. These precincts designs and built form requirements take into account their location in the vicinity of the Port of Townsville and include measures to limit exposure to port influences and to limit their influence upon the port. Such measures include screening, orientation, design and construction of buildings, and navigational lighting considerations.

The scenic amenity report identified key issues regarding scenic amenity that were highlighted as part of consultation with relevant stakeholders. These issues included:

[1] Visual Exposure is a measure of the extent to which a place in the landscape is seen from public viewing locations.

[2] Scenic preference is the rating of the community's liking for scenery of open space compared to areas occupied by built structures. These ratings are measured using photographs and include people's visual response, emotional and other sensory responses.

- Encroachment of inappropriate development on hill sides and in the vicinity of iconic landscape features
- The need to protect the natural values of the Townsville coastline
- The protection of key view points and corridors.

The scenic amenity report identified that the majority of the mainland landscape around Townsville is of moderate scenic amenity (values around 5). Pockets of higher scenic amenity include Castle Hill, The Strand, Mount Stuart, Cape Pallarenda, Nelly Bay, Horseshoe Bay, the Picnic Bay Jetty and viewpoints along the ferry route to Magnetic Island. Lower scenic amenity values (2) are associated with land in the vicinity of the Port and there were no significant viewpoints identified around Cleveland Bay.

The Townsville City Plan identifies (3.4.4 Element - Strong and connected community) areas of high scenic amenity which include the following:

- mountainous backdrops, including Mount Elliot, Mount Cleveland, the Pinnacles, Many Peaks Range and Hervey Range to Paluma
- significant hills and ridgelines within and framing urban areas, including Castle Hill, Mount Stuart and Mount Louisa
- coastal headlands, foreshores and waters, including The Strand, Magnetic Island, Cape Pallarenda, Cape Cleveland, Cleveland Bay and Halifax Bay.

The Port of Townsville is highly visible from several of the higher value scenic amenity viewpoints, including Castle Hill, The Strand, Cape Pallarenda, Picnic Bay and Nelly Bay on Magnetic Island, and along the ferry route between Townsville and Magnetic Island.

7.2.14 Social Infrastructure

According to the QGSO, as at June 2015, Townsville (SA3) had the following social infrastructure:

- 7 police stations, located at:
  - Garbutt, Gulliver, Kirwan, Magnetic Island, Northern Beaches, Townsville City and Wulguru.
- 5 ambulance stations, located at:
  - Garbutt, Gulliver, Kirwan, Magnetic Island, Northern Beaches.
- 5 fire stations, located at:
  - Kirwan, Magnetic Island, Mount Louisa, South Townsville, and Wulguru.
- 8 hospitals, located at:
  - 4 in Hyde Park / Pimlico
  - 1 in each of South Townsville, Garbutt, Douglas, and Magnetic Island
- 28 aged care services, located in the following areas, with several services each located in the following locations:
  - Pallarenda, Gulliver, Townsville City, and Wulguru.
- 1,499 aged care service operational places, with top five locations by number:
  - Pallarenda, Bohle Plains, Gulliver, Mundingburra, Townsville City.
- 58 schools, with most located in the following areas:
  - 5 schools in Annandale, Condon and Deeragun

- 4 schools at Garbutt, Mundingburra and Townsville City
- 3 schools at Cranbrook, Gulliver, Pimlico, Kirwan, North Beaches and South Townsville.

7.2.15 Community Needs and Interests

The 2014 Townsville City Plan provides insight into the community needs and interests of the Townsville Community. Following from community engagement during the development of the Plan, it provides the vision of how Townsville should grow to meet the social, environmental and economic challenges of the future by providing a balance between encouraging continued growth whilst protecting the lifestyle of the community.

The Townsville City Plan identifies aims to achieve the following key outcomes:

- supporting the growth of Townsville as a more compact city structured around a network of centres, with more housing choice and affordability
- encouraging the revitalisation of the Townsville CBD to create a more vibrant and cosmopolitan community heart
- protecting traditional suburbs by preventing further development of small units in these areas, by targeting higher density development in centre locations
- seeking to control the cost of living for the community by managing future infrastructure needs
- protecting the natural environment, both in and out of the urban area, ensuring the city's waterways, wetlands, critical habitat and ecological corridors are retained and enhanced
- managing hazards in order to protect residents and build resilience
- protecting heritage and preserving culture
- supporting economic growth.

7.3 Cultural Heritage Values

7.3.1 Overview

The term *cultural heritage significance* is defined in the dictionary of the *Queensland Heritage Act* 1992 as 'a place or feature of a place, means its aesthetic, architectural, historical, scientific, social, or other significance, to the present generation or past or future generations'.

Cultural heritage may be a tangible representation of traditions, beliefs, lifestyles and values systems, but may also be intangible. Tangible representations may be preserved in the built environment or as artefacts, or may relate to the natural environment.

7.3.2 Indigenous Cultural Heritage

Indigenous cultural heritage values are interconnected with Aboriginal and Torres Strait Islander people's ongoing connection with land and sea country to connect their past and retell their stories. It is defined and managed by Aboriginal persons that are culturally responsible for the values of heritage significance.

The Indigenous heritage of Townsville is vast and spans for thousands of years. Traditional custodians of the Townsville land include the Bindal and Wulgurukaba Peoples. The Gurambilbarra Wulgurukaba

People have recently filed a native title claim with the National Native Title Tribunal (QC2016/007) over a substantial portion of the study area.

The study by Bird and Heim (2009) presents the results of an Indigenous cultural heritage investigation for the proposed Port of Townsville Marine Precinct and Port Expansion Projects.

The major findings of the study were that there was clear evidence that the overall Cleveland Bay coastline, which includes the Port of Townsville and areas adjacent to the Townsville SDA, has significant Aboriginal cultural heritage values. The area retains Indigenous cultural heritage based on the following:

- Current archaeological evidence indicates that Aboriginal people have occupied the Cleveland Bay coastline and adjacent coastal plains of Townsville for at last the last 4,000 years
- The onshore and offshore areas of the port represent part of the traditional land and sea country of the Gurambilbarra people, and with which the Traditional Owners maintain an enduring 'connection to country'
- Locations within or close to the Port of Townsville and Townsville SDA (such as Ross Creek, Ross River and Ross Island) have Aboriginal language names
- Ross River and Ross Creek are integral components of the Aboriginal creation story
- The areas in the vicinity of the Port of Townsville and the Townsville SDA were used traditionally for camping, foraging, and for other cultural purposes as meeting places and places where corroborees were held
- Tangible archaeological evidence in the form of shell middens, stone artefact scatters, rock shelters with paintings, scarred trees, ceremonial sites and a burial ground are contained on land areas in the vicinity of the Port of Townsville
- Ross River, Ross Island and Ross Creek represented one of the frontiers between European and Aboriginal societies in the first decade of Townsville's existence, commencing in 1864
- The areas accessible to the public continue to be visited today by the local Aboriginal people, mainly for fishing and beach foraging
- Further development at the port is anticipated to have no greater impact on Aboriginal cultural values than the many previous development projects (e.g. The Strand Redevelopment, existing Port of Townsville, land reclaimed for the Casino complex, marina, breakwater etc)
- While alterations to the environment in the development of the Port of Townsville have impacted Traditional Owner cultural values, Cleveland Bay, the Townsville Coastline and major waterways, such as Ross Creek and Ross River will nevertheless continue to be fundamental and significant places for Indigenous Culture.

The findings of the desktop study by Bird (2006) of the Townsville SDA were summarised in the Townsville Industrial Land Suitability Study (Maunsell AECOM, 2006) and reflected in the Townsville SDA Environmental Constraints Analysis Report (Saunders Havill Group, 2011). The cultural heritage literature within Bird (2006) confirmed that a substantial number of significant Aboriginal and non-Indigenous (historical) cultural heritage sites, places and values have been recorded within and adjacent to the Townsville SDA. That study identified five zones of cultural heritage value, four of which related to Indigenous cultural heritage. These are presented in Figure 7-5.

Table 7-17 Indigenous Cultural Heritage Zones Within or Adjacent to the Townsville

Zone	Location	Description
1	Sandfly Creek coastal areas	The hinterland beach ridges of the North of the Townsville SDA and extending into the Sunmetal property contain the Sandfly Creek Aboriginal burial ground with very high cultural heritage significance. The burial ground is a designated Reserve for Cultural Heritage Purposes. The study recommended a 200-250m buffer zone. This area is principally outside the SDA, and bordered mostly within the SDA by Environmental Conservation Precinct. It was strongly recommended that any future development within the Townsville SDA avoid the area immediately abutting the Sandyfly Creek area. Much of this area is zoned as Environmental Conservation Precinct within the Townsville SDA Development Scheme.
2	South bank of Ross River	The beach ridges and dune extending south from the Ross River have a high level of cultural significance to the Traditional Owners. Evidence suggested that Aboriginal people historically occupied the area and the potential exists for additional unrecorded cultural sites to occur. Any proposed development within this zone should be subject to detailed cultural heritage impact assessment and the development of a Cultural Heritage Management Plan (CHMP). Much of this area lies outside the Townsville SDA area. The portion within the SDA is currently zoned as Environmental Conservation Precinct or Minerals Transportation/ Services Corridor Precinct.
3	Stuart Creek and surrounds	Of non-Indigenous cultural heritage significance. Refer to Section 7.3.3.
4	Muntalunga Range	Toward the south of the Townsville SDA is the Muntalunga Range, which is reported to be the site of at least one rock art site, and has a high potential for additional Aboriginal cultural heritage site to occur. Very little archaeological research has been carried out across Muntalunga Range. Much of this area is set aside in the Townsville SDA as Transition Precinct.
5	Lagoons and wetlands	The lagoons and wetlands that occur across the TSDA were utilised by Aboriginal people during prehistoric and historic times, however the archaeological potential of these areas is considered low due to periodic flooding and seasonal inundation. These areas are zoned within in the Townsville SDA Development Scheme as Environmental Conservation Precinct, Ecological Corridors and Priority Offsets Precinct or Low – Medium Impact Port Related Industry Precinct.

Source: Saunders Havill Group, 2011

It was considered that generally, all lands across the Townsville Coastal plain, including the Townsville SDA, retains some level of cultural heritage significance to the Aboriginal Traditional Owners, as it was part of their traditional country and an integral part of their Aboriginal cultural landscape. From an archaeological perspective, those areas of the Townsville SDA lying outside of the five zones of cultural sensitivity (i.e. in the central and western areas) were considered to be potentially suitable for industrial development.

7.3.3 Non-Indigenous Cultural Heritage

Schedule 7 of the Townsville City Plan identifies areas of state and local cultural heritage significance. A non-Indigenous heritage study was commissioned by POTL as part of the Port Expansion Project EIS. That study conducted by AECOM (2009) examined heritage values in the existing Port of Townsville area and the nearby portion of the suburb of South Townsville. This area of investigation allowed for the consideration of potential direct impacts from the construction and operation of the Port Expansion Project, but also considered the cultural heritage values of areas adjoining, including the heritage values of the GBRWHA.

The study (AECOM, 2009) presented the findings of a thematic history, register search and site survey. The findings of the assessment are presented against a range of history themes, including:

- Selecting township sites
- Administering Australia
- Using natural resources
- Developing primary production
- Moving goods and people
- Defending the nation
- Enjoying the natural environment
- Making suburbs.

The historical accounts under these themes are recommended reading in the Port Expansion Project EIS (AECOM, 2013) for those seeking further detail. Clearly, the Port of Townsville has been highly significant to the history and development of the city of Townsville, and more broadly, since its establishment in 1864.

Searches of the Commonwealth, State and local heritage register and databases confirmed that there are 539 places of heritage significance in the study area. Search outcomes are summarised below:

- The Great Barrier Reef is the only place on the World Heritage List. It is also on the National Heritage List and the Commonwealth Heritage List. The Great Barrier Reef World Heritage Area extends seaward of the low tide mark along the coastline.
- 84 locations are listed on the Queensland Heritage Database
  - 70 of these places are located to the north of Ross Creek, and east of Woolcock Street/Boundary Street, and particularly along Flinders Street, and east to the Strand. The remaining eight comprise of:
    - Three properties on Magnetic Island
    - Two properties in South Townsville:

    - Victoria Park Hotel on Boundary Street
    - St John's Anglican Church Precinct on Macrossan Street
  - Rosebank on Lawson Street, Mysterton
  - Ross River Meatworks Chimney on Stuart Drive, Idalia
  - Grandstand at Cluden Racecourse
  - Operations and signals bunker (former) off Stuart Drive, Wulguru
  - St. Brigid's Church on Stuart Drive, Stuart
  - Stewart's Creek Gaol (former) on Centenary Drive off Dwyer Street, Stuart.
- 454 locations are on the local heritage register of Townsville City Council, which was informed by Brannock (2011)
  - As for places on the State register, many local heritage places lie on the northern side of Ross Creek, and to the east of Woolcock Street.
  - South Townsville has 48, which likely is a reflection of the development of Townsville being inextricably linked to the adjacent Port of Townsville.

While not included on any of the searches, Stuart Creek and surrounds were identified by Bird (2006) to be of non-Indigenous (historical) cultural heritage value. The channel and banks of Stuart Creek along the western side of the Townsville SDA is the site of several World War II sites, including Army camps and building foundations. The area was identified as having a high level of significance and research potential. Within the Townsville SDA Development Scheme, part of this area is designated as Transport and Support Services Precinct and Ecological Corridors and Priority Offset Precinct, and so is afforded a level of protection.

Search of the Australian National Shipwrecks Database maintained under the requirements of the *Historic Shipwrecks Act* 1976 listed 10 shipwreck locations within about five kilometres of the Port, including in Ross River and Ross Creek and in the Port of Townsville inner harbour. The ongoing presence of shipwrecks within the inner port, Ross River and Ross Creek is unknown, but seems unlikely given the disturbance that has occurred. There are no locations identified within the footprint of the POTL proposed PEP, which is expected to reflect the extent of reclamation within the Master Plan timeframe.

Townsville Evidence Base Report

Figure 7-5:
Indigenous (TSDA) and Non-Indigenous Cultural Heritage Locations

REGIONAL LOCATION

CITY CENTRE / PORT INSET

Townsville
Bowen
PROJECT LOCATION

0 2.5 5 7.5 10
Kilometres

Coordinate System: GCS GDA 1994
Datum: GDA 1994
Scale at A3 - 1:200,000

RATTLESNAKE ISLAND
HALIFAX BAY
MAGNETIC ISLAND
TOWNSVILLE CITY COUNCIL AREA
ROSS RIVER

Kissing Point Fort
Kissing Point Fortification & Jezzine Barracks (part)
Townsville Central State School
Queens Gardens
Castle Hill
Tobruk Memorial Baths
Anzac Memorial Park and adjacent Banyan trees
Townsville Magistrates Court (former)
Townsville City
St John's Anglican Church Precinct
South Townsville
West End Cemetery
Townsville Railway Station and North Yards Railway Workshops
Townsville Showground
Victoria Park Hotel
Port of Townsville

Horseshoe Bay
Arcadia
Nelly Bay
Picnic Bay
Cape Cleveland
Toolakea
Saunders Beach
Bluewater
Bushland Beach
Pallarenda
Yabulu
Deeragun
Garbutt
Townsville City
Port of Townsville
South Townsville
Mount Louisa
Pimlico
Gullivero
Hyde Park
Kirwano
Mundingburra
Cluden
Stuart
Bohle Plains
Alice River
Douglas
Condon
Wulguru
Elliot Springs

Cultural Heritage

- Existing local road network
- Existing rail network
- Townsville City Council LGA boundary
- Project area of interest
- Cemetery

Cultural Heritage

- Commonwealth non-indigenous heritage register places
- Queensland non-indigenous heritage register places

Townsville City Plan - Cultural heritage properties

- Local heritage
- State heritage

Townsville State Development Area

- Gazetted State Development Area - Townsville

TSDA cultural heritage zones

- Zone 1 - Sandfly Creek Coastal Area
- Zone 2 - South Bank of Ross River
- Zone 3 - Stuart Creek and Surrounds
- Zone 4 - Muntalunga Range
- Zone 5 - Lagoons and Wetlands

Source Information:
Local Government Area Boundaries - Queensland
Rail network - Queensland
Cemetery areas - Queensland
Queensland Department of Natural Resources and Mines
Commonwealth Heritage List Database
Australian Government Department of the Environment, Water, Heritage and the Arts
Queensland heritage register boundaries
Department of Environment and Heritage Protection
Townsville City Plan - Cultural heritage properties
Townsville City Plan - Overlay Map OM-04.1
State Development Area boundary - Townsville SDA
Queensland Department of State Development
TSDA cultural heritage zones
Indicative Cultural Heritage Zones digitised from Plan 9 of the Townsville State Development Area Environmental Constraints Analysis Report prepared by the Saunders Havill Group 9 November 2011 (Document no. 6045)

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30/11/2016 Rev: B ISSUED FOR INFORMATION Org: KM Chk: JAK

7.4 Constraining Values and Protection Measures

7.4.1 Environmental Values and Protection Areas

The study area is located within an environmentally sensitive region with a range of marine conservation areas, national parks and essential habitats, declared in statutory notices, within the study area. These areas are recognised as providing protection for the various communities they support (i.e. hard corals, fringing reefs, seagrasses and mangroves, endangered or vulnerable species). These sensitive items have been identified throughout the environment section of this document and have been summarised in Table 7-18.

Table 7-18 Environmental Constraints

Zone	Receiver	Description
	National and conservation Parks	National parks and other reserves include Magnetic Island, Paluma Range, and Bowling Green Bay National Parks; and the Cape Pallarenda and Townsville Town Common Conservation Parks.
	Regional Ecosystems (RE) (of concern and endangered)	376 RE's were identified, of these, 55 have been identified as endangered or of concern. Some endangered and of concern RE's occur adjacent to industrial and / or urban land. These include RE 11.3.4 adjacent to Queensland Nickel, RE 11.2.1 within the TSDA, RE 11.2.3/11.2.5 adjacent to Sun Metals. Several of concern and endangered RE's also occur along Bluewater Creek with urban development.
	Ecological communities (MNES)	Broad leaf tea-tree woodlands, Littoral Rainforest and Coastal Vine Thickets of Eastern Australia and semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregion have been identified.
	Threatened and migratory species (MNES)	43 listed threatened species and 41 migratory species have been identified. This includes birds, frogs, mammals, reptiles and plants.
	Nature Conservation Act (NCA) listed species (MSES)	Seven (7) endangered, 16 vulnerable and two near threatened species were identified.
Marine (including intertidal and wetland areas)	Mangroves	Substantial mangrove stands occur in Cleveland Bay and around Magnetic Island. These are protected by legislation administered by Department of Agriculture, Fisheries and Forestry, provide nursery habitat for many fish and invertebrate species as well as nesting habitat for birds and animals (POTL, 2014).

Zone	Receiver	Description
	Coral and seagrass communities	Coral reefs are present around Magnetic Island and between Magnetic Island and Townsville (e.g. Middle Reef). Sparse ephemeral deep seagrass beds have been identified throughout Cleveland Bay, including some detected in the offshore DMPA in 2007 and 2008. These communities support megafauna and a diversity of fish species.
	Wetlands (MNES)	Wetlands provide an important habitat for wading shorebirds and animals as well as removing nutrients from runoff and providing water retention areas. In addition to Bowling Green Bay and GBRMP, there are four wetlands of national importance (listed in the Directory of Important Wetlands): Burdekin-Townsville coastal aggregation and the Ross River Reservoir, RAAF Townsville, Ross River Reservoir and Wongaloo Swamps Aggregation
	Fish Nurseries	Estuaries and sheltered bays are recognised fish nurseries for a number of species, including key commercial / recreational species (e.g. barramundi). These are protected by various mechanisms including declared Fish Habitat Areas, zoning plans, licensing and catch limits.
	Threatened and migratory species (MNES)	12 listed threatened species and 23 migratory species have been identified. This includes birds, frogs, mammals, reptiles and plants.
	Nature Conservation Act (NCA) listed species (MSES)	Eight (8) vulnerable species were identified.

Zone	Receiver	Description
Protected Areas	GBRWHA	Cleveland and Halifax Bays are within the GBRWHA which is both a world and national heritage place.
	Marine Park	Cleveland and Halifax Bays are within both the Central region of the Commonwealth GBRMP and the State Great Barrier Reef Coast Marine Park. Port infrastructure is in an exclusion area, but some infrastructure abuts the marine park
	Dugong Protection Areas	A Dugong Protection Area has been declared throughout Cleveland Bay and in the southern portion of Halifax bay, with a range of controls e.g. regulated speed limits etc. to minimise dugong strikes from vessels.
	FHA	A Fish Habitat Area has been declared on the east side of Cleveland Bay and within estuaries of Ross River and Bowling Green Bay, as well as north of the Townsville Town Common Regional Park within Halifax Bay and the estuary of Bohle River to sustain local and regional fisheries. The FHA in Cleveland bay overlaps the GBRMP boundary near Ross River.
	Ramsar	A declared Ramsar wetland, Bowling Green Bay, is largely situated to the east of Cape Cleveland but also extends along the southeast coastline and tip of Cleveland Bay. The tip of Cleveland Bay is approximately 6 km from the closest point of the offshore DMPA. The maintenance dredge areas and the offshore DMPA are located >9 km from the Ramsar wetland.

7.4.2 Social Values

Social constraints in relation to the port generally refer to interfaces between sensitive land uses (urban) and port operations/infrastructure or port related land uses/infrastructure outside of the ports boundary. Sensitive land uses may be impacted by light, noise, dust or odour from port and port related activities (operations within the port, transportation corridors or port related/reliant industry). This may have amenity or health related impacts for communities in these areas.

Additionally the impacts these social constraints might also adversely impact on the operations of the port and related activities or infrastructure. The application of curfews or restricted operational hours and areas can adversely impact on the efficiency of port operations making it less attractive to potential users and increasing costs for existing ones.

Ultimate location (and intensified use) of supply chain corridors (e.g. road and rail lines) need to properly consider impact avoidance on the surrounding community – both in the short and long term.

7.4.3 Cultural Heritage Values

7.4.3.1 Indigenous Cultural Heritage

Bird and Heim (2009) state that generally, all lands across the Townsville Coastal plain, including the Townsville SDA, retains some level of cultural heritage significance to the Aboriginal Traditional Owners, as it was part of their traditional country and an integral part of their Aboriginal cultural landscape. Studies regarding the Port of Townsville and adjacent TSDA reflect the following considerations:

- Further development at the port is anticipated to have no greater impact on Aboriginal cultural values than the many previous development projects (e.g. The Strand Redevelopment, existing Port of Townsville, land reclaimed for the Casino complex, marina, breakwater etc)
- From an archaeological perspective, those areas of the Townsville SDA lying outside of the five zones of cultural sensitivity were considered to be potentially suitable for industrial development (i.e. in the central and western areas).

There is significant potential for currently unknown heritage sites to exist that have not yet been investigated. In Queensland, the key Acts relevant to Indigenous cultural heritage include the *Aboriginal Cultural Heritage Act* 2003 and the *Torres Strait Islander Cultural Heritage Act* 2003:

These Acts:

- provide blanket protection of areas and objects of traditional, customary, and archaeological significance
- recognise the key role of Traditional Owners in cultural heritage matters
- establish practical and flexible processes for dealing with cultural heritage in a timely manner.

'Guidelines' have been developed to assist land users and developers in assessing reasonable and practicable measures for meeting the cultural heritage duty of care. Those involved in land management and development that should exercise great caution before proceeding with an activity in circumstances where the nature and extent of the past land use of an area is not inconsistent with the continued presence of Aboriginal or Torres Strait Islander cultural heritage.

The Port of Townsville has a Cultural Heritage Management Plan in place that identifies how matters of Indigenous cultural heritage matters will be managed. The endorsed parties signed the CHMP in September 2008. Since that time 'Variation Agreements' have been signed addressing particular matters covered by the initial agreement.

7.4.3.2 Non-Indigenous Cultural Heritage

The development of Townsville has been inextricably linked with the Port of Townsville. Accordingly, there are numerous places of non-Indigenous cultural heritage in the vicinity, including South Townsville and central Townsville. There are few listed National or State cultural heritage locations compared to the many local heritage locations. Master planning should take into consideration areas of National and State cultural heritage and, where possible, aim to avoid or minimise development in that would impact on these heritage sites.

8 World Heritage – Outstanding Universal Value (OUV)

This section presents a method and results for identifying the local presence of Outstanding Universal Value (OUV) within the Great Barrier Reef World Heritage Area (GBRWHA) surrounding the Port of Townsville. It is based on previously accepted approaches (Eco Logical Australia and Open Lines 2013; and Adaptive Strategies and Open Lines 2015), which clearly reference important policy settings such as: the relevant EPBC Policy Statement, GBR Strategic Assessment, Outlook Report 2014 (GBRMPA, 2014) and the Reef 2050 Long Term Sustainability Plan.

8.1 Method and Results for Identifying the Local Presence of OUV

The method comprises two components:

- contextual information about OUV and the GBRWHA to provide a framework for the analysis; and
- a process to be applied at the local scale.

The local scale refers to the study area surrounding the Port of Townsville, with a focus on the marine and coastal areas of Cleveland Bay as well as Magnetic Island.

8.1.1 Contextual Information about OUV and the GBRWHA

All World Heritage properties have OUV. The concept of OUV underpins the basis for listing properties on the World Heritage List and protecting and managing World Heritage properties. OUV is defined in the *Operational Guidelines for the Implementation of the World Heritage Convention* (the Guidelines, UNESCO 2015). The definition states that OUV is "cultural and/or natural significance which is so exceptional as to transcend national boundaries and to be of common importance for present and future generations of all humanity."

For a World Heritage Property to be considered to have OUV, it must:

a) meet one or more of the ten World Heritage criteria listed in the Guidelines (UNESCO 2013);
b) meet the conditions of integrity and/or authenticity (noting that authenticity is not relevant to the GBR as a natural area); and
c) have an adequate protection and management system.

8.1.2 Statement of OUV for the GBRWHA

The OUV of a World Heritage Property is articulated in a Statement of OUV that is normally prepared at the time of inscription. Besides describing the attributes of the property that contribute to its OUV, the Statement of OUV provides the basis for the future protection and management of the property.

A Statement of OUV was not prepared for the GBRWHA at the time of inscription in 1981. However a retrospective Statement of OUV was prepared and adopted by the World Heritage Commission in July 2012 (GBRMPA 2012). The statement includes the following:

"As the world's most extensive coral reef ecosystem, the GBR is a globally outstanding and significant entity… The latitudinal and cross-shelf diversity, combined with diversity through the depths of the water column, encompasses a globally unique array of ecological communities, habitats and species. This diversity of species and habitats, and their interconnectivity, make the GBR one of the richest and most complex natural ecosystems on earth. There are over 1,500 species of fish, about 400 species of coral, 4,000 species of mollusc, and some 240 species of birds, plus a great diversity of sponges, anemones, marine worms, crustaceans, and other species. No other World Heritage property contains such biodiversity. This diversity, especially the endemic species, means the GBR is of enormous scientific and intrinsic importance, and it also contains a significant number of threatened species. At time of inscription, the IUCN evaluation stated "...if only one coral reef site in the world were to be chosen for the World Heritage List, the Great Barrier Reef is the site to be chosen."

8.1.3 Criteria for Assessing OUV

For a property to be listed, it must meet one or more of the following World Heritage criteria:

- Criterion (i) represent a masterpiece of human creative genius.
- Criterion (ii) exhibit an important interchange of human values, over a span of time or within a cultural area of the world, on developments in architecture or technology, monumental arts, town-planning or landscape design.
- Criterion (iii) bear a unique or at least exceptional testimony to a cultural tradition or to a civilization which is living or which has disappeared.
- Criterion (iv) be an outstanding example of a type of building, architectural or technological ensemble or landscape which illustrates (a) significant stage(s) in human history.
- Criterion (v) be an outstanding example of a traditional human settlement, land-use, or sea-use which is representative of a culture (or cultures), or human interaction with the environment especially when it has become vulnerable under the impact of irreversible change.
- Criterion (vi) be directly or tangibly associated with events or living traditions, with ideas, or with beliefs, with artistic and literary works of outstanding universal significance. (The Committee considers that this criterion should preferably be used in conjunction with other criteria).
- ✓ Criterion (vii) contain superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance.
- ✓ Criterion (viii) be outstanding examples representing major stages of earth's history, including the record of life, significant on-going geological processes in the development of landforms, or significant geomorphic or physiographic features.
- ✓ Criterion (ix) be outstanding examples representing significant on-going ecological and biological processes in the evolution and development of terrestrial, fresh water, coastal and marine ecosystems and communities of plants and animals.
- ✓ Criterion (x) contain the most important and significant natural habitats for in-situ conservation of biological diversity, including those containing threatened species of Outstanding Universal Value from the point of view of science or conservation.

The GBRWHA meets four of the natural World Heritage criteria: Criterion (vii), Criterion (viii), Criterion (ix) and Criterion (x) as marked with a tick (✓).

8.1.4 Integrity

All World Heritage properties are required to meet the conditions of integrity. This is defined by the Operational Guidelines (UNESCO 2013) as "a measure of the wholeness and intactness of the natural and/or cultural heritage and its attributes." An assessment of the integrity of a property is required to determine the extent to which the property:

- includes all elements necessary to express its OUV;
- is of adequate size to ensure the complete representation of the features and processes which convey the property's significance; and
- suffers from adverse effects of development and/or neglect.

The Statement of OUV (GBRMPA 2012) concludes that in relation to integrity:

- The integrity of the GBR is "enhanced by the unparalleled size and current good state of conservation across the area."
- While a number of natural pressures occur (e.g. cyclones and crown-of-thorns starfish outbreaks), given the scale of the GBR "most habitats or species groups have the capacity to recover from disturbance or withstand ongoing pressures."
- "The property is largely intact and includes the fullest possible representation of marine ecological, physical and chemical processes from the coast to the deep abyssal waters enabling the key interdependent elements to exist in their natural relationships."
- Effective conservation programs are essential in areas adjacent to the GBR (e.g. coastal catchments) given that some of the key processes of the Reef occur outside its boundaries.

8.1.5 Protection and Management

All World Heritage properties are required to be adequately protected and managed to ensure that their OUV (including the conditions of integrity at the time of inscription) are sustained or enhanced over time.

The Guidelines outline the broad level requirements for effective protection and management. This includes:

- appropriate legislative, regulatory and contractual measures for protection;
- boundaries for effective protection;
- buffer zones; and
- appropriate management systems.

Finally, the Guidelines also provide for the sustainable use of World Heritage Areas where that use does not adversely impact on the OUV of the property.

The Statement of OUV (GBRMPA 2012) outlines the protection and management arrangements that are in place for the GBRWHA. Responsibility for management is shared between the Commonwealth and Queensland Governments. Broadly these arrangements are:

- GBRMPA (an independent Australian Government agency) is responsible for protection and management of the GBR Marine Park. They administer the GBRMPA Act 1975, which is a component of the broader environment portfolio.
- The Queensland Government is responsible for management of the Great Barrier Reef Coast Marine Park which is established under the *Marine Parks Act 2004* (Qld). This area is contiguous with the GBR Marine Park and covers the "area between low and high water marks and many of the waters within the jurisdictional limits of Queensland." The Queensland Government is also responsible for management of most of the islands within the GBR. Both marine parks have consistent zoning and permitted activity schemes.
- The Commonwealth Government is responsible for administration of the EPBC Act, which provides an overarching mechanism for protecting the World Heritage attributes from inappropriate development, including actions taken inside or outside which could impact on its heritage attributes.
- A range of other Queensland and Commonwealth legislation also protects the World Heritage attributes of the GBR, for example, by addressing such matters as water quality, shipping management, sea dumping (dredging), fisheries management and environmental protection.

In addition to these broad governance arrangements, the Australian and Queensland governments have introduced a number of administrative and guidance documents to help protect the GBR, these include the following.

- Intergovernmental Agreement
  - In 2009 both the Australian and Queensland governments signed the Great Barrier Reef Intergovernmental Agreement, formalising the approach to manage marine and land environments within the Great Barrier Reef World Heritage Area.
- GBR Strategic Assessment
  - The Australian and Queensland governments have completed a comprehensive Strategic Assessment of the Great Barrier Reef World Heritage Area and adjacent coastal zone.
  - Strategic assessments enable a 'big-picture' approach to environment and heritage protection that provides certainty in the long term, by determining areas where no development will be allowed as well as those areas where sustainable development can go, the type of development that will be allowed and the conditions under which such development may proceed.
- Reef 2050 Long-Term Sustainability Plan
  - Stemming from the outcomes of the strategic assessment a Reef 2050 Long-Term Sustainability Plan (CoA 2015) has been developed that targets areas of action and seeks to address gaps for future management of the Great Barrier Reef World Heritage Area.
- EPBC Act Guidelines
  - The EPBC Act protects the World Heritage values of the Great Barrier Reef World Heritage Area from actions that have, will have or are likely to have a significant impact on those values. The protection and management of World Heritage properties should ensure that their values at the time of inscription are sustained and enhanced over time. This is done primarily through the protection of a property's attributes of Outstanding Universal Value.
- Great Barrier Reef Outlook Report
  - Produced every 5 years the GBR Outlook (GBRMPA, 2014) report provides an assessment and findings on the Great Barrier Reef's health, pressures and likely future condition.

8.1.6 Key attributes of the GBRWHA

The Statement of OUV identifies the key attributes that contribute to the OUV of the GBRWHA. It is noted in the EPBC Act guidelines (DoE, 2014) that attributes may not be expressed equally over the whole GBRWHA and that attributes can change over time as new information comes to light.

Table 8-1 Key Attributes of OUV for the GBRWHA

Natural beauty and natural phenomena (Criterion (vii))	Major stages of the Earth's evolutionary history (Criterion (viii))	Ecological and biological processes (Criterion (ix))	Habitats for conservation of biodiversity (Criterion (x))
Superlative natural beauty above and below the water	Continental shelf	Significant diversity of reef and island morphologies that reflects ongoing geomorphic, oceanographic and environmental processes	Diversity supporting marine and terrestrial species (global conservation significance)
String of reef structures	Flat-topped hills of eroded limestone	Cross-shelf, longshore and vertical connectivity	Coral reefs (400 species of corals in 60 genera)
Mosaic patterns of reefs, islands and coral cays that produce an unparalleled aerial panorama of seascapes	Continental islands	Coral reefs, sand banks and coral cays	Diversity of mangroves
Green vegetated islands	Coral cays	Beds of *Halimeda* algae	Diversity of seagrass
Spectacular sandy beaches	New phases of coral growth	Evolution of hard corals	Dugong
Azure waters	Old massive corals	Other fauna, including microfauna	Species of whales
Vast mangrove forests	Coral reef ecosystem	Over 4000 species of molluscs and over 1500 species of fish, plus a great diversity of sponges, anemones, marine worms, crustaceans	Species of dolphins

Natural beauty and natural phenomena (Criterion (vii))	Major stages of the Earth's evolutionary history (Criterion (viii))	Ecological and biological processes (Criterion (ix))	Habitats for conservation of biodiversity (Criterion (x))
Vegetated mountains	Inshore fringing reefs, mid-shelf reefs, and exposed outer reefs including examples of all stages of reef development	Vegetation of the cays and continental islands	Humpback whale calving
Lush rainforest gullies	Processes of geological and geomorphic evolution	Important role of birds, such as the pied imperial pigeon, in processes such as seed dispersal and plant colonisation	Marine turtles
Breeding colonies of seabirds and marine turtles	Unique and varied seascapes and landscapes		Green turtle breeding
Green turtle breeding	Continental slope		Marine turtle rookeries
Over-wintering butterflies	Deep oceanic waters		242 species of birds
Hard and soft corals	Abyssal plains		22 seabird species breeding (cays and some continental islands have globally significant sites)
Thousands of species of reef fish			Plant species and diversity and endemism (species being unique to a defined geographic location)
Coral spawning			Coral cays
Migrating whales			
Nesting turtles			
Significant spawning aggregations of many fish species			

Source: DoE 2014

8.1.7 Process for determining local presence of OUV

The process for determining the local presence of OUV is based around understanding which attributes are present and how important those attributes are within the context of the wider GBRWHA. The process involves:

- Identification of the attributes that occur within the local area (or surrounds).
- Analysis of the 'relative importance' of the presence of those attributes when compared with the broader GBRWHA.

8.1.7.1 Analysis of relative importance of attributes

For those attributes that are present, an analysis should be carried out to determine their 'relative importance' with respect to the overall GBRWHA. The following terms are used in this report:

- Not present: These attributes are not known to occur within or adjacent to the study area.
- Minor presence: These attributes occur in low abundance or across a small area (relative to the nature of the attribute across the GBRWHA).
- Moderate presence: These attributes occur in moderate abundances or across a moderately large area (relative to the nature of the attribute across the GBRWHA).
- Significant presence: These attributes are present in significant abundances or represent significant examples of the relevant attribute (relative to the nature of the attribute across the GBRWHA) - i.e. the occurrence of the attribute is specifically referred to within the Statement of OUV for the GBRWHA.

8.1.7.2 Outstanding Universal Value attributes relevant to Port of Townsville

The Port of Townsville's sea jurisdiction is within the GBRWHA, which is also a national heritage place. The port and its marine infrastructure, however, are in an exclusion area from the Central region of the Commonwealth GBRMP and the State Great Barrier Reef Coast Marine Park, but some port infrastructure abuts the marine park, e.g. the Sea Channel and the dredge material placement area (DMPA). Existing shipping channels accessing the Port of Townsville approach within approximately one kilometre of Bremner Point on Magnetic Island.

The following sections identify the attributes relevant to each listing criterion and identify if, and how, they are represented within the study area.

8.2 Assessment of Presence of Key Attributes within the Study Area

8.2.1 Contain superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance (Criterion vii)

The following table identifies the key attributes that contribute to the OUV of natural beauty and natural phenomena (Criterion vii) of the GBRWHA. Details of each attribute's presence within, or adjacent to the study area, are provided below.

Table 8-2: Key Attributes Contributing to the Natural Beauty And Natural Phenomena (Criterion vii) of the GBRWHA

Natural beauty and natural phenomena (Criterion vii)	Presence within or adjacent to Port of Townsville	Description of presence within or adjacent to the Port of Townsville study area
Vast mangrove forests	Significant presence	Substantial mangrove stands occur in Cleveland Bay and around Magnetic Island provide nursery habitat for many fish and invertebrate species as well as nesting habitat for birds and animals. The Bowling Green Bay Ramsar wetland (internationally listed) is located to the south of Townsville. Encompassing an area of 35,500 ha, the site is significant for its extensive and diverse complex of coastal wetlands, which are typical of the coastal wet-dry tropics of North Eastern Australia. The wetlands are mostly coastal plain covered in tidal mudflats, mangrove forest and salt marshes. The mangrove communities provide vital protection from strong winds, tidal surges and heavy rainfalls associated with cyclones and also trap tide-borne sediments and help control coastal erosion.

Natural beauty and natural phenomena (Criterion vii)	Presence within or adjacent to Port of Townsville	Description of presence within or adjacent to the Port of Townsville study area
Aggregations of a diversity of bird species, particularly migratory shorebirds in summer months	Significant presence	Shorebirds frequently occur within the study area, while feeding, resting or overflying from one area to another. Nearby inter-tidal shores are known for shorebird occurrence, providing a key roosting and feeding habitat. Many of those bird species that occur are listed as threatened or migratory species. The predominant nearby areas of bird habitation are located on the sandspit on the eastern bank of Ross River. On a broader scale, the Townsville region supports a number of wetland areas, including lake, marsh, river, estuarine and marine habitats. These habitats support extensive and valuable bird populations, including the migratory birds that fly through the coastal plain on their annual journey along the East Australian Flyway. Internationally significant numbers of shorebirds occur at a number of sites with the Great Barrier Reef World Heritage Area, including within the Bowling Green Bay Ramsar wetland.

Natural beauty and natural phenomena (Criterion vii)	Presence within or adjacent to Port of Townsville	Description of presence within or adjacent to the Port of Townsville study area
Superlative natural beauty above and below the water	Moderate presence	Castle Hill and Mount Stuart are key landform elements in the wider landscape rising above the urban areas of Townsville. The most important designated landscape in the region is the coastal vista bounding the waters of the GBRWHA. This includes the Port of Townsville, which existed prior to the listing of the GBRWHA. The bowl-shaped landscape of Cleveland Bay combined with the two key headlands of Cape Pallarenda and Cape Cleveland, and Magnetic Island. The natural character of this part of the GBRWHA is already influenced by the existing industrial development in a context of productive human endeavours and urban and industrial establishments along the shores of Cleveland Bay and Magnetic Island. Cleveland Bay supports numerous rich and diverse coastal habitats with varying ecological sensitivities, typically abundant in north-east Australia's coastal wet-dry tropics including: ▪ soft bottom communities, ▪ mangroves ▪ seagrass ▪ corals which occupy only around 1% of the Bay however, scenic amenity is of lower significance than in other areas within the GBRWHA. A wide diversity of marine habitat types including intertidal beaches, mangrove forests, saltmarshes, intertidal shoals, subtidal soft sediment habitats, rock walls, coral reefs and rocky shores exist within Cleveland Bay. Coral communities of biodiversity significance exist, particularly those around Magnetic Island.
Green vegetated islands	Moderate presence	Magnetic Island is a continental island with rocky granite headlands, sandy bays, covered with open eucalypt woodlands and surrounded by coral reefs.

Natural beauty and natural phenomena (Criterion vii)	Presence within or adjacent to Port of Townsville	Description of presence within or adjacent to the Port of Townsville study area
Hard and soft corals	Moderate presence	Reef communities comprised of hard corals exist around Magnetic Island, at Middle Reef and at Virago Shoal (located between Magnetic Island and Cape Pallarenda). A large number of hard corals have been recorded in these communities, including extensive areas of *Montipora digitata*. The distribution and abundance of coral species varies in the fringing reefs and is related to the physical characteristics of the substrate and energy environments. Coral cover, species diversity and aesthetic quality is generally considered higher in the fringing reefs on the northern side of Magnetic Island (Horseshoe Bay) than in other fringing reefs. The Cockle Bay reefs, located on the south-western side of Magnetic Island, are characterised by species that are better adapted to high siltation and turbidity, with a general trend toward decreasing coral density in comparison to reef habitat in Geoffrey Bay, located on the south-eastern side of Magnetic Island.
String of reef structures	Minor presence	Coral reefs are present fringing Magnetic Island and between Magnetic Island and Townsville (e.g. Middle Reef). Larger coral reefs, reefal lagoons or a string of reefs are absent for the study area.
Spectacular sandy beaches	Minor presence	Magnetic Island has a number of sandy beaches and bays. Mainland beaches are primarily course sand and mudflats.
Vegetated mountains	Minor presence	Rugged mountains rise abruptly from the coastal plain and include the mountains of Castle Hill and Mount Stuart, as well as the landform of Magnetic Island. Castle Hill and Mount Stuart are partially vegetated.

Natural beauty and natural phenomena (Criterion vii)	Presence within or adjacent to Port of Townsville	Description of presence within or adjacent to the Port of Townsville study area
Breeding colonies of seabirds and marine turtles	Minor presence	A number of species of sea turtles, including the endangered Loggerhead, Leatherback and olive ridley species, frequent Cleveland Bay and surrounding beaches. Green turtles are the most common. Magnetic Island beaches are known to be regular nesting sites for Green turtles, however, the density and population recruitment from these nesting locations is low in comparison the other sites within the GBR (e.g. Capricorn/Bunker islands group and at Raine Island). A variety of seabirds are present in the marine areas, including sea eagles, ospreys and brown boobies. However, large colonies of nesting seabirds (such as boobies and terns) do not occur within the study area. Most seabird colonies in the Great Barrier Reef are found on the islands and cays of the far northern, northern and southern areas where suitable nesting habitats are more common, with the most significant sites being Raine Island, Michaelmas Cay, the cays of the Swain Reefs and the islands of the Capricorn and Bunker Groups.
Green turtle breeding	Minor presence	Magnetic Island beaches are known to be regular nesting sites for Green turtles, however, the density and population recruitment from these nesting locations is low in comparison the other sites within the GBR (e.g. Capricorn/Bunker islands group and at Raine Island).

Natural beauty and natural phenomena (Criterion vii)	Presence within or adjacent to Port of Townsville	Description of presence within or adjacent to the Port of Townsville study area
Thousands of species of reef fish	Minor presence	The mangroves, seagrasses, reef and soft bottom benthic communities present in Cleveland Bay provide habitat for a variety of fish species. Fishing for target species is a common practice in Cleveland Bay, undertaken by traditional owner, commercial and recreational fishers within the tidal creeks and estuaries. Protected fish habitat areas have been established in Cleveland Bay and in the nearby Bohle River and Bowling Green Bay. These areas provide protection and are breeding grounds for target species such as barramundi, grunter, mud crabs and prawns. While these species are highly mobile, it is recognised that the loss of important habitat such as for feeding or breeding associated with habitats, including seagrasses, reef and benthic habitat, may affect long-term stock levels and abundance. Reef species are less abundant and are primarily restricted to the fringing reef areas around Magnetic Island and Middle Reef. Major aggregations for fish spawning have not been recorded. A compilation of existing records of soft sediment habitat associated fish species in Cleveland Bay (excluding reef fish and pelagic species) identified 253 species from 65 families in Cleveland Bay and the lower reaches of Ross Creek and Ross River. Approximately one-third of these species are migratory, including over 40 species that migrate between marine and freshwaters but not for breeding, 23 species that migrate in marine waters, 12 species that migrate between marine and freshwaters for breeding, and two species that migrate in freshwater environments.
Coral spawning	Minor presence	Reef communities comprised of hard corals exist around Magnetic Island, at Middle Reef and at Virago Shoal. As with other coral communities annual coral spawning occurs at these sites, generally for inshore reefs this occurs in October. The size and density of inshore reefs does not result in the mass spawning events more commonly associated with mid shelf and outer reefs.

Natural beauty and natural phenomena (Criterion vii)	Presence within or adjacent to Port of Townsville	Description of presence within or adjacent to the Port of Townsville study area
Migrating whales	Minor presence	Humpback whale adults and calves have occasionally been recorded within the coastal waters of Cleveland Bay, usually during August- September. The timing of these records indicates that whales were making their return journey to southern waters. The presence of calves indicates that the animals maybe resting during their migrations. Calving has not been observed in Cleveland Bay.
Nesting turtles	Minor presence	A number of species of sea turtles, including the endangered Loggerhead, Leatherback and Olive ridley species, frequent Cleveland Bay and surrounding beaches. Green turtles are the most common. Magnetic Island beaches are known to be regular nesting sites for green turtles, however, the density and population recruitment from these nesting locations is low in comparison the other sites within the GBR (e.g. Capricorn/Bunker islands group and at Raine Island).
Significant spawning aggregations of many fish species	Minor presence	The mangroves, seagrass, reef and soft bottom benthic communities present in Cleveland Bay provide habitat for a variety of fish species. Fishing for target species is a common practice in Cleveland Bay, undertaken by traditional owner, commercial and recreational fishers within the tidal creeks and estuaries. Protected fish habitat areas have been established in Cleveland Bay and in the nearby Bohle River and Bowling Green Bay. These areas provide protection and are breeding grounds for target species such as barramundi, grunter, mud crabs and prawns. While these species are highly mobile, it is recognised that the loss of important habitat such as for feeding or breeding associated with habitats, including seagrass, reef and benthic habitat, may affect long-term stock levels and abundance. Reef species are less abundant and are primarily restricted to the fringing reef areas around Magnetic Island and Middle Reef. Major aggregations for fish spawning have not been recorded.

Natural beauty and natural phenomena (Criterion vii)	Presence within or adjacent to Port of Townsville	Description of presence within or adjacent to the Port of Townsville study area
Mosaic patterns of reefs, islands and coral cays that produce an unparalleled aerial panorama of seascapes	Not present	The iconic image of corals, reefs, cays and islands is absent from Cleveland Bay. Magnetic Island, approximately 8 km north-east of Townsville, is surrounded by coral reefs, however, this land and seascape does not provide the panorama usually associated with the Great Barrier Reef.
Azure waters	Not present	
Lush rainforest gullies	Not present	
Over-wintering butterflies	Not present	

8.2.2 Be outstanding examples representing major stages of earth's history, including the record of life, significant on-going geological processes in the development of landforms, or significant geomorphic or physiographic features (Criterion viii)

The following table identifies the key attributes that contribute to the OUV of major stages of Earth's evolutionary history (Criterion viii) of the GBRWHA. Details of each attribute's presence within, or adjacent to study area, are provided below.

Table 8-3 : Key attributes Contributing to The Major Stages OF Earth's Evolutionary History (Criterion viii) of the GBRWHA

Major stages of the Earth's evolutionary history (Criterion viii)	Presence within or adjacent to Port of Townsville	Description of presence within or adjacent to the Port of Townsville study area
Coral reef ecosystem	Moderate presence	Reef communities comprised of hard corals exist around Magnetic Island, at Middle Reef and at Virago Shoal (located between Magnetic Island and Cape Pallarenda). A large number of hard corals have been recorded in these communities, including extensive areas of *Montipora digitata*. The distribution and abundance of coral species varies in the fringing reefs and is related to the physical characteristics of the substrate and energy environments.
Inshore fringing reefs, mid-shelf reefs, and exposed outer reefs including examples of all stages of reef development	Moderate presence	Reef communities comprised of hard corals exist around Magnetic Island, at Middle Reef and at Virago Shoal (located between Magnetic Island and Cape Pallarenda). A large number of hard corals have been recorded in these communities, including extensive areas of *Montipora digitata*. The distribution and abundance of coral species varies in the fringing reefs and is related to the physical characteristics of the substrate and energy environments.
Continental islands	Minor presence	Magnetic Island is a continental island about 8 km north-east of Townsville. Magnetic Island is a moderately mountainous island with rocky granite headlands, sandy bays, covered with open eucalypt woodlands and surrounded by coral reefs.

Major stages of the Earth's evolutionary history (Criterion viii)	Presence within or adjacent to Port of Townsville	Description of presence within or adjacent to the Port of Townsville study area
Processes of geological and geomorphic evolution	Minor presence	Townsville is underlain by Quaternary-age alluvium and colluvium sediments, which in turn overlie basement geology comprising Late-Palaeozoic age Granite. The near surface lithology comprises Holocene sediments more than 12,000 years old, including silts, mud and sand described as coastal tidal flats, mangrove flats and saltpans.
Unique and varied seascapes and landscapes	Minor presence	Cleveland Bay provides a variety of seascapes and landscapes including open water, continental islands, sand beaches, mudflats, mangroves and vegetated hills and headlands. The seascapes and landscapes are not unique or unusual in a GBR wide context.
Coral cays	Not present	
New phases of coral growth	Not present	
Old massive corals	Not present	
Continental slope	Not present	
Deep oceanic waters	Not present	
Abyssal plains	Not present	

8.2.3 Be outstanding examples representing significant on-going ecological and biological processes in the evolution and development of terrestrial, fresh water, coastal and marine ecosystems and communities of plants and animals (Criterion IX)

The following table identifies the key attributes that contribute to the OUV of ecological and biological processes (Criterion ix) of the GBRWHA. Details of each attribute's presence within, or adjacent to the study area, are provided below.

Table 8-4 Key Attributes Contributing to the Ecological and Biological Processes (Criterion ix) of the Great Barrier Reef World Heritage Area

Ecological and biological processes (Criterion ix)	Presence within or adjacent to the Port of Townsville study area	Description of presence within or adjacent to the Port of Townsville study area
Over 4000 species of molluscs and over 1500 species of fish, plus a great diversity of sponges, anemones, marine worms, crustaceans and many others	Moderate presence	Common benthic flora and fauna are present in the marine areas. The intertidal areas are a key habitat for many species of invertebrates (e.g. crabs, shell fish, worms).
Significant diversity of reef and island morphologies that reflects ongoing geomorphic, oceanographic and environmental processes	Minor presence	Fringing coral reefs are present around Magnetic Island and between Magnetic Island and Townsville (e.g. Middle Reef). Magnetic Island and coastal areas represent geomorphic processes, including ancient volcanic activity.
Cross-shelf, longshore and vertical connectivity	Minor presence	The offshore areas of Cleveland Bay form part of the larger longshore connections within the GBR lagoon.

Ecological and biological processes (Criterion ix)	Presence within or adjacent to the Port of Townsville study area	Description of presence within or adjacent to the Port of Townsville study area
Coral reefs, sand banks and coral cays	Minor presence	Fringing coral reefs are present around Magnetic Island and between Magnetic Island and Townsville. No coral cays are present in Cleveland Bay.
Beds of Halimeda algae	Minor presence	Halimeda beds occur around Cockle Bay (southern Magnetic island), but at the time of 2012 reef surveys, were not found to be a significant (>5% cover).
Vegetation of the cays and continental islands	Minor presence	Magnetic Island is covered with open eucalypt woodlands as well as Hoop pines and other remnant vegetation.
Evolution of hard corals	Not present	
Important role of birds, such as the pied imperial pigeon, in processes such as seed dispersal and plant colonisation.	Not present	

8.2.4 Contain the most important and significant natural habitats for in-situ conservation of biological diversity, including those containing threatened species of Outstanding Universal Value from the point of view of science or conservation (Criterion x)

The following table identifies the key attributes that contribute to habitats for conservation of biodiversity (Criterion x) of the GBRWHA. Details of each attribute's presence within, or adjacent to the study area, are provided below.

Table 8-5 Key Attributes Contributing to Habitats for Conservation of Biodiversity (Criterion x) of the Great Barrier Reef World Heritage Area

Habitats for conservation of biodiversity (Criterion x)	Presence within or adjacent to the Port of Townsville study area	Description of presence within or adjacent to the Port of Townsville study area
Diversity of mangroves	Significant presence	Substantial mangrove stands occur in Cleveland Bay and around Magnetic Island, which provide nursery habitat for many fish and invertebrate species as well as nesting habitat for birds and animals. A total of 12 species of mangrove have been recorded. Mangrove communities are most extensive in the southern portion of Cleveland Bay between Sandfly and Cocoa creeks and in the Ross River, south of the port. Smaller, structurally simpler mangrove stands occur in Rowes Bay and at Three Mile Creek.

Habitats for conservation of biodiversity (Criterion x)	Presence within or adjacent to the Port of Townsville study area	Description of presence within or adjacent to the Port of Townsville study area
Diversity of seagrass	Significant presence	Cleveland Bay contains some of the most extensive and diverse seagrass meadows in north Queensland. Eight species of seagrass have been recorded in Cleveland Bay, namely *Zostera muelleri*, *Halodule uninervis*, *Syringodium isoetifolium*, *Cymodocea serrulata*, *Halophila spinulosa*, *Halophila ovalis*, *Halophila decipiens* and *Thalassia hemprichii*. Seagrass beds are most extensive in the eastern portion of Cleveland Bay, with smaller beds occurring off the Strand, Kissing Point, Pallarenda Beach and some bays fringing Magnetic Island. The seagrass habitats within this region are of high ecological significance and provide a regionally important foraging habitat for threatened species such as dugongs and turtles and economically important fishery species. The primary locations within Cleveland Bay for seagrasses tend to be in areas that are less than 4 m in depth, between the mainland and Magnetic Island, and adjacent to Cape Cleveland (Lee Long et al. 1993).
Dugong	Significant presence	Cleveland Bay is recognised as dugong habitat and is a declared Dugong Protection Area. Dugongs are abundant in Cleveland Bay, and as mentioned above, the Bay is thought to be an important dugong habitat at a regional scale.
242 species of birds	Significant presence	Intertidal areas provide foraging habitat for many species of wading birds and migratory bird species, particularly the east bank of Ross River and at Cape Cleveland. A variety of sea birds are present in the marine areas, including sea eagles, ospreys and brown boobies.
Diversity supporting marine and terrestrial species (global conservation significance)	Moderate presence	Cleveland Bay, Magnetic Island and surrounding areas provide habitat for a large range of species and ecosystems, the most notable being the habitats of the Bowling Green Bay Ramsar wetland area and the migratory birds that use this area. Absent from the area is the biological diversity of coral reefs and cays, rainforests, seabird rookeries and marine fauna aggregations.

Habitats for conservation of biodiversity (Criterion x)	Presence within or adjacent to the Port of Townsville study area	Description of presence within or adjacent to the Port of Townsville study area
Coral reefs (400 species of corals in 60 genera)	Moderate presence	Coral reefs form a benthic primary producer habitat. Cleveland Bay supports a network of near-shore reefs, which have different levels of inter-connectivity and habitat structure. Based on mapping from the GBRMPA, the total area of reef habitat in Cleveland Bay is approximately 987 hectares. Reef habitats in Cleveland Bay include shallow fringing reefs and rocky shores around Magnetic Island; the well-developed reef platform of Middle Reef; and smaller, less developed reef areas between the mainland and Magnetic Island (e.g. Virago Shoal).
Species of dolphins	Moderate presence	A number of dolphin species are known or likely to occur in Cleveland Bay, including: Australian snubfin dolphin, Indo-Pacific humpback dolphin, Common dolphin and the Bottlenose dolphin. While many of these species favour offshore habitats, the Australian snubfin dolphin (and Indo-Pacific humpback dolphin are common in nearshore environments throughout Cleveland Bay, and are likely to regularly feed in the port area, including the mouths of Ross Creek and Ross River.
Species of whales	Minor presence	Humpback whale adults and calves have occasionally been recorded within the coastal waters of Cleveland Bay, usually during August- September. The timing of these records indicates that were whales were making their return journey to southern waters. The presence of calves indicates that the animals maybe resting during their migrations. Calving has not been observed in Cleveland Bay.
Marine turtles	Minor presence	A number of species of sea turtles, including the endangered Loggerhead, Leatherback and olive ridley species, frequent Cleveland Bay and surrounding beaches. Green turtles are the most common.

Habitats for conservation of biodiversity (Criterion x)	Presence within or adjacent to the Port of Townsville study area	Description of presence within or adjacent to the Port of Townsville study area
Green turtle breeding	Minor presence	Magnetic Island beaches are known to be regular nesting sites for green turtles, however, the density and population recruitment from these nesting locations is low in comparison the other sites within the GBR (e.g. Capricorn/Bunker islands group and at Raine Island).
Marine turtle rookeries	Minor presence	Cleveland Bay is not an important turtle breeding area, with most turtles in the region believed to have originated from rookeries elsewhere on the central and north Queensland coast and islands, or in other countries. The exception to this is Green turtles. Low density nesting for this species has been reported on a number of sandy beaches adjacent to the Study Area and surrounds, including Magnetic Island.
Plant species and diversity and endemism (species being unique to a defined geographic location)	Minor presence	There is only very minor representation of plant species of conservation significance present within the study area, including several threatened mangrove species and *Croton magneticus*, which is recorded from Magnetic Island.
Humpback whale calving	Not present	
22 seabird species breeding (cays and some continental islands have globally significant breeding sites)	Not present	
Coral cays	Not present	

8.2.5 Integrity

Integrity of the Great Barrier Reef World Heritage Area is also a key aspect of OUV. The Statement of OUV recognises that "The ecological integrity of the Great Barrier Reef is enhanced by the unparalleled size and good state of conservation across the property. At the time of inscription it was felt that to include virtually the entire Great Barrier Reef within the property was the only way to ensure the integrity of the coral reef ecosystems in all their diversity."

The components of integrity include wholeness, intactness and threats (DoE 2014). The following table identifies the key attributes that contribute to the integrity of the GBRWHA. Details of each attribute's relevance to the study area and future development are provided below.

Table 8-6 Attributes of Integrity

Integrity (wholeness, intactness and threats)	Relevance to the Port of Townsville study area
Unparalleled size	The GBRWHA is 348 000 km2, the coastal and offshore areas of the study area represents a minor fraction of this area. The future development of Port of Townsville will not lead to a decrease in the overall size of the WHA.
Scale of the Great Barrier Reef ecosystem	The reef ecosystem is extremely large and complex, it is made up of a large number of different but connected ecosystems from coral reefs and lagoons to islands, beaches and mangrove areas. The mangrove, wetland habitats, open water and Magnetic Island environments represents an important component of this ecosystem.
Integrity of the coral reef ecosystems in all their diversity	The nearest significant coral reef ecosystems to Port of Townsville are over 20 km distant. The fringing reef systems around Magnetic Island and Middle reef represent a minor contribution to these ecosystems.
Property is largely intact and includes the fullest possible representation of marine ecological, physical and chemical processes enabling key interdependent attributes to exist in their natural relationships	The study area represents a minor fraction of the property and has been an industrial port since the inception of the World Heritage area.

Integrity (wholeness, intactness and threats)	Relevance to the Port of Townsville study area
Key ecological, physical and chemical processes essential for long-term conservation of marine and island ecosystems and their associated biodiversity occur outside property's boundaries	The Bowling Green Bay wetland complex represents an important and valuable component of the regional ecosystem. Whilst not directly within the GBRWHA, the wetland's adjacency allows connectivity between the wetland and the World Heritage Area. This helps ensure that the ecological functions within the WHA continue to exist and function effectively.
Good state of conservation across the property	Protected areas and management regimes within Cleveland Bay will continue to provide for the conservation of relevant values.

8.2.6 Expression of OUV

The evaluation of key attributes expressed within Cleveland Bay - Port of Townsville study area has determined that there are several attributes with moderate or significant presence. These attributes can be summarised as follows.

Significant presence

- Important populations of migratory shorebirds occurring in wetland and intertidal and roosting locations primarily within the Bowling Green Bay Ramsar wetland and areas east of the Ross River
- Substantial mangrove stands occur in Cleveland Bay and around Magnetic Island that provide nursery habitat for many fish and invertebrate species as well as nesting habitat for birds and animals. A total of 12 species of mangrove have been recorded
- Cleveland Bay contains some of the most extensive and diverse seagrass meadows in north Queensland. Eight species of seagrass have been recorded in Cleveland Bay
- Cleveland Bay is recognised as dugong habitat and is a declared Dugong Protection Area.

Moderate presence

- The broader areas of Cleveland Bay, Magnetic Island and Cape Cleveland provide a contribution to the superlative natural beauty of the World Heritage Area
- Magnetic Island is a notable example of a green vegetated island
- The reef communities comprised of hard corals around Magnetic Island, at Middle Reef and at Virago Shoal contribute to OUV as do the intertidal areas, which are a key habitat for many species of invertebrates (e.g. crabs, shell fish, worms).

The findings indicate that the OUV of the GBRWHA is expressed within the Port of Townsville study area through the presence of important populations of shorebirds and occurrences of mangroves, seagrass and to a lesser extent coral reefs and island and seascapes.

9 Proposed Boundary of Master Plan and Precincts

In the context of determining the proposed boundaries of the master plan it is important to consider the legal/regulatory purpose of the master plan. Under the *Sustainable Ports Development* Act the purpose of the master plan is defined as:

- concentrating port development in priority ports;
- recognising the diverse functions of the port network (trade, tourism and defence);
- efficiently using port and supply chain infrastructure;
- expanding port and supply chain capacity in a staged and incremental way to meet emerging demand for imports and exports;
- identifying and protecting land and infrastructure critical to the port network.

The master plan will take a long term approach to planning for the port (2050 planning horizon) and will be implemented through a Port Overlay. The Port Overlay allows for the implementation of the master plan through the existing planning system and can address both planning and non-planning (operational) matters.

9.1 Methodology

In determining a proposed boundary for the Port Master Plan a primary objective was to apply a transparent process where the criteria used for determining the boundaries are clearly defined and can be tested/questioned. The process is qualitative and the outcomes reflect the information available to decision makers at the time of the study.

Important locations to the port were first identified at a broad level across the region using the first group of screening criteria. These locations were then refined with specific boundaries determined utilising the second group of criteria.

9.1.1 Development Scenarios

The Australian and Queensland Governments are currently driving agendas to develop northern Australia.

- In June 2015, the Australian Government released its White Paper on Developing Northern Australia, which is a plan to unlock the economic potential and opportunities of the North.
- In February 2016, Infrastructure Australia (IA) released its Australian Infrastructure Plan which sets out the infrastructure challenges and opportunities Australia faces over the next 15 years and the solutions required to drive productivity forward. IA completed an audit of the infrastructure and found that in the coming decades, the Pilbara, Townsville, Gladstone and Cairns are likely to grow their populations and economies.

- In March 2016, the Queensland Government published its State Infrastructure Plan (SIP) which sets out its plan for major infrastructure for the future with a focus on the next four years. The SIP allocated funds for projects related to Townsville, including funds for the Townsville Port Berth 4 upgrade.
- The Australian Government has approved a $5 billion North Australia Infrastructure Facility (NAIF) which will offer concessional loans to encourage and complement private sector investment in economic infrastructure.

These initiatives point towards continued investment in northern Queensland to encourage and support economic development in the future.

Based on the available economic data and forecasts available to the project and the need for the Master Plan to accommodate all future growth, only a single 'ultimate growth' scenario has been considered assuming that predicted trade volumes for 2043/44 are achieved. These estimates have been prepared by the POTL and utilised throughout their forward planning for the future of the port. They are considered to be the logical 'upper threshold' of all future development at the port.

Consequently, any intermediate scenarios would serve little purpose in the context of a long term master plan for the ultimate development of the port as they would only represent intermediate steps towards the ultimate development of the port.

It should be noted that there is greater confidence in the total long term volumes and product types identified than their build up over time. Fluctuating global markets, a move towards more renewable energy sources and competing resources in other locations will all influence the long term development of trade volumes through the Port.

Use of these forecasts will ensure that the master plan represents a 30 year planning horizon. Monitoring of freight volumes, port and industrial activities during this time period will provide adequate time to adjust these boundaries through future reviews of the Master Plan should this be required.

9.1.2 Criteria

The following criteria have been developed to guide the identification of the master plan boundary and its precincts.

9.1.2.1 Group 1 Criteria

The following high level criteria have been used to determine the general areas, corridors and infrastructure that should be included in the master planned area. Key environmental, social and cultural heritage values are considered for inclusion to ensure that the proposed Master Plan Boundary has sufficient coverage to allow these to be assessed in subsequent phases of master plan development.

Level of Influence Required

Key to the future success of the Master Plan is ensuring that it includes all necessary land uses and infrastructure for the future operation of the port:

"Is this activity/land/infrastructure required within the Master Plan boundary to ensure an adequate level of influence over planning and operations in the future?"

Existing/Proposed Future Land Uses

This criterion relates to the type of activity or land use on a given land parcel both existing and planned and how they will influence future port operations:

"How directly are the existing or proposed land uses on a given parcel of land connected to the future operations of the port? Are they critical port related activities?"

Existing/Proposed Infrastructure

This criterion relates to port related infrastructure extending out of the port into the broader region:

"Is the infrastructure directly related to the operation of the port? Will this relationship change in the future? Are there external relationships that will influence the operation of this infrastructure?"

Key Environment, Social and Heritage Values

This criterion relates to areas of high environmental, social, cultural heritage value or OUV, which may influence port and associated infrastructure development and operations:

"Are there areas of high environmental, social or cultural heritage value that may influence or be influenced by port (or associated infrastructure) development or operations and must be included within the Master Plan boundary to ensure adequate level of consideration in subsequent phases of master planning?"

High value aspects for consideration include:

- Areas of significant or moderate OUV as identified in Section 8.2.6
- Areas identified as constraining environmental values and protection areas in Section 7.4.1
- Areas of Indigenous cultural heritage significance
- Areas of National or Queensland non-Indigenous cultural heritage significance.

Townsville City Plan areas of environmental management are not specifically included but should, together with other environmental values, be considered in the environmental risk assessment.

9.1.2.2 Group 2 Criteria

These criteria have been used to refine the areas initially identified and develop firm boundaries that recognise as far as practical the existing spatial framework.

Environmental and Social Constraints

The Port of Townsville is located in the heart of Townsville with transportation corridors extending out into the hinterland. Supporting industrial activities are located throughout the wider urban area and the region itself. In some locations these activities may have an interface with existing areas of social and environmental significance. These locations must be considered in the context of the Master Plan's ultimate boundaries.

"Are there environmental and social constraints that influence the use of this land or adjacent land parcels for particular port related land uses?"

Boundaries

Proposed boundaries for the master plan precincts should be logical and where practical acknowledge existing boundaries.

"The boundary for the Master Plan including the identification of precincts should consider existing boundaries relating to cadastre, planning areas, ownership and cultural or environmental areas, however it is not bound nor restricted by them."

Ownership

"Although the land ownership does not impact on the application of the Master Plan it is still important to acknowledge existing ownership arrangements."

Infrastructure Corridors

Infrastructure corridors are of critical importance to the current and future operation of the port, they should therefore form a critical part of the master plan.

"In addition to the reserve within which the Infrastructure is constructed (or is planned) the broad corridor (adjacent land) should also be considered in the context of how these adjoining land uses impact on the operation of the corridor and how the corridor impacts adjacent land uses."

9.1.3 Assumptions

Two simple assumptions have been used to underpin the selection of all precincts and their boundaries. These are:

- All boundaries identified in this study will be further refined in future stages of the master plan as more detailed investigations are undertaken

- If there is any doubt as to whether an area should be included in the master plan, it should be included at this stage to facilitate further discussion

9.2 Proposed Master Planned Area Boundary

Development of the proposed Master Planned Area boundary has occurred in two steps:

1. Identification of areas of interest at high level based on the screening criteria outlined in section 9.1.2.1.

2. Further definition of the areas of interest based on the screening criteria outlined in section 9.1.2.2.

Not all areas of interest have been suggested for inclusion in the proposed Master Planned Area boundary. Following stakeholder consultation, it has been agreed that industrial areas need not be included in the proposed Master Planned Area at this stage but should be further considered in the Infrastructure and Supply Chain Study.

Stakeholder consultation resulted in the Oonoonba PDA not being included in the proposed Master Planned Area at this stage. This recognises that interface issues such as urban encroachment are not unique to the Oonoonba PDA and occur along all transport corridors and as such are best dealt with through corridor planning.

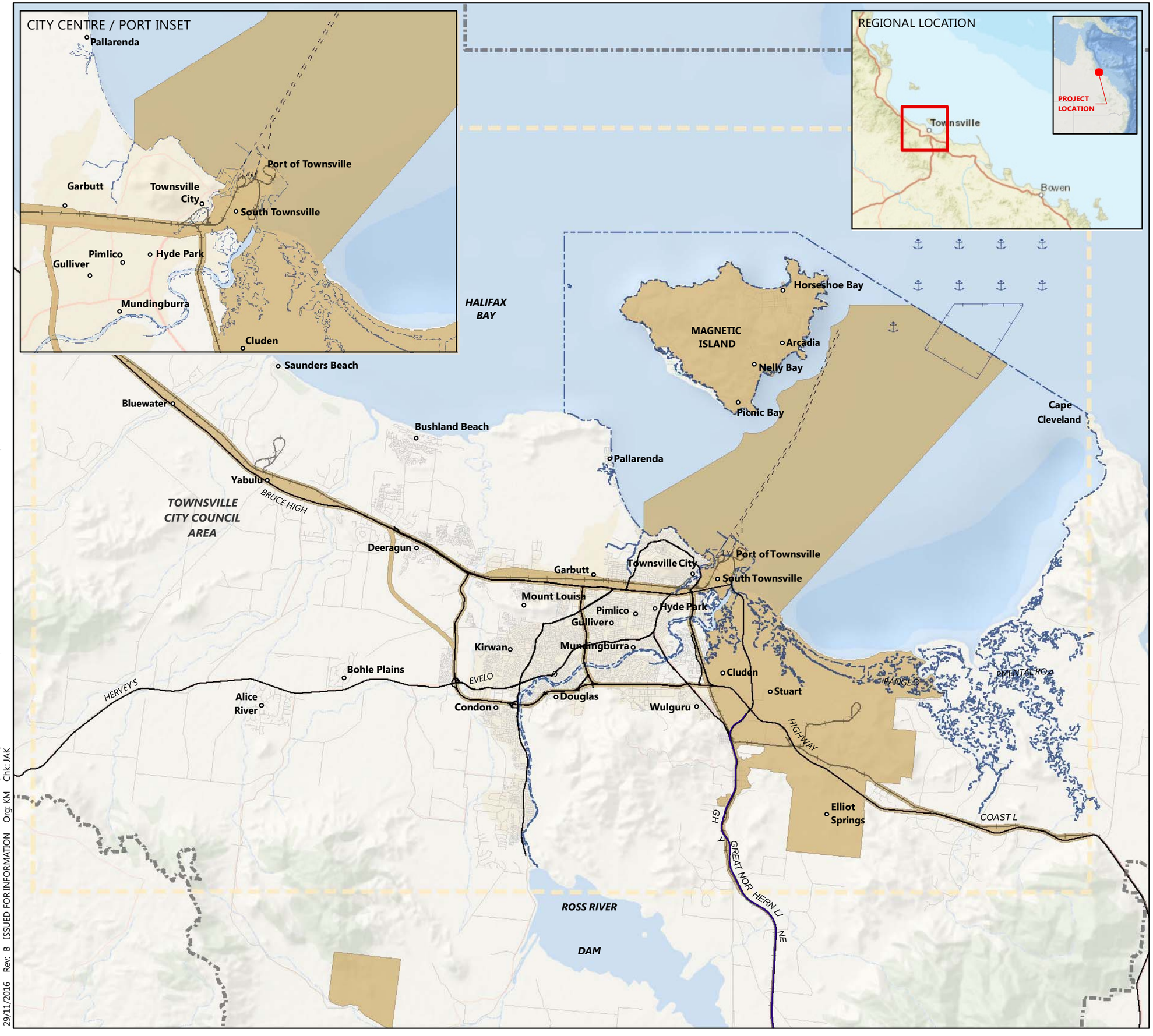
The transport corridors enabling access to key industrial areas and to the port are to be the focus of master planning and therefore are suggested for inclusion in the proposed Master Planned Area. Figure 6-23 identifies the broad areas of interest as identified earlier in Section 6.6.

9.2.1 Basis for Proposed Master Plan Boundary

Figure 9-2 identifies the proposed boundary for the master planned area. This area is then broken down into a number of precincts which are then discussed in Section 9.3.

Townsville Evidence Base Report

Figure 9-1:
Proposed Master Plan Boundary



- Existing state-controlled road
- Existing road network
- Existing rail network
- Existing port anchorage
- Existing channel
- Existing dredge material placement area
- Port bounds
- Townsville City Council LGA boundary
- Project area of interest
- Proposed Master Plan Boundary

Source Information:
Maritime Safety Queensland Port Areas
Queensland Department of Transport and Main Roads
Local Government Area Boundaries - Queensland
Rail network - Queensland
Queensland Department of Natural Resources and Mines
Road network
Townsville City Council
Existing channel
Digitised from Seafarer Chart AUS827 Cape Bowling Green to Palm Isles

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Scale at A3 - 1:200,000
Coordinate System: GCS GDA 1994
Datum: GDA 1994

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29/11/2016 Rev: B ISSUED FOR INFORMATION Org: KM Chk: JAK

9.3 Proposed Precinct Types

Within the Master Planned area there will be a number of precincts. The purpose of these precincts is to define different areas, uses or activities within the overall Master Plan precinct areas.

Table 9-1 provides definitions that have been developed as part of parallel master planning projects at other priority ports in Queensland.

Table 9-1 Proposed Precinct Types

Precinct (and Code)	Purpose	Description	Indicative Uses
Environmental Management (EM)	To limit development and manage environmental values consistent with ESD principles.	Development in this precinct is not encouraged. Low impact development that supports the protection of the values of the area is preferred. Development is compatible with Traditional Owner access, but general public access is limited.	Cultural heritage management Cultural centre Visitor's centre Environmental research or management centre Walking trails Bird observation platform

Precinct (and Code)	Purpose	Description	Indicative Uses
Interface (I)	To manage interface issues between sensitive uses and port related uses and development.	Development will not hinder the growth or development of port related infrastructure and supply chain corridors and industry. Development appropriately manages port related impacts on sensitive uses.	Intensification of existing sensitive uses will be limited adjacent to port related infrastructure, supply chain corridors and industry. New development will be required to mitigate any impacts from adjoining port operations or development Areas may include buffer zones, parks, and recreational activities. These areas are generally accessible to the public.
Infrastructure and supply chain corridors (ISCC)	To allow for aggregation and protection of critical on-land and marine infrastructure and supply chain functions to and from the port, as well as within the master planned area.	Development includes defined corridors to accommodate existing and planned major roads, rail, conveyors, pipelines, power lines and other utilities that service multiple sites within the master planned area.	Roads Railway Conveyors Shipping channels Pipelines Energy supply and reticulation

Precinct (and Code)	Purpose	Description	Indicative Uses
Port industry and commerce (PIC)	To allow for port operations, general and heavy industry, port related commercial activities and related development.	Development is for port related purposes, development for other purposes will be limited. Public access is generally limited in this area to the workforce, except where necessary to access public facilities. It may include undeveloped land that has been identified as having potential to house port related development or infrastructure that supports transporting commodities to and from port areas. It may also accommodate other associated commercial development that supports port activities.	Export and import terminals Manufacturing plants, storage facilities Cruise ship facilities Defence facilities Extractive industries, support industries Transport services Commercial facilities, warehousing, laydown areas, offices, service facilities Industry services, connecting roads, rail and utilities

Precinct (and Code)	Purpose	Description	Indicative Uses
Marine (M)	To ensure port access to wharves, channels, anchorages and waterside areas and to provide for marine based port infrastructure	Development takes place in or over tidal waters for port related purposes. Development includes actions necessary for the safety and efficiency of port operations.	Below water: channels, moorings, berth pockets, swing basins. Above water: road, rail, pipelines, wharves, jetties, causeways, ship berths, tug harbours, boat harbours, and boat ramps, marine offloading facilities. Dredging Creation of reclaimed land Beneficial reuse of dredged materials. Road, rail, conveyors or services may be located on the marine infrastructure.

Precinct (and Code)	Purpose	Description	Indicative Uses
Marine services and recreation (MSR)	To provide for coastal dependent development other than port infrastructure, including a range of maritime services, marina, related commercial activities and public use activities that in order to function must be located in tidal waters or be able to access tidal water	Light industrial and commercial development that in order to function must be located in tidal waters or be able to access tidal water. Development that is compatible with port operations and infrastructure. Provides for commercial and recreational fishing and boating (where not restricted for safety or security reasons). Development is located to provide direct public access to the harbour, such as boat ramps and public car parks. Residential and retail development is generally limited in this area.	Marina Boat harbours Slipways Boat yards Service industries Boat ramps Refuelling and waste management Parks, recreational facilities, public beaches, open space boat harbours, boat ramps, community facilities and sporting facilities such as surf clubs, marine rescue, rowing and sailing clubs.

9.3.1 Basis for Proposed Master Plan Precinct Boundaries

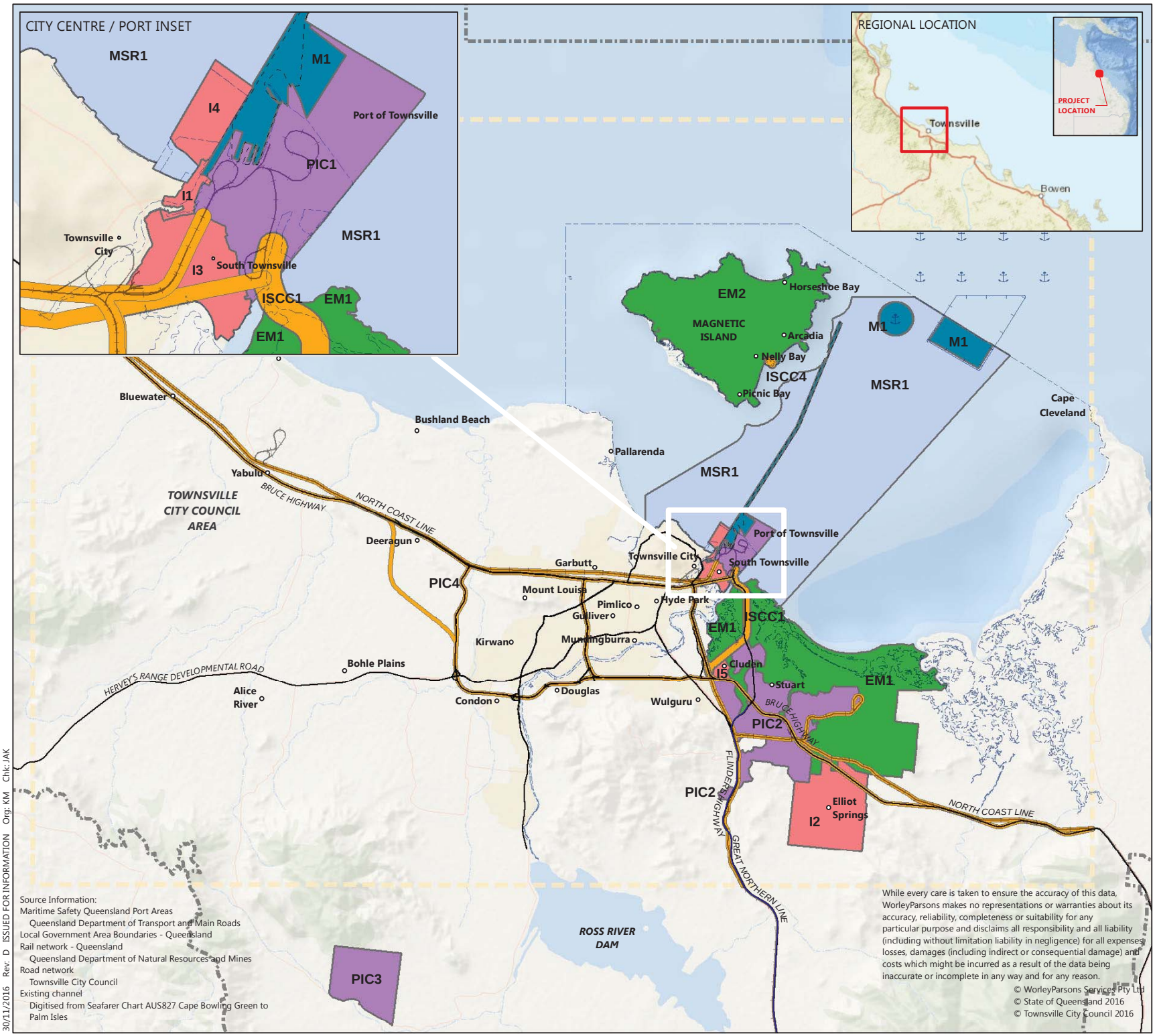
Table 9-2 outlines each of the proposed precincts that make up the overall proposed master planned area, their precinct classification and the purpose for including this land within the proposed master planned area.

The proposed master plan precinct boundaries are shown in Figure 9-2.

Table 9-2 Precinct Names, Purpose and Description

ID	Precinct Classification	Precinct Name	Purpose	Boundary Description
M1	Marine	Port of Townsville (Marine Side - Port Operations)	To protect the current port marine side operations.	This boundary is aligned with the marine boundary identified in the PEP excluding the area allocated to the Great Barrier Reef Marine Park. It also includes the offshore dredge material placement area (DMPA) and anchorage area that lies within the port limits but outside the GBRMP.
MSR1	Marine Services and Recreation	Port of Townsville (Marine Side - excluding port operations)	To provide for coastal dependent development other than port infrastructure, including a range of maritime services, marina, related commercial activities and public use activities that in order to functions must be located in tidal waters or be able to access tidal water.	This precinct includes all marine activities outside of those areas identified in the marine precinct and the area designated as the Great Barrier Reef Marine Park. It includes the Breakwater Marina.
EM1	Environmental Management	Townsville State Development Area (Environmental Management)	To limit development and manage environmental values consistent with ESD.	This precinct occupies both environmentally and culturally sensitive areas within and adjacent to the TSDA. Environmental areas largely relate to tidal and drainage areas and include a declared Fish Habitat Area. Cultural areas relate to areas of Indigenous cultural heritage.
EM2	Environmental Management	Magnetic Island - Land (Environmental Management)	To limit development and manage environmental values consistent with ESD.	Magnetic Island is a continental island located within the GBRWHA. The land side of Magnetic Island contributes to the superlative natural beauty of the WHA, containing forested areas of high environmental value. The proposed master planned area cannot include the waters surrounding the island as these are within the boundary of the GBRMP, however the master plan must consider the impacts on this surrounding area. It is noted that Magnetic Island also includes several residential and commercial areas, including Nelly Bay, Horseshoe Bay, Arcadia and Picnic Bay. These have been included in this precinct for the purposes of master planning.
PIC1	Port Industry and Commerce	Port of Townsville (Land Side)	To protect current and future port land side operations and avoid/manage impacts of external land uses on port operations.	This boundary is aligned with the boundary of port in the Port Expansion Project and includes all land currently owned/occupied by the port.
PIC2	Port Industry and Commerce	Townsville State Development Area	To protect land within the TSDA and ensure that a sufficient supply of industrial land is available in the future to support port related industry.	This precinct reflects the area of the TSDA and adjacent industrial area (Stuart Industrial Estate) outside the TSDA Environmental Management precinct
PIC3	Port Industry and Commerce	Port of Townsville Quarry	To protect the quarry from encroachment by other land uses and ensure that it can function into the future. The quarry occupies only a small portion of the two lots which form this precinct providing a buffer area to surrounding land uses.	This precinct is defined as the two lots currently owned by POTL for the purpose of quarrying materials required for the future Port Expansion Project.
ISCC1	Infrastructure and Supply Chain Corridors	Townsville Eastern Access Rail Corridor	To protect this future transport corridor to/from the port and ensure that it is able to operate at maximum efficiency in the future. Ensure that all options are explored and an optimal solution selected by government (Building Queensland is leading this process).	This precinct is defined as a 400m corridor offset from the centreline of the stage 1 and stage 2 TEARC alignments as proposed in the TEARC Study.

ID	Precinct Classification	Precinct Name	Purpose	Boundary Description
ISCC2	Infrastructure and Supply Chain Corridors	Rail Corridors	To manage the interface and protect the function of these corridors throughout the urban areas of the city and ensure that adverse impacts on the community are adequately managed.	All rail corridors have been defined as a 220m corridor based on the centreline of the existing rail reserve. This is aligned with the rail corridors identified in the TCC's Infrastructure Noise Corridors Overlay. Corridors include parts of the: ▪ North Coast Liine ▪ Mount Isa Rail Line
ISCC3	Infrastructure and Supply Chain Corridors	Road Corridors	To manage the interface and protect the function of these corridors throughout the urban areas of the city and ensure that adverse impacts on the community are adequately managed.	All road corridors have been defined as a 220m corridor based on the centreline of the existing rail reserve. This is aligned with the road corridors identified in the TCC's Infrastructure Noise Corridors Overlay. Road corridors include: ▪ Townsville Ring Road ▪ Bruce Highway (north and south of Townsville) ▪ Woolcock Street ▪ Southern Port Access Road ▪ Abbott Street ▪ Flinders Highway ▪ Boundary Street
ISCC4	Infrastructure and Supply Chain Corridors	Magnetic Island Ferry Terminal	To protect the function of the ferry terminal that is a key infrastructure and supply chain node for Magnetic Island.	Ferry terminal and ancillary infrastructure.
I1	Interface	Townsville Waterfront Priority Development Area	To manage the interface between several of the PDA precincts and the port.	This precinct boundary is aligned with the current boundary of the PDA incorporating only precincts five, six and seven.
I2	Interface	Elliot Springs Urban Development	To influence development of this area and ensure that it does not have a negative impact on future port operations and in particular on transportation corridors leading to/from the port. Likewise it is also important to ensure that sensitive land uses within this precinct are not adversely impacted by transport corridor operations.	This precinct is defined by the boundary for the Elliot Springs urban development as outlined in the TCC City Plan
I3	Interface	Boundary Street/Archer Street Precinct	This urban precinct is immediately adjacent to the port and is traversed by several transport corridors to/from the port. The purpose of this precinct is to manage the interface between this precinct and existing road/rail corridors and port land side operations.	This precinct occupies the area immediately south of the port precinct. Its northern and eastern boundaries are defined by the port precinct whilst its southern boundary follows the peninsula created by Ross River. Its western boundary is located along Davidson Street.
I4	Interface	Casino and Breakwater Precinct	To manage the interface between this precinct and port land side operations. Although no development is currently proposed for this site, there is the potential for future development therefore it forms part of the interface precinct with the port.	This precinct boundary incorporates the existing casino and the area of the now expired Townsville Ocean Terminal project.
I5	Interface	Cluden	The purpose of this precinct is to manage the interface between this urban land use and port related rail traffic and port related industry and commerce.	This urban precinct is immediately adjacent to the TSDA. It is bounded by the proposed TEARC infrastructure and supply chain corridor, and the TSDA Environmental Management and Port Industry and Commerce precincts.



Townsville Evidence Base Report

Figure 9-2: Proposed Master Plan Precinct Boundaries

- Existing rail network
- State controlled road
- Existing port anchorage
- Existing channel
- Existing dredge material placement area
- Port bounds
- Townsville City Council LGA boundary
- Project area of interest

Precinct Classifications

- Marine
- Marine Services and Recreation
- Environmental Management Area
- Infrastructure and Supply Chain Corridors
- Port Industry and Commerce
- Interface

Precinct Name

- M1 - Port of Townsville (Marine Side - Port Operations)
- MSR1 - Port of Townsville (Marine Side - excluding port operations)
- EM1 - Townsville State Development Area (Environmental Management)
- EM2 - Magnetic Island Environmental Management Area
- ISCC1 - Townsville Eastern Access Rail Corridor
- ISCC2 - Rail Corridors
- ISCC3 - Road Corridors
- ISCC4 - Magnetic Island Ferry Terminal
- PIC1 - Port of Townsville (Land Side)
- PIC2 - Townsville State Development Area
- PIC3 - Port of Townsville Quarry
- I1 - Townsville City Waterfront Priority Development Area
- I2 - Elliot Springs Urban Development
- I3 - Boundary Street / Archer Street Precinct
- I4 - Casino and Breakwater Precinct
- I5 - Cluden

0 2.5 5 7.5 10
Kilometres

Coordinate System: GCS GDA 1994
Datum: GDA 1994
Scale at A3 - 1:200,000

N

Source Information:
Maritime Safety Queensland Port Areas
Queensland Department of Transport and Main Roads
Local Government Area Boundaries - Queensland
Rail network - Queensland
Queensland Department of Natural Resources and Mines
Road network
Townsville City Council
Existing channel
Digitised from Seafarer Chart AUS827 Cape Bowling Green to Palm Isles

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30/11/2016 Rev: D ISSUED FOR INFORMATION Org: KM Chk: JAK

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Appendix 1 Detail of Environmental Values

Priority Port of Townsville Master Plan

Detailed Environmental Values

02 December 2016

Level 31, 12 Creek St
Brisbane QLD 4000
Australia

301310-13663-00-EN-RPT-00002

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Synopsis

This is the synopsis text. It is used for reports. IT MAY BE DELETED IF NOT REQUIRED – typically it is not used on proposals.

In formal reports, the synopsis text should be no more than about ten lines. It can contain paragraph breaks if desired

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Project No: 301310-13663-301310-13663-00-EN-RPT-00002 – Priority Port of Townsville Master Plan: Detailed Environmental Values

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2	Issued for use	A Kochnieff	J Kennedy	J Kennedy	02/12/16

Table of Contents

Table List

Figures List

Appendix List

1 Marine and Estuarine Environment

This document provides detailed analyses of environmental values, which are summarised in the primary report of the Priority Port of Townsville Evidence Base Report. Please refer to the primary report regarding the need for an Evidence Base Report to support Priority Port of Townsville master planning and for the designated study area.

The marine and estuarine portions of the study area are identified as Halifax Bay south of Rattlesnake Island and the Port of Townsville boundary which includes Cleveland Bay and Magnetic Island. The marine study area is wholly within the Great Barrier Reef World Heritage Area (GBRWHA), and partly within the Great Barrier Reef Marine Park (GBRMP) and the Queensland State Marine Park. Using existing studies, this section summarises marine environmental values relevant to the study area.

The majority of studies completed in the Townsville area are focused on the Port of Townsville and therefore within Cleveland Bay. No studies have been identified that focus on marine values of Halifax Bay. It is assumed that similar environmental values exist in Halifax Bay as in Cleveland Bay.

Cleveland Bay supports coastal habitats rich with ecological populations and diversity. AECOM (2013) identified that the marine habitats and associated communities are slightly to moderately modified and relatively resilient to disturbance. However, habitats and associated communities in the Port of Townsville area, the dredged channels, and the foreshore of Townsville are in a modified condition (AECOM, 2013). Port of Townsville Limited (PoTL) (2014) identified the following marine ecological values for Cleveland Bay:

- Diverse marine habitats such as:
  - beaches
  - mangrove forests and intertidal shoals, saltmarshes and saltpans
  - subtidal soft sediment habitats (occupying over 85 per cent of the bay)
  - rock walls, fringing coral reefs and rocky shores
  - forested, brackish and freshwater swamps
  - habitats for a wide range of fish and shellfish of direct economic significance.
- Mangrove lined estuaries, containing 12 species of mangrove that provide a nursery and shelter for fish, mud crabs and prawns, trap tide-borne sediments and help control coastal erosion and provide vital protection from strong winds, tidal surges and heavy rainfall associated with cyclones, which occasionally affect this part of Queensland's coastline
- Intertidal and subtidal seagrass beds, which are one of the largest seagrass communities in central Queensland coast (BMT WBM, 2012), are present in about 10 per cent of the Bay and provide food for dugong and turtles and are also a nursery for prawns
- Corals which occupy only around 1 per cent of the Bay but are of high biodiversity significance around Magnetic Island

- Habitat for a range of other threatened or otherwise listed marine megafauna species, including whales, dugong and dolphins.

Intact coastal habitats are vital to a healthy Great Barrier Reef. They are important in the life cycle of some marine species and also play a role in slowing overland water flow and trapping sediments and nutrients.

Marine and estuarine ecological values are presented in Figure 1-1 and summarised in the sections overleaf.

Townsville Evidence Base Report

Figure 1-1:
Marine Ecological Values

RATTLESNAKE ISLAND
HALIFAX BAY
Toolakea
Saunders Beach
Bluewater
Bushland Beach
Yabulu
TOWNSVILLE CITY COUNCIL AREA
Deeragun
Garbutt
RAAF Townsville Wetland
Townsville City
Port of Townsville
South Townsville
Mount Louisa
Pimlico
Hyde Park
Gulliver
Kirwan
Mundingburra
Bohle Plains
Alice River
Condon
Douglas
Cluden
Stuart
Wulguru
Elliot Springs
Ross River Reservoir Wetland
ROSS RIVER DAM
MAGNETIC ISLAND
Horseshoe Bay
Arcadia
Nelly Bay
Picnic Bay
Cape Cleveland
Pallarenda
Cleveland Bay - Magnetic Island Dugong Protection Area
Burdekin - Townsville Coastal Aggregation Wetland
Bowling Green Bay Wetland

- Townsville City Council LGA boundary
- Project area of interest
- Directory of Important Wetlands - wetland area
- Dugong protection area
- Declared fish habitat area
- All seagrass habitats examined in Sept 2016
- All seagrass habitats examined in Oct 2013
- All seagrass habitats examined from 2007 through 2015.

Reef communities

- Indicative reef boundary
- Drying Reef

Source Information:
Local Government Area Boundaries - Queensland
Rail network - Queensland
Declared Fish Habitat Areas
Dugong Protection Areas
Queensland Department of Natural Resources and Mines
Directory of important wetlands - Queensland
Department of Environment and Heritage Protection
Reef Communities
Great Barrier Reef Marine Park Authority
Seagrass Habitats
Centre for Tropical Water & Aquatic Ecosystem Research (TropWATER)

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Coordinate System: GCS GDA 1994
Datum: GDA 1994
Scale at A3 - 1:200,000

0 2.5 5 7.5 10
Kilometres

REGIONAL LOCATION
PROJECT LOCATION
Townsville
Bowen

Advisian
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28/11/2016 Rev: B ISSUED FOR INFORMATION Org: KM Chk: JAK

1.1 Mangrove Communities

PROFILE: Mangrove Communities

Description

Mangroves and saltmarsh grow in the intertidal zone, typically within quiescent (calm) environments (BMT WBM, 2012) such as estuaries and bays. Mangroves and saltmarshes represent benthic primary producer habitats (BPPH). BMT WBM (2012) indicate these habitats have potentially high conservation values because:

- they provide food and shelter resources for a range of invertebrates, birds and fish
- many of the fish species inhabiting mangrove forests and saltmarshes are of direct recreational and commercial fisheries value
- mangroves and saltmarshes are also highly productive and are important in the stabilisation of the beds and banks of estuaries.

Regional Ecosystem (RE) mapping indicates mangrove forests and saltmarsh communities are of least concern (BMT WBM, 2012) and occur along Ross Creek, Ross River, the eastern shoreline of Cleveland Bay and a small patch adjacent to the esplanade. They are mapped as the following:

- Mangrove forests - RE 11.1.4 mangrove forest/woodland on marine clay plains
- Saltmarsh communities - RE 11.1.1 *Sporobolus virginicus* grassland on marine clay plains and RE 11.1.2 samphire forbland on marine clay plains

POTL (2014) identify that 12 species of mangroves have been recorded in Cleveland Bay. These are listed in the table below.

Scientific Name	Common Name
Acrostichum speciosum	Mangrove fern
Aegialitis annulata	Club mangrove
Aegiceras corniculatum	River mangrove
Avicennia marina	Grey mangrove
Bruguiera exaristata	Small-leafed orange mangrove
Bruguiera gymnorrhiza	Large-leafed orange mangrove
Bruguiera parviflora	Small-leafed orange mangrove
Carallia brachiata	Freshwater mangrove, corkwood

PROFILE: Mangrove Communities

Ceriops tagal	Yellow mangrove
Excoecaria agallocha	Blind your eye mangrove
Lumnitzera racemosa	White-flowered black mangrove
Rhizophora stylosa	Red mangrove

Contribution to OUV

Mangrove communities are a significant contributor to the OUV of the GBR. Substantial mangrove stands occur in Cleveland Bay and around Magnetic Island provide nursery habitat for many fish and invertebrate species as well as nesting habitat for birds and animals.

The Bowling Green Bay Ramsar wetland (internationally listed) is located to the south of Townsville. Encompassing an area of 35,500 hectares, the site is significant for its extensive and diverse complex of coastal wetlands, which are typical of the coastal wet-dry tropics of North Eastern Australia.

Threats

Predominant threats to mangrove ecosystems arise from land use conflicts and local effects on water quality, particularly through the introduction of nutrients and herbicides (BMT WBM, 2012). Climate-induced disturbances may also create conditions that make them more susceptible to anthropogenic disturbance (POTL, 2014).

Information Gaps

The reports reviewed focus on the Port of Townsville and associated projects. Limited information is available regarding marine ecosystem values within Halifax Bay. While Halifax Bay is located within the study area, it is outside the port limits and within the GBRMP and so cannot be included in the master planned area.

1.2 Reef Communities

PROFILE: Reef communities

Description

Reef habitats in Cleveland Bay include shallow fringing reefs and rocky shores around Magnetic Island, the well-developed reef platform of Middle Reef and smaller, less developed reef areas between the mainland and Magnetic Island (i.e. Virago Shoal) (BMT WBM, 2012) (Figure 1-1). These form part of an extensive system of nearshore reefs within the Coastal Central Reefs Bioregion (BMT WBM, 2012). Nearby nearshore reef systems include Herald Island, Bramble Rock Reef, Cordelia Rocks Reef, Acheron Reef and the Palm Island group to the northwest of Cleveland Bay, and Salamander, Bray and Bald Reefs around Point Cleveland.

BMT WBM (2012) described the Cleveland Bay reefs as follows:

- Magnetic Island – north: small fringing reefs
- Magnetic Island – southeast: fringing reefs with the largest reefs in embayments (i.e. Picnic, Nelly and Geoffrey Bays)
- Magnetic Island – south (i.e. Cockle Bay): extensive intertidal/shallow subtidal coral reef flat covered by fine sand, mud, seagrass and patches of bare (coral) reef substrate
- Middle Reef: elongated and comprised of four inter-connected reef patches and extends from -4m below LAT to sea level
- Virago Shoal: south west of Middle Reef: mosaic of reef patches and sediments.

A large number of hard corals have been recorded in these communities, including areas of *Montipora digitate* (POTL, 2014). The distribution and abundance of coral species varies in the fringing reefs and is related to the physical characteristics of the substrate and energy environments (POTL, 2014). Coral cover, species diversity and aesthetic quality is generally considered higher in the fringing reefs on the northern side of Magnetic Island (Horseshoe Bay) than in other fringing reefs.

Cleveland Bay has naturally high turbidity levels and therefore corals must have adaptations to cope with periods of low light and high sedimentation rates. As such the reefs are considered to be resilient to change with rapid recovery following disturbance (BMT WBM, 2012). This is consistent with POTL (2014), which suggests reefs show more pronounced depth gradients compared with most other reefs of the GBR due to the high water turbidity in Cleveland Bay.

A study reviewed by BMT WBM (2012) stated that low levels of coral recruitment were recorded on settlement plates located at Middle Reef. Therefore conditions in the last few years would not facilitate rapid recovery following a catastrophic disturbance (BMT WBM, 2012). However, it is stated that the degree of resilience is expected to improve as communities recover from the successive climatic disturbances (BMT WBM, 2012).

Contribution to OUV

PROFILE: Reef communities

The fringing reefs around Magnetic Island and Middle Reef etc. provide a moderate contribution to the overall presence of coral reefs within the GBR.

Threats

Cleveland Bay coral communities are subject to a range of environmental pressures, with the main threats being:

- low salinity flood waters (e.g. flooding from 2009-2011) that promote disease incidence
- physical disturbance from cyclones (e.g. Cyclone Yasi)
- increase seawater temperatures leading to coral bleaching
- temporary reduction of productivity and their resident prey populations due to water quality and/or sedimentation effects from dredging (AECOM, 2013)
- Climate change effects.

The resilience of reef communities will be important in responding to climate change effects. Increased frequency and severity of cyclonic events cause change in coral cover, with effects ranging from damaging tips or edges of coral through to severely damaging or removing coral and coral communities. After events resulting in severe damage, further changes can occur on reef structures including extensive growth of algae over injured colonies, potentially blanketing damaged reef structure.

Information Gaps

The reports reviewed focus on the Port of Townsville and associated projects. Marine ecosystem values within Halifax Bay have not been reviewed due to lack of publicly available information. While Halifax Bay is located within the study area, it is outside the port limits and within the GBRMP and so cannot be included in the master planned area.

1.3 Benthic Communities

PROFILE: Benthic Communities

Description

Soft-sediment habitats can include both vegetated (i.e. contains macroalgae, seagrass) and non-vegetated habitats.

Benthic habitat and communities were assessed as part of the PoTL Port Expansion Project (PEP). This study identified that the benthic habitat was comprised of silty-sands occurred over a majority of the higher energy outer harbour. In sheltered and / or deeper areas, such as quiescent waters and deeper dredged areas of the harbour like the swing basins, the benthic habitat was comprised of muddy sands and silts (BMT WBM, 2012).

This study suggested that epibenthic communities had a sparse cover across the PEP study area and surrounds, varying in community structure between offshore and nearshore environments (BMT WBM, 2012). A summary of the findings were as follows:

- The dredge material placement area (DMPA) and offshore control locations were dominated by small burrowing gobies and sea pens
- Hydrozoans (stinging hydroids) were the most abundant taxon in the nearshore areas
- Slight differences in communities between offshore control sites and DMPA included:
  - lower alcyoniid soft coral abundance within the DMPA
  - higher abundances of fouling species such as sea pens, ascidians and bryozoans associated with isolated patches of gravel and rock fragments in the DMPA
- Macrobenthos communities (also differing between nearshore and offshore areas) were dominated by polychaete worms, amphipods, decapod crustaceans and numerous other invertebrate taxa within the PEP study areas (DMPA, outer harbour project area, existing channels and channel extension project area)
- Most macrobenthos taxa were recorded as singletons or had low overall abundance, and taxa richness and abundance were consistently low across the study area and surrounds
- The macrobenthic communities within the DMPA and the channel extension project areas had similar characteristics to those located within adjacent control areas
- The dredged channel and outer harbour had impoverished fauna
- Previous studies suggested microbenthic communities within the DMPA are resilient to disturbance, and can rapidly recolonise shortly after dredging
- Habitats within the reclamation and breakwater construction footprint of the PEP are characterised as having low to moderate biodiversity values.

PROFILE: Benthic Communities

Contribution to OUV

Benthic communities provide a moderate contribution to OUV by providing habitat and food sources for many species of fish and invertebrates.

Threats

- Temporary loss caused by the disturbance of benthic habitat (i.e. seabed) through dredging campaigns
- Permanent loss of benthic habitat from construction of seawalls and reclamation areas

Information Gaps

The reports reviewed focus on the Port of Townsville and associated projects. Marine ecosystem values within Halifax Bay have not been reviewed. While Halifax Bay is located within the study area, it is outside the port limits and within the GBRMP and so cannot be included in the master planned area.

1.4 Seagrass and Macroalgae

PROFILE: Seagrass and Macroalgae

Description

Seagrass meadows occur in nearshore and deep-water of Cleveland Bay and are considered to be among the largest in the central Queensland coast (BMT WBM, 2012). They are extensive in the eastern portion of Cleveland Bay with smaller beds occurring off the Strand, Kissing Point, Pallarenda Beach and some bays fringing Magnetic Island; however, seagrass is not known in the vicinity of the existing port infrastructure (POTL, 2014) (Figure 1-2).

PoTL (2016) reported results of the 2015 annual survey completed by James Cook University, and references similar studies conducted since 2007 as part of a long-term seagrass health monitoring program. The survey details seagrass species and density (biomass) and maps the areas of meadows.

The September 2015 (Davies *et al.*, 2016) survey results are summarised as follows:

- Most meadows were classed as being in either Very Good or Good for meadow area and species composition
- Overall seagrass condition was classed as Satisfactory
- Dugong feeding trails were observed throughout the area
- 2015 was the fourth consecutive year of seagrass meadow area increase
- Widespread losses of seagrass occurred along Queensland's coast east coast between 2009-2011 related to climate, cyclones and flooding, but Townsville's seagrasses have been among the quickest to recover with over 4,323 ha of seagrass recovered
- Favourable climate conditions in 2015 are likely to have enabled seagrasses to continue to expand in the area
- Biomass declined from 2014, but remained similar to levels observed in 2012-2013 and above lows observed during 2009 – 2011.

According to Davies *et al.* (2016), the dominant species include:

- *Halophila ovalis*, *Halodule uninervis*, *Zostera capricorni*, and *Cymodocea serrulata* in shallow waters
- *Thalassia hemprichii* on reef flats surrounding Magnetic Island. (refer Figure 1-3)

PROFILE: Seagrass and Macroalgae

Contribution to OUV

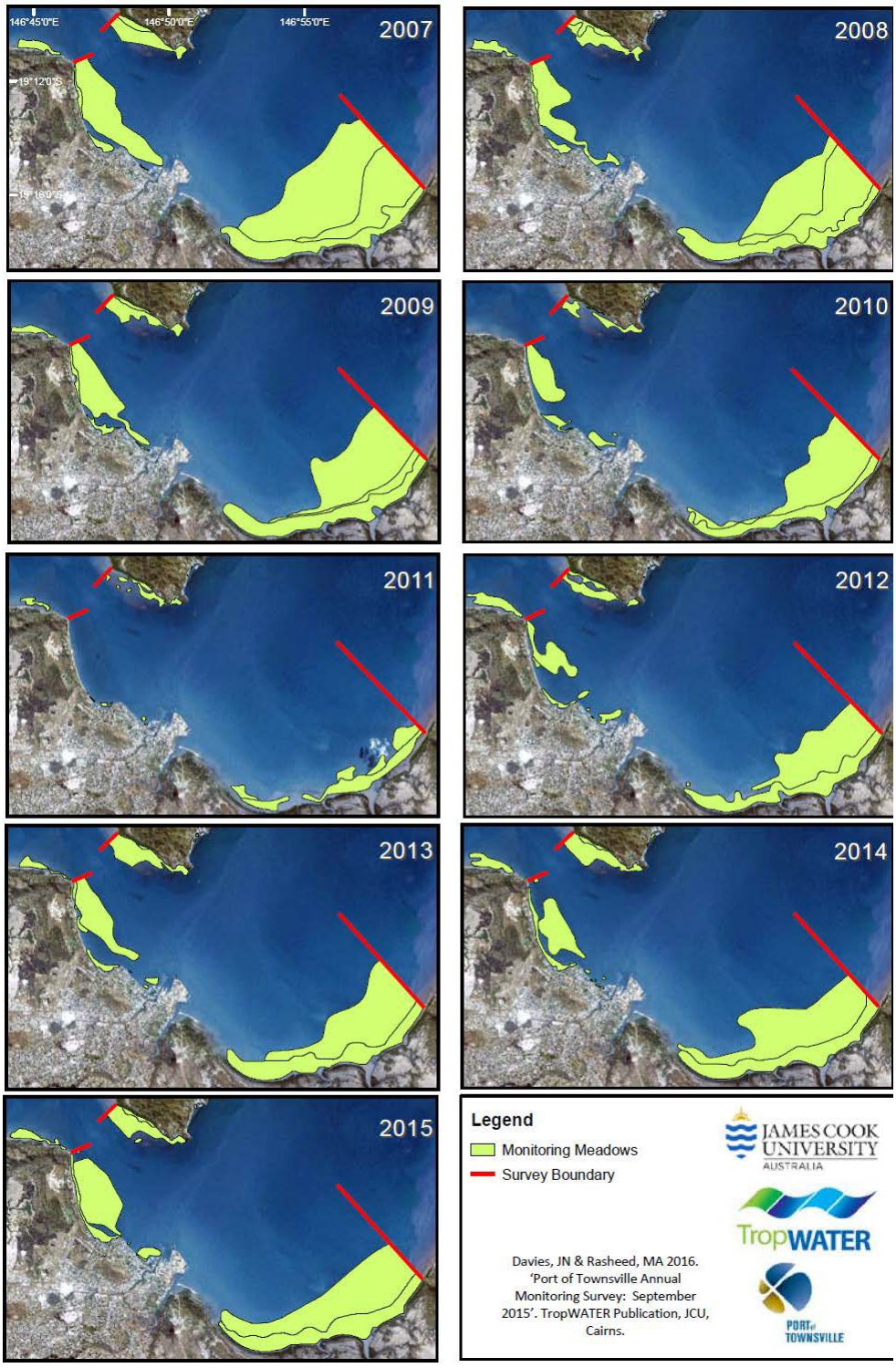
There is a significant presence of seagrass within the study area. Cleveland Bay contains some of the most extensive and diverse seagrass meadows in north Queensland. Eight species of seagrass have been recorded in Cleveland Bay. Seagrass beds are most extensive in the eastern portion of Cleveland Bay, with smaller beds occurring off the Strand, Kissing Point, Pallarenda Beach and some bays fringing Magnetic Island. The seagrass habitats within this region are of high ecological significance and provide a regionally important foraging habitat for threatened species such as dugongs and turtles and economically important fishery species. The primary locations within Cleveland Bay for seagrasses tend to be in areas that are less than 4 m in depth, between the mainland and Magnetic Island, and adjacent to Cape Cleveland.

Threats

- Seagrasses are sensitive to low light conditions, therefore changes to water quality (i.e. turbidity) may impact communities. Changes to the light conditions may result from wave-driven bed sediment remobilisation and turbidity associated with catchment discharges or dredging campaigns. Some species, however, are more resilient to low light conditions, but are slower to recover should they be lost (BMT WBM, 2014)
- Frequency of disturbance, i.e. successive periods of disturbance will deplete energy stores, seed banks, and standing crop (BMT WBM, 2014)
- Temporary reduction of benthic seagrass productivity and their resident prey populations due to water quality and/or sedimentation effects from dredging (AECOM, 2013).

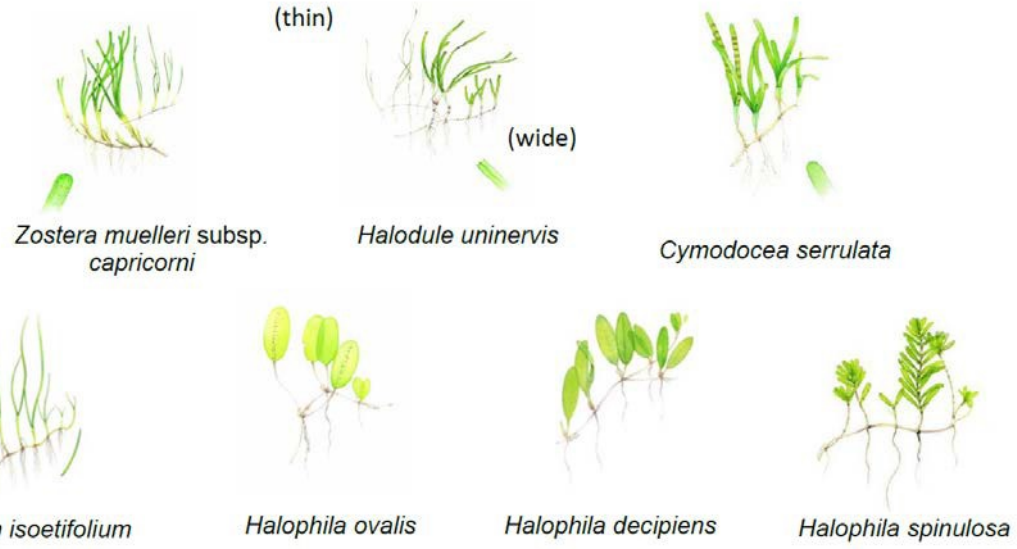
Information Gaps

The reports reviewed focus on the Port of Townsville and associated projects. Limited information is available regarding marine ecosystem values, including seagrasses, within Halifax Bay. While Halifax Bay is located within the study area, it is outside the port limits and within the GBRMP and so cannot be included in the master planned area.



Source: Davies et al., 2016.

Figure 1-2 Seagrass Spatial and Temporal Distribution Since October 2007



Source: Davies et al., 2016.

Figure 1-3 Seagrass Species Within Port of Townsville

1.5 Marine Megafauna

PROFILE: Marine megafauna

Description

Cleveland Bay and the waters around Magnetic Island are an important habitat for sea turtles, dugongs and nearshore dolphin species (BMT WBM, 2012). Other species have been identified as Matters of National Environmental Significance (MNES) (refer Section 1.10.3), however, most other listed marine species tend to favour offshore waters (i.e. whales) and only occasionally observed within Port navigational areas.

Turtles

Six turtle species have been recorded in Cleveland Bay and around Magnetic Island with the green turtle being the most abundant, accounting for approximately 90 per cent of turtles within the Bay (BMT WBM, 2012). It grazes on seagrass and macroalgae and occurs in highest densities at seagrass meadows and reefs, while key foraging habitats for other marine turtles in Cleveland Bay are not well known (BMT WBM, 2012).

Cleveland Bay does not represent a critical turtle nesting area. It is noted that flatback and green turtles nest in low densities on a number of sandy beaches within the study area, including those of Magnetic, Herald and Rattlesnake Islands, The Strand beach and AIMS beach (BMT WBM, 2012).

Dolphins and Whales

A number of dolphin species are known or likely to occur in Cleveland Bay, including: Australian snubfin dolphin, Indo-Pacific humpback dolphin, common dolphin and the bottlenose dolphin.

Australian snubfin dolphins and Indo-Pacific humpback dolphins occur nearshore and in shallow-water habitat opportunistically feeding on fish with the Australian snubfin dolphin also feeding on cephalopods (BMT WBM, 2012). A frequented area for both species is within and adjacent to Ross River and Ross Creek.

Little is known about the population, distribution, ecology and movement patterns of both species at a regional and national level. Studies of these species in Queensland indicate that populations are usually small (< 100 individuals), with some level of site fidelity (ELA and Open Lines 2013). Genetic separation and geographic isolation suggest these small populations can be relatively disconnected and little is known about the scale of movement between habitats (ELA and Open Lines 2013).

Humpback whale adults and calves have occasionally been recorded within the coastal waters of Cleveland Bay, usually during August-September. The timing of these records indicates that whales were making their return journey to southern waters. The presence of calves indicates that the animals maybe resting during their migrations. Calving has not been observed in Cleveland Bay.

PROFILE: Marine megafauna

Dugongs

Dugongs are herbivores and feed selectively on dominant seagrass species (BMT WBM, 2012). As Cleveland Bay is a regionally important habitat for this species it has been designated as a Dugong Protection Area (DPA). The primary feeding areas are the dense nearshore meadows in eastern Cleveland Bay Dugong Protection Area (DPA) (Figure 1-7) (BMT WBM, 2012). Surveys conducted by GHD reported (POTL, 2014) that dugongs were found most often in areas with greater concentration of seagrass in Cleveland Bay (i.e. meadows near the southern and eastern shores). Boat and aerial surveys observed turtles, dugongs, rays, sea snakes and dolphins (POTL, 2014). Dugong feeding scars were noted across the area in the September 2015 annual seagrass survey (Davies *et al.*, 2016). While seagrass is not present at the Port of Townsville operations area, dugong would likely traverse the area as they move between seagrass meadow areas.

POTL, 2014 indicated that the following species of marine mega fauna, listed under the Nature *Conservation (Wildlife) Regulation* 2006, have been observed within two kilometres of the port:

- Endangered:
  - loggerhead turtle (*Caretta caretta*)
  - leatherback turtle (*Dermochelys coriacea*)
  - olive ridley (*Lepidochelys olivacea*)
- Vulnerable:
  - dugong (*Dugong dugon*)
  - green turtle (*Chelonia mydas*)
  - hawksbill turtle (*Eretmochelys imbricate*)
  - flatback turtle (*Natator depressus*)
- Near Threatened:
  - Australian snubfin dolphin (*Orcaella heinsohni*)
  - Indo-Pacific humpback dolphin (*Sousa chinensis*).

The following conservation plans, in accordance with the *Nature Conservation Act* 1992, are in place:

- Nature Conservation (Whales and Dolphins) Conservation Plan 1997
- Nature Conservation (Dugong) Conservation Plan 1999
- Recovery Plan for Marine Turtles in Australia 2003 (Environment Australia 2003).

Other species listed as vulnerable under the EPBC Act include the great white shark, largetooth sawfish, freshwater sawfish, river sawfish, Leichhardt's sawfish, northern sawfish, green sawfish, Dindagubba, narrowsnout sawfish and the whale shark. These species have not been discussed in the studies reviewed for this project. These species are not expected to occur within the study area despite being included in results of database searched. Sawfish in particular have reduced in

PROFILE: Marine megafauna

distribution extent over past decades and Townsville would likely be outside their current distribution. Whale sharks prefer waters further offshore, and Great White Shark's distribution is more limited to temperate waters.

Contribution to OUV

- Species of turtles - Six turtle species have been recorded in Cleveland Bay and around Magnetic Island with the green turtle being the most abundant
- Green turtle breeding - Magnetic Island beaches are known to be regular nesting sites for green turtles, however the density and population recruitment are relatively low
- Marine turtle rookeries – Apart from green turtles which known to nest of Magnetic Island beaches, Cleveland Bay is not an important turtle breeding area, with most turtles in the region believed to have originated from rookeries elsewhere
- Species of whales - Humpback whale adults and calves have occasionally been recorded within the coastal waters of Cleveland Bay
- Migrating whales - The timing of humpback whale sightings in August- September indicates that whales were making their return journey to southern waters. The presence of calves indicates that the animals maybe resting during their migrations.
- Species of dolphins - A number of dolphin species are known or likely to occur in Cleveland Bay, including: Australian snubfin dolphin, Indo-Pacific humpback dolphin, common dolphin and the bottlenose dolphin

Dugong - Cleveland Bay is recognised as dugong habitat and is a declared Dugong Protection Area. The Bay is thought to be an important dugong habitat at a regional scale.

Overall the contribution to OUV is assessed as being significant for Dugong and minor for turtles, whales and dolphins.

Threats

- Incidental capture in shark nets set for bather safety and in set mesh net fisheries
- Disturbances to habitat and feeding areas
- Increased vessel traffic and noise during port constructions and operations will increase the likelihood for megafauna interactions, particularly green turtles, or the avoidance of the area by some mobile species.
- Impacts caused by pollution resulting from spills, or inadequate stormwater management.

PROFILE: Marine megafauna

Information Gaps

The reports reviewed focus on the Port of Townsville and associated projects. It is expected that marine megafauna would similarly occur in Halifax Bay, however very little information is available to confirm this assumption. While Halifax Bay is located within the study area, it is outside the port limits and within the GBRMP, and so cannot be included in the master planned area.

Relatively little is known regarding the distribution of the inshore dolphin species, and the extent of site fidelity and genetic separation from populations elsewhere.

1.6 Fish and Fisheries

PROFILE: Fish and Fisheries

Description

Fish Habitat Areas (FHA) have been established in Cleveland Bay and in the nearby Bohle River and Bowling Green Bay (refer Figure 1-7), with the main commercial fisheries operating directly in Cleveland Bay including:

- Queensland Mud Crab
- East Coast Otter Trawl
- Queensland Blue Swimmer Crab
- Queensland East Coast Spanish Mackerel
- Queensland East Coast Inshore Fin Fish
- The Queensland Spanner Crab Fishery includes waters adjacent to Cleveland Bay.

These areas provide protection vital to sustaining fish stocks and fisheries and are breeding grounds for target species such as barramundi, grunter, mud crabs and prawns. Once an area is declared as a FHA, it protects all habitat types (e.g. vegetation, sand bars and rocky headlands) from direct physical disturbance and coastal development from fishing disturbance.

Fishing for target species is a common practice and undertaken by traditional owner, commercial and recreational fishers within the tidal creeks and estuaries.

Commercial: key species targeted include: prawns (i.e. tiger, banana and Endeavour prawns), mud crabs, blue swimmer crabs, bugs, barramundi, tropical sharks, mackerel (primarily grey mackerel) and threadfin, Spanish mackerel, coral trout and red throat emperor (BMT WBM, 2012). Sea cucumber (Beche-de-mer), marine aquarium fish (damsel fish (Pomacentridae), butterfly fish (Chaetodontidae), angel fish (Pomacanthidae), and wrasses (Labridae) and coral trout are harvested by small commercial collection fishers (BMT WBM, 2012).

Recreational: key species targeted are similar to commercial species but there is a strong focus on barramundi, mullet, whiting, bream and mud crabs in inshore areas; and reef fish such as coral trout (Plectropomus spp.), snapper (Lutjanidae), sweetlip (Lethrinidae) and trevally (Caranx spp.) (BMT WBM, 2012).

Traditional: key species are similar to recreational species (BMT WBM, 2012).

No major aquaculture facilities are currently operating in the Cleveland Bay area.

PROFILE: Fish and Fisheries

Contribution to OUV

- There is a minor contribution to OUV. The mangroves, seagrasses, reef and soft bottom benthic communities present in Cleveland Bay provide habitat for a variety of fish species. Fishing for target species is a common practice in Cleveland Bay, undertaken by traditional owner, commercial and recreational fishers.
- Protected fish habitat areas have been established in Cleveland Bay and in the nearby Bohle River and Bowling Green Bay. These areas provide protection and are breeding grounds for target species such as barramundi, grunter, mud crabs and prawns. Reef species are less abundant and are primarily restricted to the fringing reef areas around Magnetic Island and Middle Reef. Major aggregations for fish spawning have not been recorded.

Threats

- Loss of habitat (used for feeding or breeding) including seagrasses, reef and benthic habitat, may affect long-term stock levels and abundance
- Impacts caused by pollution resulting from spills, or inadequate stormwater management.

Information Gaps

The reports reviewed focus on the Port of Townsville and associated projects. Marine ecosystem values within Halifax Bay have not been reviewed. While Halifax Bay is located within the study area, it is outside the port limits and within the GBRMP, and so cannot be included in the master planned area.

1.7 Marine Coastal Processes

PROFILE: Coastal Processes

Description

Cleveland Bay is a broad and shallow bay bounded by Cape Cleveland to the east and Cape to the west. It is a turbid water body (maintaining significant sediment mobility through re-suspension) and characteristic of a low wave-energy environment as Cape Cleveland shelters the bay from the south-easterly trade wind and swells (Murtha, 1982). The shelter provided by the beach ridges linking Cape Cleveland to the mainland and the generally low tidal range generate an ideal environment for the formation of mud flats (Murtha, 1982). Ross River and local streams are a source of sediment, in addition to sediment from streams in the south such as the Burdekin River (Murtha, 1982 and AECOM, 2013). These accumulated sediments make the bay relatively shallow, less than -10 mAHD across most of the bay, but deeper further north at the entrance (AECOM, 2013).

The coastline is shaped by the prevailing low energy waves and occasional higher energy cyclone waves that penetrate across the bay onto the shoreline (POTL, 2014). The Port of Townsville and surrounding coastal areas have been extensively modified over time. The port lands have mostly been created by land reclamation and dredged material placement since it was in 1864 (POTL, 2014). Both Ross River and Ross Creek have weirs, while natural longshore transport of sand along The Strand Beach is controlled by artificial rocky headlands.

The coastal processes active in Cleveland Bay are conceptualised in Figure 1-4. Key points are identified below.

Hydrodynamics

- Hydrodynamics in Cleveland Bay are driven by astronomical tide, direct forcing by wind stress at sea surface and influence from the East Australian Current (POTL, 2014)
- Water levels relating to tides and storm surges
- Semi-diurnal tides (i.e. 2 high and 2 low tides per day) with tides ranging from highest astronomical tide (HAT) 4.11 m local datum (2.25mAHD) to Mean Low Water Springs (MLWS) 0.77m local chart datum (-1.09mAHD)
- Tidal currents near shore are generally low (<0.1 m/s) with the exception of significant current between Magnetic Island and the mainland (POTL, 2014).

The wave climate

- Ocean waves entering the Bay, which may be long period 'swell' or shorter period 'sea' (i.e. local) and arrive from predominantly north to east-south-east direction sectors and propagate towards the port from the north to north-east direction
- GBR shelters the bay from deep ocean waves
- Wind waves generated with Cleveland Bay

PROFILE: Coastal Processes

- Currents in the Bay, generated predominantly by tidal and wind forcing
- Freshwater inflows from the Burdekin River, Ross River and Ross Creek
- Tidal flows at the Ross River and Ross Creek
- Key influencing factors of cyclones and other severe weather events.

Marine Sedimentation Processes

- Fluvial sediment supply from the rivers and streams, which may be fine wash load that extends out into the Bay before settling to the seabed or coarser sand that deposits near the stream mouths and may be re-distributed along the coast by wave/currents action
- Fine sediment supply to the Bay from the Burdekin River, carried in suspension by currents either directly or, predominantly, after nearshore deposition and subsequent re-suspension
- Bay seabed sediment re-suspension, transport and deposition, potentially changing the seabed morphology or sediment composition and/or infilling dredged areas
- Combined natural swell and wind-driven waves are capable of resuspending bed sediments and producing high turbidity conditions in the bay (POTL, 2014). Wave-induced bed stress is the most significant long-term contributor to sediment resuspension and elevated suspended sediment concentrations (POTL, 2014).
- The combination of tide, wind-driven, and three-dimensional currents are fundamental to the dominant northward, shore parallel transport of suspended sediment along the inner shelf (POTL, 2014).

Shoreline Sedimentation Processes

- Alongshore sand transport at the beach shorelines, driven by wave breaking
- Sand along The Strand Beach tends to move from east to west and from south to north in Rowes Bay during the South East Trade season (winter/dry). Sand moves in the opposite direction during summer, when northeast to north winds and waves prevail (POTL, 2014).
- Beach erosion and accretion along the adjacent beach system
- Factors affecting and required for beach stability.

Contribution to OUV

Cleveland Bay provides a variety of seascapes and landscapes including open water, continental islands, sand beaches, mudflats, mangroves and river estuaries. Coastal processes and contribution to OUV is based mostly on open water sediment movements, tidal area formation and river discharges.

PROFILE: Coastal Processes

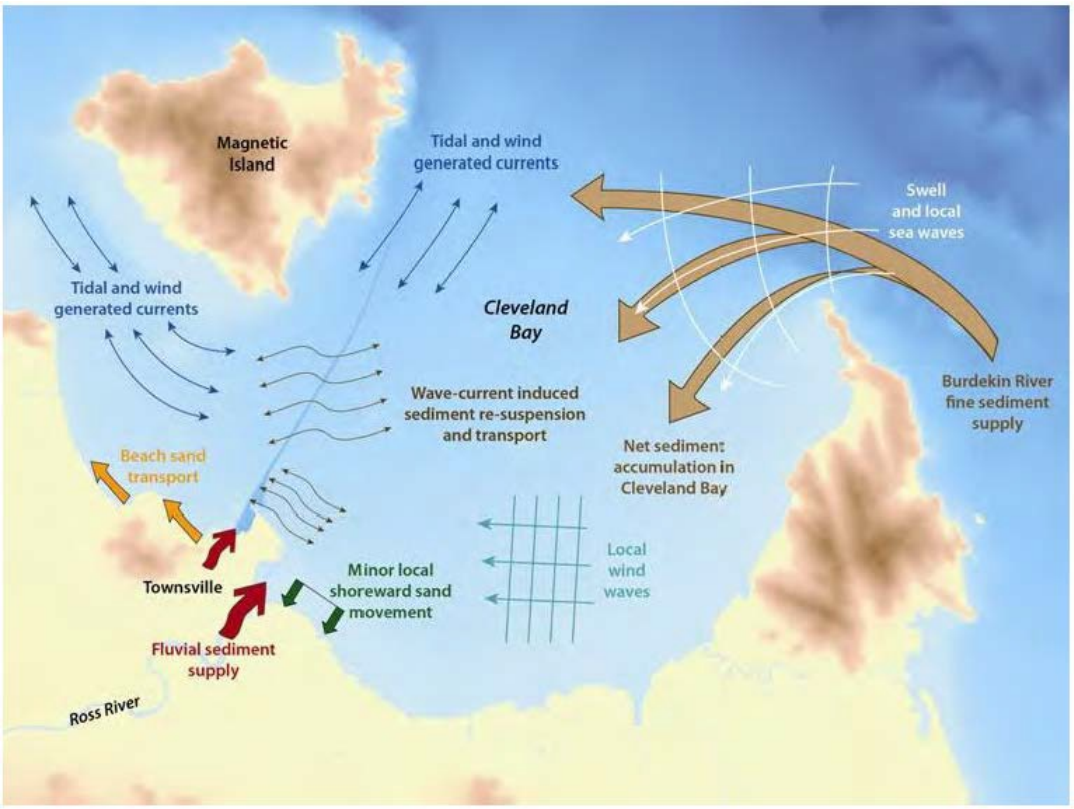
Threats

Threats to the natural coastal processes of Cleveland Bay may result from the construction of port infrastructure that interferes with longshore sediment transport pathways and local wind and wave processes and local current patterns. The most recent study of coastal processes and potential impacts from anthropogenic influences was undertaken for the proposed PEP. The results of this study generally indicate that Cleveland Bay sedimentation processes will be significantly altered by affecting the bathymetry and hydrodynamics. These impacts include:

- Changes in longshore sand transport regime at The Strand
- Reduced storm erosion exposure at southern end of The Strand beach
- Changes in longshore sand transport regime at Rowes Bay
- Changes in velocity magnitudes in the immediate vicinity of the Port
- Changes in Cleveland Bay morphology in the immediate vicinity of the Port
- Siltation in the harbour and channel
- Siltation at The Strand due to Ross River sediment discharge
- Sediment resuspension from the dredge material placement area.

Information Gaps

The reports reviewed focus on the Port of Townsville and associated projects. Limited information is available regarding marine ecosystem values within Halifax Bay. While Halifax Bay is located within the study area, it is outside the port limits and within the GBRMP, and so cannot be included in the master planned area.



Source: AECOM., 2013.

Figure 1-4 General Coastal Processes of Cleveland Bay

1.8 Marine Water Quality

PROFILE: Marine Water Quality

Description

Cleveland Bay is considered to be a 'slightly to moderately' disturbed open coastal system in the Central Coast region (DEHP, 2009). Turbid fresh water and nutrients flow into Cleveland Bay via numerous creeks and rivers with highest flows occurring during summer (AECOM, 2013). The principal factor controlling suspended sediment in Cleveland Bay is the wind regime and ensuing waves and swells (AECOM, 2013). The near-shore waters of Cleveland Bay are frequently turbid with ambient total suspended solids (TSS) levels for the Eastern Near Shore Seagrass Meadows, the Strand and the outer harbour exceeding the Queensland Water Quality Guidelines (QWQG; DEHP, 2009) (PoTL, 2014). Ambient TSS in the greater Cleveland Bay area is within the QWQG.

POTL (2014) reports that contaminant substances generated by industrial activity and municipal services in the catchment are released (either through leaching or license discharge) into Cleveland Bay directly or via estuarine flows to the bay. These include:

- refineries, manufacturing and repair facilities, old rail sidings and industrial areas
- sites with licensed discharge waste streams, i.e. refineries, sewage treatment plant, meatworks etc.)
- several landfills (both operating and rehabilitated).

AECOM (2013) reports that metals/metalloids comply with the (ANZECC, 2000) 95 per cent protection trigger levels, with the exception of zinc in the outer harbour which slightly exceeds the trigger level.

Long-term POTL monitoring data indicate that the median concentrations for total nitrogen and phosphorus are compliant with the QWQG (AECOM, 2013). However, AECOM (2013) report that data from GHD (2009) in-situ grab sampling monitoring indicated high nutrient concentrations in the existing boat moorings of the Ross River. These elevated levels were considered to be related to anthropogenic influences. This is similarly the case for oil and grease concentrations which are also elevated in Ross River potentially due to boat mooring (AECOM, 2013).

Despite a number of monitoring programs being conducted in the Bay over 40 years, no clear long term trend for water clarity is evident (PoTL 2014).

Contribution to OUV

- Many of the elements of OUV are dependent on good water quality, accordingly the contribution to OUV from water quality within the study area is significant.

PROFILE: Marine Water Quality

Threats

- Impact pathways may include increased suspended sediment (i.e. plumes) from dredging, reclamation, construction of breakwaters and increased shipping leading to light attenuation reducing photosynthetic activity, fouling of fish gills and invertebrates and increases in water temperature through absorption of solar radiation. Numerical modelling reported by AECOM (2013) has shown that the extent of plumes during dredging will depend on a range of factors including season, wind strength and direction, currents, tide status, location and type of dredge, as well as dredge working methods and productivity.
- Increased sediments from poor land management leading to blue-green algae blooms, smoothing of coral and promotion of heavy metal bioavailability
- Altered hydrodynamic regimes (creation / removal of marine structures)
- Potential releases of pollution (vessel bilge water, antifouling paints, sewage, garbage, stormwater runoff)
- Historic contamination levels in sediments and the past and present inputs from catchment sources.

Information Gaps

The reports reviewed focus on the Port of Townsville and associated projects. Limited information is available regarding marine ecosystem values within Halifax Bay. While Halifax Bay is located within the study area, it is outside the port limits and within the GBRMP, and so cannot be included in the master planned area.

1.9 Marine Sediment Quality

PROFILE: Marine Sediment Quality

Description

The majority of the geology in the study area is comprised of Quaternary aged alluvium and colluvium sediments that form the beaches, littoral zones (i.e. coastal tidal flats, mangrove flats and supratidal saltpans) and the low lying and elevated plains. These deposits are underlain by Late-Palaeozoic age granite.

Sediments in Cleveland Bay are terrigenous deposits originating from local streams (including Ross River) and the Burdekin River (Murtha, 1982 and AECOM, 2013). These sediments, occurring throughout the bay, are characterised as being "slightly gravelly, muddy sand" with a high silt and clay component (POTL, 2014). Previous studies within port navigational areas (Outer Harbour basin, and the Platypus and Sea Channels) indicates that surface layers (approximately 0.5-1.5m thick) are a mixture of very soft to soft silty clay to clayey silt with very loose and loose sand to silty sand to clayey sand (POTL, 2014). Note that AECOM, (2013) report the thickness of these sediments as ranging from 1 to 3 m. They are very dark in colour, contain significant shell and organic material and are potential acid sulfate soils (PASS) (AECOM, 2013). These overlie older stiff to hard clays and sandy clays and medium dense to very dense clayey sands and sands which are lighter in colour and not PASS.

Closer to Magnetic Island's coral reef colonies, sediments are rich in calcium carbonate (POTL, 2014), while north of Ross River and along The Strand, courser sediments (i.e. sand) are predominate. The Strand beach can be considered as a "pocket" beach. Its sand supply has been interrupted by anthropogenic activities changing the natural hydrodynamics and transport of coarse sediments. As such Townsville City Council undertake an ongoing beach monitoring and sand renourishment project to assist in the rehabilitation of beaches (POTL, 2014).

AECOM (2013) describes results from Golder Associate's seismic analysis investigation in 2008 and 2011, undertaken offshore from the north-east boundary of the existing port land. This investigation reported bedrock occurring at least 16.5 m below the current seabed.

Geochemical composition

Catchment land uses, coastal zone industry, urban development and transportation have resulted in elevated levels of nutrients and other contaminants in surface sediments, particularly within areas of Ross River and Ross Creek waterways and nearshore areas of Cleveland Bay (AECOM, 2013). POTL (2014) however, indicates that coastal sediments are generally uncontaminated (when compared to National Assessment Guidelines for Dredging (NAGD) (Commonwealth of Australia, 2009) even with the strong industrial and coastal history of Townsville (POTL, 2014).

Results from PoTL's long term marine sediment monitoring indicate that the more industrialised areas of Ross Creek, the port and Ross River show higher levels of contamination than the surrounding bay, with Ross Creek in particular, being an upstream diffuse source of contaminants (AECOM, 2013). AECOM (2013) reports low level contamination within sediments adjacent to the existing Berth 11 and the future Berth 12 area. These sediments are to be removed prior to PEP

PROFILE: Marine Sediment Quality

capital dredging commencing. The deeper, stiffer clay sediments below 1 m of the outer harbour and channels have been characterised as being uncontaminated (AECOM, 2013).

The soft surface sediments including, intertidal flats within Bowling Green Bay are acid sulfate materials. Within Bowling Green Bay, estuarine areas and land below 5m AHD these sediments are mapped as having a high probability of ASS occurrence. This is discussed further in Section 2.5.

Contribution to OUV

Sediments within the study area provide the growth medium for the benthic, seagrass and mangrove communities that support the diverse species of birds, mammals, reptiles and plants including endangered, vulnerable and rare species within the GBRWHA.

Threats

The principal impacts from marine sediment quality are associated with the liberation of potential contaminants within them as a result of dredging or onshore excavation disturbance. This includes the potential oxidisation of PASS.

Information Gaps

The reports reviewed focus on the Port of Townsville and associated projects. Marine sediment quality within Halifax Bay has not been reviewed. While Halifax Bay is located within the study area, it is outside the port limits and within the GBRMP, and so cannot be included in the master planned area.

1.10 Marine Matters of National Environmental Significance

A protected matters search (Appendix 1) identified MNES as potentially occurring within the study area. These are listed below:

- World Heritage Properties: Great Barrier Reef World Heritage Area
- National Heritage Places
- Wetlands of International Importance (listed under the Ramsar Convention): Bowling Green Bay
- Great Barrier Reef Marine Park: 17 GBRMP zones. This includes most of Cleveland Bay and portions of Halifax Bay
- Commonwealth Marine Area: This is based on Australian Maritime Boundaries and includes water in the northeast of the study area and outside of Cleveland Bay. This is not considered further.
- Listed Threatened Ecological Communities: 3 listed ecological communities
- Listed Threatened Species: 12 listed threatened species
- Listed Migratory Species: 23 migratory species.

Defined MNES relevant marine and estuarine areas are shown in Figure 1-5. Note that this figure and search results in Appendix 1 also include terrestrial matters, which are discussed in Section 2.6.

Townsville Evidence Base Report

Figure 1-5:
Matters of National Environmental Significance

REGIONAL LOCATION

Townsville

Bowen

PROJECT LOCATION

CITY CENTRE / PORT INSET

Kissing Point Fort

Port of Townsville

Townsville City

South Townsville

Burdekin Townsville Coastal Aggregation Wetland

RATTLESNAKE ISLAND

0 2.5 5 7.5 10

Kilometres

Coordinate System: GCS GDA 1994
Datum: GDA 1994
Scale at A3 - 1:200,000

HALIFAX BAY

Horseshoe Bay

MAGNETIC ISLAND

Arcadia

Nelly Bay

Picnic Bay

Cape Cleveland

Toolakea

Saunders Beach

Bluewater

Bushland Beach

Pallarenda

Yabulu

TOWNSVILLE CITY COUNCIL AREA

RAAF Townsville Wetland

Deeragun

Garbutt

Townsville City

Port of Townsville

South Townsville

Mount Louisa

Hyde Park

Pimlico

Gulliver

Kirwano

Mundingburra

Bohle Plains

Cluden

Stuart

Bowling Green Bay Ramsar Wetalnd

Bowling Green Bay Wetland

Burdekin Townsville Coastal Aggregation Wetland

Alice River

Douglas

Condon

Wulguru

Elliot Springs

Ross River Reservoir Wetland

ROSS RIVER DAM

Legend

- Existing local road network
- Existing rail network
- Townsville City Council LGA boundary
- Project area of interest
- National Heritage Properties
- Great Barrier Reef World Heritage Area
- Ramsar Wetland
- Directory of Important Wetlands
- Territorial Sea (Commonwealth Marine Area)
- Great Barrier Reef Marine Park boundary

Great Barrier Reef Marine Park Zoning

- General Use
- Habitat Protection
- Conservation Park
- Marine National Park

Source Information:
Local Government Area Boundaries - Queensland
Rail network - Queensland
Queensland Department of Natural Resources and Mines
Commonwealth Heritage List Database
Australian Government Department of the Environment, Water, Heritage and the Arts
Territorial Sea
Seas and Submerged Lands Act 1973 - Australian Maritime Boundaries Dataset 2014
Geoscience Australia
Great Barrier Reef Marine Park boundary and zoning
Great Barrier Reef Marine Park Authority
Ramsar Wetlands of Australia
Great Barrier Reef World Heritage Area
Australian Government Department of Sustainability, Environment, Water, Population and Communities
Directory of important wetlands - Queensland
Department of Environment and Heritage Protection

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1.10.1 Great Barrier Reef World Heritage Area and Marine Park

The Great Barrier Reef is listed as a United Nations Educational, Scientific and Cultural Organization (UNESCO) World Heritage site. The GBRWHA is also an Australian National Heritage Place. Due to its management as a marine park (established in 1975), the Great Barrier Reef has several designations controlled by the Commonwealth and State governments. The Great Barrier Reef Marine Park Authority (GBRMPA) is the Australian Government agency responsible for its overall management, in conjunction with Queensland's Department of National Parks, Recreation, Sport and Racing (DNPSR) whom provide the day-to-day management.

Cleveland and Halifax Bays, including the Port of Townsville, is located within the GBRWHA, with all waters to low water mark along the coastline in the region included in the GBRWHA. It is important to note that the marine park boundary differs slightly for the GBRWHA as it excludes some port areas including the Port of Townsville. Continental islands, such as Magnetic Island, are also excluded from the marine park. This means existing port infrastructure is outside the GBRMP, however, the Dredge Material Placement Area (DMPA) and the sea channel are directly adjacent. The proximity of Magnetic Island to the Port of Townsville makes consideration of its values also relevant to the development of the master plan.

PROFILE: Great Barrier Reef World Heritage Area and Marine Park

Description

The GBRWHA is a globally outstanding and significant entity and is located within the study area. As a World Heritage site, the GBRWHA has Outstanding Universal Value (OUV). OUV is the central idea of the World Heritage Convention and a listing of World heritage sites that are important to and belong to everyone, regardless of where they are located (SEWPAC, 2012a). All World Heritage sites have OUV and are:

- of outstanding universal value as they are exceptional, or superlative
- universal as they are outstanding from a global perspective
- naturally and culturally valuable.

The GBRWHA was inscribed on the World Heritage List in 1981. It covers an area of approximately 348 000 km^2 and extends along the Queensland coast for 2000 km from Cape York to Fraser Island and up to 250 kilometres offshore from the low water mark along the mainland and down to 2000 m in depth (Figure 1-6). The GBRWHA forms the world's largest coral reef ecosystem and includes approximately 2,500 individual reefs, more than 900 islands, over 1,500 species of fish, approximately 400 species of coral, 4,000 species of mollusc, and approximately 240 species of birds including a range of sponges, anemones, marine worms, crustaceans, and other species. No other World Heritage property contains such biodiversity (UNESCO, 2016).

PROFILE: Great Barrier Reef World Heritage Area and Marine Park

Contribution to OUV

The GBR meets all four world heritage natural criteria:

- An outstanding example representing the major stages of the earth's evolutionary history
- An outstanding example representing significant ongoing geological processes, biological evolution, and man's interaction with his natural environment
- Contain unique, rare or superlative natural phenomena, formations, or features or areas of exceptional natural beauty, such as superlative examples of the most important ecosystems to man
- Provide habitats where populations of rare or endangered species of plants and animals still survive.

Threats

According to the Great Barrier Reef Outlook Report (GBRMPA, 2014), the northern third of the Great Barrier Reef has good water quality and its ecosystem is in good condition, while key habitats, species and ecosystem processes in central and southern inshore areas have continued to deteriorate from the cumulative effects of impacts (GBRMPA, 2014).

GBRMPA has undertaken surveys of the Great Barrier Reef to assess the extent of the coral bleaching event that occurred in 2016. GBRMPA identified findings (prior to the last survey) showing that 22 per cent of coral on the Reef has died due to the worst mass bleaching event on record. Eighty-five per cent of this mortality occurred in the 600 kilometre stretch between the tip of Cape York and just north of Lizard Island. Overall, the area below Cairns has escaped significant mortality.

The major threats to the future vitality of the GBR include:

- Climate change
- Poor water quality from land-based run-off
- Impacts from coastal development (i.e. construction of revetment walls)
- Loss of soft sediment benthic habitat due to reclamation
- Temporary impacts to benthos due to dredging
- Noise generated by maritime activities such as dredging, piling and construction is also likely to result in the temporary avoidance by marine megafauna and fish
- Direct use (i.e. illegal fishing, anchorages)
- Other threats include major storms and floods, crown of thorns starfish outbreaks, marine pest introduction, marine debris and release of emissions or pollutants / waste.

These threats have the potential to work in combination to weaken the resilience of the Great Barrier Reef ecosystem and therefore its ability to recover from serious disturbances (such as major coral bleaching events) that will become more frequent in the future (GBRMPA, 2014).

Information Gaps

Sufficient information is available for the purposes of priority port master planning.

Source: GBRMPA, 2014.

Figure 1-6 Great Barrier Reef World Heritage Area

1.10.2 Ramsar – Bowling Green Bay

PROFILE: Ramsar – Bowling Green Bay

Description

Bowling Green Bay is a Ramsar listed wetland (refer Figure 1-5). Ramsar wetlands represent wetlands of international significance and area also protected nationally and listed on the Directory of Important Wetlands of Australia. Bowling Green Bay is mainly located to the east of Cape Cleveland, but extends partly along the southeast coastline of Cleveland Bay and within the study area. It is a diverse complex of coastal wetland systems that include:

- inter-tidal seagrass beds
- mangrove woodlands
- saltpan communities on the coast
- brackish to freshwater wetlands inland
- extensive areas of forest and woodland some closed forest, on the mountainous areas and the coastal dune system. (DEE, 2016)

The wetland receives a majority of its fresh water during summer. This dilutes salinity levels of the shallow inshore marine areas, the surface soils of the saltpans and the mangrove areas and recharges the two aquifers (DEE, 2016).

Contribution to OUV

Bowling Green Bay contributes to OUV as:

- The wetland plays a major role in protection of this area from erosion by cyclones and is significant for its diversity and extent of wetland types
- It provides habitat for approximately 50 per cent of the migratory species listed and seasonally supports 20,000 waterbirds and supports 1 per cent of the total population of Brolgas
- The intertidal and subtidal seagrass beds provide feeding habitat for listed threatened turtles and dugongs

Threats

- Clearing / destruction of habitat
- Disturbances to feeding and foraging habitats
- Pollution resulting from spills, or inadequate stormwater management
- Turbid plumes.

Information Gaps

Sufficient information is available across the study area for the purposes of priority port master planning.

1.10.3 Listed Threatened and Migratory Species

PROFILE: Listed threatened and migratory species

Description

Cleveland Bay supports habitats for migratory or transient threatened or protected marine fauna including whales, dugongs, dolphins and marine turtles. These animals have different likelihoods of occurring in the study area with only a few species having been observed. These are described in Section 1.5 along with other listed marine species such as sharks and sawfish. Migratory marine birds are discussed below. Migratory species relate to their listing under one or more agreements including Japan-Australia Migratory Bird Agreement (JAMBA), China-Australia Migratory Bird Agreement (CAMBA), Bonn Convention, and Republic of Korea- Australia Migratory Bird Agreement (ROKAMBA).

A number of migratory marine birds are listed within the MNES search as likely to occur within the study area. Surveys of the Eastern Access Corridor and the site of the bridge over Ross River (NRA, 2005) identified the following migratory shore bird species as present during the survey: Redneck Stint, Great Knot, Sharp-tailed Sandpiper, Bar-tailed Godwit, Great Sand Plover and Eastern Curlew. Favoured use areas appeard to be the South Bank beach and a sand bar south of the entrance channel to Ross River. AECOM, 2013 reported that recent studies indicated that the sooty oystercatcher, among other species, is known to use existing POTL breakwaters and revetments for roosting, while other migratory birds use the POTL eastern reclamation for foraging. It was also reported that newly reclaimed areas are likely to enhance opportunistic foraging opportunities in emplaced marine sediments and roosting along greater lengths of breakwater and revetments (AECOM, 2013).

Contribution to OUV

Contributions to OUV include:

- Significant aggregations of a diversity of bird species, particularly migratory shorebirds in summer months
- Migrating whales
- Nesting turtles.

Threats

The following processes are of relevance to listed threatened and/or marine migratory species:

- animal interactions
- noise emissions and visual disturbance, resulting in modified foraging and breeding behaviours, and movement patterns
- light pollution and its effects on habitat usage patterns.

PROFILE: Listed threatened and migratory species

Information Gaps

The reports reviewed focus on the Port of Townsville and associated projects. It is expected that listed threatened and migratory marine megafauna would similarly occur in Halifax Bay, however very little information is available to confirm this assumption. Relatively little is known regarding the distribution of the inshore dolphin species, and the extent of site fidelity and genetic separation from populations elsewhere.

1.11 Marine Matters of State Environmental Significance

Matters of State Environmental Significance (MSES) refers to biodiversity within the State Planning Policy (SPP) and is comprised of:

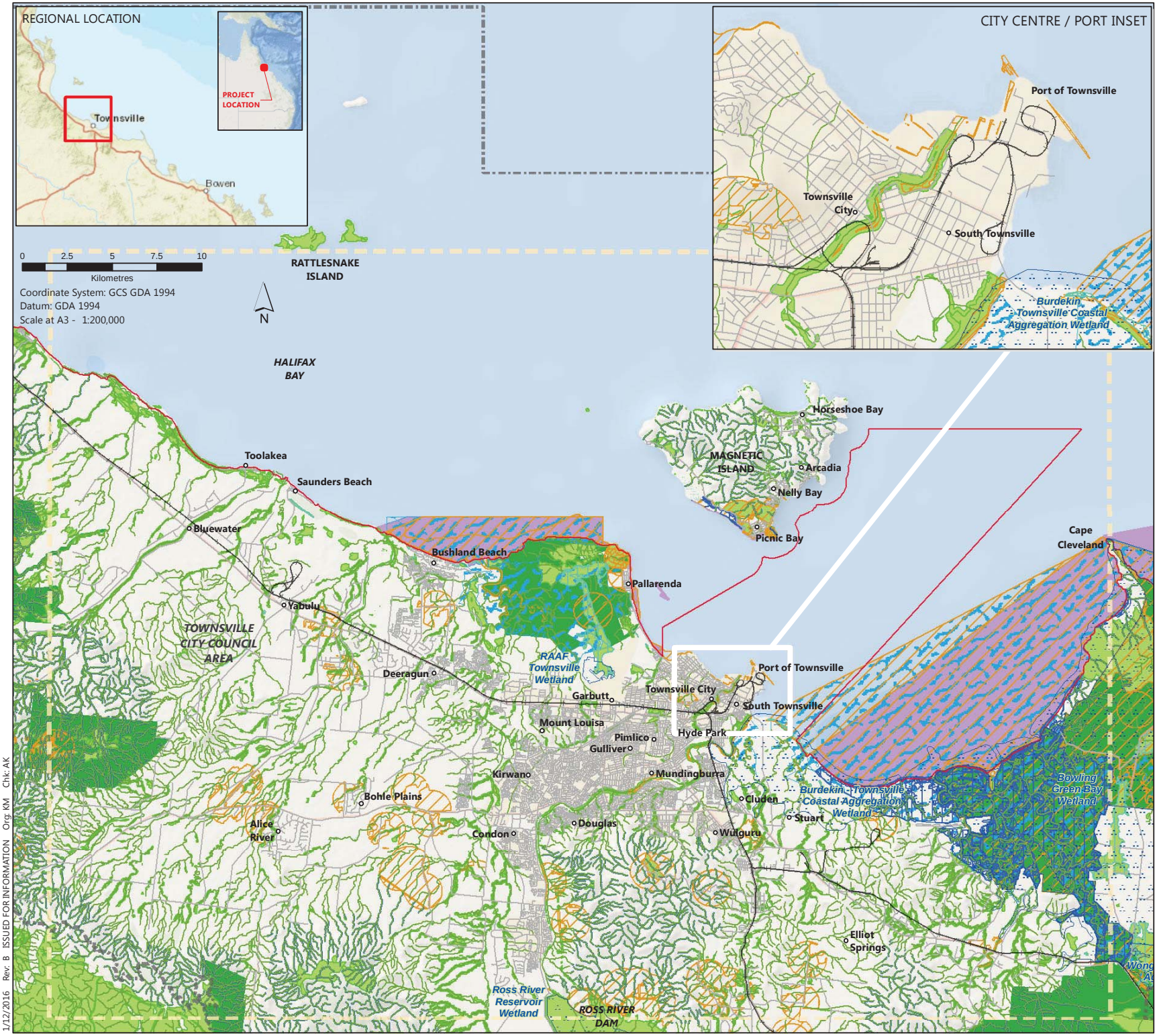
- State Conservation Areas such as Protected Areas (*Nature Conservation Act* 1992, *Marine Parks Act* 2004, *Fisheries Act* 1994)
- wetlands and waterways (*Environmental Protection Act* 1992; *Regional Planning Interests* Act 2014)
- threatened species (*Nature Conservation Act* 1992)
- regulated vegetation (*Vegetation Management Act* 1999)
- offset areas (various acts).

A search of Wildlife Online was completed on 29 July 2016 for the study area in order to identify species listed under the *Nature Conservation Act* (NCA) 1992 that occur within the study area. The results identified 2000 species (Appendix 1). In order to identify taxon status under the NCA, this result was filtered for Queensland listed endangered (E), vulnerable (V) and near threatened (NT) species. Eight (8) vulnerable species were identified. This filtered result is provided in Table 1-1.

Designated areas of MSES relevant to the study area are presented in Figure 1-7.

Townsville Evidence Base Report

Figure 1-7:
Matters of State Environmental Significance



Existing local road network
Existing rail network
Great Barrier Reef Marine Park boundary
Directory of Important Wetlands
Townsville City Council LGA boundary
Project area of interest

Matters of State Environmental Significance

- MSES - Regulated vegetation (intersecting a watercourse)
- MSES - High ecological value waters
- MSES - High ecological value waters (wetland)
- MSES - 'High Ecological Significance' wetlands
- MSES - Wildlife habitat
- MSES - Regulated vegetation
- MSES - Protected area
- MSES - Declared fish habitat area
- MSES - Marine park

Source Information:
Local Government Area Boundaries - Queensland
Rail network - Queensland
Queensland Department of Natural Resources and Mines
Matters of State environmental significance - v4.1 - Queensland
Queensland Department of Environment and Heritage Protection

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Table 1-1: Wildlife Online search – Queensland listed results

Kingdom	Class	Family	Scientific Name	Common Name	QLD	AUST	Sighting Records	Specimen Records
animals	*mammals*	Balaenopteridae	Megaptera novaeangliae	humpback whale	V	V	15	0
animals	*mammals*	Delphinidae	Sousa sahulensis	Australian humpback dolphin	V		10	10
animals	*mammals*	Delphinidae	Orcaella heinsohni	Australian snubfin dolphin	V		59	29
animals	*mammals*	Dugongidae	Dugong dugon	dugong	V		11	1
animals	*reptiles*	Cheloniidae	Eretmochelys imbricata	hawksbill turtle	V	V	2	0
animals	*reptiles*	Cheloniidae	Chelonia mydas	green turtle	V	V	13	0
animals	*reptiles*	Cheloniidae	Natator depressus	flatback turtle	V	V	3	0
animals	*reptiles*	Crocodylidae	Crocodylus porosus	estuarine crocodile	V		16	2

2 Terrestrial Environment

Terrestrial ecological values (i.e. vegetation and fauna) can be identified within the study area. Specific environmentally protected areas include state and national parks and other reserves including Magnetic Island, Paluma Range, and Bowling Green Bay National Parks; and the Cape Pallarenda, Townsville Town Common Conservation Park, Stuart Creek Nature Refuge, Cape Pallarenda Regional Park and Magnetic Island's Horseshoe Bay Lagoon Conservation Park.

This analysis draws on a range of information sources including the following key reports and searches of database searches, including EPBC Act Protected Matters Database and Wildlife Online.

- AECOM, 2013. Port Expansion Project EIS
- PoTL, 2014. A Description of the Existing Environment Surrounding the Port of Townsville
- Maunsell AECOM, 2007. Port of Townsville Master Plan Report R5 – Master Plan
- Saunders Havill, 2011. Townsville State Development Area. Ecological Assessment Report.

2.1 Vegetation

PROFILE: Vegetation
Description
Based on communities that are mapped under the *Vegetation Management Act* (VMA) 1999, the study area is comprised of 376 Regional Ecosystems (RE), of these, 55 have been identified as endangered or of concern. These are listed in Table 2-1 and occur largely outside of built up areas such as land used for urban or industrial, however, some RE's do occur adjacent to the built up areas. These include RE 11.3.4 adjacent to Queensland Nickel, RE 11.2.1 within the TSDA, RE 11.2.3/11.2.5 adjacent to Sun Metals. Several of concern and endangered RE's also occur along Bluewater Creek with urban development. The landside port area has been either cleared or reclaimed and is utilised for port operations and associated industry and does not support terrestrial flora values. These are mainly associated with the coastal zone inter-tidal and littoral habitats. AECOM (2013) listed several species that have be observed or are likely to occur within the PEP study area. These include:

PROFILE: Vegetation				
Species name	***Common Name***	***EPBCA status***	***NCA Status***	***Comment***
Acacia jackesiana		-	C	Species identified using habitat on Magnetic Island
Bonamia dietrichiana		-	C	Mapped Essential habitat on Magnetic Island
Cassia sp. (Paluma Range G.Sankowsky+450)	golden shower	-	C	Species identified using habitat on Magnetic Island
Corchorus hygrophilus		-	V	Species identified using habitat on Magnetic Island
Croton magneticus		-	V	Species identified using habitat on Magnetic Island
Grewia graniticola		-	C	Mapped Essential habitat on Magnetic Island
Hydrocharis dubia	frogbit	Not listed	Not listed	Suitable habitat in broader area
Leucopogon cuspidatus		-	C	Suitable habitat in broader area
Marsdenia brevifolia		V	V	Species identified using habitat on Magnetic Island
Peripleura scabra		-	C	Species identified using habitat on Magnetic Island
Solanum sporadotrichum		-	NT	Species identified using habitat on Magnetic Island
Taeniophyllum muelleri	minute orchid, ribbonroot orchid	Not listed	Not listed	Suitable habitat in broader area

Notes
C – least concern, V- Vulnerable, E – Endangered, NT - Near threatened

The report completed by Saunders Havill Group in 2011 identified key EPBC Act and *National Conservation Act* (NCA) 1992 regulated species and communities and RE within the TSDA. These are summarised in the table below. A desktop review completed for the Townsville Port Expansion Project (PEP) by AECOM/BMT WBM in 2013 also identified threatened, migratory and marine species.

PROFILE: Vegetation

Key terrestrial environmental values within the TSDA

Legislation	*Category*	*Environmental Value Conservation Significance*
EPBC	Plants	*Tylophora williamsii* (located within the western side of Stuart Creek)
EPBC	Other	Matalunga Range
EPBC	Wetlands	Wetlands - The GBRMP (World Heritage property and Natural Heritage Place) and Bowling Green Bay (Wetland of International Significance)
NCA	Other	All common species (natives) within road reserves, lease and government owned land are protected under the NCA
VMA	REs	RE 11.1.1 Least Concern - *Sporobolus virginicus* grassland on Quarternary estuarine deposits
VMA	REs	RE11.3.31 Of Concern - *Ophiuros exaltatus* and *Dicanthium spp.* Grasslands
VMA	REs	RE11.3.12 Least Concern - *Eucalyptus platyphylla*, *Corymbia clarksoniana* woodlands with *Corymbia tessellaris* occurring in some areas
VMA	REs	RE11.3.25b Least Concern - riverine wetlands or fringing riverine wetlands with *Melaleuca leucadendra* and/or *Melaleuca fluviatilis*, *Nauclea orientalis* open forest
LP (PSRMA)	Weed species	Water lettuce and I (class 3 aquatic weed species) were observed within the watercourse
LP (PSRMA)	Weed species	Low level of weed infestation across the salt plain. Parkinsonia (Class 2 weed) was observed on the higher points of the clay pan
LP (PSRMA)	Weed species	All open paddock areas are dominated by introduced weed species. Identified Class 2 weeds include; I, Chinee Apple, Prickly Acacia and Mesquites
LP (PSRMA)	Weed species	The clay pan and estuarine areas generally have a low level of weeds. The heavily grazed open paddock areas contain a number of Class 2 weeds *Parkinsonia*, Chinee Apple, Prickly Acacia and Mesquites
LP (PSRMA)	Weed species	The level of weed densities vary greatly across the wetlands. One of these water bodies was entirely covered with *Salvinia*, a Class 2 weed

PROFILE: Vegetation

Notes

EPBC – Environmental Protection and Biodiversity Conservation Act 1999
NCA - Nature Conservation Act 1992
VMA – Vegetation Management Act 1999
LP (PSRMA) - Land Protection (Pest and Stock Route Management) Act 2002

Contribution to OUV

The contribution to OUV from flora is considered.

Significant for:

- Vast mangrove forests and diversity of mangrove species

Moderate for:

- Green vegetated islands
- Diversity supporting marine and terrestrial species (global conservation significance)

Minor for:

- Plant species and diversity and endemism (species being unique to a defined geographic location)

Threats

- direct removal and/or creation of land forming habitat for plants and animals
- indirect effects from changed hydrology and potential sedimentation at the interface with intertidal lands
- spread of invasive terrestrial pest and weed species
- expansion of port areas into threatened / sensitive communities
- increased activity / traffic.

Information Gaps

Comprehensive ground-truthed RE mapping has not been completed throughout all of the study area. Area of current or planned development has in most cases been surveyed and mapped.

Table 2-1 Regional Ecosystems

RE	Area within study area (ha)	biodivstat	Combo desc
11.12.12	67.8	Of concern	Araucaria cunninghamii woodland on igneous rocks. Coastal hills
11.12.15	195.6	Of concern	Allocasuarina torulosa. Livistona decora woodland on igneous rocks. Coastal hills
11.12.16	3104.4	Of concern	Mixed low woodland to shrubland on igneous rocks. Coastal hills
11.12.16a	9.7	Of concern	Mixed low woodland to shrubland on igneous rocks. Coastal hills
11.12.16x1	288.4	Of concern	Mixed low woodland to shrubland on igneous rocks. Coastal hills
11.12.19	73.6	Of concern	Eucalyptus exserta. E. moluccana. E. crebra. Corymbia citriodora woodland on igneous rocks
11.2.1	160.2	Of concern	Corymbia tessellaris woodland on flat coastal dunes
11.2.2	166.9	Of concern	Complex of Spinifex sericeus. Ipomoea pes-caprae subsp. brasiliensis and Casuarina equisetifolia grassland and herbland on fore dunes
11.2.1/11.3.27x1b	3.8	Of concern	Freshwater wetlands
11.2.1/11.2.2	10.8	Of concern	Corymbia tessellaris woodland on flat coastal dunes / Complex of Spinifex sericeus. Ipomoea pes-caprae subsp. brasiliensis and Casuarina equisetifolia grassland and herbland on fore dunes
11.2.1/11.2.3/11.2.2	18.3	Of concern	Corymbia tessellaris woodland on flat coastal dunes / Microphyll vine forest (beach scrub) on sandy beach ridges and dune swales / Complex of Spinifex sericeus. Ipomoea pes-caprae subsp. brasiliensis and Casuarina equisetifolia grassland and herbland on fore dunes
11.2.2/11.1.1	8.7	Of concern	Complex of Spinifex sericeus. Ipomoea pes-caprae subsp. brasiliensis and Casuarina equisetifolia grassland and herbland on fore dunes / Sporobolus virginicus grassland on marine clay plains
11.2.3/11.2.2	1.7	Of concern	Microphyll vine forest (beach scrub) on sandy beach ridges and dune swales Complex of Spinifex sericeus. Ipomoea pes-caprae subsp. brasiliensis and Casuarina equisetifolia grassland and herbland on fore dunes
11.2.2/11.2.3	3.7	Of concern	Complex of Spinifex sericeus. Ipomoea pes-caprae subsp. brasiliensis and Casuarina equisetifolia grassland and herbland on fore dunes / Microphyll vine forest (beach scrub) on sandy beach ridges and dune swales
11.2.3/11.3.9	2.3	Of concern	Microphyll vine forest (beach scrub) on sandy beach ridges and dune swales / Eucalyptus platyphylla. Corymbia spp. woodland on alluvial plains
11.2.2/11.1.4/11.1.2	3.2	Of concern	Complex of Spinifex sericeus. Ipomoea pes-caprae subsp. brasiliensis and Casuarina equisetifolia grassland and herbland on fore dunes / Mangrove forest and/or woodland on marine clay plains / Samphire forbland on marine clay plains
11.2.3	32.5	Of concern	Microphyll vine forest (beach scrub) on sandy beach ridges and dune swales
11.2.3/11.2.5	15.1	Of concern	Microphyll vine forest (beach scrub) on sandy beach ridges and dune swales / Corymbia-Melaleuca woodland complex of beach ridges and swales

RE	Area within study area (ha)	biodivstat	Combo desc
11.2.3/11.2.2	12.1	Of concern	Microphyll vine forest ("beach scrub") on sandy beach ridges and dune swales / Complex of Spinifex sericeus, Ipomoea pes-caprae subsp. brasiliensis and Casuarina equisetifolia grassland and herbland on fore dunes
11.2.3/11.2.4/11.2.1	16.7	Of concern	Microphyll vine forest ("beach scrub") on sandy beach ridges and dune swales / Lagoons in coastal dune swales / Corymbia tessellaris woodland on flat coastal dunes
11.2.4	1.0	Of concern	Lagoons in coastal dune swales
11.2.4/11.3.9/11.2.2	1.7	Of concern	Lagoons in coastal dune swales / Eucalyptus platyphylla, Corymbia spp. woodland on alluvial plains / Complex of Spinifex sericeus, Ipomoea pes-caprae subsp. brasiliensis and Casuarina equisetifolia grassland and herbland on fore dunes
11.3.13	7.9	Endangered	Grevillea striata open woodlands on coastal alluvial plains
11.3.4	170.8	Of concern	Eucalyptus tereticornis and/or Eucalyptus spp. woodland on alluvial plains
11.3.4/11.1.3	0.0	Of concern	Eucalyptus tereticornis and/or Eucalyptus spp. woodland on alluvial plains / Sedgelands on marine clay plains
11.3.4/11.3.12a	11.4	Of concern	Eucalyptus tereticornis and/or Eucalyptus spp. woodland on alluvial plains / Palustrine wetland (e.g. vegetated swamp): Melaleuca viridiflora M. argentea +/- M. dealbata woodland on alluvial plains
7.1.2a	88.3	Of concern	Sporobolus virginicus grassland, samphire open forbland to sparse forbland and bare saltpans on plains adjacent to mangroves
7.1.2b	38.4	Of concern	Sporobolus virginicus grassland, samphire open forbland to sparse forbland and bare saltpans on plains adjacent to mangroves
7.1.3a	5.3	Endangered	Schoenoplectus subulatus and/or Eleocharis dulcis sparse sedgeland, or Melaleuca quinquenervia low open forest, in swamps which fluctuate periodically between freshwater and estuarine
7.12.10a	163.2	Of concern	Notophyll vine forest with emergent Araucaria cunninghamii of the moist and dry foothills and uplands on granites and rhyolites of the Seaview and Paluma Ranges
7.12.37a	4.2	Of concern	Rock pavements and seepage areas of wet lowlands, uplands and highlands of the eastern escarpment and central range (excluding Hinchinbrook Island and Bishop Peak) on granite and rhyolite, with Allocasuarina spp. shrublands and/or sedgelands
7.12.60b	0.8	Endangered	Melaleuca viridiflora +/- Corymbia clarksoniana +/- Eucalyptus platyphylla woodland to open forest on granite and rhyolite
7.12.66a	91.0	Of concern	Lophostemon confertus low shrubland or low closed forest on exposed rocky slopes on granite and rhyolite
7.12.66b	6.0	Of concern	Lophostemon confertus low shrubland or low closed forest on exposed rocky slopes on granite and rhyolite
7.2.3a	308.8	Of concern	Corymbia tessellaris and/or Acacia crassicarpa and/or C. intermedia and/or C. clarksoniana woodland to closed forest on beach ridges (predominantly Holocene)
7.2.3b	26.3	Of concern	Corymbia tessellaris and/or Acacia crassicarpa and/or C. intermedia and/or C. clarksoniana woodland to closed forest on beach ridges (predominantly Holocene)
7.2.3g	57.3	Of concern	Corymbia tessellaris and/or Acacia crassicarpa and/or C. intermedia and/or C. clarksoniana woodland to closed forest on beach ridges (predominantly Holocene)
7.2.7a	43.3	Endangered	Casuarina equisetifolia +/- Corymbia tessellaris open forest +/- groved vine forest shrublands on strand and foredunes
7.2.8	15.5	Endangered	Melaleuca leucadendra open forest to woodland on sands of beach origin
7.3.19b	6.3	Of concern	Corymbia intermedia or C. tessellaris +/- Eucalyptus tereticornis open forest (or vine forest with these species as emergents) on well-drained alluvium

RE	Area within study area (ha)	biodivstat	Combo desc
7.3.21a	132.6	Of concern	Eucalyptus portuensis +/- Corymbia intermedia open forest to woodland on alluvium on alluvial fans at the base of ranges
7.3.21b	4.9	Of concern	Eucalyptus portuensis +/- Corymbia intermedia open forest to woodland on alluvium on alluvial fans at the base of ranges
7.3.25a	177.9	Of concern	Melaleuca leucadendra +/- vine forest species open forest to closed forest on alluvium fringing streams
7.3.28a	26.8	Endangered	Rivers and streams including riparian herbfield and shrubland on river and stream bed alluvium and rock within stream beds
7.3.28b	78.4	Endangered	Rivers and streams including riparian herbfield and shrubland on river and stream bed alluvium and rock within stream beds
7.3.29b	1.1	Endangered	Sedgelands and grasslands of permanently and semi-permanently inundated swamps, including areas of open water
7.3.43a	6.8	Endangered	Eucalyptus tereticornis open forest to woodland on uplands on well-drained alluvium
7.3.50a	140.0	Endangered	Melaleuca fluviatilis +/- vine forest species open forest to closed forest on alluvium fringing streams
7.3.50b	2.3	Endangered	Melaleuca fluviatilis +/- vine forest species open forest to closed forest on alluvium fringing streams
11.1.1/11.1.3	10.7	Of concern	Sporobolus virginicus grassland on marine clay plains / Sedgelands on marine clay plains
11.1.2/11.2.3/11.1.4	16.9	Of concern	Samphire forbland on marine clay plains / Microphyll vine forest ("beach scrub") on sandy beach ridges and dune swales / Mangrove forest and/or woodland on marine clay plains
11.12.13/11.12.4/11.12.15/11.12.16	317.4	Of concern	Eucalyptus crebra, Corymbia spp., E. acmenoides woodland on igneous rocks. Coastal hills / Semi-evergreen vine thicket and microphyll vine forest on igneous rocks / Allocasuarina torulosa, Livistona decora woodland on igneous rocks. Coastal hillsAllocasuarina torulosa, Livistona decora woodland on igneous rocks. Coastal hills / Mixed low woodland to shrubland on igneous rocks. Coastal hills
11.3.9/11.2.1	3.6	Of concern	Eucalyptus platyphylla, Corymbia spp. woodland on alluvial plains / Corymbia tessellaris woodland on flat coastal dunes
11.3.9/11.2.1/11.3.25b	2.2	Of concern	Eucalyptus platyphylla, Corymbia spp. woodland on alluvial plains / Corymbia tessellaris woodland on flat coastal dunes / Eucalyptus tereticornis or E. camaldulensis woodland fringing drainage lines
11.3.9/11.2.3	4.8	Of concern	Eucalyptus platyphylla, Corymbia spp. woodland on alluvial plains / Microphyll vine forest ("beach scrub") on sandy beach ridges and dune swales

Townsville Evidence Base Report

Figure *2-1*:
Regional Ecosystems

CITY CENTRE / PORT INSET

RATTLESNAKE ISLAND
HALIFAX BAY
TOWNSVILLE CITY COUNCIL AREA
ROSS RIVER DAM
MAGNETIC ISLAND
Toolakea
Saunders Beach
Bluewater
Bushland Beach
Queensland Nickel Refinery
Yabulu
Deeragun
Pallarenda
RAAF Townsville Base
Townsville City
Port of Townsville
South Townsville
Garbutt
Mount Louisa
Pimlico
Gulliver
Hyde Park
Kirwan
Mundingburra
Bohle Plains
Alice River
Condon
Douglas
Wulguru
Cluden
Stuart
Horseshoe Bay
Arcadia
Nelly Bay
Picnic Bay
Cape Cleveland
Elliot Springs
Aurizon locomotive and rolling stock maintenance facility
Sun Metals
Zinc Refinery
JBS Australia abattoir
Townsville City Council landfill
Toll NQX Townsville rail freight terminal
Mt Stuart peaking generator plant
Xstrata Copper refinery
RAAF Townsville Wetland
Ross River Reservoir Wetland
Burdekin Townsville Coastal Aggregation Wetland
Bowling Green Bay Wetland
11.1.4
11.3.35
11.12.9
11.3.31
11.1.2b
11.1.2a
11.1.4b
11.1.1
11.2.5
11.1.4a
11.2.2
11.1.4c

Existing local road
Existing rail
Townsville City Council LGA
Project area of interest
Directory of Important Wetlands - Wetland

Regional Ecosystems v8.0

As listed under the Qld Vegetation Management

Remnant vegetation containing endangered regional ecosytems
Remnant vegetation containing of concern regional ecosystems
Remnant vegetation that is a least concern regional ecosystem

Source Information:
Local Government Area Boundaries - Queensland
Rail network - Queensland
Vegetation management regional ecosystem and remnant map - v8.0
Queensland Department of Natural Resources and Mines

While every care is taken to ensure the accuracy of this data, WorleyParsons makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaims all responsibility and all liability (including without limitation liability in negligence) for all expenses, losses, damages (including indirect or consequential damage) and costs which might be incurred as a result of the data being inaccurate or incomplete in any way and for any reason.

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Coordinate System: GCS GDA 1994
Datum: GDA 1994
Scale at A3 - 1:200,000

0 2.5 5 7.5 10
Kilometres

REGIONAL LOCATION
PROJECT LOCATION
Townsville
Bowen

Advisian
WorleyParsons Group

G:\301310a\13663 PROJ - EEM Townsville Port Evidence\10.0 Engineering\10 GM-Geomatics\Output\301310-13663-00-GM-SKT-0015-B (RE).mxd
1/12/2016 Rev: B ISSUED FOR INFORMATION Orgr: KM Chk: AK

2.2 Fauna

PROFILE: Fauna

Description

The study area supports a number of habitats that support mammals, reptiles, and extensive bird populations, including the migratory birds that fly through the coastal plain on their annual journey along the East Australian Flyway. Although the landside port area does not generally support critical terrestrial fauna habitat, avifauna (birds) may visit the coastal zone and use nearby shoreline and littoral habitats. Marine birds frequently occur at the port, while feeding, resting or overflying from one habitat to another. Nearby inter-tidal shores are known for shorebird occurrence, providing a key roosting and feeding habitat. Many of those bird species that occur are listed as threatened or migratory species. The predominant areas of bird habitation are located on the sandspit on the eastern bank of Ross River.

The endangered (EPBC Act) Black-throated Finch (southern) (*Poephila cincta cincta*) is identified in the EPBC Act SPRAT database as occuring at two broad locations in Queensland, one of which is the Townsville region, where it is considered to be locally common at a few sites around Townsville and Charters Towers. Within the Townsville region they occur at Giru, Serpentine Lagoon, Toonpan, and near Ross River Dam. Of these, only the northern part of Ross River Dam is located within the study area. The Black throated finch is also recorded as occuring in the Bohle Plains Industrial Investigation Area and the natural habitat extending across the area is significant as potential nesting habitat for the finch and other threatened species. Other listed species known to occur include the vulnerable Squatter Pigeon (southern subspecies) (*Geophaps scripta scripta)* and high probability that the critically endangered Bare Rumped Sheath Tail Bat also occurs.

AECOM (2013) listed several species that have be observed or are likely to occur within the PEP study area. These include:

PROFILE: Fauna

Species name	*Common name*			*Comment*
Accipiter novaehollandiae	grey goshawk	-	C	Species identified on Magnetic Island
Aerodramus terraereginae	Australian swiftlet	-	C	Suitable habitat in broader area
Ephippiorhynchus asiaticus	black-necked stork	-	C	Species identified using habitat near the mouth of the Ross River and on Magnetic Island
Erythrotriorchis radiatus	red goshawk	V	E	Suitable habitat in broader area
Geophaps scripta scripta	squatter pigeon	V	V	Suitable habitat in broader area
Haematopus fuliginosus	sooty oystercatcher	-	C	Species identified using habitat near the mouth of the Ross River and on Magnetic Island
Dasyurus hallucatus	northern quoll	E	C	Rediscovered on Magnetic Island
Hipposideros semoni	semon's leaf-nosed bat	Not listed	Not listed	Suitable habitat in broader area
Pteropus conspicillatus	spectacled flying fox	Not listed	Not listed	Suitable habitat in broader area
Rhinolophus philippinensis (large form)	greater large-eared horseshoe bat	Not listed	Not listed	Suitable habitat in broader area
Taphozous australis	coastal sheathtail bat	Not listed	Not listed	Species identified using habitat near the mouth of the Ross River and on Magnetic Island
Xeromys myoides	water mouse, false water rat	Not listed	Not listed	Suitable habitat in broader area
Acanthophis antarcticus	common death adder	-	V	Mapped Essential habitat on Magnetic Island
Delma labialis	striped-tailed delma	-	C	Mapped Essential habitat on Magnetic Island and identified
Egernia rugosa	yakka skink	Not listed	Not listed	Web search - suitable habitat
Lampropholis mirabilis	saxicoline sunskink	-	NT	Mapped Essential habitat on Magnetic Island

PROFILE: Fauna				
Menetia sadlieri	Sadliers dwarf skink	Not listed	Not listed	Species identified

Notes

C – least concern, V- Vulnerable, E – Endangered, NT - Near threatened

The report completed by Saunders Havill Group in 2011 identified key EPBC Act and *National Conservation Act* (NCA) 1992 regulated species and communities and RE within the TSDA. These are summarised in the table below. A desktop review completed for the Townsville Port Expansion Project (PEP) by AECOM BMT WBM in 2013 also identified threatened, migratory and marine species.

Key terrestrial environmental values within the TSDA

Legislation	***Category***	***Environmental Value***
EPBC	Mammals	Water Mouse (Listed as Vulnerable)
EPBC	Birds	Migratory and Wader Bird Species (Listed as Migratory) observed within the study area including: White- bellied Sea eagle, White-throated Needletail, Cattle Egret, Eastern Great Egret, Caspian Tern, Rainbow Bee-eater, and Black-faced Monarch Black-throated Finch (not likely to occur within Stuart Creek – but more studies required)
NCA	Birds	Black Necked Stork (Listed as Near Threatened)
NCA	Reptiles	Sunskink (listed as rare)
NCA	Other	All common species (natives) within road reserves, lease and government owned land are protected under the NCA

Notes

EPBC – *Environmental Protection and Biodiversity Conservation Act* 1999

NCA - *Nature Conservation Act* 1992

VMA – *Vegetation Management Act* 1999

LP (PSRMA) - *Land Protection (Pest and Stock Route Management) Act* 2002

PROFILE: Fauna

Contribution to OUV

The contribution to OUV from fauna values is considered

Significant for:

- Aggregations of a diversity of bird species, particularly migratory shorebirds in summer months
- Many species of birds

Moderate for:

- Diversity supporting marine and terrestrial species (global conservation significance)

Minor for:

- Breeding colonies of seabirds.

Threats

- Direct removal and/or creation of land forming habitat for plants and animals
- Spread of invasive terrestrial species
- Noise, vibration and light emissions
- Expansion of port areas into threatened / sensitive communities
- Increased activity / traffic

Information Gaps

Comprehensive ground-truthing of mapping has not been completed throughout all of the study area. Area of current or planned development have in most cases been surveyed and mapped.

2.3 Wetlands and Catchment Water Quality

PROFILE: Wetlands and Catchment Water Quality

Description

The study area supports a number of wetland areas, including lacustrine (lake), palustrine (marsh), riverine, estuarine and marine wetland types. Such habitats support extensive and valuable bird populations, including the migratory birds that fly through the coastal plain on their annual journey along the East Australian Flyway. Bowling Green Bay and Great Barrier Reef Marine Park are discussed in Section 1.10, there are also another four wetlands of national importance (listed in the Directory of Important Wetlands) located within the study area, including:

- Burdekin-Townsville coastal aggregation and the Ross River Reservoir
- RAAF Townsville
- Ross River Reservoir
- Wongaloo Swamps Aggregation.

Water quality within the study area is influenced by a number of factors. This includes land uses (i.e. agricultural, urban and industrial) and catchment management practices and existing contamination of surface water bodies and groundwater. A water quality improvement plan (WQIP) prepared by Gunn and Manning (2010), assessed catchment water quality and identified water quality improvements within the Black Ross (Townsville) area. This includes the Black River and Ross River catchments which cover most waterways within the Townsville City LGA including Magnetic Island and the study area (Figure 2-2). The waterways have been grouped into sub-basins, all of which flow to the GBR. The activities on this land therefore have significant impact on the GBR water quality (Gunn and Manning, 2010). The most significant land use within the study area is grazing on native pastures, followed by urban land uses including heavy industry uses and conservation and natural environments (DSITI, 2016). The sub-basins most relevant to the study area include:

- Bluewater Creek
- Black River
- Bohle River
- Upper Ross River
- Lower Ross River
- Stuart Creek
- Alligator Creek
- Magnetic Island.

Only 36 per cent of waterways within the Black Ross (Townsville) WQIP area have available water quality data, therefore Gunn and Manning (2010) could only provide an indication of water

PROFILE: Wetlands and Catchment Water Quality

conditions. This limited assessment indicated the following:

- 50 per cent of the waterways achieved the total nitrogen (TN) water quality objective (WQO)
- 50 per cent of the waterways achieved total phosphorus (TP) WQO
- 33 per cent achieved the total suspended solids (TSS) WQO. TSS is therefore likely to be the main focus for water quality improvement with nutrient reduction also being important.

Contribution to OUV

The water quality of the GBR is affected by the quality of water entering the marine environment from the adjacent catchments. The Black River and Ross River Basins are part of the GBR catchment and include Townsville City, which is the largest urban population adjacent to the GBR (Gunn and Manning, 2010).

Threats

Gunn and Manning (2010) identify the principal threat to water quality as being land use intensification resulting from population growth. This is generally due to inappropriate planning, design and/or management.

Gunn and Manning (2010) state that the key pollutants generated from the GBR catchments leading to water quality decline are sediment (TSS) and nutrients (nitrogen and phosphorus). Pesticides are another pollutant of concern, particularly in agricultural areas, however water quality monitoring to date has indicated that pesticides are not a significant issue in the Black Ross (Townsville) WQIP area (Gunn and Manning, 2010). Townsville City was identified as a point source pollutant area as it contains intensive land uses such as industry; however, the only significant point source pollutant identified in terms of water quality impacts are the wastewater treatment plants.

The main ecosystem health impacts in freshwater include:

- Algal blooms from excessive nutrients
- Alteration of habitat due to sedimentation
- Eutrophication and reduced oxygen levels associated with excess nutrients and primary production and organic gross pollutants (may result in fish kills).

Gunn and Manning (2010) suggest that there is unlikely to be significant impacts to water quality in the short and medium term due to climate change; however, longer-term changes may include:

- Indirect impacts through changes to physical condition and structure of vegetation and vegetation communities, with leading to changes to soil erosion rates
- Direct impacts may include increase in the severity and/or intensity of rainfall events that would lead to increase sheet and gully erosion and subsequent pollutant loads entering receiving waters and increase instream bank and channel erosion and subsequent discharge

PROFILE: Wetlands and Catchment Water Quality

loads to marine receiving water

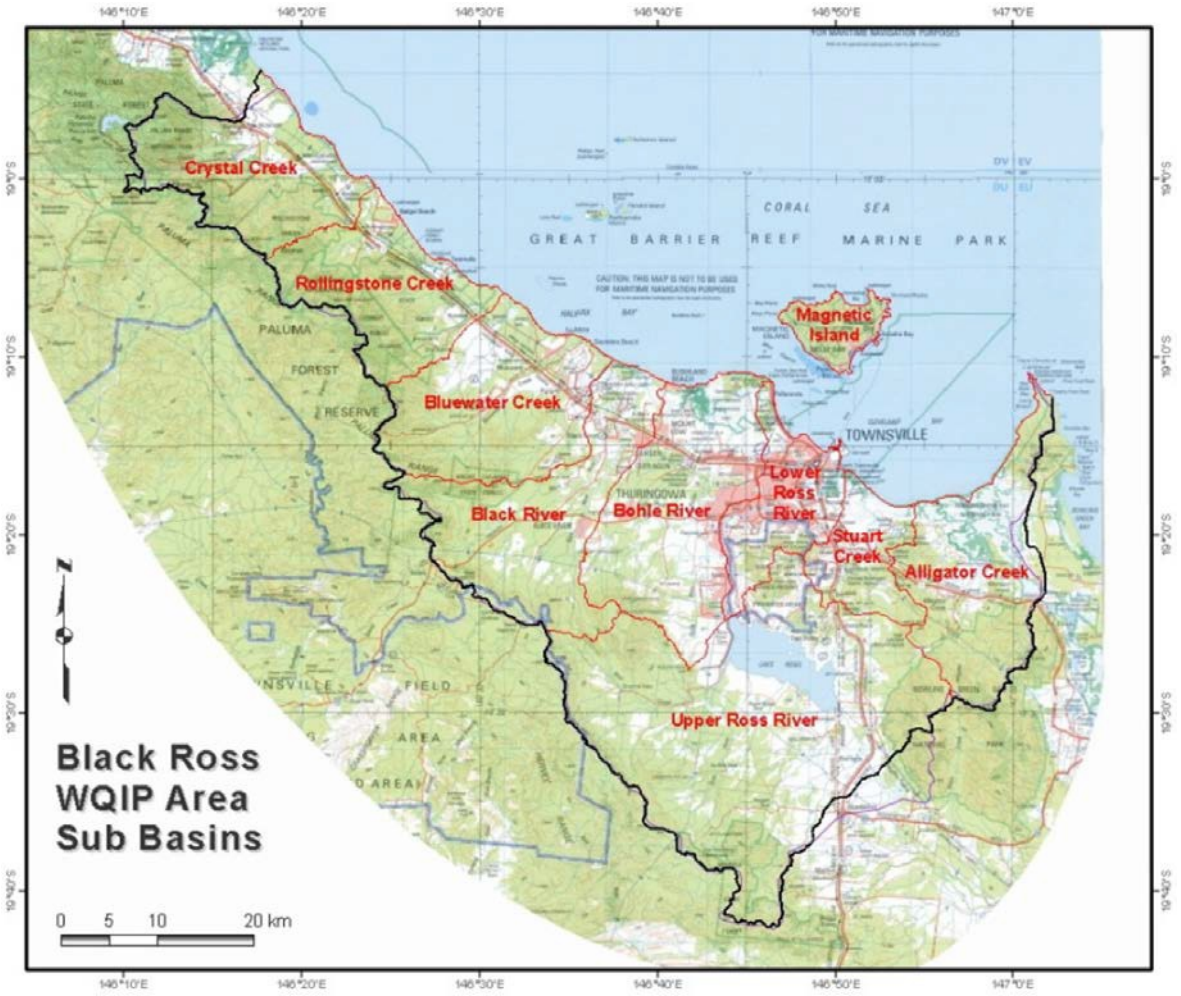
- Increased freshwater discharge to marine waters leading to coral bleaching
- Temperature increases of water bodies due to increases in average temperatures and extreme daily temperatures
- Sea level rise altering fresh water coastal wetlands to brackish or salt water wetlands.

Information Gaps

Gaps exist in the amount of available water quality data. This includes availability of water quality data in receiving waters from industries that may impact catchment water quality, such as:

- Queensland Nickel refinery
- Origin Energy Mt Stuart peaking generator plant
- Yabulu power station
- Pacific National rail freight terminal
- Aurizon locomotive and rolling stock maintenance facility
- Sun Metals Zinc refinery
- JBS Australia abattoir
- Townsville City Council landfill
- Townsville correctional facility
- Xstrata Copper refinery.

These industries are regulated to minimise their environmental impact. Part of this regulation typically includes environmental monitoring such as surface water and groundwater monitoring, where relevant. A review of such data would be beneficial in understanding potential contaminant inputs.



Source: Gunn and Manning, 2010

Figure 2-2 Water Quality Improvement Plan Area Sub-Basins

2.4 Groundwater Quality

PROFILE: Groundwater Quality

Description

The DEHP have identified environmental values (EVs) and WQOs for Townsville region waters. These have been derived from information in the Black Ross (Townsville) Water Quality Improvement Plan (Gunn and Manning, 2010) (Section 2.3), available local water quality data, and Queensland (DEHP, 2009) and national (ANZECC, 20000) water quality guidelines. EVs and WQOs are identified for the Black and Ross Basins. This indicates that groundwater beneath Townsville City and its surrounds, including Townsville Town Common Conservation Park and Bluewater Creek near the coastline, are located within high salinity alluvial deposits. Groundwater in other areas near the coast (i.e. Bowling Green Bay) and at Ross Lake are located in coastal and floodplain zones with low salinity. Groundwater in floodplains inland are sodic with low to moderate salinity, while groundwater beneath mountains are located in tropical alluvium with low to very low salinity.

AECOM (2013) reports that a number of groundwater monitoring wells were installed and sampled in the vicinity of the PEP area by Maunsell between 2002 and 2005 and two wells by GHD in 2008. The results of groundwater monitoring were:

- The shallow groundwater is saline and not suitable for any land-based beneficial use.
- Elemental concentrations were elevated in two locations 300 m and 130 m from the PEP reclamation area. In December 2004 groundwater conditions in these wells were slightly acidic (pH 6.24 and 5.08, respectively).
- GHD wells were observed to give off a strong 'mangrove mud' odour and GW2 a slight 'rotten egg' odour, which suggests the presence of hydrogen sulphide in groundwater.
- Dissolution and leaching of minerals present in the existing reclaim sediments may account for the above conditions, as rainwater infiltrates the unsaturated zone and as groundwater levels fluctuate due to natural tidal fluctuations.

Contribution to OUV

The water quality of the GBR is impacted by the quality of water entering the marine environment from the adjacent catchments. Interchange between groundwater, surface water and marine system can affect the quality of waters within the GBR. As such the activities that take place on land ultimately have significant impacts on the quality of the water of the GBR. The Black River and Ross River Basins are part of the GBR catchment and include Townsville City, which is the largest urban population adjacent to the GBR (Gunn and Manning, 2010).

PROFILE: Groundwater Quality

Threats

Potential impacts arise from:

- Development and agricultural practices leading to dewatering and wastage
- Pollution / contamination leading to decline in water quality

Information Gaps

Similar to catchment water quality, gaps exist in the amount of available groundwater quality data from industry, particularly those that include notifiable activities listed in Section 2.3.

These industries are regulated to minimise their environmental impact. Part of this regulation typically includes groundwater monitoring. A review of such data would be beneficial in understanding potential contaminant inputs.

2.5 Geology, Landform and Soils

PROFILE: Landform, Geology and Soils

Description

Geology and Landform

Wyatt *et al.* (1968) describes the geology of the study area as being primarily comprised of Late Palaeozoic granite and acid volcanic rocks with smaller areas of intermediate volcanics, interbedded sediment and granodiorite (Wyatt, 1986). The granites and acid volcanics occur as hilly mountainous lands with rock outcrop (Murtha, 1975). Basic rocks however, weathered to subdued landscapes (Murtha, 1975). Landform and soils are described by Murtha (1975, 1982), who identifies broad physiographic units (Figure 2-3) within the study area. These are summarised below.

- Coastal sand dunes representing beach ridges north of Ross River and littoral zones mainly along the Cleveland Bay coastline to the south of Ross River consisting of shallow freshwater and coastal swamps and extensive areas of mangrove estuaries, saltpan and mudflats containing Acid Sulfate Soils (ASS). The Townsville City Plan defines the extent of ASS (refer Part 9.4.2 and Figure 9-2 of the Townsville City Plan Healthy waters code). On the Townsville 1:100000 geology sheet 8259, these areas are mapped as Holocene aged tidal flats (Qhc*t*) and beach ridge sand (Qhc*b*) that generally occur two to nine kilometres from the coastline. Colluvium slope wash and residual sands on granite have been mapped as Pleistocene to Holocene aged Qr^{g} and Qr^{v}, and Q*rs* respectively.
- Low lying and elevated alluvial plains used for cattle grazing and containing numerous rivers, creeks and wetlands such as Bluewater Creek, Bohle River, Ross Creek, Ross River and Bowling Green Bay. The low lying plains have been mapped as Holocene aged channel deposits (Q*as*) and alluvial sand (Qh*a*). Elevated alluvial plains have been mapped as Pleistocene alluvium (Qp*a*).
- Piedmont slopes and gently undulating uplands (i.e. foot hills). These are the mapped as Permian aged granites (P*g*, P*g*p, P*g*c, P*g*m, P*g*u, P*g*s) or Carboniferous volcanic (Cv).
- Hilly and mountainous lands featuring unique landmarks such as Mt Louisa, Castle Hill, Mount Stuart and Magnetic Island. These isolated rock hills or mountains are the residuals of intrusive volcanics (mainly granite and granodiorite) of Upper Carboniferous to Permian age (Wyatt et al., 1986). The highest peak in the study area and on the Townsville 1:100,000 Sheet 8259 is Mt Stuart (1.223 km). They are mapped as Pj, however, Magnetic Island and Castle hill are mapped P*g*m and P*g*c respectively.

Port of Townsville land does not conform to the above units as it is constructed predominantly from reclaimed land using dredged material from the seafloor of the Outer Harbour basin. Study area geology is presented as Figure 2-4.

PROFILE: Landform, Geology and Soils

Soils

The majority of the study area is located on alluvial plans comprised of sodic duplex soils (i.e. Sodosols), but some cracking clays (i.e. Vertosols) and gradational earths (i.e. Kandosols) do occur. Murtha (1975) indicates the extensive fine textured deposits are indicative of a wide spread low energy depositional environment. Murtha adds that clay deposits were probably a result of very extensive swamps during the period of higher sea-level associated with the series of Pleistocene beach ridges. The beach ridges are predominately comprised of uniform sands to sandy loams with mottled subsoils (i.e. Podosols). Some minor gradational grey clays with mottled subsoils (i.e. Vertosols) also occur. The swampy areas have been partially filled by coarse sandy alluvial fan deposits originating from granites and granodiorites (Murtha, 1975). Infilled channels are common on the gentle piedmonts surrounding Mt Elliot (Murtha, 1975). Note the physiographic unit identified as Alluvial Fans and Channel Infills on Figure 2-3 occur outside of the study area boundary to the southwest.

The Hilly and mountainous lands are dominated by large granitic intrusions (i.e. Mt Elliot, Stuart, Cape Cleveland) that rise abruptly from alluvial plans (Murtha, 1975). Soils developed on these lands are shallow to deep uniform massive sands and earths (i.e. Tenosols) or texture contrast soils. The soils developed on piedmont slopes are similar to those developed on adjacent hard-rock uplands.

Murtha (1975, 1982) describes a large proportion of soils that occur in Bowling Green Bay and Townsville Town Common Conservation Park as saline soils and denoted as mangroves and salt pans on mapping. These dark brown muds of unknown depth, contain substantial organic material (i.e. decomposing mangrove roots) and are inundated by tidal waters. The soils developed on the salt pans are texture contrast soils with strongly mottled yellow and red subsoils. These are inundated by tidal water four to five times per year. Both saline soils have been mapped as ASS (Figure 2-4) and occur below 5mAHD.

Strategic Cropping Area (SCA) is an area of regional interest under the *Regional Planning Interests Act* 2014 (RPI Act) and consists of the areas shown on the SCL Trigger Map as strategic cropping land (SCL). SCL is defined in the RPI Act as:

> *land that is highly suitable for cropping, or likely to be highly suitable for cropping, based on a particular combination of soil, climate and landscape features*

Land that is SCL must meet the following RPI Regulation (the 'SCL criteria'):

- (1) slope
- (2) rockiness
- (3) gilgai
- (4) soil depth
- (5) soil wetness
- (6) soil pH

PROFILE: Landform, Geology and Soils

- (7) salinity
- (8) soil water storage.

Land mapped as SCL will need to be proven not to be SCL (using the criteria above) if development is proposed in the SCA.

SCL has been mapped throughout the study area mainly low lying flat areas along creeks. Within the study area the most significant areas of SCL have been mapped around the Queensland Nickel Refinery, along Bluewater Creek, along Ross River at the Townsville Golf Club, Endeavour Park, south of Hervey Road and largely vacant land near River Edge Boulevard, Dalrymple Road east of Mt Louisa, and within the TSDA (Figure 2-5).

Contribution to OUV

The contribution to OUV from geology, landform and soils is considered:

Moderate in terms of:

- Superlative natural beauty above and below the water
- Green vegetated islands

Minor in regards to:

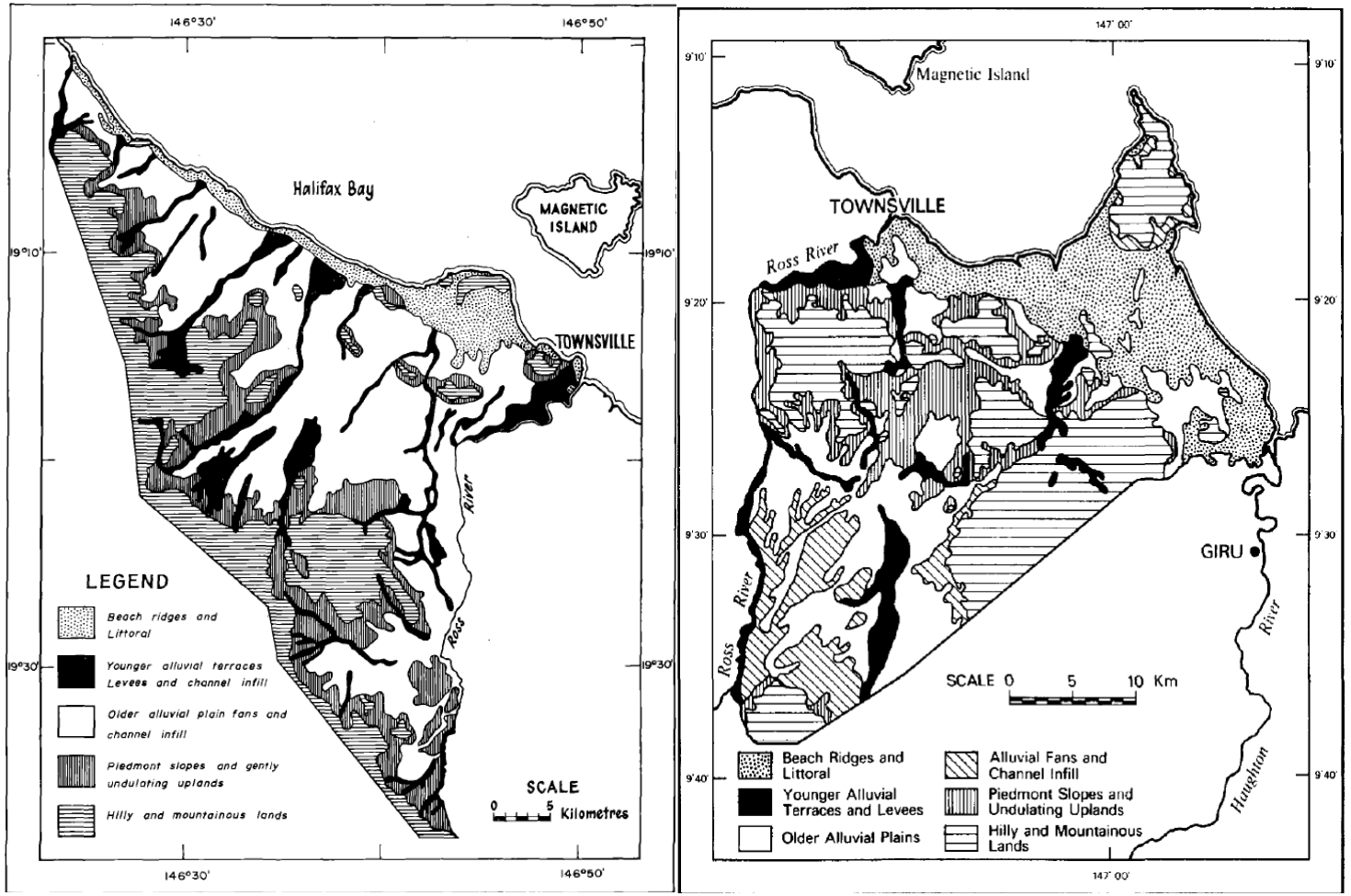
- Spectacular sandy beaches
- Vegetated mountains
- Continental islands
- Processes of geological and geomorphic evolution
- Unique and varied seascapes and landscapes.

Threats

- development / clearing leading to erosion, land degradation, secondary salinity
- poor land management practices

Information Gaps

Studies of the soils of Magnetic Island have not been reviewed, however, as similar physiographic units and geologies are present. Therefore, the soil types are expected to be similar to those on the mainland. Additional site specific ASS investigations have not been completed. Land below 5mAHD will need to be assessed prior to development.

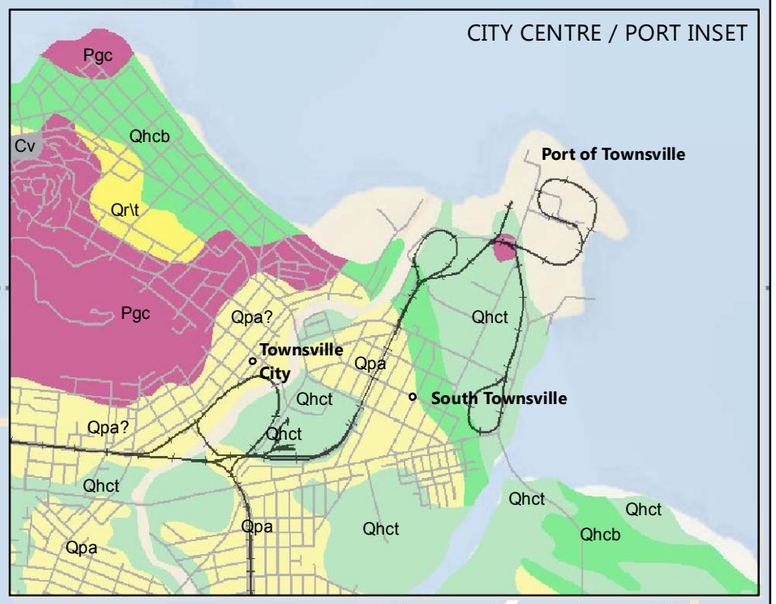


Source: Murtha, 1975 and 1982

Figure 2-3 Physiographic Units

Townsville Evidence Base Report

Figure 2.4:
Geology and Acid Sulfate Soils



RATTLESNAKE ISLAND

0 2.5 5 7.5 10
Kilometres

Coordinate System: GCS GDA 1994
Datum: GDA 1994
Scale at A3 - 1:200,000

HALIFAX BAY

MAGNETIC ISLAND

TOWNSVILLE CITY COUNCIL AREA

ROSS RIVER DAM

Toolakea
Saunders Beach
Bluewater
Yabulu
Bushland Beach
Pallarenda
Horseshoe Bay
Arcadia
Nelly Bay
Picnic Bay
Cape Cleveland
Deeragun
Garbutt
Townsville City
South Townsville
Port of Townsville
Mount Louisa
Pimlico
Hyde Park
Gulliver
Mundingburra
Kirwano
Bohle Plains
Alice River
Condon
Douglas
Cluden
Stuart
Wulguru
Elliot Springs

EXTENT LIMIT OF GEOLOGICAL DATA

Source Information:
Local Government Area Boundaries - Queensland
Rail network - Queensland
Declared Fish Habitat Areas
Dugong Protection Areas
Queensland Department of Natural Resources and Mines
Road network, Acid Sufate Soils (Townsville City Plan Figure 9.2)
Townsville City Council 2016
Geology
Geodata - Queensland geological mapping data - Nov 2011
Department of Employment, Economic Development and Innovation

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ACID SULFATE SOILS
- 0-5 metres AHD
- 5-20 metres AHD

SURFACE GEOLOGY

HOLOCENE
- Qhcb-QLD
- Qhct-QLD

QUATERNARY
- Qa-QLD
- Qa/s-SE55
- Qa\f-QLD
- Qe-QLD
- Qhh/d-QLD
- Qr-QLD
- Qr\s-QLD
- Qr\t-QLD

PLEISTOCENE
- Qpa-QLD
- Qpa?-QLD
- Qpcb-SE55

CRETACEOUS (Intrusive)
- Kg-8259

PERMIAN
- Julago Volcanics

PERMIAN (Intrusive)
- Castle Hill Granite
- Magnetic Island Granite
- Mount Storth Granite
- Muntalunga Range Granite
- Pg-8259
- Pg/p-8259
- Pg?-8259

EARLY PERMIAN (Intrusive)
- Speed Creek Granite

CARBONIFEROUS - PERMIAN (Intrusive)
- CPg\h-SE55
- CPg\l-SE55

CARBONIFEROUS - EARLY PERMIAN (Intrusive)
- CPg/a-8159
- CPg\m-SE55

CARBONIFEROUS
- Cv-8259
- Saint Giles Volcanics

CARBONIFEROUS (Intrusive)
- Cg-8259
- Cir-Kennedy Province

EARLY CARBONIFEROUS
- Glenrock Group

ORDOVICIAN - DEVONIAN (Intrusive)
- ODg?-Ravenswood Batholith

NEOPROTEROZOIC - EARLY PALAEOZOIC
- Argentine Metamorphics/sa?

Advisian
WorleyParsons Group

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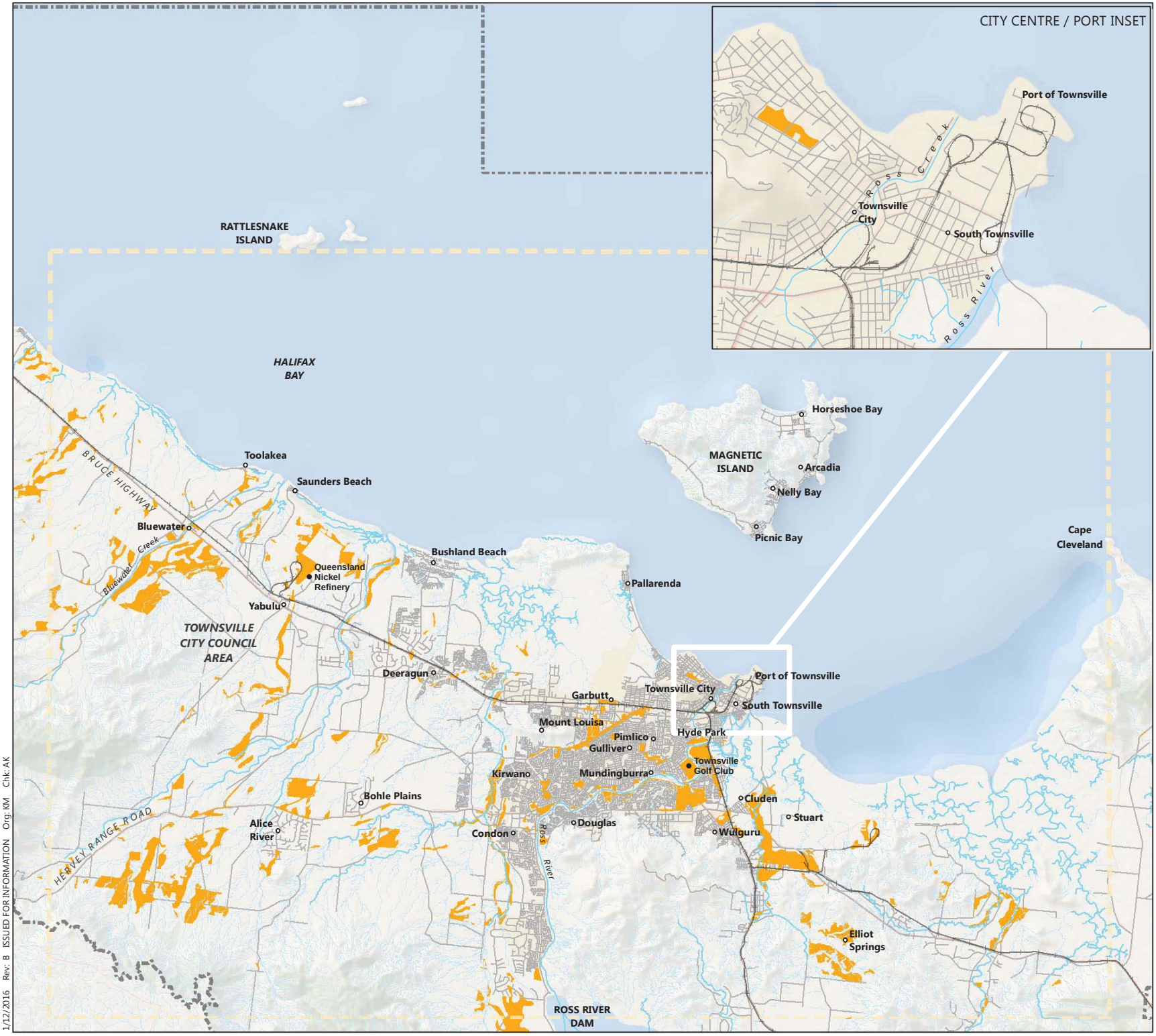

Townsville Evidence Base Report

Figure `2-5:
Strategic Cropping Area

- Perennial watercourse
- Non-perennial watercourse
- Existing local road network
- Existing rail network
- Strategic cropping area
- Townsville City Council LGA boundary
- Project area of interest

Source Information:
Local Government Area Boundaries - Queensland
Rail network - Queensland
Queensland Department of Natural Resources and Mines
Strategic Cropping Area
Electronic mapping data for Strategic Cropping Land in Queensland under the RPI Act 2014 v3.4
Queensland Department of Natural Resources and Mines

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Datum: GDA 1994
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Kilometres

Advisian
WorleyParsons Group

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2.6 Terrestrial Matters of National Environmental Significance (MNES)

A protected matters search (Appendix 1) identified MNES as potentially occurring within the study area. MNES relevant to the terrestrial component of the study area are described below and presented in Figure 1-5. Note that the search results in Appendix 1 also include marine and estuarine matters, which are discussed in Section 1.10. The following sections provide a summary of terrestrial MNES.

2.6.1 Listed Threatened Ecological Communities

PROFILE: Listed threatened ecological communities

Description

MNES search results indicated that there are three listed ecological communities:

- Broad leaf tea-tree (*Melaleuca viridiflora*) woodlands in high rainfall coastal north Queensland
- Littoral Rainforest and Coastal Vine Thickets of Eastern Australia
- Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions

Broad leaf tea-tree woodlands

This ecological community is listed as endangered as it has been cleared or degraded by heavy grazing and incursion of weeds. The relatively small amount that remains in good condition is now protected under the EPBC Act as an endangered ecological community (SEWPaC, 2012b). According to the distribution map, this community is likely to occur within the northwest corner of the study area typically as woodland but can have a more dense forest structure in some areas.

Littoral Rainforest and Coastal Vine Thickets

This ecological community is listed as critically endangered and occurs on Quaternary sands (beach ridges) in the northern portion of the South Eastern Queensland Bioregion. This ecological community represents a complex of rainforest and coastal vine thickets, including some that are deciduous. They typically occur near to the coast or adjacent to estuaries on landforms derived from coastal processes that can include dunes and flats, cheniers, berms, cobbles, headlands, scree, seacliffs, marginal bluffs, spits, deltaic deposits, coral rubble and islands (DEWHA, 2009). According to the distribution map, a patch of this community is likely to occur within the northwest corner of the study area as RE 11.2.3.

Semi-evergreen vine thickets of the Brigalow Belt

This ecological community is listed as endangered as it has been fragmented, reduced in area and degraded through land clearing and agricultural/grazing practices. The thickets comprised of vines, twining or scrambling plants, typically have an uneven canopy 4–9m high with mixed evergreen, semi-evergreen and deciduous emergent tree species 9–18m high. They are widely

PROFILE: Listed threatened ecological communities

scattered with a common structure (architecture) but considerable regional variation in floristic associations (DERM, 2010). According to the distribution map, this community is likely to occur within the northwest corner of the study area, Bowling Green Bay and Magnetic Island.

Broad leaf tea-tree woodlands

Littoral rainforest at Mission Beach, QLD. Wet Tropics Bioregion

Extensive vine thicket in the Upper Walker Creek Valley (Bunya Mountains)

Contribution to OUV

Moderate contributions to OUV include:

- Superlative natural beauty above and below the water
- Green vegetated islands
- Vegetated mountains

Threats

Potential threats are:

- Coastal development (i.e. clearing, grazing)
- Agricultural clearing
- Weeds
- Fire
- Feral animals

Information Gaps

Ground truthing of MNES mapping has not been completed. Although mapped within the study area, the occurrence of these communities has not been confirmed.

2.6.2 Listed Threatened and Migratory Species

PROFILE: Listed threatened and migratory species
Description
MNES search results indicated the following: ▪ 43 listed threatened species ▪ 41 migratory species The study area supports habitats for migratory or transient threatened or protected terrestrial fauna including birds, frogs, mammals, reptiles and plants. These animals have different likelihoods of occurring in the study area with only a few species having been observed within the TSDA. These are described in Sections 2.1 and 2.2.
Contribution to OUV
Contributions to OUV include: ▪ Vegetated mountains ▪ Aggregations of a diversity of bird species, particularly migratory shorebirds in summer months ▪ Diversity supporting marine and terrestrial species (global conservation significance) ▪ Plant species and diversity and endemism (species being unique to a defined geographic location)
Threats
The following threatening processes are of relevance to listed threatened and/or marine migratory species: ▪ habitat clearing (development and agricultural) ▪ animal interactions and feral animal introductions ▪ noise emissions and visual disturbance, resulting in modified foraging and breeding behaviours, and movement patterns ▪ light pollution and its effects on habitat usage patterns.
Information Gaps
Ground truthing of MNES mapping has not been completed for the entire study area.

2.7 Terrestrial Matters of State Environmental Significance

Matters of State Environmental Significance (MSES) refers to biodiversity within the State Planning Policy (SPP) and is comprised of:

- State Conservation Areas such as Protected Areas (*Nature Conservation Act* 1992)
- wetlands and waterways (*Environmental Protection Act* 1992; *Regional Planning Interests Act* 2014)
- threatened species (*Nature Conservation Act* 1992)
- regulated vegetation (*Vegetation Management Act* 1999)
- offset areas (various acts).

MSES relevant to the study area are presented in Figure 1-7.

A search of *Wildlife Online* was completed on 29 July 2016 for the study area in order to identify species listed under the NCA that occur within the study area. The results identified 2000 species (Appendix 1). In order to identify taxon status under the NCA, this result was filtered for Queensland listed critically endangered (CE), endangered (E), vulnerable (V) and near threatened (NT) species. Seven (7) endangered, 16 vulnerable and two near threatened species were identified. This filtered result is provided in Table 2-2.

Table 2-2 Terrestrial Wildlife Online Search Results for Study Area

Kingdom	Class	Family	Scientific Name	Common Name	QLD	AUST	Sighting Records	Specimen Records
animals	birds	Accipitridae	Erythrotriorchis radiatus	red goshawk	E	V	9	0
animals	birds	Estrildidae	Erythrura gouldiae	Gouldian finch	E	E	1	0
animals	birds	Estrildidae	Poephila cincta cincta	black-throated finch (white-rumped subspecies)	E	E	26	0
animals	birds	Procellariidae	Macronectes giganteus	southern giant-petrel	E	E	4	0
animals	birds	Burhinidae	Esacus magnirostris	beach stone-curlew	V		88	0
animals	birds	Cacatuidae	Lophochroa leadbeateri	Major Mitchell's cockatoo	V		1	0
animals	birds	Columbidae	Geophaps scripta scripta	squatter pigeon (southern subspecies)	V	V	9	0
animals	birds	Falconidae	Falco hypoleucos	grey falcon	V		1	0
animals	birds	Psittacidae	Cyclopsitta diophthalma macleayana	Macleay's fig parrot	V		9	0
animals	birds	Rostratulidae	Rostratula australis	Australian painted snipe	V	E	12	0
animals	birds	Scolopacidae	Numenius madagascariensis	eastern curlew	V	CE	269	0
animals	birds	Tytonidae	Tyto novaehollandiae kimberli	masked owl (northern subspecies)	V	V	1	0
animals	mammals	Emballonuridae	Saccolaimus saccolaimus nudicluniatus	bare-rumped sheathtail bat	E	CE	1	1
animals	mammals	Phascolarctidae	Phascolarctos cinereus	koala	V	V	85	0
animals	reptiles	Carphodactylidae	Phyllurus gulbaru	Gulbaru gecko	E	CE	1	0
animals	reptiles	Scincidae	Lampropholis mirabilis	saxicoline sunskink	NT		9	9
animals	reptiles	Elapidae	Acanthophis antarcticus	common death adder	V		9	0
plants	higher dicots	Myrtaceae	Sannantha papillosa		E		2	2
plants	higher dicots	Solanaceae	Solanum sporadotrichum		NT		9	9
plants	higher dicots	Apocynaceae	Marsdenia brevifolia		V	V	2	2
plants	higher dicots	Elaeocarpaceae	Dubouzetia saxatilis		V		6	6
plants	higher dicots	Euphorbiaceae	Croton magneticus		V		11	9
plants	higher dicots	Myrtaceae	Eucalyptus paedoglauca	Mt. Stuart ironbark	V	V	10	10
plants	higher dicots	Sparrmanniaceae	Corchorus hygrophilus		V		9	9
plants	monocots	Poaceae	Paspalidium udum		V		2	2

3 Air Quality, Noise and Vibration

3.1 Air Quality

PROFILE: Air
Description
General Air Quality Prevailing winds are typically from the south-east during the morning hours, shifting to stronger sea breezes from the north-east in the afternoon (BOM, 2016a). The DEHP have conducted air quality monitoring in Townsville since the year 2000. The parameters measured include meteorological data, PM10, TSP and metals. The air quality index applied is the pollutant concentration expressed as a proportion of the National Environment Protection Measure for Ambient Air Quality (Air NEPM) standard or the *Environmental Protection (Air) Policy* 2008 (Air EPP) objective. Based on monitoring data from 2000 to 2014, Townsville's air quality has been rated as Very Good (DEHP, 2016). **Greenhouse Gas** AECOM (2013) report that the existing sources of greenhouse gas emissions by POTL include refrigerants (from air conditioning), stationary energy fuel use (from emergency generators) and electricity use, plus POTL owned fleet, pilot vessel and machinery. These will continue throughout the development and operation of the Port. AECOM (2013) indicate that the quantity of POTL emissions or future emissions do not trigger the *National Greenhouse and Energy Reporting (NGER) Act* 2007 and are considered minimal in the context of Australian corporations (AECOM, 2013).
Contribution to OUV
Air quality has limited relevance to OUV.
Threats
▪ Particulate and dust emissions from development (i.e. construction, operations, increased traffic) ▪ Odours.
Information Gaps
Air quality monitoring is focused around Townsville City, primarily due to the density of urban and industrial activity. Regional areas as well as other industrial areas within the study area have not been assessed.

3.2 Noise and Vibration

PROFILE: Noise and vibration

Description

Noise

Baseline noise monitoring was undertaken at residential locations for the PEP from 02/06/11 to 14/06/11 to assess noise from the Port and the ambient noise environment in the vicinity of the Port. AECOM (2013) report that the existing ambient acoustic environment at the port is characterised by noise from both port and urban traffic from Townsville and noise from port activities.

Sensitive receptors, as defined in the *Environmental Protection (Noise) Policy* 2008, include dwellings, libraries and educational institutions, childcare centres and kindergartens, outdoor school playground areas, medical institutions, commercial and retail activities, protected areas, marine parks and passive parks and gardens. Sensitive receptors relevant to the Port of Townsville include:

- Dwellings in Townsville CBD, South Townsville, Railway Estate and The Ville Resort -Casino on the mainland, as well as dwellings on Magnetic Island
- Townsville South Primary School in South Townsville
- Buildings with commercial and retail activity in South Townville, Townsville CBD and The Strand
- Commercial and retail buildings in the otherwise predominantly industrial Townsville Marine Precinct
- Passive recreational parks/gardens in and South Townsville, Townsville CBD area and The Strand.

AECOM (2013) reported that predicted noise levels for the PEP were below the existing daytime background typical quietest and ambient average noise levels for construction activities. Exceptions to this being piling at berths and wharves and limited rock breaking work for breakwaters and revetments.

Vibration

AECOM (2013) report that key vibration sources associated with the port include heavy vehicles moving to, from and about the site, overhead cranes moving and the impact of items being unloaded from ships onto the wharves. No ground-borne vibration was discernible by acoustic engineers in attendance during periods of noise measurements. AECOM (2013) conservatively estimate the existing background vibration environment as a Peak Particle Velocity vibration level lower than 0.10 mm/s.

PROFILE: Noise and vibration

Contribution to OUV

- Noise and vibration have limited relevance to OUV unless they lead to a decline in fauna habitat values or impact on human appreciation of the World Heritage Area.

Threats

Increased noise (variable or continuous) can disturb terrestrial and marine species and affect their behaviour, including breeding or foraging. Increased noise may be generated by:

- Traffic
- Construction (moving equipment such as generators, pile-driving, alarms etc)
- Dredging
- Reclamation
- Operation of machinery (including conveyors and alarms, fans, cranes, vehicles)

Information Gaps

Noise and vibration monitoring was focused around the Port of Townsville for the PEP. Noise and vibration monitoring of the greater study area have not been assessed.

4 Hazards

4.1 Flooding and Inundation

PROFILE: Flooding and Inundation
Description
A majority of the study area is located within a naturally low-lying coastal floodplain susceptible to inundation by a combination of heavy rainfall and/or high tides (AECOM, 2012). With the exception of several residual mountains, the area is primarily flat. Heavy rainfalls during the wet seasons often coincide with high tides therefore having a significant impact on flooding extent (AECOM, 2012). Overflows from the Ross River and Ross Creeks can cause significant inundation around Port of Townsville, Townsville CBD and the suburbs of South Townsville, Railway Estate and Oonoonba (AECOM, 2012). The Ross River catchment is the largest within the Townsville LGAwhile Ross Creek drains most of the urbanised area of Townsville City including the suburbs of South Townsville, Hyde Park, Mundingburra, Gulliver, Currajong, Pimlico, Mysterston, Aitkenvale, Vincent and Cranbrook (AECOM, 2012). Three hydraulic extremes could exist to create flooding within the study area: ▪ Storm tide only (refers to the elevation of the storm surge in combination with the astronomical tide and wave setup.) ▪ Stormwater only ▪ A combination of elevated storm tide and stormwater flow. Townsville City Council flood inundation mapping in relation to the study area is presented in Figure 4-1 while storm surge inundation is presented on Figure 4-2. Both of these mapped hazard extents are derived from the Townsville City Plan (Townsville City Council, 2014), with mapping having been through a formal State interest review process. Note that these maps include the effects of climate change such as sea level rise.
Contribution to OUV
N/A
Threats
N/A
Information Gaps
Nil

Townsville Evidence Base Report

Figure 4-1:
Catchment Flooding Extent

CITY CENTRE / PORT INSET

Port of Townsville
Townsville City
South Townsville

RATTLESNAKE ISLAND
HALIFAX BAY
MAGNETIC ISLAND
Horseshoe Bay
Arcadia
Nelly Bay
Picnic Bay
Cape Cleveland
Toolakea
Saunders Beach
Bluewater
Bushland Beach
Pallarenda
Yabulu
TOWNSVILLE CITY COUNCIL AREA
Deeragun
Garbutt
Townsville City
Port of Townsville
South Townsville
Mount Louisa
Pimlico
Hyde Park
Gulliver
Kirwan
Mundingburra
Bohle Plains
Cluden
Stuart
Alice River
Douglas
Condon
Wulguru
Elliot Springs
ROSS RIVER DAM

- Existing local road network
- Existing rail network
- Townsville City Council LGA boundary
- Project area of interest

Flood hazard classification

- High hazard area
- Medium hazard area
- Low hazard area
- Medium hazard - further investigation area

Source Information:
Local Government Area Boundaries - Queensland
Rail network - Queensland
Queensland Department of Natural Resources and Mines
Catchment Flooding Extents
Flood hazard overlay map (OM-06.1) Townsville City Council - Townsville City Plan
Townsville City Council

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0 2.5 5 7.5 10
Kilometres

REGIONAL LOCATION

PROJECT LOCATION
Townsville
Bowen

Advisian
WorleyParsons Group

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Townsville Evidence Base Report

Figure 4-2:
Stormtide Inundation Extent

CITY CENTRE / PORT INSET

Port of Townsville
Townsville City
South Townsville

RATTLESNAKE ISLAND
HALIFAX BAY
MAGNETIC ISLAND
Horseshoe Bay
Arcadia
Nelly Bay
Picnic Bay
Cape Cleveland
Toolakea
Saunders Beach
Bluewater
Bushland Beach
Pallarenda
Yabulu
TOWNSVILLE CITY COUNCIL AREA
Deeragun
Garbutt
Townsville City
Port of Townsville
South Townsville
Mount Louisa
Pimlico
Gulliver
Hyde Park
Kirwan
Mundingburra
Cluden
Stuart
Bohle Plains
Douglas
Condon
Wulguru
Alice River
Elliot Springs
ROSS RIVER DAM

- Existing local road network
- Existing rail network
- Townsville City Council LGA boundary
- Project area of interest

Stormtide inundation areas

- High hazard
- Medium hazard

Source Information:
Local Government Area Boundaries - Queensland
Rail network - Queensland
Queensland Department of Natural Resources and Mines
Catchment Flooding Extents
Stormtide inundation areas (OM-03.1) Townsville City Council - Townsville City Plan
Townsville City Council

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0 2.5 5 7.5 10
Kilometres

REGIONAL LOCATION

PROJECT LOCATION
Townsville
Bowen

Advisian
WorleyParsons Group

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4.2 Contaminated Land, Sulfate Soils and Bushfire

PROFILE: Contaminated Land, Acid Sulfate Soils and Bushfire

Description

In Queensland, contaminated land regulated under the Queensland *Environmental Protection Act* (EP Act) 1994. The primary objective of the EP Act is to protect environmental values and human health while allowing for developments that improve the total quality of life, both now and in the future, in a way that maintains ecological processes. The EP Act accomplishes these objectives by imposing two main duties: the general environmental duty and the duty to notify.

The DEHP have the responsibility for overseeing the management of contaminated land as outlined in Chapter 7, Part 8 of the EP Act. DEHP administers guidelines for contaminated land on their website to assist with the land assessment and remediation.

To assist with the management of contaminated sites, DEHP maintains databases of confirmed contaminated and potentially contaminated sites in Queensland. Potentially contaminated sites are defined as land where one or more notifiable activities have been carried out. Notifiable activities are listed in Schedule 3 of the EP Act, 1994. Land presently or formerly used for a notifiable activity or land that is confirmed as being contaminated is recorded on the Environmental Management Register (EMR). Land that is proven contaminated and has the potential to cause serious environmental harm is recorded on the Contaminated Land Register (CLR).

There are a number of land uses with activities in the study area that may be listed as 'notifiable activities' in Schedule 3 of the EP Act. Within the study area these potentially include:

- Chemical manufacture
- Chemical storage
- Coal fired power station
- Dry cleaning
- Electrical transformers
- Engine reconditioning works
- Explosives production or storage
- Fertilizer manufacture
- Foundry operations
- Herbicide or pesticide manufacture
- Landfilling (waste disposal)
- Livestock dip or spray race
- Metal treatment
- Mine waste
- Mineral processing
- Paint manufacture
- Pest control
- Petroleum / petrochemical industries
- Petroleum product or oil storage
- Commercial printing
- Railway yards
- Scrap yards
- Service stations
- Smelting or refining
- Tannery
- Waste storage, treatment or disposal
- Wood treatment and preservation

PROFILE: Contaminated Land, Acid Sulfate Soils and Bushfire

A community based website, State of Environment Townsville (SoE) indicates that 447 land parcels within the Townsville LGA are listed on the EMR and of these, 19 are subject to Site Management Plans (SMPs) (SoE, 2003).

AECOM, 2013 completed EMR/CLR searches for the PEP. These identified 20 lots near the PEP listed on the EMR.

Unexploded ordnance (UXO)

UXO represents a specific form of land contamination arising from any sort of military ammunition or explosive ordnance which has failed to function as intended. Explosive ordnance that has functioned yet contains residual explosive or chemical warfare agent is normally treated as UXO. Derelict or discarded explosive ordnance is also treated similarly to UXO.

As a result of military training and live firing undertaken by Australian and Allied Forces, there are many areas throughout Australia not controlled by the Commonwealth that may be subject to residual UXO contamination. Townsville has a significant Second World War history both as a staging point for Australian and Allied Forces campaigns in the Pacific region against enemy combatants and as a reported target from enemy fire and bombing raids. The Australian Department of Defence (DoD) provide online mapping that identifies UXO affected sites (DOD, 2016). This mapping was used to search the study area. The search indicates several areas with "slight" and "other" UXO potential with significant potential areas located at Yabulu, Townsville Town Common Conservation Park, Bowling Green Bay National Park and smaller areas within the TSDA. A "slight" potential indicates sites with a confirmed history of military activities that have resulted in residual UXO, while the classification "other" potential confirm that the area was used for military training but do not confirm that the site was used for live firing. UXO or explosive ordnance fragments / components have not been recovered from the site. The result of the search is provided below.

PROFILE: Contaminated Land, Acid Sulfate Soils and Bushfire

Acid sulfate soils

Littoral zones mainly along the Cleveland Bay coastline to the south of Ross River consist of shallow freshwater and coastal swamps and extensive areas of mangrove estuaries, saltpan and mudflats contain ASS. These soils generally occur below 5 m AHD. Development on these areas requires assessment for and management of acid sulfate soils.

Bushfire

The Townsville City Plan includes a Development Constraints - Bushfire hazard overlay which identified areas of high and medium hazard. It identifies that the majority of the study area is classed as medium hazard. This is predominantly due to the uniform vegetation community found across much of the area combined with the generally flat terrain. High bushfire hazard areas include those around Granite Vale and Calcium, Mount Elliot and Alligator Creek, Mount Stuart and Julago, Clemant and Blue Hills, The Pinnacles and Cape Cleveland. The Townsville City Plan includes a Bushfire Hazard Overlay Code to manage development in bushfire hazard areas.

Contribution to OUV
N/A
Threats
N/A

PROFILE: Contaminated Land, Acid Sulfate Soils and Bushfire

Information Gaps

Current searches of the EMR/CLR register have not been completed. These searches should be completed to provide an initial assessment of contaminated land within the study area. In addition, no specific contaminated land reports have been reviewed. If available, these reports may provide specific geochemical information for soil, surface water and / or groundwater contamination relevant to the study area.

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Appendix 1 Government Database Search Results

Australian Government
Department of the Environment

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

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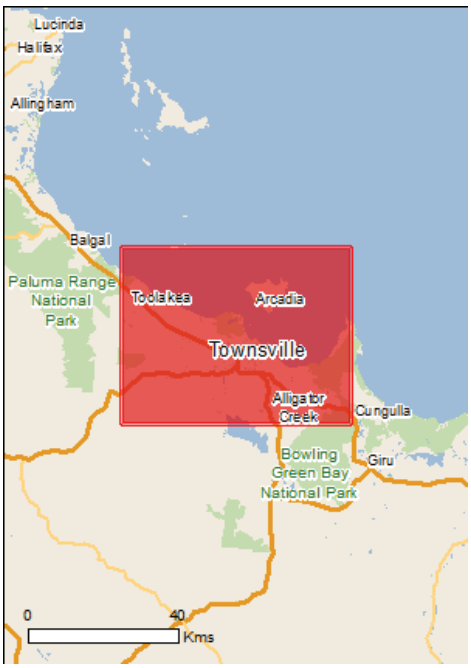

This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

Coordinates
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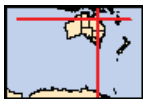

Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	1
National Heritage Places:	1
Wetlands of International Importance:	1
Great Barrier Reef Marine Park:	17
Commonwealth Marine Area:	1
Listed Threatened Ecological Communities:	3
Listed Threatened Species:	55
Listed Migratory Species:	64

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	15
Commonwealth Heritage Places:	None
Listed Marine Species:	117
Whales and Other Cetaceans:	12
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	16
Regional Forest Agreements:	None
Invasive Species:	40
Nationally Important Wetlands:	6
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

World Heritage Properties [Resource Information]

Name	State	Status
Great Barrier Reef	QLD	Declared property

National Heritage Properties [Resource Information]

Name	State	Status
Natural		
Great Barrier Reef	QLD	Listed place

Wetlands of International Importance (Ramsar) [Resource Information]

Name	Proximity
Bowling green bay	Within Ramsar site

Great Barrier Reef Marine Park [Resource Information]

Type	Zone	IUCN
Commonwealth Island (Other)	Herald Island (19002100)	VI
Commonwealth Island (Other)	Rattlesnake Island (19003100)	VI
Conservation Park	CP-19-4057	IV
Conservation Park	CP-19-4058	IV
Conservation Park	CP-19-4059	IV
General Use	GU-16-6004	VI
Habitat Protection	HP-19-5163	VI
Habitat Protection	HP-19-5161	VI
Habitat Protection	HP-19-5160	VI
Habitat Protection	HP-19-5158	VI
Habitat Protection	HP-19-5162	VI
Marine National Park	MNP-19-1092	II
Marine National Park	MNP-19-1090	II
Marine National Park	MNP-19-1094	II
Marine National Park	MNP-19-1093	II
Marine National Park	MNP-19-1091	II
Marine National Park	MNP-19-1089	II

Commonwealth Marine Area [Resource Information]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside the Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area. Generally the Commonwealth Marine Area stretches from three nautical miles to two hundred nautical miles from the coast.

Name
EEZ and Territorial Sea

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Broad leaf tea-tree (Melaleuca viridiflora) woodlands in high rainfall coastal north Queensland	Endangered	Community likely to occur within area
Littoral Rainforest and Coastal Vine Thickets of Eastern Australia	Critically Endangered	Community likely to occur within area
Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions	Endangered	Community likely to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		

Name	Status	Type of Presence
Calidris canutus Red Knot, Knot [855]	Endangered	Roosting known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Foraging, feeding or related behaviour known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Roosting known to occur within area
Casuarius casuarius johnsonii Southern Cassowary, Australian Cassowary, Double-wattled Cassowary [25986]	Endangered	Species or species habitat known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Roosting known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Erythrotriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat known to occur within area
Fregetta grallaria grallaria White-bellied Storm-Petrel (Tasman Sea), White-bellied Storm-Petrel (Australasian) [64438]	Vulnerable	Species or species habitat likely to occur within area
Limosa lapponica baueri Bar-tailed Godwit (baueri), Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat likely to occur within area
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Bar-tailed Godwit (menzbieri) [86432]	Critically Endangered	Species or species habitat may occur within area
Neochmia ruficauda ruficauda Star Finch (eastern), Star Finch (southern) [26027]	Endangered	Species or species habitat likely to occur within area
Numenius madagascariensis Eastern Curlew [847]	Critically Endangered	Roosting known to occur within area
Poephila cincta cincta Southern Black-throated Finch [64447]	Endangered	Species or species habitat known to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Tyto novaehollandiae kimberli Masked Owl (northern) [26048]	Vulnerable	Species or species habitat known to occur within area
Frogs		
Litoria dayi Australian Lace-lid, Lace-eyed Tree Frog [86707]	Endangered	Species or species habitat likely to occur within area
Litoria nannotis Waterfall Frog, Torrent Tree Frog [1817]	Endangered	Species or species habitat may occur within area
Litoria rheocola Common Mistfrog [1802]	Endangered	Species or species habitat likely to occur within area
Mammals		
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat may occur within area

Name	Status	Type of Presence
Bettongia tropica Northern Bettong [214]	Endangered	Species or species habitat likely to occur within area
Dasyurus hallucatus Northern Quoll, Digul [331]	Endangered	Species or species habitat known to occur within area
Hipposideros semoni Semon's Leaf-nosed Bat, Greater Wart-nosed Horseshoe-bat [180]	Endangered	Species or species habitat may occur within area
Macroderma gigas Ghost Bat [174]	Vulnerable	Breeding likely to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Breeding known to occur within area
Mesembriomys gouldii rattoides Black-footed Tree-rat (north Queensland) [87620]	Vulnerable	Species or species habitat may occur within area
Petauroides volans Greater Glider [254]	Vulnerable	Species or species habitat known to occur within area
Petrogale sharmani Mount Claro Rock Wallaby, Sharman's Rock Wallaby [59281]	Vulnerable	Species or species habitat known to occur within area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT) Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat known to occur within area
Pteropus conspicillatus Spectacled Flying-fox [185]	Vulnerable	Species or species habitat likely to occur within area
Rhinolophus robertsi Large-eared Horseshoe Bat, Greater Large-eared Horseshoe Bat [87639]	Endangered	Species or species habitat known to occur within area
Saccolaimus saccolaimus nudicluniatus Bare-rumped Sheathtail Bat [66889]	Critically Endangered	Species or species habitat known to occur within area
Xeromys myoides Water Mouse, False Water Rat, Yirrkoo [66]	Vulnerable	Species or species habitat may occur within area
Plants		
Bulbophyllum globuliforme Miniature Moss-orchid, Hoop Pine Orchid [6649]	Vulnerable	Species or species habitat likely to occur within area
Cajanus mareebensis [8635]	Endangered	Species or species habitat may occur within area
Dichanthium setosum bluegrass [14159]	Vulnerable	Species or species habitat likely to occur within area
Eucalyptus paedoglauca Mt Stuart Ironbark [56188]	Vulnerable	Species or species habitat known to occur within area
Marsdenia brevifolia [64585]	Vulnerable	Species or species habitat known to occur within area
Myrmecodia beccarii Ant Plant [11852]	Vulnerable	Species or species

Name	Status	Type of Presence
		habitat likely to occur within area
Omphalea celata [64586]	Vulnerable	Species or species habitat likely to occur within area
Phaius australis Lesser Swamp-orchid [5872]	Endangered	Species or species habitat may occur within area
Phalaenopsis amabilis subsp. rosenstromii Native Moth Orchid [87535]	Endangered	Species or species habitat may occur within area
Tephrosia leveillei [16946]	Vulnerable	Species or species habitat likely to occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Denisonia maculata Ornamental Snake [1193]	Vulnerable	Species or species habitat may occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Egernia rugosa Yakka Skink [1420]	Vulnerable	Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Breeding likely to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Phyllurus gulbaru Gulbaru Gecko [84753]	Critically Endangered	Species or species habitat known to occur within area
Sharks		
Carcharodon carcharias Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Pristis pristis Largetooth Sawfish, Freshwater Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat known to occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		

Name	Threatened	Type of Presence
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Sterna albifrons Little Tern [813]		Breeding known to occur within area
Migratory Marine Species		
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat may occur within area
Carcharodon carcharias Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Crocodylus porosus Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Dugong dugon Dugong [28]		Species or species habitat known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Lamna nasus Porbeagle, Mackerel Shark [83288]		Species or species habitat may occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Breeding likely to occur within area
Manta alfredi Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray [84994]		Species or species habitat likely to occur within area
Manta birostris Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Breeding known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Orcaella brevirostris Irrawaddy Dolphin [45]		Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Pristis pristis Largetooth Sawfish, Freshwater Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish	Vulnerable	Species or species habitat known to occur

Name	Threatened	Type of Presence
[60756]		within area
Pristis zijsron		
Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus		
Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Sousa chinensis		
Indo-Pacific Humpback Dolphin [50]		Breeding known to occur within area
Migratory Terrestrial Species		
Cuculus optatus		
Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat known to occur within area
Hirundapus caudacutus		
White-throated Needletail [682]		Species or species habitat known to occur within area
Hirundo rustica		
Barn Swallow [662]		Species or species habitat known to occur within area
Monarcha melanopsis		
Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus		
Spectacled Monarch [610]		Species or species habitat known to occur within area
Motacilla flava		
Yellow Wagtail [644]		Species or species habitat known to occur within area
Myiagra cyanoleuca		
Satin Flycatcher [612]		Species or species habitat known to occur within area
Rhipidura rufifrons		
Rufous Fantail [592]		Species or species habitat known to occur within area
Migratory Wetlands Species		
Actitis hypoleucos		
Common Sandpiper [59309]		Roosting known to occur within area
Arenaria interpres		
Ruddy Turnstone [872]		Roosting known to occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]		Roosting known to occur within area
Calidris alba		
Sanderling [875]		Foraging, feeding or related behaviour known to occur within area
Calidris canutus		
Red Knot, Knot [855]	Endangered	Roosting known to occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Foraging, feeding or related behaviour known to occur within area
Calidris melanotos		
Pectoral Sandpiper [858]		Foraging, feeding or related behaviour known to occur within area
Calidris ruficollis		
Red-necked Stint [860]		Roosting known to occur

Name	Threatened	Type of Presence
		within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Roosting known to occur within area
Charadrius bicinctus Double-banded Plover [895]		Foraging, feeding or related behaviour known to occur within area
Charadrius dubius Little Ringed Plover [896]		Foraging, feeding or related behaviour known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Roosting known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Roosting known to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Foraging, feeding or related behaviour known to occur within area
Gallinago megala Swinhoe's Snipe [864]		Roosting likely to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area
Heteroscelus brevipes Grey-tailed Tattler [59311]		Roosting known to occur within area
Heteroscelus incanus Wandering Tattler [59547]		Foraging, feeding or related behaviour known to occur within area
Limicola falcinellus Broad-billed Sandpiper [842]		Foraging, feeding or related behaviour known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Roosting known to occur within area
Numenius madagascariensis Eastern Curlew [847]	Critically Endangered	Roosting known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting known to occur within area
Numenius phaeopus Whimbrel [849]		Roosting known to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Philomachus pugnax Ruff (Reeve) [850]		Foraging, feeding or related behaviour known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area
Pluvialis squatarola Grey Plover [865]		Roosting known to occur within area

Name	Threatened	Type of Presence
Tringa glareola Wood Sandpiper [829]		Roosting known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Roosting known to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Defence - AMAROO - MAGNETIC ISLAND
Defence - Commonwealth Centre
Defence - DEFENCE COMMUNITY ORGANISATION
Defence - JEZZINE BARRACKS - TOWNSVILLE
Defence - LAVARACK BARRACKS - TOWNSVILLE
Defence - Mount Stuart Close Training Area
Defence - NORTH WARD TRAINING DEPOT - TOWNSVILLE
Defence - ROSS ISLAND BARRACKS
Defence - TOWNSVILLE - AP28 TACAN
Defence - TOWNSVILLE - AP37 NAVAID
Defence - TOWNSVILLE - AP40 BOHLE RIVER TRANS STATION
Defence - TOWNSVILLE - AP7 SPORTS GROUND
Defence - TOWNSVILLE - AP8 BOMBING & GUNNERY RANGE
Defence - TOWNSVILLE - RAAF BASE
Defence - TOWNSVILLE FIELD TRAINING AREA

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Roosting known to occur within area
Anseranas semipalmata Magpie Goose [978]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Breeding known to occur within area
Ardea ibis Cattle Egret [59542]		Breeding likely to occur within area
Arenaria interpres Ruddy Turnstone [872]		Roosting known to occur

Name	Threatened	Type of Presence
		within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Roosting known to occur within area
Calidris alba Sanderling [875]		Foraging, feeding or related behaviour known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Roosting known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Foraging, feeding or related behaviour known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Foraging, feeding or related behaviour known to occur within area
Calidris ruficollis Red-necked Stint [860]		Roosting known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Roosting known to occur within area
Charadrius bicinctus Double-banded Plover [895]		Foraging, feeding or related behaviour known to occur within area
Charadrius dubius Little Ringed Plover [896]		Foraging, feeding or related behaviour known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Roosting known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Charadrius ruficapillus Red-capped Plover [881]		Roosting known to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Roosting known to occur within area
Cuculus saturatus Oriental Cuckoo, Himalayan Cuckoo [710]		Species or species habitat known to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Foraging, feeding or related behaviour known to occur within area
Gallinago megala Swinhoe's Snipe [864]		Roosting likely to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Heteroscelus brevipes Grey-tailed Tattler [59311]		Roosting known to occur within area
Heteroscelus incanus Wandering Tattler [59547]		Foraging, feeding or related behaviour known to occur within area
Himantopus himantopus Black-winged Stilt [870]		Roosting known to occur

Name	Threatened	Type of Presence
		within area
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat known to occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat known to occur within area
Limicola falcinellus Broad-billed Sandpiper [842]		Foraging, feeding or related behaviour known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Roosting known to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat known to occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat known to occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew [847]	Critically Endangered	Roosting known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting known to occur within area
Numenius phaeopus Whimbrel [849]		Roosting known to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Philomachus pugnax Ruff (Reeve) [850]		Foraging, feeding or related behaviour known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area
Pluvialis squatarola Grey Plover [865]		Roosting known to occur within area
Recurvirostra novaehollandiae Red-necked Avocet [871]		Foraging, feeding or related behaviour known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur

Name	Threatened	Type of Presence
		within area
Sterna albifrons Little Tern [813]		Breeding known to occur within area
Stiltia isabella Australian Pratincole [818]		Foraging, feeding or related behaviour known to occur within area
Tringa glareola Wood Sandpiper [829]		Roosting known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Roosting known to occur within area
Fish		
Acentronura tentaculata Shortpouch Pygmy Pipehorse [66187]		Species or species habitat may occur within area
Campichthys tryoni Tryon's Pipefish [66193]		Species or species habitat may occur within area
Choeroichthys brachysoma Pacific Short-bodied Pipefish, Short-bodied Pipefish [66194]		Species or species habitat may occur within area
Choeroichthys suillus Pig-snouted Pipefish [66198]		Species or species habitat may occur within area
Corythoichthys amplexus Fijian Banded Pipefish, Brown-banded Pipefish [66199]		Species or species habitat may occur within area
Corythoichthys flavofasciatus Reticulate Pipefish, Yellow-banded Pipefish, Network Pipefish [66200]		Species or species habitat may occur within area
Corythoichthys intestinalis Australian Messmate Pipefish, Banded Pipefish [66202]		Species or species habitat may occur within area
Corythoichthys ocellatus Orange-spotted Pipefish, Ocellated Pipefish [66203]		Species or species habitat may occur within area
Corythoichthys paxtoni Paxton's Pipefish [66204]		Species or species habitat may occur within area
Corythoichthys schultzi Schultz's Pipefish [66205]		Species or species habitat may occur within area
Cosmocampus darrosanus D'Arros Pipefish [66207]		Species or species habitat may occur within area
Cosmocampus maxweberi Maxweber's Pipefish [66209]		Species or species habitat may occur within area
Doryrhamphus dactyliophorus Banded Pipefish, Ringed Pipefish [66210]		Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Doryrhamphus excisus Bluestripe Pipefish, Indian Blue-stripe Pipefish, Pacific Blue-stripe Pipefish [66211]		Species or species habitat may occur within area
Festucalex cinctus Girdled Pipefish [66214]		Species or species habitat may occur within area
Festucalex gibbsi Gibbs' Pipefish [66215]		Species or species habitat may occur within area
Halicampus dunckeri Red-hair Pipefish, Duncker's Pipefish [66220]		Species or species habitat may occur within area
Halicampus grayi Mud Pipefish, Gray's Pipefish [66221]		Species or species habitat may occur within area
Halicampus macrorhynchus Whiskered Pipefish, Ornate Pipefish [66222]		Species or species habitat may occur within area
Halicampus nitidus Glittering Pipefish [66224]		Species or species habitat may occur within area
Halicampus spinirostris Spiny-snout Pipefish [66225]		Species or species habitat may occur within area
Hippichthys cyanospilos Blue-speckled Pipefish, Blue-spotted Pipefish [66228]		Species or species habitat may occur within area
Hippichthys heptagonus Madura Pipefish, Reticulated Freshwater Pipefish [66229]		Species or species habitat may occur within area
Hippichthys penicillus Beady Pipefish, Steep-nosed Pipefish [66231]		Species or species habitat may occur within area
Hippichthys spicifer Belly-barred Pipefish, Banded Freshwater Pipefish [66232]		Species or species habitat may occur within area
Hippocampus bargibanti Pygmy Seahorse [66721]		Species or species habitat may occur within area
Hippocampus histrix Spiny Seahorse, Thorny Seahorse [66236]		Species or species habitat may occur within area
Hippocampus kuda Spotted Seahorse, Yellow Seahorse [66237]		Species or species habitat may occur within area
Hippocampus planifrons Flat-face Seahorse [66238]		Species or species habitat may occur within area
Hippocampus zebra Zebra Seahorse [66241]		Species or species habitat may occur within area
Micrognathus andersonii Anderson's Pipefish, Shortnose Pipefish [66253]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Micrognathus brevirostris thorntail Pipefish, Thorn-tailed Pipefish [66254]		Species or species habitat may occur within area
Nannocampus pictus Painted Pipefish, Reef Pipefish [66263]		Species or species habitat may occur within area
Siokunichthys breviceps Softcoral Pipefish, Soft-coral Pipefish [66270]		Species or species habitat may occur within area
Solegnathus hardwickii Pallid Pipehorse, Hardwick's Pipehorse [66272]		Species or species habitat may occur within area
Solenostomus cyanopterus Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183]		Species or species habitat may occur within area
Solenostomus paegnius Rough-snout Ghost Pipefish [68425]		Species or species habitat may occur within area
Solenostomus paradoxus Ornate Ghostpipefish, Harlequin Ghost Pipefish, Ornate Ghost Pipefish [66184]		Species or species habitat may occur within area
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
Trachyrhamphus bicoarctatus Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within area
Trachyrhamphus longirostris Straightstick Pipefish, Long-nosed Pipefish, Straight Stick Pipefish [66281]		Species or species habitat may occur within area
Mammals		
Dugong dugon Dugong [28]		Species or species habitat known to occur within area
Reptiles		
Acalyptophis peronii Horned Seasnake [1114]		Species or species habitat may occur within area
Aipysurus duboisii Dubois' Seasnake [1116]		Species or species habitat may occur within area
Aipysurus eydouxii Spine-tailed Seasnake [1117]		Species or species habitat may occur within area
Aipysurus laevis Olive Seasnake [1120]		Species or species habitat may occur within area
Astrotia stokesii Stokes' Seasnake [1122]		Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area

Name	Threatened	Type of Presence
Crocodylus porosus Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Disteira kingii Spectacled Seasnake [1123]		Species or species habitat may occur within area
Disteira major Olive-headed Seasnake [1124]		Species or species habitat may occur within area
Enhydrina schistosa Beaked Seasnake [1126]		Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Hydrophis elegans Elegant Seasnake [1104]		Species or species habitat may occur within area
Hydrophis mcdowelli null [25926]		Species or species habitat may occur within area
Hydrophis ornatus Spotted Seasnake, Ornate Reef Seasnake [1111]		Species or species habitat may occur within area
Lapemis hardwickii Spine-bellied Seasnake [1113]		Species or species habitat may occur within area
Laticauda colubrina a sea krait [1092]		Species or species habitat may occur within area
Laticauda laticaudata a sea krait [1093]		Species or species habitat may occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Breeding likely to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Pelamis platurus Yellow-bellied Seasnake [1091]		Species or species habitat may occur within area

Whales and other Cetaceans [Resource Information]

Name	Status	Type of Presence
Mammals		
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat may occur within area

Name	Status	Type of Presence
Delphinus delphis Common Dophin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Breeding known to occur within area
Orcaella brevirostris Irrawaddy Dolphin [45]		Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Breeding known to occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area

Extra Information

State and Territory Reserves [Resource Information]

Name	State
Bolger Bay	QLD
Bolger Bay	QLD
Bowling Green Bay	QLD
Bowling Green Bay	QLD
Cape Pallarenda	QLD
Endeavour Creek	QLD
Horseshoe Bay	QLD
Horseshoe Bay Lagoon	QLD
Magnetic Island	QLD
Magnetic Island	QLD
Paluma Range	QLD
Pinnacles	QLD
Stuart Creek	QLD
Townsville Town Common	QLD
Upper Sleeper Log Creek	QLD
Wongaloo	QLD

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Gallus gallus Red Junglefowl, Domestic Fowl [917]		Species or species habitat likely to occur within area
Lonchura punctulata Nutmeg Mannikin [399]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Pavo cristatus Indian Peafowl, Peacock [919]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Frogs		
Rhinella marina Cane Toad [83218]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Lepus capensis Brown Hare [127]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species

Name	Status	Type of Presence
		habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Acacia nilotica subsp. indica Prickly Acacia [6196]		Species or species habitat may occur within area
Annona glabra Pond Apple, Pond-apple Tree, Alligator Apple, Bullock's Heart, Cherimoya, Monkey Apple, Bobwood, Corkwood [6311]		Species or species habitat likely to occur within area
Cabomba caroliniana Cabomba, Fanwort, Carolina Watershield, Fish Grass, Washington Grass, Watershield, Carolina Fanwort, Common Cabomba [5171]		Species or species habitat likely to occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area
Cryptostegia grandiflora Rubber Vine, Rubbervine, India Rubber Vine, India Rubbervine, Palay Rubbervine, Purple Allamanda [18913]		Species or species habitat likely to occur within area
Dolichandra unguis-cati Cat's Claw Vine, Yellow Trumpet Vine, Cat's Claw Creeper, Funnel Creeper [85119]		Species or species habitat likely to occur within area
Eichhornia crassipes Water Hyacinth, Water Orchid, Nile Lily [13466]		Species or species habitat likely to occur within area
Hymenachne amplexicaulis Hymenachne, Olive Hymenachne, Water Stargrass, West Indian Grass, West Indian Marsh Grass [31754]		Species or species habitat likely to occur within area
Jatropha gossypifolia Cotton-leaved Physic-Nut, Bellyache Bush, Cotton-leaf Physic Nut, Cotton-leaf Jatropha, Black Physic Nut [7507]		Species or species habitat likely to occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area
Parkinsonia aculeata Parkinsonia, Jerusalem Thorn, Jelly Bean Tree, Horse Bean [12301]		Species or species habitat likely to occur within area
Parthenium hysterophorus Parthenium Weed, Bitter Weed, Carrot Grass, False Ragweed [19566]		Species or species habitat likely to occur within area
Prosopis spp. Mesquite, Algaroba [68407]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Vachellia nilotica Prickly Acacia, Blackthorn, Prickly Mimosa, Black Piquant, Babul [84351]		Species or species habitat likely to occur within area

Reptiles		
Hemidactylus frenatus Asian House Gecko [1708]		Species or species habitat likely to occur within area
Lepidodactylus lugubris Mourning Gecko [1712]		Species or species habitat likely to occur within area
Ramphotyphlops braminus Flowerpot Blind Snake, Brahminy Blind Snake, Cacing Besi [1258]		Species or species habitat likely to occur within area

Nationally Important Wetlands [Resource Information]

Name	State
Bowling Green Bay	QLD
Burdekin - Townsville Coastal Aggregation	QLD
Great Barrier Reef Marine Park	QLD
RAAF Townsville	QLD
Ross River Reservoir	QLD
Wongaloo Swamps Aggregation	QLD

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under 'type of presence'. For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-19.03739 146.48735,-19.03739 147.02568,-19.42638 147.02568,-19.42638 146.48735,-19.03739 146.48735

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Parks and Wildlife Commission NT, Northern Territory Government
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Atherton and Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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Queensland Government

Wildlife Online Extract

Search Criteria: Species List for a Defined Area
Species: All
Type: All
Status: All
Records: All
Date: All
Latitude: 19.037 to 19.422
Longitude: 146.484 to 147.016
Email: alex.kochnieff@advisian.com
Date submitted: Friday 29 Jul 2016 13:09:15
Date extracted: Friday 29 Jul 2016 13:10:07

The number of records retrieved = 2003

Disclaimer

As the DSITIA is still in a process of collating and vetting data, it is possible the information given is not complete. The information provided should only be used for the project for which it was requested and it should be appropriately acknowledged as being derived from Wildlife Online when it is used.

The State of Queensland does not invite reliance upon, nor accept responsibility for this information. Persons should satisfy themselves through independent means as to the accuracy and completeness of this information.

No statements, representations or warranties are made about the accuracy or completeness of this information. The State of Queensland disclaims all responsibility for this information and all liability (including without limitation, liability in negligence) for all expenses, losses, damages and costs you may incur as a result of the information being inaccurate or incomplete in any way for any reason.

Feedback about Wildlife Online should be emailed to wildlife.online@science.dsitia.qld.gov.au

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	amphibians	Bufonidae	*Rhinella marina*	cane toad	Y			188/3
animals	amphibians	Hylidae	*Litoria gracilenta*	graceful treefrog		C		7
animals	amphibians	Hylidae	*Cyclorana novaehollandiae*	eastern snapping frog		C		8/2
animals	amphibians	Hylidae	*Litoria lesueuri sensu lato*	stony creek frog		C		3/2
animals	amphibians	Hylidae	*Litoria infrafrenata*	white lipped treefrog		C		1
animals	amphibians	Hylidae	*Cyclorana alboguttata*	greenstripe frog		C		35/18
animals	amphibians	Hylidae	*Cyclorana brevipes*	superb collared frog		C		14/10
animals	amphibians	Hylidae	*Litoria wilcoxii*	eastern stony creek frog		C		1
animals	amphibians	Hylidae	*Litoria caerulea*	common green treefrog		C		78/11
animals	amphibians	Hylidae	*Litoria rubella*	ruddy treefrog		C		39/7
animals	amphibians	Hylidae	*Litoria inermis*	bumpy rocketfrog		C		29/10
animals	amphibians	Hylidae	*Litoria bicolor*	northern sedgefrog		C		30/10
animals	amphibians	Hylidae	*Litoria rothii*	northern laughing treefrog		C		32/10
animals	amphibians	Hylidae	*Litoria nasuta*	striped rocketfrog		C		22/3
animals	amphibians	Hylidae	*Litoria sp.*					1
animals	amphibians	Hylidae	*Litoria fallax*	eastern sedgefrog		C		26/7
animals	amphibians	Limnodynastidae	*Limnodynastes convexiusculus*	marbled frog		C		11
animals	amphibians	Limnodynastidae	*Limnodynastes terraereginae*	scarlet sided pobblebonk		C		1
animals	amphibians	Limnodynastidae	*Limnodynastes tasmaniensis*	spotted grassfrog		C		51
animals	amphibians	Limnodynastidae	*Platyplectrum ornatum*	ornate burrowing frog		C		98/14
animals	amphibians	Limnodynastidae	*Notaden melanoscaphus*	brown shovelfoot		C		1
animals	amphibians	Myobatrachidae	*Uperoleia lithomoda*	stonemason gungan		C		1
animals	amphibians	Myobatrachidae	*Crinia deserticola*	chirping froglet		C		12/4
animals	amphibians	Myobatrachidae	*Mixophyes coggeri*	mottled barred frog		C		1
animals	amphibians	Myobatrachidae	*Uperoleia mimula*	mimicking gungan		C		37/14
animals	birds	Acanthizidae	*Acanthiza nana*	yellow thornbill		C		1
animals	birds	Acanthizidae	*Gerygone mouki*	brown gerygone		C		2
animals	birds	Acanthizidae	*Gerygone olivacea*	white-throated gerygone		C		27
animals	birds	Acanthizidae	*Gerygone levigaster*	mangrove gerygone		C		144
animals	birds	Acanthizidae	*Sericornis citreogularis*	yellow-throated scrubwren		C		1
animals	birds	Acanthizidae	*Acanthiza chrysorrhoa*	yellow-rumped thornbill		C		1
animals	birds	Acanthizidae	*Gerygone magnirostris*	large-billed gerygone		C		57
animals	birds	Acanthizidae	*Smicrornis brevirostris*	weebill		C		10
animals	birds	Acanthizidae	*Gerygone palpebrosa*	fairy gerygone		C		47/1
animals	birds	Accipitridae	*Pandion cristatus*	eastern osprey		SL		232
animals	birds	Accipitridae	*Circus approximans*	swamp harrier		C		50
animals	birds	Accipitridae	*Lophoictinia isura*	square-tailed kite		C		16
animals	birds	Accipitridae	*Accipiter fasciatus*	brown goshawk		C		199
animals	birds	Accipitridae	*Aviceda subcristata*	Pacific baza		C		145/2
animals	birds	Accipitridae	*Haliastur sphenurus*	whistling kite		C		727
animals	birds	Accipitridae	*Haliaeetus leucogaster*	white-bellied sea-eagle		C		364
animals	birds	Accipitridae	*Hieraaetus morphnoides*	little eagle		C		30
animals	birds	Accipitridae	*Accipiter cirrocephalus*	collared sparrowhawk		C		59
animals	birds	Accipitridae	*Hamirostra melanosternon*	black-breasted buzzard		C		1
animals	birds	Accipitridae	*Accipiter novaehollandiae*	grey goshawk		C		26
animals	birds	Accipitridae	*Erythrotriorchis radiatus*	red goshawk		E	V	3

Queensland Government Wildlife Online - Extract Date 29/07/2016 at 13:10:07

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	birds	Accipitridae	*Aquila audax*	wedge-tailed eagle		C		121
animals	birds	Accipitridae	*Milvus migrans*	black kite		C		930/4
animals	birds	Accipitridae	*Elanus scriptus*	letter-winged kite		C		1
animals	birds	Accipitridae	*Haliastur indus*	brahminy kite		C		664
animals	birds	Accipitridae	*Circus assimilis*	spotted harrier		C		18
animals	birds	Accipitridae	*Elanus axillaris*	black-shouldered kite		C		63
animals	birds	Acrocephalidae	*Acrocephalus australis*	Australian reed-warbler		SL		111
animals	birds	Acrocephalidae	*Acrocephalus orientalis*	oriental reed-warbler		SL		6
animals	birds	Aegothelidae	*Aegotheles cristatus*	Australian owlet-nightjar		C		15
animals	birds	Alaudidae	*Mirafra javanica*	Horsfield's bushlark		C		194
animals	birds	Alcedinidae	*Ceyx azureus*	azure kingfisher		C		43/1
animals	birds	Alcedinidae	*Ceyx pusilla*	little kingfisher		C		53
animals	birds	Anatidae	*Anas querquedula*	garganey		SL		7
animals	birds	Anatidae	*Oxyura australis*	blue-billed duck		C		1
animals	birds	Anatidae	*Tadorna radjah*	radjah shelduck		C		5
animals	birds	Anatidae	*Cygnus atratus*	black swan		C		37
animals	birds	Anatidae	*Anas gracilis*	grey teal		C		71
animals	birds	Anatidae	*Anas castanea*	chestnut teal		C		8
animals	birds	Anatidae	*Anas superciliosa*	Pacific black duck		C		416
animals	birds	Anatidae	*Chenonetta jubata*	Australian wood duck		C		33
animals	birds	Anatidae	*Dendrocygna eytoni*	plumed whistling-duck		C		124
animals	birds	Anatidae	*Dendrocygna arcuata*	wandering whistling-duck		C		153
animals	birds	Anatidae	*Nettapus pulchellus*	green pygmy-goose		C		12
animals	birds	Anatidae	*Stictonetta naevosa*	freckled duck		C		4
animals	birds	Anatidae	*Nettapus coromandelianus*	cotton pygmy-goose		C		40/1
animals	birds	Anatidae	*Malacorhynchus membranaceus*	pink-eared duck		C		10
animals	birds	Anatidae	*Anas rhynchotis*	Australasian shoveler		C		3
animals	birds	Anatidae	*Aythya australis*	hardhead		C		85
animals	birds	Anhingidae	*Anhinga novaehollandiae*	Australasian darter		C		396
animals	birds	Anseranatidae	*Anseranas semipalmata*	magpie goose		C		398
animals	birds	Apodidae	*Hirundapus caudacutus*	white-throated needletail		SL		20
animals	birds	Apodidae	*Aerodramus terraereginae*	Australian swiftlet		C		25
animals	birds	Apodidae	*Apus pacificus*	fork-tailed swift		SL		37
animals	birds	Apodidae	*Apus affinis*	house swift		C		1
animals	birds	Ardeidae	*Egretta novaehollandiae*	white-faced heron		C		403
animals	birds	Ardeidae	*Nycticorax caledonicus*	nankeen night-heron		C		127
animals	birds	Ardeidae	*Ixobrychus flavicollis*	black bittern		C		26
animals	birds	Ardeidae	*Ardea alba modesta*	eastern great egret		SL		603
animals	birds	Ardeidae	*Ixobrychus dubius*	Australian little bittern		C		4
animals	birds	Ardeidae	*Butorides striata*	striated heron		C		318
animals	birds	Ardeidae	*Egretta garzetta*	little egret		C		463
animals	birds	Ardeidae	*Ardea intermedia*	intermediate egret		C		382/1
animals	birds	Ardeidae	*Ardea sumatrana*	great-billed heron		C		7
animals	birds	Ardeidae	*Egretta picata*	pied heron		C		19
animals	birds	Ardeidae	*Ardea pacifica*	white-necked heron		C		91
animals	birds	Ardeidae	*Ardea ibis*	cattle egret		SL		233

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	birds	Ardeidae	*Ardea sp.*					1
animals	birds	Ardeidae	*Egretta sacra*	eastern reef egret		C		171
animals	birds	Artamidae	*Strepera graculina*	pied currawong		C		154
animals	birds	Artamidae	*Artamus cyanopterus*	dusky woodswallow		C		2
animals	birds	Artamidae	*Cracticus torquatus*	grey butcherbird		C		8
animals	birds	Artamidae	*Artamus leucorynchus*	white-breasted woodswallow		C		788
animals	birds	Artamidae	*Artamus superciliosus*	white-browed woodswallow		C		20
animals	birds	Artamidae	*Artamus personatus*	masked woodswallow		C		8
animals	birds	Artamidae	*Cracticus quoyi*	black butcherbird		C		73
animals	birds	Artamidae	*Artamus minor*	little woodswallow		C		5/1
animals	birds	Artamidae	*Cracticus tibicen*	Australian magpie		C		722
animals	birds	Artamidae	*Artamus cinereus*	black-faced woodswallow		C		27
animals	birds	Artamidae	*Cracticus nigrogularis*	pied butcherbird		C		345
animals	birds	Burhinidae	*Esacus magnirostris*	beach stone-curlew		V		68
animals	birds	Burhinidae	*Burhinus grallarius*	bush stone-curlew		C		556/3
animals	birds	Cacatuidae	*Cacatua galerita*	sulphur-crested cockatoo		C		813
animals	birds	Cacatuidae	*Cacatua sanguinea*	little corella		C		418/1
animals	birds	Cacatuidae	*Cacatua tenuirostris*	long-billed corella	Y	C		6
animals	birds	Cacatuidae	*Calyptorhynchus banksii*	red-tailed black-cockatoo		C		650
animals	birds	Cacatuidae	*Eolophus roseicapillus*	galah		C		188
animals	birds	Cacatuidae	*Lophochroa leadbeateri*	Major Mitchell's cockatoo		V		1
animals	birds	Cacatuidae	*Nymphicus hollandicus*	cockatiel		C		33
animals	birds	Campephagidae	*Coracina papuensis*	white-bellied cuckoo-shrike		C		669/2
animals	birds	Campephagidae	*Coracina tenuirostris*	cicadabird		C		27
animals	birds	Campephagidae	*Coracina novaehollandiae*	black-faced cuckoo-shrike		C		784
animals	birds	Campephagidae	*Coracina maxima*	ground cuckoo-shrike		C		2
animals	birds	Campephagidae	*Lalage tricolor*	white-winged triller		C		92
animals	birds	Campephagidae	*Coracina lineata*	barred cuckoo-shrike		C		3
animals	birds	Campephagidae	*Lalage leucomela*	varied triller		C		395/2
animals	birds	Caprimulgidae	*Caprimulgus macrurus*	large-tailed nightjar		C		65
animals	birds	Casuariidae	*Dromaius novaehollandiae*	emu		C		2
animals	birds	Charadriidae	*Charadrius leschenaultii*	greater sand plover		SL	V	42
animals	birds	Charadriidae	*Charadrius bicinctus*	double-banded plover		SL		1
animals	birds	Charadriidae	*Vanellus miles*	masked lapwing		C		540
animals	birds	Charadriidae	*Pluvialis fulva*	Pacific golden plover		SL		35
animals	birds	Charadriidae	*Charadrius ruficapillus*	red-capped plover		C		133
animals	birds	Charadriidae	*Vanellus miles miles*	masked lapwing (northern subspecies)		C		328/1
animals	birds	Charadriidae	*Pluvialis squatarola*	grey plover		SL		14
animals	birds	Charadriidae	*Erythrogonys cinctus*	red-kneed dotterel		C		21
animals	birds	Charadriidae	*Charadrius hiaticula*	ringed plover		SL		1
animals	birds	Charadriidae	*Elseyornis melanops*	black-fronted dotterel		C		229
animals	birds	Charadriidae	*Charadrius mongolus*	lesser sand plover		SL	E	43
animals	birds	Charadriidae	*Charadrius veredus*	oriental plover		SL		3
animals	birds	Charadriidae	*Vanellus tricolor*	banded lapwing		C		2
animals	birds	Charadriidae	*Charadrius dubius*	little ringed plover		SL		3
animals	birds	Ciconiidae	*Ephippiorhynchus asiaticus*	black-necked stork		C		222

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	birds	Cisticolidae	*Cisticola juncidis laveryi*	zitting cisticola		C		1
animals	birds	Cisticolidae	*Cisticola exilis*	golden-headed cisticola		C		662
animals	birds	Climacteridae	*Climacteris picumnus*	brown treecreeper		C		2
animals	birds	Columbidae	*Leucosarcia melanoleuca*	wonga pigeon		C		1
animals	birds	Columbidae	*Streptopelia chinensis*	spotted dove	Y			98
animals	birds	Columbidae	*Phaps elegans*	brush bronzewing		C		2
animals	birds	Columbidae	*Ducula bicolor*	pied imperial-pigeon		C		286/5
animals	birds	Columbidae	*Geopelia cuneata*	diamond dove		C		13
animals	birds	Columbidae	*Geopelia striata*	peaceful dove		C		3367/11
animals	birds	Columbidae	*Geophaps scripta*	squatter pigeon		C		14
animals	birds	Columbidae	*Columba leucomela*	white-headed pigeon		C		3
animals	birds	Columbidae	*Ocyphaps lophotes*	crested pigeon		C		251
animals	birds	Columbidae	*Phaps chalcoptera*	common bronzewing		C		11
animals	birds	Columbidae	*Ptilinopus regina*	rose-crowned fruit-dove		C		25/1
animals	birds	Columbidae	*Chalcophaps indica*	emerald dove		C		47
animals	birds	Columbidae	*Geopelia humeralis*	bar-shouldered dove		C		414/4
animals	birds	Columbidae	*Ptilinopus superbus*	superb fruit-dove		C		27
animals	birds	Columbidae	*Ptilinopus magnificus*	wompoo fruit-dove		C		12
animals	birds	Columbidae	*Macropygia amboinensis*	brown cuckoo-dove		C		14
animals	birds	Columbidae	*Lopholaimus antarcticus*	topknot pigeon		C		15
animals	birds	Columbidae	*Geophaps scripta scripta*	squatter pigeon (southern subspecies)		V	V	3
animals	birds	Columbidae	*Columba livia*	rock dove	Y			344
animals	birds	Coraciidae	*Eurystomus orientalis*	dollarbird		C		297
animals	birds	Corcoracidae	*Struthidea cinerea*	apostlebird		C		17
animals	birds	Corvidae	*Corvus orru*	Torresian crow		C		625/1
animals	birds	Corvidae	*Corvus coronoides*	Australian raven		C		252/1
animals	birds	Corvidae	*Corvus sp.*					25
animals	birds	Cuculidae	*Cacomantis pallidus*	pallid cuckoo		C		69/1
animals	birds	Cuculidae	*Chalcites osculans*	black-eared cuckoo		C		2
animals	birds	Cuculidae	*Chalcites lucidus*	shining bronze-cuckoo		C		28
animals	birds	Cuculidae	*Chalcites basalis*	Horsfield's bronze-cuckoo		C		63/2
animals	birds	Cuculidae	*Cuculus optatus*	oriental cuckoo		SL		24
animals	birds	Cuculidae	*Chalcites sp.*					4
animals	birds	Cuculidae	*Chalcites minutillus russatus*	Gould's bronze-cuckoo		C		34
animals	birds	Cuculidae	*Scythrops novaehollandiae*	channel-billed cuckoo		C		324
animals	birds	Cuculidae	*Chalcites minutillus*	little bronze-cuckoo		C		64
animals	birds	Cuculidae	*Eudynamys orientalis*	eastern koel		C		399/1
animals	birds	Cuculidae	*Cacomantis flabelliformis*	fan-tailed cuckoo		C		50
animals	birds	Cuculidae	*Centropus phasianinus*	pheasant coucal		C		658
animals	birds	Cuculidae	*Cacomantis variolosus*	brush cuckoo		C		391
animals	birds	Dicruridae	*Dicrurus bracteatus bracteatus*	spangled drongo (eastern Australia)		C		2
animals	birds	Dicruridae	*Dicrurus bracteatus*	spangled drongo		C		922
animals	birds	Estrildidae	*Neochmia modesta*	plum-headed finch		C		29
animals	birds	Estrildidae	*Neochmia phaeton*	crimson finch		C		11/2
animals	birds	Estrildidae	*Neochmia phaeton phaeton*	crimson finch		C		1
animals	birds	Estrildidae	*Erythrura gouldiae*	Gouldian finch		E	E	1

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	birds	Estrildidae	*Neochmia ruficauda*	star finch		C		1
animals	birds	Estrildidae	*Poephila personata*	masked finch		C		2
animals	birds	Estrildidae	*Lonchura punctulata*	nutmeg mannikin	Y			525
animals	birds	Estrildidae	*Neochmia temporalis*	red-browed finch		C		19
animals	birds	Estrildidae	*Taeniopygia guttata*	zebra finch		C		359
animals	birds	Estrildidae	*Heteromunia pectoralis*	pictorella mannikin		C		1
animals	birds	Estrildidae	*Poephila cincta cincta*	black-throated finch (white-rumped subspecies)		E	E	26
animals	birds	Estrildidae	*Taeniopygia bichenovii*	double-barred finch		C		286/2
animals	birds	Estrildidae	*Lonchura castaneothorax*	chestnut-breasted mannikin		C		223
animals	birds	Eurostopodidae	*Eurostopodus argus*	spotted nightjar		C		4
animals	birds	Eurostopodidae	*Eurostopodus mystacalis*	white-throated nightjar		C		13
animals	birds	Falconidae	*Falco berigora*	brown falcon		C		90
animals	birds	Falconidae	*Falco subniger*	black falcon		C		8
animals	birds	Falconidae	*Falco hypoleucos*	grey falcon		V		1
animals	birds	Falconidae	*Falco peregrinus*	peregrine falcon		C		49
animals	birds	Falconidae	*Falco longipennis*	Australian hobby		C		202
animals	birds	Falconidae	*Falco cenchroides*	nankeen kestrel		C		246/1
animals	birds	Fregatidae	*Fregata ariel*	lesser frigatebird		SL		15
animals	birds	Fregatidae	*Fregata minor*	great frigatebird		SL		1
animals	birds	Glareolidae	*Stiltia isabella*	Australian pratincole		C		18
animals	birds	Glareolidae	*Glareola maldivarum*	oriental pratincole		SL		7
animals	birds	Gruidae	*Grus antigone*	sarus crane		C		2
animals	birds	Gruidae	*Grus rubicunda*	brolga		C		233
animals	birds	Haematopodidae	*Haematopus fuliginosus*	sooty oystercatcher		C		46
animals	birds	Haematopodidae	*Haematopus longirostris*	Australian pied oystercatcher		C		121
animals	birds	Halcyonidae	*Dacelo novaeguineae*	laughing kookaburra		C		335
animals	birds	Halcyonidae	*Todiramphus sanctus*	sacred kingfisher		C		384
animals	birds	Halcyonidae	*Todiramphus sordidus*	Torresian kingfisher		C		23
animals	birds	Halcyonidae	*Todiramphus macleayii*	forest kingfisher		C		442/1
animals	birds	Halcyonidae	*Tanysiptera sylvia*	buff-breasted paradise-kingfisher		C		3
animals	birds	Halcyonidae	*Dacelo leachii*	blue-winged kookaburra		C		575/1
animals	birds	Halcyonidae	*Todiramphus pyrrhopygius*	red-backed kingfisher		C		18
animals	birds	Hirundinidae	*Petrochelidon ariel*	fairy martin		C		496
animals	birds	Hirundinidae	*Petrochelidon nigricans*	tree martin		C		36
animals	birds	Hirundinidae	*Hirundo neoxena*	welcome swallow		C		829
animals	birds	Hirundinidae	*Hirundo rustica*	barn swallow		SL		3
animals	birds	Jacanidae	*Irediparra gallinacea*	comb-crested jacana		C		119
animals	birds	Laridae	*Sterna dougallii*	roseate tern		SL		1
animals	birds	Laridae	*Sterna sumatrana*	black-naped tern		SL		11
animals	birds	Laridae	*Thalasseus bergii*	crested tern		C		166
animals	birds	Laridae	*Chlidonias hybrida*	whiskered tern		C		25
animals	birds	Laridae	*Hydroprogne caspia*	Caspian tern		SL		312
animals	birds	Laridae	*Sternula albifrons*	little tern		SL		60
animals	birds	Laridae	*Larus crassirostris*	black-tailed gull		C		2
animals	birds	Laridae	*Thalasseus bengalensis*	lesser crested tern		C		46

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	birds	Laridae	*Chroicocephalus novaehollandiae*	silver gull		C		716/3
animals	birds	Laridae	*Anous minutus*	black noddy		C		5/1
animals	birds	Laridae	*Anous stolidus*	common noddy		SL		2
animals	birds	Laridae	*Sterna hirundo*	common tern		SL		15
animals	birds	Laridae	*Onychoprion fuscata*	sooty tern		C		2
animals	birds	Laridae	*Leucophaeus pipixcan*	Franklin's gull		C		2
animals	birds	Laridae	*Gelochelidon nilotica*	gull-billed tern		SL		231
animals	birds	Laridae	*Chlidonias leucopterus*	white-winged black tern		SL		10
animals	birds	Laridae	*Onychoprion anaethetus*	bridled tern		SL		19
animals	birds	Maluridae	*Malurus amabilis*	lovely fairy-wren		C		8
animals	birds	Maluridae	*Malurus melanocephalus*	red-backed fairy-wren		C		400
animals	birds	Megaluridae	*Megalurus gramineus*	little grassbird		C		10
animals	birds	Megaluridae	*Megalurus timoriensis*	tawny grassbird		C		66
animals	birds	Megaluridae	*Cincloramphus cruralis*	brown songlark		C		2
animals	birds	Megaluridae	*Cincloramphus mathewsi*	rufous songlark		C		5
animals	birds	Megapodiidae	*Megapodius reinwardt*	orange-footed scrubfowl		C		98
animals	birds	Megapodiidae	*Alectura lathami*	Australian brush-turkey		C		122
animals	birds	Meliphagidae	*Purnella albifrons*	white-fronted honeyeater		C		1
animals	birds	Meliphagidae	*Plectorhyncha lanceolata*	striped honeyeater		C		4
animals	birds	Meliphagidae	*Melithreptus albogularis*	white-throated honeyeater		C		666
animals	birds	Meliphagidae	*Acanthagenys rufogularis*	spiny-cheeked honeyeater		C		5
animals	birds	Meliphagidae	*Gavicalis fasciogularis*	mangrove honeyeater		C		21
animals	birds	Meliphagidae	*Conopophila rufogularis*	rufous-throated honeyeater		C		155
animals	birds	Meliphagidae	*Conopophila albogularis*	rufous-banded honeyeater		C		1
animals	birds	Meliphagidae	*Anthochaera carunculata*	red wattlebird		C		1
animals	birds	Meliphagidae	*Philemon citreogularis*	little friarbird		C		367/1
animals	birds	Meliphagidae	*Myzomela sanguinolenta*	scarlet honeyeater		C		22
animals	birds	Meliphagidae	*Manorina melanocephala*	noisy miner		C		13
animals	birds	Meliphagidae	*Xanthotis macleayanus*	Macleay's honeyeater		C		1
animals	birds	Meliphagidae	*Ramsayornis fasciatus*	bar-breasted honeyeater		C		5
animals	birds	Meliphagidae	*Ptilotula penicillata*	white-plumed honeyeater		C		1
animals	birds	Meliphagidae	*Sugomel niger*	black honeyeater		C		1
animals	birds	Meliphagidae	*Ptilotula fusca*	fuscous honeyeater		C		11
animals	birds	Meliphagidae	*Meliphaga notata*	yellow-spotted honeyeater		C		61
animals	birds	Meliphagidae	*Myzomela obscura*	dusky honeyeater		C		245
animals	birds	Meliphagidae	*Stomiopera flava*	yellow honeyeater		C		811
animals	birds	Meliphagidae	*Meliphaga lewinii*	Lewin's honeyeater		C		24
animals	birds	Meliphagidae	*Caligavis chrysops*	yellow-faced honeyeater		C		7
animals	birds	Meliphagidae	*Entomyzon cyanotis*	blue-faced honeyeater		C		665
animals	birds	Meliphagidae	*Manorina flavigula*	yellow-throated miner		C		72
animals	birds	Meliphagidae	*Meliphaga gracilis*	graceful honeyeater		C		4
animals	birds	Meliphagidae	*Phylidonyris niger*	white-cheeked honeyeater		C		4
animals	birds	Meliphagidae	*Bolemoreus frenatus*	bridled honeyeater		C		1
animals	birds	Meliphagidae	*Epthianura tricolor*	crimson chat		C		1
animals	birds	Meliphagidae	*Gavicalis virescens*	singing honeyeater		C		7
animals	birds	Meliphagidae	*Philemon buceroides*	helmeted friarbird		C		774/1

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	birds	Meliphagidae	*Stomiopera unicolor*	white-gaped honeyeater		C		521/2
animals	birds	Meliphagidae	*Cissomela pectoralis*	banded honeyeater		C		3
animals	birds	Meliphagidae	*Epthianura aurifrons*	orange chat		C		3
animals	birds	Meliphagidae	*Gavicalis versicolor*	varied honeyeater		C		216
animals	birds	Meliphagidae	*Lichmera indistincta*	brown honeyeater		C		856
animals	birds	Meliphagidae	*Melithreptus gularis*	black-chinned honeyeater		C		9
animals	birds	Meliphagidae	*Melithreptus lunatus*	white-naped honeyeater		C		4
animals	birds	Meliphagidae	*Philemon argenticeps*	silver-crowned friarbird		C		3
animals	birds	Meliphagidae	*Ptilotula flavescens*	yellow-tinted honeyeater		C		2
animals	birds	Meliphagidae	*Ramsayornis modestus*	brown-backed honeyeater		C		423
animals	birds	Meliphagidae	*Philemon corniculatus*	noisy friarbird		C		179
animals	birds	Meropidae	*Merops ornatus*	rainbow bee-eater		SL		1006
animals	birds	Monarchidae	*Symposiachrus trivirgatus*	spectacled monarch		SL		88
animals	birds	Monarchidae	*Myiagra rubecula*	leaden flycatcher		C		550/1
animals	birds	Monarchidae	*Myiagra cyanoleuca*	satin flycatcher		SL		12
animals	birds	Monarchidae	*Myiagra alecto*	shining flycatcher		C		31
animals	birds	Monarchidae	*Machaerirhynchus flaviventer*	yellow-breasted boatbill		C		1
animals	birds	Monarchidae	*Myiagra inquieta*	restless flycatcher		C		18
animals	birds	Monarchidae	*Carterornis leucotis*	white-eared monarch		C		42
animals	birds	Monarchidae	*Monarcha melanopsis*	black-faced monarch		SL		23
animals	birds	Monarchidae	*Grallina cyanoleuca*	magpie-lark		C		1086
animals	birds	Monarchidae	*Myiagra ruficollis*	broad-billed flycatcher		C		1
animals	birds	Motacillidae	*Motacilla flava sensu lato*	yellow wagtail		SL		3
animals	birds	Motacillidae	*Motacilla cinerea*	grey wagtail		SL		1
animals	birds	Motacillidae	*Anthus novaeseelandiae*	Australasian pipit		C		297
animals	birds	Nectariniidae	*Nectarinia jugularis*	olive-backed sunbird		C		867/4
animals	birds	Nectariniidae	*Dicaeum hirundinaceum*	mistletoebird		C		686
animals	birds	Neosittidae	*Daphoenositta chrysoptera*	varied sittella		C		5
animals	birds	Oceanitidae	*Pelagodroma marina*	white-faced storm-petrel		C		2
animals	birds	Oriolidae	*Oriolus sagittatus*	olive-backed oriole		C		209/1
animals	birds	Oriolidae	*Oriolus flavocinctus*	yellow oriole		C		2
animals	birds	Oriolidae	*Sphecotheres vieilloti*	Australasian figbird		C		824/4
animals	birds	Otididae	*Ardeotis australis*	Australian bustard		C		45
animals	birds	Pachycephalidae	*Pachycephala pectoralis*	golden whistler		C		8/1
animals	birds	Pachycephalidae	*Colluricincla harmonica*	grey shrike-thrush		C		22
animals	birds	Pachycephalidae	*Colluricincla boweri*	Bower's shrike-thrush		C		1
animals	birds	Pachycephalidae	*Pachycephala simplex peninsulae*	grey whistler		C		1
animals	birds	Pachycephalidae	*Colluricincla megarhyncha*	little shrike-thrush		C		157/2
animals	birds	Pachycephalidae	*Pachycephala rufiventris*	rufous whistler		C		181
animals	birds	Pardalotidae	*Pardalotus striatus*	striated pardalote		C		187
animals	birds	Pardalotidae	*Pardalotus punctatus*	spotted pardalote		C		1
animals	birds	Passeridae	*Passer domesticus*	house sparrow	Y			615
animals	birds	Pelecanidae	*Pelecanus conspicillatus*	Australian pelican		C		380
animals	birds	Petroicidae	*Tregellasia capito*	pale-yellow robin		C		2
animals	birds	Petroicidae	*Microeca fascinans*	jacky winter		C		9
animals	birds	Petroicidae	*Peneonanthe pulverulenta*	mangrove robin		C		14

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	birds	Petroicidae	*Microeca flavigaster*	lemon-bellied flycatcher		C		74
animals	birds	Petroicidae	*Eopsaltria australis*	eastern yellow robin		C		4
animals	birds	Petroicidae	*Poecilodryas superciliosa*	white-browed robin		C		24/1
animals	birds	Phalacrocoracidae	*Microcarbo melanoleucos*	little pied cormorant		C		410
animals	birds	Phalacrocoracidae	*Phalacrocorax carbo*	great cormorant		C		65
animals	birds	Phalacrocoracidae	*Phalacrocorax varius*	pied cormorant		C		134
animals	birds	Phalacrocoracidae	*Phalacrocorax sulcirostris*	little black cormorant		C		482
animals	birds	Phasianidae	*Coturnix ypsilophora*	brown quail		C		149
animals	birds	Phasianidae	*Coturnix pectoralis*	stubble quail		C		1
animals	birds	Phasianidae	*Pavo cristatus*	Indian peafowl	Y			7
animals	birds	Phasianidae	*Excalfactoria chinensis*	king quail		C		5
animals	birds	Pittidae	*Pitta versicolor*	noisy pitta		C		16
animals	birds	Podargidae	*Podargus papuensis*	Papuan frogmouth		C		1
animals	birds	Podargidae	*Podargus strigoides*	tawny frogmouth		C		105
animals	birds	Podicipedidae	*Podiceps cristatus*	great crested grebe		C		8
animals	birds	Podicipedidae	*Poliocephalus poliocephalus*	hoary-headed grebe		C		3
animals	birds	Podicipedidae	*Tachybaptus novaehollandiae*	Australasian grebe		C		58
animals	birds	Procellariidae	*Ardenna tenuirostris*	short-tailed shearwater		SL		4/3
animals	birds	Procellariidae	*Macronectes giganteus*	southern giant-petrel		E	E	4
animals	birds	Procellariidae	*Ardenna pacifica*	wedge-tailed shearwater		SL		6
animals	birds	Psittacidae	*Trichoglossus haematodus rubritorquis*	red-collared lorikeet		C		1
animals	birds	Psittacidae	*Cyclopsitta diophthalma macleayana*	Macleay's fig-parrot		V		3
animals	birds	Psittacidae	*Trichoglossus chlorolepidotus*	scaly-breasted lorikeet		C		307
animals	birds	Psittacidae	*Platycercus adscitus adscitus*	pale-headed rosella (northern form)		C		3
animals	birds	Psittacidae	*Aprosmictus erythropterus*	red-winged parrot		C		132
animals	birds	Psittacidae	*Melopsittacus undulatus*	budgerigar		C		10
animals	birds	Psittacidae	*Psephotus haematonotus*	red-rumped parrot		C		1
animals	birds	Psittacidae	*Platycercus venustus*	northern rosella		C		1
animals	birds	Psittacidae	*Platycercus adscitus*	pale-headed rosella		C		299/2
animals	birds	Psittacidae	*Platycercus elegans*	crimson rosella		C		1
animals	birds	Psittacidae	*Parvipsitta pusilla*	little lorikeet		C		10
animals	birds	Psittacidae	*Trichoglossus haematodus moluccanus*	rainbow lorikeet		C		1113
animals	birds	Ptilonorhynchidae	*Ptilonorhynchus nuchalis*	great bowerbird		C		936/5
animals	birds	Ptilonorhynchidae	*Ptilonorhynchus maculatus*	spotted bowerbird		C		8
animals	birds	Rallidae	*Fulica atra*	Eurasian coot		C		17
animals	birds	Rallidae	*Porzana pusilla*	Baillon's crake		C		10
animals	birds	Rallidae	*Gallirallus philippensis*	buff-banded rail		C		30
animals	birds	Rallidae	*Amaurornis moluccana*	pale-vented bush-hen		C		17
animals	birds	Rallidae	*Porphyrio melanotus*	purple swamphen		C		80
animals	birds	Rallidae	*Gallinula tenebrosa*	dusky moorhen		C		49
animals	birds	Rallidae	*Tribonyx ventralis*	black-tailed native-hen		C		1
animals	birds	Rallidae	*Amaurornis cinerea*	white-browed crake		C		41
animals	birds	Rallidae	*Porzana fluminea*	Australian spotted crake		C		6
animals	birds	Rallidae	*Rallina tricolor*	red-necked crake		C		1
animals	birds	Rallidae	*Porzana tabuensis*	spotless crake		C		3
animals	birds	Recurvirostridae	*Himantopus himantopus*	black-winged stilt		C		179

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	birds	Recurvirostridae	*Recurvirostra novaehollandiae*	red-necked avocet		C		17
animals	birds	Rhipiduridae	*Rhipidura leucophrys*	willie wagtail		C		251
animals	birds	Rhipiduridae	*Rhipidura rufifrons*	rufous fantail		SL		98
animals	birds	Rhipiduridae	*Rhipidura albiscapa*	grey fantail		C		323
animals	birds	Rhipiduridae	*Rhipidura rufiventris*	northern fantail		C		13
animals	birds	Rostratulidae	*Rostratula australis*	Australian painted snipe		V	E	12
animals	birds	Scolopacidae	*Calidris canutus*	red knot		SL	E	16
animals	birds	Scolopacidae	*Numenius madagascariensis*	eastern curlew		V	CE	269
animals	birds	Scolopacidae	*Limosa lapponica baueri*	Western Alaskan bar-tailed godwit		SL	V	119
animals	birds	Scolopacidae	*Calidris tenuirostris*	great knot		SL	CE	66
animals	birds	Scolopacidae	*Limicola falcinellus*	broad-billed sandpiper		SL		3
animals	birds	Scolopacidae	*Gallinago hardwickii*	Latham's snipe		SL		36
animals	birds	Scolopacidae	*Calidris ruficollis*	red-necked stint		SL		52
animals	birds	Scolopacidae	*Tringa stagnatilis*	marsh sandpiper		SL		37
animals	birds	Scolopacidae	*Philomachus pugnax*	ruff		SL		2
animals	birds	Scolopacidae	*Calidris melanotos*	pectoral sandpiper		SL		13
animals	birds	Scolopacidae	*Calidris acuminata*	sharp-tailed sandpiper		SL		61
animals	birds	Scolopacidae	*Calidris alba*	sanderling		SL		9
animals	birds	Scolopacidae	*Limosa limosa*	black-tailed godwit		SL		26
animals	birds	Scolopacidae	*Xenus cinereus*	terek sandpiper		SL		18
animals	birds	Scolopacidae	*Tringa brevipes*	grey-tailed tattler		SL		172
animals	birds	Scolopacidae	*Calidris ferruginea*	curlew sandpiper		SL	CE	16
animals	birds	Scolopacidae	*Tringa glareola*	wood sandpiper		SL		12
animals	birds	Scolopacidae	*Numenius minutus*	little curlew		SL		15
animals	birds	Scolopacidae	*Tringa nebularia*	common greenshank		SL		76
animals	birds	Scolopacidae	*Numenius phaeopus*	whimbrel		SL		278
animals	birds	Scolopacidae	*Actitis hypoleucos*	common sandpiper		SL		72
animals	birds	Scolopacidae	*Arenaria interpres*	ruddy turnstone		SL		11
animals	birds	Stercorariidae	*Stercorarius parasiticus*	Arctic jaeger		SL		1
animals	birds	Strigidae	*Ninox connivens*	barking owl		C		172
animals	birds	Strigidae	*Ninox boobook*	southern boobook		C		80
animals	birds	Strigidae	*Ninox rufa queenslandica*	rufous owl (southern subspecies)		C		9/2
animals	birds	Sturnidae	*Sturnus vulgaris*	common starling	Y			3
animals	birds	Sturnidae	*Aplonis metallica*	metallic starling		C		5
animals	birds	Sturnidae	*Acridotheres tristis*	common myna	Y			631
animals	birds	Sulidae	*Sula dactylatra*	masked booby		SL		1
animals	birds	Sulidae	*Sula sula*	red-footed booby		SL		2
animals	birds	Sulidae	*Morus serrator*	Australasian gannet		C		1
animals	birds	Sulidae	*Sula leucogaster*	brown booby		SL		25/1
animals	birds	Threskiornithidae	*Threskiornis molucca*	Australian white ibis		C		1088
animals	birds	Threskiornithidae	*Plegadis falcinellus*	glossy ibis		SL		51
animals	birds	Threskiornithidae	*Platalea flavipes*	yellow-billed spoonbill		C		62
animals	birds	Threskiornithidae	*Threskiornis spinicollis*	straw-necked ibis		C		558
animals	birds	Threskiornithidae	*Platalea regia*	royal spoonbill		C		399/1
animals	birds	Timaliidae	*Zosterops lateralis*	silvereye		C		14
animals	birds	Turnicidae	*Turnix maculosus*	red-backed button-quail		C		12

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	birds	Turnicidae	*Turnix varius*	painted button-quail		C		1
animals	birds	Turnicidae	*Turnix velox*	little button-quail		C		1
animals	birds	Turnicidae	*Turnix pyrrhothorax*	red-chested button-quail		C		14
animals	birds	Tytonidae	*Tyto delicatula*	eastern barn owl		C		14
animals	birds	Tytonidae	*Tyto longimembris*	eastern grass owl		C		3
animals	birds	Tytonidae	*Tyto novaehollandiae kimberli*	masked owl (northern subspecies)		V	V	1
animals	cartilaginous fishes	Aetobatidae	*Aetobatus ocellatus*	whitespotted eagle ray				1
animals	cartilaginous fishes	Mobulidae	*Manta alfredi*	Alfred manta				1
animals	cartilaginous fishes	Sphyrnidae	*Sphyrna lewini*	scalloped hammerhead				1
animals	insects	Hesperiidae	*Proeidosa polysema*	spinifex sand-skipper				1
animals	insects	Hesperiidae	*Taractrocera sp.*					1
animals	insects	Hesperiidae	*Suniana sunias*					1
animals	insects	Hesperiidae	*Suniana sp.*					1
animals	insects	Hesperiidae	*Cephrenes trichopepla*	yellow palm-dart				1
animals	insects	Lycaenidae	*Liphyra brassolis major*	moth butterfly		C		1/1
animals	insects	Lycaenidae	*Zizina otis labradus*	common grass-blue (Australian subspecies)				1
animals	insects	Lycaenidae	*Ogyris amaryllis*					1/1
animals	insects	Lycaenidae	*Ogyris zosine*					1/1
animals	insects	Lycaenidae	*Hypolycaena phorbas phorbas*	black-spotted flash				1
animals	insects	Nymphalidae	*Libythea geoffroy nicevillei*	purple beak				2
animals	insects	Nymphalidae	*Junonia orithya albicincta*	blue argus				1
animals	insects	Nymphalidae	*Mycalesis perseus perseus*	dingy bush-brown				1
animals	insects	Nymphalidae	*Hypolimnas alimena lamina*	blue-banded eggfly				2
animals	insects	Nymphalidae	*Hypolimnas bolina nerina*	varied eggfly				4
animals	insects	Nymphalidae	*Tirumala hamata hamata*	blue tiger				1
animals	insects	Nymphalidae	*Junonia hedonia zelima*	brown argus				1
animals	insects	Nymphalidae	*Danaus affinis affinis*	marsh tiger				3
animals	insects	Nymphalidae	*Cupha prosope*					1
animals	insects	Nymphalidae	*Danaus petilia*	lesser wanderer				2
animals	insects	Nymphalidae	*Euploea core corinna*	common crow				3
animals	insects	Papilionidae	*Graphium eurypylus lycaon*	pale-blue triangle (eastern subspecies)				1
animals	insects	Papilionidae	*Ornithoptera priamus*			C		8
animals	insects	Papilionidae	*Atrophaneura polydorus queenslandicus*	red-bodied swallowtail				3
animals	insects	Papilionidae	*Graphium agamemnon ligatum*	green-spotted triangle				1
animals	insects	Papilionidae	*Cressida cressida cressida*	greasy swallowtail				3
animals	insects	Papilionidae	*Ornithoptera euphorion*	Cairns birdwing		C		4
animals	insects	Papilionidae	*Papilio ulysses joesa*	Ulysses butterfly		C		10
animals	insects	Pieridae	*Eurema brigitta australis*	no-brand grass-yellow				1
animals	insects	Pieridae	*Eurema hecabe*	large grass-yellow				1
animals	mammals	Balaenopteridae	*Megaptera novaeangliae*	humpback whale		V	V	15
animals	mammals	Bovidae	*Bos taurus*	European cattle	Y			3
animals	mammals	Canidae	*Canis sp.*					2
animals	mammals	Canidae	*Canis lupus dingo*	dingo				11
animals	mammals	Canidae	*Canis lupus familiaris*	dog	Y			7

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	mammals	Canidae	*Vulpes vulpes*	red fox	Y			1
animals	mammals	Dasyuridae	*Planigale maculata*	common planigale		C		31/3
animals	mammals	Dasyuridae	*Sminthopsis murina*	common dunnart		C		2
animals	mammals	Dasyuridae	*Dasyurus hallucatus*	northern quoll		C	E	4
animals	mammals	Delphinidae	*Sousa sahulensis*	Australian humpback dolphin		V		10/10
animals	mammals	Delphinidae	*Orcaella heinsohni*	Australian snubfin dolphin		V		59/29
animals	mammals	Delphinidae	*Tursiops aduncus*	Indo-Pacific bottlenose dolphin		C		4/3
animals	mammals	Dugongidae	*Dugong dugon*	dugong		V		11/1
animals	mammals	Emballonuridae	*Saccolaimus sp.*					36
animals	mammals	Emballonuridae	*Saccolaimus saccolaimus nudicluniatus*	bare-rumped sheathtail bat		E	CE	1/1
animals	mammals	Emballonuridae	*Saccolaimus flaviventris*	yellow-bellied sheathtail bat		C		2
animals	mammals	Emballonuridae	*Taphozous troughtoni*	Troughton's sheathtail bat		C		1
animals	mammals	Emballonuridae	*Taphozous sp.*					54
animals	mammals	Felidae	*Felis catus*	cat	Y			11
animals	mammals	Hipposideridae	*Hipposideros ater aruensis*	eastern dusky leaf-nosed bat		C		3
animals	mammals	Hypsiprymnodontidae	*Hypsiprymnodon moschatus*	musky rat-kangaroo		C		1/1
animals	mammals	Leporidae	*Oryctolagus cuniculus*	rabbit	Y			11
animals	mammals	Leporidae	*Lepus europaeus*	European brown hare	Y			1
animals	mammals	Macropodidae	*Macropus agilis*	agile wallaby		C		44/2
animals	mammals	Macropodidae	*Macropus parryi*	whiptail wallaby		C		8
animals	mammals	Macropodidae	*Lagorchestes conspicillatus*	spectacled hare-wallaby		C		3
animals	mammals	Macropodidae	*Macropus robustus*	common wallaroo		C		11
animals	mammals	Macropodidae	*Macropus giganteus*	eastern grey kangaroo		C		15/1
animals	mammals	Macropodidae	*Petrogale assimilis*	allied rock-wallaby		C		34/13
animals	mammals	Macropodidae	*Thylogale sp.*					1
animals	mammals	Macropodidae	*Petrogale sp.*			C		1
animals	mammals	Macropodidae	*Wallabia bicolor*	swamp wallaby		C		1
animals	mammals	Miniopteridae	*Miniopterus australis*	little bent-wing bat		C		56
animals	mammals	Miniopteridae	*Miniopterus schreibersii oceanensis*	eastern bent-wing bat		C		87/6
animals	mammals	Molossidae	*Mormopterus lumsdenae*	northern free-tailed bat		C		55
animals	mammals	Molossidae	*Chaerephon jobensis*	northern freetail bat		C		78
animals	mammals	Molossidae	*Mormopterus ridei*	eastern free-tailed bat		C		94
animals	mammals	Molossidae	*Tadarida australis*	white-striped freetail bat		C		11
animals	mammals	Muridae	*Pseudomys delicatulus*	delicate mouse		C		15
animals	mammals	Muridae	*Uromys caudimaculatus*	giant white-tailed rat		C		3
animals	mammals	Muridae	*Leggadina lakedownensis*	Lakeland Downs mouse		C		1
animals	mammals	Muridae	*Pseudomys gracilicaudatus*	eastern chestnut mouse		C		8/1
animals	mammals	Muridae	*Mus musculus*	house mouse	Y			67/7
animals	mammals	Muridae	*Rattus rattus*	black rat	Y			6
animals	mammals	Muridae	*Hydromys chrysogaster*	water rat		C		16/2
animals	mammals	Muridae	*Melomys cervinipes*	fawn-footed melomys		C		15
animals	mammals	Muridae	*Rattus sordidus*	canefield rat		C		18/6
animals	mammals	Muridae	*Rattus tunneyi*	pale field-rat		C		1
animals	mammals	Muridae	*Melomys burtoni*	grassland melomys		C		33/6
animals	mammals	Ornithorhynchidae	*Ornithorhynchus anatinus*	platypus		SL		1
animals	mammals	Peramelidae	*Isoodon macrourus*	northern brown bandicoot		C		23/1

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	mammals	Phalangeridae	*Trichosurus vulpecula*	common brushtail possum		C		56/14
animals	mammals	Phascolarctidae	*Phascolarctos cinereus*	koala		V	V	85
animals	mammals	Physeteridae	*Physeter macrocephalus*	sperm whale		C		1/1
animals	mammals	Potoroidae	*Aepyprymnus rufescens*	rufous bettong		C		5/1
animals	mammals	Pteropodidae	*Pteropus sp.*					1
animals	mammals	Pteropodidae	*Pteropus scapulatus*	little red flying-fox		C		8/1
animals	mammals	Pteropodidae	*Syconycteris australis*	eastern blossom bat		C		1
animals	mammals	Pteropodidae	*Nyctimene robinsoni*	eastern tube-nosed bat		C		1
animals	mammals	Pteropodidae	*Pteropus alecto*	black flying-fox		C		23/6
animals	mammals	Rhinolophidae	*Rhinolophus megaphyllus*	eastern horseshoe-bat		C		10
animals	mammals	Suidae	*Sus scrofa*	pig	Y			7
animals	mammals	Tachyglossidae	*Tachyglossus aculeatus*	short-beaked echidna		SL		35
animals	mammals	Vespertilionidae	*Chalinolobus gouldii*	Gould's wattled bat		C		34
animals	mammals	Vespertilionidae	*Scotorepens balstoni*	inland broad-nosed bat		C		2
animals	mammals	Vespertilionidae	*Scotorepens sanborni*	northern broad-nosed bat		C		6
animals	mammals	Vespertilionidae	*Nyctophilus bifax*	northern long-eared bat		C		3
animals	mammals	Vespertilionidae	*Chalinolobus nigrogriseus*	hoary wattled bat		C		46
animals	mammals	Vespertilionidae	*Myotis macropus*	large-footed myotis		C		7
animals	mammals	Vespertilionidae	*Nyctophilus sp.*					11
animals	mammals	Vespertilionidae	*Vespadelus pumilus*	eastern forest bat		C		5/4
animals	mammals	Vespertilionidae	*Vespadelus troughtoni*	eastern cave bat		C		41
animals	ray-finned fishes	Ambassidae	*Ambassis macleayi*	Macleay's glassfish				1
animals	ray-finned fishes	Ambassidae	*Ambassis agrammus*	sailfin glassfish				91
animals	ray-finned fishes	Anguillidae	*Anguilla reinhardtii*	longfin eel				48
animals	ray-finned fishes	Anguillidae	*Anguilla sp.*					3
animals	ray-finned fishes	Apogonidae	*Glossamia aprion*	mouth almighty				281
animals	ray-finned fishes	Atherinidae	*Craterocephalus stercusmuscarum*	flyspecked hardyhead				1479/1
animals	ray-finned fishes	Belonidae	*Strongylura krefftii*	freshwater longtom				170
animals	ray-finned fishes	Centropomidae	*Lates calcarifer*	barramundi				1104
animals	ray-finned fishes	Cichlidae	*Tilapia mariae*	spotted tilapia	Y			2
animals	ray-finned fishes	Cichlidae	*Amphilophus labiatus*	red devil	Y			18
animals	ray-finned fishes	Cichlidae	*Amatitlania nigrofasciata*	convict cichlid	Y			5
animals	ray-finned fishes	Cichlidae	*Oreochromis mossambicus*	Mozambique mouthbrooder	Y			425
animals	ray-finned fishes	Clupeidae	*Nematalosa erebi*	bony bream				644
animals	ray-finned fishes	Eleotridae	*Mogurnda adspersa*	southern purplespotted gudgeon				1/1
animals	ray-finned fishes	Eleotridae	*Hypseleotris compressa*	empire gudgeon				14
animals	ray-finned fishes	Eleotridae	*Oxyeleotris lineolata*	sleepy cod				267
animals	ray-finned fishes	Eleotridae	*Ophiocara porocephala*	spangled gudgeon				2
animals	ray-finned fishes	Eleotridae	*Giurus margaritacea*	snakehead gudgeon				2
animals	ray-finned fishes	Eleotridae	*Hypseleotris galii*	firetail gudgeon				10
animals	ray-finned fishes	Eleotridae	*Mogurnda mogurnda*	northern purplespotted gudgeon				1
animals	ray-finned fishes	Eleotridae	*Hypseleotris species 1*	Midgley's carp gudgeon				1
animals	ray-finned fishes	Gobiidae	*Chlamydogobius ranunculus*	tadpole goby				1/1
animals	ray-finned fishes	Gobiidae	*Glossogobius illimis*	false celebes goby				2
animals	ray-finned fishes	Gobiidae	*Redigobius bikolanus*	speckled goby				1
animals	ray-finned fishes	Lutjanidae	*Lutjanus argentimaculatus*	mangrove jack				101

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	ray-finned fishes	Megalopidae	*Megalops cyprinoides*	oxeye herring				3
animals	ray-finned fishes	Melanotaeniidae	*Melanotaenia splendida splendida*	eastern rainbowfish				327/12
animals	ray-finned fishes	Percichthyidae	*Macquaria novemaculeata*	Australian bass				1
animals	ray-finned fishes	Plotosidae	*Neosilurus ater*	black catfish				13
animals	ray-finned fishes	Plotosidae	*Neosilurus hyrtlii*	Hyrtl's catfish				3
animals	ray-finned fishes	Plotosidae	*Porochilus rendahli*	Rendahl's catfish				7
animals	ray-finned fishes	Poeciliidae	*Poecilia reticulata*	guppy	Y			2
animals	ray-finned fishes	Poeciliidae	*Gambusia holbrooki*	mosquitofish	Y			2
animals	ray-finned fishes	Pseudomugilidae	*Pseudomugil signifer*	Pacific blue eye				4/1
animals	ray-finned fishes	Terapontidae	*Amniataba percoides*	barred grunter				253
animals	ray-finned fishes	Terapontidae	*Leiopotherapon unicolor*	spangled perch				14
animals	ray-finned fishes	Toxotidae	*Toxotes chatareus*	sevenspot archerfish				52
animals	ray-finned fishes	Toxotidae	*Toxotes jaculatrix*	banded archerfish				1
animals	reptiles	Acrochordidae	*Acrochordus granulatus*	little file snake		C		1
animals	reptiles	Agamidae	*Pogona barbata*	bearded dragon		C		2
animals	reptiles	Agamidae	*Diporiphora nobbi*	nobbi		C		2/1
animals	reptiles	Agamidae	*Diporiphora sp.*					1
animals	reptiles	Agamidae	*Chlamydosaurus kingii*	frilled lizard		C		7/1
animals	reptiles	Agamidae	*Diporiphora australis*	tommy roundhead		C		32/5
animals	reptiles	Agamidae	*Diporiphora bilineata*	two-lined dragon		C		1
animals	reptiles	Agamidae	*Intellagama lesueurii*	eastern water dragon		C		1
animals	reptiles	Boidae	*Liasis mackloti*	water python		C		4
animals	reptiles	Boidae	*Simalia kinghorni*	amethystine python (Australian form)		C		4
animals	reptiles	Boidae	*Antaresia maculosa*	spotted python		C		15/2
animals	reptiles	Boidae	*Aspidites melanocephalus*	black-headed python		C		1
animals	reptiles	Boidae	*Morelia spilota*	carpet python		C		15/1
animals	reptiles	Carphodactylidae	*Nephrurus asper*	spiny knob-tailed gecko		C		1
animals	reptiles	Carphodactylidae	*Phyllurus sp.*					1
animals	reptiles	Carphodactylidae	*Phyllurus gulbaru*	Gulbaru gecko		E	CE	1
animals	reptiles	Chelidae	*Elseya irwini*	Irwin's turtle		C		1/1
animals	reptiles	Chelidae	*Chelodina canni*	Cann's longneck turtle		C		7/4
animals	reptiles	Chelidae	*Emydura macquarii macquarii*	Murray turtle		C		1/1
animals	reptiles	Chelidae	*Wollumbinia latisternum*	saw-shelled turtle		C		2/1
animals	reptiles	Chelidae	*Emydura macquarii krefftii*	Krefft's river turtle		C		13
animals	reptiles	Cheloniidae	*Eretmochelys imbricata*	hawksbill turtle		V	V	2
animals	reptiles	Cheloniidae	*Chelonia mydas*	green turtle		V	V	13
animals	reptiles	Cheloniidae	*Natator depressus*	flatback turtle		V	V	3
animals	reptiles	Colubridae	*Stegonotus cucullatus*	slaty-grey snake		C		1/1
animals	reptiles	Colubridae	*Tropidonophis mairii*	freshwater snake		C		32/3
animals	reptiles	Colubridae	*Boiga irregularis*	brown tree snake		C		9
animals	reptiles	Colubridae	*Dendrelaphis punctulatus*	green tree snake		C		52/1
animals	reptiles	Crocodylidae	*Crocodylus johnstoni*	Australian freshwater crocodile		C		1
animals	reptiles	Crocodylidae	*Crocodylus porosus*	estuarine crocodile		V		16/2
animals	reptiles	Diplodactylidae	*Lucasium steindachneri*	Steindachner's gecko		C		3
animals	reptiles	Diplodactylidae	*Oedura castelnaui*	northern velvet gecko		C		6
animals	reptiles	Diplodactylidae	*Amalosia lesueurii*	Lesueur's velvet gecko		C		1/1

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	reptiles	Diplodactylidae	*Amalosia rhombifer*	zig-zag gecko		C		11/6
animals	reptiles	Diplodactylidae	*Diplodactylus platyurus*	eastern fat-tailed gecko		C		1
animals	reptiles	Diplodactylidae	*Oedura monilis*	ocellated velvet gecko		C		3/1
animals	reptiles	Elapidae	*Suta suta*	myall snake		C		1/1
animals	reptiles	Elapidae	*Demansia sp.*					1
animals	reptiles	Elapidae	*Furina ornata*	orange-naped snake		C		3
animals	reptiles	Elapidae	*Furina diadema*	red-naped snake		C		2/1
animals	reptiles	Elapidae	*Furina barnardi*	yellow-naped snake		C		1
animals	reptiles	Elapidae	*Demansia torquata*	collared whipsnake		C		6/1
animals	reptiles	Elapidae	*Demansia papuensis*	greater black whipsnake		C		1/1
animals	reptiles	Elapidae	*Demansia vestigiata*	lesser black whipsnake		C		11/1
animals	reptiles	Elapidae	*Pseudonaja textilis*	eastern brown snake		C		5
animals	reptiles	Elapidae	*Cryptophis nigrescens*	eastern small-eyed snake		C		2
animals	reptiles	Elapidae	*Oxyuranus scutellatus*	coastal taipan		C		3
animals	reptiles	Elapidae	*Acanthophis praelongus*	northern death adder		C		1/1
animals	reptiles	Elapidae	*Acanthophis antarcticus*	common death adder		V		3
animals	reptiles	Elapidae	*Cryptophis nigrostriatus*	black-striped snake		C		4/2
animals	reptiles	Elapidae	*Microcephalophis gracilis*	slender sea snake		C		1/1
animals	reptiles	Elapidae	*Pseudonaja nuchalis sensu lato*	western brown snake		C		2
animals	reptiles	Gekkonidae	*Gehyra dubia*	dubious dtella		C		44/13
animals	reptiles	Gekkonidae	*Nactus cheverti*	Chevert gecko		C		1/1
animals	reptiles	Gekkonidae	*Hemidactylus frenatus*	house gecko	Y			13/3
animals	reptiles	Gekkonidae	*Heteronotia binoei*	Bynoe's gecko		C		30/1
animals	reptiles	Pygopodidae	*Pygopus schraderi*	eastern hooded scaly-foot		C		1
animals	reptiles	Pygopodidae	*Lialis burtonis*	Burton's legless lizard		C		16/3
animals	reptiles	Pygopodidae	*Delma labialis*	striped-tailed delma		C		6
animals	reptiles	Pygopodidae	*Delma tincta*	excitable delma		C		13/7
animals	reptiles	Scincidae	*Cryptoblepharus sp.*					1
animals	reptiles	Scincidae	*Lygisaurus foliorum*	tree-base litter-skink		C		7/1
animals	reptiles	Scincidae	*Concinnia brachysoma*	northern bar-sided skink		C		2/1
animals	reptiles	Scincidae	*Ctenotus taeniolatus*	copper-tailed skink		C		12
animals	reptiles	Scincidae	*Lygisaurus sesbrauna*	Eastern Cape litter-skink		C		1
animals	reptiles	Scincidae	*Lampropholis delicata*	dark-flecked garden sunskink		C		19/13
animals	reptiles	Scincidae	*Carlia rubrigularis*	red-throated rainbow-skink		C		1
animals	reptiles	Scincidae	*Carlia rhomboidalis*	blue-throated rainbow-skink		C		5
animals	reptiles	Scincidae	*Tiliqua scincoides*	eastern blue-tongued lizard		C		10
animals	reptiles	Scincidae	*Ctenotus spaldingi*	straight-browed ctenotus		C		34
animals	reptiles	Scincidae	*Ctenotus eutaenius*	black-backed yellow-lined ctenotus		C		1/1
animals	reptiles	Scincidae	*Bellatorias frerei*	major skink		C		1
animals	reptiles	Scincidae	*Lygisaurus laevis*	rainforest edge litter-skink		C		2/2
animals	reptiles	Scincidae	*Concinnia tenuis*	bar-sided skink		C		3/1
animals	reptiles	Scincidae	*Carlia schmeltzii*	robust rainbow-skink		C		23/4
animals	reptiles	Scincidae	*Cryptoblepharus virgatus sensu lato*			C		33/8
animals	reptiles	Scincidae	*Cryptoblepharus pulcher pulcher*	elegant snake-eyed skink		C		1
animals	reptiles	Scincidae	*Lygisaurus aeratus sensu lato*			C		4
animals	reptiles	Scincidae	*Carlia pectoralis sensu lato*			C		39/5

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	reptiles	Scincidae	*Glaphyromorphus punctulatus*	fine-spotted mulch-skink		C		15/8
animals	reptiles	Scincidae	*Cryptoblepharus metallicus*	metallic snake-eyed skink		C		3/1
animals	reptiles	Scincidae	*Glaphyromorphus mjobergi*	Atherton Tableland mulch-skink		C		1/1
animals	reptiles	Scincidae	*Cryptoblepharus virgatus*	striped snake-eyed skink		C		7
animals	reptiles	Scincidae	*Saproscincus basiliscus*	basilisk shadeskink		C		1
animals	reptiles	Scincidae	*Lampropholis mirabilis*	saxicoline sunskink		NT		9/3
animals	reptiles	Scincidae	*Carlia sp.*					4
animals	reptiles	Scincidae	*Carlia amax*	bauxite rainbow-skink		C		1/1
animals	reptiles	Scincidae	*Carlia munda*	shaded-litter rainbow-skink		C		11/1
animals	reptiles	Scincidae	*Carlia vivax*	tussock rainbow-skink		C		22/12
animals	reptiles	Scincidae	*Carlia storri*	Storr's rainbow-skink		C		12
animals	reptiles	Scincidae	*Lygisaurus zuma*	sun-loving litter-skink		C		1
animals	reptiles	Scincidae	*Carlia jarnoldae*	lined rainbow-skink		C		77
animals	reptiles	Scincidae	*Carlia rostralis*	black-throated rainbow-skink		C		1
animals	reptiles	Scincidae	*Morethia taeniopleura*	fire-tailed skink		C		14/4
animals	reptiles	Typhlopidae	*Anilios sp.*					2/1
animals	reptiles	Typhlopidae	*Indotyphlops braminus*	flowerpot blind snake	Y			4/1
animals	reptiles	Typhlopidae	*Anilios unguirostris*	claw-snouted blind snake		C		2
animals	reptiles	Varanidae	*Varanus tristis*	black-tailed monitor		C		3
animals	reptiles	Varanidae	*Varanus gouldii*	sand monitor		C		19
animals	reptiles	Varanidae	*Varanus varius*	lace monitor		C		18
animals	reptiles	Varanidae	*Varanus storri*	Storr's monitor		C		3/2
animals	reptiles	Varanidae	*Varanus semiremex*	rusty monitor		C		5/2
animals	reptiles	Varanidae	*Varanus acanthurus*	ridge-tailed monitor		C		1/1
animals	reptiles	Varanidae	*Varanus sp.*	goanna				5
animals	reptiles	Varanidae	*Varanus panoptes*	yellow-spotted monitor		C		4
animals	uncertain	Indeterminate	*Indeterminate*	Unknown or Code Pending		C		6
fungi	club fungi	Basidiomycota	*Cyathus*			C		1/1
fungi	club fungi	Basidiomycota	*Pisolithus albus*			C		1/1
fungi	club fungi	Basidiomycota	*Cyathus stercoreus*			C		1/1
fungi	club fungi	Basidiomycota	*Ganoderma*			C		1/1
fungi	club fungi	Basidiomycota	*Pisolithus marmoratus*			C		2/2
fungi	sac fungi	Parmeliaceae	*Parmotrema lobulascens*			C		1/1
fungi	sac fungi	Pertusariaceae	*Pertusaria xanthoplaca*			C		1/1
fungi	sac fungi	Physciaceae	*Dirinaria flava*			C		1/1
fungi	sac fungi	Physciaceae	*Dirinaria confluens*			C		1/1
fungi	sac fungi	Ramalinaceae	*Ramalina subfraxinea var. norstictica*			C		2/2
fungi	sac fungi	Ramalinaceae	*Ramalina confirmata*			C		1/1
fungi	sac fungi	Ramalinaceae	*Ramalina subfraxinea var. subfraxinea*			C		1/1
plants	conifers	Araucariaceae	*Araucaria cunninghamii var. cunninghamii*			C		3/3
plants	conifers	Podocarpaceae	*Podocarpus grayae*			C		1/1
plants	cycads	Cycadaceae	*Cycas media subsp. media*			C		3/3
plants	ferns	Adiantaceae	*Pellaea nana*			C		2/2
plants	ferns	Adiantaceae	*Adiantum atroviride*			C		3/3
plants	ferns	Adiantaceae	*Cheilanthes brownii*			C		3/3
plants	ferns	Adiantaceae	*Cheilanthes nudiuscula*			C		2/2

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	ferns	Adiantaceae	*Pityrogramma calomelanos*		Y			1/1
plants	ferns	Adiantaceae	*Pityrogramma calomelanos var. calomelanos*		Y			2/2
plants	ferns	Aspleniaceae	*Asplenium paleaceum*	scaly asplenium		C		2/2
plants	ferns	Davalliaceae	*Davallia pyxidata*			C		1/1
plants	ferns	Davalliaceae	*Davallia denticulata var. denticulata*			C		5/5
plants	ferns	Dennstaedtiaceae	*Pteridium esculentum x P.revolutum*			C		1/1
plants	ferns	Dennstaedtiaceae	*Pteridium revolutum*	hairy bracken		C		1/1
plants	ferns	Dennstaedtiaceae	*Microlepia speluncae*	cave fern		C		1/1
plants	ferns	Dicksoniaceae	*Calochlaena dubia*			C		1/1
plants	ferns	Dryopteridaceae	*Lastreopsis tenera*			C		1/1
plants	ferns	Dryopteridaceae	*Arachniodes aristata*	prickly shield fern		C		2/2
plants	ferns	Dryopteridaceae	*Coveniella poecilophlebia*			C		1/1
plants	ferns	Gleicheniaceae	*Dicranopteris linearis var. linearis*			C		2/2
plants	ferns	Hymenophyllaceae	*Crepidomanes saxifragoides*			C		1/1
plants	ferns	Lindsaeaceae	*Lindsaea brachypoda*			C		1/1
plants	ferns	Lindsaeaceae	*Lindsaea ensifolia subsp. agatii*			C		2/2
plants	ferns	Lindsaeaceae	*Lindsaea ensifolia subsp. ensifolia*			C		1/1
plants	ferns	Marsileaceae	*Marsilea crenata*			C		3/3
plants	ferns	Nephrolepidaceae	*Nephrolepis obliterata*			C		2/2
plants	ferns	Nephrolepidaceae	*Nephrolepis acutifolia*			C		1/1
plants	ferns	Parkeriaceae	*Ceratopteris thalictroides*			C		2/2
plants	ferns	Polypodiaceae	*Pyrrosia rupestris*	rock felt fern		C		2/2
plants	ferns	Polypodiaceae	*Drynaria sparsisora*			C		1/1
plants	ferns	Polypodiaceae	*Microsorum punctatum*			C		1/1
plants	ferns	Pteridaceae	*Pteris tremula*			C		1/1
plants	ferns	Salviniaceae	*Salvinia molesta*	salvinia	Y			3/3
plants	ferns	Schizaeaceae	*Lygodium reticulatum*			C		1/1
plants	ferns	Thelypteridaceae	*Cyclosorus interruptus*			C		1/1
plants	higher dicots	Acanthaceae	*Hemigraphis reptans*		Y			1/1
plants	higher dicots	Acanthaceae	*Rostellularia*			C		1/1
plants	higher dicots	Acanthaceae	*Hypoestes*			C		1/1
plants	higher dicots	Acanthaceae	*Rostellularia adscendens var. juncea*			C		1/1
plants	higher dicots	Acanthaceae	*Hypoestes floribunda var. floribunda*			C		1/1
plants	higher dicots	Acanthaceae	*Asystasia gangetica subsp. gangetica*		Y			5/5
plants	higher dicots	Acanthaceae	*Brunoniella acaulis subsp. acaulis*			C		2/2
plants	higher dicots	Acanthaceae	*Rostellularia adscendens*			C		1/1
plants	higher dicots	Acanthaceae	*Harnieria hygrophiloides*	white karambal		C		1/1
plants	higher dicots	Acanthaceae	*Hygrophila angustifolia*			C		1/1
plants	higher dicots	Acanthaceae	*Thunbergia grandiflora*	sky flower	Y			4/4
plants	higher dicots	Acanthaceae	*Thunbergia arnhemica*			C		1/1
plants	higher dicots	Acanthaceae	*Hypoestes floribunda*			C		4/3
plants	higher dicots	Acanthaceae	*Thunbergia fragrans*		Y			12/12
plants	higher dicots	Acanthaceae	*Nelsonia campestris*			C		1/1
plants	higher dicots	Acanthaceae	*Hygrophila triflora*		Y			3/3
plants	higher dicots	Acanthaceae	*Ruellia simplex*		Y			2/2
plants	higher dicots	Acanthaceae	*Barleria prionitis*		Y			2/2

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	higher dicots	Acanthaceae	*Justicia betonica*		Y			3/3
plants	higher dicots	Acanthaceae	*Barleria lupulina*		Y			3/3
plants	higher dicots	Acanthaceae	*Barleria cristata*		Y			1/1
plants	higher dicots	Acanthaceae	*Thunbergia alata*	black-eyed Susan	Y			1/1
plants	higher dicots	Acanthaceae	*Ruellia tuberosa*		Y			6/6
plants	higher dicots	Aizoaceae	*Trianthema compacta*			C		2/2
plants	higher dicots	Aizoaceae	*Trianthema triquetra*	red spinach		C		4/4
plants	higher dicots	Aizoaceae	*Sesuvium portulacastrum*	sea purslane		C		6/2
plants	higher dicots	Aizoaceae	*Trianthema portulacastrum*	black pigweed	Y			2/2
plants	higher dicots	Amaranthaceae	*Celosia argentea*		Y			5/4
plants	higher dicots	Amaranthaceae	*Ptilotus obovatus*			C		1/1
plants	higher dicots	Amaranthaceae	*Achyranthes aspera*			C		4/4
plants	higher dicots	Amaranthaceae	*Alternanthera nana*	hairy joyweed		C		1/1
plants	higher dicots	Amaranthaceae	*Aerva javanica*		Y			1/1
plants	higher dicots	Amaranthaceae	*Alternanthera denticulata var. micrantha*			C		2/2
plants	higher dicots	Amaranthaceae	*Alternanthera denticulata*	lesser joyweed		C		1/1
plants	higher dicots	Amaranthaceae	*Alternanthera brasiliana*		Y			1/1
plants	higher dicots	Amaranthaceae	*Alternanthera nodiflora*	joyweed		C		1/1
plants	higher dicots	Amaranthaceae	*Amaranthus interruptus*			C		1/1
plants	higher dicots	Amaranthaceae	*Deeringia amaranthoides*	redberry		C		5/4
plants	higher dicots	Amaranthaceae	*Gomphrena celosioides*	gomphrena weed	Y			2/2
plants	higher dicots	Amaranthaceae	*Alternanthera ficoidea*		Y			9/8
plants	higher dicots	Anacardiaceae	*Euroschinus falcatus*			C		2/1
plants	higher dicots	Anacardiaceae	*Pleiogynium timorense*	Burdekin plum		C		8/4
plants	higher dicots	Anacardiaceae	*Schinus terebinthifolius*		Y			1/1
plants	higher dicots	Anacardiaceae	*Euroschinus falcatus var. falcatus*			C		1/1
plants	higher dicots	Anacardiaceae	*Mangifera indica*	mango	Y			1
plants	higher dicots	Apiaceae	*Cyclospermum leptophyllum*		Y			1/1
plants	higher dicots	Apiaceae	*Mackinlaya macrosciadea*	mackinlaya		C		1/1
plants	higher dicots	Apiaceae	*Centella asiatica*			C		1/1
plants	higher dicots	Apiaceae	*Platysace valida*			C		1/1
plants	higher dicots	Apocynaceae	*Alyxia spicata*			C		2/2
plants	higher dicots	Apocynaceae	*Wrightia saligna*			C		1/1
plants	higher dicots	Apocynaceae	*Calotropis procera*		Y			1/1
plants	higher dicots	Apocynaceae	*Marsdenia rostrata*			C		1/1
plants	higher dicots	Apocynaceae	*Parsonsia velutina*	hairy silkpod		C		1/1
plants	higher dicots	Apocynaceae	*Secamone elliptica*			C		4/4
plants	higher dicots	Apocynaceae	*Calotropis gigantea*		Y			1/1
plants	higher dicots	Apocynaceae	*Catharanthus roseus*	pink periwinkle	Y			8/6
plants	higher dicots	Apocynaceae	*Gymnanthera oblonga*			C		1/1
plants	higher dicots	Apocynaceae	*Melodinus australis*	southern melodinus		C		1/1
plants	higher dicots	Apocynaceae	*Vincetoxicum ovatum*			C		2/2
plants	higher dicots	Apocynaceae	*Ceropegia cumingiana*			C		1/1
plants	higher dicots	Apocynaceae	*Marsdenia brevifolia*			V	V	2/2
plants	higher dicots	Apocynaceae	*Marsdenia microlepis*			C		2/2
plants	higher dicots	Apocynaceae	*Parsonsia lanceolata*	northern silkpod		C		4/4

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	higher dicots	Apocynaceae	*Tylophora williamsii*	Williams' tylophora		C		3/3
plants	higher dicots	Apocynaceae	*Rauvolfia tetraphylla*		Y			5/5
plants	higher dicots	Apocynaceae	*Vincetoxicum carnosum*			C		2/2
plants	higher dicots	Apocynaceae	*Ichnocarpus frutescens*			C		1/1
plants	higher dicots	Apocynaceae	*Parsonsia lenticellata*	narrow-leaved parsonsia		C		2/2
plants	higher dicots	Apocynaceae	*Parsonsia plaesiophylla*			C		1/1
plants	higher dicots	Apocynaceae	*Cryptostegia grandiflora*	rubber vine	Y			4/2
plants	higher dicots	Apocynaceae	*Parsonsia longipetiolata*			C		2/2
plants	higher dicots	Apocynaceae	*Tabernaemontana orientalis*			C		2
plants	higher dicots	Apocynaceae	*Cynanchum viminale subsp. brunonianum*			C		1/1
plants	higher dicots	Apocynaceae	*Wrightia pubescens subsp. penicillata*			C		1/1
plants	higher dicots	Aquifoliaceae	*Ilex arnhemensis subsp. ferdinandi*			C		1/1
plants	higher dicots	Araliaceae	*Trachymene montana*			C		1/1
plants	higher dicots	Araliaceae	*Polyscias elegans*	celery wood		C		1/1
plants	higher dicots	Araliaceae	*Hydrocotyle acutiloba*			C		1/1
plants	higher dicots	Argophyllaceae	*Argophyllum lejourdanii*			C		2/2
plants	higher dicots	Asteraceae	*Eclipta prostrata*	white eclipta	Y			2/2
plants	higher dicots	Asteraceae	*Erigeron pusillus*		Y			1/1
plants	higher dicots	Asteraceae	*Olearia xerophila*			C		1/1
plants	higher dicots	Asteraceae	*Peripleura scabra*			C		3/3
plants	higher dicots	Asteraceae	*Sonchus oleraceus*	common sowthistle	Y			1/1
plants	higher dicots	Asteraceae	*Tridax procumbens*	tridax daisy	Y			3/2
plants	higher dicots	Asteraceae	*Blumea benthamiana*			C		1/1
plants	higher dicots	Asteraceae	*Calotis lappulacea*	yellow burr daisy		C		1/1
plants	higher dicots	Asteraceae	*Centipeda borealis*			C		1/1
plants	higher dicots	Asteraceae	*Peripleura bicolor*			C		2/2
plants	higher dicots	Asteraceae	*Peripleura diffusa*			C		1/1
plants	higher dicots	Asteraceae	*Peripleura virgata*			C		1/1
plants	higher dicots	Asteraceae	*Chromolaena odorata*	Siam weed	Y			9/6
plants	higher dicots	Asteraceae	*Coronidium rupicola*			C		1/1
plants	higher dicots	Asteraceae	*Praxelis clematidea*		Y			4/4
plants	higher dicots	Asteraceae	*Streptoglossa odora*			C		4/4
plants	higher dicots	Asteraceae	*Erigeron bonariensis*		Y			2/2
plants	higher dicots	Asteraceae	*Pterocaulon serrulatum var. serrulatum*			C		5/5
plants	higher dicots	Asteraceae	*Pterocaulon ciliosum*			C		1/1
plants	higher dicots	Asteraceae	*Synedrella nodiflora*		Y			1/1
plants	higher dicots	Asteraceae	*Xanthium occidentale*		Y			1
plants	higher dicots	Asteraceae	*Cyanthillium cinereum*			C		2/2
plants	higher dicots	Asteraceae	*Glossocardia refracta*			C		1/1
plants	higher dicots	Asteraceae	*Gnaphalium polycaulon*		Y			2/2
plants	higher dicots	Asteraceae	*Tithonia diversifolia*	Japanese sunflower	Y			2/2
plants	higher dicots	Asteraceae	*Coronidium lanuginosum*			C		1/1
plants	higher dicots	Asteraceae	*Acanthospermum hispidum*	star burr	Y			1/1
plants	higher dicots	Asteraceae	*Gamochaeta pensylvanica*		Y			1/1
plants	higher dicots	Asteraceae	*Pterocaulon sphacelatum*	applebush		C		1
plants	higher dicots	Asteraceae	*Sphagneticola trilobata*		Y			1/1

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plants	higher dicots	Asteraceae	*Bidens alba var. radiata*		Y			1/1
plants	higher dicots	Asteraceae	*Coronidium newcastlianum*			C		1/1
plants	higher dicots	Asteraceae	*Symphyotrichum subulatum*		Y			2/2
plants	higher dicots	Asteraceae	*Chrysocephalum apiculatum*	yellow buttons		C		1
plants	higher dicots	Asteraceae	*Eleutheranthera ruderalis*		Y			2/2
plants	higher dicots	Asteraceae	*Phacellothrix cladochaeta*			C		1/1
plants	higher dicots	Asteraceae	*Sphaeromorphaea subintegra*			C		1/1
plants	higher dicots	Asteraceae	*Pseudognaphalium luteoalbum*	Jersey cudweed		C		1/1
plants	higher dicots	Asteraceae	*Apowollastonia spilanthoides*			C		5/5
plants	higher dicots	Asteraceae	*Peripleura hispidula var. setosa*			C		1/1
plants	higher dicots	Asteraceae	*Emilia sonchifolia var. sonchifolia*		Y			2/2
plants	higher dicots	Asteraceae	*Thymophylla tenuiloba var. tenuiloba*		Y			2/2
plants	higher dicots	Asteraceae	*Acmella grandiflora var. brachyglossa*			C		2/2
plants	higher dicots	Asteraceae	*Ageratum conyzoides subsp. conyzoides*		Y			2/2
plants	higher dicots	Asteraceae	*Camptacra barbata*			C		2/2
plants	higher dicots	Asteraceae	*Youngia japonica*			C		1/1
plants	higher dicots	Asteraceae	*Bidens bipinnata*	bipinnate beggar's ticks	Y			3/3
plants	higher dicots	Asteraceae	*Cassinia laevis*			C		1/1
plants	higher dicots	Asteraceae	*Olearia*			C		1/1
plants	higher dicots	Asteraceae	*Pluchea rubelliflora*			C		4/4
plants	higher dicots	Bignoniaceae	*Dolichandra unguis-cati*	cat's claw creeper	Y			2/2
plants	higher dicots	Bignoniaceae	*Tecoma stans var. stans*		Y			2/2
plants	higher dicots	Bombacaceae	*Lagunaria queenslandica*			C		1/1
plants	higher dicots	Boraginaceae	*Heliotropium sarmentosum*			C		1/1
plants	higher dicots	Boraginaceae	*Heliotropium cunninghamii*			C		1/1
plants	higher dicots	Boraginaceae	*Trichodesma zeylanicum var. zeylanicum*			C		1/1
plants	higher dicots	Boraginaceae	*Heliotropium peninsulare*			C		4/4
plants	higher dicots	Boraginaceae	*Heliotropium pauciflorum*			C		1/1
plants	higher dicots	Boraginaceae	*Heliotropium ovalifolium*			C		2/2
plants	higher dicots	Boraginaceae	*Trichodesma zeylanicum*			C		1
plants	higher dicots	Boraginaceae	*Heliotropium leptaleum*			C		1/1
plants	higher dicots	Boraginaceae	*Heliotropium*			C		2
plants	higher dicots	Boraginaceae	*Coldenia procumbens*			C		2/2
plants	higher dicots	Boraginaceae	*Heliotropium indicum*		Y			3/3
plants	higher dicots	Boraginaceae	*Heliotropium collinum*			C		2/2
plants	higher dicots	Brassicaceae	*Cardamine flexuosa*	wood bittercress	Y			1/1
plants	higher dicots	Burseraceae	*Canarium australianum*			C		3
plants	higher dicots	Burseraceae	*Canarium australianum var. australianum*			C		3/3
plants	higher dicots	Burseraceae	*Canarium australianum var. glabrum*			C		2/2
plants	higher dicots	Burseraceae	*Garuga floribunda var. floribunda*			C		3/3
plants	higher dicots	Byblidaceae	*Byblis liniflora*			C		1/1
plants	higher dicots	Byttneriaceae	*Waltheria indica*			C		2/2
plants	higher dicots	Byttneriaceae	*Melochia corchorifolia*			C		2/2
plants	higher dicots	Cactaceae	*Cereus uruguayanus*		Y			1/1
plants	higher dicots	Cactaceae	*Opuntia stricta*		Y			1/1
plants	higher dicots	Cactaceae	*Hylocereus undatus*	night blooming cactus	Y			2/2

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plants	higher dicots	Caesalpiniaceae	*Cassia fistula*	Indian laburnum	Y			1/1
plants	higher dicots	Caesalpiniaceae	*Senna pendula var. glabrata*	Easter cassia	Y			1/1
plants	higher dicots	Caesalpiniaceae	*Chamaecrista mimosoides*	dwarf cassia		C		1/1
plants	higher dicots	Caesalpiniaceae	*Chamaecrista longipes*			C		1/1
plants	higher dicots	Caesalpiniaceae	*Parkinsonia aculeata*	parkinsonia	Y			8/7
plants	higher dicots	Caesalpiniaceae	*Lysiphyllum hookeri*	Queensland ebony		C		3/3
plants	higher dicots	Caesalpiniaceae	*Lysiphyllum binatum*			C		1/1
plants	higher dicots	Caesalpiniaceae	*Chamaecrista absus var. absus*			C		1/1
plants	higher dicots	Caesalpiniaceae	*Cassia sp. (Paluma Range G.Sankowsky+ 450)*			C		4/4
plants	higher dicots	Caesalpiniaceae	*Chamaecrista rotundifolia var. rotundifolia*		Y			3/1
plants	higher dicots	Caesalpiniaceae	*Senna occidentalis*	coffee senna	Y			1/1
plants	higher dicots	Caesalpiniaceae	*Senna gaudichaudii*			C		2/2
plants	higher dicots	Caesalpiniaceae	*Caesalpinia bonduc*	nicker bean		C		2/1
plants	higher dicots	Caesalpiniaceae	*Tamarindus indica*		Y			2/2
plants	higher dicots	Caesalpiniaceae	*Senna alata*		Y			2/2
plants	higher dicots	Caesalpiniaceae	*Labichea nitida*			C		1/1
plants	higher dicots	Caesalpiniaceae	*Delonix regia*	poinciana	Y			1/1
plants	higher dicots	Caesalpiniaceae	*Senna obtusifolia*		Y			2/2
plants	higher dicots	Caesalpiniaceae	*Senna aciphylla*	Australian senna		C		1/1
plants	higher dicots	Campanulaceae	*Wahlenbergia caryophylloides*			C		1/1
plants	higher dicots	Campanulaceae	*Wahlenbergia graniticola*	granite bluebell		C		2/2
plants	higher dicots	Campanulaceae	*Lobelia quadrangularis*			C		1/1
plants	higher dicots	Campanulaceae	*Lobelia leucotos*			C		1/1
plants	higher dicots	Campanulaceae	*Wahlenbergia communis*	tufted bluebell		C		1/1
plants	higher dicots	Capparaceae	*Capparis arborea*	brush caper berry		C		1/1
plants	higher dicots	Capparaceae	*Capparis lucida*			C		4/3
plants	higher dicots	Capparaceae	*Capparis sepiaria*			C		3/3
plants	higher dicots	Caryophyllaceae	*Polycarpaea spirostylis subsp. spirostylis*			C		1/1
plants	higher dicots	Caryophyllaceae	*Polycarpaea corymbosa*			C		2/2
plants	higher dicots	Caryophyllaceae	*Drymaria cordata subsp. cordata*		Y			2/2
plants	higher dicots	Caryophyllaceae	*Polycarpaea corymbosa var. corymbosa*			C		1/1
plants	higher dicots	Casuarinaceae	*Casuarina equisetifolia subsp. incana*			C		1/1
plants	higher dicots	Casuarinaceae	*Allocasuarina torulosa*			C		1/1
plants	higher dicots	Celastraceae	*Denhamia disperma*			C		3/3
plants	higher dicots	Celastraceae	*Elaeodendron melanocarpum*			C		2/2
plants	higher dicots	Celastraceae	*Denhamia cunninghamii*			C		2/2
plants	higher dicots	Chenopodiaceae	*Tecticornia*			C		1
plants	higher dicots	Chenopodiaceae	*Tecticornia pergranulata subsp. queenslandica*			C		2/2
plants	higher dicots	Chenopodiaceae	*Atriplex muelleri*	lagoon saltbush		C		1/1
plants	higher dicots	Chenopodiaceae	*Salsola australis*			C		3/3
plants	higher dicots	Chenopodiaceae	*Tecticornia indica*			C		4/1
plants	higher dicots	Chenopodiaceae	*Dissocarpus biflorus*			C		1/1
plants	higher dicots	Chenopodiaceae	*Dysphania littoralis*	red crumbweed		C		1/1
plants	higher dicots	Chenopodiaceae	*Suaeda arbusculoides*			C		3/2
plants	higher dicots	Chenopodiaceae	*Sclerolaena ventricosa*			C		1
plants	higher dicots	Chenopodiaceae	*Tecticornia pergranulata*			C		1/1

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	higher dicots	Chenopodiaceae	*Tecticornia halocnemoides*			C		3
plants	higher dicots	Chenopodiaceae	*Enchylaena tomentosa var. glabra*			C		1/1
plants	higher dicots	Chenopodiaceae	*Tecticornia indica subsp. indica*			C		1/1
plants	higher dicots	Chenopodiaceae	*Tecticornia indica subsp. leiostachya*			C		1/1
plants	higher dicots	Chenopodiaceae	*Dissocarpus biflorus var. cephalocarpus*			C		1/1
plants	higher dicots	Chenopodiaceae	*Dysphania glomulifera subsp. glomulifera*			C		1/1
plants	higher dicots	Chenopodiaceae	*Suaeda australis*			C		4/1
plants	higher dicots	Cleomaceae	*Cleome viscosa*	tick-weed		C		1/1
plants	higher dicots	Cleomaceae	*Cleome tetrandra var. tetrandra*			C		1/1
plants	higher dicots	Cleomaceae	*Cleome gynandra*		Y			2/2
plants	higher dicots	Cleomaceae	*Cleome aculeata*		Y			1/1
plants	higher dicots	Cochlospermaceae	*Cochlospermum gillivraei*			C		5/3
plants	higher dicots	Combretaceae	*Terminalia muelleri*			C		5/5
plants	higher dicots	Combretaceae	*Terminalia melanocarpa*			C		1/1
plants	higher dicots	Combretaceae	*Terminalia sericocarpa*	damson		C		2/1
plants	higher dicots	Combretaceae	*Lumnitzera racemosa*			C		3
plants	higher dicots	Combretaceae	*Terminalia arenicola*	beach almond		C		3/3
plants	higher dicots	Convolvulaceae	*Ipomoea hederifolia*		Y			2/1
plants	higher dicots	Convolvulaceae	*Bonamia dietrichiana*			C		5/5
plants	higher dicots	Convolvulaceae	*Evolvulus alsinoides*			C		1/1
plants	higher dicots	Convolvulaceae	*Evolvulus nummularius*		Y			3/3
plants	higher dicots	Convolvulaceae	*Merremia quinquefolia*		Y			4/4
plants	higher dicots	Convolvulaceae	*Xenostegia tridentata*			C		1/1
plants	higher dicots	Convolvulaceae	*Jacquemontia paniculata*			C		7/7
plants	higher dicots	Convolvulaceae	*Ipomoea carnea subsp. fistulosa*		Y			1/1
plants	higher dicots	Convolvulaceae	*Ipomoea pes-caprae subsp. brasiliensis*	goatsfoot		C		4/4
plants	higher dicots	Convolvulaceae	*Ipomoea*			C		1
plants	higher dicots	Convolvulaceae	*Ipomoea nil*		Y			3/3
plants	higher dicots	Convolvulaceae	*Bonamia media*			C		1/1
plants	higher dicots	Convolvulaceae	*Ipomoea abrupta*			C		2/2
plants	higher dicots	Convolvulaceae	*Ipomoea cairica*		Y			1/1
plants	higher dicots	Convolvulaceae	*Ipomoea coptica*			C		1/1
plants	higher dicots	Convolvulaceae	*Ipomoea plebeia*	bellvine		C		1/1
plants	higher dicots	Convolvulaceae	*Ipomoea triloba*		Y			3/3
plants	higher dicots	Convolvulaceae	*Argyreia nervosa*		Y			4/4
plants	higher dicots	Convolvulaceae	*Cressa australis*			C		3/3
plants	higher dicots	Convolvulaceae	*Ipomoea aquatica*			C		1/1
plants	higher dicots	Convolvulaceae	*Ipomoea violacea*			C		1/1
plants	higher dicots	Convolvulaceae	*Cuscuta australis*	Australian dodder		C		1/1
plants	higher dicots	Convolvulaceae	*Cuscuta chinensis*			C		1/1
plants	higher dicots	Convolvulaceae	*Ipomoea eriocarpa*			C		3/3
plants	higher dicots	Convolvulaceae	*Merremia dissecta*		Y			3/3
plants	higher dicots	Convolvulaceae	*Ipomoea mauritiana*			C		1/1
plants	higher dicots	Convolvulaceae	*Ipomoea polymorpha*			C		4/4
plants	higher dicots	Convolvulaceae	*Ipomoea funicularis*			C		2/2
plants	higher dicots	Cornaceae	*Alangium villosum subsp. tomentosum*			C		1/1

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plants	higher dicots	Crassulaceae	*Bryophyllum x houghtonii*		Y			1/1
plants	higher dicots	Crassulaceae	*Bryophyllum delagoense*		Y			2
plants	higher dicots	Cucurbitaceae	*Momordica balsamina*	balsam apple	Y			2/2
plants	higher dicots	Cucurbitaceae	*Diplocyclos palmatus subsp. palmatus*			C		1/1
plants	higher dicots	Cucurbitaceae	*Cucumis althaeoides*			C		2/2
plants	higher dicots	Cucurbitaceae	*Citrullus lanatus*		Y			1/1
plants	higher dicots	Cucurbitaceae	*Coccinia grandis*		Y			3/3
plants	higher dicots	Cucurbitaceae	*Momordica charantia*	balsam pear	Y			1/1
plants	higher dicots	Dilleniaceae	*Hibbertia longifolia*			C		1/1
plants	higher dicots	Droseraceae	*Drosera serpens*			C		1/1
plants	higher dicots	Ebenaceae	*Diospyros geminata*	scaly ebony		C		5/3
plants	higher dicots	Elaeocarpaceae	*Elaeocarpus eumundi*	Eumundi quandong		C		2/2
plants	higher dicots	Elaeocarpaceae	*Dubouzetia saxatilis*			V		5/5
plants	higher dicots	Ericaceae	*Leucopogon cuspidatus*			C		4/4
plants	higher dicots	Euphorbiaceae	*Beyeria viscosa*			C		1/1
plants	higher dicots	Euphorbiaceae	*Ricinus communis*	castor oil bush	Y			1/1
plants	higher dicots	Euphorbiaceae	*Croton arnhemicus*			C		1/1
plants	higher dicots	Euphorbiaceae	*Croton magneticus*			V		11/9
plants	higher dicots	Euphorbiaceae	*Euphorbia serpens*		Y			2/2
plants	higher dicots	Euphorbiaceae	*Mallotus discolor*	white kamala		C		3/2
plants	higher dicots	Euphorbiaceae	*Baloghia inophylla*	scrub bloodwood		C		1/1
plants	higher dicots	Euphorbiaceae	*Macaranga tanarius*	macaranga		C		1/1
plants	higher dicots	Euphorbiaceae	*Euphorbia hassallii*			C		1/1
plants	higher dicots	Euphorbiaceae	*Euphorbia prostrata*		Y			4/4
plants	higher dicots	Euphorbiaceae	*Mallotus ficifolius*			C		1/1
plants	higher dicots	Euphorbiaceae	*Mallotus nesophilus*			C		7/6
plants	higher dicots	Euphorbiaceae	*Mallotus polyadenos*			C		1/1
plants	higher dicots	Euphorbiaceae	*Euphorbia thymifolia*		Y			3/3
plants	higher dicots	Euphorbiaceae	*Excoecaria agallocha*	milky mangrove		C		3/2
plants	higher dicots	Euphorbiaceae	*Euphorbia cyathophora*	dwarf poinsettia	Y			3/3
plants	higher dicots	Euphorbiaceae	*Euphorbia dallachyana*			C		2/2
plants	higher dicots	Euphorbiaceae	*Mallotus philippensis*	red kamala		C		3/1
plants	higher dicots	Euphorbiaceae	*Euphorbia heterophylla*		Y			3/3
plants	higher dicots	Euphorbiaceae	*Euphorbia hyssopifolia*		Y			6/6
plants	higher dicots	Euphorbiaceae	*Excoecaria dallachyana*	scrub poison tree		C		1/1
plants	higher dicots	Euphorbiaceae	*Jatropha gossypiifolia*	bellyache bush	Y			4/3
plants	higher dicots	Euphorbiaceae	*Microstachys chamaelea*			C		7/7
plants	higher dicots	Euphorbiaceae	*Tragia novae-hollandiae*	stinging-vine		C		2/2
plants	higher dicots	Euphorbiaceae	*Euphorbia schultzii var. schultzii*			C		1/1
plants	higher dicots	Euphorbiaceae	*Euphorbia tannensis subsp. tannensis*			C		5/5
plants	higher dicots	Euphorbiaceae	*Euphorbia tannensis subsp. eremophila*			C		1/1
plants	higher dicots	Euphorbiaceae	*Macaranga involucrata var. mallotoides*			C		1/1
plants	higher dicots	Euphorbiaceae	*Euphorbia mitchelliana var. mitchelliana*			C		2/2
plants	higher dicots	Euphorbiaceae	*Pedilanthus tithymaloides subsp. smallii*	zig zag plant	Y			1/1
plants	higher dicots	Euphorbiaceae	*Claoxylon tenerifolium subsp. tenerifolium*			C		2/2
plants	higher dicots	Euphorbiaceae	*Euphorbia hirta*		Y			2/2

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	higher dicots	Euphorbiaceae	*Euphorbia bifida*			C		10/10
plants	higher dicots	Fabaceae	*Abrus precatorius*	crabs-eye vine		C		1
plants	higher dicots	Fabaceae	*Canavalia papuana*	wild jack bean		C		1/1
plants	higher dicots	Fabaceae	*Clitoria ternatea*	butterfly pea	Y			8/7
plants	higher dicots	Fabaceae	*Crotalaria brevis*			C		6/6
plants	higher dicots	Fabaceae	*Crotalaria juncea*	sunhemp	Y			1/1
plants	higher dicots	Fabaceae	*Cullen leucanthum*			C		2/2
plants	higher dicots	Fabaceae	*Flemingia lineata*			C		2/2
plants	higher dicots	Fabaceae	*Galactia muelleri*			C		1/1
plants	higher dicots	Fabaceae	*Glycine cyrtoloba*			C		2/2
plants	higher dicots	Fabaceae	*Millettia pinnata*			C		2/1
plants	higher dicots	Fabaceae	*Tephrosia filipes*			C		1
plants	higher dicots	Fabaceae	*Zornia stirlingii*			C		3/3
plants	higher dicots	Fabaceae	*Cajanus marmoratus*			C		2/2
plants	higher dicots	Fabaceae	*Crotalaria pallida*		Y			2
plants	higher dicots	Fabaceae	*Desmodium muelleri*			C		1/1
plants	higher dicots	Fabaceae	*Desmodium pullenii*			C		3/3
plants	higher dicots	Fabaceae	*Glycine tomentella*	woolly glycine		C		7/7
plants	higher dicots	Fabaceae	*Indigofera colutea*	sticky indigo		C		1/1
plants	higher dicots	Fabaceae	*Indigofera hirsuta*	hairy indigo		C		3/3
plants	higher dicots	Fabaceae	*Indigofera spicata*	creeping indigo	Y			1/1
plants	higher dicots	Fabaceae	*Indigofera tryonii*			C		4/4
plants	higher dicots	Fabaceae	*Sesbania cannabina*			C		2
plants	higher dicots	Fabaceae	*Aeschynomene indica*	budda pea		C		5/5
plants	higher dicots	Fabaceae	*Centrosema plumieri*		Y			1/1
plants	higher dicots	Fabaceae	*Crotalaria calycina*			C		6/6
plants	higher dicots	Fabaceae	*Desmodium filiforme*			C		3/3
plants	higher dicots	Fabaceae	*Desmodium tortuosum*	Florida beggar-weed	Y			5/5
plants	higher dicots	Fabaceae	*Galactia tenuiflora*			C		3/3
plants	higher dicots	Fabaceae	*Stylosanthes hamata*		Y			1/1
plants	higher dicots	Fabaceae	*Stylosanthes scabra*		Y			1/1
plants	higher dicots	Fabaceae	*Tephrosia barbatala*			C		7/7
plants	higher dicots	Fabaceae	*Aeschynomene villosa*		Y			1/1
plants	higher dicots	Fabaceae	*Crotalaria goreensis*	gambia pea	Y			3/1
plants	higher dicots	Fabaceae	*Crotalaria verrucosa*			C		1/1
plants	higher dicots	Fabaceae	*Desmodium gangeticum*			C		1/1
plants	higher dicots	Fabaceae	*Desmodium scorpiurus*		Y			5/5
plants	higher dicots	Fabaceae	*Flemingia parviflora*	flemingia		C		1/1
plants	higher dicots	Fabaceae	*Flemingia trifoliata*			C		1/1
plants	higher dicots	Fabaceae	*Indigofera linifolia*			C		6/6
plants	higher dicots	Fabaceae	*Indigofera pratensis*			C		5/5
plants	higher dicots	Fabaceae	*Indigofera tinctoria*		Y			7/7
plants	higher dicots	Fabaceae	*Isotropis filicaulis*			C		1/1
plants	higher dicots	Fabaceae	*Pycnospora lutescens*	pycnospora		C		2/2
plants	higher dicots	Fabaceae	*Sesbania grandiflora*		Y			1/1
plants	higher dicots	Fabaceae	*Stylosanthes humilis*	Townsville stylo	Y			1

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plants	higher dicots	Fabaceae	*Stylosanthes viscosa*		Y			1/1
plants	higher dicots	Fabaceae	*Uraria lagopodioides*			C		2/2
plants	higher dicots	Fabaceae	*Alysicarpus vaginalis*		Y			5/5
plants	higher dicots	Fabaceae	*Crotalaria mitchellii*			C		1/1
plants	higher dicots	Fabaceae	*Desmodium brachypodum*	large ticktrefoil		C		1/1
plants	higher dicots	Fabaceae	*Dunbaria rotundifolia*			C		3/3
plants	higher dicots	Fabaceae	*Erythrina vespertilio*			C		1
plants	higher dicots	Fabaceae	*Macrotyloma uniflorum*		Y			1/1
plants	higher dicots	Fabaceae	*Cajanus confertiflorus*			C		5/5
plants	higher dicots	Fabaceae	*Crotalaria medicaginea*	trefoil rattlepod		C		1
plants	higher dicots	Fabaceae	*Tephrosia macrostachya*			C		2/2
plants	higher dicots	Fabaceae	*Aeschynomene brevifolia*			C		2/2
plants	higher dicots	Fabaceae	*Alysicarpus aurantiacus*			C		1/1
plants	higher dicots	Fabaceae	*Crotalaria laburnifolia*		Y			3/2
plants	higher dicots	Fabaceae	*Crotalaria quinquefolia*			C		1/1
plants	higher dicots	Fabaceae	*Indigastrum parviflorum*			C		1/1
plants	higher dicots	Fabaceae	*Indigofera polygaloides*			C		2/2
plants	higher dicots	Fabaceae	*Indigofera suffruticosa*		Y			1
plants	higher dicots	Fabaceae	*Tephrosia astragaloides*			C		3/3
plants	higher dicots	Fabaceae	*Desmodium trichostachyum*			C		2/2
plants	higher dicots	Fabaceae	*Macroptilium lathyroides*		Y			1
plants	higher dicots	Fabaceae	*Aphyllodium biarticulatum*			C		7/7
plants	higher dicots	Fabaceae	*Rhynchosia acuminatissima*			C		2/2
plants	higher dicots	Fabaceae	*Macroptilium atropurpureum*	siratro	Y			2
plants	higher dicots	Fabaceae	*Vigna radiata var. sublobata*			C		1/1
plants	higher dicots	Fabaceae	*Crotalaria retusa var. retusa*		Y			4/4
plants	higher dicots	Fabaceae	*Rhynchosia minima var. minima*			C		2/1
plants	higher dicots	Fabaceae	*Crotalaria montana var. exserta*			C		1/1
plants	higher dicots	Fabaceae	*Crotalaria pallida var. obovata*		Y			5/5
plants	higher dicots	Fabaceae	*Galactia tenuiflora var. lucida*			C		3/3
plants	higher dicots	Fabaceae	*Neonotonia wightii var. wightii*		Y			1/1
plants	higher dicots	Fabaceae	*Galactia tenuiflora var. villosa*			C		2/2
plants	higher dicots	Fabaceae	*Tephrosia filipes subsp. filipes*			C		2/2
plants	higher dicots	Fabaceae	*Vigna lanceolata var. filiformis*			C		1/1
plants	higher dicots	Fabaceae	*Vigna lanceolata var. lanceolata*			C		1/1
plants	higher dicots	Fabaceae	*Sesbania cannabina var. cannabina*			C		1/1
plants	higher dicots	Fabaceae	*Zornia dyctiocarpa var. filifolia*			C		3/3
plants	higher dicots	Fabaceae	*Zornia muriculata subsp. angustata*			C		3/3
plants	higher dicots	Fabaceae	*Zornia muriculata subsp. muriculata*			C		2/2
plants	higher dicots	Fabaceae	*Cajanus reticulatus var. reticulatus*			C		8/8
plants	higher dicots	Fabaceae	*Crotalaria aridicola subsp. glabrata*			C		1/1
plants	higher dicots	Fabaceae	*Crotalaria medicaginea var. neglecta*			C		2/1
plants	higher dicots	Fabaceae	*Crotalaria montana var. angustifolia*			C		3/3
plants	higher dicots	Fabaceae	*Tephrosia brachyodon var. brachyodon*			C		6/6
plants	higher dicots	Fabaceae	*Aeschynomene americana var. americana*		Y			1/1
plants	higher dicots	Fabaceae	*Desmodium heterocarpon var. strigosum*			C		1/1

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plants	higher dicots	Fabaceae	*Zornia muelleriana subsp. muelleriana*			C		5/5
plants	higher dicots	Fabaceae	*Macrotyloma uniflorum var. stenocarpum*		Y			1/1
plants	higher dicots	Fabaceae	*Crotalaria medicaginea var. medicaginea*			C		2/2
plants	higher dicots	Fabaceae	*Crotalaria mitchellii subsp. mitchellii*			C		3/3
plants	higher dicots	Fabaceae	*Cajanus scarabaeoides var. scarabaeoides*			C		2/2
plants	higher dicots	Fabaceae	*Vigna sp. (Station Creek R.J.Lawn CQ3284)*			C		5/5
plants	higher dicots	Fabaceae	*Tephrosia sp. (Miriam Vale E.J.Thompson+ MIR33)*			C		2/2
plants	higher dicots	Fabaceae	*Tephrosia sp. (Copperfield River P.I.Forster PIF14768)*			C		3/3
plants	higher dicots	Fabaceae	*Crotalaria mitchellii subsp. laevis - C.mitchellii subsp. mitchellii*			C		2/2
plants	higher dicots	Fabaceae	*Glycine*			C		2/2
plants	higher dicots	Fabaceae	*Galactia*			C		2/2
plants	higher dicots	Fabaceae	*Tephrosia*			C		3/3
plants	higher dicots	Fabaceae	*Indigofera*			C		1
plants	higher dicots	Fabaceae	*Macroptilium*			C		1/1
plants	higher dicots	Fabaceae	*Cajanus cajan*	pigeon pea	Y			1/1
plants	higher dicots	Fabaceae	*Canavalia rosea*	coastal jack bean		C		5/5
plants	higher dicots	Fabaceae	*Centrosema molle*		Y			2/1
plants	higher dicots	Fabaceae	*Desmodium gunnii*			C		2/2
plants	higher dicots	Fabaceae	*Glycine tabacina*	glycine pea		C		1
plants	higher dicots	Fabaceae	*Indigofera trita*			C		1/1
plants	higher dicots	Fabaceae	*Tephrosia juncea*			C		3/3
plants	higher dicots	Fabaceae	*Zornia latifolia*		Y			1/1
plants	higher dicots	Flacourtiaceae	*Scolopia braunii*	flintwood		C		2/2
plants	higher dicots	Gentianaceae	*Canscora diffusa*			C		3/3
plants	higher dicots	Gentianaceae	*Schenkia australis*			C		1/1
plants	higher dicots	Goodeniaceae	*Velleia pubescens*			C		1/1
plants	higher dicots	Goodeniaceae	*Velleia spathulata*	wild pansies		C		1/1
plants	higher dicots	Goodeniaceae	*Goodenia grandiflora*			C		1/1
plants	higher dicots	Goodeniaceae	*Goodenia purpurascens*			C		1/1
plants	higher dicots	Goodeniaceae	*Scaevola*			C		1/1
plants	higher dicots	Goodeniaceae	*Goodenia pilosa*			C		1/1
plants	higher dicots	Haloragaceae	*Gonocarpus acanthocarpus*			C		1/1
plants	higher dicots	Helicteraceae	*Helicteres semiglabra*			C		2/2
plants	higher dicots	Hydroleaceae	*Hydrolea zeylanica*			C		1/1
plants	higher dicots	Lamiaceae	*Lamiaceae*			C		1/1
plants	higher dicots	Lamiaceae	*Clerodendrum longiflorum var. glabrum*			C		4/4
plants	higher dicots	Lamiaceae	*Vitex trifolia var. trifolia*			C		2/2
plants	higher dicots	Lamiaceae	*Clerodendrum floribundum*			C		8/4
plants	higher dicots	Lamiaceae	*Plectranthus graveolens*	flea bush		C		1/1
plants	higher dicots	Lamiaceae	*Mesosphaerum suaveolens*		Y			12/7
plants	higher dicots	Lamiaceae	*Plectranthus congestus*			C		1/1
plants	higher dicots	Lamiaceae	*Holmskioldia sanguinea*		Y			1/1
plants	higher dicots	Lamiaceae	*Basilicum polystachyon*			C		2/2
plants	higher dicots	Lamiaceae	*Plectranthus diversus*			C		1/1

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	higher dicots	Lamiaceae	*Pityrodia salviifolia*	pityrodia		C		2/2
plants	higher dicots	Lamiaceae	*Glossocarya hemiderma*			C		1/1
plants	higher dicots	Lamiaceae	*Callicarpa candicans*			C		3/3
plants	higher dicots	Lamiaceae	*Premna serratifolia*			C		3/2
plants	higher dicots	Lamiaceae	*Clerodendrum inerme*	coastal lolly bush		C		4/2
plants	higher dicots	Lamiaceae	*Anisomeles moschata*			C		3/3
plants	higher dicots	Lamiaceae	*Vitex rotundifolia*			C		3/3
plants	higher dicots	Lamiaceae	*Vitex acuminata*			C		2/2
plants	higher dicots	Lamiaceae	*Hyptis capitata*		Y			2/2
plants	higher dicots	Lamiaceae	*Teucrium sp. (Ormeau G.Leiper AQ476858)*			C		1/1
plants	higher dicots	Lamiaceae	*Vitex trifolia*			C		1
plants	higher dicots	Lecythidaceae	*Planchonia careya*	cockatoo apple		C		7/2
plants	higher dicots	Lentibulariaceae	*Utricularia aurea*	golden bladderwort		C		1/1
plants	higher dicots	Loganiaceae	*Mitrasacme prolifera*			C		2/2
plants	higher dicots	Loganiaceae	*Mitrasacme nudicaulis var. nudicaulis*			C		2/2
plants	higher dicots	Loganiaceae	*Mitrasacme multicaulis*			C		1/1
plants	higher dicots	Loganiaceae	*Strychnos psilosperma*	strychnine tree		C		1/1
plants	higher dicots	Loranthaceae	*Amyema congener subsp. congener*			C		3/3
plants	higher dicots	Loranthaceae	*Amyema bifurcata*			C		1/1
plants	higher dicots	Loranthaceae	*Diplatia furcata*			C		1/1
plants	higher dicots	Loranthaceae	*Amyema congener subsp. rotundifolia*			C		3/3
plants	higher dicots	Loranthaceae	*Amyema sanguinea var. sanguinea*			C		1/1
plants	higher dicots	Loranthaceae	*Dendrophthoe homoplastica*			C		1/1
plants	higher dicots	Loranthaceae	*Dendrophthoe vitellina*	long-flowered mistletoe		C		4/4
plants	higher dicots	Loranthaceae	*Lysiana subfalcata*			C		2/2
plants	higher dicots	Loranthaceae	*Amyema mackayensis*			C		1/1
plants	higher dicots	Loranthaceae	*Lysiana maritima*			C		1
plants	higher dicots	Lythraceae	*Ammannia multiflora*	jerry-jerry		C		2/2
plants	higher dicots	Lythraceae	*Ammannia baccifera*			C		1/1
plants	higher dicots	Lythraceae	*Rotala mexicana*			C		3/3
plants	higher dicots	Maesaceae	*Maesa dependens var. pubescens*			C		1/1
plants	higher dicots	Malpighiaceae	*Stigmaphyllon australiense*			C		3/3
plants	higher dicots	Malvaceae	*Sida*			C		1
plants	higher dicots	Malvaceae	*Sida acuta*	spinyhead sida	Y			3/2
plants	higher dicots	Malvaceae	*Sida spinosa*	spiny sida	Y			2/2
plants	higher dicots	Malvaceae	*Urena lobata*	urena weed	Y			1/1
plants	higher dicots	Malvaceae	*Sida magnifica*			C		2/2
plants	higher dicots	Malvaceae	*Sida cordifolia*		Y			6/3
plants	higher dicots	Malvaceae	*Abutilon auritum*	Chinese lantern		C		1/1
plants	higher dicots	Malvaceae	*Sida hackettiana*			C		2/2
plants	higher dicots	Malvaceae	*Sida rhombifolia*		Y			1/1
plants	higher dicots	Malvaceae	*Hibiscus normanii*			C		1/1
plants	higher dicots	Malvaceae	*Abutilon oxycarpum var. oxycarpum*			C		1/1
plants	higher dicots	Malvaceae	*Malvastrum americanum var. americanum*		Y			1/1
plants	higher dicots	Malvaceae	*Abelmoschus moschatus subsp. tuberosus*			C		2/2
plants	higher dicots	Malvaceae	*Abutilon albescens*			C		5/5

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plants	higher dicots	Malvaceae	*Abutilon guineense*		Y			3/3
plants	higher dicots	Malvaceae	*Thespesia populnea*			C		2/2
plants	higher dicots	Malvaceae	*Hibiscus divaricatus*			C		3/3
plants	higher dicots	Malvaceae	*Hibiscus meraukensis*	Merauke hibiscus		C		2/2
plants	higher dicots	Martyniaceae	*Martynia annua*	small-fruited devil's claw	Y			2/1
plants	higher dicots	Meliaceae	*Toona ciliata*	red cedar		C		1/1
plants	higher dicots	Meliaceae	*Turraea pubescens*	native honeysuckle		C		2/1
plants	higher dicots	Meliaceae	*Azadirachta indica*		Y			1/1
plants	higher dicots	Meliaceae	*Aglaia elaeagnoidea*			C		2/1
plants	higher dicots	Meliaceae	*Xylocarpus granatum*	cedar mangrove		C		1/1
plants	higher dicots	Meliaceae	*Xylocarpus moluccensis*			C		5/4
plants	higher dicots	Memecylaceae	*Memecylon pauciflorum*			C		3/3
plants	higher dicots	Menyanthaceae	*Nymphoides indica*	water snowflake		C		2/2
plants	higher dicots	Menyanthaceae	*Nymphoides crenata*	wavy marshwort		C		1/1
plants	higher dicots	Menyanthaceae	*Nymphoides exiliflora*			C		1/1
plants	higher dicots	Menyanthaceae	*Nymphoides parvifolia*			C		1/1
plants	higher dicots	Mimosaceae	*Acacia nesophila x A.spirorbis*			C		2/2
plants	higher dicots	Mimosaceae	*Acacia mangium x A.polystachya*			C		1/1
plants	higher dicots	Mimosaceae	*Acacia nesophila x A.polystachya*			C		1/1
plants	higher dicots	Mimosaceae	*Acacia spirorbis subsp. solandri*			C		4/4
plants	higher dicots	Mimosaceae	*Acacia victoriae subsp. fasciaria*			C		1/1
plants	higher dicots	Mimosaceae	*Prosopis juliflora var. juliflora*		Y			1/1
plants	higher dicots	Mimosaceae	*Neptunia gracilis forma glandulosa*			C		2/2
plants	higher dicots	Mimosaceae	*Prosopis glandulosa var. glandulosa*		Y			1/1
plants	higher dicots	Mimosaceae	*Leucaena leucocephala subsp. glabrata*		Y			1/1
plants	higher dicots	Mimosaceae	*Dichrostachys cinerea subsp. malesiana*		Y			1/1
plants	higher dicots	Mimosaceae	*Leucaena leucocephala subsp. leucocephala*		Y			2/2
plants	higher dicots	Mimosaceae	*Acacia simsii*			C		7/7
plants	higher dicots	Mimosaceae	*Acacia mangium*			C		1/1
plants	higher dicots	Mimosaceae	*Neptunia major*			C		3/3
plants	higher dicots	Mimosaceae	*Acacia hemsleyi*			C		1/1
plants	higher dicots	Mimosaceae	*Albizia lebbeck*	Indian siris		C		2/2
plants	higher dicots	Mimosaceae	*Albizia procera*			C		1
plants	higher dicots	Mimosaceae	*Acacia nesophila*			C		1/1
plants	higher dicots	Mimosaceae	*Acacia umbellata*			C		1/1
plants	higher dicots	Mimosaceae	*Prosopis pallida*		Y			1/1
plants	higher dicots	Mimosaceae	*Acacia flavescens*	toothed wattle		C		4/2
plants	higher dicots	Mimosaceae	*Acacia jackesiana*			C		2/2
plants	higher dicots	Mimosaceae	*Acacia leptocarpa*	north coast wattle		C		1
plants	higher dicots	Mimosaceae	*Acacia platycarpa*			C		1/1
plants	higher dicots	Mimosaceae	*Acacia aulacocarpa*			C		4/4
plants	higher dicots	Mimosaceae	*Acacia crassicarpa*			C		8/2
plants	higher dicots	Mimosaceae	*Acacia holosericea*			C		1
plants	higher dicots	Mimosaceae	*Acacia polystachya*			C		1/1
plants	higher dicots	Mimosaceae	*Vachellia nilotica*	prickly acacia	Y			1/1
plants	higher dicots	Mimosaceae	*Acacia leptostachya*	Townsville wattle		C		8/7

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plants	higher dicots	Mimosaceae	*Acacia multisiliqua*			C		1/1
plants	higher dicots	Mimosaceae	*Neptunia monosperma*			C		1/1
plants	higher dicots	Mimosaceae	*Vachellia bidwillii*			C		5/4
plants	higher dicots	Mimosaceae	*Vachellia farnesiana*		Y			3/3
plants	higher dicots	Mimosaceae	*Acacia auriculiformis*	black wattle		C		1/1
plants	higher dicots	Mimosaceae	*Leucaena leucocephala*		Y			1
plants	higher dicots	Mimosaceae	*Neptunia dimorphantha*			C		1/1
plants	higher dicots	Mimosaceae	*Acaciella angustissima*	white ball acacia	Y			2/2
plants	higher dicots	Mimosaceae	*Desmanthus pernambucanus*		Y			5/4
plants	higher dicots	Mimosaceae	*Acacia julifera subsp. julifera*			C		1/1
plants	higher dicots	Molluginaceae	*Glinus lotoides*	hairy carpet weed		C		1/1
plants	higher dicots	Molluginaceae	*Glinus oppositifolius*			C		7/7
plants	higher dicots	Molluginaceae	*Mollugo verticillata*		Y			5/5
plants	higher dicots	Moraceae	*Ficus microcarpa*			C		3/1
plants	higher dicots	Moraceae	*Ficus virens var. virens*			C		1/1
plants	higher dicots	Moraceae	*Ficus benjamina var. benjamina*	weeping fig		C		1/1
plants	higher dicots	Moraceae	*Trophis scandens subsp. scandens*			C		3/3
plants	higher dicots	Moraceae	*Ficus rubiginosa forma rubiginosa*			C		6/6
plants	higher dicots	Moraceae	*Ficus virens*			C		1
plants	higher dicots	Moraceae	*Ficus obliqua*			C		2/2
plants	higher dicots	Moraceae	*Ficus opposita*			C		10/7
plants	higher dicots	Moringaceae	*Moringa oleifera*		Y			2/2
plants	higher dicots	Muntingiaceae	*Muntingia calabura*		Y			1/1
plants	higher dicots	Myrsinaceae	*Aegiceras corniculatum*	river mangrove		C		2/2
plants	higher dicots	Myrsinaceae	*Myrsine variabilis*			C		3/2
plants	higher dicots	Myrsinaceae	*Myrsine urceolata*			C		1/1
plants	higher dicots	Myrsinaceae	*Lysimachia ovalis*			C		1/1
plants	higher dicots	Myrsinaceae	*Myrsine porosa*			C		2/2
plants	higher dicots	Myrsinaceae	*Tapeinosperma pseudojambosa*	tapeinosperma		C		3/3
plants	higher dicots	Myrtaceae	*Sannantha papillosa*			E		2/2
plants	higher dicots	Myrtaceae	*Corymbia dallachiana*			C		5
plants	higher dicots	Myrtaceae	*Corymbia tessellaris*	Moreton Bay ash		C		9
plants	higher dicots	Myrtaceae	*Eucalyptus granitica*	granite ironbark		C		3/3
plants	higher dicots	Myrtaceae	*Eucalyptus moluccana*	gum-topped box		C		1/1
plants	higher dicots	Myrtaceae	*Backhousia tetraptera*			C		1/1
plants	higher dicots	Myrtaceae	*Corymbia clarksoniana*			C		5/1
plants	higher dicots	Myrtaceae	*Eucalyptus portuensis*			C		5/5
plants	higher dicots	Myrtaceae	*Eugenia reinwardtiana*	beach cherry		C		5/3
plants	higher dicots	Myrtaceae	*Lophostemon confertus*	brush box		C		2/2
plants	higher dicots	Myrtaceae	*Melaleuca fluviatilis*			C		1/1
plants	higher dicots	Myrtaceae	*Melaleuca leucadendra*	broad-leaved tea-tree		C		2
plants	higher dicots	Myrtaceae	*Melaleuca viridiflora*			C		7
plants	higher dicots	Myrtaceae	*Eucalyptus paedoglauca*	Mt. Stuart ironbark		V	V	10/10
plants	higher dicots	Myrtaceae	*Eucalyptus platyphylla*	poplar gum		C		7/3
plants	higher dicots	Myrtaceae	*Eucalyptus xanthoclada*	yellow-branched ironbark		C		1/1
plants	higher dicots	Myrtaceae	*Leptospermum anfractum*			C		1/1

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	higher dicots	Myrtaceae	*Leptospermum neglectum*			C		2/2
plants	higher dicots	Myrtaceae	*Lophostemon suaveolens*	swamp box		C		2/2
plants	higher dicots	Myrtaceae	*Eucalyptus tereticornis*			C		4
plants	higher dicots	Myrtaceae	*Leptospermum amboinense*			C		1/1
plants	higher dicots	Myrtaceae	*Melaleuca quinquenervia*	swamp paperbark		C		1
plants	higher dicots	Myrtaceae	*Eucalyptus drepanophylla*			C		5/3
plants	higher dicots	Myrtaceae	*Lophostemon grandiflorus*			C		1
plants	higher dicots	Myrtaceae	*Archirhodomyrtus beckleri*	rose myrtle		C		2/2
plants	higher dicots	Myrtaceae	*Corymbia citriodora x C.peltata*			C		1/1
plants	higher dicots	Myrtaceae	*Corymbia dallachiana x C.dimorpha*			C		1/1
plants	higher dicots	Myrtaceae	*Corymbia dimorpha x C.tessellaris*			C		1/1
plants	higher dicots	Myrtaceae	*Eucalyptus exserta x E.platyphylla*			C		1/1
plants	higher dicots	Myrtaceae	*Eucalyptus drepanophylla x E.shirleyi*			C		1/1
plants	higher dicots	Myrtaceae	*Lophostemon confertus x L.grandiflorus*			C		1/1
plants	higher dicots	Myrtaceae	*Lophostemon grandiflorus subsp. riparius*			C		2/2
plants	higher dicots	Myrtaceae	*Eucalyptus tereticornis subsp. tereticornis*			C		1/1
plants	higher dicots	Myrtaceae	*Melaleuca viminalis*			C		1/1
plants	higher dicots	Myrtaceae	*Corymbia intermedia*	pink bloodwood		C		3/3
plants	higher dicots	Myrtaceae	*Osbornia octodonta*	myrtle mangrove		C		2/1
plants	higher dicots	Myrtaceae	*Melaleuca dealbata*	swamp tea-tree		C		3
plants	higher dicots	Myrtaceae	*Eucalyptus exserta*	Queensland peppermint		C		5/5
plants	higher dicots	Myrtaceae	*Syzygium australe*	scrub cherry		C		1/1
plants	higher dicots	Myrtaceae	*Eucalyptus crebra*	narrow-leaved red ironbark		C		1/1
plants	higher dicots	Myrtaceae	*Corymbia peltata*	yellowjacket		C		1/1
plants	higher dicots	Myrtaceae	*Gossia bidwillii*			C		6/4
plants	higher dicots	Nyctaginaceae	*Pisonia aculeata*	thorny pisonia		C		1/1
plants	higher dicots	Nyctaginaceae	*Boerhavia diffusa*		Y			4/4
plants	higher dicots	Nyctaginaceae	*Boerhavia dominii*			C		3/3
plants	higher dicots	Nyctaginaceae	*Boerhavia*			C		1/1
plants	higher dicots	Nyctaginaceae	*Boerhavia pubescens*			C		7/7
plants	higher dicots	Nyctaginaceae	*Boerhavia burbidgeana*			C		3/3
plants	higher dicots	Nyctaginaceae	*Boerhavia sp. (Bargara L.Pedley 5382)*			C		3/3
plants	higher dicots	Nyctaginaceae	*Boerhavia mutabilis*			C		6/6
plants	higher dicots	Oleaceae	*Olea paniculata*			C		1/1
plants	higher dicots	Oleaceae	*Jasminum simplicifolium subsp. australiense*			C		1/1
plants	higher dicots	Oleaceae	*Chionanthus ramiflorus*	northern olive		C		6/4
plants	higher dicots	Oleaceae	*Jasminum didymum subsp. racemosum*			C		5/4
plants	higher dicots	Oleaceae	*Jasminum didymum*			C		2
plants	higher dicots	Oleaceae	*Jasminum simplicifolium*			C		1
plants	higher dicots	Oleaceae	*Notelaea microcarpa var. microcarpa*			C		1/1
plants	higher dicots	Onagraceae	*Ludwigia octovalvis*	willow primrose		C		3/3
plants	higher dicots	Onagraceae	*Ludwigia perennis*			C		2/2
plants	higher dicots	Onagraceae	*Ludwigia hyssopifolia*		Y			5/5
plants	higher dicots	Orobanchaceae	*Rhamphicarpa australiensis*			C		5/5
plants	higher dicots	Orobanchaceae	*Buchnera linearis*			C		3/3
plants	higher dicots	Oxalidaceae	*Oxalis perennans*			C		1/1

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plants	higher dicots	Oxalidaceae	*Oxalis thompsoniae*			C		1/1
plants	higher dicots	Passifloraceae	*Passiflora*			C		1
plants	higher dicots	Passifloraceae	*Passiflora foetida*		Y			7/5
plants	higher dicots	Passifloraceae	*Passiflora aurantia*			C		1
plants	higher dicots	Passifloraceae	*Passiflora suberosa*	corky passion flower	Y			1/1
plants	higher dicots	Passifloraceae	*Passiflora aurantia var. aurantia*			C		3/3
plants	higher dicots	Pedaliaceae	*Josephinia eugeniae*	josephinia burr		C		4/4
plants	higher dicots	Pentapetaceae	*Melhania oblongifolia*			C		3/3
plants	higher dicots	Phyllanthaceae	*Breynia cernua*			C		1/1
plants	higher dicots	Phyllanthaceae	*Phyllanthus*			C		1/1
plants	higher dicots	Phyllanthaceae	*Phyllanthus simplex*			C		4/4
plants	higher dicots	Phyllanthaceae	*Phyllanthus sulcatus*			C		1/1
plants	higher dicots	Phyllanthaceae	*Phyllanthus tenellus*		Y			1/1
plants	higher dicots	Phyllanthaceae	*Phyllanthus urinaria*			C		1/1
plants	higher dicots	Phyllanthaceae	*Phyllanthus virgatus*			C		2/2
plants	higher dicots	Phyllanthaceae	*Antidesma parvifolium*			C		2/2
plants	higher dicots	Phyllanthaceae	*Glochidion disparipes*			C		1/1
plants	higher dicots	Phyllanthaceae	*Glochidion lobocarpum*			C		2/2
plants	higher dicots	Phyllanthaceae	*Actephila sessilifolia*			C		1/1
plants	higher dicots	Phyllanthaceae	*Antidesma ghaesembilla*			C		1/1
plants	higher dicots	Phyllanthaceae	*Phyllanthus carpentariae*			C		1/1
plants	higher dicots	Phyllanthaceae	*Cleistanthus dallachyanus*			C		2/2
plants	higher dicots	Phyllanthaceae	*Phyllanthus lamprophyllus*			C		1/1
plants	higher dicots	Phyllanthaceae	*Phyllanthus novae-hollandiae*			C		2/2
plants	higher dicots	Phyllanthaceae	*Flueggea virosa subsp. melanthesoides*			C		3/3
plants	higher dicots	Phyllanthaceae	*Phyllanthus amarus*		Y			1/1
plants	higher dicots	Picrodendraceae	*Petalostigma pubescens*	quinine tree		C		3/2
plants	higher dicots	Pittosporaceae	*Pittosporum ferrugineum subsp. linifolium*			C		2/2
plants	higher dicots	Pittosporaceae	*Bursaria incana*			C		2/2
plants	higher dicots	Pittosporaceae	*Bursaria tenuifolia*			C		1/1
plants	higher dicots	Plantaginaceae	*Limnophila aromatica*			C		1/1
plants	higher dicots	Plantaginaceae	*Limnophila brownii*			C		1/1
plants	higher dicots	Plantaginaceae	*Bacopa floribunda*			C		2/2
plants	higher dicots	Plantaginaceae	*Scoparia dulcis*	scoparia	Y			4/4
plants	higher dicots	Plantaginaceae	*Limnophila fragrans*			C		2/2
plants	higher dicots	Plumbaginaceae	*Limonium solanderi*			C		1/1
plants	higher dicots	Plumbaginaceae	*Aegialitis annulata*	club mangrove		C		5/4
plants	higher dicots	Polygalaceae	*Polygala triflora*			C		1/1
plants	higher dicots	Polygalaceae	*Salomonia ciliata*			C		2/2
plants	higher dicots	Polygalaceae	*Polygala parviloba*			C		1/1
plants	higher dicots	Polygalaceae	*Polygala wightiana*			C		2/2
plants	higher dicots	Polygalaceae	*Polygala longifolia*			C		1/1
plants	higher dicots	Polygalaceae	*Polygala paniculata*		Y			1/1
plants	higher dicots	Polygonaceae	*Polygonum aviculare*	wireweed	Y			1/1
plants	higher dicots	Polygonaceae	*Persicaria attenuata*			C		2/2
plants	higher dicots	Polygonaceae	*Persicaria orientalis*	princes feathers		C		1/1

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	higher dicots	Polygonaceae	*Polygonum plebeium*	small knotweed		C		1/1
plants	higher dicots	Polygonaceae	*Antigonon leptopus*		Y			2/2
plants	higher dicots	Portulacaceae	*Portulaca*			C		3/3
plants	higher dicots	Portulacaceae	*Calandrinia gracilis*			C		2/2
plants	higher dicots	Portulacaceae	*Portulaca filifolia*			C		1/1
plants	higher dicots	Portulacaceae	*Portulaca australis*			C		2/1
plants	higher dicots	Portulacaceae	*Portulaca oleracea*	pigweed	Y			1/1
plants	higher dicots	Portulacaceae	*Portulaca bicolor*			C		1/1
plants	higher dicots	Portulacaceae	*Portulaca pilosa*		Y			3/3
plants	higher dicots	Proteaceae	*Grevillea pteridifolia*	golden parrot tree		C		2/2
plants	higher dicots	Proteaceae	*Xylomelum scottianum*			C		3/3
plants	higher dicots	Proteaceae	*Grevillea parallela*			C		7/6
plants	higher dicots	Proteaceae	*Helicia nortoniana*			C		1/1
plants	higher dicots	Proteaceae	*Persoonia falcata*			C		1
plants	higher dicots	Proteaceae	*Grevillea striata*	beefwood		C		1
plants	higher dicots	Proteaceae	*Grevillea glauca*	bushy's clothes peg		C		1/1
plants	higher dicots	Proteaceae	*Grevillea stenobotrya*			C		1/1
plants	higher dicots	Putranjivaceae	*Drypetes deplanchei*	grey boxwood		C		4/1
plants	higher dicots	Rhamnaceae	*Colubrina asiatica*			C		3/3
plants	higher dicots	Rhamnaceae	*Alphitonia excelsa*	soap tree		C		13/10
plants	higher dicots	Rhamnaceae	*Ziziphus mauritiana*	Indian jujube	Y			14/6
plants	higher dicots	Rhamnaceae	*Alphitonia*			C		1
plants	higher dicots	Rhizophoraceae	*Ceriops tagal*	yellow mangrove		C		5/3
plants	higher dicots	Rhizophoraceae	*Bruguiera exaristata*			C		4/4
plants	higher dicots	Rhizophoraceae	*Rhizophora stylosa*	spotted mangrove		C		6/3
plants	higher dicots	Rhizophoraceae	*Carallia brachiata*	carallia		C		1/1
plants	higher dicots	Rosaceae	*Rubus moluccanus var. trilobus*			C		1/1
plants	higher dicots	Rubiaceae	*Psychotria poliostemma*			C		1/1
plants	higher dicots	Rubiaceae	*Psychotria interstans*			C		1/1
plants	higher dicots	Rubiaceae	*Psychotria fitzalanii*			C		4/4
plants	higher dicots	Rubiaceae	*Oldenlandia galioides*			C		4/4
plants	higher dicots	Rubiaceae	*Pavetta australiensis var. australiensis*			C		1/1
plants	higher dicots	Rubiaceae	*Coelospermum paniculatum var. paniculatum*			C		2/2
plants	higher dicots	Rubiaceae	*Atractocarpus fitzalanii subsp. fitzalanii*			C		1/1
plants	higher dicots	Rubiaceae	*Cyclophyllum coprosmoides var. coprosmoides*			C		1/1
plants	higher dicots	Rubiaceae	*Oldenlandia mitrasacmoides subsp. mitrasacmoides*			C		1/1
plants	higher dicots	Rubiaceae	*Oldenlandia mitrasacmoides subsp. trachymenoides*			C		2/2
plants	higher dicots	Rubiaceae	*Pavetta australiensis var. australiensis - P.granitica*			C		1/1
plants	higher dicots	Rubiaceae	*Psychotria*			C		1/1
plants	higher dicots	Rubiaceae	*Aidia racemosa*			C		5/4
plants	higher dicots	Rubiaceae	*Psydrax lepida*			C		1/1
plants	higher dicots	Rubiaceae	*Dentella repens*	dentella		C		1/1
plants	higher dicots	Rubiaceae	*Psydrax odorata*			C		2/2
plants	higher dicots	Rubiaceae	*Ixora timorensis*			C		1/1
plants	higher dicots	Rubiaceae	*Spermacoce remota*		Y			1/1

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plants	higher dicots	Rubiaceae	*Knoxia sumatrensis*			C		2/2
plants	higher dicots	Rubiaceae	*Mitracarpus hirtus*		Y			2/2
plants	higher dicots	Rubiaceae	*Oldenlandia subulata*			C		2/2
plants	higher dicots	Rubiaceae	*Larsenaikia ochreata*			C		3/2
plants	higher dicots	Rubiaceae	*Nauclea orientalis*	Leichhardt tree		C		1
plants	higher dicots	Rubiaceae	*Morinda citrifolia*			C		3/2
plants	higher dicots	Rubiaceae	*Psydrax odorata subsp. australiana*			C		4/4
plants	higher dicots	Rubiaceae	*Psydrax odorata forma australiana*			C		1/1
plants	higher dicots	Rubiaceae	*Psydrax saligna forma saligna*			C		4/3
plants	higher dicots	Rubiaceae	*Spermacoce brachystema*			C		2/1
plants	higher dicots	Rubiaceae	*Triflorensia ixoroides*			C		2/2
plants	higher dicots	Rubiaceae	*Gynochthodes canthoides*			C		1/1
plants	higher dicots	Rubiaceae	*Timonius timon var. timon*			C		1/1
plants	higher dicots	Rubiaceae	*Oldenlandia corymbosa var. corymbosa*		Y			5/5
plants	higher dicots	Rubiaceae	*Coelospermum reticulatum*			C		3/2
plants	higher dicots	Rutaceae	*Melicope rubra*			C		1/1
plants	higher dicots	Rutaceae	*Zieria smithii*			C		1/1
plants	higher dicots	Rutaceae	*Acronychia laevis*	glossy acronychia		C		2/2
plants	higher dicots	Rutaceae	*Micromelum minutum*	clusterberry		C		2/1
plants	higher dicots	Rutaceae	*Clausena brevistyla*	clausena		C		5/5
plants	higher dicots	Rutaceae	*Geijera salicifolia*	brush wilga		C		9/9
plants	higher dicots	Rutaceae	*Glycosmis trifoliata*			C		1/1
plants	higher dicots	Rutaceae	*Murraya ovatifoliolata*			C		2/2
plants	higher dicots	Rutaceae	*Dinosperma erythrococcum*			C		1/1
plants	higher dicots	Rutaceae	*Phebalium glandulosum subsp. glandulosum*			C		2/2
plants	higher dicots	Rutaceae	*Sarcomelicope simplicifolia subsp. simplicifolia*	yellow aspen		C		1/1
plants	higher dicots	Santalaceae	*Exocarpos latifolius*			C		4/2
plants	higher dicots	Sapindaceae	*Cardiospermum halicacabum var. halicacabum*		Y			1/1
plants	higher dicots	Sapindaceae	*Arytera divaricata*	coogera		C		1/1
plants	higher dicots	Sapindaceae	*Atalaya hemiglauca*			C		1/1
plants	higher dicots	Sapindaceae	*Atalaya multiflora*	broad-leaved whitewood		C		1/1
plants	higher dicots	Sapindaceae	*Dodonaea triquetra*	large-leaved hop bush		C		1/1
plants	higher dicots	Sapindaceae	*Dodonaea dodecandra*			C		4/4
plants	higher dicots	Sapindaceae	*Alectryon tomentosus*			C		1/1
plants	higher dicots	Sapindaceae	*Ganophyllum falcatum*			C		2/1
plants	higher dicots	Sapindaceae	*Alectryon reticulatus*	wild quince		C		1
plants	higher dicots	Sapindaceae	*Mischocarpus anodontus*	veiny pearfruit		C		1/1
plants	higher dicots	Sapindaceae	*Cupaniopsis wadsworthii*			C		1/1
plants	higher dicots	Sapindaceae	*Elattostachys bidwillii*			C		1/1
plants	higher dicots	Sapindaceae	*Dodonaea viscosa subsp. viscosa*			C		1/1
plants	higher dicots	Sapindaceae	*Cupaniopsis anacardioides*	tuckeroo		C		2/1
plants	higher dicots	Sapindaceae	*Alectryon connatus*	grey birds-eye		C		1/1
plants	higher dicots	Sapindaceae	*Harpullia pendula*			C		1/1
plants	higher dicots	Sapindaceae	*Dodonaea viscosa*			C		1
plants	higher dicots	Sapindaceae	*Dodonaea vestita*			C		1
plants	higher dicots	Sapindaceae	*Dodonaea lanceolata var. subsessilifolia*			C		2/2

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	higher dicots	Sapindaceae	*Dodonaea viscosa subsp. burmanniana*			C		4/4
plants	higher dicots	Sapotaceae	*Mimusops elengi*			C		3/3
plants	higher dicots	Sapotaceae	*Planchonella pohlmaniana*			C		4/3
plants	higher dicots	Sapotaceae	*Sersalisia sericea*			C		1
plants	higher dicots	Scrophulariaceae	*Myoporum acuminatum*	coastal boobialla		C		1/1
plants	higher dicots	Solanaceae	*Lycianthes shanesii*			C		1/1
plants	higher dicots	Solanaceae	*Solanum lycopersicum var. cerasiforme*		Y			1/1
plants	higher dicots	Solanaceae	*Solanum sporadotrichum*			NT		3/3
plants	higher dicots	Solanaceae	*Solanum nodiflorum*		Y			2/2
plants	higher dicots	Solanaceae	*Solanum torvum*	devil's fig	Y			3/3
plants	higher dicots	Solanaceae	*Physalis angulata*		Y			2/2
plants	higher dicots	Solanaceae	*Nicotiana forsteri*			C		1/1
plants	higher dicots	Solanaceae	*Solanum ellipticum*	potato bush		C		1/1
plants	higher dicots	Solanaceae	*Capsicum frutescens*		Y			1/1
plants	higher dicots	Solanaceae	*Datura inoxia*		Y			1/1
plants	higher dicots	Sparrmanniaceae	*Corchorus olitorius*	jute		C		3/3
plants	higher dicots	Sparrmanniaceae	*Grewia retusifolia*			C		3/3
plants	higher dicots	Sparrmanniaceae	*Corchorus hygrophilus*			V		3/3
plants	higher dicots	Sparrmanniaceae	*Triumfetta rhomboidea*	chinese burr	Y			2/2
plants	higher dicots	Sparrmanniaceae	*Grewia asiatica*		Y			8/6
plants	higher dicots	Sparrmanniaceae	*Grewia australis*			C		3/3
plants	higher dicots	Sparrmanniaceae	*Grewia scabrella*			C		1/1
plants	higher dicots	Sparrmanniaceae	*Corchorus pumilio*			C		1/1
plants	higher dicots	Sparrmanniaceae	*Triumfetta pentandra*		Y			1/1
plants	higher dicots	Sparrmanniaceae	*Grewia graniticola*			C		48/7
plants	higher dicots	Sparrmanniaceae	*Corchorus aestuans*			C		5/5
plants	higher dicots	Stackhousiaceae	*Stackhousia intermedia*			C		1/1
plants	higher dicots	Sterculiaceae	*Brachychiton bidwillii*	little kurrajong		C		2/2
plants	higher dicots	Sterculiaceae	*Brachychiton australis*	broad-leaved bottle tree		C		1/1
plants	higher dicots	Sterculiaceae	*Sterculia quadrifida*	peanut tree		C		3/2
plants	higher dicots	Sterculiaceae	*Argyrodendron polyandrum*	brown tulip oak		C		1/1
plants	higher dicots	Stylidiaceae	*Stylidium velleioides*			C		1/1
plants	higher dicots	Stylidiaceae	*Stylidium tenerum*			C		1/1
plants	higher dicots	Tamaricaceae	*Tamarix aphylla*	athel pine	Y			7/7
plants	higher dicots	Thymelaeaceae	*Thecanthes cornucopiae*			C		1/1
plants	higher dicots	Thymelaeaceae	*Pimelea sericostachya subsp. sericostachya*			C		1/1
plants	higher dicots	Turneraceae	*Turnera ulmifolia*		Y			6/6
plants	higher dicots	Ulmaceae	*Trema tomentosa*			C		1/1
plants	higher dicots	Ulmaceae	*Aphananthe philippinensis*			C		1/1
plants	higher dicots	Ulmaceae	*Celtis sp. (Cape Melville D.G.Fell+ DGF3025)*			C		1/1
plants	higher dicots	Ulmaceae	*Celtis paniculata*	native celtis		C		3/2
plants	higher dicots	Urticaceae	*Dendrocnide moroides*	Gympie stinger		C		1/1
plants	higher dicots	Urticaceae	*Pipturus argenteus*	white nettle		C		1/1
plants	higher dicots	Verbenaceae	*Duranta erecta*	duranta	Y			1/1
plants	higher dicots	Verbenaceae	*Stachytarpheta jamaicensis*	Jamaica snakeweed	Y			7/3
plants	higher dicots	Verbenaceae	*Verbena incompta*		Y			1/1

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	higher dicots	Verbenaceae	*Phyla canescens*		Y			1/1
plants	higher dicots	Verbenaceae	*Stachytarpheta*					2
plants	higher dicots	Verbenaceae	*Lantana camara*	lantana	Y			5/3
plants	higher dicots	Violaceae	*Hybanthus enneaspermus*			C		7/5
plants	higher dicots	Violaceae	*Hybanthus stellarioides*			C		2/2
plants	higher dicots	Viscaceae	*Viscum articulatum*	flat mistletoe		C		3/3
plants	higher dicots	Vitaceae	*Clematicissus opaca*			C		5/5
plants	higher dicots	Vitaceae	*Leea novoguineensis*			C		1/1
plants	higher dicots	Vitaceae	*Tetrastigma thorsborneorum*			C		3/3
plants	higher dicots	Vitaceae	*Cissus penninervis*			C		1/1
plants	higher dicots	Vitaceae	*Cayratia trifolia*			C		4/4
plants	higher dicots	Vitaceae	*Cissus oblonga*			C		3/2
plants	higher dicots	Vitaceae	*Cissus hastata*			C		1/1
plants	higher dicots	Vitaceae	*Tetrastigma nitens*	shining grape		C		1/1
plants	higher dicots	Vitaceae	*Cissus reniformis*			C		1/1
plants	higher dicots	Zygophyllaceae	*Tribulus*			C		1/1
plants	higher dicots	Zygophyllaceae	*Tribulus terrestris*	caltrop		C		1/1
plants	higher dicots	Zygophyllaceae	*Tribulus cistoides*	bulls head vine		C		3/3
plants	lower dicots	Annonaceae	*Melodorum crassipetalum*			C		4/4
plants	lower dicots	Annonaceae	*Polyalthia nitidissima*	polyalthia		C		2/1
plants	lower dicots	Annonaceae	*Melodorum leichhardtii*			C		1/1
plants	lower dicots	Annonaceae	*Fitzalania heteropetala*			C		7/5
plants	lower dicots	Annonaceae	*Annona reticulata*	custard apple	Y			1/1
plants	lower dicots	Aristolochiaceae	*Aristolochia pubera var. pubera*			C		6/6
plants	lower dicots	Aristolochiaceae	*Aristolochia ringens*		Y			1/1
plants	lower dicots	Aristolochiaceae	*Aristolochia elegans*	calico-flower	Y			2/2
plants	lower dicots	Aristolochiaceae	*Aristolochia thozetii*			C		2/2
plants	lower dicots	Avicenniaceae	*Avicennia marina subsp. australasica*			C		1/1
plants	lower dicots	Avicenniaceae	*Avicennia marina*			C		2
plants	lower dicots	Avicenniaceae	*Avicennia marina subsp. eucalyptifolia*			C		3/1
plants	lower dicots	Cabombaceae	*Cabomba caroliniana var. caroliniana*	cabomba	Y			3/3
plants	lower dicots	Ceratophyllaceae	*Ceratophyllum demersum*	hornwort		C		3/3
plants	lower dicots	Lauraceae	*Cryptocarya triplinervis var. triplinervis*			C		1/1
plants	lower dicots	Lauraceae	*Cryptocarya triplinervis*			C		1
plants	lower dicots	Lauraceae	*Beilschmiedia bancroftii*			C		1/1
plants	lower dicots	Lauraceae	*Endiandra hypotephra*	blue walnut		C		1/1
plants	lower dicots	Lauraceae	*Cryptocarya vulgaris*			C		2/2
plants	lower dicots	Lauraceae	*Cryptocarya grandis*			C		1
plants	lower dicots	Lauraceae	*Cassytha filiformis*	dodder laurel		C		3/3
plants	lower dicots	Lauraceae	*Cassytha capillaris*			C		1/1
plants	lower dicots	Lauraceae	*Litsea fawcettiana*			C		2/2
plants	lower dicots	Lauraceae	*Endiandra discolor*	domatia tree		C		1/1
plants	lower dicots	Lauraceae	*Cinnamomum oliveri*	Oliver's sassafras		C		1/1
plants	lower dicots	Lauraceae	*Neolitsea brassii*			C		1
plants	lower dicots	Lauraceae	*Litsea glutinosa*			C		3/2
plants	lower dicots	Lauraceae	*Cassytha*			C		1

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plants	lower dicots	Linderniaceae	*Lindernia crustacea*			C		1/1
plants	lower dicots	Linderniaceae	*Lindernia ciliata*			C		1/1
plants	lower dicots	Linderniaceae	*Lindernia tenuifolia*			C		1/1
plants	lower dicots	Menispermaceae	*Hypserpa laurina*			C		1/1
plants	lower dicots	Menispermaceae	*Pachygone ovata*			C		5/3
plants	lower dicots	Menispermaceae	*Tinospora smilacina*	snakevine		C		7/7
plants	lower dicots	Menispermaceae	*Pleogyne australis*	wiry grape		C		3/3
plants	lower dicots	Menispermaceae	*Stephania japonica*			C		1
plants	lower dicots	Menispermaceae	*Stephania tuberosa*			C		1
plants	lower dicots	Menispermaceae	*Stephania japonica var. timoriensis*			C		1/1
plants	lower dicots	Monimiaceae	*Wilkiea pubescens*			C		1/1
plants	lower dicots	Myristicaceae	*Myristica globosa subsp. muelleri*	native nugmeg		C		1/1
plants	lower dicots	Nelumbonaceae	*Nelumbo nucifera*	pink waterlily		C		1/1
plants	lower dicots	Nymphaeaceae	*Nymphaea*			C		2/2
plants	lower dicots	Nymphaeaceae	*Nymphaea immutabilis*			C		2/1
plants	lower dicots	Nymphaeaceae	*Nymphaea pubescens*			C		1/1
plants	lower dicots	Nymphaeaceae	*Nymphaea gigantea*			C		2/1
plants	lower dicots	Nymphaeaceae	*Nymphaea nouchali*			C		1/1
plants	lower dicots	Nymphaeaceae	*Nymphaea violacea*			C		1/1
plants	lower dicots	Phrymaceae	*Mimulus uvedaliae*			C		1/1
plants	lower dicots	Piperaceae	*Peperomia blanda var. floribunda*			C		1/1
plants	lower dicots	Piperaceae	*Peperomia pellucida*		Y			1/1
plants	lower dicots	Piperaceae	*Piper sarmentosum*		Y			1/1
plants	lower dicots	Ranunculaceae	*Clematis glycinoides*			C		1/1
plants	monocots	Agavaceae	*Agave vivipara var. vivipara*		Y			1/1
plants	monocots	Alismataceae	*Caldesia oligococca*			C		1/1
plants	monocots	Amaryllidaceae	*Crinum arenarium*			C		1/1
plants	monocots	Amaryllidaceae	*Proiphys infundibularis*			C		3/2
plants	monocots	Anthericaceae	*Chlorophytum laxum*	spider plant		C		2/2
plants	monocots	Aponogetonaceae	*Aponogeton queenslandicus*			C		2/2
plants	monocots	Araceae	*Pistia stratiotes*	water lettuce	Y			1/1
plants	monocots	Arecaceae	*Livistona decora*			C		5/3
plants	monocots	Asphodelaceae	*Aloe*			C		1/1
plants	monocots	Centrolepidaceae	*Centrolepis exserta*			C		1/1
plants	monocots	Colchicaceae	*Gloriosa superba*	glory lily	Y			1/1
plants	monocots	Colchicaceae	*Iphigenia indica*			C		1/1
plants	monocots	Commelinaceae	*Murdannia graminea*	murdannia		C		2/2
plants	monocots	Commelinaceae	*Murdannia vaginata*		Y			1/1
plants	monocots	Commelinaceae	*Pollia macrophylla*			C		1/1
plants	monocots	Commelinaceae	*Aneilema acuminatum*			C		1/1
plants	monocots	Commelinaceae	*Commelina ensifolia*	scurvy grass		C		6/6
plants	monocots	Commelinaceae	*Cyanotis axillaris*			C		1/1
plants	monocots	Commelinaceae	*Commelina lanceolata*			C		1/1
plants	monocots	Commelinaceae	*Commelina ciliata*			C		1/1
plants	monocots	Cymodoceaceae	*Syringodium isoetifolium*			C		1/1
plants	monocots	Cymodoceaceae	*Cymodocea serrulata*			C		1/1

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	monocots	Cymodoceaceae	*Halodule uninervis*			C		2/2
plants	monocots	Cyperaceae	*Cyperus*			C		1
plants	monocots	Cyperaceae	*Eleocharis*			C		1
plants	monocots	Cyperaceae	*Cyperus iria*			C		3/3
plants	monocots	Cyperaceae	*Fimbristylis*			C		1
plants	monocots	Cyperaceae	*Gahnia aspera*			C		1/1
plants	monocots	Cyperaceae	*Scleria levis*			C		1/1
plants	monocots	Cyperaceae	*Cyperus fulvus*			C		2/2
plants	monocots	Cyperaceae	*Cyperus haspan*			C		1/1
plants	monocots	Cyperaceae	*Cyperus scaber*			C		2/2
plants	monocots	Cyperaceae	*Schoenoplectus*					1
plants	monocots	Cyperaceae	*Scleria rugosa*			C		1/1
plants	monocots	Cyperaceae	*Cyperus conicus*			C		1/1
plants	monocots	Cyperaceae	*Cyperus enervis*			C		1/1
plants	monocots	Cyperaceae	*Cyperus pumilus*			C		1/1
plants	monocots	Cyperaceae	*Eleocharis nuda*			C		1/1
plants	monocots	Cyperaceae	*Scleria brownii*			C		4/3
plants	monocots	Cyperaceae	*Scleria pygmaea*			C		1/1
plants	monocots	Cyperaceae	*Cyperus bulbosus*			C		1/1
plants	monocots	Cyperaceae	*Cyperus flavidus*			C		1/1
plants	monocots	Cyperaceae	*Fuirena ciliaris*			C		3/3
plants	monocots	Cyperaceae	*Cyperus aquatilis*			C		1/1
plants	monocots	Cyperaceae	*Cyperus difformis*	rice sedge		C		4/4
plants	monocots	Cyperaceae	*Cyperus javanicus*			C		4/4
plants	monocots	Cyperaceae	*Cyperus scariosus*			C		2/2
plants	monocots	Cyperaceae	*Cyperus subulatus*			C		1/1
plants	monocots	Cyperaceae	*Cyperus trinervis*			C		2/2
plants	monocots	Cyperaceae	*Fuirena umbellata*			C		3/3
plants	monocots	Cyperaceae	*Rhynchospora leae*			C		2/2
plants	monocots	Cyperaceae	*Schoenus falcatus*			C		1/1
plants	monocots	Cyperaceae	*Schoenus sparteus*			C		1/1
plants	monocots	Cyperaceae	*Scleria polycarpa*			C		1/1
plants	monocots	Cyperaceae	*Fimbristylis littoralis*			C		2/2
plants	monocots	Cyperaceae	*Fimbristylis tristachya*			C		2/2
plants	monocots	Cyperaceae	*Lipocarpha microcephala*			C		1/1
plants	monocots	Cyperaceae	*Fimbristylis depauperata*			C		1/1
plants	monocots	Cyperaceae	*Fimbristylis schoenoides*			C		1/1
plants	monocots	Cyperaceae	*Fimbristylis subaristata*			C		2/2
plants	monocots	Cyperaceae	*Scleria novae-hollandiae*			C		1/1
plants	monocots	Cyperaceae	*Eleocharis philippinensis*			C		2/2
plants	monocots	Cyperaceae	*Fimbristylis bisumbellata*			C		1/1
plants	monocots	Cyperaceae	*Rhynchospora heterochaeta*			C		2/2
plants	monocots	Cyperaceae	*Fimbristylis cinnamometorum*			C		2/2
plants	monocots	Cyperaceae	*Fimbristylis polytrichoides*			C		6/6
plants	monocots	Cyperaceae	*Cyperus conicus var. conicus*			C		1/1
plants	monocots	Cyperaceae	*Fimbristylis fimbristyloides*			C		1/1

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plants	monocots	Cyperaceae	*Schoenoplectiella articulata*			C		1/1
plants	monocots	Cyperaceae	*Schoenoplectus tabernaemontani*			C		1/1
plants	monocots	Cyperaceae	*Cyperus nutans var. eleusinoides*	flatsedge		C		1/1
plants	monocots	Cyperaceae	*Lepidosperma laterale var. laterale*			C		1/1
plants	monocots	Cyperaceae	*Cyperus polystachyos var. laxiflorus*			C		1/1
plants	monocots	Cyperaceae	*Eleocharis setifolia subsp. setifolia*			C		1/1
plants	monocots	Cyperaceae	*Cyperus polystachyos var. polystachyos*			C		1/1
plants	monocots	Cyperaceae	*Cyperus dietrichiae var. brevibracteatus*			C		1/1
plants	monocots	Cyperaceae	*Abildgaardia ovata*			C		1/1
plants	monocots	Cyperaceae	*Cyperus aromaticus*		Y			1/1
plants	monocots	Cyperaceae	*Cyperus compressus*		Y			1/1
plants	monocots	Cyperaceae	*Cyperus cyperoides*			C		2/2
plants	monocots	Cyperaceae	*Cyperus leiocaulon*			C		1/1
plants	monocots	Cyperaceae	*Cyperus squarrosus*	bearded flatsedge		C		1/1
plants	monocots	Cyperaceae	*Cyperus zollingeri*			C		2/2
plants	monocots	Cyperaceae	*Scleria sphacelata*			C		2/2
plants	monocots	Cyperaceae	*Bulbostylis barbata*			C		8/8
plants	monocots	Cyperaceae	*Cyperus alaticaulis*			C		1
plants	monocots	Cyperaceae	*Cyperus brevifolius*	Mullumbimby couch	Y			1/1
plants	monocots	Cyperaceae	*Cyperus perangustus*			C		2/2
plants	monocots	Cyperaceae	*Cyperus platystylis*			C		2/2
plants	monocots	Cyperaceae	*Cyperus tetracarpus*			C		4/3
plants	monocots	Cyperaceae	*Fimbristylis dolera*			C		1/1
plants	monocots	Cyperaceae	*Tetraria capillaris*			C		2/2
plants	monocots	Cyperaceae	*Cyperus decompositus*			C		1/1
plants	monocots	Cyperaceae	*Cyperus involucratus*		Y			1/1
plants	monocots	Cyperaceae	*Cyperus pedunculatus*			C		4/4
plants	monocots	Cyperaceae	*Scleria mackaviensis*			C		2/2
plants	monocots	Cyperaceae	*Scleria tricuspidata*			C		1/1
plants	monocots	Cyperaceae	*Cyperus alopecuroides*			C		3/3
plants	monocots	Cyperaceae	*Eleocharis geniculata*			C		1/1
plants	monocots	Cyperaceae	*Fimbristylis dichotoma*	common fringe-rush		C		6/6
plants	monocots	Cyperaceae	*Fimbristylis acicularis*			C		1/1
plants	monocots	Cyperaceae	*Fimbristylis ferruginea*			C		3/3
plants	monocots	Dioscoreaceae	*Dioscorea bulbifera var. bulbifera*			C		1/1
plants	monocots	Dracaenaceae	*Sansevieria trifasciata var. trifasciata*		Y			2/2
plants	monocots	Eriocaulaceae	*Eriocaulon pallidum*			C		1/1
plants	monocots	Haemodoraceae	*Haemodorum coccineum*			C		5/5
plants	monocots	Hemerocallidaceae	*Dianella caerulea var. vannata*			C		1/1
plants	monocots	Hemerocallidaceae	*Geitonoplesium cymosum*	scrambling lily		C		2/2
plants	monocots	Hydrocharitaceae	*Halophila decipiens*			C		4/4
plants	monocots	Hydrocharitaceae	*Halophila spinulosa*			C		4/4
plants	monocots	Hydrocharitaceae	*Halophila tricostata*			C		3/3
plants	monocots	Hydrocharitaceae	*Thalassia hemprichii*			C		2/2
plants	monocots	Hydrocharitaceae	*Hydrilla verticillata*	hydrilla		C		1/1
plants	monocots	Hydrocharitaceae	*Ottelia ovalifolia subsp. ovalifolia*			C		2/2

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plants	monocots	Hydrocharitaceae	*Ottelia alismoides*			C		3/3
plants	monocots	Hydrocharitaceae	*Vallisneria annua*			C		1/1
plants	monocots	Hydrocharitaceae	*Enhalus acoroides*			C		1/1
plants	monocots	Hydrocharitaceae	*Vallisneria nana*			C		2/2
plants	monocots	Hydrocharitaceae	*Halophila ovalis*			C		7/7
plants	monocots	Hydrocharitaceae	*Blyxa aubertii*			C		2/2
plants	monocots	Hydrocharitaceae	*Halophila minor*			C		7/7
plants	monocots	Hypoxidaceae	*Hypoxis pratensis*			C		1/1
plants	monocots	Hypoxidaceae	*Curculigo ensifolia var. ensifolia*			C		1/1
plants	monocots	Johnsoniaceae	*Tricoryne anceps*			C		1/1
plants	monocots	Johnsoniaceae	*Tricoryne anceps subsp. anceps*			C		1/1
plants	monocots	Johnsoniaceae	*Tricoryne elatior*	yellow autumn lily		C		1/1
plants	monocots	Juncaginaceae	*Cycnogeton dubius*			C		1/1
plants	monocots	Laxmanniaceae	*Lomandra confertifolia subsp. pallida*			C		1/1
plants	monocots	Laxmanniaceae	*Cordyline manners-suttoniae*			C		1/1
plants	monocots	Limnocharitaceae	*Hydrocleys nymphoides*		Y			1/1
plants	monocots	Limnocharitaceae	*Limnocharis flava*	yellow burrhead	Y			6/6
plants	monocots	Musaceae	*Musa banksii*			C		1/1
plants	monocots	Orchidaceae	*Dendrobium canaliculatum*			C		2/2
plants	monocots	Orchidaceae	*Dendrobium discolor*			C		1/1
plants	monocots	Orchidaceae	*Nervilia holochila*			C		3/3
plants	monocots	Orchidaceae	*Dockrillia bowmanii*	scrub pencil orchid		C		1/1
plants	monocots	Pandanaceae	*Pandanus cookii*			C		5/2
plants	monocots	Pandanaceae	*Pandanus*			C		1
plants	monocots	Pandanaceae	*Pandanus brookei*			C		1/1
plants	monocots	Philydraceae	*Philydrum lanuginosum*	frogsmouth		C		1/1
plants	monocots	Poaceae	*Eragrostis leptostachya*			C		2/2
plants	monocots	Poaceae	*Eragrostis spartinoides*			C		3/3
plants	monocots	Poaceae	*Eragrostis stenostachya*			C		2/2
plants	monocots	Poaceae	*Sporobolus jacquemontii*		Y			4/4
plants	monocots	Poaceae	*Sporobolus lenticularis*			C		1/1
plants	monocots	Poaceae	*Capillipedium spicigerum*	spicytop		C		1/1
plants	monocots	Poaceae	*Cenchrus pennisetiformis*		Y			2/2
plants	monocots	Poaceae	*Dactyloctenium aegyptium*	coast button grass	Y			6/5
plants	monocots	Poaceae	*Enneapogon robustissimus*			C		4/4
plants	monocots	Poaceae	*Sporobolus australasicus*			C		1/1
plants	monocots	Poaceae	*Capillipedium parviflorum*	scented top		C		1/1
plants	monocots	Poaceae	*Cymbopogon queenslandicus*			C		2/2
plants	monocots	Poaceae	*Mnesithea rottboellioides*			C		2/2
plants	monocots	Poaceae	*Diplachne fusca var. fusca*			C		2/2
plants	monocots	Poaceae	*Eriochloa pseudoacrotricha*			C		1/1
plants	monocots	Poaceae	*Sporobolus coromandelianus*		Y			4/4
plants	monocots	Poaceae	*Aristida utilis var. utilis*			C		1/1
plants	monocots	Poaceae	*Aristida calycina var. calycina*			C		1/1
plants	monocots	Poaceae	*Sorghum nitidum forma aristatum*			C		1/1
plants	monocots	Poaceae	*Dinebra decipiens var. decipiens*			C		1/1

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	monocots	Poaceae	*Ischaemum australe var. australe*			C		1/1
plants	monocots	Poaceae	*Megathyrsus maximus var. maximus*		Y			1/1
plants	monocots	Poaceae	*Aristida holathera var. holathera*			C		8/8
plants	monocots	Poaceae	*Panicum decompositum var. tenuius*			C		1/1
plants	monocots	Poaceae	*Hymenachne amplexicaulis cv. Olive*		Y			1/1
plants	monocots	Poaceae	*Megathyrsus maximus var. coloratus*		Y			4/4
plants	monocots	Poaceae	*Panicum seminudum var. cairnsianum*			C		2/2
plants	monocots	Poaceae	*Setaria pumila subsp. subtesselata*		Y			1/1
plants	monocots	Poaceae	*Bothriochloa bladhii subsp. bladhii*			C		2/2
plants	monocots	Poaceae	*Megathyrsus maximus var. pubiglumis*		Y			1/1
plants	monocots	Poaceae	*Urochloa panicoides var. panicoides*		Y			1/1
plants	monocots	Poaceae	*Dichanthium sericeum subsp. sericeum*			C		4/4
plants	monocots	Poaceae	*Ischaemum australe var. arundinaceum*			C		1/1
plants	monocots	Poaceae	*Bothriochloa decipiens var. decipiens*			C		1/1
plants	monocots	Poaceae	*Eragrostis lacunaria*	purple lovegrass		C		1/1
plants	monocots	Poaceae	*Eragrostis pubescens*			C		1/1
plants	monocots	Poaceae	*Eragrostis schultzii*			C		2/2
plants	monocots	Poaceae	*Eriachne triodioides*			C		5/5
plants	monocots	Poaceae	*Mnesithea granularis*			C		3/3
plants	monocots	Poaceae	*Paspalum longifolium*			C		1/1
plants	monocots	Poaceae	*Phragmites australis*	common reed		C		1/1
plants	monocots	Poaceae	*Sorghum arundinaceum*	Rhodesian Sudan grass	Y			1/1
plants	monocots	Poaceae	*Themeda quadrivalvis*	grader grass	Y			4/3
plants	monocots	Poaceae	*Triodia stenostachya*			C		2/2
plants	monocots	Poaceae	*Urochloa holosericea*			C		1/1
plants	monocots	Poaceae	*Urochloa oligotricha*		Y			1/1
plants	monocots	Poaceae	*Whiteochloa airoides*			C		2/2
plants	monocots	Poaceae	*Alloteropsis cimicina*			C		1/1
plants	monocots	Poaceae	*Cymbopogon bombycinus*	silky oilgrass		C		3/3
plants	monocots	Poaceae	*Dichanthium annulatum*	sheda grass	Y			2/2
plants	monocots	Poaceae	*Dichanthium aristatum*	angleton grass	Y			1/1
plants	monocots	Poaceae	*Eragrostis interrupta*			C		2/2
plants	monocots	Poaceae	*Eragrostis parviflora*	weeping lovegrass		C		2/2
plants	monocots	Poaceae	*Eragrostis tenuifolia*	elastic grass	Y			1/1
plants	monocots	Poaceae	*Eragrostis unioloides*		Y			1/1
plants	monocots	Poaceae	*Eremochloa bimaculata*	poverty grass		C		1/1
plants	monocots	Poaceae	*Heteropogon contortus*	black speargrass		C		10/7
plants	monocots	Poaceae	*Heteropogon triticeus*	giant speargrass		C		5/2
plants	monocots	Poaceae	*Setaria oplismenoides*			C		1/1
plants	monocots	Poaceae	*Sporobolus natalensis*		Y			1/1
plants	monocots	Poaceae	*Echinochloa crus-galli*	barnyard grass	Y			2/2
plants	monocots	Poaceae	*Enneapogon lindleyanus*			C		1/1
plants	monocots	Poaceae	*Enneapogon polyphyllus*	leafy nineawn		C		1/1
plants	monocots	Poaceae	*Paspalidium criniforme*			C		1/1
plants	monocots	Poaceae	*Paspalidium disjunctum*			C		2/2
plants	monocots	Poaceae	*Urochloa mosambicensis*	sabi grass	Y			2/2

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	monocots	Poaceae	*Urochloa subquadripara*		Y			6/6
plants	monocots	Poaceae	*Dactyloctenium radulans*	button grass		C		2/2
plants	monocots	Poaceae	*Digitaria nematostachya*			C		2/2
plants	monocots	Poaceae	*Paspalum*			C		1
plants	monocots	Poaceae	*Arundo donax*		Y			1/1
plants	monocots	Poaceae	*Avena sativa*	common oats	Y			1/1
plants	monocots	Poaceae	*Perotis rara*	comet grass		C		1/1
plants	monocots	Poaceae	*Eriachne rara*			C		2/2
plants	monocots	Poaceae	*Eulalia aurea*	silky browntop		C		1/1
plants	monocots	Poaceae	*Aristida acuta*			C		1/1
plants	monocots	Poaceae	*Chloris gayana*	rhodes grass	Y			4/3
plants	monocots	Poaceae	*Chloris lobata*			C		1/1
plants	monocots	Poaceae	*Sporobolus virginicus*	sand couch		C		6/2
plants	monocots	Poaceae	*Alloteropsis semialata*	cockatoo grass		C		2/2
plants	monocots	Poaceae	*Arundinella nepalensis*	reedgrass		C		4/4
plants	monocots	Poaceae	*Bothriochloa ewartiana*	desert bluegrass		C		1/1
plants	monocots	Poaceae	*Brachyachne convergens*	common native couch		C		2/2
plants	monocots	Poaceae	*Aristida queenslandica var. dissimilis*			C		2/2
plants	monocots	Poaceae	*Panicum decompositum var. decompositum*			C		1/1
plants	monocots	Poaceae	*Urochloa holosericea subsp. holosericea*			C		2/2
plants	monocots	Poaceae	*Cenchrus pedicellatus subsp. unispiculus*		Y			2/2
plants	monocots	Poaceae	*Dichanthium sericeum subsp. polystachyum*			C		1/1
plants	monocots	Poaceae	*Aristida queenslandica var. queenslandica*			C		1/1
plants	monocots	Poaceae	*Bothriochloa decipiens var. cloncurrensis*			C		1/1
plants	monocots	Poaceae	*Cenchrus pedicellatus subsp. pedicellatus*		Y			1/1
plants	monocots	Poaceae	*Panicum queenslandicum var. queenslandicum*			C		2/2
plants	monocots	Poaceae	*Chrysopogon aciculatus*	Mackie's pest	Y			1/1
plants	monocots	Poaceae	*Digitaria leucostachya*			C		4/4
plants	monocots	Poaceae	*Leersia hexandra*	swamp rice grass		C		1/1
plants	monocots	Poaceae	*Paspalidium udum*			V		2/2
plants	monocots	Poaceae	*Paspalum notatum*	bahia grass	Y			2/2
plants	monocots	Poaceae	*Themeda triandra*	kangaroo grass		C		5/3
plants	monocots	Poaceae	*Cenchrus setaceus*		Y			4/4
plants	monocots	Poaceae	*Digitaria diffusa*			C		5/5
plants	monocots	Poaceae	*Digitaria gibbosa*			C		2/2
plants	monocots	Poaceae	*Ectrosia leporina*			C		1/1
plants	monocots	Poaceae	*Eragrostis fallax*			C		1/1
plants	monocots	Poaceae	*Eragrostis pilosa*	soft lovegrass	Y			2/2
plants	monocots	Poaceae	*Eriochloa procera*	slender cupgrass		C		1/1
plants	monocots	Poaceae	*Mnesithea formosa*			C		2/2
plants	monocots	Poaceae	*Panicum paludosum*	swamp panic		C		1/1
plants	monocots	Poaceae	*Paspalidium rarum*			C		5/5
plants	monocots	Poaceae	*Sporobolus caroli*	fairy grass		C		1/1
plants	monocots	Poaceae	*Urochloa pubigera*			C		1/1
plants	monocots	Poaceae	*Andropogon gayanus*	gamba grass	Y			2/2
plants	monocots	Poaceae	*Aristida latifolia*	feathertop wiregrass		C		1/1

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	monocots	Poaceae	*Arundinella setosa*			C		1/1
plants	monocots	Poaceae	*Cenchrus echinatus*	Mossman River grass	Y			2/2
plants	monocots	Poaceae	*Cenchrus elymoides*			C		1/1
plants	monocots	Poaceae	*Cenchrus setigerus*		Y			2/2
plants	monocots	Poaceae	*Chrysopogon fallax*			C		2
plants	monocots	Poaceae	*Digitaria bicornis*			C		3/3
plants	monocots	Poaceae	*Digitaria ciliaris*	summer grass	Y			4/4
plants	monocots	Poaceae	*Echinochloa colona*	awnless barnyard grass	Y			3/3
plants	monocots	Poaceae	*Pseudopogonatherum irritans*			C		1/1
plants	monocots	Poaceae	*Hyparrhenia rufa subsp. rufa*		Y			2/2
plants	monocots	Poaceae	*Arthragrostis deschampsioides*			C		4/4
plants	monocots	Poaceae	*Cynodon dactylon var. dactylon*		Y			1/1
plants	monocots	Poaceae	*Diplachne fusca var. uninervia*		Y			1/1
plants	monocots	Poaceae	*Ischaemum rugosum var. rugosum*			C		1/1
plants	monocots	Poaceae	*Ischaemum rugosum var. segetum*			C		1/1
plants	monocots	Poaceae	*Dinebra neesii*			C		2/2
plants	monocots	Poaceae	*Lolium perenne*	perennial ryegrass	Y			1/1
plants	monocots	Poaceae	*Melinis repens*	red natal grass	Y			10/4
plants	monocots	Poaceae	*Sarga plumosum*			C		2/2
plants	monocots	Poaceae	*Chloris inflata*	purpletop chloris	Y			11/7
plants	monocots	Poaceae	*Chloris pumilio*			C		2/2
plants	monocots	Poaceae	*Chloris virgata*	feathertop rhodes grass	Y			2/1
plants	monocots	Poaceae	*Eriachne obtusa*			C		1/1
plants	monocots	Poaceae	*Lepturus repens*	stalky grass		C		1/1
plants	monocots	Poaceae	*Panicum effusum*			C		3/3
plants	monocots	Poaceae	*Sehima nervosum*			C		3/3
plants	monocots	Poaceae	*Setaria surgens*			C		3/3
plants	monocots	Poaceae	*Sorghum x almum*		Y			2/2
plants	monocots	Poaceae	*Themeda arguens*			C		3/3
plants	monocots	Poaceae	*Urochloa mutica*		Y			2/1
plants	monocots	Poaceae	*Cynodon dactylon*		Y			1
plants	monocots	Poaceae	*Cynodon radiatus*		Y			1/1
plants	monocots	Poaceae	*Digitaria brownii*			C		6/6
plants	monocots	Poaceae	*Digitaria fumida*			C		1/1
plants	monocots	Poaceae	*Digitaria minima*			C		1/1
plants	monocots	Poaceae	*Digitaria orbata*			C		2/2
plants	monocots	Poaceae	*Eriachne ciliata*			C		2/2
plants	monocots	Poaceae	*Eriachne humilis*			C		1/1
plants	monocots	Poaceae	*Eriachne triseta*			C		2/2
plants	monocots	Poaceae	*Eriochloa crebra*	spring grass		C		1/1
plants	monocots	Poaceae	*Hyparrhenia rufa*		Y			1/1
plants	monocots	Poaceae	*Eragrostis brownii*	Brown's lovegrass		C		2/1
plants	monocots	Poaceae	*Eragrostis curvula*		Y			3/3
plants	monocots	Poaceae	*Eragrostis dielsii*	mallee lovegrass		C		1/1
plants	monocots	Poaceae	*Eragrostis tenella*		Y			1/1
plants	monocots	Poaceae	*Eriachne squarrosa*			C		1/1

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	monocots	Poaceae	*Oplismenus aemulus*	creeping shade grass		C		1/1
plants	monocots	Poaceae	*Oryza meridionalis*			C		3/3
plants	monocots	Poaceae	*Panicum mitchellii*			C		2/2
plants	monocots	Poaceae	*Paspalum distichum*	water couch		C		1/1
plants	monocots	Poaceae	*Sacciolepis indica*	Indian cupscale grass		C		2/2
plants	monocots	Poaceae	*Urochloa distachya*		Y			2/2
plants	monocots	Poaceae	*Aristida gracilipes*			C		2/2
plants	monocots	Poaceae	*Aristida perniciosa*			C		2/2
plants	monocots	Poaceae	*Brachyachne tenella*			C		1/1
plants	monocots	Poaceae	*Cymbopogon ambiguus*	lemon grass		C		3/3
plants	monocots	Poaceae	*Cymbopogon obtectus*			C		1/1
plants	monocots	Poaceae	*Digitaria didactyla*	Queensland blue couch	Y			1/1
plants	monocots	Poaceae	*Digitaria ramularis*			C		1/1
plants	monocots	Poaceae	*Ectrosia lasioclada*			C		1/1
plants	monocots	Poaceae	*Ectrosia nervilemma*			C		1/1
plants	monocots	Poaceae	*Eragrostis cumingii*			C		2/2
plants	monocots	Poaceae	*Eragrostis elongata*			C		4/4
plants	monocots	Poaceae	*Eragrostis mexicana*	Mexican lovegrass	Y			3/3
plants	monocots	Poaceae	*Imperata cylindrica*	blady grass		C		2/2
plants	monocots	Poaceae	*Megathyrsus maximus*		Y			5
plants	monocots	Poaceae	*Oryza australiensis*			C		1/1
plants	monocots	Poaceae	*Panicum mindanaense*			C		1/1
plants	monocots	Poaceae	*Paspalidium distans*	shotgrass		C		2/2
plants	monocots	Poaceae	*Paspalidium gracile*	slender panic		C		6/6
plants	monocots	Poaceae	*Paspalum plicatulum*	plicatulum	Y			1/1
plants	monocots	Poaceae	*Sporobolus fertilis*	giant Parramatta grass	Y			1/1
plants	monocots	Poaceae	*Bothriochloa pertusa*		Y			3/2
plants	monocots	Poaceae	*Cymbopogon refractus*	barbed-wire grass		C		1
plants	monocots	Poaceae	*Dichanthium fecundum*	curly bluegrass		C		4/3
plants	monocots	Poaceae	*Digitaria longiflora*			C		1/1
plants	monocots	Poaceae	*Digitaria violascens*	bastard summergrass	Y			1/1
plants	monocots	Poaceae	*Enneapogon nigricans*	niggerheads		C		1/1
plants	monocots	Poaceae	*Eragrostis basedowii*			C		2/2
plants	monocots	Pontederiaceae	*Monochoria vaginalis*			C		1/1
plants	monocots	Pontederiaceae	*Eichhornia crassipes*	water hyacinth	Y			2/2
plants	monocots	Pontederiaceae	*Monochoria cyanea*			C		2/2
plants	monocots	Potamogetonaceae	*Potamogeton octandrus*			C		1/1
plants	monocots	Potamogetonaceae	*Potamogeton crispus*	curly pondweed		C		1/1
plants	monocots	Potamogetonaceae	*Potamogeton*			C		2/2
plants	monocots	Typhaceae	*Typha orientalis*	broad-leaved cumbungi		C		1
plants	monocots	Typhaceae	*Typha domingensis*			C		2/2
plants	monocots	Xyridaceae	*Xyris complanata*	yellow-eye		C		1/1
plants	monocots	Zingiberaceae	*Alpinia*			C		1/1
plants	mosses	Calymperaceae	*Calymperes tenerum*			C		1/1
plants	mosses	Calymperaceae	*Calymperes motleyi*			C		1/1
plants	mosses	Pterigynandraceae	*Trachyphyllum inflexum*			C		1/1

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	uncertain	Indet.	*Indet.*			C		2/2
plants	whisk ferns	Psilotaceae	*Psilotum nudum*	skeleton fork fern		C		1/1
plants		Streptophyceae	*Nitella*			C		2/2
plants		Streptophyceae	*Chara*			C		2/2
protists	blue-green algae	Cyanophyceae	*Cyanophyceae*			C		1/1
protists	blue-green algae	Cyanophyceae	*Phormidium*			C		1/1
protists	blue-green algae	Cyanophyceae	*Lyngbya semiplena*			C		1/1
protists	brown algae	Phaeophyceae	*Turbinaria*			C		1/1
protists	brown algae	Phaeophyceae	*Dictyopteris woodwardia*			C		1/1
protists	brown algae	Phaeophyceae	*Colpomenia sinuosa*			C		1/1
protists	brown algae	Phaeophyceae	*Dictyota ciliolata*			C		2/2
protists	brown algae	Phaeophyceae	*Dictyopteris australis*			C		2/2
protists	brown algae	Phaeophyceae	*Dictyota bartayresiana*			C		1/1
protists	brown algae	Phaeophyceae	*Padina tetrastromatica*			C		2/2
protists	brown algae	Phaeophyceae	*Dictyopteris delicatula*			C		2/2
protists	brown algae	Phaeophyceae	*Sargassum*			C		1/1
protists	brown algae	Phaeophyceae	*Dictyota*			C		4/4
protists	brown algae	Phaeophyceae	*Padina*			C		1/1
protists	brown algae	Phaeophyceae	*Padina australis*			C		2/2
protists	green algae	Chlorophyceae	*Cladophora herpestica*			C		2/2
protists	green algae	Chlorophyceae	*Rhizoclonium tortuosum*			C		1/1
protists	green algae	Chlorophyceae	*Ulva flexuosa subsp. flexuosa*			C		1/1
protists	green algae	Chlorophyceae	*Caulerpa racemosa var. laetevirens*			C		2/2
protists	green algae	Chlorophyceae	*Halimeda opuntia*			C		1/1
protists	green algae	Chlorophyceae	*Cladophora*			C		1/1
protists	green algae	Chlorophyceae	*Ulva rigida*			C		2/2
protists	green algae	Chlorophyceae	*Ulva sapora*			C		2/2
protists	green algae	Chlorophyceae	*Enteromorpha*			C		1/1
protists	green algae	Chlorophyceae	*Ulva lactuca*			C		1/1
protists	green algae	Chlorophyceae	*Udotea flabellum*			C		1/1
protists	green algae	Chlorophyceae	*Caulerpa racemosa*			C		1/1
protists	green algae	Chlorophyceae	*Codium extricatum*			C		1/1
protists	green algae	Chlorophyceae	*Caulerpa taxifolia*			C		1/1
protists	green algae	Chlorophyceae	*Valonia aegagropila*			C		2/2
protists	green algae	Chlorophyceae	*Cladophora prolifera*			C		2/2
protists	red algae	Rhodophyceae	*Gracilaria*			C		3/3
protists	red algae	Rhodophyceae	*Laurencia*			C		2/2
protists	red algae	Rhodophyceae	*Hypnea cornuta*			C		1/1
protists	red algae	Rhodophyceae	*Catenella nipae*			C		1/1
protists	red algae	Rhodophyceae	*Ceramium maryae*			C		1/1
protists	red algae	Rhodophyceae	*Hypnea spinella*			C		1/1
protists	red algae	Rhodophyceae	*Gelidium corneum*			C		1/1
protists	red algae	Rhodophyceae	*Gelidium crinale*			C		1/1
protists	red algae	Rhodophyceae	*Hypnea valentiae*			C		1/1
protists	red algae	Rhodophyceae	*Laurencia obtusa*			C		1/1
protists	red algae	Rhodophyceae	*Gracilaria edulis*			C		3/3

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
protists	red algae	Rhodophyceae	*Ceramium cimbricum*			C		1/1
protists	red algae	Rhodophyceae	*Chondria rainfordi*			C		1/1
protists	red algae	Rhodophyceae	*Hypnea boergesenii*			C		1/1
protists	red algae	Rhodophyceae	*Laurencia gracilis*			C		1/1
protists	red algae	Rhodophyceae	*Laurencia nidifica*			C		1/1
protists	red algae	Rhodophyceae	*Bostrychia radicans*			C		1/1
protists	red algae	Rhodophyceae	*Laurencia papillosa*			C		1/1
protists	red algae	Rhodophyceae	*Polysiphonia coacta*			C		1/1
protists	red algae	Rhodophyceae	*Pyropia denticulata*			C		1/1
protists	red algae	Rhodophyceae	*Sarconema filiforme*			C		2/2
protists	red algae	Rhodophyceae	*Ahnfeltiopsis pygmaea*			C		1/1
protists	red algae	Rhodophyceae	*Amphiroa fragilissima*			C		1/1
protists	red algae	Rhodophyceae	*Caloglossa leprieurii*			C		1/1
protists	red algae	Rhodophyceae	*Polysiphonia fragilis*			C		1/1
protists	red algae	Rhodophyceae	*Acanthophora muscoides*			C		1/1
protists	red algae	Rhodophyceae	*Acanthophora spicifera*			C		3/3
protists	red algae	Rhodophyceae	*Centroceras clavulatum*			C		1/1
protists	red algae	Rhodophyceae	*Chondrophycus succisus*			C		1/1
protists	red algae	Rhodophyceae	*Coelothrix irregularis*			C		1/1
protists	red algae	Rhodophyceae	*Gelidiopsis variabilis*			C		2/2
protists	red algae	Rhodophyceae	*Antrocentrum nigrescens*			C		1/1
protists	red algae	Rhodophyceae	*Gracilaria purpurascens*			C		1/1
protists	red algae	Rhodophyceae	*Tricleocarpa cylindrica*			C		3/3
protists	red algae	Rhodophyceae	*Chondrophycus perforatus*			C		1/1
protists	red algae	Rhodophyceae	*Gracilaria eucheumioides*			C		1/1
protists	red algae	Rhodophyceae	*Heterosiphonia multiceps*			C		1/1
protists	red algae	Rhodophyceae	*Bostrychia tenella subsp. tenella*			C		1/1
protists	red algae	Rhodophyceae	*Scinaia*			C		1/1
protists	red algae	Rhodophyceae	*Ceramium*			C		1/1
protists	red algae	Rhodophyceae	*Solieria*			C		1/1
protists	yellow-green algae	Xanthophyceae	*Vaucheria*			C		1/1

CODES

I - Y indicates that the taxon is introduced to Queensland and has naturalised.

Q - Indicates the Queensland conservation status of each taxon under the *Nature Conservation Act 1992.* The codes are Extinct in the Wild (PE), Endangered (E), Vulnerable (V), Near Threatened (NT), Least Concern (C) or Not Protected ( ).

A - Indicates the Australian conservation status of each taxon under the *Environment Protection and Biodiversity Conservation Act 1999.* The values of EPBC are Conservation Dependent (CD), Critically Endangered (CE), Endangered (E), Extinct (EX), Extinct in the Wild (XW) and Vulnerable (V).

Records – The first number indicates the total number of records of the taxon for the record option selected (i.e. All, Confirmed or Specimens).
This number is output as 99999 if it equals or exceeds this value. The second number located after the / indicates the number of specimen records for the taxon.
This number is output as 999 if it equals or exceeds this value.

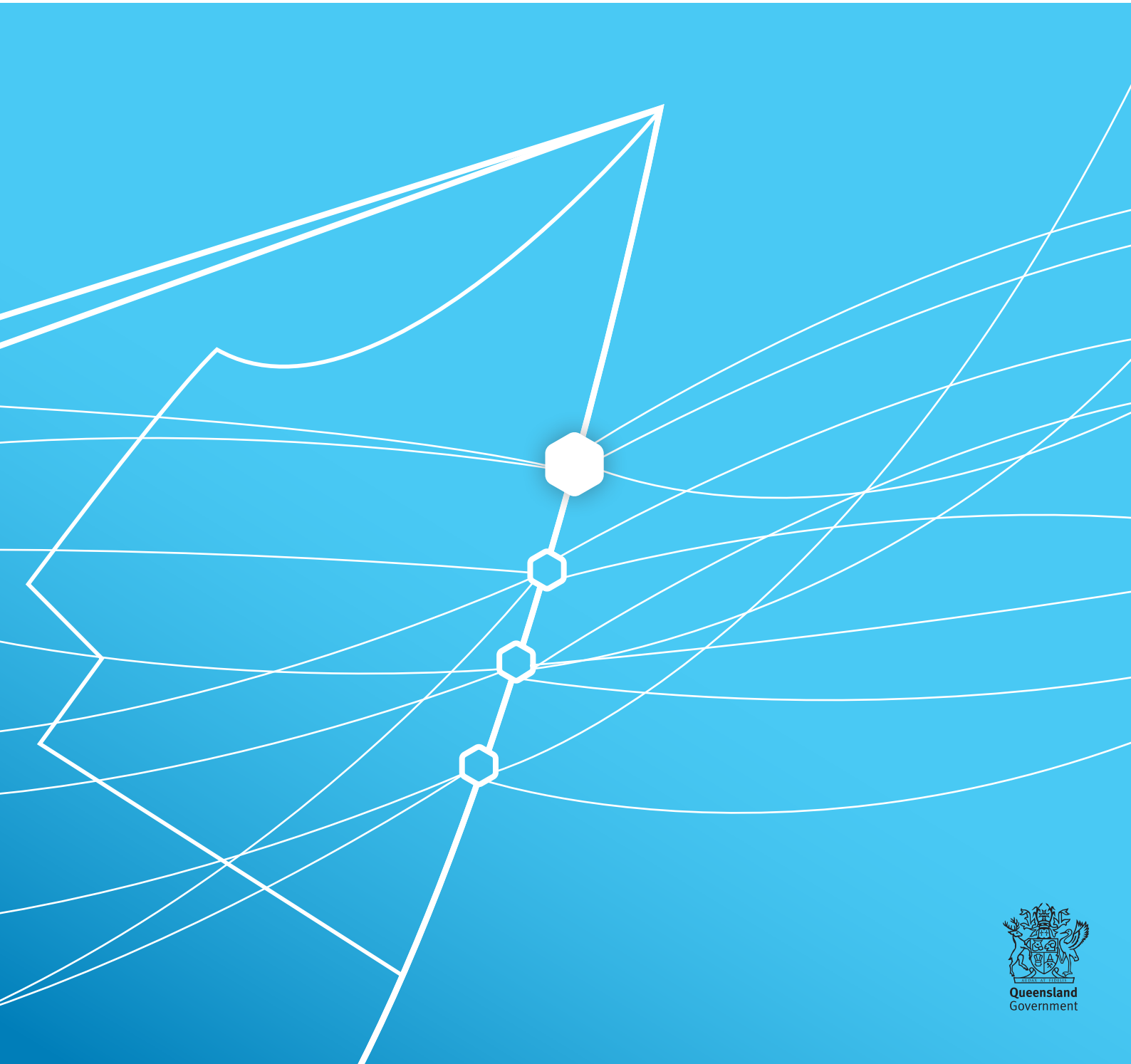
Priority port master planning

Evidence base documentation

Infrastructure and supply chain analysis

Priority Port of Townsville

Queensland | Australia | 2018



Queensland Government

Priority port master planning

Infrastructure and supply chain analysis

Priority Port of Townsville

Final

July 2017

Table of contents

Table index

Figure index

Appendices

Executive summary

Introduction

The Port of Townsville is located 1,360 kilometres north of Brisbane on the east coast of Queensland and situated on reclaimed land between Ross River and Ross Creek. The facility is a government owned corporation operated by the Port of Townsville Limited (PoTL).

The Port of Townsville currently operates 8 berths and is the largest container and automotive port in Northern Australia. It is critical to defence operations and cruise ship tourism in the region. It handled more than $10 billion in trade during the 2015/2016 financial year.

The Port of Townsville is one of four priority ports under the *Sustainable Ports Development Act 2015* (Ports Act). The Queensland Government is master planning for the priority ports in accordance with the Ports Act and to meet its commitments under the Reef 2050 Long-Term Sustainability Plan (the Reef 2050 Plan).

The Queensland Government is currently progressing master planning for the priority Port of Townsville.

The first phase involved the preparation of the Evidence Base Report (EBR) and was completed in December 2016. The second phase is the subject of this study – the Infrastructure and supply chain analysis report (Infrastructure study).

The scope of the Infrastructure study is to develop an infrastructure, supply chain and economic assessment of the priority Port of Townsville, including potential infrastructure and supply chain growth requirements within the master planned area over the master planning timeframes.

The approach adopted for the Infrastructure study consisted of a number of steps:

- Use of the information and recommendations of EBR as a reference and starting position, acknowledging that the EBR initial recommendations on a suggested master planned area (the precincts) may change as a result of the Infrastructure Study findings
- A literature review of recent, relevant studies and reports commissioned by Queensland Government agencies
- Communication with the Building Queensland's TEARC project team to ensure alignment of future master planning forecasts and the TEARC development
- Targeted stakeholder consultation
- A series of workshops with targeted stakeholders.

The Project Management Team included a representative from PoTL as an advisor.

Existing infrastructure locations and descriptions

Marine precinct:

The existing infrastructure within the proposed Marine precinct is bounded by a set of Marine infrastructure precincts which consist of:

- A ship anchorage point
- A dredged material placement area
- A ship pilot boarding ground

- Two connecting shipping channels to allow port access (the Sea Channel and the Platypus Channel), and an additional shipping channel (Arrival Channel) for the existing Berth 11
- Two ship swing basins (inner and outer) to allow ships to turn for berthing
- Three breakwaters (Western/Offshore and Eastern) to protect the harbours, berths and the entrance to the Ross Creek from rough seas.

There are also marine linkages beyond the existing port limits and the proposed master planned area which are critical to the operation of the Port of Townsville. These marine linkages are designated shipping routes, including specific passages, through reef areas along the Queensland coast.

Infrastructure and supply chain corridors precinct:

The Infrastructure and supply chain corridors precinct (ISCC1) is located at the boundary of the Port of Townsville's Port Industry and Commerce precinct and extends through the Townsville State Development Area (TSDA) until it connects with the North Coast Line (NCL) and the Mount Isa Rail Line (MIRL).

The ISCC1 precinct follows the proposed alignment of the Townsville Eastern Access Rail Corridor (TEARC) which is located within the Materials transportation and services corridor precinct of the TSDA. ISCC1 contains part of the Townsville Port Access Road (TPAR), also known as the Southern Port Road, including the existing bridge over the Ross River.

The ISCC 2 – Rail Corridors comprises sections the two main rail lines: the NCL MIRL that are closest to the Port of Townsville.

The ISCC 3 – Road Corridors comprises key primary and secondary road corridors used by port-related traffic.

Marine Services & Recreation precinct:

This Marine services & Recreation precinct includes the Breakwater Marina comprising infrastructure to cater for recreational, residential, commercial and administration uses.

Port industry & commerce precinct – TSDA and Port of Townsville quarry:

The TSDA spans an area of approximately 4900 hectares, six kilometres south-east of the Townsville Central Business District and immediately south of the Port of Townsville. The TSDA is a critical element of the North Queensland supply chain and is the key area for industrial development requiring access to the Port of Townsville.

The trunk infrastructure services (water/sewage) of the TSDA are connected to Townsville City Council (TCC) infrastructure.

The Port of Townsville quarry has been considered as a supply chain origin linked to future port expansion activities providing for the extraction and haulage of a maximum of 500,000 tonnes a year of rock with a total capacity to produce 11 million tonnes of material.

Environmental management precinct:

The Environmental management precinct occupies both environmentally and culturally sensitive areas within and adjacent to the TSDA. This precinct, covering more than 1800 hectares of land, protects wetlands, vegetation and fauna habitats closely related to the Great Barrier Reef Marine Park (GBRMP) and associated catchment.

Magnetic Island is located 8 kilometres offshore from Townsville in Cleveland Bay and has been considered part of the Environmental Management precinct. This island is effectively a satellite suburb of City of Townsville with over 2500 permanent residents. The current Port of Townsville

shipping channels run along the southern side of Magnetic Island. Magnetic Island is serviced by existing marine-related infrastructure relating to the ferry services between the island and the City of Townsville.

Economic analysis and growth scenarios

Current and historic peak trade at the Port of Townsville:

The Port of Townsville is a multi-commodity import and export port with current trade throughput (FY 2015-16) at around 9 million mass tonnes (including 59,000 TEU of containers) and over 600 visits by cargo vessels.

Historically, the port has handled a peak of almost 13 million tonnes which occurred in FY 2011-12 and included almost 750 vessels visits.

Geographic area served by the Port of Townsville:

The Port of Townsville has a geographical catchment with a current population base estimated at around 720,000 (as of mid-2016), of which almost 200,000 persons are located in the Townsville City Council local government area. The catchment area services coastal communities from Cairns to Mackay, and also the North West Minerals Province (NWMP) around Mount Isa for minerals. The catchment also encompasses central and western Queensland for agricultural products connected via road to Townsville.

Future trade forecasts for the Port of Townsville:

The forecasting approach uses a timeframe to 2050 with three main growth scenarios to guide the infrastructure assessment and master planning processes for the priority Port of Townsville.

The three scenarios have been jointly developed and agreed with GHD, DSD, Queensland Treasury, the Department of Transport and Main Roads and PoTL, and have also been reviewed by other government stakeholders and agencies.

There is inherent uncertainty in growth projections, in the possible size and timing of future development and the timing of trigger points for industry developments.

The results of the modelling for **scenario one** indicate:

- Maximum port throughput of 10.2 million tonnes per annum (mtpa) comprising:
    - Liquid Bulk 2.1 mtpa
    - Dry Bulk 6.2 mtpa
    - Break-bulk 0.5 mtpa
    - Containers 1.2 mtpa (or 112,000 TEU)
    - Livestock (Cattle) 0.2 mtpa.

The results of the modelling for **scenario 2** indicate:

- Maximum port throughput of 18.4 mtpa comprising:
    - Liquid Bulk 2.4 mtpa
    - Dry Bulk 13.6 mtpa
    - Break-bulk 0.5 mtpa
    - Containers 1.7 mtpa (or 186,000 TEU)
    - Livestock (Cattle) 0.2 mtpa

The results of the modelling for **scenario 3** indicate:

- Maximum port throughput of 28.3 mtpa comprising:
  - Liquid Bulk 2.8 mtpa
  - Dry Bulk 23.1 mtpa
  - Break-bulk 0.5 mtpa
  - Containers 1.7 mtpa (or 186,000 TEU)
  - Livestock (Cattle) 0.2 mtpa.

Assessment of future infrastructure and supply chain requirements

The results of the future trade growth scenarios are compared with the estimated levels of the existing infrastructure capacity to produce a set of implications, where applicable, regarding any needs for additional infrastructure capacity and possible resulting impacts for the port's proposed master plan area and overlays.

Scenario 1:

Infrastructure component	Estimated effect(s)	Implications for master planning
Anchorages	Sufficient existing capacity	Remain as total 13 anchorage points.
Shipping Channels	Sufficient existing capacity	Remain as single-lane channels with delays to non-port users waiting for commercial shipping to swing into harbour.
	With increased container demand, the capacity of existing channels limits ship sizes, particularly direct call Australia/Asia services. Some larger cruise-ships and car carriers may be impacted	Potential channel modifications (widening) and legislated storage of dredged material in holding area for future land reclamation use and beneficial reuse.
Berths and land	Sufficient existing capacity & capability	As a result of increased container trade, logistics operations and land needs are likely to intensify around Berths 3/4 (container terminals), including the increased storage of empty containers. This may require 24/7 landside operations and a port truck traffic management plan to accommodate increased container high productivity freight vehicles (HPFV) access.
Road network	Sufficient existing capacity & capability	No change required to current specifications & operations of the primary and secondary road network.

Rail network	Sufficient existing capacity with some inefficiencies remaining	No change required to current specifications & operations unless triggered by TEARC Business Case investment decision to proceed. If TEARC proceeds, the preferred alignment needs to be addressed in proposed master planned area.
Industrial Areas	Sufficient existing capacity & capability	Increased container trade may trigger requirement for 24/7 logistics operations and container HPFV access to/from distribution centres in industrial areas.

Legend:	Description
	Sufficient existing capacity
	Approaching existing capacity
	Insufficient existing capacity

Source: GHD analysis.

Scenario 2:

Infrastructure component	Estimated effect(s)	Implications for master planning
Anchorages	Sufficient existing capacity & capability	Remain as total 13 anchorage points.
Shipping Channels	Sufficient existing capacity	Remain as single-lane channels with delays to non-port users waiting for commercial shipping to swing into harbour.
	With increased container demand, capability of existing channels limits ship sizes if Australia/Asia services to direct call. Some larger cruise-ships, car carriers, and deeper-draft tankers also potentially impacted	Potential channel modifications (widening and deepening) and legislated storage of dredged material in holding area for future land reclamation use and beneficial reuse to develop new berths.
		Breakwater and berth construction would require need for operation of PoTL rock quarry & supply chain to port during this construction period.
Berths and land	Insufficient existing berth capacity for maximum dry and liquid bulk demand suggesting shortfall of possibly one berth for dry bulk and one berth for liquid bulk	Requirement for two new berths with associated capital dredging and storage - dry bulk in shed(s) and liquid as tanks and rail connectivity.

	Increased container terminal demand and associated logistics operations around Berths 3/4	As a result of increased container trade, logistics operations and land needs are likely to intensify around Berths 3/4 (container terminal), including the increased storage of empty containers. This may require 24/7 landside operations and port truck traffic management plan to accommodate increased container HPFV access.
	Increased break-bulk project cargoes associated with assumed higher level of mineral developments	Efficient project cargo operations require land for lay-down and special vehicle access to/from port and project sites suggesting need to secure option of additional area in TSDA.
	Increased trade, including cruise-ship and Australian Defence Force (ADF) vessel visits, and use of enlarged channels by larger vessels will see an increased need for tugs	Increased tug harbour capacity requiring relocation of the tug harbour from Berth 8 to a future expanded port land area.
	Increased trade activity will require services and utilities	Increased potable water and wastewater services which may require augmentation of networks external to the port.
Road network	Sufficient existing capacity & capability based on a possible required duplication of TPAR for increased demand in future background traffic growth	No change needed to current specifications and operations noting TPAR duplication may be required if TPAR used by non-port related traffic.
Rail network	Insufficient existing capacity & capability	TEARC solution and alignment to and within port requiring this corridor to be identified and protected in master plan and port overlay.
Landside - Industrial Areas	Sufficient existing capacity & capability	Increased container trade may trigger requirement for 24/7 logistics operations and container HPFV access to/from distribution centres in industrial areas.

Legend:	Description
	Sufficient existing capacity
	Approaching existing capacity
	Insufficient existing capacity

Source: GHD analysis.

Scenario 3:

Infrastructure component	Estimated effect(s)	Implications for master planning
Anchorages	Sufficient existing capacity & capability	Remain as total 13 anchorage points.
Shipping Channels	Sufficient existing capacity	Remain as single-lane channels with delays to non-port users waiting for commercial shipping to swing into harbour.
	With increased container demand, capability of existing channels limits ship sizes if Australia/Asia services to direct call. Some larger cruise-ships, car carriers, and deeper-draft bulk carriers and tankers also potentially impacted	Potential channel modifications (widening and deepening) and legislated storage of dredged material in holding area for future land reclamation use and beneficial reuse to develop new berths.
		Breakwater and berth construction would require need for operation of PoTL rock quarry & supply chain to port during this construction period.
Berths & land	Insufficient existing berth capacity for maximum dry and liquid bulk demand suggesting shortfall of possibly two berths for dry bulk and one berth for liquid bulk	Requirement for three additional new berths with associated capital dredging and storage (dry bulk in possible shed(s) and liquid as tanks and rail connectivity). Alternative could be to locate dry bulk and liquid bulk storage in TSDA with conveyor/pipelines using TEARC – this would need protecting in master planned area.
	Increased container terminal and associated logistics operations around Berths 3/4	As a result of increased container trade, logistics operations and land needs are likely to intensify around Berths 3/4 (container terminal), including the increased storage of empty containers. This may require 24/7 landside operations and port truck traffic management plan to accommodate increased container HPFV access.

	Increased break-bulk project cargoes associated with assumed higher level of mineral developments	Efficient project cargo operations require need for land for lay-down and special vehicle access to/from port and project sites suggesting need to secure option of additional area in TSDA.
	Increased trade, including cruise-ship and ADF vessel visits, and use of enlarged channels by larger vessels will increase need for tugs	Increased tug harbour capacity requiring relocation of the tug harbour from Berth 8 to a future expanded port land area.
	Increased cruise ship and ADF vessel visits and limited existing capacity at Berth 10.	Creation of new additional berth with associated capital dredging to create new basin/channel that will operate as cruise ship terminal. This involves separating the Ross Creek / Magnetic Island ferry traffic from commercial shipping at the start of the Platypus Shipping Channel bounded by the Western Breakwater to limit conflicting activities.
	Increased trade dry bulk activity will require services and utilities.	Increased demand for non-potable water and wastewater services for stockpiles which may require augmentation of networks external to the port.
Road network	Sufficient existing capacity & capability based on a possible required duplication of TPAR for increased demand in future background traffic growth	No change needed to current specifications and operations noting TPAR duplication may be required if TPAR used by non-port related traffic.
Rail network	Insufficient existing capacity & capability	TEARC solution and alignment to and within Port requiring this corridor to be identified and protected in the master plan and port overlay.
Landside - Industrial Areas	Sufficient existing capacity & capability	Increased container trade may trigger requirement for 24/7 logistics operations and container HPFV access to/from distribution centres in industrial areas.

Legend:	Description
	Sufficient existing capacity
	Approaching existing capacity
	Insufficient existing capacity

Source: GHD analysis.

Suggestions for the draft master plan content

Precincts:

It is suggested that the initial EBR proposed master planned study area (scope) is modified with:

- Inclusion of the southern section of the TPAR, which includes the road train de-coupling area, in the Infrastructure and supply chain corridor precinct to recognise its role in serving the port and future port-related development in the TSDA
- The inner ship anchorage point remains as the sole anchorage infrastructure within the Marine Infrastructure precinct for port master planning purposes, and the Marine Infrastructure precinct is not extended beyond existing port limits to accommodate the outer ship anchorage points
- The dredged material placement area as a Marine infrastructure precinct remains as the sole materials placement area for port master planning purposes, and the Marine infrastructure precinct is not extended beyond existing port limits due to restrictions on the master planned area outlined in the Ports Act
- The ship pilot boarding ground currently located in the Marine precinct is recognised as a Marine Infrastructure precinct for port master planning purposes to help protect its function in the safe and efficient passage of commercial vessels using the Port of Townsville
- The shipping arrival channel currently located in the Marine infrastructure precinct is also recognised as important infrastructure for port master planning purposes
- The inner and outer ship swing basins currently located in the Marine infrastructure precinct are recognised as important infrastructure for port master planning purposes
- The Eastern, Western and Offshore Breakwaters are recognised as part of the Marine infrastructure precinct for port master planning purposes
- The Marine infrastructure precinct is extended for port master planning purposes to include the potential future location of a cruise ship terminal and the separation of non-commercial marine traffic (i.e. ferries and recreational boating) from commercial marine traffic visiting the port for safety reasons
- Removal of the EBR PoTL Quarry precinct due to the nature of its future operation if required for port construction projects as opposed to daily port operations. If the PoTL Quarry becomes operational, permits and approvals outside of the master planning process will be required. Otherwise, material can be sourced from other local quarries outside the proposed master planned area and hauled via the Flinders Highway
- Removal of the EBR Elliot Springs precinct as it is now an approved area of residential development within the TCC planning scheme.

Infrastructure and supply-chain networks:

The following are specific precinct related and itemised infrastructure suggestions for the Port of Townsville draft master plan:

1. As existing single-user berth agreements come close to termination, multi-user agreements are investigated as a priority to provide access to latent capacity where commodity compatibility and design enhancements exist and facilities are under-utilised
2. Protect the routes used by port traffic close to and within the Port, in particular the routing of over-size / over-mass vehicles to reduce delays and manage intersection upgrades

3. Consider removal of the rail crossing and re-routing of the rail line across Archer Street to improve both road and rail efficiency, subject to port users migrating to new loading facilities

4. Inclusion of the preferred alignment of the TEARC to protect future improved rail operations to/from and within the port which may include use of the existing port reclaimed area to route rail into the port and remove its existing alignment over Archer Street

5. Continued protection of required land for future bulk handling connection to the port, such as conveyor/pipeline within the Coordinator-General owned materials transportation and services corridor

6. Recommend that TPAR is managed in the future, once service-levels start to significantly degrade, as a freight-only road or restricted for non-port related background traffic, noting its management is beyond the scope of the master plan

7. Requirement that sufficient appropriately zoned land close to the port is identified and reserved in the TSDA for port-related storage and logistics activities such as project cargo lay-down area and warehousing for consolidating / deconsolidating containerised cargoes. This port-related requirement for land may possibly be up to 100 (or more) hectares over the period out to 2050 dependent on market choice of other industrial locations around Townsville. Currently, the TSDA Development Scheme has appropriately zoned land in the TSDA for port-related storage and logistics activities, should these be required by proponents in the future

8. Based on the possibility of wider and longer containerships, cruise-ships, and pure car carriers calling at the Port of Townsville in the future, a requirement to initially widen the existing shipping channels and possibly deepen the channels at a later stage as part of a port expansion for larger (fully-laden) dry bulk carriers and tankers. It is noted that this recommendation has been articulated in the Townsville City Deal and the recent endorsement of the Channel Capacity Upgrade Business Case by shareholding Ministers of the Queensland Government

9. Requirement of up to three additional berths in an expanded port area with associated new marine infrastructure (breakwater protection, a ship swing basin and berth pockets) and land behind the berths for cargo handling and storage with road and rail connections

10. With increased trade volumes and ship calls, combined with increased recreational boating, a need to separate Ross Creek marine traffic from commercial shipping using the port so as to mitigate the possible increased risk of navigational incidents and the possible decline in the schedule integrity of Magnetic Island ferry sailings for island residents and visitors

11. Given future increased use of Berth 10 by the cruise-ship industry and the ADF(navy), the protection of an area along and behind the Western/Offshore Breakwater for a possible new Berth to accommodate additional cruise ship movements. This may include the separation of Ross Creek ferry and recreational boat traffic from commercial port traffic and provision of a connection to the existing cruise-ship facilities at Berth 10.

Glossary

The Study uses a series of terms and abbreviations which are detailed in Table 1 below.

Table 1 Glossary of terms, abbreviations and definitions

Term	Description
ADF	Australian Defence Force
Break-bulk	Break-bulk refers to a category of cargo handling and shipment of general and project cargoes without the use of unitised shipping containers
CAGR	Compound Annual Growth Rate (percentage)
Cargo	Freight transported by commercial shipping and handled at a commercial port
DILGP	Queensland Government Department of Infrastructure, Local Government and Planning
DSD	Queensland Government Department of State Development
DTMR	Queensland Government Department of Transport and Main Roads
EBR	Evidence Base Report for the priority Port of Townsville - produced by Advisian (Dec. 2016)
EMF	Environmental Management Framework
FNQ	Far North Queensland
Freight	Goods or commodities transported by ships, trucks and trains
FY(E)	Financial Year (End)
GBR	Great Barrier Reef
GBRMPA	Great Barrier Reef Marine Park Authority
GBRWHA	Great Barrier Reef World Heritage Area
HAT	Highest Astronomical Tide
HLP	Heavy Load Platform (road transportation permission category)
HML	Higher Mass Limit (road transportation permission category)
HPFV	High Productivity Freight Vehicle
HV	Heavy (freight) Vehicle
km	Kilometre
LAT	Lowest Astronomical Tide
LGA	Local Government Area (council or shire)
LOA	Length Over All of a ship or vessel

m	Metre
MIRL	Mount Isa Rail Line
MSQ	Queensland Government Maritime Safety Queensland (attached to DTMR)
mt	Million tonnes
mtpa	Million tonnes per annum
NCL	North Coast rail-line
Nm	Nautical mile
OUV	Outstanding Universal Value
PEP	Port Expansion Project of the Port of Townsville
Ports Act	*Sustainable Ports Development Act 2015*
PoTL	Port of Townsville Limited – the port of Townsville manager (authority)
QR	Queensland Rail
Ro/Ro	Roll-on / Roll-off (type of cargo handling and ship involving ramps)
Supply Chain	Transportation, or movement, of types of freight along geographic routes or corridors from initial places of loading to final places of distribution/production/consumption. Supply chains can be either domestic (intra- or inter- state) or international and for this study will use the Port of Townsville, or a competing port, as a maritime import/export gateway
TEARC	Townsville Eastern Access Rail Corridor
TEU	Twenty-foot length Equivalent Unit – measure of the quantity of shipping containers shipped, handled at a commercial port, or as a measure of containerised capacity
tph	tonnes per hour (cargo handling rate)
Trade	A physical grouping of goods/commodities imported or exported at a commercial port requiring a specific form of port handling (infrastructure/equipment) and design of ship for maritime transportation
Transport Mode	Type of inland (landside) transportation, either Road (by truck) or Rail (by train)
TSDA	Townsville State Development Area
Vessel	Alternative name for a ship

1. Introduction

1.1 Overview of the Port of Townsville

The Port of Townsville is located 1,360 kilometres north of Brisbane on the east coast of Queensland (see Figure 1) and situated on reclaimed land between Ross River and Ross Creek. The facility is a government owned corporation operated by the Port of Townsville Limited (PoTL).

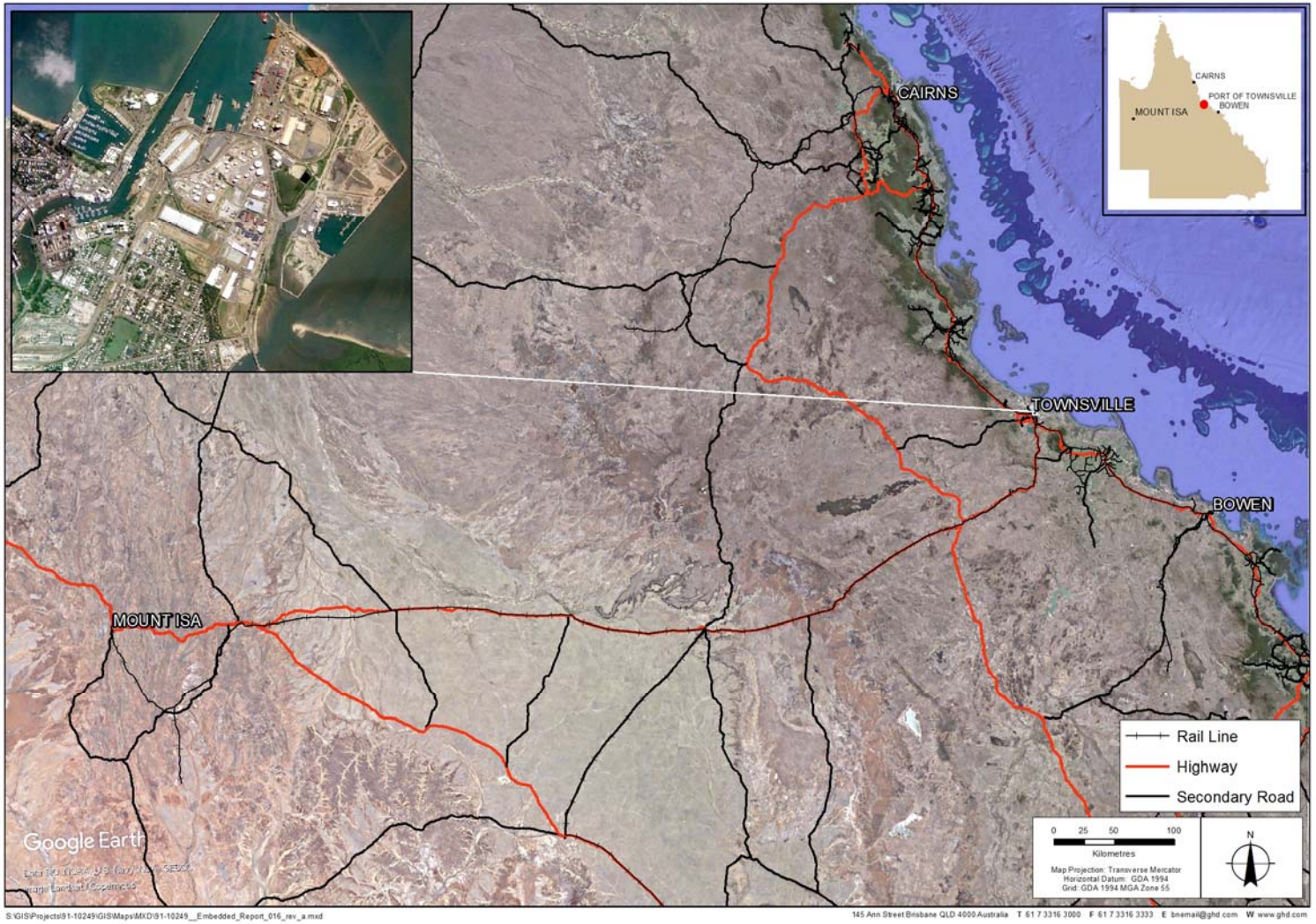
The port has been the economic cornerstone of the North Queensland region since it started trading in 1864, supporting around 8000 jobs and servicing a current regional population of around 720,000 people. It handled more than $10 billion in trade during the 2015/2016 financial year.

The Port of Townsville currently operates 8 berths and is the largest container and automotive port in northern Australia. It is critical to defence operations and cruise ship tourism in the region.

More than 20 shipping lines operate out of the port, offering more than 40 services and covering 136 ports around the world. Townsville has close proximity to Asian markets and is the largest exporter in Australia of copper, zinc, lead and minerals. North Queensland farmers also export agricultural products and sugar.

The Port of Townsville is also important for imports. Imports include essential everyday goods such as fuel, gas, furniture, electrical goods, cement, bitumen and vehicles.

Figure 1 Map of the location of the Port of Townsville



Source: GHD mapping.

1.2 Project background

The Port of Townsville is one of four priority ports under the Ports Act. The Queensland Government is master planning for the priority ports in accordance with the Ports Act and to meet its commitments under the Reef 2050 Long-Term Sustainability Plan (the Reef 2050 Plan).

Priority port master planning across all four priority ports has a timeframe out to 2050 to align with Reef 2050. The Ports Act outlines a strategic planning process for priority ports which seeks to obtain a balance between environmental values and the protection of the States' priority ports which are vital economic infrastructure.

Under the Ports Act master planning is required to consider issues beyond strategic port land and may include surrounding areas in order to provide a comprehensive account of marine and land-based environmental impacts of port development associated supply chains.

The Queensland Government is currently progressing master planning for the priority Port of Townsville.

The first phase involved the preparation of the EBR and was completed in December 2016. The second phase is the subject of the Infrastructure study – the Infrastructure and supply chain analysis report.

1.3 Study scope of work

The scope of the Infrastructure study is to develop an infrastructure, supply chain and economic assessment of the priority Port of Townsville, including potential infrastructure and supply chain growth requirements within the proposed master planned area over the master planning timeframes.

Specifically, the Infrastructure Study covers:

1. an existing situation analysis of infrastructure and supply chain activities/industries supporting the priority Port of Townsville
2. an analysis of current and future trade growth through the priority Port of Townsville and the development of three trade growth scenarios out to 2050
3. an assessment of future infrastructure and supply chain requirements under each trade growth scenario
4. suggestions for master plan content including: objectives and desired outcomes for the proposed master planned area and each draft precinct and identification of draft state interests in accordance with the requirements of the Ports Act.

It should be noted that interface and port overlay aspects are the subject of a separate annexure to this study.

1.4 Study approach

The approach adopted for the Infrastructure study consisted of a number of steps:

- Use of the information and recommendations of the EBR as a reference and starting position, acknowledging that the EBR initial recommendations on a proposed master planned area and draft precincts may change as a result of the Infrastructure Study findings
- A literature review of recent, relevant studies and reports commissioned by Queensland Government agencies involving existing and potential new markets, resource industries,

future agricultural development plans, port-related supply chains and infrastructure – see list of literature references in Appendix A

- Communication with the Building Queensland's TEARC project team to ensure alignment of future master planning forecasts and the TEARC development
- Stakeholder consultation to:
    - Validate information and understand the necessary detail of future operations and supply chains (data provided by stakeholders in confidence)
    - Validate findings and suggestions for the draft master planning.
- A series of workshops with targeted stakeholders to:
    - Develop and agree on the use of the growth scenarios used to assess future infrastructure and supply chain requirements
    - Inform the development of the growth scenarios and agree on the use of three growth scenarios
    - Review, inform and validate the findings of the infrastructure and supply chain assessment.
- The Project Management Team included a representative from PoTL as an advisor.

The findings of the targeted stakeholder consultations have assisted in the identification of the future infrastructure and supply chain network requirements over the future development period out to 2050.

1.5 Evidence Base Report - initial reference point

The EBR forms the initial reference point and provides initial recommendations for the priority Port of Townsville proposed master planned area and draft precincts. This report considers the EBR initial recommendations and provides further analysis.

Prior to the commencement of the Infrastructure study, the draft precincts, as presented in the EBR, were further refined by the then Department of State Development to ensure consistency with classifications across the four priority ports. A Marine infrastructure precinct was added and a new map (dated 15/05/2017) with the seventh precinct classification issued (see Figure 2). This did not modify the extent of the proposed master planned area.

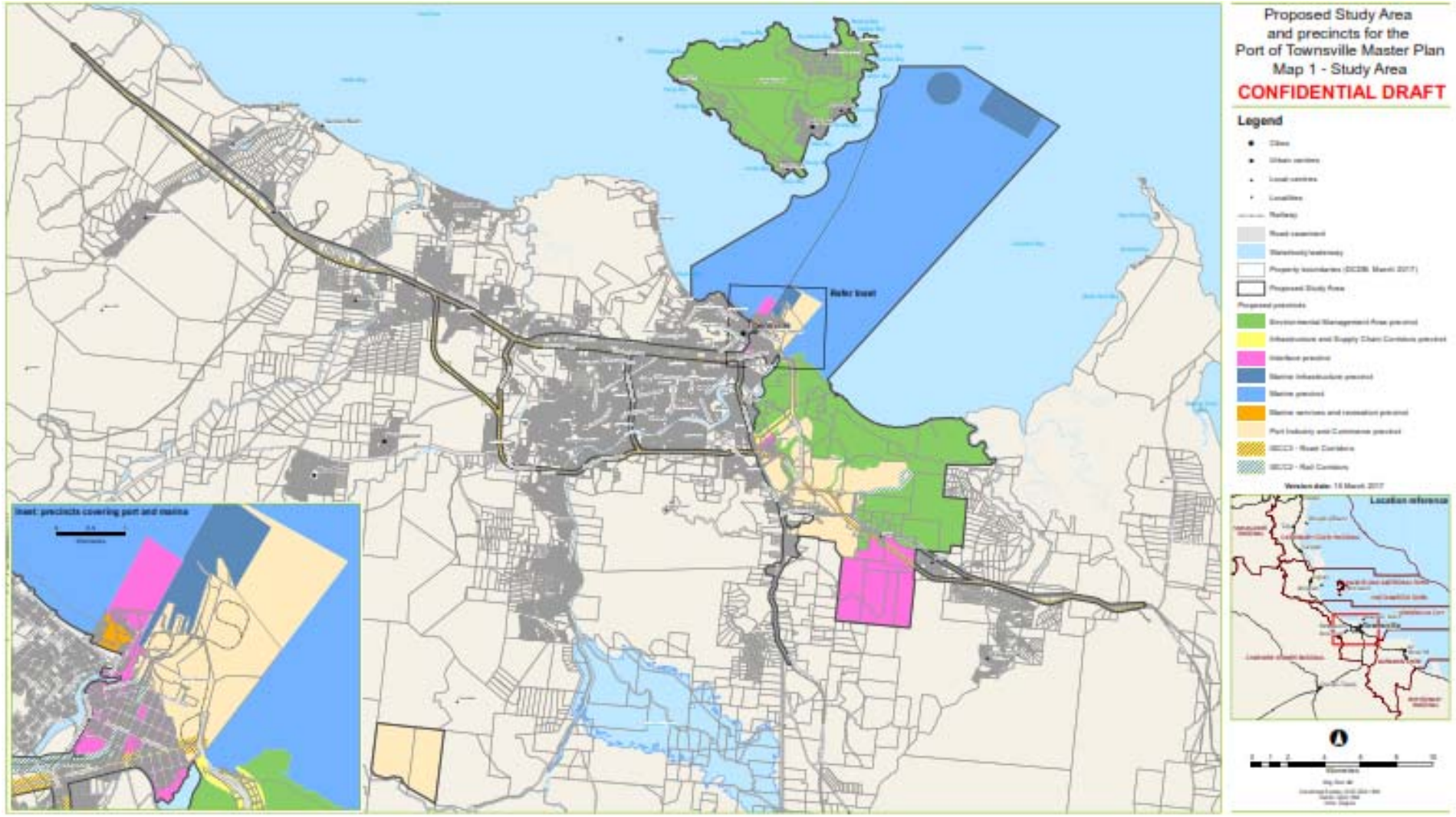
The seven draft precinct classifications comprise:

1. Environmental management precinct – to include areas with identified environmental values, including those that contribute to the OUV of the GBRWHA, and/or identified in planning instruments as having a predominantly environmental management purpose, where development should be limited

- Infrastructure and supply chain corridors precinct - to include areas with existing and planned infrastructure and supply chain corridors over land and marine areas
- Interface precinct – to include areas where there are known or possible incompatible land use activities
- Marine infrastructure precinct - to include existing and planned marine infrastructure corridors and nodes
- Marine precinct – to include marine areas identified as having environmental values, including those that contribute to the OUV of the GBRWHA, where development should be limited

- Marine services and recreation precinct - to include areas identified in planning instruments to provide for marine services and recreation
- Port industry and commerce precinct – to include areas identified in planning instruments to predominantly provide for port operations, industry and commerce.

Figure 2 Priority port of Townsville proposed study area, master planned area and precincts



Source: EBR, Dec. 2016 (Advisian) / Queensland Government DSD re-mapping issued 15/03/2017.

1.6 Report structure

This report comprises the following:

- Existing infrastructure locations and descriptions (Section 2) – summarises the EBR data and presents additional information about the infrastructure identified during the study
- Economic analysis and growth scenarios (Section 3) – discusses recent trade developments at the port of Townsville; the port's geographical catchment area; relevant industry trends and emerging issues; and presents three future trade growth scenarios (Scenario 1, Scenario 2 and Scenario 3)
- Assessment of future infrastructure & supply chain requirements (Section 4) – presents estimates of the existing port and connecting landside infrastructure capacity; compares this with future capacity needs under the different trade growth scenarios, and suggests options on the provision of additional infrastructure to meet any gaps/shortfalls
- Suggestions for draft master plan (Section 5) – discusses proposed content of the draft master plan, and provides suggestions on how to achieve state interests, objectives and desired outcomes.

The resulting interface and port overlay aspects are the subject of a separate annexure to the Infrastructure study.

2. Existing infrastructure locations and descriptions

2.1 Introduction to this section

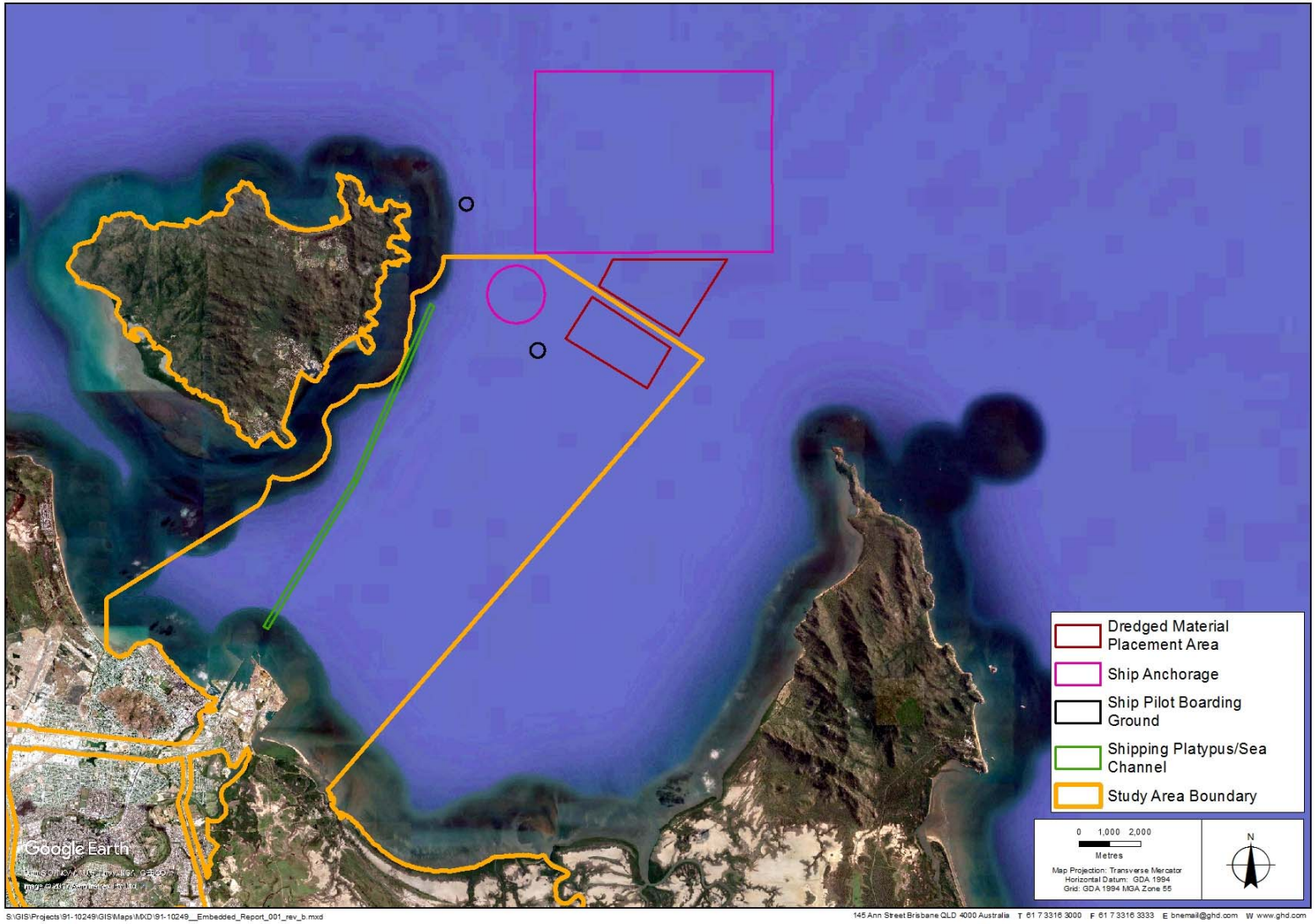
This section presents an overview of the locations and summary descriptions of existing infrastructure relevant to the priority Port of Townsville. The existing capacity and capability of this infrastructure is analysed in section 4.2.

2.2 Existing infrastructure - Marine precinct

The existing infrastructure within the proposed Marine precinct is bounded by a set of Marine infrastructure precincts which consist of the following existing marine-side infrastructure as shown in the maps of the Marine precinct (Figure 3 – outer area, and Figure 4 – inner area):

- A ship anchorage point
- A dredged material placement area
- A ship pilot boarding ground
- Two connecting shipping channels to allow port access (the Sea Channel and the Platypus Channel), and an additional shipping channel (Arrival Channel) for the existing Berth 11
- Two ship swing basins (inner and outer) to allow ships to turn for berthing
- Three breakwaters (Offshore/Western and Eastern) to protect the harbours, berths and the entrance to the Ross Creek from rough seas.

Figure 3 Map of existing infrastructure within the Marine precinct – outer area



Source: GHD mapping.

Figure 4 Map of existing infrastructure within the Marine precinct – inner area

Source: GHD mapping.

The existing infrastructure in the Marine precinct is now described in more detail.

2.2.1 Ship Anchorages

Background

Ship anchorages are a critical part of the operations of ports including the Port of Townsville. The designated anchorages are waiting points for vessels prior to entering the port to go to a berth to either unload or load cargo. The anchorages provide a critical function in the supply chain allowing optimal use of port infrastructure by vessels and cargoes, and maximum availability of vessels to bring commodities to markets. Some vessels enter the port directly and do not use anchorages.

Anchorage points – inside and outside of port limits

Within port limits, the existing ship anchorage point is located in the Marine infrastructure precinct. This ship anchorage has a minimum water depth of 11 metres allowing a maximum vessel draft of 8 metres, and a turning diameter of one nautical mile.

However, outside of port limits, and in the GBRMP, there are an additional 12 existing outer anchorage points available for vessels visiting the Port of Townville (see Table 2 for details).

Table 2 Port of Townsville Ship Anchorage Points

Category	No	Water Depth (metres)	Diameter (nautical mile)	Max. Vessel Draft (metres)
Inner anchorage point	1	11	1	8
Outer anchorage points	2	14	1	8
	3	14	1	8
	4	16	1	10
	5	17	1	11
	6	16	1	10
	7	18	1	12
	8	19	1	13
	9	19	1	13
	10	19	1	13
	11	19	1	13
	12	20	1	14
	13	21	1	15

Sources: PoTL/DTMR-MSQ data.

The inclusion of the outer ship anchorage points in the Marine infrastructure precincts for Port of Townsville master planning would mean that the draft precinct would have to be extended outwards beyond port limits to include part of the neighbouring GBRMP. These areas cannot be included in the master planned area as the Ports Act restricts a master planned area to outside the GBRMP and within port limits.

2.2.2 Dredged Material Placement Area

Background

Dredging involves the digging, excavating or removing of material from waterways to deepen channels, create harbours and maintain navigation channels and approaches to ports at defined depths to allow the safe passage of vessels. Dredging can either be capital dredging associated with new navigation channels, berth pockets and swing basins, or maintenance dredging that is necessary to maintain existing and approved seafloor profiles (DTMR 2016).

Capital dredging is an essential part of port operations and is required to create new, or improve existing navigation channels, berth pockets and swing basins.

The Ports Act prohibits major capital dredging for development of new or expansion of existing port facilities in the GBRWHA outside the priority ports. The Ports Act allows capital dredging for priority ports, however the dredged material generated must be beneficially reused.

Maintenance dredging involves dredging carried out for the purposes of removing sediments that have accumulated in the existing navigation channels, berth pockets, approaches and swing basins of a port in order to maintain an existing approved capital dredging seafloor profile.

Maintenance dredge material may continue to be placed at sea in accordance with existing approvals and the Maintenance Dredging Strategy for Great Barrier Reef Ports (DTMR 2016) which was released in direct response to Reef 2050 action WQA16.

Future capital dredged material will need to be beneficially reused for approved port expansion purposes, and non-reusable maintenance dredge material will need to be placed in the approved area. In the past, some suitable maintenance dredged material has been used by the Port of Townsville to reclaim land around the port.

The quantity of annual maintenance dredge material from the channels, inner and outer harbours for placement by the Port of Townsville is typically around 450,000 cubic metres[1] with volumes varying on past weather and coastal materials movement events. The dredge material is typically unconsolidated clays and silt resulting from the natural processes of the Ross and Burdekin Rivers combined with tidal movements.

Dredged material placement area

The Dredged material placement area (DMPA) is located in the Marine infrastructure precinct which has been used in the past for the placement of both capital and maintenance dredged material. The DMPA extends beyond the existing port limits into the neighbouring GBRMP / GBRWHA. Since the operation of the Ports Act, the placement area can only be used for the placement of maintenance dredged material with capital dredged material to be beneficially reused.

2.2.3 Ship Pilot Boarding Grounds

There are currently two ship pilot boarding grounds used by ships entering and departing the Port of Townsville. These grounds are used for pilot boats to meet with commercial ships whereby a pilot either climbs aboard an arriving ship or climbs off a departing ship in order to

[1] PoTL statistic from Port of Townsville Stakeholder presentation to Magnetic Island residents, May 2017.

safely navigate ships through the channels to/from the berths at the port. One is located within port limits, whilst the other is located outside of the port limits in the neighbouring GBRMP. The existence and location of the ship boarding ground is important to recognise given the requirement to provide safe and efficient passage to commercial vessels using the Port of Townsville.

2.2.4 Shipping Channels

There are currently two main shipping channels connecting with the Port of Townsville which are located in the Marine infrastructure precinct.

The vessels visiting the Port of Townsville use an approximately 13 kilometre long single-lane channel, divided into two access channels, the Sea Channel and the Platypus Channel. The minimum width of the Platypus Channel and its shape currently limits its capability to provide 24/7 access to vessels of certain specifications (maximum Panamax size class of vessels with tidal assistance) due to bend and wind impacts. Tidal assistance, in combination with allowed vessel under keel clearance by the port's Harbour Master, provides an additional water depth for arriving and departing vessels on rising or falling tides beyond the minimum (at all times) declared water depth. Table 3 outlines the main specifications of the two channels.

Table 3 Port of Townsville Shipping Channels

Name	Location	Length	Width	Maintained Actual depth*	Max Vessel Beam
Sea Channel	Deep water to south of Magnetic Island	Approx. 6 kilometres	92 metres	-11.7 metres	32.3 metres
Platypus Channel	South of Magnetic Island to the Port swing basins	Approx. 7 kilometres	80 metres	-11.7 metres	32.8 metres

Sources: PoTL/DTMR-MSQ data.

(*) Declared Actual Depths below port datum (Lowest Astronomical Tide) as of 30th June 2017 per Notice to Mariners 257 (T) of 2017 authorised by Regional Harbour Master (Townsville), MSQ.

There is also an additional smaller access channel providing access to Berth 11, known as the Arrival Channel. The main function of the Arrival Channel is to provide deep-water access in a limited area to Berth 11. The Arrival Channel is located in the Marine infrastructure precinct which recognises its role to provide access for commercial vessels using Berth 11.

2.2.5 Ship Swing Basins

There are currently two ship swing basins, an outer and an inner, which provide sufficient area and depth for the commercial vessels manoeuvring within the harbour to/from the berths of the Port of Townsville. The specifications of the two ship swing basins are outlined in Table 4.

Table 4 Port of Townsville Ship Swing Basins

Location	Maximum Vessel LOA	Minimum Swing Diameter
Outer harbour - Berth 11	238 metres	1.6 times LOA
Inner harbour - Between Berths 1 & Berth 10	238 metres	-

Sources: PoTL/MSQ data.

The location of the two ship swing basins in the Marine infrastructure precinct is important given the need to provide adequate access to commercial vessels using the berths at the Port of Townsville.

2.2.6 Breakwaters

There are currently three breakwaters - Eastern, Western and Offshore – which provide coastal protection for the harbour, berths, and commercial vessels at the Port of Townsville. The Western and Offshore Breakwaters also form boundaries of an Interface precinct which includes the Townsville casino and convention centre area.

The three breakwaters are included in the Marine infrastructure precinct to recognise that these provide adequate coastal protection for the Port of Townsville.

2.2.7 Marine linkages beyond the port limits and master planned area

There are also marine linkages beyond the existing port limits and the proposed master planned area which are critical to the operation of the Port of Townsville. These marine linkages are designated shipping routes, including specific passages, through reef areas along the Queensland coast. The safe passage of vessels through these environmentally sensitive areas is managed by the Australian government though a combination of real-time vessel traffic management and monitoring systems, and the operation of reef pilots.

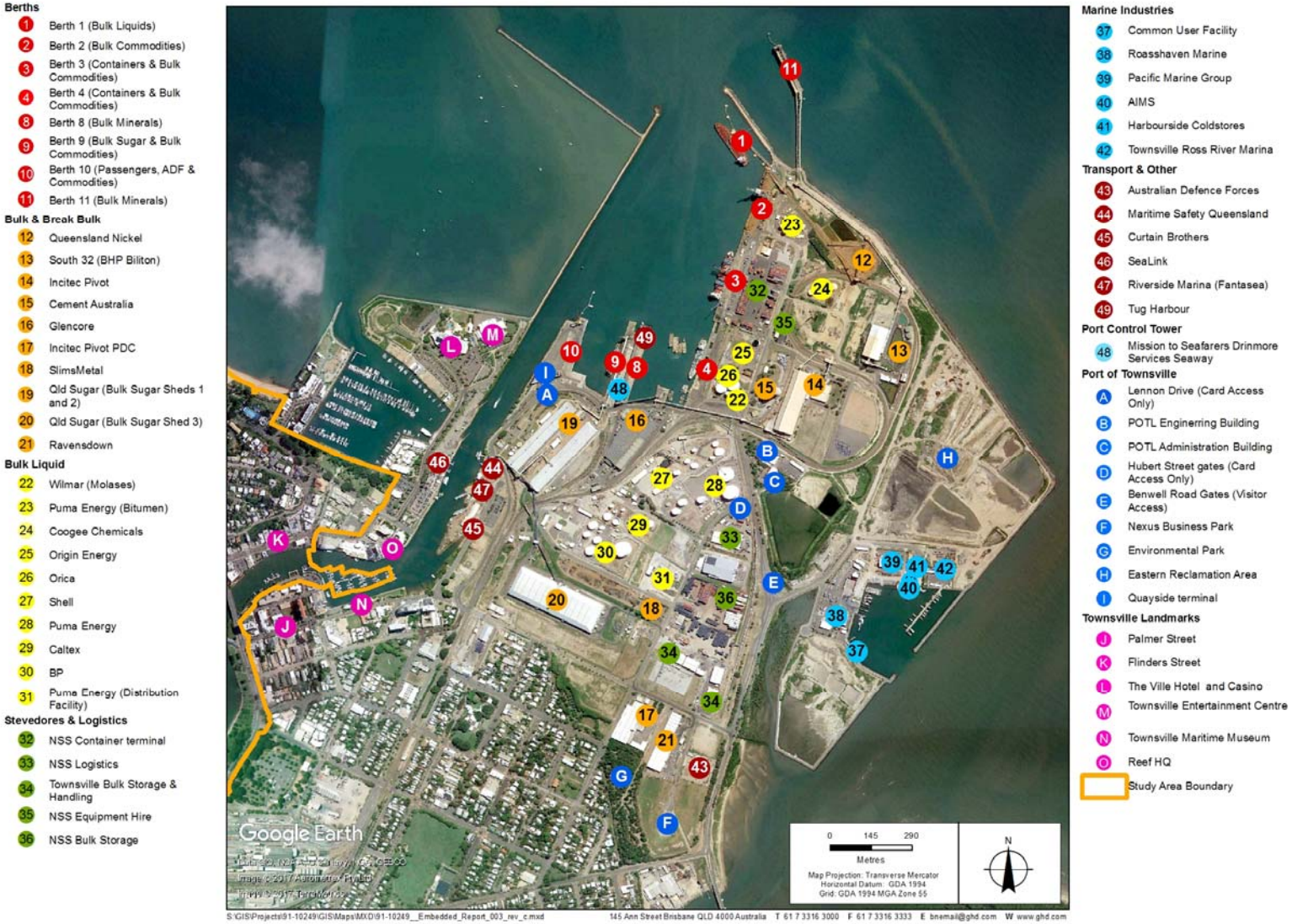
2.3 Port industry and commerce precinct - Port of Townsville (land-side)

The key existing infrastructure within this Port industry and commerce precinct is mapped in Figure 5 and comprises:

- Berth facilities (total 8 operational commercial berths, including a Tug harbour)
- Port (internal) rail network
- Port (internal) road network
- Strategic port land availability for future development of port related industries
- Terminal facilities (e.g. sugar shed, diesel/petroleum terminals, etc.)
- Other port facilities (Port office, stevedoring – quarantine facilities, e.g. TBHS)

Many of the storage and cargo handling facilities located within the precinct are owned and/or operated by third parties (exporters, importers and logistics service providers).

Figure 5 Map of existing infrastructure within the Port Industry and Commerce precinct – Port of Townsville (land-side)



Source: GHD mapping / PoTL.

2.3.1 Berth infrastructure (including Tug harbour)

The import and export commodities transported via the Port of Townsville, utilise a diverse range of ship and cargo-handling facilities and equipment allowing these goods to move to/from the hinterland and overseas markets. Table 5 provides a summary of the main characteristics of the berth infrastructure used to transfer cargo at the port.

The current eight berths, including a tug harbour between the ends of Berths 8 and 9, are a mix of common-user facilities and facilities leased by the PoTL to either cargo-owners or stevedores. As a result, some berths handle specific commodities, whilst others handle a mix of goods:

- Berth 1 (common-user) handles liquid bulk commodities such as fuels, liquefied gases, sulphuric acid, and bitumen
- Berth 2 (leased), currently not operating due to the closure of the Townsville nickel refinery, handles dry bulk commodities (in the past nickel ore)
- Berth 3 (leased) handles a mixture of dry bulk, break-bulk (refined metals, project cargoes and roll-on/roll-off such as new motor vehicles) and general cargo (containerised) commodities
- Berth 4 (common user with stevedore manager) handles a mixture of dry bulk, break-bulk (refined metals, project cargoes and roll-on/roll-off such as new motor vehicles) and general cargo (containerised) commodities
- Berth 8 (leased) handles dry bulk commodities such as mineral concentrates and fertilisers
- Berth 9 (leased – non-exclusive) handles various bulk commodities including agricultural sugar-related products such as raw/refined sugar and molasses (liquid), as well as cars and scrap metal
- Berth 10 (common-user) handles a mixture of commodities and vessel types including dry bulk, livestock, break-bulk, cruise-ships (at the cruise terminal facility), and defence (navy) vessels
- Berth 11 (leased) handles dry bulk commodities (mineral concentrates).

In total, the eight berths handled around 9 million tonnes of commodities which includes around 59,000 TEU of containers in FY 2015-16 with a peak total of around 13 million tonnes handled within the last five years. These tonnage throughput numbers do not reflect that Berth 10 also handles cruise-ships for tourism and defence (navy) vessels (including some re-fuelling) for a number of months of the year.

The Port has an existing tug harbour between the ends of Berth 8 and 9 where two tugs are moored when not towing or waiting for vessels.

The existing effective operating capacity and utilisation of the berth infrastructure is analysed and discussed in Section 4.

Table 5 Port of Townsville operational berth characteristics

Berth No.	Berth Pocket Declared Actual Depth (metres)*	Height Above LAT (metres)	Berth Pocket Length (metres)	Maximum Vessel LOA (metres)	Available Equipment	Additional information
1	-13.4	5.46	250	238	Pipelines and flexible hoses	
2	-11.4	6.07	281	238	One gantry crane and conveyor system for handling bulk materials (at an unspecified rate)	
3	-11.1	6.0	284	238	55.9 t gantry crane shared between Berth 2 and 3	
4	-9.4	5.46	220	185	Molasses loading equipment @ 400 tph Landing pad to service stern angle ramp Ro/Ro vessels	
8	-12.0 m	5.77	240	220	Bulk ship loader @ 3,000 tph (nominal) and conveyor system	Vessels with LOA greater than 200 metres (but less than 220 metres) must discuss with pilots the mooring arrangements to ensure suitable preparation of mooring lines prior to approaching the berth. Use of mid-ship mooring lines if available is recommended.
9	-11.3	5.77	248	228	Rail mounted gantry @ 1800 tph (nominal) and conveyor system	

Berth No.	Berth Pocket Declared Actual Depth (metres)*	Height Above LAT (metres)	Berth Pocket Length (metres)	Maximum Vessel LOA (metres)	Available Equipment	Additional information
10	-11.1	5.80	319	238	Mobile crane Ro/Ro ramp	Berth 10 is designed to accommodate vessels with LOA 300 metres. Current limitations of a maximum LOA 238 metres are imposed by the channel dimensions.
11	-11.7 (at berth marks 10m to 260m) & -8.1 (at berth marks 0m to 10m)	9.45	240	225	Ship loader @ 1350 tph (nominal) and conveyor system	Berth 11 has a priority berthing arrangement with South32.

Sources: PoTL / MSQ.

(*) Declared Actual Depths below port datum (Lowest Astronomical Tide) as of 30th June 2017 per Notice to Mariners 257 (T) of 2017 authorised by Regional Harbour Master (Townsville), MSQ.

Vessels visiting the Port of Townsville have access to services and utilities provided at the berths as summarised in Table 6. These services provide connections to networks outside of the port area (i.e. potable water, waste management and processing, and power).

Table 6 Services and utilities at Port of Townsville berths

Service	Description
Bunkering	Road tankers are used to bunker ships at berths (with the exception of a pipeline to Berth 9 and a new dedicated fuel line to Berth 10 for defence vessel refuelling)
Fresh water	Fresh (potable) water is available at all berths
Waste	- Facilities are available at the port for the collection of tank washing slops, oily mixtures containing chemicals, oily bilge water, oil sludge and sewage (with the exception of Berth 1) - Ships moored to a commercial wharf must arrange for the appropriate collection and disposal of all wastes

Power	Shore power connections are available as follows: - Berths 2, 3 and 4 berths at 100 amperes, 415 volts - Berths 1, 8 and 9 at 60 amperes, 415 volts - Berths 10 and 11 – Information not available

Source: PoTL/MSQ.

Network connections are provided to the Port of Townsville for port operations through connecting to services that are external to the port – e.g. mains sewers and bulk water supply. Bulk water and wastewater services are supplied by TCC and power by Ergon. The demand for these services is determined by the specific activity involved. For example, cruise-ships have a requirement to refill with potable water which may lead to significant additional water demand compared to other activities which may require more non-potable water or wastewater treatment.

2.4 Infrastructure and supply chain corridors precinct

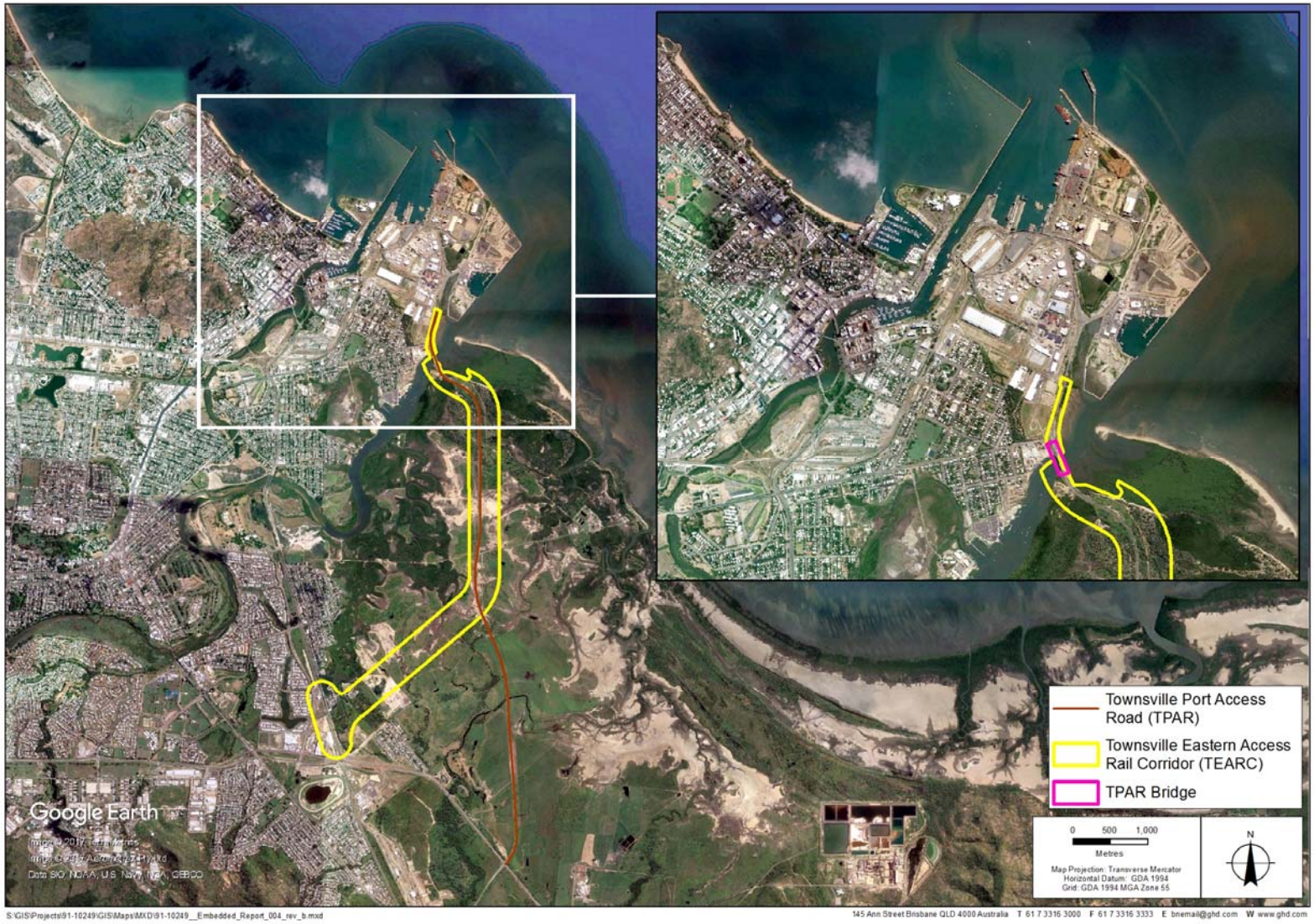
The Infrastructure and supply chain corridors precinct (ISCC1) is mapped in Figure 6 and is located at the boundary of the port's Port industry and commerce precinct and extends through the TSDA until it connects with the NCL and the MIRL.

The ISCC1 precinct follows the proposed alignment of the TEARC which is located within the Materials transportation and services corridor Precinct of the TSDA.

The key existing and planned infrastructure within the ISCC1 precinct includes the following:

- Part of the TPAR, also known as the Southern Port Road, including the existing bridge over the Ross River
- Townsville Eastern Access Rail Corridor (under current planning as part of Building Queensland's TEARC business case).

Figure 6 Map of existing infrastructure within the ISCC1 precinct



Source: GHD mapping.

2.4.1 Townsville Port Access Road (TPAR) section within the ISCC1

This section of the TPAR is the existing two-way single lane road which opened in November 2012. In its design and traffic impact assessment, the TPAR was expected to remove over 500 trucks per day from suburban roads in Townsville City.

The TPAR is a state-controlled road managed by DTMR and provides access to/from the Port of Townsville for over-size / over-mass vehicles such as B-Triples and road-trains. These HPFVs currently use the TPAR to transport materials between the two mineral refineries located in the TSDA and also between mines and other industry in the NW Minerals Province via the Flinders Highway.

The existing traffic use and capacity of the TPAR is analysed in section 4.

2.4.2 TEARC and planned new rail connection

The ISCC1 precinct fully covers the extent of the proposed TEARC. The timing of the construction of the new rail connection will be subject to future planning approvals and a business case currently under development by Building Queensland.

2.5 Infrastructure and supply chain corridor - Rail

The existing infrastructure within the ISCC 2 – Rail corridors comprises sections the two main rail lines: the NCL and the MIRL that are closest to the Port of Townsville. Figure 8 identifies the full extent of the two rail lines. A proposed rail link between Mount Isa and Tennant Creek is discussed in section 2.5.5 below.

Both lines are owned and managed by Queensland Rail (QR) which manages access to the railway infrastructure and provides maintenance services. Above rail operators, provide freight services on the two rail lines. QR also operates a limited number of passenger services on the lines as well.

The existing infrastructure within the ISCC2 – Rail corridors is mapped in Figure 7. In addition to sections of the two main rail lines, the ISCC2 – Rail corridors also include:

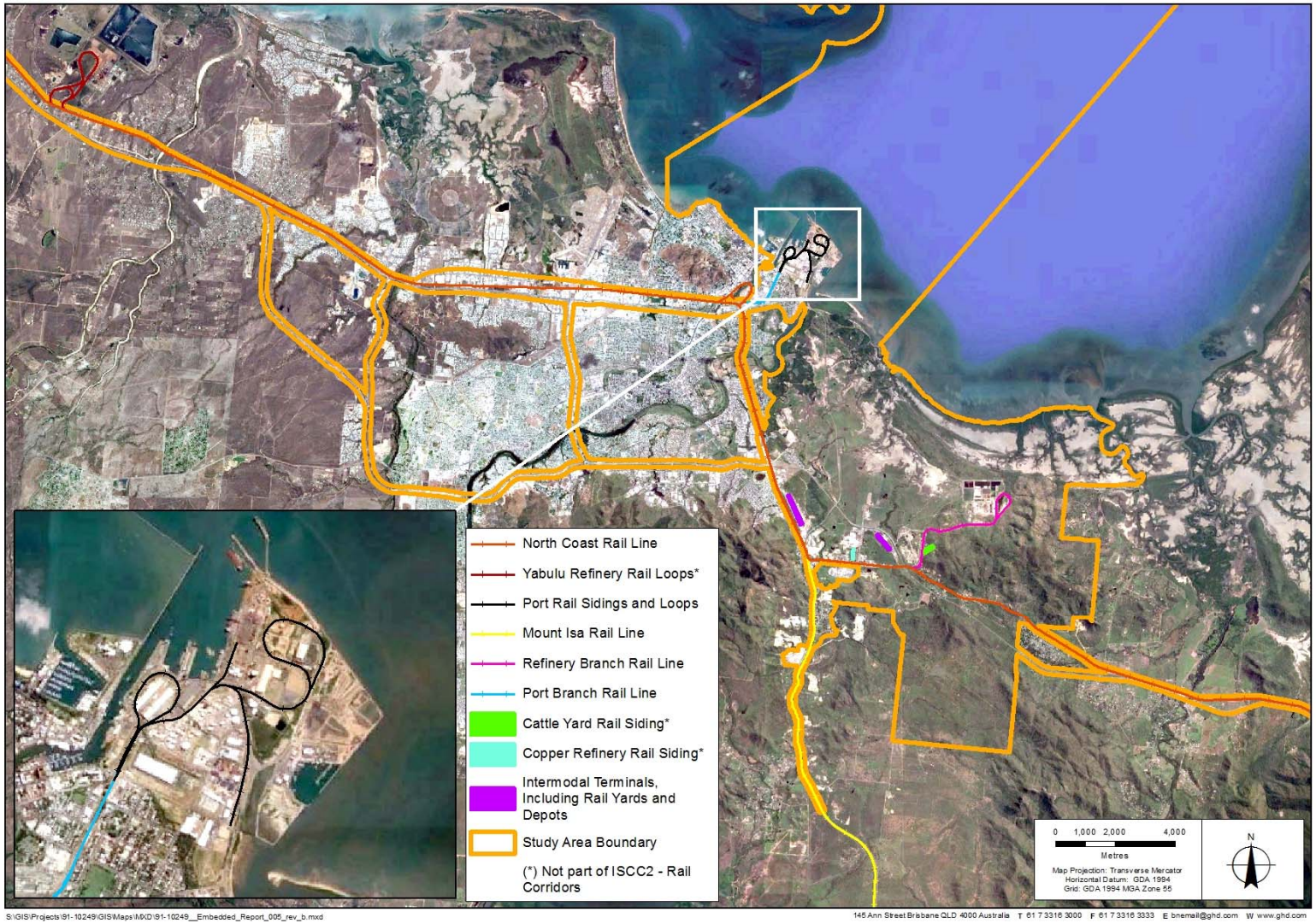
- The Port of Townsville (Jetty) Branch Rail Line connecting with the sidings and cargo handling and storage facilities within the port
- The Refinery Branch Rail Line connecting with the zinc refinery, and a livestock facility both located within the TSDA.

It should be noted that there is additional rail infrastructure which has not been included within the proposed master planned area:

- Port private rail sidings and loops
- Yabulu nickel refinery rail loops (owned by Aurizon) and QR owned track connecting the NCL to the rail loops
- Two intermodal rail terminals at Stuart (one linked to the NCL, and the other to the MIRL)
- Rail siding into the Copper refinery at Stuart (linked to the NCL)
- Multiple road to rail access points providing intermodal connections along the rail lines.

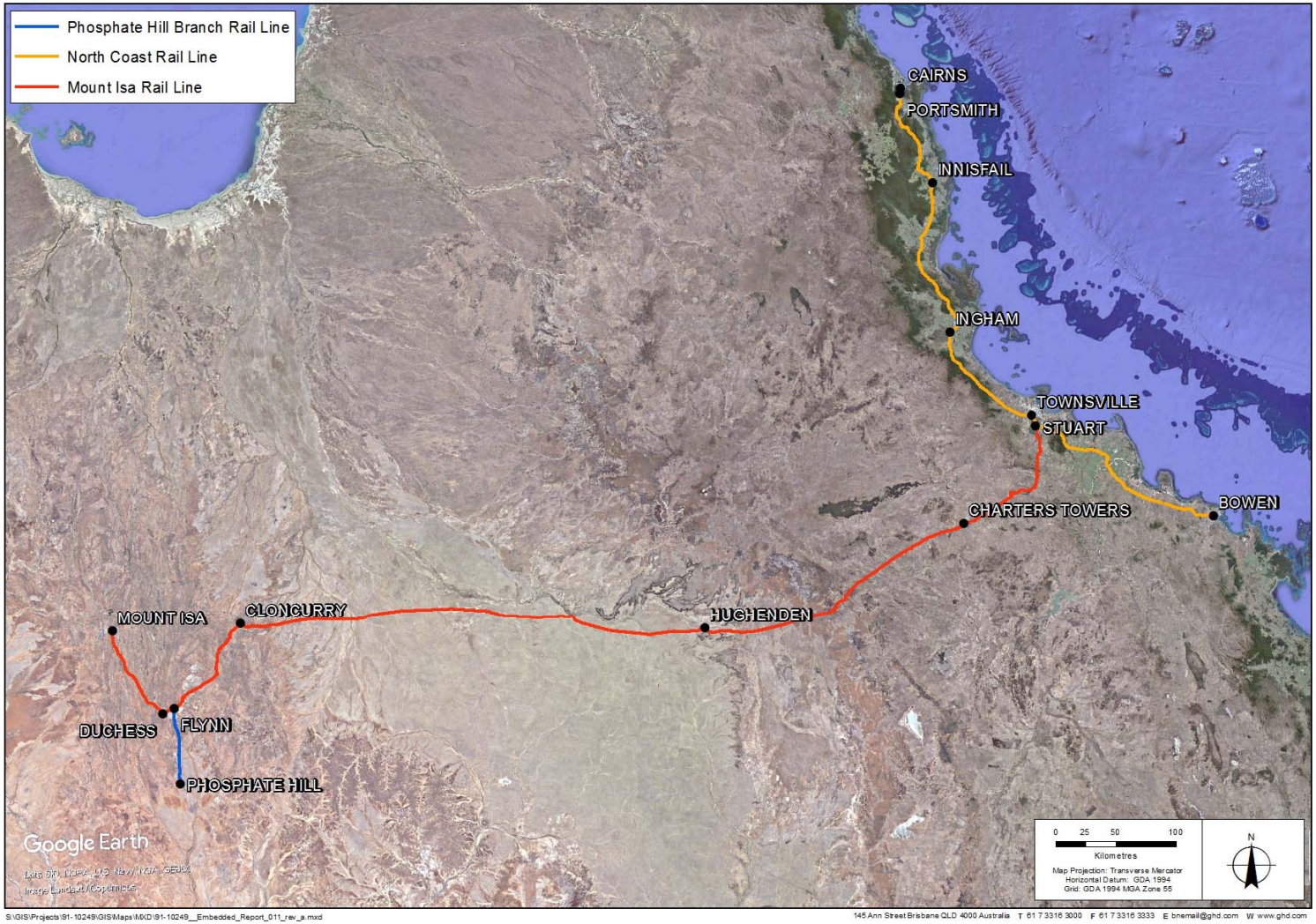
The existing use and capacity of the rail infrastructure within the ISCC2 – Rail corridors is analysed in section 4.

Figure 7 Map of existing rail infrastructure within the ISCC2



Source: GHD mapping.

Figure 8 Existing rail network serving the Port of Townsville



Source: GHD mapping / QR.

2.5.1 North Coast Rail Line

The NCL is the principal regional freight and passenger line within the QR network, running the length of coastal Queensland between Nambour and Cairns extending over approximately 1,400 kilometres. It enters Townsville from the south along the Bruce Highway and travels west through the city along the general alignment of Ingham Road until re-joining the Bruce Highway.

The NCL carries various freight products, including containerised and industrial freight, minerals, livestock and bulk commodities including sugar and grain. Agricultural products are largely seasonal, resulting in peak train operation requirements during the June to December period each year. Long distance passenger and high-speed tilt train services also operate on the line servicing central and north Queensland.

The 10 kilometre section from Nome to Stuart (elevation 18 m) is double track. Stuart is the junction of the NCL and the MIRL. From Stuart, the double track continues into Townsville stopping south of Boundary Street. Crossing over Boundary Street, the single line continues east to South Yard and Townsville Jetty or west to Townsville Station, constructed over the Ross River.

2.5.2 Mount Isa Rail Line

The MIRL stretches 1,032 kilometres linking Mount Isa to Stuart where it joins the NCL and proceeds to the Port of Townsville. It is a major freight route connecting the Mount Isa Mines to the Port of Townsville where the majority of bulk products are exported. Freight products include minerals concentrates, fertiliser, acid, fuel, refined metals, cattle and general freight.

The MIRL is significant as it traverses some of the world's largest deposits of copper, lead, zinc, silver and phosphate rock. The region surrounding the MIRL produces 75% of Queensland's non-coal mineral output.

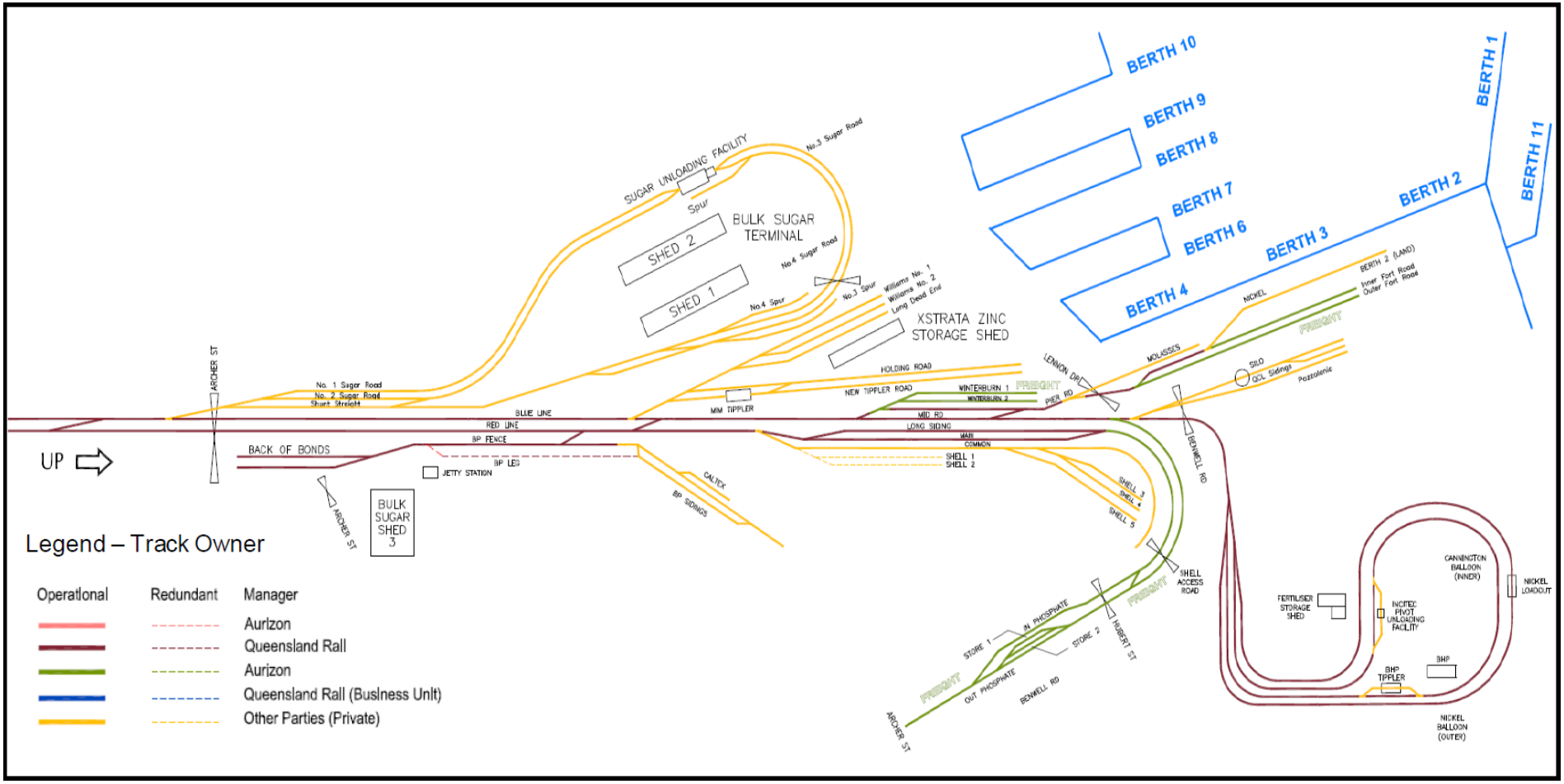
It also provides a passenger service called the Inlander which services western Queensland, travelling between Townsville and Mount Isa.

2.5.3 Port Branch Rail Line and track within the Port of Townsville

The Port Branch Rail Line provides the rail connection into the Port from the NCL and the MIRL. Once inside the port area, the Port Branch Rail Line becomes a network of rail-sidings (some privately managed), for handling cargo to/from storage and shipping facilities, and rail-loops allowing trains to turn in the port area.

There are more than ten different rail loading/unloading facilities at the Port (see Figure 9).

Figure 9 Port Branch Rail Line and track layout within the Port of Townsville



Source: QR Line Diagrams 2012

NCL traffic can run directly into the Port of Townsville due to the shorter length of trains. While some MIRL services that are closer to 800 metres can, in theory, directly enter the Port, all MIRL traffic has to wait at Stuart for entry to the Port.

2.5.4 Refinery Branch Rail Line – TSDA

The Refinery Branch Rail Line, operated by QR, connects local industries located within the TSDA with the NCL, MIRL and the port. These industries include Sun Metals' zinc refinery, and livestock/cattle (feed) yards.

2.5.5 Mount Isa to Tennant Creek proposed rail link

Since 2015, a number of collaborative studies, funded by the Northern Territory, Queensland and Commonwealth Governments, have been completed, or are underway, to analyse and understand the government policies, economics, potential financing, external drivers and technical/engineering requirements needed to develop a 600 kilometre rail link between Mount Isa in North West Queensland and Tennant Creek in the Northern Territory.

This potential rail link may emerge as 'enabling infrastructure' potentially allowing seamless supply-chain connections between regions around Mount Isa and Tennant Creek with the port gateways of Townsville and Darwin.

If this rail link proves to be technically, environmentally and economically feasible, then some current and future freight that moves or may move through the Port of Townsville to/from the Mount Isa region may become contestable through the Port of Darwin given sufficient supply-chain cost and efficiency benefits over the existing routing via Townsville.

2.6 Infrastructure and supply chain corridor - road

The EBR identifies the following key primary and secondary road corridors (ISCC3), used by port-related traffic:

Primary road corridors

- *Townsville Port Access Road (TPAR)* **-** provides access to the port for over-size / over-mass vehicles (B-Triples and Road Trains) from the Ring Road and areas south of Townsville. There is a road-train de-coupling site at the start of the TPAR (Bruce Highway end) for vehicles coming from the Flinders Highway. TPAR becomes Benwell Road as it enters the port
- *Bruce Highway (North of Townsville)* - connects the port to industry and freight generators/users in northern Queensland
- *Bruce Highway (South of Townsville)* - connects the port to industry and freight generators/users in southern Queensland
- *Flinders Highway* - links the port to agricultural and resource activities at a number of sites located to the west of Townsville. It is a high efficiency freight route with some of the largest freight vehicles in Australia travelling the route. Heavy vehicle combinations up to 53.5 metres in length travel on the Highway between the Port of Townsville and the Northern Territory border. Heavy freight vehicles include B-Doubles, Type 1 and Type 2 road trains, and multi–combination quad vehicles having access under permit arrangements. The Highway is designated a Higher Mass Limit (HML) route. It is a Heavy Load Platform (HLP) route allowing the transportation of over-size and over-mass loads

Townsville Ring Road (Deeragun to Cluden) **-** an important road for freight vehicles with origins to the north/south of Townsville accessing the port.

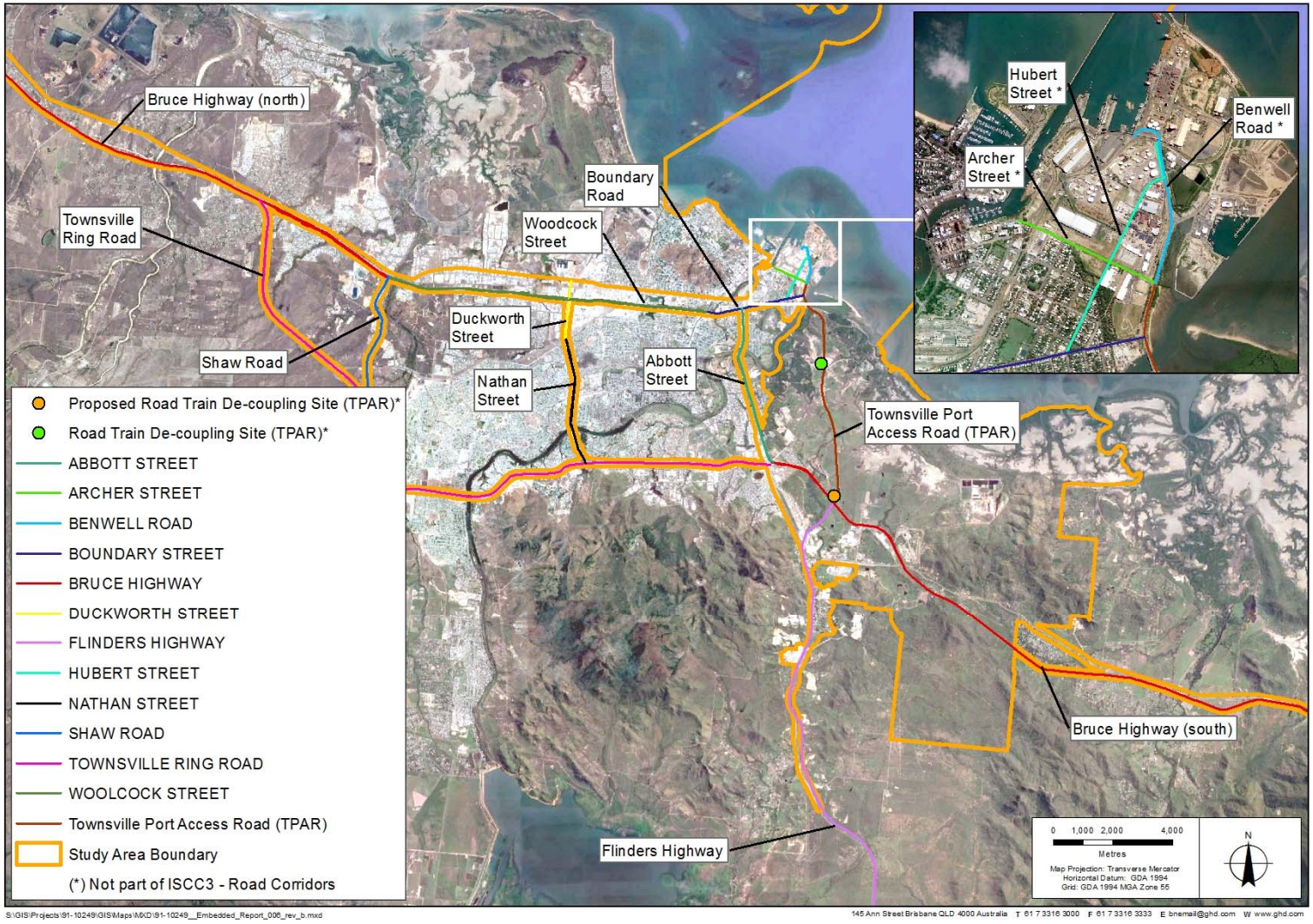
Secondary road corridors

- *Duckworth/Nathan Streets* **–** links Woolcock Street in the north to the Townsville Ring Road in the south and provides access to a light industrial and retail/commercial precinct along Duckworth Street (northern half)
- *Woolcock Street* **-** connects existing industrial uses to the Ring Road and the port;
- Abbott Street - connects from Woolcock Street through to the Ring Road. This is not the primary heavy vehicle corridor for entering the port but, in connection with Boundary Street, it provides alternative access to the port
- *Boundary Street* - in conjunction with Abbott Street, Boundary Street provides an important connection to the port
- *Archer Street* – provides access to the northern side of the port and connects with the TPAR/Benwell Road. Different sections of Archer Street are currently managed by different agencies (TCC and PoTL)
- *Hubert Street* – provides access from Archer Street for heavy vehicles servicing port users in the central area of the port.

These road corridors are mapped in Figure 10.

It should be noted that the Bruce Highway and Flinders Highway extend as important land linkages beyond the proposed master planned area allowing transportation of commodities to/from the Port of Townsville both along the Queensland coast and further inland to/from agricultural and minerals regions.

Figure 10 Map of existing ISCC3 road network connecting with the Port of Townsville



Source: GHD mapping.

Archer Street, Benwell Road, Hubert Street and the southern section of the TPAR outside of the ISCC1, are all currently used by port-related traffic. Given the potential for increased traffic on the TPAR, it is important to address all of the TPAR as relevant infrastructure for Port of Townsville master planning.

The existing use and capacity of the port-related road network is analysed in section 4.

2.7 Marine services and recreation precinct

This precinct includes the Breakwater Marina comprising infrastructure to cater for recreational, residential, commercial and administration uses. Table 7 provides an overview of the infrastructure forming the Breakwater Marina.

Table 7 Breakwater Marina – Overview of specifications

Infrastructure component	Function
Access Channel	Provides marine-side access for the small-craft visiting the Breakwater Marina. The channel was dredged to -1.1 metres LAT, in 2005
Number of marina small-craft	• 46 operational berths at berth group B • 42 operational berths at berth group C • 68 operational berths at berth group D • 50 operational berths at berth group E • 77 operational berths at berth group F • 32 operational berths at berth group G • 35 metre long fuel wharf • 38 metre long loading dock
Power & Other facilities	• Single phase electrical connections up to 15 amps for all the berths • Fresh water available at all berths • Dedicated waste compound for garbage, sullage, black water & oils • Toilets and showers • Apartments/restaurant/sailing club/retail outlets

Source: PoTL

Townsville Yacht Club

The Townsville Yacht Club is located outside the proposed Marine services and recreation precinct. Recreational boating from the Townsville Yacht Club currently utilises the Ross Creek to access Cleveland Bay.

2.8 Port industry and commerce precinct - Townsville State Development Area

2.8.1 TDSA land use area

The TSDA spans an area of approximately 4900 hectares, six kilometres south-east of the Townsville Central Business District and immediately south of the Port of Townsville. The TSDA is a critical element of the North Queensland supply chain and is the key area for industrial development requiring access to the Port of Townsville.

Table 8 outlines the land use summary, based on the key assumptions and the physical capacity of the land to accommodate development discussed in the TSDA Development Opportunities Strategy (Urbis, 2013).

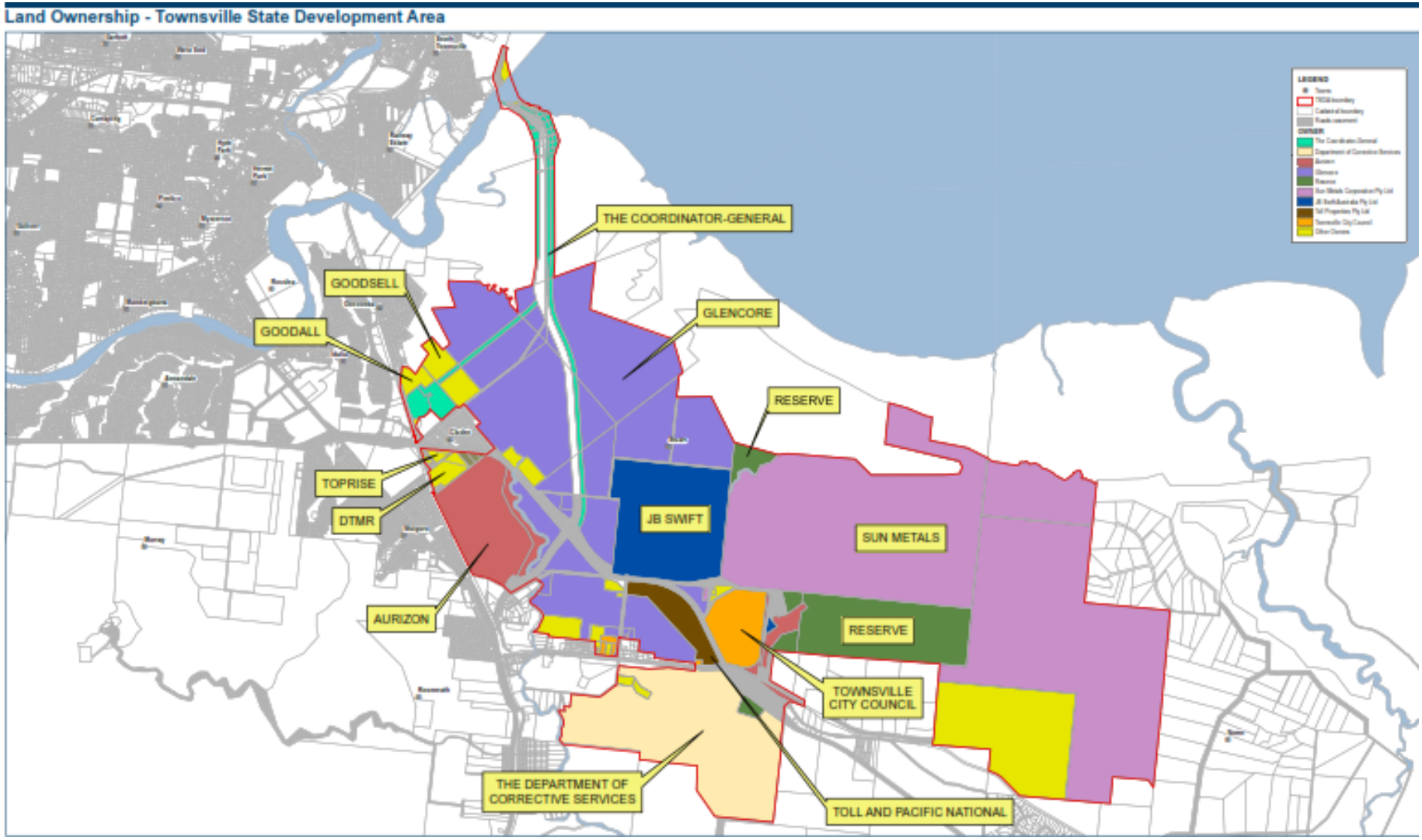
Table 8 TSDA Land Use Summary

Land Use Type / Feature	Area
Total area of the Townsville SDA	4,900 ha (approx.)
Total Gross Developable Area (GDA)	1,840 ha (approx.)
Area of GDA requiring cut and fill	1,155 ha (approx.)

Source: Urbis, 2013.

The TSDA already has a number of existing landholders with holdings as shown in Figure 11 below.

Figure 11 Land Ownership within the Townsville State Development Area, 2014



Source: OCG, current as of 2014.

Table 9 Overview of TDSA main landholders

Owner	Industry	Land Area	Current status
Glencore	Refining of copper	1,060 Ha	Various parcels. Some advised as required for environmental license compliance and other for future use.
State of Qld (Department of Justice and Attorney General)	Government	658 Ha	Currently not zoned for industrial use.
JBS QLD Assets	Meat Processing	285 Ha	Used for abattoir related uses.
Sunmetals Corp Pty Ltd	Refining of Zinc	1,692 Ha	Hosts existing Sun Metals operation and requisite buffers. Advised that Sunmetals require land for future expansion and uses related to its processing facility.
Aurizon Property Pty Ltd	Rolling-stock Maintenance Depot	164 Ha	Rail rolling-stock maintenance, provisioning and intermodal terminal facility.
ATN Access Pty Ltd	Transport	55 Ha	Rail transport terminal.
Glencore	Refining of copper	50 Ha	Glencore advise transaction pending for solar farm to service Glencore refinery and other customers.

Source: GHD analysis.

The quantum of land potentially available for new industrial use in the TSDA may be significantly less than currently contemplated under the TSDA Development Scheme, and by the various reports and studies undertaken over time on the TSDA. Factors that have influenced this conclusion include:

- Existing occupier/owners proposing future uses for land to support their existing operations
- Pending land sale transactions by a major land-holder which include proposed sub-divisions.

2.8.2 Services connected to the Townsville State Development Area (TSDA)

The trunk infrastructure services (water/sewage) of the TSDA are connected to TCC infrastructure. TCC infrastructure is included in the TCC priority infrastructure area (PIA) which is mapped in the Townsville City Plan 2014. However, as the PIA does not cover all of the TSDA, this means that any future development outside of the PIA will need to make the connection to the trunk network inside the PIA.

Trunk infrastructure services (water/sewage) in the TSDA are part of the TCC infrastructure network. Not all of the TSDA is included in the TCC priority infrastructure plan (PIP) which is mapped in the Townsville City Plan 2014. The Coordinator-General is currently investigating trunk infrastructure requirements and development of an infrastructure charges plan for the whole TSDA.

2.8.3 Environmental management precinct - TSDA

The Environmental Management precinct defined in the EBR occupies both environmentally and culturally sensitive areas both within and adjacent to the TSDA. This precinct, covering more than 1800 hectares of land, protects wetlands, vegetation and fauna habitats closely related to the GBRMP and associated catchment.

Environmental areas largely relate to tidal and drainage areas and include a declared Fish Habitat Area. In addition, parts of this area, have been recognised in various environmental impact and analysis studies to contain cultural heritage values.

2.9 Port industry and commerce precinct – Port of Townsville Quarry

The Port of Townsville quarry has been considered as a supply chain origin linked to future port expansion activities providing for the extraction and haulage of a maximum of 500,000 tonnes a year of rock with a total capacity to produce 11 million tonnes of material. Around 2 million tonnes of material is planned to be used in the Port Expansion Project (PEP).

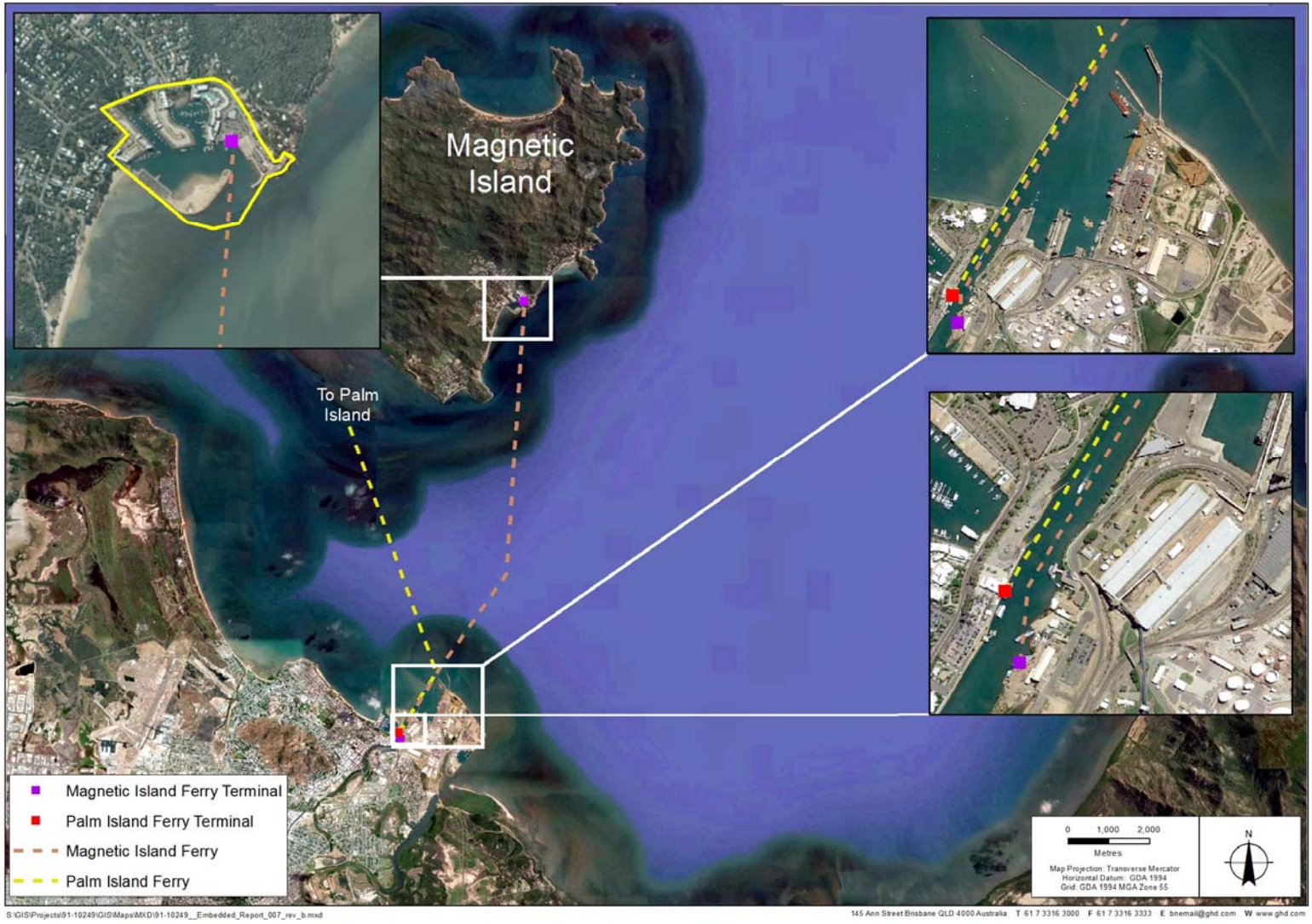
2.10 Environmental management precinct - Magnetic Island

Magnetic Island is located 8 kilometres offshore from Townsville in Cleveland Bay. This island is effectively a satellite suburb of City of Townsville with over 2,500 permanent residents. The current Port of Townsville shipping channels run along the southern side of Magnetic Island.

Magnetic Island is serviced by existing marine-related infrastructure (see Figure 12) comprising:

- The wharf/jetty for docking at Magnetic Island
- A maritime ferry route between Magnetic Island and Townville City. The Ferry currently uses a section of the Port of Townsville's Platypus Shipping Channel bounded by the Western Breakwater
- Two Magnetic Island ferry facilities at Townsville, one for passengers on the western side of Ross Creek and the other for vehicles and the eastern side of Ross Creek

Figure 12 Map of existing marine-related infrastructure for Magnetic Island



Source: GHD mapping.

In addition, the ferry to Palm Island uses the same ferry facilities in Townsville, and the sea route includes exiting the Ross Creek and passing along the south-western side of Magnetic Island and onwards to Palm Island.

3. Economic analysis and growth scenarios

3.1 Introduction to this section

This section discusses the economic, geographic and industry drivers for trade development at the Port of Townsville and presents three growth scenario forecasts for the port through to the year 2050. The intention of the trade growth scenarios is to understand the potential size and nature of the future freight task and then compare this with existing and required port marine and land-side infrastructure capacity in Section 4.

3.2 Historic and current trade at the Port of Townsville

The Port of Townsville is a multi-commodity import and export port with current trade throughput (FY 2015-16) at around 9 million tonnes (including 59,000 TEU of containers) and over 600 visits by cargo vessels.

Historically, the port has handled a peak of almost 13 million tonnes which occurred in FY 2011-12 and included almost 750 vessel visits. The commodities (cargo) that have passed through the Port of Townsville include:

Trade	Commodity
Exports	Motor vehicles, general cargo, cement, sulphuric acid, fertiliser, copper, nickel, zinc, copper anode, petroleum products, gas, sulphur, containers (carrying furniture, electrical goods, household items, clothing, construction materials, etc.) and tyres;
Imports	Sugar, timber, general cargo, fertiliser, containers, cattle, refrigerated meat, magnetite, copper, lead, zinc, zinc ferrite, zinc oxide, silver, molasses, sand, gravel, coke, project cargo, and tallow.

The current level of trade throughput is slightly lower than previous years (see Table 10) due to the closure of the nickel refinery at Yabulu in 2016. The nickel refinery traded up to 4 mtpa of commodities through the port, comprising of bulk nickel ore imports through Berth 2 and refined metal exports through Berths 3-4. Prior to the closure of the nickel refinery, in 2013, bulk magnetite exports of over 1 mtpa through Berth 8 ceased due to the downturn in the price of iron ore on global markets.

Table 10 Summary of Port of Townsville historical trade throughput

Trade (Mln.T)	FY 2011-12	FY 2012-13	FY 2013-14	FY 2014-15	FY 2015-16
Exports	6.3	5.4	4.6	5.3	5.2
Imports	6.5	6.7	5.7	5.2	4.0
Total:	**12.9**	**12.1**	**10.3**	**10.5**	**9.2**
Vessel visits:	*747*	*692*	*635*	*643*	*618*

Source: DTMR/PoTL. Trade is in Million mass Tonnes. Vessel visits are for cargo vessels. In FY 2015-16, there were an extra 14 non-cargo vessels visits (cruise-ships and navy).

The current mix of commodities (and corresponding supply chains) reflects the role of the port as a trade gateway for regional mining and mineral resource industries, the region's consuming

population, and various manufacturing and agricultural industries from fertiliser production to sugar/molasses and live cattle exports. In addition, the port serves as a regional hub for seasonal cruise-ship tourism and the Australian Defence Force (as navy logistics replenishment and provisioning).

The main commodities (also known as goods, cargo or freight), or groups of commodities, and their historic volumes, handled at the Port of Townsville are shown in Table 11.

Table 11 Port of Townsville historic trade statistics by commodity, 2010-2015

Port of Townsville Trade Statistics

Financial Year	2010-11	2011-12	2012-13	2013-14	2014-15
Export tonnes					
Fertiliser	828,105	866,066	810,338	637,203	923,987
General Cargo	145,404	191,633	163,846	171,126	219,604
Livestock - Cattle	23,888	10,863	2,072	100,905	152,890
Magnetite	278,476	846,523	773,177	386,662	153,095
Meat & By-Products	27,188	21,288	13,014	5,633	8,427
Metal Cons - Copper	213,874	180,492	276,305	227,734	148,114
Metal Cons - Lead	381,792	373,058	365,430	387,697	369,176
Metal Cons - Lead/Silver	14,257	0	1,705	31,755	10,176
Metal Cons - Zinc	776,315	808,480	889,953	755,588	1,106,054
Metal Cons - Zinc Ferrites	154,328	210,651	210,175	252,513	226,857
Metals - Refined Copper	228,520	272,221	198,633	257,536	314,855
Metals - Refined Nickel	17,733	27,967	16,998	17,773	14,863
Metals - Refined Zinc	289,014	156,889	139,109	175,451	155,567
Metals - Smelted Lead	113,658	164,430	129,623	132,563	109,201
Metals - Zinc Oxide	24,339	0	0	0	0
Molasses	233,710	381,782	254,731	271,032	247,856
Motor Vehicles					50
Petroleum - Contaminated Oil	3,259	8,628	6,978	5,955	0
Sugar	958,720	1,490,541	1,091,626	784,400	1,140,806
Sulphuric Acid	12,488	5,502	0	0	0
Timber	0	318,696	90,700	0	0
Total exports	**4,725,068**	**6,335,710**	**5,434,413**	**4,601,526**	**5,301,578**
Import tonnes					
Cement	466,668	482,254	540,158	503,908	414,645
Fertiliser	87,775	96,817	118,814	157,962	114,356
General Cargo	211,621	300,493	265,215	254,596	263,869
Metal Cons - Nickel	13,311	52,714	16,283	0	8,117
Metal Cons - Zinc	258,309	250,230	322,078	251,841	282,856
Metals - Copper Anode	30,630	73,564	97,968	77,055	47,005
Motor Vehicles	19,329	27,092	24,224	19,150	22,819
Nickel Ore	3,719,507	3,978,616	3,958,967	3,160,244	2,926,579
Oxide Containers	0	0	0	69,132	63,063
Petroleum Products	941,103	1,111,296	1,112,244	1,087,606	939,699
Sulphur	103,746	112,733	102,460	52,909	79,210
Sulphuric Acid	24,067	63,396	112,980	22,398	26,517
Total imports	**5,876,066**	**6,549,205**	**6,671,391**	**5,656,801**	**5,188,735**
Total throughput	**10,601,134**	**12,884,915**	**12,105,804**	**10,258,327**	**10,490,313**

Source: DTMR – Trade Statistics for Queensland Ports, issued Aug. 2016.

Refined mineral products include metals such as copper, zinc, and lead which are smelted or refined either at Mount Isa or locally around Townsville. Mineral concentrates are intermediate mine-processed products or smelter by-products such as copper, zinc, zinc/silver, lead and zinc ferrite concentrates. Containerised agricultural products include meat, fruit and vegetables, and seeds/pulses. Project cargoes (plant, equipment and machinery) are typically related to the development of new mining projects and other special projects such as energy-generation.

3.3 Catchment area of the Port of Townsville

A port has a geographical cargo catchment area for each import and export commodity and this can be local, regional or overlapping with alternative ports with competitive boundaries depending on the dynamics of logistics costs and port access for different commodities. It is important to understand the catchment area when determining the future freight task and the required capability and capacity of the infrastructure. The catchment area includes both existing and future consumption and production requiring transportation through the port.

3.3.1 Geographical area served

The Port of Townsville has a geographical catchment with a current population base estimated at around 720,000 (as of mid-2016), of which almost 200,000 persons are located in the Townsville City Council local government area (LGA). The catchment area services coastal communities from Cairns to Mackay, and also the NWMP (around Mount Isa) for minerals. The catchment also encompasses central and western Queensland for agricultural products connected via road to Townsville.

Townsville's competing ports for existing trade include Cairns, Mackay and Brisbane (in particular for containerised imports and exports).

3.3.2 Future population within Port of Townsville's catchment area

Growth in the household consumption economy within Port of Townsville's catchment is driven in particular by future population growth which has three levels of projections – low, medium and high (see Table 12). These projections are relevant for future trade at the Port of Townsville for containerised general cargo imports, fuel imports, new motor vehicle imports and non-industrial/agricultural fuel imports.

Table 12 Future population projections for Port of Townsville's catchment

POPULATION PROJECTION SERIES for Demand Driver & Background Traffic					
Geographical area	**Units**	**2016**	**FYE 2051**		
		Base*	**Low**	**Medium**	**High**
Townsville City	*CAGR (final 5-yr.)*	-	*1.0%*	*1.5%*	*1.9%*
	Persons	199,358	305,876	363,246	424,782
FNQ - Townsville Port Catchment, incl. Townsville City	*CAGR (final 5-yr.)*	-	*0.8%*	*1.2%*	*1.5%*
	Persons	720,421	986,057	1,141,465	1,308,730
FNQ - Townsville Port Catchment, excl. Townsville City	*CAGR (final 5-yr.)*	-	*0.7%*	*1.0%*	*1.4%*
	Persons	521,063	680,671	779,026	885,071
Total Queensland	*CAGR (final 5-yr.)*	-	*1.0%*	*1.4%*	*1.7%*
	Persons	**4,853,048**	**7,319,246**	**8,402,785**	**9,569,453**

(*) Medium projection assumed as Base for FYE 2016.

Source: Queensland Government Treasury, 2015 report (to 2036 and 2056).

The range of projections up to June 2051 show the population in Port of Townsville's catchment area rising to between around 986,000 and 1.3 million.

The population projections are relevant as determinants of future growth in background traffic levels on the road network used by Port of Townsville freight imports and exports.

3.4 Relevant industry trends and emerging issues

3.4.1 Supply chain

Containerisation

Containerisation is more than 50 years old as a logistics / supply chain technology and solution. The largest growth in the containerisation of commodities has occurred with current and future changes relevant for the Port of Townsville focussing on:

- Further containerisation of specific agricultural export products to overseas markets where these markets have a need for smaller size consignments avoiding the need for large bulk storage and distribution infrastructure
- Further containerisation of refined metal exports currently shipped as break-bulk cargoes;
- Potential increased direct supply of imported containerised household goods to Townsville as the population grows to levels supporting the economics of direct containership calls instead of supply via the Port of Brisbane and on-transportation by road and rail
- Potential increased share of existing containerised exports originating in the Port of Townsville's catchment area, but currently routed via the Port of Brisbane. This possible capture would be aided by potentially increasing direct container imports due to the local availability of empty returned import containers as well as a potential increase in the number of container services calling at the Port of Townsville allowing for connections to global markets most likely via other transhipment ports in Asia
- Improved heavy vehicle access enabling road connections to Port of Townsville for triple road trains carrying containerised agricultural export products from Central Queensland.

Given sufficient volumes, direct calls by vessels to the goods' nearest load or discharge port are likely to be the least cost option to supply the import or export markets and, as a result, will be the dominant supply chain method. For example, the current level of fuel and new motor vehicles demand in the Port of Townsville's catchment area allows for direct calls by tanker vessels and car carrier vessels, i.e. there is no-longer a need for the majority to be supplied via the Port of Brisbane.

3.4.2 Global fleet ship size

Shipping serving the Port of Townsville is part of a global fleet of commercial vessels of various designs to service commodity markets and trade routes. The global fleet is categorised into main sectors based on vessel design groups, size classes and cargo handling methods:

- Dry bulk carriers with size classes: Handy, Handymax, Panamax, Post-Panamax, and Cape - Handy and Handymax vessels generally have on-board cranes for cargo handling
- Liquid bulk tankers with size classes: short-, medium- and long- range with specialised tankers for crude oil, fuel products, bitumen, chemicals and edible/vegetable oils
- Break-bulk/Ro-Ro/Multi-purpose: includes specialised pure car carriers and heavy-lift project cargo vessels
- Containerships with size classes: less than Panamax (for intra-regional routes), Panamax, Post-Panamax, Ultra Large (less than Panamax vessels tend to have own cranes for container handling)

- Cruise-ships with size classes: less than Panamax (expedition and intra-regional), Panamax, and Post-Panamax.

Average ship sizes have steadily increased over the last ten years, resulting in new, larger size classes in the containership, pure car carrier and cruise-ship sectors where economies of scale and cost saving measures introduced by shipowners have driven these developments.

The types of vessels calling at the Port of Townsville mostly consist of Panamax and smaller dry bulk carriers for minor bulk commodities rather than large scale iron ore and coal shipments and petroleum tankers for fuel imports. These vessels have tended to be in sectors of the global fleet where there has been less need to increase ship sizes, as the ship sizes are already economically optimum for the type of cargoes and routes traded. This sector of the global shipping fleet will continue to serve the Port of Townsville in the future for the Port's minor dry bulk, liquid bulk and break-bulk trades with little change in required shipment sizes (a finding mentioned by a number of the key stakeholders interviewed during the Infrastructure study).

Multi-port calling itineraries

The exception in the future are containerships, pure car carriers and cruise-ships that operate on multi-port calling itineraries calling at capital city and some larger regional ports around Australia. The shipping and port industry is anticipating that the main Australia capital city-Asia container trade may see some containerships of over double the current average size deployed in the trade over the next five years, i.e. 8,000 TEU+ size versus typical size of 4,000 to 5,000 TEU. The containerships currently calling at the Port of Townsville are small (1,000 to 2,000 TEU) by these standards reflecting the current small size of the local market and the overseas route destinations of the vessels, such as Papua New Guinea and Pacific Islands combined with some Asian calls.

3.4.3 Regulatory – coastal shipping

The Australian coastal shipping industry is regulated and subject to Federal Government policy for inter-state coastal trade and State Government policy for intra-state coastal trade. Over the last ten years, Australian coastal shipping has gone through several iterations with changes in Australian Governments, moving from a relatively open (permit-based) system allowing international foreign-flagged vessels to carry domestic cargoes economically to the current more restricted licence system.

In 2016-17, the Australian Government proposed a number of reforms to the coastal shipping regulations, which if implemented as reform legislation in 2017, should see a return to a more open, light-handed and cost effective approach to coastal shipping around Australia including domestic cargoes to/from the Port of Townsville. This is relevant to the Port of Townsville domestic container trade, which if made more cost effective through revised regulations, may allow competition between landside transportation (road and rail) and coastal shipping between the Port of Townsville, other Queensland ports (Brisbane and Cairns), and inter-state ports including for the transhipment of international containers.

3.4.4 Port and logistics equipment and technology developments

The cargo handling equipment used at ports globally has not significantly changed over the last ten years. The main functional changes have been limited to:

- Increased size (scale) of equipment to accommodate larger vessels and cargo exchanges over the berth
- Increased efficiency, productivity and communications through part or full automation of handling equipment operations (most notably in the container terminal sector)

- Niche handling developments in the minor dry bulk sectors to provide low investment options for junior miners with low volume / short reserve life production. This consists of the ‘rotainer or tippler’ operation of loading vessels used at the Port of Townsville.

Logistics equipment on the road network nationally and in Queensland has seen the increased permitting and utilisation of HPFVs over the last ten years. The productivity of rail freight logistics is dependent on increasing access charges to fund improvements, such as longer trains, increased speeds and double stacking, and has remained more static in terms of its overall efficiency. This has contributed to a loss of market share to HPFVs over the last several years, most notably on the (NWMP) – Townsville, route which involve an alternative cost recovery model for contributions to road network improvements.

As a response to climate change and the need to reduce carbon emissions, shipping, ports and logistics equipment are likely to see a greater uptake in cleaner fuels - low sulphur fuels, LPG, LNG and hydrogen - over the next ten to twenty years including on-shore powering of vessels when in port. Part of the uptake will be driven by the implementation of international agreements via the International Maritime Organisation (IMO) of which Australia is a signatory.

There is increasing industry agreement that the next ten to twenty years may see the introduction of the first fully-automated cargo vessels, tugs and remote pilotage. The level of investments involved will probably mean that these technological developments will first occur on major or specialised trades and at major ports in Europe, North America, Asia and the Middle East.

3.4.5 Port infrastructure optimisation

The efficient use of port and supply chain infrastructure is critical to supporting sustainable ongoing growth of port capacity. Reef 2050 includes a specific action (EBA3) requiring port master planning to address port infrastructure optimisation.

In order to achieve optimisation of port infrastructure, there are principles of optimisation enshrined in the Ports Act:

- concentrating port development in priority ports
- efficiently using port and supply chain infrastructure
- identifying and protecting land and infrastructure critical to the effective operation of the port network.

There are a number of ways of optimising port infrastructure of relevance for the Port of Townsville. These include:

- multi-entity use of berths and cargo-handling equipment where cargo contamination is not an issue
- single-use currently exists with latent capacity available
- extending jetties outwards into deeper waters where applicable to avoid channel deepening
- maximising trains lengths and road-vehicle size
- eliminating double-handling of commodities at load and discharge points, and
- increasing landside supply-chain velocities.

3.5 Approach to forecasting and growth scenario descriptions

The forecasting approach uses a time-frame to 2050 with three main growth scenarios to guide the infrastructure assessment and master planning processes for the priority Port of Townsville.

The three scenarios have been jointly developed and agreed with GHD, DSD, Queensland Treasury, the Department of Transport and Main Roads and PoTL, and have also been reviewed by other government stakeholders and agencies.

The scenarios modelled are:

- Scenario 1
- Scenario 2
- Scenario 3 which comprises Scenario 2 plus an additional 10 mtpa Dry Bulk.

Undertaking an infrastructure analysis of Scenario 3 is valuable as it allows assessment of any additional planning that would be required should additional dry bulk at these levels ever eventuate.

The forecast throughputs are based on modelling assumptions and a detailed understanding of PoTL's current customers and cargoes, Queensland government projections of population, development of minerals projects and irrigated agriculture, interviews with key exporters and feedback from stakeholder project workshops which included various Queensland Government agencies and PoTL.

There is inherent uncertainty in growth projections, in the possible size and timing of future development and the timing of trigger points for industry developments. The growth scenarios developed are based on the 30 year master planning timeframe, with incremental growth over the next 10 years and 20 years expected.

A range of growth scenarios have been developed to account for the inherent uncertainty in the magnitude and timing of growth, providing flexibility in a range of possible long term port growth outcomes. Scenarios 2 and 3 will guide the infrastructure assessment and inform the development of an environmental management framework (EMF).

However, Scenario 3 will inform the master plan of future possible infrastructure requirements for the ultimate footprint of the Port of Townsville. It should also be recognised that ports are inter-generational assets, which are likely to drive economic growth in the region for extended periods of time beyond the 30 year master planning timeframe.

The following should be noted when reading the growth scenarios in this report:

- Growth scenarios are for priority port master planning out to the year 2050, focusing on maximum reasonable estimates of throughputs over the life of a master plan, regardless of when this throughput is achieved;
- The analysis does not form a view about the likelihood of any of the scenarios occurring or indicate government support for any particular infrastructure project or industry development
- The analysis recognises that individual ports compete for trade, with growth scenarios for each port accommodating of maximum trades without forming a view about which port may be more likely to receive the trade
- The analysis focuses on informing infrastructure, supply chain, and environmental implications resulting from the growth scenarios
- The results of the analysis are used to predominately inform consideration of land and marine use, including supply chain/infrastructure corridors and areas, as well as inform development of an EMF

3.6 Scenario 1

3.6.1 Assumptions used

Scenario one has the following overall assumptions:

- Growth in the port's existing trade (exports and imports)
- Development of the currently known (NWMP) projects (including phosphate and excluding coal and uranium), northern Queensland irrigated agriculture projects and ethanol plant projects
- Part capture of contestable agricultural export and household goods import container trades
- The Townsville nickel refinery remains closed
- Magnetite remains uneconomical to export
- Central Galilee Basin coal development starts with fuel and project cargo routed via the Port of Townsville.

3.6.2 Results of modelling

The results of the modelling for scenario one indicate:

- **Maximum port throughput of 10.2 mtpa** comprising:
    - Liquid Bulk 2.1 mtpa
    - Dry Bulk 6.2 mtpa
    - Break-bulk 0.5 mtpa
    - Containers 1.2 mtpa (or 112,000 TEU)
    - Livestock (Cattle) 0.2 mtpa.

3.6.3 Demand implications of scenario 1 for infrastructure

Scenario one forecasts a maximum trade throughput which is at levels of throughput experienced by the port in the last five years. This implies that the demand on port, road and rail infrastructure does not exceed levels handled in the recent past with the exception of an increased container trade at almost double the highest level handled to date.

3.7 Scenario 2

3.7.1 Assumptions used

Trade Growth Scenario 2 has the following overall assumptions:

- Further growth in the port's existing trade (exports and imports)
- Further development of currently known (NWMP) projects generating dry bulk exports (including phosphate as dry bulk and excluding coal and uranium), northern Queensland irrigated agriculture projects and ethanol plant projects
- Further part capture of contestable agricultural export and household goods import container trades
- The Townsville nickel refinery re-opens (of which ore imports as dry bulk)
- Existing stock-piled magnetite (as dry bulk) becomes economic to export

- Central Galilee Basin coal development is expanded with two mines being supplied with fuel and project cargo via the Port of Townsville.

3.7.2 Results of modelling

The results of the modelling for scenario 2 indicate:

- **Maximum port throughput of 18.4 mtpa** comprising:
    - Liquid Bulk 2.4 mtpa
    - Dry Bulk 13.6 mtpa
    - Break-bulk 0.5 mtpa
    - Containers 1.7 mtpa (or 186,000 TEU)
    - Livestock (Cattle) 0.2 mtpa.

3.7.3 Demand implications of scenario 2 for infrastructure

Scenario 2 forecasts a maximum trade throughput which would represent a historic new high level. This implies that the demand on port, road and rail infrastructure has never been stretched/tested to this level of throughput, i.e. it would be in a new territory of operations for the Port. In particular, dry bulk and container throughputs would be at significantly higher levels than current.

3.8 Scenario 3

3.8.1 Assumptions used

Scenario 3 adds additional dry bulk exports routed through the Port of Townsville to scenario 2. It has the following overall assumptions:

- Up to a combined 10 mtpa of additional dry bulk export projects are assumed to occur together with some additional export liquid bulk.

New dry bulk commodities could be, for example, the Northern Galilee Basin thermal coal exported through the Port of Townsville (with a limited amount of shale oil from the (NWMP).

3.8.2 Results of modelling

The results of the modelling for scenario 3 indicate:

- **Maximum port throughput of 28.3 mtpa** comprising:
    - Liquid Bulk 2.8 mtpa
    - Dry Bulk 23.1 mtpa
    - Break-bulk 0.5 mtpa
    - Containers 1.7 mtpa (or 186,000 TEU)
    - Livestock (Cattle) 0.2 mtpa.

3.8.3 Demand implications of Scenario 3 for infrastructure

Scenario 3 forecasts a maximum trade throughput which would represent the port operating at a level double of the historic highs. In particular, dry bulk would be at levels four times higher than current levels with the majority of this increase requiring rail transportation on the MIRL, an increased storage foot-print at the port and increased shipments (numbers of ship calls)

4. Assessment of future infrastructure & supply chain requirements

4.1 Introduction to this section

This section provides an analysis of existing capacity of the existing infrastructure and compares this with the future trade scenario and supply chain needs to determine if any gaps exist, and what infrastructure may be required to meet these requirements.

4.2 Capacity analysis of existing port and connecting landside infrastructure

The capacity analysis of the existing port and connecting landside infrastructure is now presented by the following components of infrastructure:

- Port of Townsville Marine Ship Anchorages
- Dredged Material Placement Area
- Port of Townsville Shipping Channels
- Port of Townsville Berths (including associated requirements)
- Rail Corridors used by port-related supply chains
- Road Corridors used by port-related supply chains
- Industrial Land with current/future port-related supply chain use.

4.2.1 Port of Townsville marine ship anchorages

Vessels visiting the Port of Townsville currently have access to a total of 13 designated anchorage areas. These anchorages are generally suitable for vessel visits as the majority of vessels arrive at the port un-laden (in ballast / without cargo) for bulk export cargoes. Two exceptions are fuel tanker vessels and bulk carriers with mineral concentrates for some refineries which are unloaded after arrival at the berths.

Assuming that the designated anchorage areas are open for 360 days of the year (net of major weather events), the existing available capacity of the Port of Townsville marine ship anchorages is a maximum total of 4,680 vessel waiting (at anchor) days per year, or the equivalent of 4.7 days/ship per 1,000 arrivals.

In practice, this capacity is limited by the capability of the port to process (handle at berth) all the ships arriving with randomised patterns in sufficient time without queuing occurring. In some instances, excess demand for anchorages (i.e. long queuing and waiting times in excess of 48 hours) can be created by an over-supply of vessels arriving on speculation of securing cargoes as witnessed a few years ago at some Australian coal and iron ore bulk ports.

4.2.2 Dredged material placement area

The existing dredge material placement area is historically the designated area for the disposal of dredged materials which are now limited to only maintenance dredging projects with capital dredging materials having to be placed on-shore or used for reclaiming land for future port use (in accordance with the Ports Act). The Port typically has around 450,000 cubic metres of maintenance dredged material per year of which some is used for land reclamation in the port area. The adequacy of the existing dredged material placement area (within port limits) to accept these ongoing volumes requires a separate assessment outside of this Infrastructure

study due to the complexities involved in modelling the remaining capacity available while not increasing environmental risk.

Future expansion of channels will require an increase in maintenance dredging volumes. It is understood that the current dredged material placement area has capacity to accommodate anticipated increases in maintenance dredged volumes.

4.2.3 Port of Townsville shipping channels

Vessels visiting the Port of Townsville currently access two linked single-lane shipping channels upon arrival and departure. The channels currently have a width limitation of 92 metres (including navigating a bend) and an average design depth of 11.7 metres. With tidal assistance and required minimum under-keel-clearance, this currently limits vessels to a maximum size of LOA of 238 metres, extreme beam of 32.3 metres and a maximum draft of 13.1 metres. This equates to a Panamax size class of vessel, or a containership of around 3,000 to 3,500 TEU.

Over the last ten years, the port has seen vessel visits of between 600 and 750 per year (around 1,200 to 1,500 channel transits per year or 3 to 4 per day) with a peak in financial year (FY) 2011-12. In FY 2015-16, the port received 632 vessel visits (around 1,260 channel transits or average 3.5 per day), of which 14 visits were from non-cargo vessels (i.e. cruise-ships and navy). It should be noted that on occasion daily ship arrivals may result in up to five arrivals transiting the channels within a 24-hour period.

The capacity of the shipping channels requires simulation of events from ship arrival at pilot station to completion of cargo handling at the berth. However, an estimate of the existing maximum capacity can be made by using a number of assumptions based on historical port data.

The assumptions used to estimate the capacity are:

- Open for transit 360 days per year (net of major weather events)
- One vessel in the channels at one time transiting for a total time of two hours (i.e. interval between each vessel transit is two hours and evenly spread)
- Allowed transit hours per day of 18 hours (due to combined tidal and wind effect restrictions)
- All of the transiting vessels can be immediately accommodated at berths.

Based on these assumptions, the estimated maximum capacity of the Port of Townsville shipping channels is 3,240 vessel transit slots per year at around 9 vessel transit slots per day. This number of vessel transit slots is limited by the availability of berths and time at berth which constrains the maximum number of possible vessel visits and hence channel transits.

It should be noted that the first section of the channel with the breakwater closest to the port is also used by Magnetic Island ferries operating on fixed schedules, and small recreational craft from the Townsville Yacht Club, which may interfere with port vessel transits occurring at the same time.

4.2.4 Port of Townsville berths (including tug harbour)

The existing capacity of the Port of Townsville berths is a complex interaction of scheduled and randomised vessel arrivals, weather events, planned and special maintenance/repair needs, vessel types and sizes, cargo-handling productivity, cargo preparation and clean-up requirements, and commercial arrangements for berth use (e.g. common-user versus single-user and priority berthing arrangements). The combined effect of these factors limits capacity of the port.

The Infrastructure study has not involved a simulation model of berth capacity. Reference has been made to various previous analyses which have estimated the existing effective combined capacity of the 8 berths at the Port of Townsville to be around 21.5 mtpa of cargo throughput (see Table 13). In terms of a cargo sector breakdown, dry bulk capacity is estimated at around 14.5 mtpa, liquid bulk at around 3.5 mtpa, and the remaining 3.5 mtpa covering break-bulk and general cargo.

Table 13 Port of Townsville estimated existing berth capacity

Berth	Main Commodities Handled	Estimated Capacity (mtpa)
1	Liquid bulk (common-user)	3.0
2	Dry bulk-nickel ore (now ceased)	4.5
3	Various (common-user*)	1.5
4	Various (common-user*)	1.5
8	Dry bulk (with some 3rd-party)	5.0
9	Dry bulk-sugar (incl. molasses)	2.0
10	Various (common-user)	1.0
11	Dry bulk	3.0
Total		**21.5**

Source: Various reports. Note: (*) Common-user via services provided by the Stevedore with lease from the Port.

Commercial lease arrangements

It should be noted that a number of the 8 berths are under commercial lease arrangements to single-users. For example, Berth 10 is subject to priority berthing for defence services for a certain maximum number of days per year. The commercial single-user arrangements may limit the ability of the latent berth capacity to be fully utilised as the operators are not incentivised to facilitate all third-party business. However, if these leases are not renewed at termination and are converted to common-user arrangements managed by the port, then latent berth capacity may be more effectively used, resulting in up to and possibly beyond the 21.5 mtpa described above.

Furthermore, a number of the berths are currently equipped with ship-loaders of relatively low handling capacities. If these berths were re-equipped with the latest design of high capacity (flexible) ship-loaders, then the effective combined capacity of the berths may exceed 21.5 mtpa.

The recent upgrade and commercialisation of Berth 4 as a general cargo/container facility to an effective linear berth length of 241 metres, and assuming an ultimate provision of two rail-mounted ship-to-shore gantry cranes, should allow for an estimated maximum container throughput capability (Berths 3 and 4 combined) of around 200,000 to 250,000 TEU per year based on all vessels calling being containerships and assuming typical current container handling rates as at Australian capital-city ports. In practice, Berths 3 and 4 may also be used by non-containerships (break-bulk / multi-purpose / Ro-Ro vessels) which may make the combined effective container throughput capacity less than the estimated maximum.

While two tugs are currently based at the existing tug harbour located at Berth 8 berth, there is insufficient space at the end of Berth 8 for more tugs. A further tug harbour would be needed to support future trade growth and larger sizes of vessels visiting the Port.

Cruise-ship tourism

Berth 10 is a multi-purpose facility for the cruise-ship industry, Australian Defence Force (ADF) visits, and commercial freight vessels. In recent years, the Port of Townsville has experienced increased cruise-ship tourism. In the 2017 calendar year, the port expects 11 cruise-ship visits involving around 14,000 passengers and crew. In 2018, the cruise-ship industry has booked 18 cruise-ship visits to the port with potentially around 22,000 passengers and crew expected. cruise-ships call at the purpose-built Quayside Terminal on Berth 10.

Currently, the ADF has priority berthing and a guaranteed number of berthing slots per year, which means that if the cruise-ship industry continues to grow in the future, there may be increasing instances of berth unavailability.

4.2.5 Rail corridors used by port-related supply chains

A significant share of Port of Townsville's cargo throughput currently uses two connecting rail networks or corridors – the MIRL, and the NCL. The 1032 kilometre MIRL, connecting the Port with the NWMP and Phosphate Hill, is currently the dominant line used by the port's supply chains. Following the recent closure of the nickel refinery only export bulk sugar and molasses currently use the NCL so it is not included in the assessment below.

Mount Isa Rail Line

The effective capacity of the MIRL is determined by a complex mix of factors. This includes rail-track technical capability (i.e. influence on axle-loads, train speeds and lengths, bridges/crossings, and number/location/length of passing-loops), rolling-stock availability, operational availability given major weather events and the effects of flooding, maintenance/repair schedules, rail-yard and siding capacities at each end of the line, as well as commercial arrangements regarding the level of common-user access. These factors limit the number of usable rail paths per week in both directions which allow trains of a maximum length (currently around 1,000 metres) with a maximum payload and minimum cycle time to operate. An additional factor affecting the effective capacity of the MIRL relates to the production/train loading capacity/efficiency of customers along the line.

The Infrastructure study has not involved a detailed study to model or simulate the effective capacity of the MIRL, so reference is made to the *Mount Isa Line Rail Infrastructure Master Plan* completed by Queensland Rail (2012) and feedback from stakeholder consultation. The *Mount Isa Line Rail Infrastructure Master Plan* describes the business as usual system capacity as 7.8 mtpa, with 5.8 mtpa actually railed in 2012. It further states that the increase in tonnages able to be hauled on current train paths will provide the potential for an increase in system capacity from the same number of available train paths.

There is a maximum number of rail paths per week available on the MIRL which QR does not contract above to allow for the continued re-sleepering program on the line. Based on a maximum 5500 net tonnes of freight per service, one-way train operation and assuming all trains are equal, a capacity may be achieved of around 12.2 mpta with no weather or flood downtimes. Based on an optimistic assumption of full trains operating in both directions this could double to a maximum theoretical capacity of 25 mpta net freight.

However, not all commodities and train services are homogenous which means that in reality train lengths may vary from 500 up to around 1000m, empty trains are highly to occur and weather/flood impacts do occur. Given all these factors, the effective capacity of the MIRL is likely to be significantly less than the maximum theoretical capacity of 25 mpta net freight.

In 2015, QR identified that the MIRL transported around 5 mtpa of freight with around 4000 freight train moments. Since 2015, it is believed that the share of freight carried on rail has declined with road-trains (B-Triples) carrying a greater share along the Flinders Highway.

It should be noted that currently not all freight on the MIRL uses the port as a gateway, which means that port-related freight requires a majority share of the available capacity but not 100% of the capacity.

Port branch line

The section of rail network into and within the port also has an effective capacity which again is determined by a complex mix of operational and technical factors including the need to de-couple trains at Stuart, ensure suburban road-crossings near the Port are not unnecessarily blocked, the length of sidings and loops to/from cargo areas, and the actual speed of unloading (dumping) and/or loading of rail-wagons within the port.

There are currently no reference materials available providing visibility on the existing effective capacity of the rail network into and within the port.

The port branch line track configuration immediately adjacent to the port boundary and the location of customer facilities in close proximity to the port entry has contributed to significant congestion on the port branch line.

However, it is understood from information provided by PoTL and some port users that the efficiency and service level of this section of the rail network was impaired several years ago when combined port rail demand included MIRL export cargoes, sugar/molasses exports and nickel ore imports – representing a combined port rail demand level of around 10 to 11 mtpa.

Queensland Rail has resumed operational control of the rail system within the Port of Townsville (this was previously performed by Aurizon under an operational agreement with QR) and has made significant operational improvements since the 10 to 11 mtpa freight-level was achieved. However, the length of trains operated into the Port of Townsville continue to be dependent on the following factors:

- Infrastructure between Stuart and Townsville Jetty - QR imposes strict scheduling restrictions for any train longer than 775 m between Stuart and Townsville Jetty to reduce the impact on road traffic in the Townsville suburban area, although some longer trains may be operated
- Infrastructure on the NCL – trains operated on the NCL are restricted to 680 metres in length
- Infrastructure on the MIRL– trains operated on the MIRL are restricted to 1009 metres in length
- Optimal train operations for the project being hauled to the port – typically shorter trains with higher frequency will provide a more cost effective transport solution to move commodities over a relatively short distance (e.g. Nickel and sugar transport in close proximity) whereas longer trains are preferred for longer hauls e.g. Mount Isa/Cloncurry
- Loading and unloading infrastructure constraints – limitations on length may also be imposed due to restrictions that loading and/or unloading infrastructure, for example tipplers at the Townsville Jetty.

Given a rail traffic mix with longer (higher payload) trains than in the past, then it is likely that congestion experienced at these levels of throughput in the past may not occur or be lessened.

This subject is also currently under investigation by Building Queensland's TEARC Business Case project team.

4.2.6 Road corridors used by port-related supply chains

The analysis of the existing capacity of road corridors used by port-related supply chains focuses on the key road infrastructure network shown in Table 14.

The capacity assessment uses DTMR[2] recommended road design parameters for capacity and acceptable road Service Levels with the available capacity (vehicles per day) at Service Level E taken as at or near actual capacity. The assumptions used for the road capacity assessment are:

- DTMR road Service Level E as representing traffic flows at or near actual capacity;
- Service Level E capacity based on traffic flow levels of:
  - 400 freight vehicles per hour per lane for a road with intended majority freight vehicles, i.e. the Southern Port Access Road
  - 1800 vehicles per hour per lane for a non-rural road (or highway) without nearby intersections with intended majority passenger (car) vehicles, i.e. Bruce and Flinders Highways
  - 1600 vehicles per hour per lane for a non-rural road (or highway) with nearby intersections with intended majority passenger (car) vehicles, i.e. other roads and streets.

Table 14 Port of Townsville existing capacity of connecting roads

Key Road Point & existing status	Port Supply Chain Relevance	EBR - Existing traffic use (vehicles per day)	Estimated capacity (vehicles per day when at DTMR Service Level E)
Townsville Port Access Road– one lane each way	Majority of road-based port freight	2,422 (incl. 630 HV)	(a). Majority freight: 19,200 (b). Majority cars: 76,800 (with nearby intersections)
Bruce Highway (north of Townsville) – one lane each way	Some mixed freight / future containers	5,916 (incl. 590 HV)	- 86,400 (majority cars)
Bruce Highway (south of Townsville) – one lane each way	Some mixed freight / future containers	11,904 (incl. 1,190 HV)	- 86,400 (majority cars)
Flinders Highway (before Stuart) – one lane each way	All Mt. Isa road-based port freight / future Woodstock area	5,561 (incl. 1,610 HV)	(a). Majority freight: 19,200 (b). Majority cars: 86,400
Abbott Street (before Boundary St) – one lane each way	All near west & north road-based port freight	27,302 (incl. 4,910 HV)	- 76,800 (majority cars)

[2] Queensland Government DTMR – Road Planning & Design Manual, Chapter 5 Traffic Parameters, Aug. 2004.

Boundary St (between Samphire Rd and Bell St) – one lane each way	Some near west & north road-based freight	6,964 (incl. 840 HV)	- 76,800 (majority cars)
Woolcock St (before Boundary St) – one lane each way	All near west & north road-based port freight	40,871 (4,090 incl. HV)	- 76,800 (majority cars)

Note (1): Archer St at Hubert intersection has current 3,600 vehicles per day (27% HV).

Sources: GHD analysis / EBR / DTMR.

The most important road linkage for the Port of Townsville is the recent purpose-built TPAR. In its current design (one-lane each way), if used primarily for port-related freight vehicles, the TPAR has an existing capacity of around 19,200 freight vehicle movements per day. Currently, around 630 heavy vehicles (HV), which most are assumed to be port-related, use the road indicating a current utilisation of around 3%. In addition, local passenger vehicles currently utilise a further 9% of available capacity. If the TPAR was duplicated, then capacity could potentially increase to 38,400 freight vehicles per day.

Two relevant road linkages, currently at more significant utilisation levels, are Abbott St (before Boundary St) at around 36%, and Woolcock St (before Boundary St) at around 53%. As these are linkages for non-port related traffic, future road congestion based on background traffic growth may occur (discussed further in section 4.3 below).

Role of Archer Street for port traffic

Archer Street (off Benwell Road and the TPAR intersection) is currently an important port access road bordering on the port and has traffic of around 3600 per day of which 27% or around 970 per day are heavy vehicles. Archer Street, in connection with the TPAR, is also used by non-port traffic and is managed by TCC, apart from a small section which is managed by the PoTL.

Archer Street is also a possible routing for project cargo on over-mass/over-size vehicles from the berths at the Port of Townsville destined for the TPAR and onto the Flinders Highway. It is noted that freight vehicles servicing the central area of the port currently use Archer Street to enter the port via Hubert Street rather than Benwell Road.

Archer Street has a rail-crossing for the Port Branch Rail Line into the port which causes some delays for traffic and limits the length of trains into the port for some of the port users. The removal of the rail-crossing would likely increase the efficiencies for both road and rail traffic.

The estimated future increase in commuter car traffic on the TPAR is likely to also occur on Archer Street as the road is used to access the city by continuing on to McIlwraith Street.

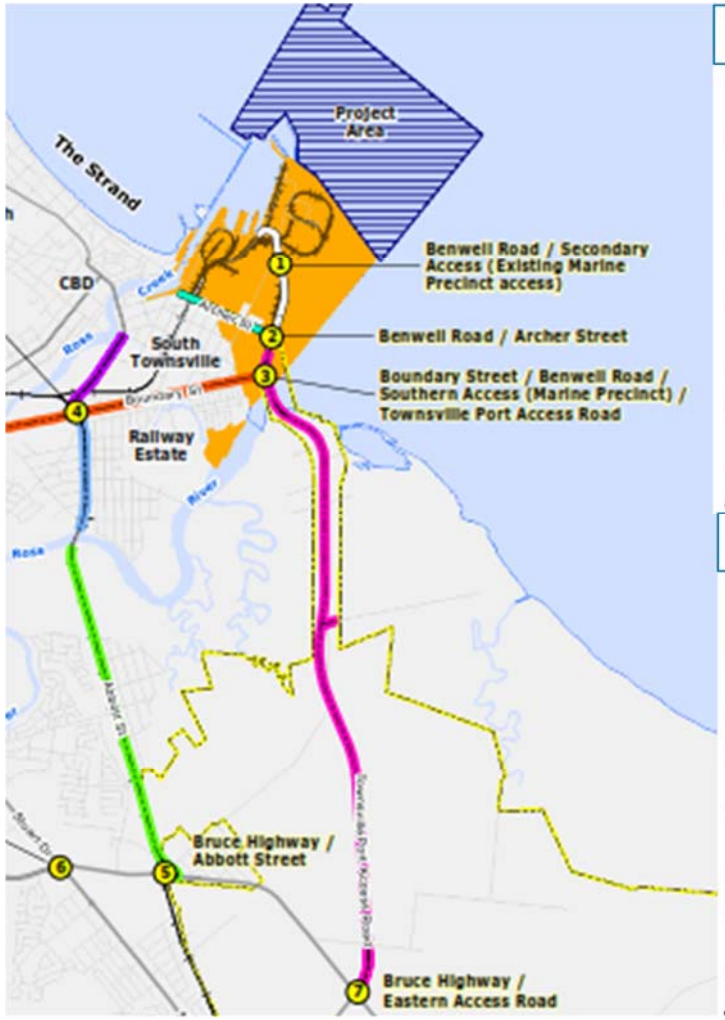
Reviewing the current inefficiencies of the rail-crossing on Archer Street is also part of the scope of work of the TEARC business case project team. However, this is likely to be considered at a later stage beyond the first phase of the TEARC.

Given the competing road user needs for Archer Street, further consideration of the removal of the rail-crossing through the TEARC rail alignment is recommended. Archer Street could also be fully managed by the port so that priority access is given to heavy freight and over-size vehicles to provide access to the TPAR.

4.2.7 Estimated future background traffic on relevant road network

This section refers to the Traffic Impact Assessment of the PEP Environmental Impact Statement (2011-12) (EIS) which forecasts estimated morning and after peak background traffic (vehicles) at seven key road network points (see Figure 13).

Figure 13 Overview of forecast background traffic for the PEP EIS



PEP EIS: Morning Peak (Vehicles/hr.)

Location	Background Traffic		
	2035	2036	2046
1) Benwell Road/Secondary Access	108	108	108
2) Benwell Road/Archer Street	244	245	261
3) Boundary Street/Benwell Road/TPAR	2,365	2,417	3,048
4) Boundary Street/Saunders Street	3,633	3,633	4,021
5) Bruce Highway/Abbott Street	3,009	3,053	3,520
6) Bruce Highway/Flinders Highway	4,420	4,475	5,073
7) Bruce Highway/TPAR	3,832	3,919	4,915

PEP EIS: Afternoon Peak (Vehicles/hr.)

Location	Background Traffic		
	2035	2036	2046
1) Benwell Road/Secondary Access	109	109	109
2) Benwell Road/Archer Street	255	257	274
3) Boundary Street/Benwell Road/TPAR	2,747	2,803	3,446
4) Boundary Street/Saunders Street	4,651	4,707	5,312
5) Bruce Highway/Abbott Street	3,895	3,958	4,655
6) Bruce Highway/Flinders Highway	5,300	5,368	6,095
7) Bruce Highway/TPAR	4,879	4,990	6,258

Source: PEP Project EIS Part B Section B14 (AECOM etc.)

In addition to the PEP EIS background traffic forecasts, an analysis of possible Elliot Springs residential traffic using the TPAR provides further insights into future road capacity needs. The assumptions used in the analysis, including ultimate maximum of 10,000 dwellings and 26,000 residents at Elliot Springs, produced an estimated possible maximum of Elliot Springs 1900 cars per hour at peak hours using the TPAR.

If an estimated future maximum 800 port related truck moves per day are added based on the maximum future trade growth scenario (and assuming a conservative 70 port related moves per hour in peak hours) then total demand in the peak hours on TPAR could be around 3000 vehicles per hour which may require duplication of the TPAR to avoid the road reaching its functional capacity.

It is important to note that this is driven by estimated future background car traffic growth and not by port-related truck movements. If background car traffic was removed from TPAR, then existing capacity is estimated to be sufficient for the maximum future trade growth scenario based on the various modelling assumptions.

It should also be noted that due to the extended duration of the PEP, there will be significant demographic and consequential traffic change over this period, and as such there is a need to undertake and develop revised traffic assessments and management plans for each stage of the project to determine haulage requirements.

As part of the AEIS process, PoTL has committed to the preparation and ongoing revision of a revised road impact assessment, traffic operations assessment and road safety audit a minimum of six months prior to the commencement of stage one of the PEP.

4.2.8 Industrial Land with current/future port-related supply chain use

It is noted that not all existing and planned (investigation) industrial land around Townsville will be required for port-related use. This study has identified the extent of the existing industrial areas to understand whether these may be sufficient to accommodate future port-related activity growth including any new activities or cargoes. Port-related activities in industrial areas include the following:

- Goods produced or processed at industrial/manufacturing facilities which are either exported through the port or require as inputs raw materials and intermediate goods imported through the port; and
- Port cargo logistics functions such as storage and distribution of goods, tank farms, intermodal terminals, empty container parks/depots, truck and rail depots/yards, project cargo lay-down areas, and live cattle export marshalling areas/yards and related truck de-coupling points.

The scale of port-related activities may vary from several hectares to several hundred hectares for a large logistics precinct or large industrial plant.

Existing available capacity is dependent on the ability to re-develop existing sites or move non-port related activities elsewhere. Hence total land areas provide a guide as shown in Table 15.

Table 15 Existing and planned industrial land around Townsville

Key industrial area	Status	Estimated Size, hectares	Road access	Rail access
Bohle Industrial Estate	Existing	ca. 30	Ingham Rd / Bruce	-
Bohle Plains Industrial Investigation Area	Investigation	400	Hervey's Range / Bruce	-
PoTL Quarry (Pinnacle) – project only use	Planned (PEP)	1200	Laudham / Riverway	-
Roseneath Medium Impact Industry Precinct	Developing	ca. 193	Flinders Hwy	MIRL (possible)
Stuart Industrial Estate	Existing	-	Flinders Hwy / Bruce	MIRL & NCL
Townsville State Development Area (usable)	Existing	200 – 1,500	Southern Port Rd / Bruce	TEARC (plans)
Woodstock Industrial Land Investigation Area	Investigation	1,361	Flinders Hwy	MIRL (possible)
Yabulu Heavy Industrial Area (closed nickel refinery)	Existing	1,705	Bruce Hwy	NCL

Sources: EBR / GHD estimates (Google) / Townsville Industrial Land Use Study.

4.3 Implications of growth scenarios for existing infrastructure

This section takes the results of the future trade growth scenarios presented in section 3 and compares them with the estimated levels of the existing infrastructure capacity to produce a set of implications, where applicable, regarding any needs for additional infrastructure capacity and possible resulting impacts for the port's proposed master plan area and overlays.

4.3.1 Scenario 1

The estimated effects of Scenario 1 (maximum 10 mpta port throughput and 112,000 TEU of containers) – on existing and required infrastructure is shown in Table 16.

Table 16 Estimated effects of scenario 1 on infrastructure

Infrastructure component	Estimated effect(s)	Implications for master planning
Anchorages	Sufficient existing capacity	Remain as total 13 anchorage points.
Ship Channels	Sufficient existing capacity	Remain as single-lane channels with delays to non-port users waiting for commercial shipping to swing into harbour.
	With increased container demand, the capacity of existing channels limits ship sizes, particularly direct call Australia/Asia services. Some larger cruise-ships and car carriers may be impacted	Potential channel modifications (widening) and legislated storage of dredged material in holding area for future land reclamation use and beneficial reuse.
Berths and land	Sufficient existing capacity & capability	As a result of increased container trade, logistics operations and land needs are likely to intensify around Berths 3/4 (container terminals), including the increased storage of empty containers. This may require 24/7 landside operations and a port truck traffic management plan to accommodate increased container HPFV access.
Road network	Sufficient existing capacity & capability	No change required to current specifications & operations of the primary and secondary road network.
Rail network	Sufficient existing capacity with some inefficiencies remaining	No change required to current specifications & operations unless triggered by TEARC Business Case investment decision to proceed. If TEARC proceeds, the preferred alignment needs to be addressed in proposed Master planned area.
Industrial Areas	Sufficient existing capacity & capability	Increased container trade may trigger requirement for 24/7 logistics operations and container HPFV access to/from distribution centres in industrial areas.

Legend:	Description
	Sufficient existing capacity
	Approaching existing capacity
	Insufficient existing capacity

Source: GHD analysis.

An alternative to widening the shipping channels for direct-calling larger containerships, would be to deploy smaller containerships (of up to 3000 to 3500 TEU) on more Queensland dedicated services. This will continue to restrict the size of vessels calling at the port.

With the increased container trade, there is likely to be increased empty container storage with potential high-stacking of containers around Berths 3 and 4. Given land availability, stacking heights may be reduced on port land by storing a significant percentage of empty containers on land close to the port within the TSDA. In general, the optimal economic solution for the port, stevedore, shipping companies and trucking companies is to have empty container storage located as close to the terminal as possible.

It is worth noting that the alternative to not using container HPFVs (i.e. use smaller trucks) is likely to increase logistics costs and traffic movements on the connecting road network around Townsville.

4.3.2 Scenario 2

The estimated effects of Scenario 2 Trade Growth (maximum 18 mpta port throughput and 186,000 TEU of containers) – on existing and required infrastructure is shown in Table 17.

Dry bulk requirements:

Under this scenario, it is estimated that maximum dry bulk demand would be around the existing available handling capacity at the port assuming that all berths are operated as common-user or with third-party throughputs. Third-party throughput on future leased dry bulk berths may be restricted, therefore the need for expanding dry bulk capacity of at least an additional berth is triggered.

Liquid bulk requirements:

Maximum liquid bulk demand is also estimated under this scenario to be fast approaching the threshold of high berth capacity utilisation (around 80%), potentially triggering the need for expanding liquid bulk capacity by an additional berth.

Rail transportation requirements:

This scenario includes the restarting of the nickel refinery and the maximum demand transport by rail is estimated to be in excess of existing rail capacity. This would require increased efficiency levels both on the MIRL and into/within the Port area triggering the need for capacity upgrade investments on the MIRL and the implementation of the TEARC preferred solution. Rail related investments would be subject to Queensland Government approved business cases and availability of funding.

Container requirements:

The container operations would be at levels significantly higher than under Scenario 1, a possible additional 66% increase in container terminal throughput at Berth 3&4 combined. This is still within existing available capacity given a linear quay arrangement for Berth 3 and 4 combined (i.e. a containership can be moved along the complete length or overlapping the two berths provided stevedoring arrangements permit).

Tug harbour requirements:

As trade increases, including cruise-ship and ADF vessel visits, and vessels become larger after widening of the existing shipping channels, there will be an increased need for tugs. This will increase the required capacity of the tug harbour which is currently located at the end of Berth 8. As a result, a new tug harbour will be needed and is likely best suited in the future port expansion area.

Table 17 Estimated effects of scenario 2 on infrastructure

Infrastructure component	Estimated effect(s)	Implications for master planning
Anchorages	Sufficient existing capacity & capability	Remain as total 13 anchorage points.
Ship Channels	Sufficient existing capacity	Remain as single-lane channels with delays to non-port users waiting for commercial shipping to swing into harbour.
	With increased container demand, capability of existing channels limits ship sizes if Australia/Asia services to direct call. Some larger cruise-ships, car carriers, and deeper-draft tankers also potentially impacted	Potential channel modifications (widening and deepening) and legislated storage of dredged material in holding area for future land reclamation use and beneficial reuse to develop new berths.
		Breakwater and berth construction would require need for operation of PoTL rock quarry & supply chain to port during this construction period.
Berths and land	Insufficient existing berth capacity for maximum dry and liquid bulk demand suggesting shortfall of possibly one berth for dry bulk and one berth for liquid bulk	Requirement for two new berths with associated capital dredging and storage - dry bulk in shed(s) and liquid as tanks and rail connectivity.
	Increased container terminal demand and associated logistics operations around Berths 3/4	As a result of increased container trade, logistics operations and land needs are likely to intensify around Berths 3/4 (container terminal), including the increased storage of empty containers. This may require 24/7 landside operations and port truck traffic management plan to accommodate increased container HPFV access.
	Increased break-bulk project cargoes associated with assumed higher level of mineral developments	Efficient project cargo operations require need for land for lay-down and special vehicle access to/from port and project sites suggesting need to secure option of additional area in TSDA.
	Increased trade, including cruise-ship and ADF vessel visits, and use of enlarged channels by larger vessels will see an increased need for tugs	Increased tug harbour capacity requiring relocation of the tug harbour from Berth 8 to a future expanded port land area.

	Increased trade activity will require services and utilities	Increased potable water and wastewater services which may require augmentation of networks external to the port.
Road network	Sufficient existing capacity & capability based on a possible required duplication of TPAR for increased demand in future background traffic growth	No change needed to current specifications and operations noting TPAR duplication may be required if TPAR used by non-port related traffic.
Rail network	Insufficient existing capacity & capability	TEARC solution and alignment to and within Port requiring this corridor to be identified and protected in master plan and port overlay.
Landside - Industrial Areas	Sufficient existing capacity & capability	Increased container trade may trigger requirement for 24/7 logistics operations and container HPFV access to/from distribution centres in industrial areas.

Legend:	Description
	Sufficient existing capacity
	Approaching existing capacity
	Insufficient existing capacity

Source: GHD analysis.

At high container throughputs in excess of 250,000 TEU per year, an on-dock intermodal container facility may utilise the improved rail connectivity provided by the TEARC preferred solution. This may influence the relocation of the re-purposed Berth 4 (as container terminal) to a new purpose-built terminal as a further stage of the port expansion. This facility would need to be designed to fully accommodate the empty container storage and logistics needs in an expanded port area.

4.3.3 Scenario 3

The estimated effects of scenario 3 (maximum just over 28 mpta port throughput and 186,000 TEU of containers) on existing and required infrastructure is shown in Table 18.

This scenario adds an additional 10 mtpa of dry bulk export throughput and an additional 0.3 mtpa of liquid bulk to the scenario 2. This additional dry and liquid bulk demand would require rail transportation via an upgraded connection to the MIRL.

This additional demand would further increase the requirement for additional MIRL capacity and the need to accommodate an additional dry bulk berth capacity and storage in future port expansion.

The liquid bulk exports may be accommodated at the new berth discussed under scenario 2, however extra dedicated tank storage would be required due to the nature of the product. Alternatively, all tank storage could be located in TSDA with pipeline connection via TEARC corridor to the additional liquid bulk berth under scenario 2.

The additional dry bulk exports may produce two options for storage and handling at the port. This would involve up to 5 hectares of storage in the TSDA with a covered conveyor connection through the materials transportation and services corridor to the berth ship loading location, or

alternatively the dry bulk product is transported by rail up to a storage area located adjacent to the berth. This would likely require covered storage and risk mitigation measures if located next to high risk environmentally sensitive area(s).

An additional berth to accommodate cruise shipping is also proposed. This will create a new berth and seek to separate recreational boating and ferry vessels using Ross Creek from commercial shipping by diverting the recreational boating and ferry vessels by creating a new channel.

Table 18 Estimated effects of scenario 3 on infrastructure

Infrastructure component	Estimated effect(s)	Implications for master planning
Anchorages	Sufficient existing capacity & capability	Remain as total 13 anchorage points.
Ship Channels	Sufficient existing capacity	Remain as single-lane channels with delays to non-port users waiting for commercial shipping to swing into harbour.
	With increased container demand, capability of existing channels limits ship sizes if Australia/Asia services to direct call. Some larger cruise-ships, car carriers, and deeper-draft bulk carriers and tankers also potentially impacted	Potential channel modifications (widening and deepening) and legislated storage of dredged material in holding area for future land reclamation use and beneficial reuse to develop new berths.
		Breakwater and berth construction would require need for operation of PoTL rock quarry & supply chain to port during this construction period.
Berths & land	Insufficient existing berth capacity for maximum dry and liquid bulk demand suggesting shortfall of possibly two berths for dry bulk and one berth for liquid bulk	Requirement for three additional new berths with associated capital dredging and storage (dry bulk in possible shed(s) and liquid as tanks and rail connectivity). Alternative could be to locate dry bulk and liquid bulk storage in TSDA with conveyor/pipelines using TEARC – this would need protecting in the master planned area.
	Increased container terminal and associated logistics operations around Berths 3/4	As a result of increased container trade, logistics operations and land needs are likely to intensify around Berths 3/4 (container terminal), including the increased storage of empty containers. This may require 24/7 landside operations and port truck traffic management plan to accommodate increased container HPFV access.

	Increased break-bulk project cargoes associated with assumed higher level of mineral developments	Efficient project cargo operations require need for land for lay-down and special vehicle access to/from port and project sites suggesting need to secure option of additional area in TSDA.
	Increased trade, including cruise-ship and ADF vessel visits, and use of enlarged channels by larger vessels will increase need for tugs	Increased tug harbour capacity requiring relocation of the tug harbour from Berth 8 to a future expanded port land area.
	Increased cruise ship and ADF vessel visits and limited existing capacity at Berth 10.	Creation of new additional berth with associated capital dredging to create new basin/channel that will operate as cruise ship terminal. This involves separating the Ross Creek / Magnetic Island ferry traffic from commercial shipping at the start of the Platypus Shipping Channel bounded by the Western Breakwater to limit conflicting activities.
	Increased trade dry bulk activity will require services and utilities.	Increased demand for non-potable water and wastewater services for stockpiles which may require augmentation of networks external to the port.
Road network	Sufficient existing capacity & capability based on a possible required duplication of TPAR for increased demand in future background traffic growth	No change needed to current specifications and operations noting TPAR duplication may be required if TPAR used by non-port related traffic.
Rail network	Insufficient existing capacity & capability	TEARC solution and alignment to and within the port requiring this corridor to be identified and protected in the master plan and port overlay.
Landside - Industrial Areas	Sufficient existing capacity & capability	Increased container trade may trigger requirement for 24/7 logistics operations and container HPFV access to/from distribution centres in industrial areas.

Legend:	Description
	Sufficient existing capacity
	Approaching existing capacity
	Insufficient existing capacity

Source: GHD analysis.

4.3.4 Potential incremental impacts of future trade growth scenarios on other local infrastructure networks

Other local infrastructure networks managed by TCC and other utility providers which are used or accessed by activities within the port area:

- Water supply
- Power supply
- Waste management.

The Infrastructure study has not involved a detailed engineering assessment of the utility needs of future scale of operations of the port. The local government infrastructure networks have not been analysed in detail and potential augmentations may be required.

The following provides a short review on potential incremental impacts based on an assumed direct (linear) relationship between port throughput levels and utility network supply requirements.

Under the future scenario 1, the maximum port throughput is estimated to be at a level which is 15-20% lower than in the most recent peak period of 2011-2013 which was 1.4ML/d. Given there was sufficient utility network supply to the port during this period, it can be assumed that this will not require future augmentation.

Under the future scenario 2, the maximum port throughput is estimated to be at a level which is almost 40% higher than in the most recent peak year of FY 2011-12. It is anticipated that potable water use would correspond with the additional cargo volumes, noting that containerised freight may not require significant additional potable water.

Power needs may well increase, but likely at a lesser level than the throughput increase due a fixed base use for activities such as lighting. The port may invest to generate a certain share of power needs and increase the use of recycled water for wash-down activities. A localised exception to utility needs within the port area may come from increased cruise-ship calls at Berth 10 which require potable water, waste disposal (sewage, grey water and garbage) and possibly in the future shore-based power supply to reduce emissions from running engines in port.

The future scenario 3, which includes additional dry bulk, would likely increase utility needs to accommodate potential dry bulk requirements to water stockpiles.

5. Suggestions for draft master plan

5.1 Introduction to this section

This section presents suggestions for the draft port master plan to protect and advance state interests. It should be noted that interface and port overlay aspects are the subject of a separate annexure to this Study.

5.2 Suggestions for the draft master plan content

5.2.1 Suggested changes to master planned precincts

It is suggested that the initial EBR proposed master planned study area (scope) is modified with:

- Inclusion of the southern section of the TPAR, which includes the road train de-coupling area, in the Infrastructure and supply chain corridor precinct to recognise its role in serving the port and future port-related development in the TSDA
- The inner ship anchorage point remains as the sole anchorage infrastructure within the Marine infrastructure precinct for port master planning purposes, and the Marine infrastructure precinct is not extended beyond existing port limits to accommodate the outer ship anchorage points
- The dredged material placement area as a Marine infrastructure precinct remains as the sole materials placement area for port master planning purposes, and the Marine infrastructure precinct is not extended beyond existing port limits due to restrictions on the master planned area outlined in the Ports Act
- The ship pilot boarding ground currently located in the Marine precinct is recognised as a Marine infrastructure precinct for port master planning purposes to help protect its function in the safe and efficient passage of commercial vessels using the Port of Townsville
- The shipping arrival channel currently located in the Marine infrastructure precinct is also recognised as important infrastructure for port master planning purposes
- The inner and outer ship swing basins currently located in the Marine infrastructure precinct are recognised as important infrastructure for port master planning purposes
- The Eastern, Western and Offshore Breakwaters are recognised as part of the Marine infrastructure precinct for port master planning purposes
- The Marine infrastructure precinct is extended for port master planning purposes to include the potential future location of a cruise ship terminal and the separation of non-commercial marine traffic (i.e. ferries and recreational boating) from commercial marine traffic visiting the port for safety reasons
- Removal of the EBR PoTL quarry precinct due to the nature of its future operation if required for port construction projects as opposed to daily port operations. If the PoTL quarry becomes operational, permits and approvals outside of the master planning process will be required. Otherwise, material can be sourced from other local quarries outside the proposed master planned area and hauled via the Flinders Highway
- Removal of the EBR Elliot Springs precinct as it is now an approved area of residential development within the TCC planning scheme.

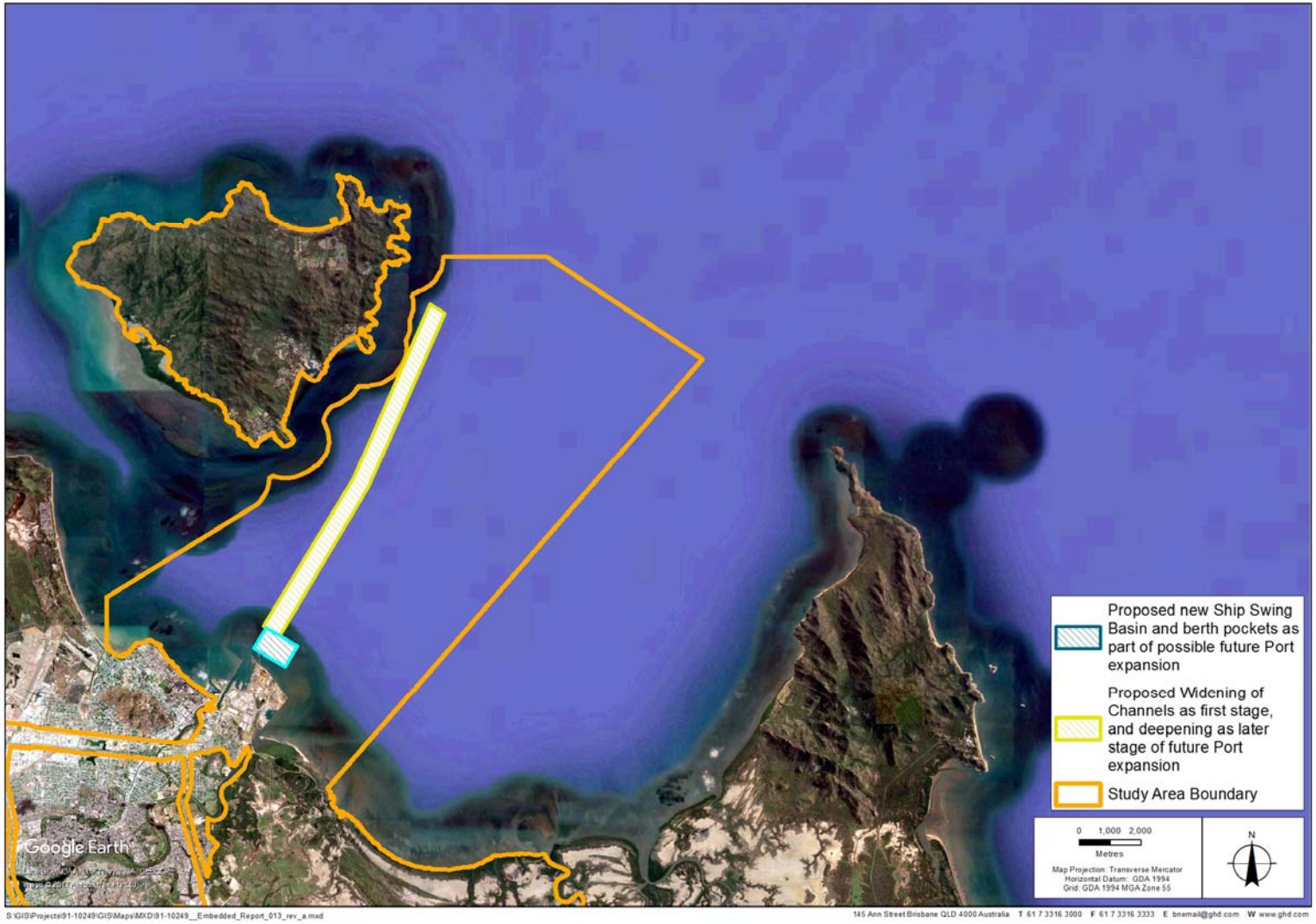
5.2.2 Infrastructure and supply chain network suggestions for the draft master plan

The following are specific precinct related and itemised infrastructure suggestions for the Port of Townsville draft master plan (key suggestions mapped in Figures 14 and 15 below):

2. As existing single-user berth agreements come close to termination, multi-user agreements are investigated as a priority to provide access to latent capacity where commodity compatibility and design enhancements exist and facilities are under-utilised
3. Protect the routes used by port traffic close to and within the port, in particular the routing of over-size / over-mass vehicles to reduce delays and manage intersection upgrades
4. Consider removal of the rail crossing and re-routing of the rail line across Archer Street to improve both road and rail efficiency, subject to port users migrating to new loading facilities
5. Inclusion of the preferred alignment of the TEARC to protect future improved rail operations to/from and within the port which may include use of the existing port reclaimed area to route rail into the port and remove its existing alignment over Archer Street
6. Continued protection of required land for future bulk handling connection to the port, such as conveyor/pipeline within the Coordinator-General owned materials transportation and services corridor
7. Recommend that TPAR is managed in the future, once service-levels start to significantly degrade, as a freight-only road or restricted for non-port related background traffic, noting its management is beyond the scope of the master plan
8. Requirement that sufficient appropriately zoned land close to the port is identified and reserved in the TSDA for port-related storage and logistics activities such as project cargo lay-down area and warehousing for consolidating / deconsolidating containerised cargoes. This port-related requirement for land may possibly be up to 100 (or more) hectares over the period out to 2050 dependent on market choice of other industrial locations around Townsville. Currently, the TSDA Development Scheme has appropriately zoned land in the TSDA for port-related storage and logistics activities should these be required by proponents in the future
9. Based on the possibility of wider and longer containerships, cruise-ships, and pure car carriers calling at the Port of Townsville in the future, a requirement to initially widen the existing shipping channels and possibly deepen the channels at a later stage as part of a port expansion for larger (fully-laden) dry bulk carriers and tankers. It is noted that this recommendation has been articulated in the Townsville City Deal and the recent endorsement of the Channel Capacity Upgrade Business Case by shareholding Ministers of the Queensland Government
10. Requirement of up to three additional berths in an expanded port area with associated new marine infrastructure (breakwater protection, a ship swing basin and berth pockets) and land behind the berths for cargo handling and storage with road and rail connections
11. With increased trade volumes and ship calls, combined with increased recreational boating, a need to separate Ross Creek marine traffic from commercial shipping using the port so as to mitigate the possible increased risk of navigational incidents and the possible decline in the schedule integrity of Magnetic Island ferry sailings for island residents and visitors

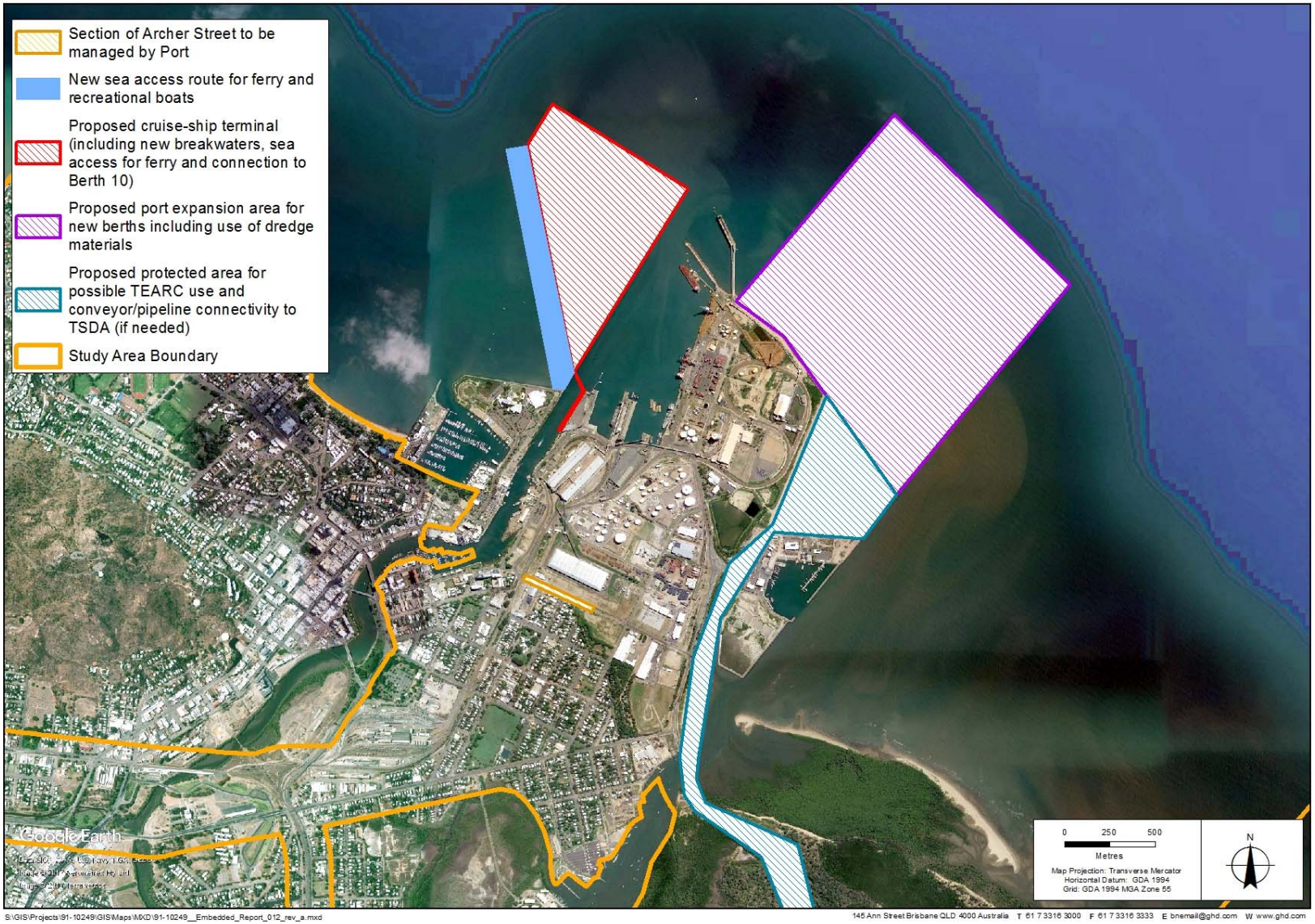
12. Given future increased use of Berth 10 by the cruise-ship industry and the Australian Defence Force (navy), the protection of an area along and behind the Western/Offshore Breakwater for a possible new Berth to accommodate additional cruise ship movements. This may include the separation of Ross Creek ferry and recreational boat traffic from commercial port traffic and provision of a connection to the existing cruise-ship facilities at Berth 10.

Figure 14 Map of Infrastructure and supply chain network suggestions for the draft master plan – outer port area



Source: GHD mapping.

Figure 15 Map of Infrastructure and supply chain network suggestions for the draft master plan – inner port area



Source: GHD mapping.

Appendices

Appendix A – References

The following is a list of public domain references materials (reports and documents) sighted for the literature review as part of the Infrastructure Study and referenced in this Report.

Priority Port of Townsville Master Plan - Evidence Base Report (Advisian, December 2016)

Infrastructure Layout and Land Allocation (Advisian, May 2016)

Townsville Port Expansion Project – Additional Information to the Environmental Impact Assessment (AECOM, October 2016)

Port Procedures and Information for Shipping – Port of Townsville (Queensland Government, September 2016)

Port Development Plan 2010 – 2040 (Port of Townsville, August 2009)

Land Use Plan (Port of Townsville, January 2013)

Townsville State Development Area Development Scheme (Queensland Government, July 2013)

Townsville City Plan (Townsville City Council, October 2013)

Port of Townsville Land Use Plan (PoTL, January 2014)

Townsville Priority Development Area Development Scheme (Queensland Government, October 2015)

Townsville City Economic Development Plan 2013-2017 (Townsville City council, 2013)

Townsville State Development Area Development Opportunities Strategy (Urbis, January 2013)

Maintenance Dredging Strategy for Great Barrier Reef World Heritage Area Ports (Department of Transport and Main Roads (DTMR), 2016)

Mount Isa Line Rail Infrastructure Master Plan completed by Queensland Rail (QR, 2012).

Appendix B - Further details

Townsville Port Expansion Project (PEP)

Since 1993 the Port of Townsville's entrance channel has measured 11.7 metres deep and 92 metres wide on average, making it around half the size of most other comparable ports in Australia. None of the improvement works completed on the channel over the past 40 years have increased the declared depth for shipping. PoTL submitted an Environmental Impact Statement (EIS) for the PEP to both State and Commonwealth regulatory authorities in March 2013. Subsequently Additional Environmental Impact Statement (AEIS) was also submitted in October 2016, taking into account the requirement for capital dredge material to be beneficially re-used (i.e. no sea placement), as well as addressing all community, stakeholder and agency feedback form public consultation.

PEP will include works to widen the channel entrance to the harbour to cater for the trend of increasing vessel sizes, and build new berths in the outer harbour, to cater for long term trade growth of up to 48 mtpa by the year 2040. The PEP is proposed to be developed progressively to match the demand for additional port facilities. The staging comprises 3 primary stages of development as follows:

- Stage 1 – Initial outer harbour reclamation, channel widening and Berth 12
- Stage 2 – Ultimate outer harbour reclamation, Berths 14, 15 and 16
- Stage 3 – Channel deepening, Berths 17 and 18.

Table 20 and Figure 23 outline the main characteristics of PEP, extracted from AEIS (AECOM, 2016).

Table 19 Main Specifications of port expansion project, as outlined in PEP AEIS

Project Aspect	Description
Reclamation size	152 ha
Capital dredge material placement at sea	No placement of capital dredge material at sea
Impact on the Great Barrier Reef Marine Park (GBRMP)	No dredging required within the GBRMP General Use Zone which means no direct impacts to benthic environments in that area
Beneficial reuse volume (reclamation)	11.4 million m^3
Dredging duration	Approximately 10.5 years
Channel length	14.9 kilometres
Channel width	• Platypus Channel – tapers from 180 m to 135 m • Sea Channel – tapers from 135 to 120 m
Channel navigation design depth	-12.8 m LAT
Number of berths considered in PEP	6 berths, increasing the total port capacity to 48 mtpa

Harbour basin area	51.4 hectares
Revetment wall (excluding breakwaters)	4 kilometres
Project impacts compared to original EIS	• Expanded reclamation footprint at an increased project cost • Shallower channel. • Berth infrastructure program delayed. • Modified dredge methodology and increased dredge duration. • Further investigations required and undertaken as part of the AEIS.

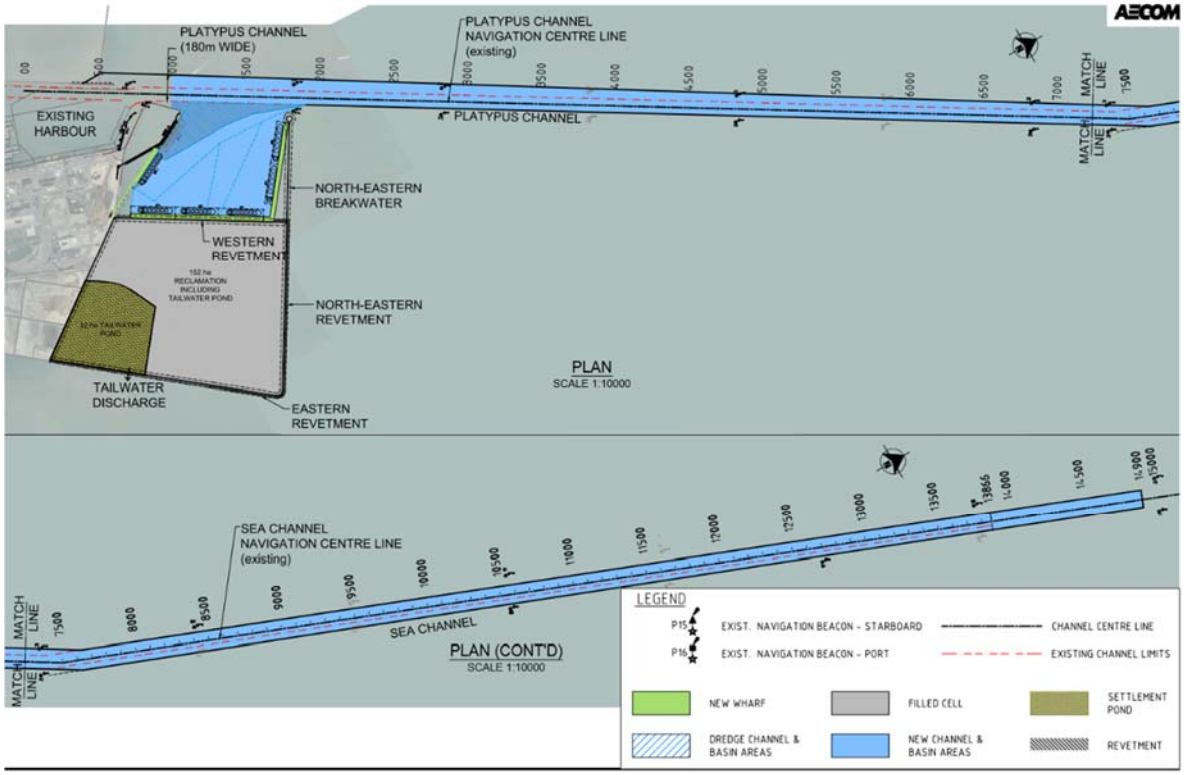


Figure 16 PEP project overview, as outlined in PEP AEIS

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Document Status

Revision	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
A (Draft)	G.Reynolds	G. Denholm	On file	G. Denholm	On file	19/05/2017
B (Draft)	G.Reynolds	G. Denholm	On file	G. Denholm	On file	16/06/2017
C (Final Draft)	G.Reynolds	G. Denholm	On file	G. Denholm	On file	24/07/2017
D (Final)	G.Reynolds	G. Denholm	On file	G. Denholm	On file	01/08/2017

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Priority port master planning

Interface and overlay assessments - annexure

Priority Port of Townsville

Final

July 2017

Table of contents

Table index

Figure index

Appendices

1. Overview of regulatory frameworks within the proposed master planned area

1.1 Introduction to this section

This section describes the current regulatory land use planning frameworks that regulate port related development at the priority Port of Townsville (PoT).

The PoT proposed master planned area (MPA) is currently subject to a number of regulatory planning instruments given effect under different heads of power. The existing planning instruments include the Townsville State Development Area Development Scheme (TSDA DS), Port of Townsville Limited Strategic Port Land Use Plan (PoTLUP), the Townsville City Waterfront Priority Development Area Development Scheme (TCWPDA DS) and the Townsville City Plan.

In the context of managing port related development, each planning framework has been analysed to identify how existing port protection measures and interface issues are currently addressed, and how the different land use planning frameworks may interact to manage port related development under the *Sustainable Ports Development Act 2015* (Ports Act).

1.2 Sustainable Ports Development Act 2015

1.2.1 Overview

The Ports Act sets a legislative framework to implement a number of Queensland's port-related Reef 2050 Long-Term Sustainability Plan actions and responds to United Nations Educational, Scientific and Cultural Organisation World Heritage Committee recommendations on the reef.

The Ports Act mandates the preparation of master plans for the priority ports of Gladstone, Townsville, Hay Point/Mackay and Abbot Point.to optimise use of existing infrastructure and address operational, economic, environmental and community relationships, as well as supply chains and surrounding land uses.

1.2.2 Master plan

The Ports Act requires that master planning is undertaken for priority ports of Townsville, Gladstone, Abbot Point, and Hay Point/Mackay.

Each master plan must:

- identify the master planned area (including the establishment of a boundary)
- apply to the whole master planned area
- state the strategic vision, objectives and desired outcomes for the master planned area
- identify state interests affected or likely to be affected by existing uses at the port and future development in, or associated with the port
- include an environmental management framework (EMF).

1.2.3 Port overlay

The Ports Act requires that a port overlay be established for each master planned area. The port overlay is a regulatory instrument that implements the master plan over the master planned area.

The purpose of the port overlay is to ensure that:

- the strategic vision, objectives and desired outcomes of the master plan are achieved
- priority management measures (PMM's) are applied consistently across a master planned area
- duplication of actions required to achieve priority management measures is avoided.

Section 21 of the Ports Act sets out the content requirements for the port overlay:

- states the purpose of the overlay
- states how the priority management measures in the master plan are to be achieved, including the entity responsible for the measures
- include any other matter prescribed by regulation.

For the *Planning Act 2016* (Planning Act) the port overlay may:

- state the matters an affected local government must consider in making or amending a local planning instrument under that Act, or
- state that development in the master planned area is exempt development, self-assessable development, development requiring compliance assessment, assessable development requiring code or impact assessment, or prohibited development, or
- state the matters an assessment manager must consider in assessing a development application for development in the master planned area, or

For the Transport Infrastructure Act, the port overlay may:

- state the matters a port authority must consider in making or amending a land use plan in relation to the priority port, or
- otherwise regulate development in the master planned area by, for example—stating aspects of development that may not take place or include measures to reduce the risk of environmental harm, or serious adverse cultural, economic or social impacts, in the master planned area.

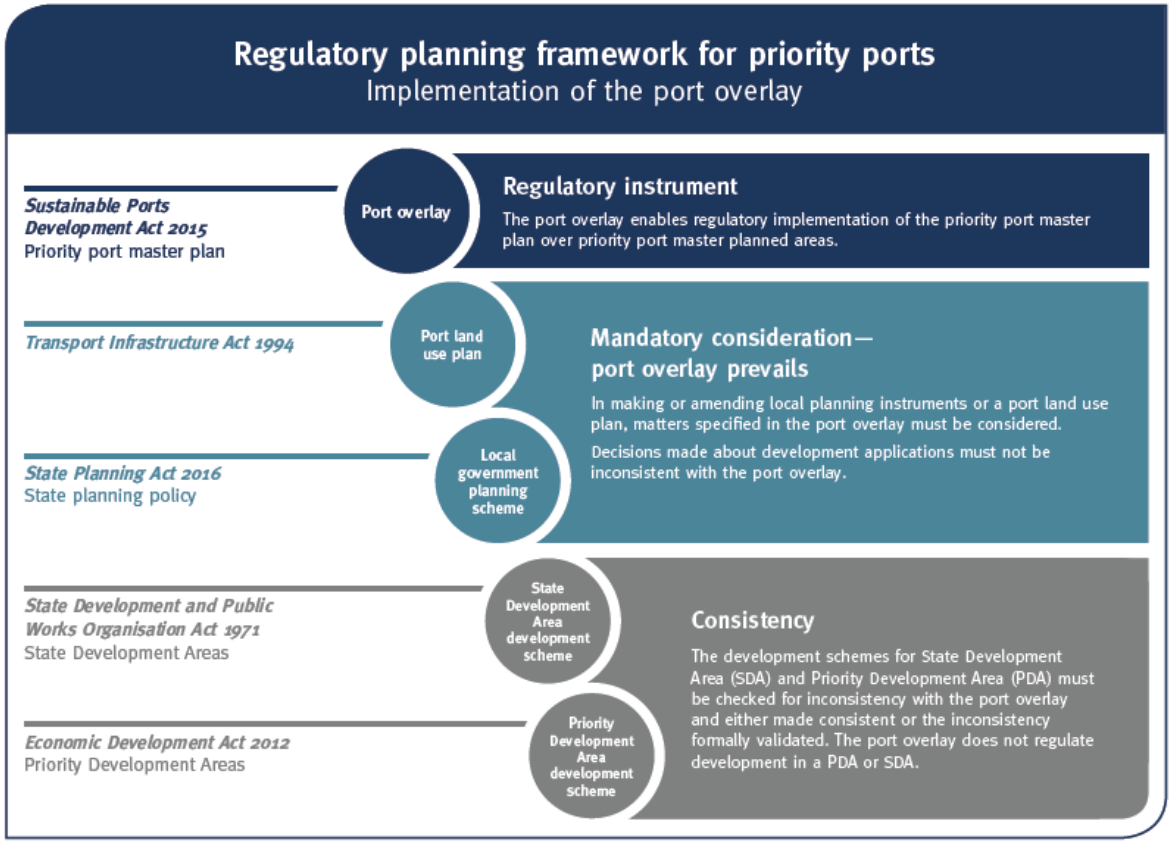
The port overlay will operate as part of a broader regulatory planning framework for priority ports. At the strategic level, the function of the port overlay will be to achieve consistency of state interests while retaining the autonomy of decision making for existing planning authorities in relation to their respective planning instruments.

The port overlay prevails over a planning instrument under the Planning Act to the extent of any inconsistency. For example, where a provision in a local government's planning scheme is inconsistent with the port overlay, the overlay would prevail to the extent of that inconsistency. Furthermore, the port overlay also prevails over a port land use plan made under the *Transport Infrastructure Act 1994* (TI Act) to the extent of any inconsistency.

The port overlay does not prevail over or require amendment of any other Act or planning instrument, including the *State Development and Public Works Organisation Act 1971* (SDPWO Act) and the *Economic Development Act 2012* (ED Act) - refer to Figure 1.

The port overlay is also limited in that it can only apply to development within the master planned area.

Figure 1 Regulatory planning framework for priority ports



1.3 Transport Infrastructure Act 1994

1.3.1 Overview

The overall objective of the Transport Infrastructure Act (TI Act) is to provide a regime that allows for and encourages the effective integrated planning and efficient management of a system of transport infrastructure. The objectives of the TI Act are to allow the government to have a strategic overview of the provision and management of all transport infrastructure, including roads, busways, rail (heavy and light), ports, air and public marine transport.

The TI Act establishes the regulatory framework under which port authorities plan for future development of strategic port land (SPL) and the identification of port limits. Under Section 285 of the TI Act, port land use plans (LUP) are required for all port authorities for the planning and development of SPL and to provide the regulatory tool for development assessment of future activities on SPL.

Under Section 287(1) of the TI Act development within SPL is not regulated under local government planning schemes which makes LUP the principal mechanism for assessing development within the jurisdiction of the port authority.

Under the requirements of the TI Act, a Port Authority's LUP must:

- identify the port authority's SPL, land proposed to become port land and current and proposed uses of the land
- coordinate and integrate the 'core matters', which include: land use and development, port facilities and valuable features, relevant to LUP
- identify Desired Environmental Outcomes (DEOs) for the SPL

- include measures to achieve the DEOs.

As part of the formal approval process established under the TI Act for LUPs, the Minister for Transport must also be satisfied that state interests will not be adversely affected.

Within SPL all development is subject to the Planning Act and the development assessment process outlined by the Planning Act.

All developments assessable under the Planning Act that are completely on SPL will be assessed by PoTL as the assessment manager under the Planning Act against the approved LUP (Port of Townsville – Land Use Plan 2013). However, if a proposed development is inconsistent with the LUP, the assessment is undertaken by the Minister administering the TI Act.

In addition to the LUP, PoTL has developed a series of non-statutory planning codes and guidelines which are called up by the LUP. These codes and guidelines are used by PoTL when assessing an application and determining if the development complies with the LUP. These codes regulate matters such as building, parking and landscaping requirements.

1.3.2 Port of Townsville Land Use Plan

Application

The PoTLUP has been prepared in accordance with the provisions of the TI Act as a framework for the assessment of development on SPL. The current LUP was adopted by the Minister for Transport on 9 August 2010 and commenced on 20 August 2010. Under the TI Act, the LUP should be reviewed at a minimum of every eight years to ensure that the port is planned, developed and managed to meet ongoing requirements for future development. It applies to all SPL, including all ramps and waterways within the SPL boundaries.

Within the proposed Townsville MPA, the PoTLUP applies to development of areas of SPL under the jurisdiction of PoT as the relevant statutory port authority.

PoT Land Use Plan Zoning

The PoTLUP locates areas of land in zones that describe broad themes of compatible and complementary land uses. The zones are further divided into precincts which recognise particular characteristics and future preferred development for that precinct consistent with the overall purpose of the zone.

Table 2 and Figure 2 identify the PoTLUP zones and precincts within the proposed Townsville MPA. Proposed marine areas are not included as the PoTLUP extent only identifies SPL.

Figure 2 Port of Townsville Land Use Plan Zoning

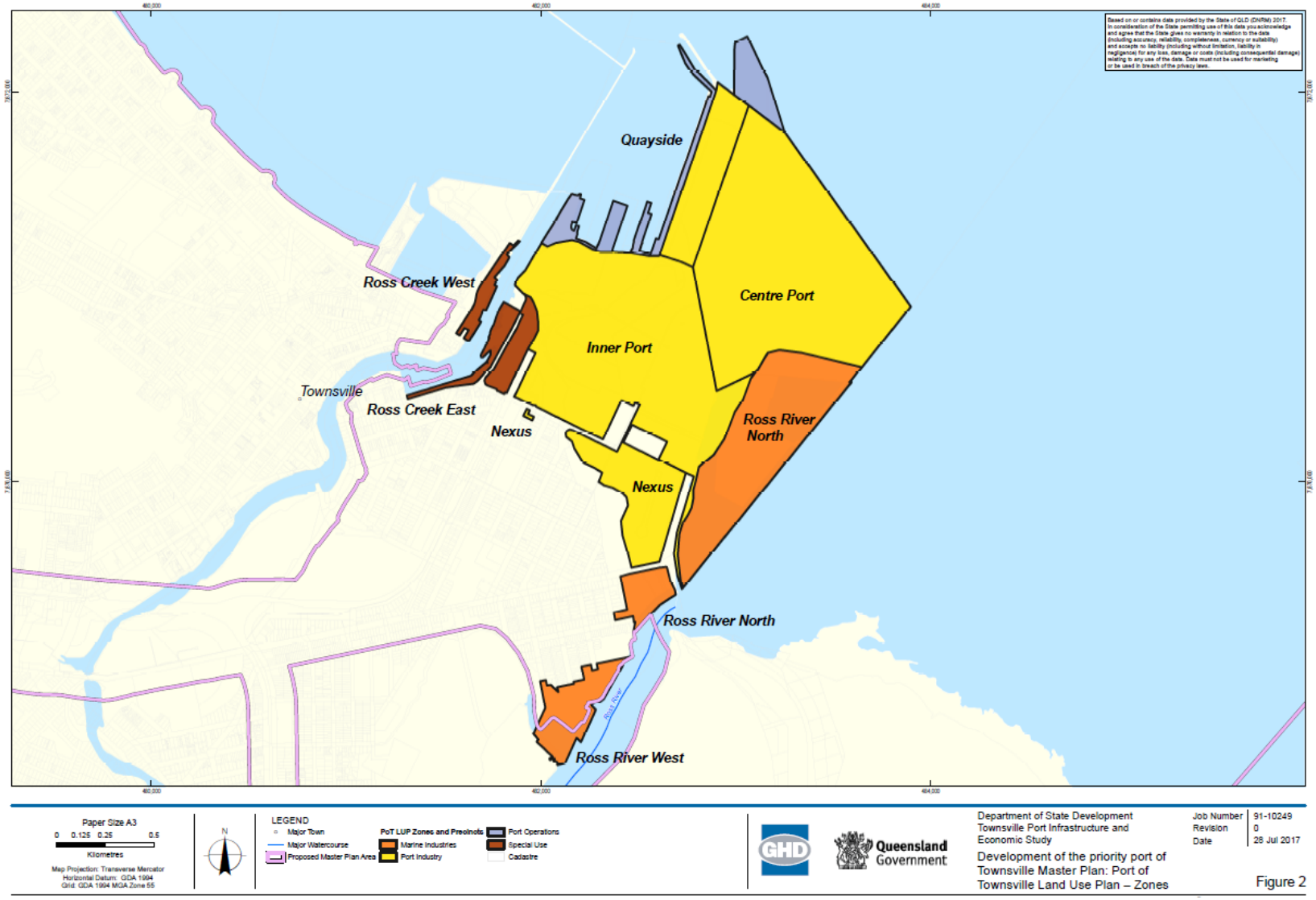


Table 1 Port of Townsville Land Use Plan Zoning and Precincts

PoT zone and precinct description	MPA precinct
Port Industry Zone The Port Industry Zone caters for a wide range of industrial uses which directly support the import and export of cargo, and which contribute to the effective, efficient and sustainable management and growth of the Port. Major port handling areas for a range of commodities are concentrated in the area adjoining and immediately behind the Port Operations Zone. Sites in this area are intended to be easily accessible by land or water for transportation of commodities. **Quayside Precinct** Development is to be for uses that support wharf activities and for consolidation and dispatch of cargo. Development encourages efficient utilisation of the land and improves cargo handling and dispatch times. **Inner Port Precinct** The Inner Port Precinct accommodates oil industry tank farms, sugar industry bulk storage facilities and a range of general cargo storage, handling and dispatch centres. Development is to accommodate and integrate with the planned Port Expansion and future road and rail Eastern Access Corridor route from the Port. Development that encourages the efficient utilisation of the land and improves cargo handling and dispatch times and contributes to a high standard of amenity. Development in this precinct is to protect and integrates with the future road and rail Eastern Access Corridor route from the Port. **Centre Port Precinct** The Centre Port Precinct comprises bulk storage facilities and industrial activities supporting port operations including operational activities and industries that require separation from sensitive adjoining land uses. Development is to accommodate and integrate with the planned Port Expansion. Development: - encourages the efficient utilisation of the land and improves cargo handling and dispatch times. - protects and integrates with the future road and rail Eastern Access Corridor route from the Port. **Nexus Precinct** Development is for uses that are associated with port-related activities and include light industrial uses which maximise the site's location and recognise the sensitivities of the adjoining land uses. Development contributes to a high standard of amenity and is sensitive to adjacent land uses	**Port industry and commerce precinct** The intent of this precinct will be to allow for port operations, general and heavy industry, port-related commercial activities and related development. Development is for port-related purposes, development for other purposes will be limited. Public access is generally limited in this area to the workforce, except where necessary to access public facilities. It may include undeveloped land that has been identified as having potential to house port related development or infrastructure that supports transporting commodities to and from port areas. It may also accommodate other associated commercial development that supports port activities. ***The intent of the Port Industry and commerce precinct is consistent with the purpose and intent of the Port Industry Zone and Precincts, as it allows port-related industry and cargo operations.***

PoT zone and precinct description	MPA precinct
Marine Industry Zone The Marine Industry Zone provides for the consolidation of existing commercial and industrial marine uses currently located in Ross Creek and South Townsville, into a new purpose-built facility. **Ross River North Precinct** The intent of the Ross River North Precinct is to consolidate commercial and industrial marine activities and waterfront uses into a purpose-built facility. Development: - encourages relocation of marine facilities away from expanding Townsville inner city developments. - provides opportunity for alternate mooring space and operational areas for industries upstream of the Port Access Road. - encourages co-location of marine related commercial industries to provide enhanced utilisation of the area. **Ross River West Precinct** The intent of the Ross River West Precinct is to promote redevelopment of the land as industrial marine activities relocate to the Ross River North Precinct, subject to master planning activities and sensitivity to receiving environmental values and surrounding residential areas.	**Port industry and commerce precinct** (refer to description above) ***The intent of the Port industry and commerce precinct is consistent with the purpose and intent of the Marine Industry Zone and Precincts, as it allows commercial marine industries that support port-related activities.***
Port Operations Zone The Port Operations Zone provides the core port infrastructure and facilities required for effective and efficient operation of the Port.	**Port Industry and commerce precinct** (refer to description above) ***The intent of the precinct is consistent with the purpose and intent of the Port Operations Zone, as it allows for port-related infrastructure facilities that*** **support transporting commodities to and from port areas.**
Port Buffer Zone The Port Buffer Zone includes areas directly south of the port. This zone provides a buffer between operational port areas and adjacent land uses, and compatible development between port and community to maintain and protect the current and future port operations.	**Port industry and commerce precinct** (refer to description above) ***The intent of the precinct is generally consistent with the purpose and intent of the Port Buffer Zone, as uses are intended to protect the current use of the port.***
Special Use Zone The Special Use Zone incorporates waterfront activities that evolve over time, including community facilities, marinas, tourism facilities and industrial marine uses. It is envisaged that industrial activities will gradually be relocated out of these areas, with redevelopment to take place which recognises the unique location of these areas within a vibrant and growing Central Business District (CBD). Future development in this zone is to be guided in a more detailed master plan currently being	**Interface precinct** To manage interface issues between sensitive uses and port-related uses and development ***The intent of the precinct is generally consistent with the purpose and intent of the Special Use Zone and Precincts, as it supports development that is sensitive to its location close to the CBD and sensitive land uses.***

PoT zone and precinct description	MPA precinct
prepared by Townsville City Council (TCC) and will provide for public access to the waterfront while maintaining and protecting current and future port operations. **Ross Creek East Precinct** The Ross Creek East Precinct will be redeveloped with the goal of integrating with the surrounding Townsville CBD areas whilst preserving and protecting the current and future operations of the commercial port. Development is consistent with planning outcomes identified by the master plan and is sensitive to receiving environmental values and surrounding residential areas. **Ross Creek West Precinct** The Ross Creek West Precinct will be redeveloped with the goal of integrating with the Strand, the Breakwater Precinct and surrounding Townsville CBD areas. Development is consistent with planning outcomes identified by the master plan and is sensitive to receiving environmental values and surrounding residential areas.	

1.3.3 Relationship with port overlay

Port protection measures within the PoTLUP currently provide for and protect the existing and future operations of the port. A port overlay prevails over the PoTLUP to the extent of any inconsistency should additional measures be required.

1.4 State Development and Public Works Organisation Act 1971

1.4.1 Overview

The SDPWO Act facilitates timely, coordinated and environmentally responsible infrastructure planning and development to support Queensland's economic and social progress. The SDPWO Act includes provision for the planning, establishment and regulation of State Development Areas (SDA) and provides the Coordinator-General (CG) the authority to regulate development in a SDA.

A SDA is a clearly defined area of land that clusters economic activity together in order to facilitate greater economic development. SDAs are managed through a development scheme which is prepared and administered by the Office of the Coordinator-General (OCG).

The 4,900 hectare Townsville SDA was declared in 2003 and is located about six kilometres south-east of the Townsville CBD adjacent to the PoT (refer to Figure 3).

1.4.2 Townsville State Development Area Development Scheme

Overview

Planning and development in the Townsville SDA is controlled by the Development Scheme for the Townsville SDA (TSDA DS). This was first approved in 2005 and most recently amended in July 2013 following a series of detailed investigations, including environmental, economic and infrastructure studies. The TSDA DS regulates development within the SDA and sets out the processes and procedure for the assessment of applications for the use of land in the SDA.

The TSDA DS regulates the use of land within the TSDA and development is assessed against the:

- strategic vision
- overall objectives
- preferred land use intent of the relevant land use precinct
- overlay
- assessment criteria.

The TSDA DS only regulates certain development within the TSDA-only land use changes. All other development, such as reconfiguration of lots, some building work and operational works, are regulated by the Townsville City Plan, and the Planning Act.

Strategic Vision for the TSDA

The protection of port access corridors is included in the strategic vision for the TSDA:

- Development is reliant on direct access to one or more of the Port of Townsville, national freight rail and major road networks
- maximise the efficient use of existing and future port, road, rail and ancillary infrastructure.

Overall Objectives for land Uses

The overall objectives for land uses in the TSDA that directly relate to the port include:

- must use land efficiently and minimise adverse impacts on infrastructure, infrastructure corridors and future development opportunities
- must be adequately serviced by infrastructure
- will privately fund infrastructure associated with the development.

Townsville SDA Land Use Precincts

The proposed Townsville MPA includes the TSDA. Figure 3 and Table 2 identify the TSDA Land Use Precincts that apply to the proposed Townsville MPA and demonstrates the alignment between the two classifications.

The TSDA precincts and land use intent mostly align with the proposed Townsville MPA precincts. The Port industry and commerce precinct of the proposed MPA aligns with the industrial precincts of the TSDA that allow low to high impact industries that are associated with the PoT. The Port industry and commerce precinct also encompasses the Buffer Precinct which provides for the physical separation of industrial activities within the TSDA and sensitive uses outside the TSDA, whilst allowing existing uses to continue.

The TSDA Low Impact Industry Precinct is located within the Interface precinct of the proposed Townsville MPA.

Figure 3 Townsville SDA precinct map

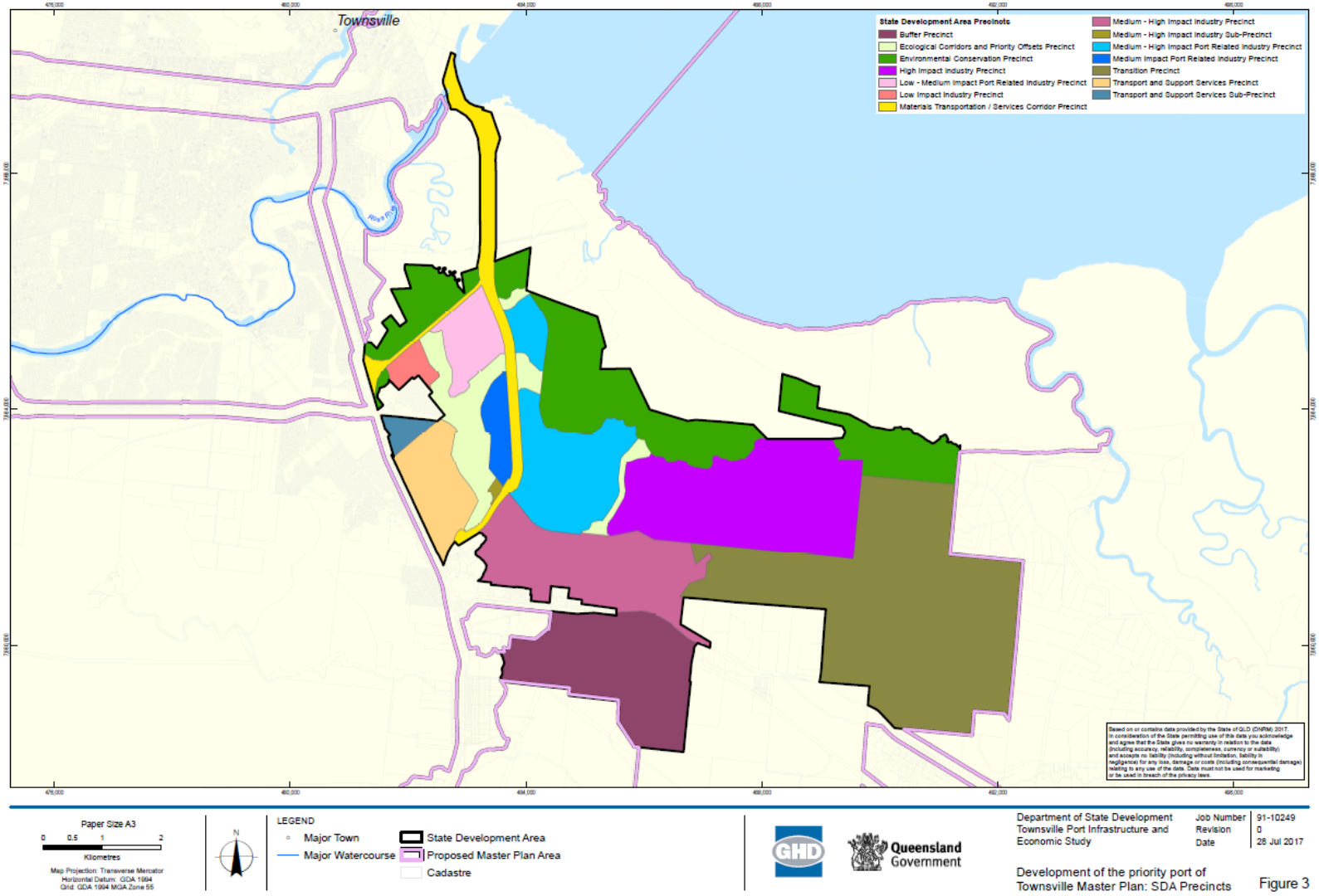


Table 2 Townsville State Development Area (TSDA) Land Use Precincts

TSDA precinct and preferred land use intent	MPA precinct
Environmental Conservation Precinct This precinct: - recognises and protects wetlands, vegetation and fauna habitats closely related to the Great Barrier Reef Marine Park, Great Barrier Reef World Heritage Area and Bowling Green Bay Ramsar site, and associated catchment, and - recognises and protects environmental values, and - provides opportunities for environmental offsets, and - provides opportunities for rehabilitation and enhancement of existing environmental values, and - recognises and protects cultural heritage values, including the Muntalunga Ranges. Conveyor infrastructure may traverse this precinct in order to support development in the High Impact Industry Precinct.	**Environmental management precinct** To limit development and manage environmental values consistent with ESD principles. Low impact development that supports the protection of the values of the area is preferred. Development is compatible with Traditional Owner access, but general public access is limited. The risk assessment process will identify and assess potential impacts development may have on environmental values within the precinct and suggest priority management measures (PMMs) for managing potential impacts.
Transition Precinct This precinct supports limited development of rural, agricultural, and extractive industry uses where they do not compromise existing or future industry development in the TSDA. Development will be expected to: - Recognise and protect cultural heritage values, including those associated with the Muntalunga Ranges, and - Minimise adverse impacts on sensitive uses located outside the TSDA. Infrastructure must not compromise the land use requirements of uses that are, or may be consistent with the land use intent for this precinct.	
Medium – High Impact Industry Precinct This precinct accommodates medium-high impact industrial development that requires access to the Bruce Highway, existing gas pipeline, or existing rail infrastructure. - Rail dependent development maximises efficient use of the existing rail infrastructure leading into and within the precinct. No additional direct access points from the Bruce Highway, or TPAR will be supported in this precinct. - Support the continued operation and expansion of existing industrial uses	

TSDA precinct and preferred land use intent	MPA precinct
within the precinct. - Potentially accommodate a single integrated service centre for the TSDA at the junction of the Bruce Highway and TPAR, which provides for small scale convenience activities focused on meeting the basic day to day convenience needs of the TSDA. The proposed service centre may be located in the Medium Impact Port Related Industry Precinct or Medium – High Impact Port Related Industry Precinct. Only one service centre will be supported within the TSDA. Development recognises sensitive uses adjacent to the precinct and mitigates and manages any adverse impacts on sensitive uses adjacent to the TSDA. Infrastructure must not compromise the land use requirements of uses that are, or may be consistent with the land use intent for this precinct.	
Materials Transportation/Services Corridor Precinct The Materials Transportation/Services Corridor precinct relates directly with the operation of the PoT as this precinct includes the following key transport corridors linking the port to the TSDA -Townsville Port Access Road (TPAR), Bruce Highway and the Townsville Eastern Access Rail Corridor (TEARC): - accommodate the TPAR and TEARC, and supports the continued operation and establishment of an efficient and effective route for linear infrastructure, including materials transportation infrastructure, utility services, and infrastructure corridors between industrial development in the TSDA and the Port of Townsville. - Future infrastructure envisaged includes rail, conveyors, pipelines, water, gas, electricity, sewerage and telecommunications. - Development maximises the efficient use of land and infrastructure in the precinct, supports the establishment of common use infrastructure, and protects existing and future infrastructure requirements within the precinct. This includes having regard to the siting of infrastructure and distances between infrastructure within the TPAR and TEARC. - Infrastructure not associated with activities in the TSDA may be accommodated in this precinct where it does not compromise the land use requirements of infrastructure associated with uses in the TSDA. Uses that are consistent with the Material Transportation/Services Corridor Precinct include Freight Terminal, Low Impact Industry, Transport depot, utility installation and warehouse. Other uses may be consistent and include commercial and offices where ancillary to other uses and service industries. All other uses are	**Infrastructure and supply chain corridors** Allow for the development of critical land and marine supply chain infrastructure to and from the port, and within the master planned area.

TSDA precinct and preferred land use intent	MPA precinct
not preferred (refer to Table 8 of the TSDA Development Scheme).	
Environmental Conservation Precinct This precinct: - recognises and protects wetlands, vegetation and fauna habitats closely related to the Great Barrier Reef Marine Park, Great Barrier Reef World Heritage Area and Bowling Green Bay Ramsar site, and associated catchment, and - recognises and protects environmental values, and - provides opportunities for environmental offsets, and - provides opportunities for rehabilitation and enhancement of existing environmental values, and - recognises and protects cultural heritage values, including the Muntalunga Ranges. Conveyor infrastructure may traverse this precinct in order to support development in the High Impact Industry Precinct.	
Ecological Corridors and Priority Offsets Precinct This precinct: - recognises and protects the environmental values of drainage lines and their tributaries, including their natural processes and function as ecological corridors for flora and fauna movement, and - facilitates the management of flood risks to development within the TSDA through appropriate flood mitigation works, and - serves as the priority area for offsets as a result of impacts from development within the TSDA that cannot otherwise be offset in the precinct of impact; and - provides opportunities for rehabilitation and enhancement of existing environmental values, and - contributes to the amenity of the TSDA. Limited development within the precinct may be appropriate where it is considered necessary to support flood mitigation works. Conveyor infrastructure may traverse this precinct in order to support development in the High Impact Industry Precinct or Medium – High Impact Port Related Industry Precinct. Development of conveyor infrastructure within this precinct minimises its footprint.	
Low Impact Industry Precinct	

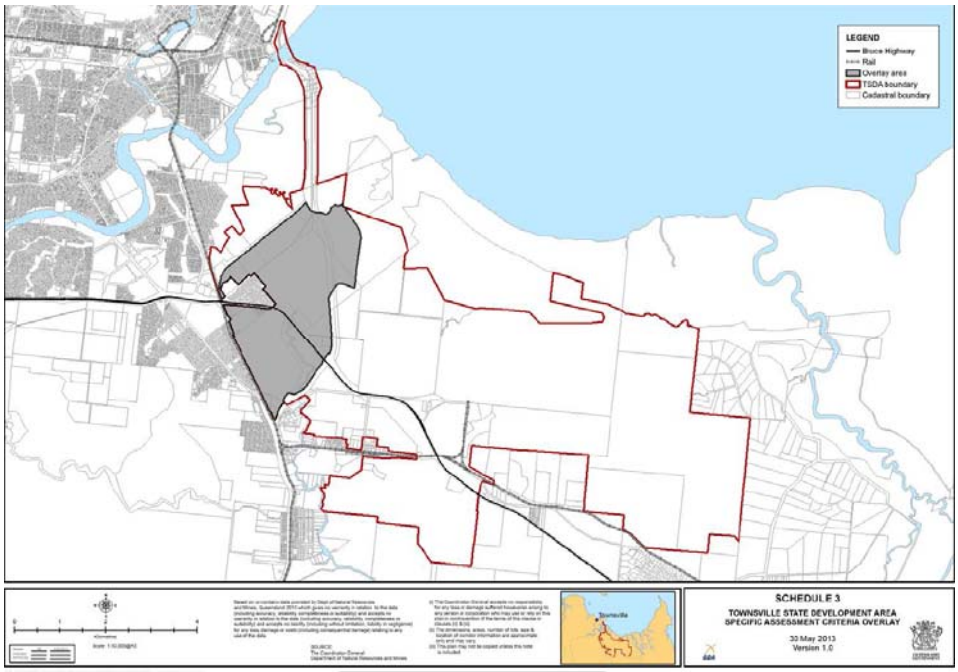
TSDA precinct and preferred land use intent	MPA precinct
This precinct is to accommodate low impact industrial development that: - requires a small development footprint; and - supports local and regional industries; and - is compatible with being in close proximity to adjacent residential uses. Development recognises sensitive uses adjacent to the precinct and mitigates and manages adverse impacts on sensitive uses adjacent to the TSDA. Infrastructure must not compromise the land use requirements of uses that are, or may be consistent with the land use intent for this precinct.	
Low - Medium Impact Port Related Industry Precinct This precinct is to accommodate industrial development that: - requires a small to medium development footprint; and - has low to medium impact; and - is associated with the Port of Townsville. Infrastructure within the precinct will work together to maximise transport and land use efficiencies such that this infrastructure does not compromise the land use requirements of uses that are, or may be consistent with the land use intent for this precinct.	

TSDA Overlay

The TSDA DS contains the Specific Assessment Criteria Overlay (SACO), which applies to development to the proposed Townsville MPA Port industry and commerce, Interface and Infrastructure and supply corridor precincts.

The SACO ensures that proposed development demonstrates integration and compatibility with existing and proposed land uses for the full extent of the overlay area.

Figure 4 TSDA Specific Assessment Criteria Overlay map



TSDA assessment criteria

Schedule 4 of the TSDA DS provides the assessment criteria that development is to be assessed against in the TSDA. The following specific assessment criteria relates to the protection of port related infrastructure and supply chains:

- Development does not compromise the establishment and operation of existing and/or potential future infrastructure in the Materials Transportation / Services Corridor Precinct (TSDA Development Scheme Table 14 (2))
- Development provides for and protects the safe and efficient function of the Bruce Highway, the North Coast rail line (NCL) and TPAR (TSDA Development Scheme Table 14 (3))
- Increased traffic arising from development is either able to be accommodated within existing road networks or works are undertaken to minimise adverse impacts on existing and future uses (TSDA Development Scheme Table 14 (16))
- New development is to demonstrate consistency with relevant legislation, regional plans, State Planning Policies to the extent practicable where the State interests articulated by these instruments may be affected by the proposed new use (TSDA Development Scheme Table 14 (30))
- New uses are to avoid or minimise adverse impacts on existing or proposed State or local infrastructure (TSDA Development Scheme Table 14 (31)).

1.4.3 Overview of relationship with port overlay

The port overlay cannot regulate development within the TSDA DS. However, in accordance with the Ports Act, the CG is required to consider whether the TSDA DS is inconsistent with the port overlay. If there is an inconsistency, the CG can decide whether to amend the TSDA DS to remove the inconsistency, or otherwise table a report in the Legislative Assembly detailing the reasons for not amending the development scheme.

Port protection measures are included within the TSDA DS, including the protection of port access corridors and the facilitation of port related industrial land within the SDA. This industrial land is likely to be required as part of scenarios 2 and 3.

The materials transportation and services corridor precinct within the TSDA will be utilised by the predicted increase of road and rail network usage predicted from scenario 3. This land has been set aside within the TSDA.

1.5 Planning Act 2016

1.5.1 Overview

The *Sustainable Planning Act 2009* was replaced by the Planning Act on the 3 July 2017. The Planning Act applies to development within the Townsville MPA.

The Planning Act forms the overarching framework for Queensland's planning and development system. The Planning Act gives effect to a range of state and local planning instruments such as the State Planning Policy, Regional Plans and Local Government Planning Schemes.

The Planning Act is supported by the Planning Regulation 2017 (Planning Regulation) which is a categorising instrument that identifies levels of assessment, assessment benchmarks and assessment managers for specific activities.

The port overlay prevails to the extent of any inconsistency between the port overlay and a planning instrument under the Planning Act. This means that if the port overlay states matters an assessment manager must consider in assessing a development application, the decision of the assessment manager must not be inconsistent with the port overlay.

1.5.2 State Development and Assessment Provisions

The State Development Assessment Provisions (SDAP) provides for the assessment of development applications where the development impacts upon a matter of state significance. The SDAP sets out the matters the assessment manager must assess a development application against when undertaking the assessment.

The state assesses development affecting the current and future state transport corridors (road/rail) that are key port access transport corridors for the PoT. The state transport corridors are identified in Figure 5.

The Planning Regulation requires state assessment of development that is located near a state transport corridor or future state transport corridors is assessed against the following state codes:

State code 1 – Development in a state-controlled road environment – is to protect state-controlled roads, future state-controlled roads and other infrastructure in state-controlled roads from adverse impacts of development. The purpose of this code is also to protect the safety of people using, and living and working near, state-controlled roads.

Specific performance outcomes are to be met that ensures development does not result in the following:

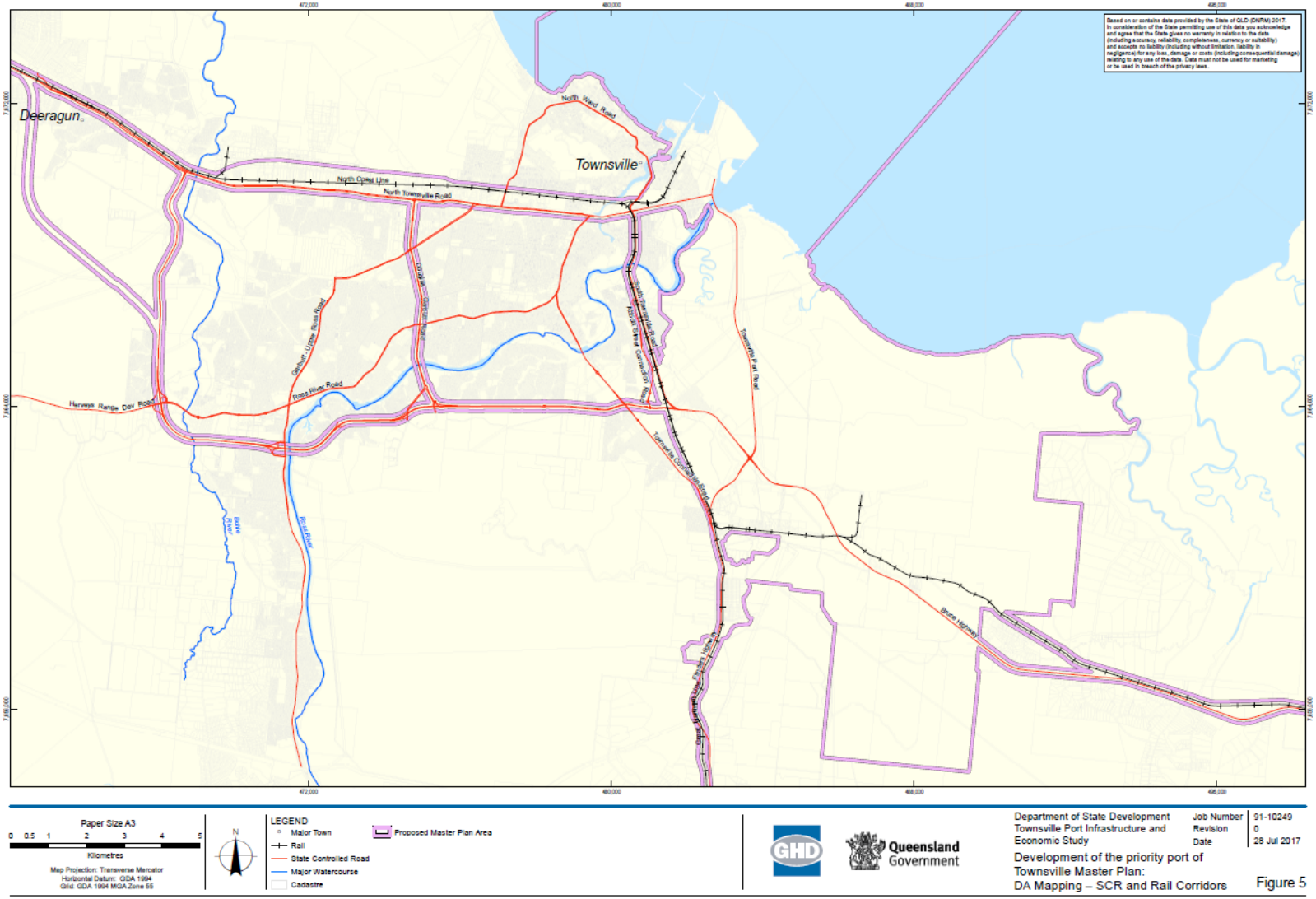
- Worsening of operating conditions on the state-controlled road network
- Does not impose traffic loading on a state-controlled road which be accommodated on a local road network.

Specific performance outcomes are also provided that ensures sensitive developments such as accommodation activities, child care centres, and hospitals minimise noise, air and light intrusions from a state-controlled road.

State code 2 – Development in a railway environment - is to protect railways, future **railways** and other infrastructure in a railway corridor from adverse impacts of development. The purpose of this code is also to protect the safety of people using, and living and working near, railways.

Specific performance outcomes are provided that ensure sensitive developments such as accommodation activities, child care centres, and hospitals minimise noise, air and light intrusions from the rail network.

Figure 5 State-controlled roads and railways



Overview of relationship with port overlay

The SDAP provide for protection of key port access routes that are identified as SCR and rail corridors from sensitive development both inside and outside the proposed MPA and port overlay. Sensitive developments that are located near SCR and railways are protected from incompatible development through performance outcomes that assist in minimising noise, air and light intrusions.

1.5.3 North Queensland Regional Plan

The Queensland Government is working with councils and the community to develop the first ever regional plan for North Queensland. This will build on opportunities linked to economic growth, population change, as well as meet the increasing demand for local public services. It is anticipated that the draft regional plan will include provisions relating to the port and related infrastructure.

Overview of relationship with port overlay

The regional plan is a state planning instrument under the Planning Act. The port overlay prevails if there is an inconsistency with the regional plan.

1.5.4 State Planning Policy

The State Planning Policy (SPP) contains 17 state interests. A state interest is a matter deemed important enough to require protection and enhancement within the planning and development system.

The SPP is a state planning instrument under the Planning Act and sits above regional plans and planning schemes in the hierarchy of planning instruments under the Act.

The SPP contains state interest policies and where relevant, the assessment benchmarks for each state interest. Strategic ports are identified as a specific state interest which outlines:

> *"The operation of strategic ports and priority ports is protected and their growth and development"*

The state interest contains the following state interest policies which must be appropriately integrated in planning and development outcomes relating to the PoT:

> *(1) Strategic ports, and associated strategic port land and core port land, are identified.*
>
> *(2) Development complements the role of a strategic port as an economic, freight and logistics hub, and enhances the economic opportunities that are available in proximity to a strategic port.*
>
> *(3) Strategic ports are protected from development that may adversely affect the safety, viability or efficiency of existing and future port operations.*
>
> *(4) Development is located and designed to mitigate adverse impacts on the development from environmental emissions generated by port operations.*
>
> *(5) Key transport corridors (including freight corridors) linking strategic ports to the broader transport network are identified and protected.*
>
> *(6) Statutory land use plans for strategic ports and the findings of planning and environmental investigations undertaken in relation to strategic ports are considered.*
>
> *(7) For priority ports, development is also consistent with the requirements of priority port master plans and priority port overlays as these are approved under the Sustainable Ports Development Act 2015.*

Overview of relationship with port overlay

The SPP sets out specific port protection policies to be integrated into local government planning schemes. These port protection measures relate to protecting the port from incompatible development and protecting the port transport routes.

As a local planning instrument, the Townsville City Plan is required to appropriately integrate the SPP and where this does not occur the SPP will prevail. Part 2 of the Townsville City Plan currently identifies that it is consistent with all aspects of the July 2014 version of the SPP.

Once the master plan and port overlay for the priority Port of Townsville are finalised, in accordance with the SPP, all planning instruments will be required to be consistent with the master plan and port overlay.

It should be noted that where there is an inconsistency with the port overlay, the port overlay prevails over the SPP to the extent of the inconsistency.

1.5.5 Townsville City Plan

Overview

The Townsville City Plan (City Plan) is a local planning instrument under the Planning Act that commenced in October 2014. The City Plan sets out Townsville City Council's vision for the future development in the planning scheme area over the next 25 years and regulates development within the Townsville City Council local government area.

The City Plan applies to all development that is not regulated by the PoTLUP, within the Townsville City Waterfront Priority Development Area (TCWPDA) or a land use change under the TSDA DS. Areas covered by the PoTLUP are zoned 'specialised centre' with the TSDA and TCWPDA zoned as 'special purpose' under the planning scheme. The City Plan does not apply to development regulated under the TCWPDA Development scheme.

The strategic framework of the City Plan recognises the PoT as a key productive precinct and supports the role of PoT to accommodate growth within the region:

> *"Townsville is the major economic and service centre for North Queensland. It is the primary port and freight hub, particularly for the agricultural areas of the surrounding region and for the North West minerals province. Townsville has a diverse and healthy economy. This is driven by population growth, by the traditionally strong defence, port and transport sectors and by Townsville's regional position as the capital of North Queensland and transport hub for the North West Minerals Province and North Queensland agricultural sector".*

PoT is identified as a 'Specialised Centre' within the City Plan. A key stated outcome of the Townsville City Plan is that:

> *"Sensitive uses are prevented from encroaching on the city's freight routes, special purpose areas, industrial areas and specialised centres, particularly Townsville Airport, Port of Townsville, the Townsville State Development Area and the Department of Defence landholdings, to ensure their ongoing efficient operation, minimise risks and avoid conflicts."*

The port is also identified as a key productive precinct needed to accommodate growth within the region.

Specialised centre zone

The PoT is located within the PoT precinct in the Specialised centre zone (refer to Figure 6) of the City Plan. The overall outcomes identify that:

- the long-term operation of the Port of Townsville is protected for the benefit of the local and regional economy
- the operations of the port are protected from incompatible land uses and activities on nearby land, and
- waterfront development within the port is integrated with the Palmer Street and The Strand areas where possible, to maximise community access to and use of waterfront areas.

This code recognises that the PoT does not fall within the regulatory jurisdiction of the City Plan, and that the zoning acknowledges the intentions of PoT's master planning documents. The code is intended to give direction to development within or in the vicinity of these sites, to the extent possible.

Notwithstanding, the purpose of the Specialised centre zone code recognises that specialised centres, including the PoT, perform a specific function for the Townsville and wider North Queensland community. It also outlines that a specialised centre retains its dominant function and that new development does not prejudice its ongoing operation or significantly impact on the amenity of nearby sensitive uses.

Special Purpose Zone

The TSDA is located in the Special Purpose Zone (refer to Figure 6) of the City Plan. Material change of use applications in the TSDA are administered by the Coordinator-General through the TSDA DS with only development applications for reconfiguration of a lot and operational works assessed by TCC.

The purpose of the Special Purpose Zone code is to facilitate industrial development that is of regional, state and national significance. A specific outcome of the code is to facilitate and maintain linkages to the PoT and major freight routes. The purpose of the code seeks to avoid the intrusion of incompatible uses to protect land availability and supports industrial uses within the TSDA that have a nexus with the Port of Townsville.

Transport impact, access and parking code

This code applies to most code and impact assessable material change of use development under the City Plan within the proposed MPA. It provides assessment criteria that seek to optimise the function, safety and efficiency of the transport network and avoid adverse impacts on the environment and locality.

This code requires that development is located on roads that are appropriate for the nature of traffic generated, having regard to the safety and efficiency of the transport network, and the functions and characteristics identified of the road hierarchy. The assessment criteria require that a traffic impact assessment is undertaken as part of a development application. This allows for the additional traffic generated by the proposed development to be assessed and maintain a satisfactory level of service for the community.

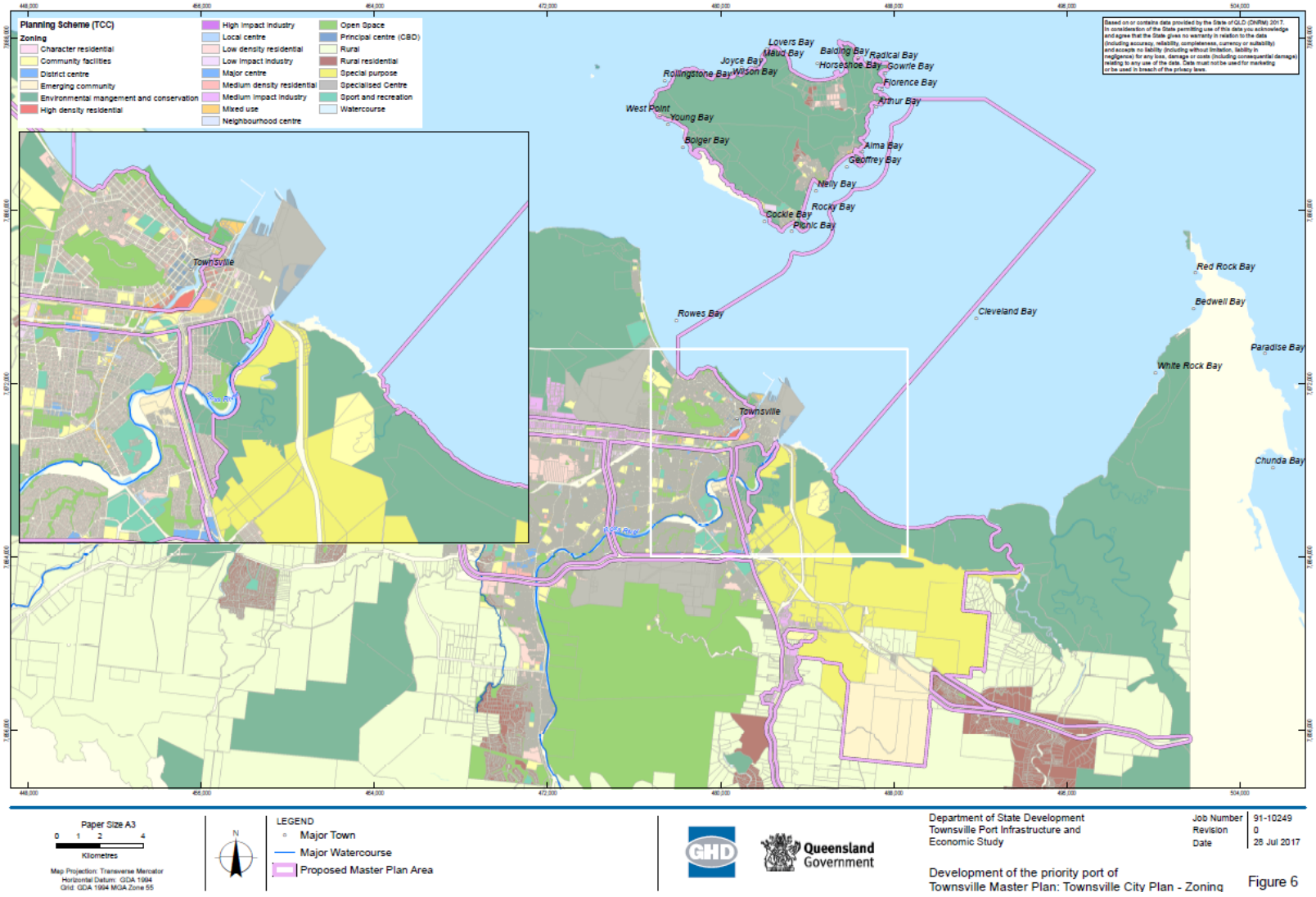
Infrastructure noise corridors

The City Plan includes overlay maps for road and railway noise corridors which is consistent with the noise corridors discussed in section 1.6 (below). This allows for noise attenuation requirements to be considered for development assessed against the City Plan rather than

solely residential buildings which are subject to the *Building Act 1975* requirements that are discussed below.

If required, TCC may gazette additional infrastructure noise corridors which would be subject to the requirements in the City Plan.

Figure 6 Townsville City Plan – Zoning



Overview of relationship with port overlay

As the City Plan is a local planning instrument, the port overlay prevails to the extent of any inconsistency over the provisions in the City Plan. The port overlay can apply to development regulated by the City Plan and may state matters that must be considered by Townsville City Council when making or amending the City Plan, or a temporary local planning instrument. This means that port protection measures can apply to manage port related development if required. Port protection measures currently exist within the City Plan to protect the existing and future operations of the port.

1.6 Building Act 1975

1.6.1 Overview

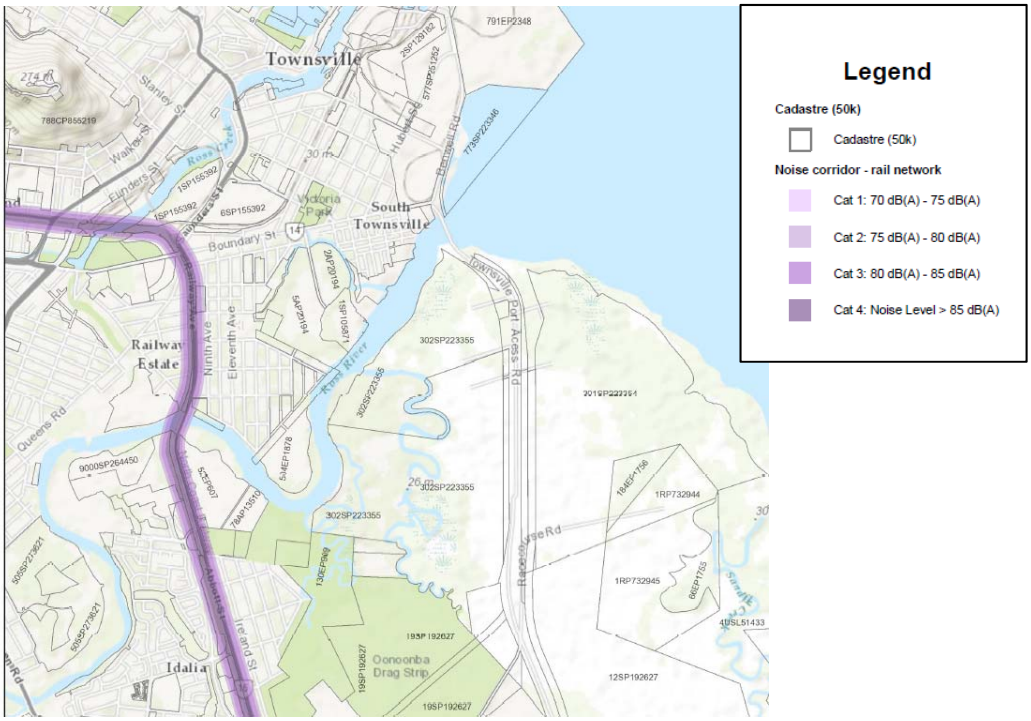
Designated transport noise corridors can be State-controlled roads, railways or major local government roads that have been designated and gazetted by the State or a local government under the *Building Act 1975* (Building Act).

Residential buildings approved after 1 September 2010 that are located in a designated transport noise corridor need to comply with the Queensland Development Code Mandatory Part 4.4—Buildings in a transport noise corridor (QDC MP4.4). Under the code, residential buildings need to achieve certain levels of noise reduction for occupants where located in a particular category of transport noise corridor. This can be achieved through incorporating appropriate building materials to the building's external envelope (e.g. windows, walls roof, floors and entry doors).

This requirement for building work is independent of additional noise-related requirements for development included in local government planning schemes or under state codes.

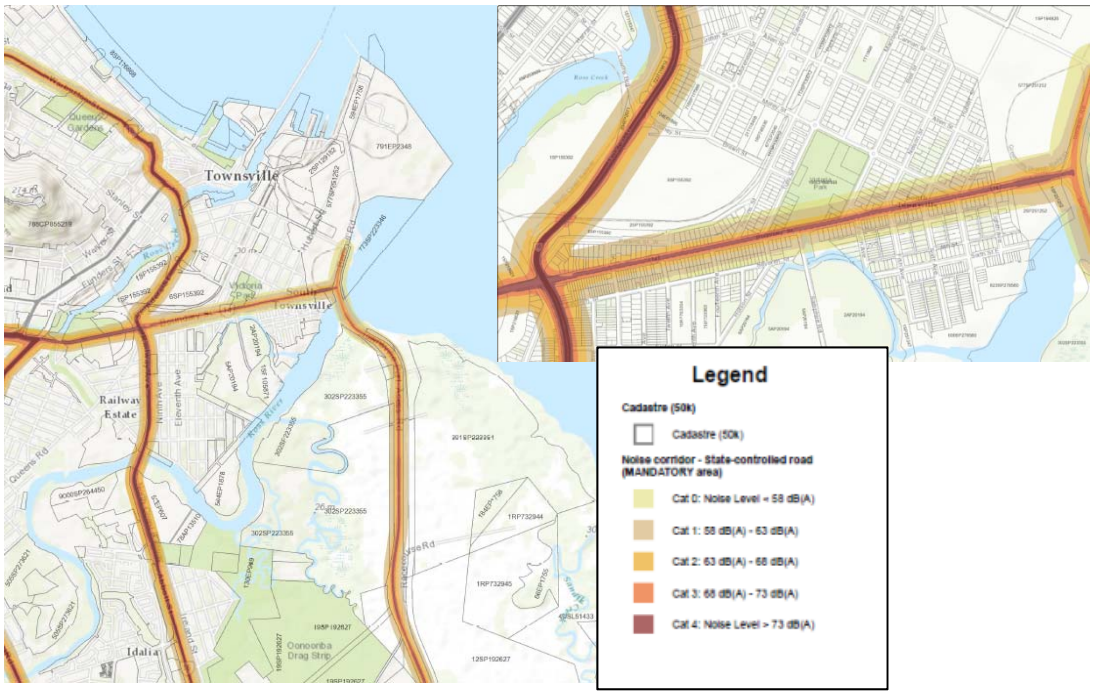
Figure 7 and Figure 8 identify the transport noise corridors within the proposed MPA.

Figure 7 Transport noise corridors - railways



Source: (DILGP, 2017)

Figure 8 Transport noise corridors – state-controlled roads



Source: (DILGP, 2017)

The QDC MP4.4 requires the use of construction materials that minimise the effects of transport noise on the building occupant's health and amenity from activities along major transport corridors.

Overview of relationship with port overlay

These requirements are outside the scope of the port overlay, unless the port overlay makes this assessable and includes requirements for consideration by an assessment manager.

1.7 Economic Development Act 2012

1.7.1 Overview

The ED Act provides for particular parts of the State to be declared as Priority Development Areas (PDA). Economic Development Queensland (EDQ) administers PDAs to identify and drive economic development and development for community purposes in consultation and partnership with local government. The aim is to provide a greater emphasis on supporting, facilitating and fast-tracking economic development through a streamlined planning and development assessment framework. The ED Act includes provision for the planning, establishment and regulation of PDAs by the Minister for Economic Development Queensland (MEDQ). Whilst a master plan and port overlay applies to the master planned area, a port overlay cannot regulate development within a PDA that is regulated by the PDA development scheme.

The Ports Act holds similar provisions for the PDAs as it does for SDAs by requiring the MEDQ to consider the provisions of the port overlay in making or amending a PDA Development Scheme. If there is an inconsistency, the MEDQ can decide whether to amend the development scheme to remove the inconsistency, or otherwise table a report in the Legislative Assembly detailing the reasons if the MEDQ decides not to amend the development scheme.

The Townsville City Waterfront PDA is located within the proposed Townsville MPA and was declared at the request of Townsville City Council on 5 September 2014. The TCWPDA development scheme's vision for the PDA includes supporting the ongoing operational requirements of essential maritime infrastructure and the Port of Townsville.

1.7.2 Townsville City Waterfront Priority Development Area

Application

The TCWPDA covers land located on both sides of Ross Creek, which is directly adjacent to Townsville's Central Business District (CBD), within the TCC local government area (LGA). The PDA has an area of approximately 97.2 hectares, including 63.7 hectares over land and 33.5 hectares over water. The northern portion of the PDA contains points of departure and arrival for ferry services (barge and passenger) between the mainland and Magnetic Island and Palm Island.

The area is set to be transformed as part of the strategy to revitalise the Townsville CBD and stimulate economic growth in the region. This will include large public spaces, housing and opportunities for maritime, tourism, commercial and business uses.

The TCWPDA will provide for mixed use development in the CBD, pedestrian and cycle paths along the banks of Ross Creek, a variety of public open spaces and includes measures designed to protect the Port of Townsville's activities from incompatible uses.

Development of the TCWPDA is facilitated through a partnership between EDQ, the PoT and TCC with planning and development assessment responsibilities shared between the EDQ and TCC (refer to Figure 10).

All development within the PDA is regulated by the TCWPDA DS. The TCWPDA includes some land that is SPL under the PoTLUP which also needs to be assessed against the PoTLUP.

Figure 9 TCWPDA precinct plan

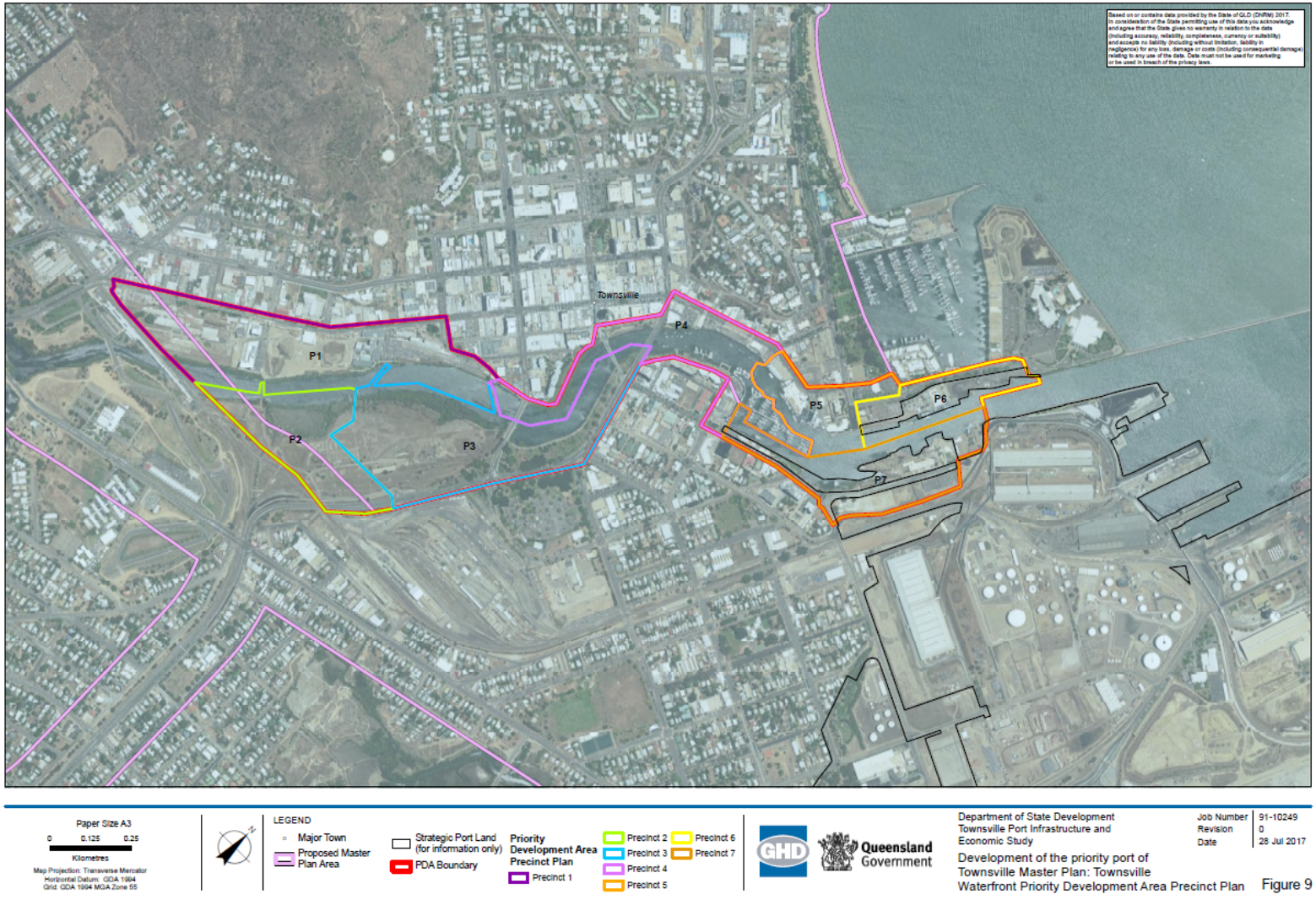


Figure 10 TCWPDA development assessment powers

Development vision

A key component of the TCWPDA vision is to protect and support the ongoing operational requirements of essential maritime infrastructure and the PoT. Development is required to be consistent with the vision.

PDA-wide assessment criteria

The development scheme contains specific PDA wide criteria which directly apply to all development, including port related development. These criteria are identified in categories – Urban design, Public realm, Sustainability, Street and movement network, Natural environment, Development constraints and public safety, and Infrastructure. The PDA-wide criteria listed below relate directly to port operations, maritime safety and siting and design measures for sensitive land uses to preserve amenity.

Development constraints and public safety

- e. not involve permanent or temporary physical obstructions that will adversely affect the operation of essential State maritime infrastructure identified on Map C 02 Noise Corridor and Essential Maritime Infrastructure, including the Port of Townsville's lead light or lead light clearance buffer, existing structures, the Port of Townsville and Reef Vessel Traffic Service, Marine Safety Queensland operations base and the Water Police base
- o. manage and minimise impacts on sensitive land uses and public health and safety through design and siting, including sources of noise from transport corridors, Port of Townsville activity, infrastructure corridors, ship-sourced pollutants, acid sulfate soils, land contamination, existing waterfront marine structures and activities in the Culture and Entertainment precinct
- p. provide common user facilities for the handling and disposal of ship-sourced pollutants, including oil, garbage and sewage, at a suitable location in any development involving a marina or berthing facilities. Where practical, the marina pollutant reception facility is connected to a sewerage or other waste reception infrastructure
- q. avoid conflict between recreational and commercial boating activity and marine structures and operation of the Port of Townsville as a key infrastructure supporting the local, regional and national economy
- r. have regard to existing and planned development to avoid adverse impacts arising from dust, noise and light and incorporate appropriate design and siting responses to minimise the impacts.

Urban design

- c. where adjoining the waterfront, provides a connected Waterfront Promenade and public realm, which has an appropriate interface with adjoining development and enhances the public's access to the waterfront
- d. integrate with, or complement, development in neighbouring sites and precincts and provide for a sensitive transition in built form intensity and scale to adjoining areas
- g. orientate buildings toward views of key attributes of the locality, primarily the waterfront, and also other significant views where practical, such as The Strand and Castle Hill
- i. ensure development minimises impacts on surrounding land and provides for a high level of amenity within the PDA.

In addition to the PDA-wide assessment criteria, footnotes provide additional matters which development needs to address. This includes achieving acceptable noise levels for sensitive uses through acoustic standards consistent with the Environmental Protection (Noise) Policy 2008 and transport noise corridors (outlined earlier in section 1.6); air quality in accordance with the Environmental Protection (Air) Policy 2008; and lighting standards consistent with AS 4828:1997 – control of the obtrusive effects of outdoor lighting.

Precincts

The TCWPDA is divided into a number of precincts for future development; these are illustrated in Figure 9. Precincts five, six and seven are most relevant to the port as future land uses are envisaged which may conflict with port operations. These three precincts are located immediately adjacent to the port and discussed further below.

Precinct 5 – Research and Tourism

Precinct 5 includes marine and research-based tourism, residential (multiple dwellings), short-term accommodation and small-scale business, centre and entertainment uses. Building heights in the precinct are set up to 5 storeys. Residential and short-term accommodation uses trigger PDA self-assessable development within existing building and does not require a development application. However, it should be noted that the PDA-wide assessment criteria and Schedule 3 of the TCWPDA DS include provisions for self-assessable development that sufficiently address amenity issues, including noise and air quality as well as lighting.

Unlike precincts 6 and 7, precinct 5 does not include specific outcomes relating to port protection. This is reasonable given that the precinct is located away from port operations and that the TCWPDA contains PDA-wide assessment criteria to address potential (limited) impacts if these were to arise.

Precinct 6 – Ocean Gateway

Precinct 6 includes commercial, well-designed residential and short-term accommodation uses. The preferred land use within this precinct is mixed use business, centre and residential activities, and short-term accommodation in the southern parts of the precinct with a mixture of dwelling types and styles. Building heights in the precinct are set up to 10 storeys.

The built form in Precinct 6 is to provide for the following port protection measures:

- openings in buildings which are located, oriented, designed and constructed to reduce exposure to noise (and other) impacts as a result of Port of Townsville operations
- design measures including physical screening are incorporated in the built form to reduce exposure to adverse light impacts associated with the Port of Townsville operations
- lighting located to ensure that illumination and glare from the development does not conflict with Port of Townsville operations
- outdoor areas that are located, oriented, designed and constructed to reduce exposure to noise, light, dust or odour from Port of Townsville operations
- for appropriate noise, dust, odour and lighting standards in future development to ensure siting, design and construction achieves acceptable levels of amenity.

Precinct 7 – Maritime Mixed Use

Precinct 7 accommodates marine transport infrastructure, State maritime infrastructure and marine-based business activities. Preferred land uses include port services, marine orientated business and centre activities, research and education establishments and allied tourism operations. The preferred land uses for this precinct does not specifically mention residential development, however residential development is not listed as prohibited development in the

level of assessment table for the precinct. There is the possibility for residential development to be supported under the development scheme. Building heights in the precinct are set up to 12 storeys which may overlook PoT operations.

The built form in Precinct 7 is to provide for the following port protection measures:

- openings in buildings which are located, oriented, designed and constructed to reduce exposure to noise (and other) impacts as a result of PoT operations
- design measures including physical screening are incorporated in the built form to reduce exposure to adverse light impacts associated with the PoT operations
- lighting located to ensure that illumination and glare from the development does not conflict with PoT operations (e.g. navigation lead lights)
- outdoor areas that are located, oriented, designed and constructed to reduce exposure to noise, light, dust or odour from PoT operations
- dense landscaping along Lennon Drive to visually screen PoT operations
- for appropriate noise, dust, odour and lighting standards in future development to ensure siting, design and construction achieves acceptable levels of amenity.

1.7.3 Overview of relationship with the port overlay

The TCWPDA DS includes assessment criteria to protect the operational requirements of the PoT which apply to all assessable development in the PDA, with more detailed provisions in some areas. For example, impacts from the port on sensitive land uses are minimised through design and siting measures such as residential building orientation and building design that reduces air, noise and visual impacts to acceptable levels.

However, should development occur in close proximity to the port, there is potential for impacts on the operational requirements of the port that will need to be addressed as part of the assessment process.

The port overlay cannot regulate development under the TCWPDA DS. However, in accordance with the Ports Act, the Minister for Economic Development Queensland (MEDQ) is required to consider whether the development scheme is inconsistent with the port overlay. If there is an inconsistency, the MEDQ can decide whether to amend the development scheme to remove the inconsistency, or otherwise table a report in the Legislative Assembly detailing the reasons if the MEDQ decides not to amend the development scheme.

1.8 Breakwater Island Casino Agreement Act 1984

1.8.1 Overview

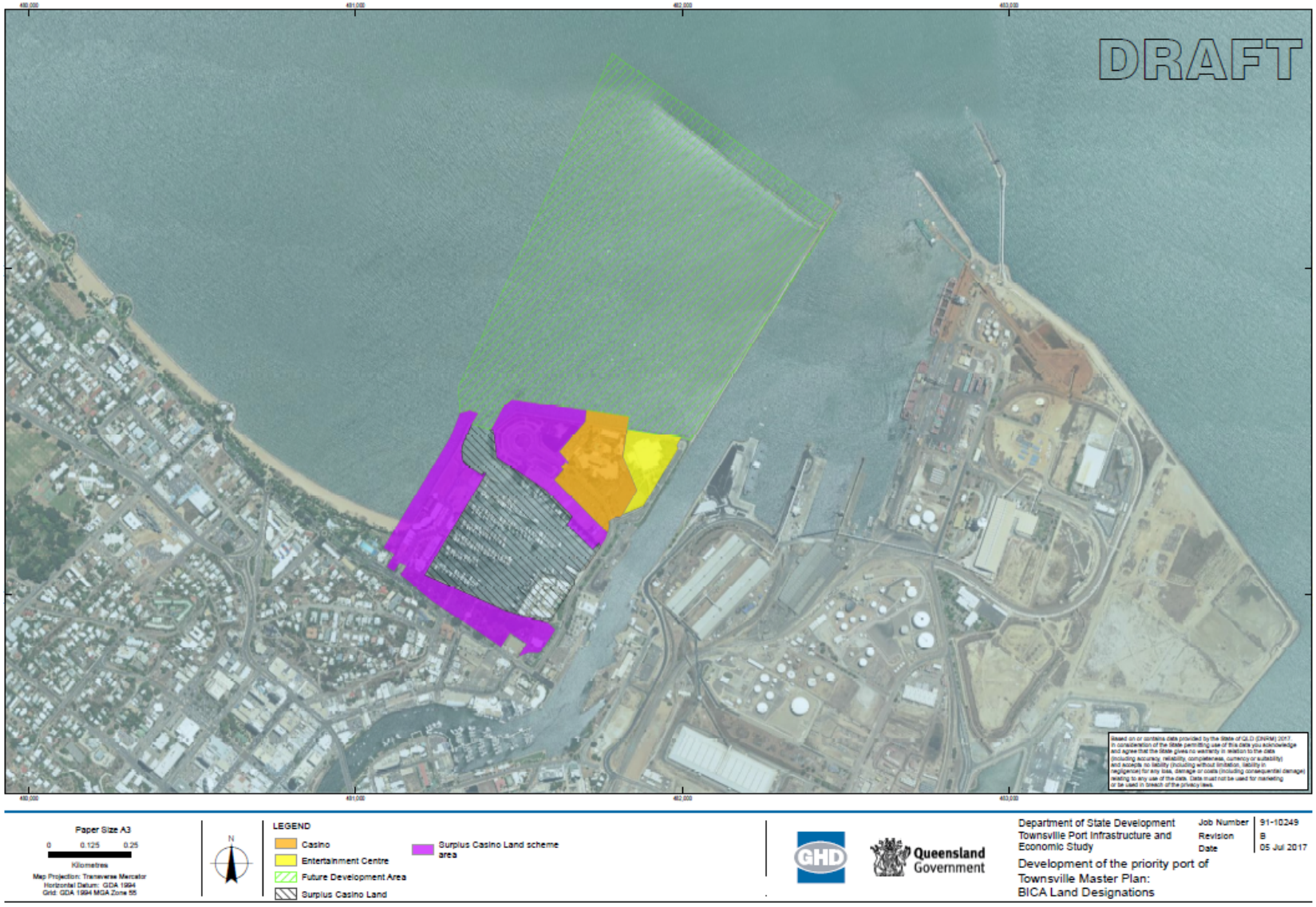
The Queensland Government entered into an agreement with Breakwater Island Limited and other parties to allow the establishment and operation of the casino on Breakwater Island in Townsville. This was enabled by the passing of the *Breakwater Island Casino Agreement Act* 1984 (BICA Act).

The BICA Act regulates Surplus Casino Land (SCL) and the Future Development Area (FDA). The Casino and Entertainment Centre (CEC) is regulated by the TCC City Plan. These areas are shown in Figure 9.

Land within the SCL and FDA still require approval under the TCC's planning scheme but the SCL development scheme and the FDA development plan override TCC's planning scheme to the extent of any inconsistency.

Amendments were made to the BICA Act to require each lot to be within a Community Title Scheme (CTS). This allows for Port Protection Measures (PPMs) to be attached to the land that require specific outcomes and performance solutions to be met in regard to air, noise and light amenity impacts.

Figure 11 BICA land designations



1.8.2 Casino and Entertainment Centre land

The BICA Act oversaw the reclamation and construction of the land that now contains The Ville Resort – Casino complex (previously Townsville Hotel and Casino Complex), the Townsville Entertainment and Convention Centre and the Mariner's North Holiday Apartments and marina facilities. This area is known as the Casino and Entertainment Centre (CEC) Land - refer to Figure 9.

Within CEC land, the Townsville Entertainment and Convention Centre is regulated by the TCC City Plan and zoned a mix of open space, high density residential and medium density residential. It is noted that there is an existing preliminary approval in place for this area which currently overrides the requirements City Plan.

1.8.3 Future Development Area

The original BICA Act provided for the Breakwater Island Trust to obtain a further development lease to later reclaim the FDA for development. Various developments have been proposed, including most recently the Townsville Ocean Terminal (TOT). This land is identified as the FDA on Figure 9.

The FDA site was earmarked for the TOT development. The development plan for the ToT was prepared to reclaim and develop an 80-hectare area of land, immediately north of the existing casino and convention centre. This project is not currently active, a similar development may occur in the future which could include:

- A dedicated cruise terminal and wharf to receive cruise ships and naval vessels
- Reclamation of land under tidal water for a residential canal development
- Development of detached and multiple-unit dwellings
- Marina facilities for general recreational vessels and visiting superyachts
- New foreshore public open space areas.

The FDA is currently not zoned as it is open water (within TCC jurisdiction).

1.8.4 Surplus Casino Land

The SCL area is shown in Figure 10 and includes:

- The Mariners Peninsula site bought and fully developed by Mirvac (marina and multiple dwellings). This development has PPMs in place.
- The other SCL site, not yet fully developed, has two main developers and provides for the following land uses:
  - 'H' dwelling house sector – 26 lots (PoT owning fence line). This area has PPMs in place.
  - Vacant multiple dwelling owned by the Casino and currently does not yet have PPMs implemented but these are required by the BICA Act.

A Port Protection Agreement (PPA) was entered between the State, the developers of the SCL sites and PoTL to ensure that port protection measures would apply to future development of the SCL sites. The PPA provided the content of Community Management Statement (CMS) documents including an architectural and landscape design code (CTS Design Code) and contractual requirements which include port covenants, disclosure statements, deeds of covenant and release.

Under section 51 of the BICA Act, the SCL development scheme, applies to certain areas as indicated in Fig 11. The SCL development scheme includes a specific Port Protection Code for the purpose of minimising the potential impact of the infrastructure and operations of the Townsville Port from incompatible development of SCL.

The performance outcomes of the Port Protection Code are intended to reduce impacts through the built form of any new development by outlining requirements for construction materials, positioning of buildings, screening, acoustic treatments, openings in buildings, location of balconies, line of sight etc. In addition to the PPA requirements, this assists in minimising any potential adverse impacts on new residential tenants and commercial operations and should protect the existing and future activities undertaken as part of Port operations.

The SCL is currently zoned as Mixed use and Open space under the City Plan which provides additional assessment requirements to regulate development, providing these are not inconsistent with the SCL development scheme.

1.8.5 Overview of relationship with port overlay

SCL

The SCL development scheme and port protection code applies to development on the SCL and provides port protection measures for this area. The port overlay may regulate development by providing requirements to be assessed under the City Plan, however the port overlay does not prevail if there is an inconsistency with the requirements of the SCL development scheme.

FDA

There is some uncertainty concerning the status of FDA development plan which was previously prepared to facilitate the proposal for the TOT. If the FDA development plan remains applicable under the BICA Act, the port overlay may provide requirements through the Townsville City Plan which would apply to development providing that these are not inconsistent with the FDA development plan. Otherwise, the master plan and port overlay may include port protection measures which can be incorporated into the future development requirements for the FDA or a future amendment of the FDA development plan.

CEC

Within the CEC land, the Townsville Entertainment and Convention Centre is regulated by the TCC City Plan. As discussed in Section 1.5.5 the port overlay may regulate development under the City Plan and prevails to the extent of any inconsistency over the provisions in the City Plan. This means that port protection measures can apply to manage development if required.

2. Infrastructure interface issues

2.1 Introduction

This section provides a review of the interface issues resulting from the growth scenarios for the priority Port of Townsville.

As the port is required to expand to accommodate the growth scenarios there will be various impacts on the surrounding areas. For example, increased dry bulk trade would see a subsequent increase in ship arrivals, additional berth and terminal facility development and operation, increased rail movements and increased road based traffic. Each of these items has the potential to increase the noise and light interface impacts on surrounding areas and it is important that the various existing regulatory frameworks consider and protect the ports ability to grow to meet trade while minimizing the potential interface issues on surrounding areas.

The evidence base report (EBR) identified a number of precincts within a proposed master planned area. These precincts included areas where potential development may conflict with or negatively impact on the port related infrastructure and supply chains.

The interface issues relate to noise, light emissions, odour, dust, visual amenity, electronic interference and other disturbance items. The management of the interface issues should seek to protect the port's existing and future operations and development and mitigate the potential amenity impacts from port operations on surrounding non-port development. Management of the interface issues directly from development adjacent to the port could be achieved through planning instruments which control the physical built form of future development.

There is the potential that non-port related development in the TSDA and outside the master planned area that utilises key port transport routes may impact on infrastructure and supply chain corridors. This encompasses a broad range of development such as residential, business and retail, industrial, recreational and environmental, infrastructure and transport corridor developments.

2.2 Growth scenarios and the impact on infrastructure and interface items

The growth scenarios identified for the priority Port of Townsville have a resultant impact on the existing and future infrastructure requirements. As the operations and infrastructure are developed under the growth scenarios there are resultant interface issues between adjacent land holdings.

The following tables respectively provide a summary of infrastructure and operational development per growth scenario and the potential interface items/issues associated therewith.

2.2.1 Scenario 1

The estimated effects of Scenario 1 (maximum 10 mtpa port throughput and 112,000 TEU of containers) – on existing and required infrastructure including for the potential interface items related to these effects is shown in Table 3.

Table 3 Scenario 1 estimated infrastructure and potential interface issues

Infrastructure component	Estimated effect(s)	Implications for master planning	Potential Interface Issues
Shipping Channels	Sufficient existing capacity.	Remain as single-lane channels with delays to non-port users waiting for commercial shipping to swing into harbour.	n/a
	With increased container demand, the capacity of existing channels limits ship sizes, particularly direct call Australia/Asia services. Some larger cruise-ships and car carriers may be impacted.	Potential channel modifications (mainly widening) & legislated storage of dredged material in holding area for future land reclamation use and beneficial reuse.	• Increased dredge shipping activity (noise impacts) • Increased reclamation activity (noise impact, visual impact) • Interaction between recreational boating and ferry operations sharing channel entrance with commercial vessels.
Berths and land	Sufficient existing capacity & capability.	As a result of increased container trade, logistics operations and land needs are likely to intensify around Berths 3/4 (container terminals), including the increased storage of empty containers. This may require 24/7 landside operations and a port truck traffic management plan to accommodate increased container HPFV access.	• Increased vessel and road based traffic in port • Increased hours of container terminal operation (light impacts, noise impacts) • Increased stack height for container storage (visual impacts).
Road network	Sufficient existing capacity & capability.	No change required to current specifications & operations of the primary and secondary road network.	• Increased container traffic on roads adjacent to port (traffic congestion impact).
Rail network	Sufficient existing capacity with some inefficiencies remaining.	No change required to current specifications & operations unless triggered by TEARC Business Case investment decision to proceed.	n/a
Industrial Areas	Sufficient existing capacity & capability.	Increased container trade may trigger requirement for 24/7 logistics operations and container HPFV access to/from distribution centres in industrial areas.	• Increased container traffic on roads adjacent to port (land impact, traffic congestion impact).

Legend:	Description
	Sufficient existing capacity
	Approaching existing capacity
	Insufficient existing capacity

2.2.2 Scenario 2

The estimated effects of Scenario 2 Trade Growth (maximum 18 mtpa port throughput and 186,000 TEU of containers) – on existing and required infrastructure including for the potential interface items related to these effects is shown in Table 4.

Table 4 Scenario 2 Estimated infrastructure and potential interface issues

Infrastructure component	Estimated effect(s)	Implications for master planning	Potential Interface Issues
Shipping Channels	Sufficient existing capacity.	Remain as single-lane channels with delays to non-port users waiting for commercial shipping to swing into harbour.	n/a
	With increased container demand, capability of existing channels limits ship sizes if Australia/Asia services to direct call. Some larger cruise-ships, car carriers, and deeper-draft tankers also potentially impacted.	Potential channel modifications (widening and deepening) and legislated storage of dredged material in holding area for future land reclamation use and beneficial reuse to develop new berths.	• Increased dredge shipping activity (noise impact) • Increased reclamation activity (noise impact, visual impact) • Interaction between recreational boating and ferry operations sharing channel entrance with commercial vessels.
		Breakwater and berth construction would require need for operation of PoTL rock quarry & supply chain to Port during construction period.	• Increased marine construction activity (noise impact, visual impact, dust impact) • Increased truck delivery of rock and construction materials (noise impact, traffic congestion impact).
Berths and land	Insufficient existing berth capacity for maximum dry and liquid bulk demand suggesting shortfall of possibly one berth	Requirement for two new berths with associated storage - dry bulk in shed(s) and liquid as tanks and rail connectivity.	• Increased port land area required for dry bulk and liquid bulk berth and storage operations (noise impact,

Infrastructure component	Estimated effect(s)	Implications for master planning	Potential Interface Issues
	for dry bulk and one berth for liquid bulk.		visual impact, light impact) • Port construction of new dry bulk and liquid bulk berths and storage facilities (noise impact, visual impact, dust impact, light impact) • Increased dry bulk operations in port (noise impact, dust impact, light impact) • Increased liquid bulk operations in port (noise impact, light impact) • Increased rail operations to support dry and liquid bulk operations (noise impact, traffic congestion impact).
	Increased container terminal demand and associated logistics operations around Berths 3 and 4	As a result of increased container trade, logistics operations and land needs are likely to intensify around Berths 3 and 4 (container terminal), including the increased storage of empty containers. This may require 24/7 landside operations and port truck traffic management plan to accommodate increased container HPFV access.	• Increased vessel and road based traffic in port • Increased container traffic on roads adjacent to the port (traffic congestion impact) • Increased hours of container terminal operation (light impacts, noise impacts) • Increased stack height for container storage (visual impacts).
	Increased break-bulk project cargoes associated with assumed higher level of mineral developments.	Efficient project cargo operations require need for land for lay-down and special vehicle access to/from port and project sites suggesting need to secure option of	• Increased vessel traffic and specialist High Wide Load vehicles to transfer project cargo to destination (noise impact, visual impact, traffic congestion

Infrastructure component	Estimated effect(s)	Implications for master planning	Potential Interface Issues
		additional area in TSDA.	impact). • Increased storage / lay down area requirement in port or adjacent land to support project cargo staging activities (noise impact, visual impact, traffic congestion impact).
	Increased trade, including cruise-ship and ADF vessel visits, and use of enlarged channels by larger vessels will see an increased need for tugs.	Increased tug harbour capacity requiring relocation of the tug harbour from Berth 8 to a future expanded port land area.	n/a
	Increased trade activity will require services and utilities.	Increased potable water and wastewater services to meet additional demand.	• Increased demand which may require augmentation of networks external to the port.
Road network	Sufficient existing capacity & capability based on a possible required duplication of TPAR for increased demand in future background traffic growth.	No change needed to current specifications and operations noting TPAR duplication may be required if TPAR used by non-port related traffic.	• Increased container traffic on roads adjacent to port (traffic congestion impact) • Increased construction traffic on roads adjacent to the port e.g. breakwater construction, berth construction, terminal and laydown area construction vehicles (traffic congestion impact, noise impact, dust impact).
Rail network	Insufficient existing capacity & capability.	TEARC solution and alignment to and within Port requiring this corridor to be identified and protected in Master Plan and Overlay	• Increased land area and construction of rail network within port and TEARC areas (noise impact, visual impact, land availability impact, traffic

Infrastructure component	Estimated effect(s)	Implications for master planning	Potential Interface Issues
			congestion impact) • Increased rail operations to support dry bulk and liquid bulk operations (noise impact, traffic congestion impact) • Increased rail operations noise from diesel locomotives entering/exiting the Port via TEARC (due to increased gradient of bridge crossing).
Landside - Industrial Areas	Sufficient existing capacity & capability.	Increased container trade may trigger requirement for 24/7 logistics operations and container HPFV access to/from distribution centres in industrial areas.	• Increased requirement for land to support port operations e.g. increased container yard operations and increased break-bulk project cargo laydown areas (land impact, traffic congestion impact).

Legend:	Description
	Sufficient existing capacity
	Approaching existing capacity
	Insufficient existing capacity

2.2.3 Scenario 3

The estimated effects of Scenario 3 Trade Growth (maximum 28 mtpa port throughput and 186,000 TEU of containers) – on existing and required infrastructure including for the potential interface items related to these effects is shown in Table 5

Table 5 Scenario 3 Estimated Infrastructure and Potential Interface Issues

Infrastructure component	Estimated effect(s)	Implications for master planning	Potential Interface Items / Issues
Shipping channels	Sufficient existing capacity.	Remain as single-lane channels with delays to non-port users waiting for commercial shipping to swing into harbour.	Same as Scenario 2.
	With increased container demand, capability of existing channels limits ship sizes if Australia/Asia services to direct call. Some larger cruise-ships, car carriers, and deeper-draft bulk carriers and tankers also potentially impacted.	Potential channel modifications (widening and deepening) and legislated storage of dredged material in holding area for future land reclamation use and beneficial reuse to develop new berths.	Same as Scenario 2.
		Breakwater and berth construction would require need for operation of PoTL rock quarry & supply chain to Port during this construction period.	Same as Scenario 2.
Berths & land	Insufficient existing berth capacity for maximum dry and liquid bulk demand suggesting shortfall of possibly two berths for dry bulk and one berth for liquid bulk.	Requirement for three additional new berths with associated capital dredging and storage (dry bulk in possible shed(s) and liquid as tanks and rail connectivity). Alternative could be to locate dry bulk and liquid bulk storage in TSDA with conveyor/pipelines using TEARC – this would need protecting in master planned area.	Same as Scenario 2 with additional dry bulk operations in the port increasing: • Port or TSDA land requirement for dry bulk operations (noise impact, land impact, visual impact, dust impact) • Port berth construction activity (noise impact, visual impact, dust impact, light impact) • Port dry bulk operations in port and

Infrastructure component	Estimated effect(s)	Implications for master planning	Potential Interface Items / Issues
			potentially in corridor connecting TSDA to Port (noise impact, dust impact, light impact) • Rail operations to support dry bulk operations (noise impact, traffic congestion impact) • Additional tank storage in the port of TSDA to accommodate liquid bulk product (visual impact).
	Increased container terminal and associated logistics operations around Berths 3/4.	As a result of increased container trade, logistics operations and land needs are likely to intensify around Berths 3/4 (container terminal), including the increased storage of empty containers. This may require 24/7 landside operations and port truck traffic management plan to accommodate increased container HPFV access.	Same as Scenario 2.
	Increased break-bulk project cargoes associated with assumed higher level of mineral developments	Efficient project cargo operations require need for land for lay-down and special vehicle access to/from port and project sites suggesting need to secure option of additional area in TSDA	Same as Scenario 2.
	Increased trade, including cruise-ship and ADF vessel visits, and use of enlarged channels by larger vessels will increase need for tugs.	Increased tug harbour capacity requiring relocation of the tug harbour from Berth 8 to a future expanded port land area.	Same as Scenario 2.

Infrastructure component	Estimated effect(s)	Implications for master planning	Potential Interface Items / Issues
	Increased cruise ship and ADF vessel visits and limited existing capacity at Berth 10.	Creation of new additional berth with associated capital dredging to create new basin/channel that will operate as cruise ship terminal. This involves separating the Ross Creek / Magnetic Island ferry traffic from commercial shipping at the start of the Platypus Shipping Channel bounded by the Western Breakwater to limit conflicting activities.	• Port construction of new berths and facilities (noise impact, visual impact, dust impact, light impact) • Increased potable water and wastewater services to meet additional demand.
	Increased trade and dry bulk activity will require services and utilities.	Increased demand for non-potable water and wastewater services for stockpiles which may require augmentation of networks external to the port.	• Increased demand which may require augmentation of networks external to the port.
Road network	Sufficient existing capacity & capability.	No change needed to current specifications and operations noting TPAR duplication may be required if TPAR used by non-port related traffic.	Same as Scenario 2.
Rail network	Insufficient existing capacity & capability.	TEARC solution and alignment to and within Port requiring this corridor to be identified and protected in Master Plan and Overlay.	Same as Scenario 2.
Landside - industrial areas	Sufficient existing capacity & capability.	Increased container trade may trigger requirement for 24/7 logistics operations and container HPFV access to/from distribution centres in industrial areas.	Same as Scenario 2.

Legend:	Description
	Sufficient existing capacity
	Approaching existing capacity
	Insufficient existing capacity

2.2.4 Summary

In summary, the following observations can be made:

- The scale of interface issues increases correspondingly with increasing trade forecast volumes set out in Scenario 1, 2 and 3.
- Near port interface issues are primarily associated with the construction and operation of port infrastructure leading to potential noise, visual, dust, light and localised traffic congestion impacts.
- Far port interface issues are predominantly associated with the increase in vehicle traffic on the port transport and supply chain corridors with interface issues related to traffic congestion.
- Land external to port land holdings with good port transport connection may be required to support the ports future bulk and container operations. This has potential interface issues related to land security and transport corridor protection between the land and the port.

The ability of the current regulatory mechanisms to manage the interface issues discussed above are detailed in Table 6 at a high level and discussed in more detail in Section 3.

Table 6 Regulatory mechanisms existing management measures

Key interface issue	PoTLUP	TSDA DS	TCWPDA DS	TCC City Plan	SDAP Code	BICA
Noise, air, dust and visual amenity impacts	Port protection measures apply.	Measures apply within the TSDA DS to mitigate impacts caused by port industry being located within the TSDA. Suitable land uses have been set aside for port industry in the TSDA.	Current provisions seek to protect the role of the PoT.	Current provisions seek to protect the role of the PoT. Character residential areas to the south of the port may be subject to increased impacts if redevelopment occurs.	Current provisions address impacts on the transport network.	Port protection measures apply for SCL, future PPM required for the CEC and FDA components.
Key port transport corridors	Increase in capacity at the port (scenario 3) likely to increase impacts to road and rail network.	Increase in capacity at the port (scenario 3) likely to increase impacts to road and rail network. Land has been set aside within the TSDA for TEARC.	Not applicable.	Current provisions address impacts on the transport network.	Current provisions address impacts on the transport network.	

3. Options to manage infrastructure interface issues

3.1 Introduction to this section

This section summarises the interface issues that occur within the jurisdiction of each regulatory framework and analyses the appropriate approach to manage these under existing regulatory mechanisms.

Table 7 provides a consolidated summary of the potential infrastructure requirements and interface items / issues associated with growth scenarios 1 to 3.

Table 7 Summary of Growth Scenario related Interface Items/Issues

Infrastructure component	Scenario 1 - Potential Interface Issues	Scenario 2 - Potential Interface Issues	Scenario 3 - Potential Interface Issues
Anchorages	n/a	n/a	n/a
Shipping channels	• Increased dredge shipping activity (noise impacts) • Increased reclamation activity (noise impact, visual impact) • Interaction between recreational boating and ferry operations sharing channel entrance with commercial vessels.	• Increased dredge shipping activity (noise impact) • Increased reclamation activity (noise impact, visual impact).	Same as Scenario 2.
		• Increased marine construction activity (noise impact, visual impact, dust impact) • Increased truck delivery of rock and construction materials (noise impact, traffic congestion impact).	Same as Scenario 2.

Infrastructure component	Scenario 1 - Potential Interface Issues	Scenario 2 - Potential Interface Issues	Scenario 3 - Potential Interface Issues
Berths and land		• Increased port land area required for dry bulk and liquid bulk berth and storage operations (noise impact, visual impact, light impact) • Port construction of new dry bulk and liquid bulk berths and storage facilities (noise impact, visual impact, dust impact, light impact) • Increased dry bulk operations in port (noise impact, dust impact, light impact) • Increased liquid bulk operations in port (noise impact, light impact) • Increased rail operations to support dry and liquid bulk operations (noise impact, traffic congestion impact) • Increased potable water and wastewater services to meet additional demand.	Same as Scenario 2 with additional dry bulk operations in the port increasing: • Port or TSDA land requirement for dry bulk operations (noise impact, land impact, visual impact, dust impact) • Port berth construction activity (noise impact, visual impact, dust impact, light impact) • Port dry bulk operations in port and potentially in corridor connecting TSDA to Port (noise impact, dust impact, light impact) • Rail operations to support dry bulk operations (noise impact, traffic congestion impact) • Additional tank storage in the port or TSDA to accommodate liquid bulk product (visual impact) • Increased non-potable, potable water and wastewater services to meet additional demand.
	• Increased vessel and road based traffic in port • Increased container traffic on roads adjacent to the port (traffic congestion impact) • Increased hours of container terminal	• Increased vessel and road based traffic in port • Increased container traffic on roads adjacent to the port (traffic congestion impact) • Increased hours of container terminal	Same as Scenario 2.

Infrastructure component	Scenario 1 - Potential Interface Issues	Scenario 2 - Potential Interface Issues	Scenario 3 - Potential Interface Issues
	operation (light impacts, noise impacts) • Increased stack height for container storage (visual impacts).	operation (light impacts, noise impacts) • Increased stack height for container storage (visual impacts).	
		• Increased vessel traffic and specialist High Wide Load vehicles to transfer project cargo to destination (noise impact, visual impact, traffic congestion impact) • Increased storage / lay down area requirement in port or adjacent land to support project cargo staging activities (noise impact, visual impact, traffic congestion impact).	Same as Scenario 2.
Road network	• Increased container traffic on roads adjacent to port (traffic congestion impact).	• Increased container traffic on roads adjacent to port (traffic congestion impact) • Increased construction traffic on roads adjacent to the port e.g. breakwater construction, berth construction, terminal and laydown area construction vehicles (traffic congestion impact, noise impact, dust impact).	Same as Scenario 2.
Rail network	n/a	• Increased land area and construction of rail network within port and TEARC areas (noise impact, visual impact, land availability impact, traffic congestion impact) • Increased rail operations to support dry bulk and liquid bulk operations (noise	Same as Scenario 2.

Infrastructure component	Scenario 1 - Potential Interface Issues	Scenario 2 - Potential Interface Issues	Scenario 3 - Potential Interface Issues
		impact, traffic congestion impact) • Increased rail operations noise from diesel locomotives entering/exiting the Port via TEARC (due to increased gradient of bridge crossing).	
Landside - industrial areas	• Increased container traffic on roads adjacent to port (land impact, traffic congestion impact).	• Increased requirement for land to support port operations e.g. increased container yard operations and increased break-bulk project cargo laydown areas (land impact, traffic congestion impact).	Same as Scenario 2.

3.2 Implications of interface issues in terms of existing regulatory framework

Table 7 provides a summary of the infrastructure development and associated interface items/issues for each future growth scenario 1 to 3.

The following section analyses the potential infrastructure development and interface items/issues in terms of the identified regulatory frameworks to determine sufficiency and gaps of the legislation with regard to protecting the future port development.

3.2.1 TSDA Development Scheme implications

Scenario 3 (with an additional 10 million tonnes per annum (mtpa) of Dry Bulk exports) forecasts the need to significantly upgrade the Port's capacity. Under this scenario, TSDA land may be required to store/handle dry bulk and/or shale oil exports utilising a conveyor and/or pipeline connection within the TEARC alignment located within the proposed Infrastructure and supply chain corridor precinct.

Future TSDA land may also be utilised for the lay down/storage of project cargoes for new mineral projects taking advantage of the TPAR for heavy oversize road movements under scenarios 2 and 3. These uses would be suitably located in the Port industry and commerce precinct of the proposed Townsville MPA.

Growth of container volumes at the Port of Townsville could see the development of remote terminal yard storage, collection, handling, processing and distribution centre within the TSDA area, or otherwise external to TSDA.

It is estimated that the Port of Townsville will require between 5-100 ha within the TSDA to support future port operations and growth by 2050.

There is sufficient capacity for the road network to accommodate development and no changes are likely to be required to the TSDA DS. The key routes that traverse through the TSDA include the:

- North Coast Line
- Bruce Highway
- Flinders Highway
- Mount Isa Rail Line
- Townsville Port Access Road.

The TSDA DS sufficiently provides for port protection measures in Schedule 4, that should ensure that development does not significantly impact these key transportation corridors. Future development within the TSDA may negatively impact upon the key port access roads and rail leading to and from the PoT if not managed according to these requirements.

It will be important to ensure that port operations are not adversely impacted by land uses within the TSDA that do not fully utilise the locational benefits of proximity to the port. For example, the Coordinator-General may undertake a review of the TSDA DS to allow for the dry bulk storage and transportation as outlined in scenario 3.

To minimise inconsistencies between the port overlay and the TSDA DS it is suggested that the drafting of the port overlay be undertaken in consultation with the Coordinator-General.

3.2.2 TCC – local government area implications

The key interface issues within the TCC local government area include:

- encroachment of incompatible developments near the port boundaries leading to potential impacts associated with noise, vibration, odour and air quality from port operations
- potential acoustic issues along major roads and rail corridors, where not addressed by QDC MP4.4, State codes or the Infrastructure noise overlays in the City Plan.

Encroachment at port boundary

The Interface precinct directly to the south of the port is currently zoned as a character residential area to ensure that existing heritage buildings are preserved into the future. This is a low-lying area which may also be subject to increased storm tide inundation. This means that the population of this area is unlikely to increase significantly in the future, but the population of this precinct may still be impacted by port operations (within the port and along transport corridors).

The land that sits immediately to the south of the port is located within a network of important port access roads (Benwell Road/Townsville Port Access Road Perkins Street, Boundary Street and Archer Street). The uses within this area have traditionally been residential in nature which has created ongoing issues with regard to traffic management along Boundary Street and interface issues with the port that have led to complaints from local residents. Major roads within these precincts carry heavy goods vehicles to and from the port which can potentially create conflicts with general traffic and can have noise impacts on adjacent residential areas.

The impacts upon these areas can be managed through implementing existing provisions within the QDC and port protection measures which may include:

- redirect heavy transport vehicles onto higher order roads to reduce impacts on the surrounding residents
- more detailed design standards for sensitive developments within proximity to the port node.

Transport corridors

Residential, commercial and industrial development may increase the traffic load on key major transportation corridors linking to the port. An increase in port related cargo over time will also have the potential to negatively impact on sensitive uses.

The City Plan includes port protection measures that protect the existing and future operations of the port, including the port's key transport corridors. However, additional assessment requirements may be considered that relate to traffic impact assessments to address cumulative impacts from non-port development that utilise key port transport corridors, where not addressed by existing measures in the City Plan.

The intent of the master plan and port overlay could build upon the well-articulated strategic intent and existing provisions within the planning scheme to address interface issues by implementing more detailed design standards for sensitive developments within proximity to the port node.

3.2.3 Townsville City Waterfront Priority Development Area - implications

The TCWPDA indicates the potential for residential uses (including hotel developments) to be located in precincts 5, 6 and 7 of the TCWPDA. As a result, these three precincts were identified as 'interface precincts' requiring further investigation within the proposed Townsville MPA. The

future development of SPL within the TCWPDA requires the duplication of assessment processes under the TI Act and ED Act.

The key interface issues relating to the TCWPDA are due to the proximity to the Port of Townsville operations. As per the trade growth scenarios, increases in port operational activities such as container operations, with extended hours of operation, increased stack heights and increasing vehicle movements all combine to increase the potential interface issues between the TCWPDA and the Port of Townsville. Specific interface issues have been identified in this study for TCWPDA precincts 6 and 7 which are discussed below.

Interface issues within Precinct 6

- Development in Precinct 6 will have direct views to PoT and may be impacted by the increase in container storage at Berths 3 and 4 as indicated in Growth Scenario 1-3.
- Future development in this precinct has a focus on public access and pedestrian connectivity along the waterfront in close proximity to the PoT.
- The built form and climate responsiveness measures address the protection of PoT operations.
- Precinct 6 includes land that is SPL and two approvals are required which creates duplication of assessment processes.

Interface issues within Precinct 7

- The PoT is located on the boundary of Precinct 7 of the TCWPDA.
- Development in this precinct will have direct views to PoT and may be impacted by an increase in container storage at Berth 4 as indicated in future trade growth scenarios 2 and 3.
- Precinct 7 has a strong focus on tourism development and increased public access to the Quayside Terminal and Palmer Street.
- The built form and climate responsiveness measures identified in the TCWPDA DS address the protection of PoT operations.
- Precinct 7 of the TCWPDA includes land that is SPL therefore duplication of assessment under the PoTLUP and TCWPDA DS will occur.

The TCWPDA DS includes port protection measures that sufficiently protect the port from sensitive development within Precincts 6 and 7.

3.2.4 Breakwater Island Casino Agreement - implications

The following interface issues are directly related to the SCL, CEC and FDA being located directly opposite the Port of Townsville.

The issues which could potentially arise from a conflict of adjacent land uses include noise, odour, dust, light, visual intrusion and loss of port security. These issues will increase under scenarios 1 to 3 with possible increases in vessel movements, port container, break bulk and bulk operations anticipated.

Whilst these issues cannot be totally avoided when sensitive receptors (such as residential) are located near an existing and expanding operating international port, they can be reduced through the built form of any new development. This will assist in minimising any potential adverse impacts on new residential tenants and commercial operations and will protect the existing and future activities undertaken as part of port operations.

Surplus Casino Land

Port protection measures are in place for the SCL area under the BICA Act. The port overlay could provide guidance to future development within the SCL through assessment processes undertaken by TCC, however these are limited if inconsistent with the SCL development scheme. Alternatively, the port protection measures could be adopted into the BICA Act to ensure consistency across the whole area neighbouring the port.

Convention and Entertainment Centre

If the current Convention and Entertainment Centre relocates this may create the opportunity for a new residential/hotel development to be developed in that location where no port protection measures currently apply under the BICA Act.

It is important that future development does not have a negative impact on future port operations and in particular on sensitive land uses being developed in close proximity to port operations. As this development would be subject to the Townsville City Plan, the master plan and port overlay may seek to include provisions that would apply to future development and protect port operations.

Future Development Area

The status of the FDA development plan is unclear. The master plan and port overlay may provide requirements to future development within the FDA, however these are limited if inconsistent with the FDA development plan. Given the proximity to the PoT, port protection measures to control noise, dust, light, odour, electromagnetic interfaces, and other disturbances should be considered within the port overlay. This may include specific requirements for construction materials, building orientation, screening, acoustic treatments, building openings, balcony location, lighting and impacts on navigation aids.

Alternatively, the port protection measures could be adopted into the BICA Act to ensure consistency across the whole area neighbouring the port.

3.2.5 Port of Townsville Land Use Plan - implications

The trade growth scenario infrastructure implications for the Port of Townsville include for the following items:

- increased channel dimensions
- additional reclaimed land and protective marine structures
- additional berths to support dry bulk and liquid bulk cargo
- additional storage areas to accommodate containers, dry bulk, liquid bulk and break-bulk project cargo
- additional areas to facilitate road and rail access
- additional areas to accommodate integration between TEARC/TPAR and the TSDA area
- additional corridor areas for transport of cargo movement via pipelines, conveyors etc.
- additional areas to facilitate cruise, Australian Defence Force and marine operations vessels.

The scenarios identified that additional land and marine areas will be required within the PoTLUP to service the port and its future operations. These reclaimed areas will eventually need to be included in the PoTLUP so that future development can be regulated.

It is suggested that the master plan should support the relocation of industrial land uses on SPL along the eastern and western side of Ross Creek as identified in the PoTLUP. These areas should allow for short-term residential and commercial tourism facilities, marine industries and port support services as outlined in the PoTLUP and TCWPDA DS.

In the areas of SPL that are also located in the TCWPDA, these activities are generally consistent with the intent of the TCWPDA DS, however there will be a duplication of assessment processes and approvals required for future development. Although outside the scope of master planning under the Ports Act, both EDQ and PoT may seek to reduce the potential for conflicting approvals that could result in delays to supported development types.

The PoT should also continue on an ongoing basis to assess the port lease / licences and identify when opportunity arises to potentially relocate port operations with higher interface item/issue potential from known and sensitive receptors.

4. Suggestions for the master plan content

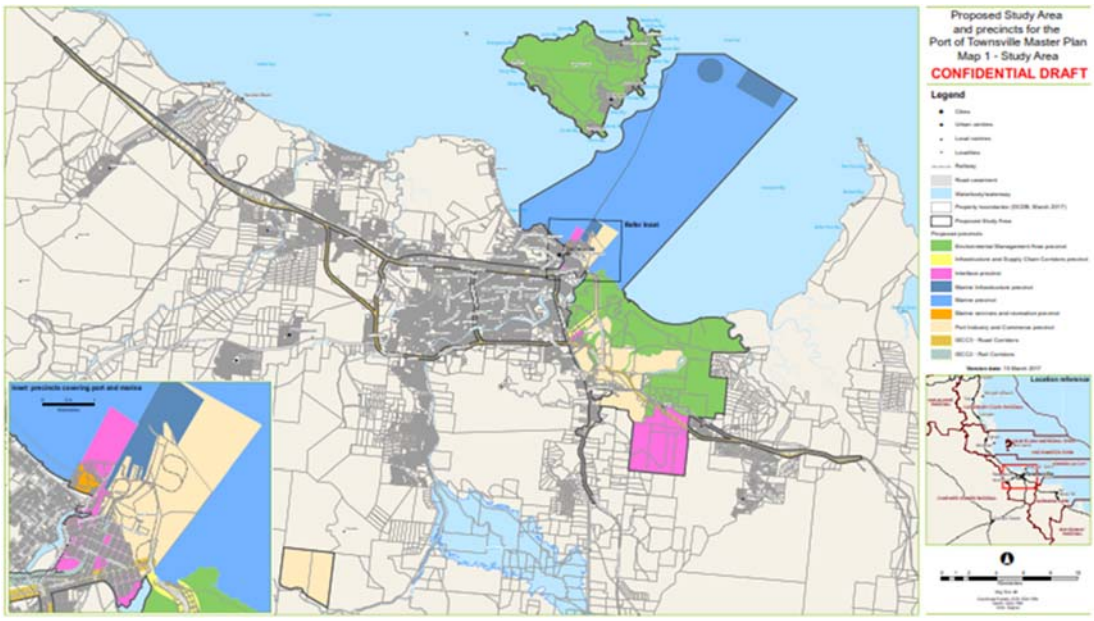
4.1 Introduction to this section

This section outlines suggestions for the content of the master plan including to the proposed master planned area, state interests, desired outcomes and objectives for the master planned area and each precinct. These suggestions will be influenced by the outcomes of the risk assessment report.

4.2 Proposed Townsville master planned area

The proposed Townsville master planned area (MPA) is set out in Figure 12.

Figure 12 Townsville master planned area



The following amendments are proposed to the Townsville MPA:

- Remove Elliot Springs from the Interface precinct as this development has already been approved and only new development can be regulated by the port overlay;
- Remove the PoT Quarry from the Interface precinct as it is not an ongoing port operation. Each period of marine construction will be regulated via construction and environmental management processes that will seek to mitigate the interface impacts and include the regulation and control of the delivery of materials from the quarry to the port;
- The Marine services and recreation precinct, located adjacent to the PoT, and the adjoining Interface precinct should be required to protect port operations.
- Due to the similar geographic location, interface issues and interface control mechanisms, that the Marine services and recreation precinct and land based marine-orientated areas of the Interface precinct may be amalgamated (subject to the future phases of the master planning process).
- Include all future marine-based port infrastructure in the Marine infrastructure precinct
- Review precinct boundaries to align with the outcomes of the risk assessment process.

4.3 State Interests

Under the Ports Act, a state interest is an interest the Minister considers to be an economic, community or environmental interest of the state or part of the state, or the interest of ensuring the purpose of the Ports Act is achieved.

State interests have been prepared so that these are consistent with the existing state interests for strategic ports as expressed in the State Planning Policy, whilst also being relevant to the requirements of the Ports Act. The following state interests have been identified for the proposed Townsville MPA:

- Managing port related development - – operation of the priority Port of Townsville and its growth and development, including infrastructure and land use planning
- Economic – sustainable economic growth of the priority Port of Townsville and the surrounding region
- Environment – OUV of the GBRWHA and all other environmental values
- Community – wellbeing of the community of the Townsville region

4.4 Desired outcomes

The overarching and holistic desired outcomes for the Townsville MPA are summarized below:

- Manage potential impact of sensitive development in the master planned area on the ports current and future operations
- Infrastructure corridors are protected from encroachment of incompatible uses
- Land and marine areas are available for the development of the port and port related industries
- Port uses are located and designed to mitigate adverse impacts on adjoining land uses.
- Adjoining land uses are located and designed in order to mitigate the operational effects of adjoining port uses
- Development maintains public access to the foreshore, unless contrary to the protection of coastal resources or public safety
- Development does not cause or result in reverse amenity impacts on port uses (impacts on key transport routes and feeder corridors)
- Development does not compromise or adversely impact on the development of (or the upgrading of existing) key transport routes critical to the PoT operation
- Development including sensitive land uses is appropriately designed in order to mitigate the potential operational effects on key transport routes and feeder corridors
- Development is appropriately located, designed, constructed and operated having regard to port operations in order to support sustainable ongoing growth of port capacity that does not compromise environmental values.

4.5 Suggested precinct purpose and intent

4.5.1 Marine Precinct

Purpose

The purpose of the Marine precinct is to provide for limited port and industry development, and non-port related marine activities which minimise impacts on environmental values. This

precinct generally extends to the highest astronomical tide (HAT) and includes intertidal and marine areas adjoining the Marine infrastructure precinct which are not critical to the operation or growth of the port and includes intertidal and marine waters.

Objectives

- Development must be appropriately designed and located to minimise impacts on environmental values within and surrounding the master planned area.
- Uses that do not compromise the environmental values of the marine area may be acceptable, including small scale maritime infrastructure, boat ramps, pontoons and coastal protection structures, coastal rescue services, commercial, tourism and recreational uses.

4.5.2 Marine infrastructure precinct

Purpose

The purpose of the Marine infrastructure precinct is to ensure port and shipping access to navigation channels and waterside areas, and provide for marine-based port infrastructure and operational requirements.

Objectives

- The Ship Inner Anchorage Point remains as the sole anchorage infrastructure within the Marine Infrastructure precinct for port master planning purposes, and the Marine Infrastructure precinct is not extended beyond existing port limits to accommodate the outer ship anchorage points
- The Ship Pilot Boarding Ground currently located in the Marine Infrastructure precinct is recognised as a Marine Infrastructure precinct for port master planning purposes to help protect its function in the safe and efficient passage of commercial vessels using the Port of Townsville
- The Shipping Arrival Channel currently located in the Marine Infrastructure precinct is also recognised as important infrastructure for port master planning purposes
- The requirement to initially widen the existing shipping channels and possibly deepen the channels at a later stage as part of a port expansion for larger (fully-laden) dry bulk carriers, cruise ships and tankers is recognised
- The dredged material placement area as a Marine infrastructure precinct remains as the sole materials placement area for maintenance dredging, and the precinct is not extended beyond existing port limits due to restrictions on the master planned area outlined in the Ports Act
- The inner and outer Ship Swing Basins currently located in the Marine infrastructure precinct are recognised as important infrastructure for port master planning purposes
- Requirement of additional two to three berths in a port expanded area with associated new marine infrastructure (breakwater protection, a ship swing basin and berth pockets) and land behind the berths for cargo handling and storage with road and rail connections
- The Eastern, Western and Offshore Breakwaters are recognised as part of the Marine infrastructure precinct for port master planning purposes
- With increased trade volumes and ship calls, combined with increased recreational boating, a need to separate Ross Creek marine traffic from commercial shipping using

the Port to mitigate increased risk of navigational incidents and the impacts on Magnetic Island ferry timetable for island residents and visitors.

4.5.3 Port industry and commerce precinct

Purpose

The purpose of this precinct will be to allow for port operations, general and heavy industry, port related commercial activities and related development. Public access is generally limited in this area to the workforce, except where necessary to access public facilities. It may include undeveloped land that has been identified as having potential to accommodate port related development or infrastructure. It may also accommodate other associated commercial development that support port activities.

Objectives

- Provide for port operations, industry, port related commercial activities and other related development.
- Development within this precinct includes industries which are of regional and state economic significance to support the port operations and industry.
- The Port industry and commerce precinct is extended for port master planning purposes to include the location of a new cruise shipping terminal.
- As existing single-user berth agreements come close to termination, that multi-user agreements are investigated as a priority to provide access to latent capacity where commodity compatibility and design enhancements exist and facilities are under-utilised;
- Requirement that sufficient appropriately zoned land close to the Port is identified for port related storage and logistics activities such as project cargo lay-down area and warehousing for consolidating / deconsolidating containerised cargoes. This port related requirement for land may be up to 100 (or more) hectares over the period out to 2050 dependent on market choice of other industrial locations around Townsville.

4.5.4 Infrastructure and supply chain corridors precinct

Purpose

The purpose of the Infrastructure and supply chain corridors precinct will be to manage the impacts on the transport feeder corridors to the port and cargo movements on the transport network with resultant impacts on sensitive receptors adjacent to these corridors. Management of the interface issues will be achieved through regulatory frameworks and the reservation of suitable reserves for transport corridor capacity development.

The purpose of the precinct will be achieved through:

- Development is located and planned in order to mitigate the operational effects of adjoining port uses
- Development does not cause or result in reverse amenity impacts on port uses (impacts on key transport routes and feeder corridors)
- Development does not compromise or adversely impact on the development of (or the upgrading of existing) key transport routes critical to the PoT operation.
- Development including sensitive land uses is appropriately designed in order to mitigate the potential operational effects on key transport routes and feeder corridors

- Development is appropriately located, designed, constructed and operated having regard to port operations in order to support sustainable ongoing growth of port capacity that does not compromise environmental values.

Objectives

- Protection of critical land for supply chain infrastructure to support port related infrastructure.
- Development must ensure safe and efficient operation and management of supply chain infrastructure.
- Protect the routes used by port traffic close to and within the Port, in particular the routing of over-size / over-mass vehicles to reduce future delays.
- Removal of the rail- crossing on Archer Street by the possible re-routing of the current rail line to improve both rail and road efficiency nearby and in the Port.
- Inclusion of the preferred alignment of the TEARC to protect future improved rail operations to/from and within the Port which may include use of the existing port reclaimed area to route rail into the Port and remove its existing alignment across Archer Street.
- Land for TEARC alignment must include protection of required space for possible future port connection for bulk handling at the Port, such as conveyor / pipeline corridors into the TSDA.
- Inclusion of the southern section of the TPAR, which includes the proposed road train de-coupling area, in the Infrastructure and Supply Chain Corridor precinct to recognise its role in serving the port and future port related development in the TSDA.
- If service-levels on the TPAR start to significantly degrade, consider managing as a freight-only road or restricted for non-port related background traffic, noting its management is beyond the scope of the port master plan.
- Consider future transfer of section of Archer Street from TCC to Port of Townsville.

4.5.5 Interface precinct

Purpose

The Interface precinct seeks to manage the interface issues between sensitive land uses and port activities to protect the port's existing and future operations and development and mitigate the potential claims on the port regarding amenity impacts on surrounding non-port development. The management of the interface issues will be achieved through control of the physical built form of future developments.

The purpose of the precinct will be achieved through:

- Port uses are located and designed to minimise adverse impacts on adjoining land uses
- Adjoining land uses are located and designed in order to minimise the operational effects of adjoining port uses
- Adjoining land uses do not cause or result in reverse amenity impacts on port uses (noise, light emissions, odour, dust, view restrictions, electronic interference and other disturbance items)
- Development maintains public access to the foreshore, unless contrary to the protection of coastal resources or public safety.

Objectives

- Manage interface areas between sensitive land uses surrounding the PoT.
- Development within this precinct should minimise impacts upon port operations and infrastructure.
- Development in the interface precincts to be designed appropriately to prevent impacts on sensitive land uses from the Port.
- Development of guidelines and regulations to protect port development and manage operations adjacent to port developments to minimize and mitigate interface issues.

4.5.6 Marine services and recreation precinct

Purpose

The purpose of the Marine services and recreation precinct is to provide for a range of activities that require marine proximity and/or access including associated marine industries and recreational areas. Development within this precinct includes marina activities and associated marine industries, small boat harbour, coastal rescue services, commercial, light industry, educational facilities, public open space and public access to the waterfront and harbour.

The precinct will provide direct access for tourism and recreational activities, including commercial fishing and facilities to support cruise ship passengers. Within this precinct, public access to the waterfront and the harbour (including boat ramps, marina, open space and community facilities) will be provided and maintained where it does not compromise public safety or the security of port operations or result in adverse impacts on environmental values.

Objectives

- Manage the interface between sensitive land uses surrounding the PoT.
- Development within this precinct should minimise impacts upon port operations and infrastructure.
- Provide for a range of maritime activities and associated marine industries and recreation opportunities.
- Provide access for marina activities and public to the waterfront.

4.5.7 Environmental management precinct

Purpose

The purpose of this precinct is to limit development and manage environmental values consistent with ESD principles. Development in this precinct is not encouraged. Low impact development that supports the protection of the values of the area is preferred. Development is compatible with Traditional Owner access, but general public access is limited.

Objectives

- Limit development and manage environmental values in a manner that is consistent with ecological sustainable development principles.
- Conveyor transport corridors may be considered where impacts can be shown to be managed within the context of maintaining and protecting the environment.
- Essential community infrastructure may be permitted (e.g. telecommunications and electricity.

- Existing infrastructure or operations are supported where impacts on environmental values can be managed.

5. Suggestions for port overlay content

5.1 Introduction to this section

This section presents suggestions for protecting and advancing state interests and managing interface issues between infrastructure and supply chain activities and the neighbouring communities through the port overlay instrument.

5.2 Regulatory overview summary

A table has been provided in Appendix B that sets out the various regulatory Heads of Power in relation to the master planned area precincts with regards to the relevance, provision and adequacy of content relating to port protection measures.

Additional and specific detail regarding the Port Protection Measures and suggestions for the port overlay content are contained in Section 5.3.

It is noted that the approach for the port overlay is to regulate port-related development in the master planned area only where it is not sufficiently addressed by the existing regulatory frameworks. Requirements for the port overlay will be informed by the outcomes of the risk assessment report.

5.3 Suggestions for implementing/advancing state interests through the port overlay

The port overlay may include assessment provisions to ensure that the strategic vision, objectives, desired outcomes and state interests identified in the proposed master plan are considered in development assessment decisions within the proposed master planned area.

Suggested criteria for assessment for the various precincts identified within the MPA are set out below.

5.3.1 Marine precinct

The Marine Precinct is recognised within the MPA however suggestions for the port overlay have not been included as the operations and planned development in this area will be informed by the outcomes of the risk assessment report.

5.3.2 Marine infrastructure precinct

The Marine Infrastructure Precinct is recognised within the MPA however suggestions for the port overlay have not been included as the operations and planned development in this area will be guided and controlled by the existing legislation.

5.3.3 Port industry and commerce precinct

The purpose and objectives of the Port industry and commerce precinct is protected by various regulatory legislation, namely:

Transport Infrastructure Act 1994

- Port of Townsville Land Use Plan
  - Contains Port Protection Measures.

State Development and Public Works Organisation Act 1971

- Townsville State Development Area Development Scheme

- Contains Port Protection Measures including the protection of port access corridors and the facilitation of port related industrial land within the SDA.

Planning Act 2016

- State Planning Policy
  - Includes specific Port Protection Measures to be integrated into local government planning schemes.
  - Protects the port from incompatible development and protects port transport routes.
- Townsville City Plan
  - Identifies importance of the port and supports the port and port related support infrastructure operation and development.
  - Port located in Specialised centre zone – requires protection of the port and outlines that a specialised centre retains its dominant function and that new development does not prejudice its ongoing operation or significantly impact on the amenity of nearby sensitive uses.
  - Townsville State Development Area (TSDA) located in Special Purpose Zone that is to facilitate industrial development that is of regional, state and national significance. The particular purpose of the code is to facilitate and maintain linkages to the PoT and major freight routes.

Economic Development Act 2012

- Townsville City Waterfront Priority Development Area
  - Vision includes the protection and support for the ongoing operational requirements of essential maritime infrastructure and the PoT.
  - PDA wide assessment criteria protect port development and operations through development constraints, public safety considerations and urban design guidelines.
  - Precinct 6 has specific port protection measures related to built form.
  - Precinct 7 has specific port protection measures related to built form.

The existing regulatory frameworks provide adequate protection for the operation and future development of the port and port related transport and industrial land holdings. Where potential gaps in the legislation occur regarding port protection measures, the following suggestions are made.

Suggestions for port overlay

- Create a mechanism to ensure consistency of development assessment criteria across the various regulatory frameworks seeking protection of port and port related transport corridors and industrial areas.
- Port overlay seeks that regulation and development scheme for FDA and CEC areas adopt relevant and consistent Port Protection Measures across regulatory frameworks.
- PoT to assess port leases and identify opportunities to potentially relocate port operations with higher interface issues from known and sensitive receptors to alternate locations.

5.3.4 Infrastructure and supply chain corridors precinct

The purpose and objectives of the Infrastructure and supply chain precinct is protected by various regulatory legislation, namely:

State Development and Public Works Organisation Act 1971

- Townsville State Development Area Development Scheme
    - Contains Port Protection Measures including the protection of port access corridors and the facilitation of port related industrial land within the SDA.

Planning Act 2016

- State Development and Assessment Provisions (SDAP): State code 1 – Development in a State Controlled Road environment
    - Contains measures to protect state-controlled roads from adverse impacts of development.
    - Contains measures to protect safety of people using, living and working near state-controlled roads.
    - Contains specific performance outcomes protecting sensitive receptors.
- State Development and Assessment Provisions (SDAP): State code 2 – Development in a rail environment
    - Contains measures that protect railways, future railways and other infrastructure in a railway corridor from adverse impacts of development.
    - Contains specific performance outcomes protecting sensitive receptors.
- North Queensland Regional Plan
    - Anticipated to include provision for protection of port and related infrastructure.
- State Planning Policy
    - Includes specific Port Protection Measures to be integrated into local government planning schemes.
    - Protects the port from incompatible development and protects port transport routes.
- Townsville City Plan
    - Identifies importance of the port and supports the port and port related support infrastructure operation and development.
    - Locates the Townsville State Development Area (TSDA) in Special Purpose Zone to facilitate industrial development that is of regional, state and national significance. The purpose of the code also facilitates and maintain linkages to the PoT and major freight routes.
    - Transport impact, access and parking code - this code applies to most code and impact assessable material change of use development under the City Plan within the proposed MPA. It provides assessment criteria that seek to optimise the function, safety and efficiency of the transport network, and avoid adverse impacts on the environment and locality.
    - Identifies infrastructure noise corridors and provision to attenuate transport noise for non-residential buildings.

Building Act 1975

- Sets out specific requirements for residential building development (post 2010) adjacent to designated transport noise corridors to minimize impact on residents.

The existing regulatory frameworks provide adequate protection for the operation and future development of the port infrastructure and supply chain corridors. Where potential gaps in the

legislation occur regarding infrastructure and supply chain protection measures, the following suggestions are made.

Suggestions for port overlay

- Create a mechanism to ensure consistency of development assessment criteria across the various regulatory frameworks seeking protection of port and port related transport corridors and industrial areas.

5.3.5 Interface precinct

The purpose and objectives of the Interface precinct is managed by various regulatory legislation, namely:

Planning Act 2016

- State Planning Policy
  - Includes specific Port Protection Measures to be integrated into local government planning schemes.
  - Protects the port from incompatible development and protects port transport routes.
- Townsville City Plan
  - Identifies importance of the port and supports the port and port related support infrastructure operation and development.
  - Port located in Specialised centre zone – requires protection of the port and outlines that a specialised centre retains its dominant function and that new development does not prejudice its ongoing operation or significantly impact on the amenity of nearby sensitive uses.
  - The Townsville State Development Area (TSDA) located in Special Purpose Zone is to facilitate industrial development that is of regional, state and national significance. The particular purpose of the code is to facilitate and maintain linkages to the PoT and major freight routes.

Economic Development Act 2012

- Townsville City Waterfront Priority Development Area
  - Includes PDA wide development scheme criteria that protect port development and operations through development constraints, public safety considerations and urban design guidelines.
  - Precinct 6 has specific port protection measures related to built form.
  - Precinct 7 has specific port protection measures related to built form.

Breakwater Island Casino Agreement Act 1984

- Surplus Casino Land (SCL)
  - Port Protection Agreement includes port protection measures in this area through specific requirements related to development built form.
- Future Development Area (FDA)
  - Presently does not include port protection measures in this area.
- Casino and Entertainment Centre (CEC)
  - Presently does not include port protection measures in this area.

Building Act 1975

- Sets out specific requirements for residential building development (post 2010) adjacent to designated transport noise corridors to minimize impact on residents.

The existing regulatory frameworks provide adequate protection for the operation and future development of the port and port related transport and industrial land holdings. Where potential gaps in the legislation occur regarding port protection measures, the following suggestions are made.

Suggestions for port overlay

- Create a mechanism to ensure consistency of development assessment criteria across the various regulatory frameworks seeking protection of port and port related transport corridors and industrial areas
- Ensure development for the FDA and the Townsville Entertainment and Convention Centre adopts relevant and consistent Port Protection Measures.
- PoT to assess port lease / licences and identify opportunities to potentially relocate port operations with higher interface items/issues from known and sensitive receptors to alternate locations.

Furthermore, the suggested criteria for assessment of the Interface and Marine Services and Recreation Precincts are as follows:

Site Layout - building orientation:

- Development should ensure that new buildings enhance and actively present to the waterfront location, and minimise overlooking port activities
- Development should be orientated, located and designed to minimise the potential for reverse amenity impacts (noise, odours, dust) created by port operations.

Building Design:

- Buildings should be of an appropriate height to accommodate new land uses, while not impacting present and future port activities
- Balconies should be oriented to protect the outdoor private space of end users
- The internal layout of development should be designed to ensure that users are not adversely impacted by port activities through reverse amenity impacts.
- Balconies and opening windows should be orientated away from port activities
- Bedrooms, living rooms and other sensitive habitable rooms should be located on the furthest side of development from the Port
- Openings in the buildings are located, designed and constructed to maximise residential comfort and safety and assist in the reduction of adverse noise impacts as a result of port operations
- Appropriate construction materials for buildings assist in the mitigation of adverse noise intrusion
- Adverse light impacts associated with the Port of Townsville operations are minimised through design measures which are demonstrated to be effective
- The location of lighting for the development ensures that illumination does not conflict with Port operations.

Building treatments:

- Development should protect the safety, viability and efficiency of existing operations at the Port of Townsville
- Development does not interfere with an aid to navigation or associated signals as per the acceptable outcomes of the model port protection code provisions of the Strategic Ports State Interest Guideline and the Port of Townsville Port Code
- Habitable rooms in a sensitive land use need to meet the acoustic quality objectives outlined in Schedule 1 of the Environmental Protection (Noise) Policy 2008
- Sensitive land uses adversely affected by air particles and dust should be designed to achieve an acceptable level of amenity through the provision of appropriate seals for all doors and windows.

Screening and landscaping

- Use screening and landscaping to establish a buffer between sensitive land uses and operational port activities.

5.3.6 Marine services and recreation precinct

No suggestions for the port overlay content have been included for the Marine services and recreation precinct as this precinct is in a similar geographical location and will be subject to the same operational and development considerations as the Interface precinct.

5.3.7 Environmental management precinct

No suggestions for port overlay content have been included for the Environmental Management and Conservation Precinct, as there were no impacts posed in this precinct that is not already considered and managed under the TSDA DS.

Appendices

Appendix A – References

The following is a list of references materials (reports and documents) sighted for the literature review as part of the Infrastructure Study and referenced in this Report.

Priority Port of Townsville Master Plan - Evidence Base Report (Advisian, Dec 2016)

Infrastructure Layout and Land Allocation (Advisian, May 2016)

Townsville Port Expansion Project – Additional Information to the Environmental Impact Assessment (AECOM, Oct 2016)

Port Procedures and Information for Shipping – Port of Townsville (Queensland Government, Sep 2016)

North Queensland Resource Supply Chain Audit (Orion Advisory, Sep 2013)

Port Development Plan 2010 – 2040 (Port of Townsville, Aug 2009)

Land Use Plan (Port of Townsville, Jan 2013)

Townsville State Development Area Development Scheme (Queensland Government, July 2013)

Townsville City Plan (Townsville City Council, October 2013)

Townsville Priority Development Area Development Scheme (Queensland Government, October 2015)

Townsville City Economic Development Plan 2013-2017 (Townsville City council)

Townsville State Development Area Development Opportunities Strategy (Urbis, Jan 2013)

Appendix B – Regulatory Summary Table

Precinct	TIA	SDPWOA	Planning Act				ED Act	BICA	BA
	PoTLUP	TSDADS	SPP	TCP	SDAP	NQRP	TCWPDA	SCL/CEC/FDA	
Marine	Adequate PPM	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Marine Infrastructure	Adequate PPM	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Port industry and commerce	Adequate PPM	Adequate PPM	Adequate PPM	Adequate PPM	n/a	n/a	Adequate PPM	Adequate PPM for SCL, PPM's for FDA and CEC required	Adequate PPM
Infrastructure and supply chain	Adequate PPM	Adequate PPM	Adequate PPM	Adequate PPM	Adequate PPM	Adequate PPM	n/a	n/a	Adequate PPM
Interface	n/a	n/a	Adequate PPM	Adequate PPM	n/a	n/a	Adequate PPM	Adequate PPM	Adequate PPM
Marine services &	Adequate	n/a	n/a	n/a	n/a	n/a	n/a	Adequate	n/a

recreation	PPM							PPM	
Environmental management and conservation	n/a	Adequate PPM	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Acronyms

BA - Building Act 1975

BICA - Breakwater Island Casino Agreement Act 1984

CEC - Casino and Entertainment Centre

ED Act - Economic Development Act 2012

FDA - Future Development Area

NQRP - North Queensland Regional Plan

PoTLUP - Port of Townsville Land Use Plan

SCL - Surplus Casino Land

SDAP – State Development and Assessment Provisions

SDPWO Act – State Development and Public Works Organisation Act 1971

SPP - State Planning Policy

TCP - Townsville City Plan

TCWPDA - Townsville City Waterfront Priority Development Area

TI Act - Transport Infrastructure Act 1994

TSDA DS - Townsville Strategic Development Area Development Scheme

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Document Status

Revision	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
A (Draft)	B. Cilliers / R. Robertson	G. Reynolds	On file	G. Denholm	On file	06/06/2017
B	B. Cilliers / R. Robertson	G. Reynolds	Draft for review	G. Denholm	Draft for review	04/07/2017
C	B. Cilliers / R. Robertson	G. Reynolds	Draft for review	G. Denholm	Draft for review	26/07/2017
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Evidence base documentation

Risk assessment

Priority Port of Townsville

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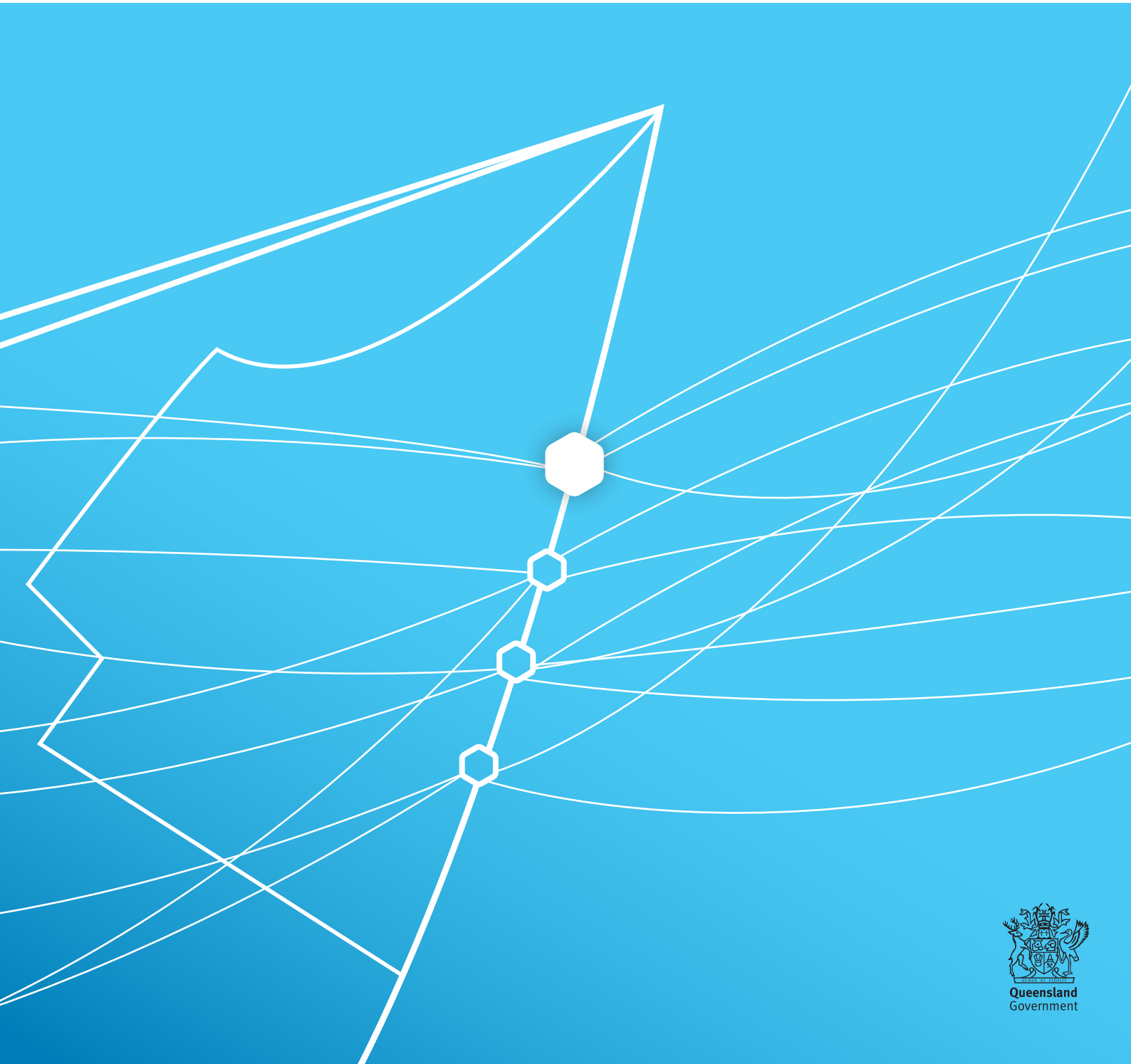

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Priority port master planning Risk Assessment – Priority Port of Townsville

Queensland Government

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surveying town planning urban design environmental management landscape architecture

Table of Contents

Figures

Tables

Acronyms

AMSA	Australian Maritime Safety Authority
CAMBA	China-Australia Migratory Bird Agreement
CEMP	Construction Environmental Management Plan
DAF	Department of Fisheries
DES	Department of Environment and Science
DMP	Dredge Management Plan
DMPA	Dredged Material Placement Area
DNRM	Department of Natural Resources and Mines (Qld)
DoE	Department of the Environment (Cwlth)
DSDMIP	Department of State Development, Manufacturing, Infrastructure and Planning
DTMR	Department of Transport and Main Roads
EBR	Evidence Base Report
EIA	Environmental Impact Assessment
EMF	Environmental Management Framework
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cwlth)
EPP	Environment Protection Policy
ERA	Environmentally Relevant Activity
EVs	Environmental Values
FHA	Fish Habitat Area
FMP	Fauna Management Plan
GBR	Great Barrier Reef
GBRWHA	Great Barrier Reef World Heritage Area
JAMBA	Japan-Australia Migratory Bird Agreement
LUP	Land Use Plan

MLES	Matters of Local Environmental Significance
MMMP	Marine Megafauna Management Plan
MNES	Matters of National Environmental Significance
MP	Management Plan
MPA	Master Planned Area
MSES	Matters of State Environmental Significance
mtpa	Million tonnes per annum
NC Act	*Nature Conservation Act 1992* (Qld)
OEMP	Operational Environmental Management Plan
OUV	Outstanding Universal Value
PDA	Priority Development Area
PEP	Port Expansion Project
PMM	Priority Management Measure
PMST	Protected Matters Search Tool
POTL	Port of Townsville Limited
RE	Regional Ecosystems
ROKAMBA	Republic of Korea-Australia Migratory Bird Agreement
SPL	Strategic Port Land
SPP	State Planning Policy (Qld)
SPRP	State Regulatory Planning Provisions (Qld)
TCC	Townsville City Council
TCW PDA	Townsville City Waterfront Priority Development Area
TEC	Threatened Ecological Community
VM Act	*Vegetation Management Act 1999* (Qld)
TPAR	Townsville Port Access Road
TSDA	Townsville State Development Area
WHA	World Heritage Area

Glossary of terms

Term	Meaning
Adaptive management	A process of implementing management while learning about which management actions are most effective at achieving the specified objectives through ongoing monitoring and modification of management processes.
Adverse impact	An impact that results in an unwanted and unanticipated result of taking a particular action.
Assessable development	Under Section 44(3) of the *Planning Act 2016* assessable development requires an application to be made and a development decision to be issued. There are two categories of assessable development code assessable and impact assessable under the Planning Act (sections 45 (3) and 45 (5) respectively). Code assessable applications are assessed against assessment benchmarks set out in a Council's planning scheme or planning regulation, approval is subject to the development application (DA) meeting the set criteria. A DA that does not meet all/some of the criteria can be refused or approved with conditions. An assessment manager can only assess code assessable applications against criteria clearly expressed in the code (i.e assessment benchmarks). While no public notification period is required for code assessable applications, for most code assessable DA's the assessment manager (local or state) must also publish the reasons for their decision. Impact assessable applications are considered to have a degree of impact that requires a merit-based assessment against the assessment benchmarks in a planning regulation or planning scheme to determine whether the DA is appropriate or not. Impact assessable development applications require a public notification stage.
Benthic	The benthic zone is the region at the lowest level of a body of water, such as an ocean or sea, including the sediment surface and some sub-surface layers.
Biodiversity	The Biological diversity of life is commonly regarded as being made up on the following components: ▪ Genetic diversity – the variety of genes (or units of heredity) in any population ▪ Species diversity – the variety of species ▪ Ecosystem diversity - the variety of communities or ecosystems.
China-Australia Migratory Bird Agreement (CAMBA)	This agreement between the Government of Australia and the Government of the People's Republic of China was developed in 1986 for the protection of migratory birds and their environment.
Capital dredging	Dredging to remove virgin material from the sea bed that has not been previously disturbed. Capital dredging occurs for various reasons including to create new or enlarge existing channel, port, marina and boat harbour areas.
Cleveland Bay	Cleveland Bay is a bay located on the north-eastern coast of Queensland, Australia. It is part of the Coral Sea and administratively, is within the City of Townsville.
Coastal ecosystems	Inshore, coastal and adjacent catchment ecosystems that connect the land and sea and have the potential to influence the health and resilience of the Great Barrier Reef.
Condition	Refers to existing state, including state of health.
Consequence	The outcome of an event which has an effect on objectives. A single event can generate a range of consequences which can have both positive and negative effects on objectives. Initial consequences can also escalate through consequential effects.

Term	Meaning
Direct impact	An impact that results from a direct interaction between a project activity and the sensitive value/receptor.
Directory of Important Wetlands in Australia	Nationally important wetlands are listed in the Directory of Important Wetlands in Australia. It includes an inventory of wetlands assessed as meeting criteria for national importance.
Ecological community	An assemblage of species occupying a particular area.
Ecologically sustainable development	Under the *Environment Protection and Biodiversity Conservation Act 1999* the principles of ecologically sustainable development (ESD) are: a) Decision-making processes should effectively integrate both long-term and short-term economic, environmental, social and equitable considerations b) If there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation c) The principle of inter-generational equity – that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations d) The conservation of biological diversity and ecological integrity should be a fundamental consideration in decision-making e) Improved valuation, pricing and incentive mechanisms should be promoted
Environment Protection and Biodiversity Conservation Act 1999 (Cwth) conservation status	Under the *Environment Protection and Biodiversity Conservation Act 1999* (Cwth) (EPBC Act), listed species and ecological communities are assigned a conservation status of extinct in the wild, critically endangered, endangered or vulnerable. Definitions of these terms under the Act are as follows: **Extinct** ▪ There is no reasonable doubt that the last member of the species has died. **Extinct in the wild** ▪ It is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range, or ▪ It has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a timeframe appropriate to its lifecycle and form **Critically endangered** ▪ It is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria **Endangered** ▪ It is not critically endangered, and ▪ It is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria

Term	Meaning
	Vulnerable ▪ It is not critically endangered or endangered, and ▪ It is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria **Conservation dependant** ▪ The species is the focus of a specific conservation program the cessation of which would result in the species becoming Vulnerable, Endangered or Critically Endangered, or ▪ The following subparagraphs are satisfied: – the species is a species of fish – the species is the focus of a plan of management that provides for management actions necessary to stop the decline of, and support the recovery of, the species so that its chances of long term survival in nature are maximised – the plan of management is in force under a law of the Commonwealth or of a State or Territory – cessation of the plan of management would adversely affect the conservation status of the species. **Migratory** ▪ Migratory species are those animals that migrate to Australia and its external territories or pass through or over Australian waters during their annual migrations. Examples of migratory species are species of birds (e.g. albatrosses and petrels), mammals (e.g. whales) or reptiles. Listed migratory species are those listed in the: – Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention) – China-Australia Migratory Bird Agreement (CAMBA) – Japan-Australia Migratory Bird Agreement (JAMBA) – Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA)
Environmental offsets	An environmental offset involves compensating for unavoidable impacts on the environment or biodiversity at one site by securing land at another site and managing that land over a period of times, to replace those significant environmental matters which were lost. At the Commonwealth level, offsets are defined as measures that compensate for the significant residual adverse impacts of an action on the environment or biodiversity. The Commonwealth and Queensland Government require that all reasonable steps should first be taken to avoid and then mitigate adverse impacts on the environment both considering environmental offsets.
Environmental value	'Environmental value' is defined under the EP Act and the *Sustainable Ports Development Act 2015* (Ports Act) as: ▪ A quality of physical characteristic of the environment that is conducive to ecological health or public amenity or safety; or ▪ Another quality of the environment identified and declared to be an environmental value under an environmental protection policy or regulation. For the purpose of this report environmental value also includes cultural heritage, visual amenity and community values.

Term	Meaning
Environmental management plan	A management plan that contains management measures and actions that will be implemented during the design, construction and/or operational phases of development. The management measures and actions have a particular focus on the specific environmental values (EVs) to be directly or indirectly impacted by the development and associated activities.
Exposure	Refers to the exposure of a sensitive value (receptor) to an activity, action and/or process (stressors) that act on that sensitive value. Exposure may be direct or indirect, acute or chronic.
Great Barrier Reef Marine Park	The area subject to protection under the *Great Barrier Reef Marine Park Act 1975* covering 344,400 square kilometres including the subsoil beneath the seabed (1000 metres below) and the airspace above (915 metres high). It is a multiple-use marine park area that supports a range of communities and industries that depend on the Reef for recreation or their livelihoods (including tourism, fishing, boating and shipping). The Great Barrier Reef Marine Park (GBRMP) is a matter of national environmental significance and the Great Barrier Reef Marine Park Authority (GBRMPA) is responsible for its protection and management.
Great Barrier Reef World Heritage Area	The Great Barrier Reef World Heritage Area (GBRWHA) extends from the top of Cape York in north-east Australia to just north of Bundaberg, and from the low water mark on the Queensland coast to the outer boundary of the Marine Park, which is beyond the edge of the continental shelf. The area was declared a World Heritage Area (WHA) in 1981 because of its 'outstanding universal value'. About 99 per cent of the WHA is within the GBRMP but encompasses: ▪ Some 980 islands which are under Queensland jurisdiction ▪ 70 islands under Commonwealth jurisdiction ▪ Some internal or Queensland waters (for examples, some deep bays, narrow inlets or channels between islands) ▪ All waters seaward of the low water mark from near Fraser Island to Cape York
Growth scenarios	Growth scenarios for the proposed master planned area developed by the Queensland Government. Refer to Sections 4.1 & 4.2.
Habitat	An area or areas permanently, periodically or occasionally occupied by a flora and/or fauna species, population or ecological community, including any and all biotic and abiotic features of the area or areas occupied.
Aboriginal and Torres Strait Islander cultural heritage	Includes all places that are part of Aboriginal and Torres Strait Islander peoples' spiritual links to the land or which tell the story of Indigenous peoples from time immemorial to the present. It can include sacred sites, ceremonial sites like bora rings and rock art, fish traps, burials, middens, scarred trees, camp sites and semi/permanent settlements.
Indirect impact	An impact that is not a direct result of activities but occurs away from the original impact or direct disturbance area via a pathway in accordance with the EPBC Act, indirect impacts for example, include the following: ▪ 'Downstream' or 'downwind' impacts, such as impact on wetlands or ocean reefs from sediment, fertilisers or chemical which are washed or discharged into river systems

Term	Meaning
	▪ 'Upstream impacts' such as impacts associated with the extraction of raw materials and other inputs which are used to undertake the action ▪ 'Facilitated impacts' which result from further actions (including actions by third parties) which are made possible or facilitated by the action
Integrity	For World Heritage property Integrity relates to the 'wholeness and intactness' of the property and how it conveys the values it holds. Integrity can also relate to the size of the property (sufficient size to continue to represent the values) and to any threats affecting the property.
Japan-Australia Migratory Bird Agreement (JAMBA)	This agreement between the Government of Australia and the Government of Japan was developed in 1974 for the protection of migratory birds and their environment.
Likelihood	The chance that something might happen. Likelihood can be defined, determined, or measured objectively or subjectively and can be expressed either qualitatively or quantitatively.
Magnitude	The nature and extent of the potential impacts to a value/receptor, including direct and indirect impacts.
Maintenance dredging	Dredging to ensure that previously dredged channels, berths, swing basins or construction works are maintained at their designated dimensions.
Management measures	A statutory or non-statutory measure to improve the environmental outcome or minimise the potential environmental impact from development (construction and operational phases).
Marine areas	The master planned area mapped within the draft marine precinct, including marine waters, seabed and associated marine flora and fauna.
Marine plants	Under the *Fisheries Act 1994* (Qld), marine plants include: ▪ a plant (a tidal plant) that usually grows on, or adjacent to, tidal land, whether it is living, dead, standing or fallen ▪ the material of a tidal plant, or other plant material on tidal land ▪ a plant, or material of a plant, prescribed under a regulation or management plan to be a marine plant. Marine plants do not include declared pest species under the *Biosecurity Act 2014* (Qld).
Master planned area	The proposed boundary for the priority Port of Townsville master planned area.
Material change of use	Under the *Planning Act 2016* material change of use means: ▪ The start of a new use of the premises ▪ The re-establishment on the premises of a use that has been abandoned; ▪ A material increase in the intensity or scale of the use of the premises.
Matters of National Environmental Significance	There are nine matters of national environmental significance (MNES) protected under the EPBC Act, which are: ▪ World Heritage properties ▪ National heritage properties ▪ Wetlands of international importance (listed under the Ramsar Convention)

Term	Meaning
	▪ Nationally threatened species and ecological communities ▪ Migratory species (protected under international agreements) ▪ Commonwealth marine areas ▪ The Great Barrier Reef Marine Park ▪ Nuclear actions (including uranium mines) ▪ A water resources in relation to coal seam gas development and large coal mining development Other matters protected include: ▪ The environment where actions proposed are on, or will affect Commonwealth land and the environment ▪ The environment where Commonwealth agencies are proposing to take an action
Matters of State Environmental Significance (MSES)	Matters of state environmental significance (MSES) means the following natural values and areas: (a) protected areas (including all classes of protected areas except coordinated conservation areas) under the *Nature Conservation Act 1992* (NC Act) (b) 'marine national park', 'conservation park', 'scientific research', 'preservation' or 'buffer' zones under the *Marine Parks Act 2004* (c) areas within declared fish habitat areas that are management A areas or management B areas under the Fisheries Regulation 2008 (d) a designated precinct, in a strategic environmental area under the Regional Planning Interests Regulation 2014, schedule 2, part 5, s15(3) (e) wetlands in a wetland protection area or wetlands of high ecological significance shown on the map of referable wetlands under the Environmental Protection Regulation 2008 (f) wetlands and watercourses in high ecological value waters identified in the Environmental Protection (Water) Policy 2009, schedule 1 (g) legally secured offset areas as defined under the *Environmental Offsets Act 2014*. (h) threatened wildlife under the NC Act and special least concern animals under the Nature Conservation (Wildlife) Regulation 2006 (i) marine plants under the *Fisheries Act 1994* (excluding marine plants in an urban area) (j) waterways that provide for fish passage under the *Fisheries Act 1994* (excluding waterways providing for fish passage in an urban area) (k) high risk area on the flora survey trigger map as described in the Environmental Offsets Regulation 2014, schedule 2, part 6(1) (l) regulated vegetation under the *Vegetation Management Act 1999* that is:

Term	Meaning
	(i) category B areas on the regulated vegetation management map, that are 'endangered' and 'of concern' regional ecosystems (ii) category C areas on the regulated vegetation management map that are 'endangered' and 'of concern' regional ecosystems (iii) category R areas on the regulated vegetation management map (iv) areas of essential habitat on the essential habitat map for wildlife prescribed as 'endangered wildlife' or 'vulnerable wildlife' under the NC Act (v) category A, B, C or R areas on the regulated vegetation management map that are located within a defined distance from the defining banks of a relevant watercourse identified on the vegetation management watercourse and drainage feature map (vi) category A, B, C or R areas on the regulated vegetation management map that are located within a wetland or within 100 metres from the defining bank of a wetland identified on the vegetation management wetlands map
Nature Conservation Act 1992 (Qld) conservation status	Under the NC Act, protected species are assigned a conservation status of extinct in the wild, endangered, vulnerable, near threatened, or least concern. Definitions of these terms under the NC Act are as follows: **Extinct in the wild** ▪ There have been thorough searches conducted for the wildlife, and ▪ It has not been seen in the wild over a period that is appropriate for the lifecycle or form of the wildlife **Endangered** ▪ There have not been thorough searches conducted for the wildlife and the wildlife has not been seen in the wild over a period that is appropriate for the lifecycle or form of the wildlife, or ▪ The habitat or distribution of the wildlife has been reduced to an extent that the wildlife may be in danger of extinction, or ▪ The population size of the wildlife has declined, or is likely to decline, to an extent that the wildlife may be in danger of extinction, or ▪ The survival of the wildlife in the wild is unlikely if a threatening process continues ▪ **Vulnerable** ▪ Its population is decreasing because of threatening processes, or ▪ Its population has been seriously depleted and its protection is not secured, or ▪ Its population, while abundant, is at risk because of threatening processes, or ▪ Its population is low or localised or depends on limited habitat that is at risk because of threatening processes **Near threatened** ▪ The population size or distribution of the wildlife is small and may become smaller, or ▪ The population size of the wildlife has declined, or is likely to decline, at a rate higher than the usual rate for population changes for the wildlife, or ▪ The survival of the wildlife in the wild is affected to an extent that the wildlife is in danger of becoming vulnerable

Term	Meaning
	Least concern ▪ The wildlife is common or abundant and is likely to survive in the wild ▪ Native wildlife may be prescribed as least concern wildlife even if: – The wildlife is the subject of a threatening process, or – The population size or distribution of the wildlife has declined, or – There is insufficient information about the wildlife to conclude whether the wildlife is common or abundant or likely to survive in the wild
Other environmental values	Includes EVs that do not contribute to the Outstanding Universal Value (OUV) of the GBRWHA but have other intrinsic values for the local and regional ecosystems.
Outstanding Universal Value of the GBRWHA	This term is used throughout this report and refers to EVs within the proposed master planned area and surrounds that contribute to the OUV of the GBRWHA
Planning instrument	As defined under the *Planning Act 2016*, a designated region's regional plan, a State planning policy, a planning scheme, a temporary local planning instrument or a planning scheme policy
Prescribed environmental matters	Includes MNES (excluding nuclear actions; the environment, where actions proposed are on, or will affect Commonwealth land and the environment; and the environment, where Commonwealth agencies are proposing to take an action) and MSES and MLES as defined under Environmental Offsets Regulation 2014.
Ramsar Convention	The Ramsar Convention also known as the Convention on Wetlands of International Importance, is the intergovernmental treaty that provides the framework for the conservation and wise use of wetlands and their resources.
Receptor	A receptor is a sensitive value. Receptors may be subject to impacts as a result of stressors.
Referral agency	A referral agency is an advice agency or a concurrence agency.
Significant residual impact	A significant residual impact is the impact which has been deemed to be 'significant' as defined by the '*Matters of National Environmental Significance – Significant Impact Guidelines* Version 1.1' (DoE 2013), which remains after avoidance and mitigation measures have been implemented. Under the *Environmental Offsets Act 2014* (EO Act) a significant residual impact is an adverse impact whether direct or indirect, of a prescribed activity on all or part of a prescribed environmental matter that: (a) Remains or is likely to remain (temporarily or permanently) despite on-site mitigation measures for the prescribed activity; and (b) Is, or will or is likely to be a significant residual impact on a prescribed environmental matter that is a matter of state environmental significance.
Resilience	Ability of a value/receptor to return to existing condition or state following exposure to a project activity, action or processes (stressors).
Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA)	This agreement between the Government of Australia and the Government of the Republic of Korea was developed in 2006 for the protection of migratory birds.
Significant impact	In accordance with the EPBC Act, a significant impact is an impact which is important, notable, or of consequence, having regard to its context or intensity. Whether or not an action is likely to have a significant impact depends upon the sensitivity, value, and quality

Term	Meaning
	of the environment which is impacted, and upon the intensity, duration, magnitude and geographic extent of the impacts.
Terrestrial areas	All areas within the draft Port industry and commerce, Supply chain, marine services and recreation, Interface, and Environmental management precincts. This includes surface water and groundwater within these precincts (where not mapped within the draft marine precinct).
Vulnerability	In relation to a value/receptor, is the potential for, or susceptibility to, harm from a project activity, action and/or process (stressor). It is the degree to which a sensitive value and/or system (receptor) is sensitive to pressures and disturbances (stressors).

Executive summary

Background

Master planning for priority ports adjacent to the Great Barrier Reef (GBR) coast is one of the port-related actions of the Reef 2050 Long-Term Sustainability Plan (the Reef 2050 Plan) and is mandated under the *Sustainable Ports Development Act 2015* (Qld) (Ports Act). Priority port master planning has a timeframe up to 2050 to align with the Reef 2050 Plan.

Under the Ports Act, the Port of Townsville is defined as one of the priority ports in Queensland (others include Port of Gladstone, Ports of Hay Point and Mackay, and the Port of Abbot Point) requiring a port master plan to ensure sustainable development of the port into the future.

The overall objectives of the priority Port of Townsville master planning project include:

- Define a long term strategic vision and associated objectives for the master planned area (MPA)
- Articulate the state interests in relation to the priority ports and how these interests will be considered in all planning decisions made regarding the master planned area
- Present an environmental management framework (EMF) for the proposed MPA that reflects the principles of ecologically sustainable development (ESD).

Purpose and scope of the risk assessment

The purpose of this risk assessment is to inform the content of the master plan by:

- Identifying and mapping the environmental values (EVs) within and surrounding the proposed MPA
- Identifying potential impacts on the Outstanding Universal Value (OUV) of the Great Barrier Reef World Heritage Area (GBRWHA) and other EVs
- Outlining objectives and risk management measures for managing potential environmental impacts from future port-related development within the proposed MPA.

The scope of this risk assessment includes:

- Mapping the EVs within each of the proposed MPA draft precincts using the Evidence Base Report (Advisian 2016) as a basis, and supplementing with additional relevant information
- Defining which EVs contribute to the OUV of the GBRWHA
- Carrying out a risk assessment of potential impacts on EVs within each proposed MPA draft precinct and surrounding areas (where relevant) associated with development scales under three growth scenarios
- Propose EMF objectives for managing potential impacts within the master plan draft precincts
- Propose measures required to achieve the EMF objectives for managing potential impacts, addressing existing gaps and inconsistencies in regulation and reducing the risk levels for activities within the proposed MPA
- Propose implementation mechanisms for the measures (e.g. planning and/or operational measures) and identify the entity responsible for implementing the measures.

The proposed EMF objectives and other outcomes of the risk assessment have been provided to DTMR for consideration in the priority port master planning process.

Growth scenarios and risk assessment

Three growth scenarios were developed in consultation with the Port of Townsville Limited (POTL), Townsville City Council (TCC) and other stakeholders. The growth scenarios represent a range of development scales and are not intended to predict specific infrastructure requirements or economic growth.

The intent of the growth scenarios is to determine the type, scale and form of impacts so that the likelihood of risk can be assessed and that the point at which mitigation may be required can be determined. For each of the growth scenarios, key assumptions were developed and then further defined into land and marine uses. The growth scenarios may result in the following overarching development types that have the potential to impact on EVs:

Marine

- Construction of the reclamation area including rock revetments to create bunds;
- Dredging associated with widening and deepening of the Platypus and Sea channels;
- Placement of dredged material in bunded areas as reclamation fill;
- Release of tailwater into the marine environment from reclamation areas;
- Construction of additional berths and breakwater including capital dredging to provide access; and
- Construction of a new cruise ship terminal on the northern side of Ross Creek and associated dredging.

Land

- Commencement of operations of the POTL Granitevale quarry to supply rock for new port infrastructure;
- New development at the port;
- Additional land requirements in the Townsville State Development Area (TSDA) to support storage of break bulk cargoes as well as dry and liquid bulk cargos including the potential for pipelines/conveyors within the Townsville Eastern Access Corridor (TEARC) alignment;
- Duplication of the Townsville Port Access Road (TPAR) to accommodate increased traffic between the TSDA and port, and
- Construction and operation of the TEARC.

Definition of the land and marine uses or activities enabled the identification of the risk of potential impacts to the OUV of the GBRWHA and other EVs within and surrounding the proposed MPA. Risk of impact was based on assessment on the likelihood and consequence of a certain impact occurring if no management measures were put in place. Risk was then reviewed in the context of the existing management measures (i.e. statutory and operational environmental management measures) to identify a revised risk rating.

Risk Assessment Outcomes

The risk assessment found that the existing regulatory and planning instruments and approval conditions for the Townsville Port Expansion Project (PEP), TPAR and Granitevale Quarry can effectively manage potential impacts to EVs from the projected growth scenarios. The risk assessment found residual risk for all potential impacts to be low. This outcome is partially achieved through the implementation of the MPA draft precincts, which avoid future development resulting in direct and indirect impacts to a number of EVs. An outcome of the risk assessment was that the precincts could be refined to further reduce the potential for impacts to EVs.

A number of modifications could be made to the MPA draft precincts to further minimise potential risks to EVs and ensure the master plan focuses on key port issues. Proposed changes are summarised below:

- Removal of the Granitevale Quarry as a draft Port industry and commerce precinct due to the nature of its future operation if required for port construction projects as opposed to daily port operations. The quarry has gained all necessary Federal, state and local approvals and will be managed in accordance with the approval conditions
- Removal of the Elliot Springs as a draft Interface precinct as this development is now an approved area of residential development with impacts on EVs addressed through previous assessment. Growth scenarios do not contemplate interactions with this precinct aside from the potential to add traffic to the TPAR which can be addressed through other means

- Changes to the Infrastructure and supply chain corridor precinct between the TSDA and port so that it aligns more closely with the TSDA Development Scheme's Materials Transportation and Services Corridor precinct boundary. This area is crucial to the ongoing development of the port area as well as containing areas of significant ecological value and should be protected and managed through the master plan
- Removal of Magnetic Island as a draft Environmental management precinct as no port-related development is anticipated to occur or impact on mainland Magnetic Island
- Minor changes to the Environmental management and Port industry and commerce precincts to avoid the Environmental management precinct overlaying existing industry areas.

The preparation of the draft master plan, will further analyse the land use planning provisions of the Townsville City Plan, TSDA Development Scheme, Townsville City Waterfront Priority Development Area (TCWPDA) Development Scheme and Port of Townsville Land Use Plan (POTLUP). This will assist identify whether additional development controls may be required to address inconsistencies in managing the interface of land uses with port operational areas, including consideration of whether a PMM is required.

Proposed environmental management framework objectives

Specific objectives have been developed for the proposed MPA draft precincts to manage the potential impacts on the OUV of the GBRWHA and other EVs within and surrounding the proposed MPA. The objectives consider the context of the existing operational port, the nature of the potential future impact, the specific environmental value and the contribution to the overall OUV of the GBRWHA. The objectives have informed the review of the gaps and inconsistencies in the existing statutory requirements and operational environmental management measures.

The objectives generally seek to:

- Avoid, minimise and offset potential impacts (direct, indirect and cumulative) from port-related development within the precinct on EVs
- Increase the understanding of the importance of habitat for the long-term conservation of threatened species
- Support development in appropriate areas that operate efficiently and effectively, in a manner that balances industrial, commercial, recreational and cultural activities, and potential impacts on environmental values
- Addressing the potential for cumulative impacts resulting from the development, other existing developments and known potential future developments (i.e. those currently within a local, state or commonwealth assessment process) located within the proposed MPA

The port overlay can give effect to the EMF objectives by identifying that the objectives are matters that must be considered when making and amending planning instruments within the proposed MPA. This ensures that the EMF objectives can be addressed in future plan-making and development assessment processes.

I. Introduction

Saunders Havill Group (**SHG**) have been commissioned by the **Department of Transport and Main Roads (DTMR)** to prepare a Risk Assessment for the priority Port of Townsville as part of the master planning process under the Ports Act. The Port of Townsville has been declared a priority port (along with the Port of Gladstone, Ports of Hay Point/Mackay, and the Port of Abbot Point), and therefore requires a master plan. Of importance, the Port of Townsville operates adjacent to the Great Barrier Reef Marine Park (GBRMP) and within the GBRWHA. Port master planning requires consideration of issues beyond strategic port land, including marine and land-based environmental impacts, port and supply chain capacity and connectivity, and plans for future priority port growth. Master planning also needs to ensure the values of the GBRWHA are protected and those values contributing to the OUV of the GBRWHA are identified.

Several technical studies have been commissioned to support the master plan including the EBR (Advisian December 2016) which reviewed the environmental and social values associated with the priority Port of Townsville and surrounding area. An infrastructure and supply-chain analysis study (the Infrastructure Study) has also been undertaken.

The environmental information within the EBR provided initial guidance on setting a preliminary master planned area boundary and draft land use precincts, however the report did not consider environmental impacts of specific growth scenarios or whether they can be managed through existing regulatory processes. Consequently, a risk assessment study is required to ensure port-related development within the proposed MPA is sustainable.

The overall objectives of the priority Port of Townsville master planning project include:

- Development of a long-term strategic vision and desired outcomes for the master planned area
- Articulation of state interests in relation to the priority ports and how those interests must be considered in all planning decisions made within the proposed MPA
- An EMF for the proposed MPA, which will also include environmental objectives and identify matters to be addressed through the port overlay that are required to manage the impacts of development occurring within the master planned area on EVs.

The draft master plan and evidence base reports will inform the development of a port overlay instrument that implements the master plan. The port overlay may achieve this through a number of mechanisms, including:

- Identifying matters to be considered when amending existing planning instruments such as the Townsville City Plan or POTLUP
- Specifying development types that cannot take place within certain areas of the port overlay
- Specifying development assessment requirements and levels of assessment for development.

The figure below (**Figure 1)** demonstrates the process undertaken to inform the development of the EMF for priority port master planning.

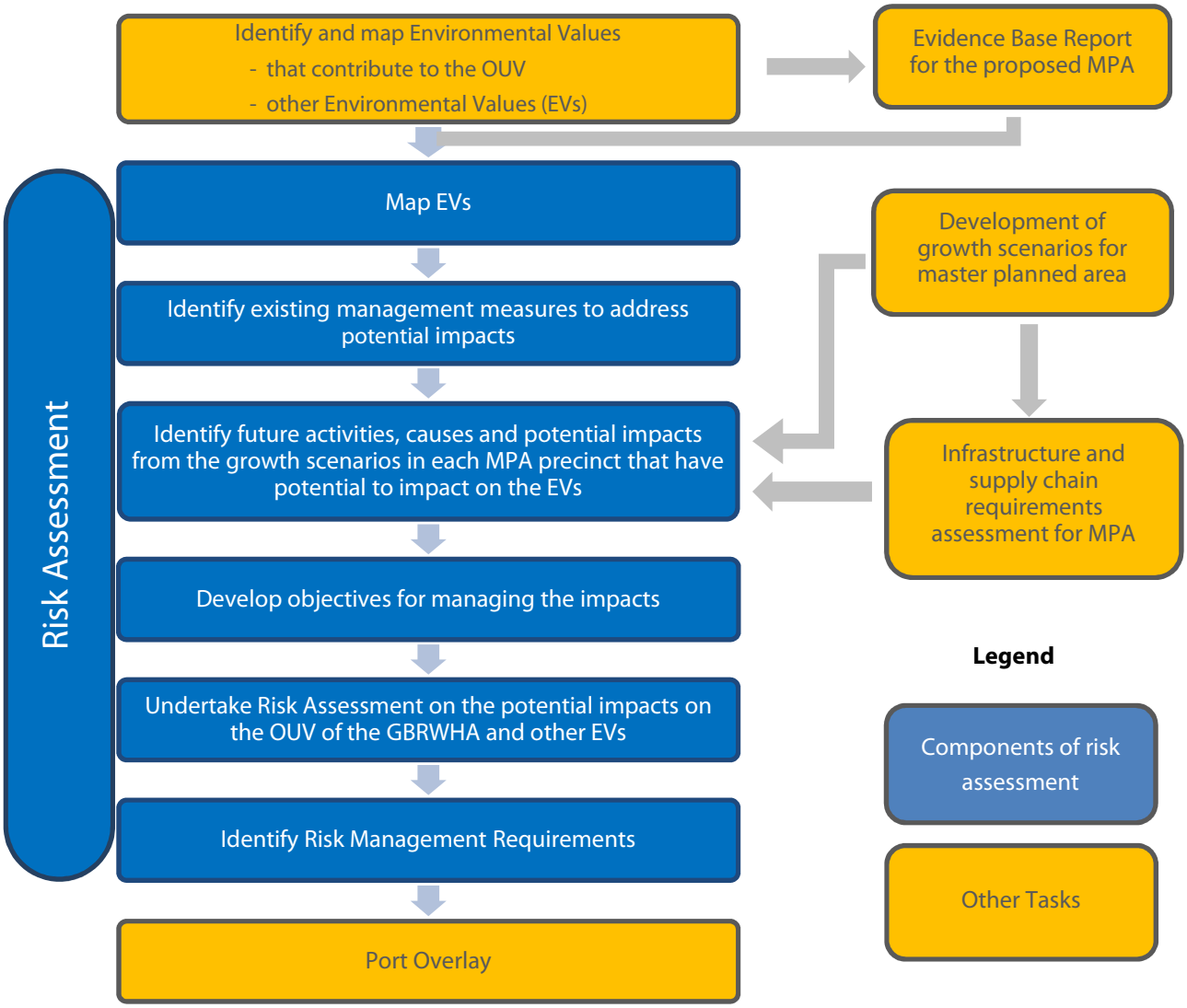


Figure 1: Relationship between the risk assessment and the EMF

I.I. Risk assessment and management

For the current study, the need for risk management requirements is triggered when a high risk to an environmental, social, or cultural value due to a potential impact **cannot** be reduced to an acceptable risk level through existing statutory requirements, planning instruments, and operational environmental management measures. Where a risk is not mitigated by existing instruments and remains high, additional management measures will be developed and implemented through the master plan and port overlay to manage these risks. These additional management measures are referred to as potential port overlay matters, which may form a key component of the master plan and port overlay when these are developed.

Under the Ports Act, Priority Management Measures (PMMs) are the management requirements that relate to managing potential impacts from development on EVs within, and surrounding, the proposed MPA. *The Risk Assessment Methodology for Priority Port Master Planning* (Appendix A) has been prepared for the priority ports

master planning program to identify high risks that are not controlled by existing regulatory processes or approvals which may require a PMM to manage the potential impact from development on EVs. If required, each PMM will be supported by a range of specific actions, which will guide the implementation of the PMM through the port overlay.

Potential PMMs and port overlay matters identified in the risk assessment will be considered in more detail as part of the master planning process with a responsible or advisory entity. This would include consideration of whether a measure was appropriate or required in relation to existing regulatory processes or approvals. The Ports Act provides for requirements to apply to development and does not regulate existing lawful uses.

The economic costs of implementation of risk management measures including port overlay matters and PMMs have not been included in this risk assessment.

1.2. Objectives of the study

The purpose of this report is to conduct a risk assessment of direct and indirect impacts of development within the proposed MPA on the environment, and to assist with the drafting of the master plan and port overlay for the priority Port of Townsville. The risk assessment focusses on the potential for port-related development and activities to impact on EVs, including those that contribute to the OUV of the GBRWHA. For properties to be of OUV they should be exceptional or superlative on a global level. The GBRWHA meets four of the ten criteria for OUV all of which are related to biological, ecological and geological processes and aesthetics (refer to section 3.3 for a detailed discussion of OUV).

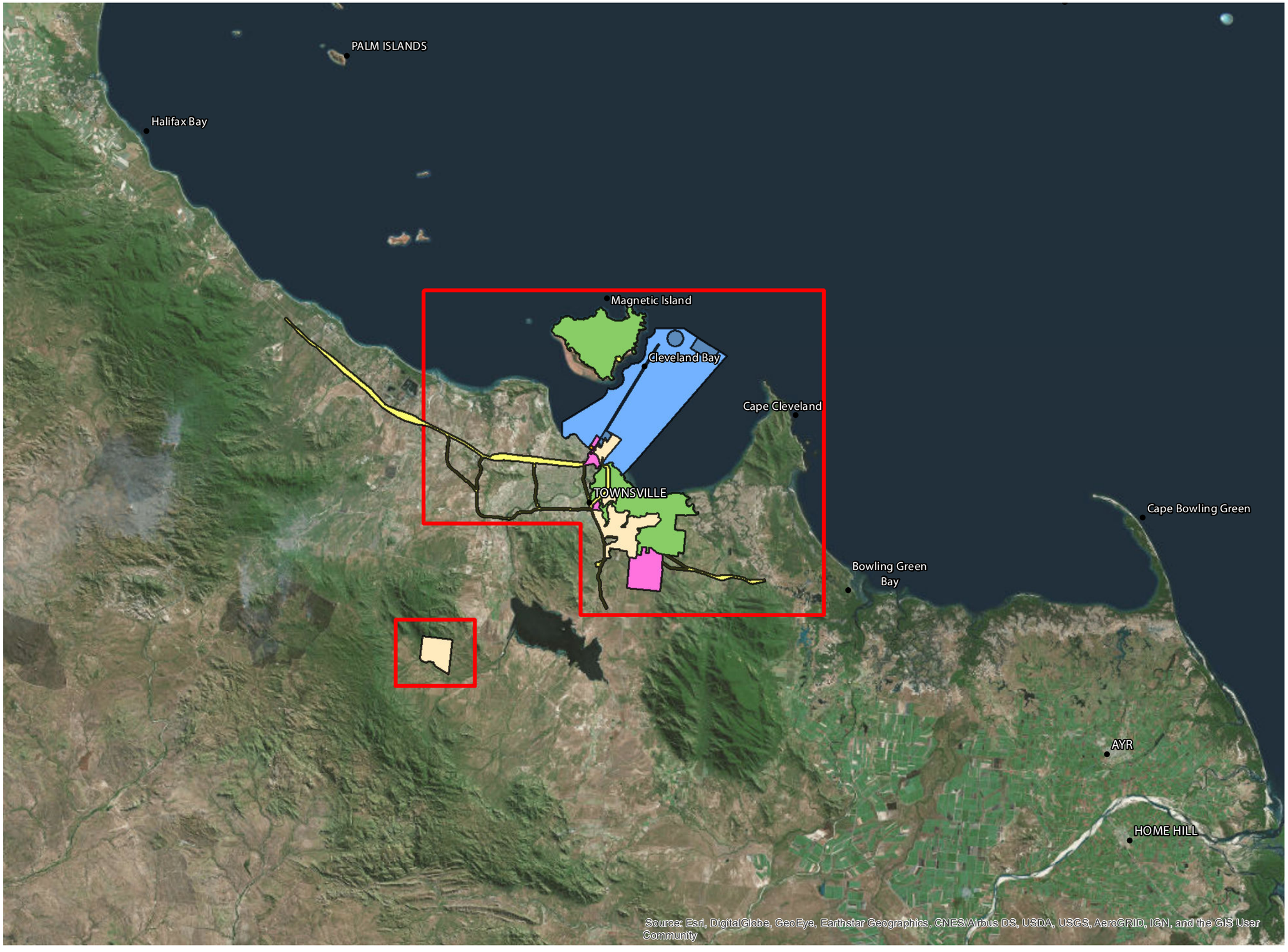
The risk assessment has been conducted using the following sources:

- Growth scenarios developed for the priority Port of Townsville through an Infrastructure Study
- Baseline environmental, social and cultural information collected as part of the EBR
- Additional information obtained from databases kept by the Port of Townsville and various local, state and Commonwealth Government Departments
- Feedback from a range of stakeholders involved in the environmental impact assessment and management.

In order to address potential indirect impacts resulting from development within the proposed MPA a broader area was adopted for the assessment to ensure potential environmental impacts were considered. The area covers a broad range spanning the marine and terrestrial environments stretching from Saunders Beach in the east to west of Bowling Green Bay and as far south as Ross River Dam to north of Magnetic Island. The vast majority of this area will not be affected by port or port-related activities however this area has been reviewed to ensure environmental risks are addressed.

The study area and proposed MPA are shown on **Figure 2** with a more detailed view of the proposed MPA including the draft precincts shown on **Figure 3**.

2. PRIORITY PORT OF TOWNSVILLE PRELIMINARY MASTER PLANNED STUDY AREA



NOTES
This plan was prepared as a desktop assessment tool.
The information on this plan is not suitable for any other purpose.
Property dimensions, areas, numbers of lots and contours and other physical features shown have been compiled from existing information and may not have been verified by field survey. These may need verification if the development application is approved and development proceeds, and may change when a full survey is undertaken or in order to comply with development approval conditions. No reliance should be placed on the information on this plan for detailed design or for any financial dealings involving the land. Saunders Havill Group therefore disclaims any liability for any loss or damage whatsoever or howsoever incurred, arising from any party using or relying upon this plan for any purpose other than as a document prepared for the sole purpose of accompanying a development application and which may be subject to alteration beyond the control of the Saunders Havill Group. Unless a development approval states otherwise, this is not an approved plan.

Layer Sources: QLD GIS Layers (QLD Gov. Information Service 2016), Aerial (Google 2017)

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LEGEND

- Preliminary Master Planned Study Area
- Proposed Master Planned Area

Draft Precincts

- Environmental Management precinct
- Infrastructure and Supply Chain Corridors precinct
- Interface precinct
- Marine Infrastructure precinct
- Marine precinct
- Marine services and recreation precinct
- Port Industry and Commerce precinct

PLAN ISSUE:

Issue	Date	Description	Drawn	Checked
A	10/08/2017	Preliminary Draft	MC	SM
D	6/04/2018	Ammended	MC	SM

0 5 10 15 20 km

Universal Transverse Mercator GDA 1994 MGA Zone 56 1:450,000 @ A3

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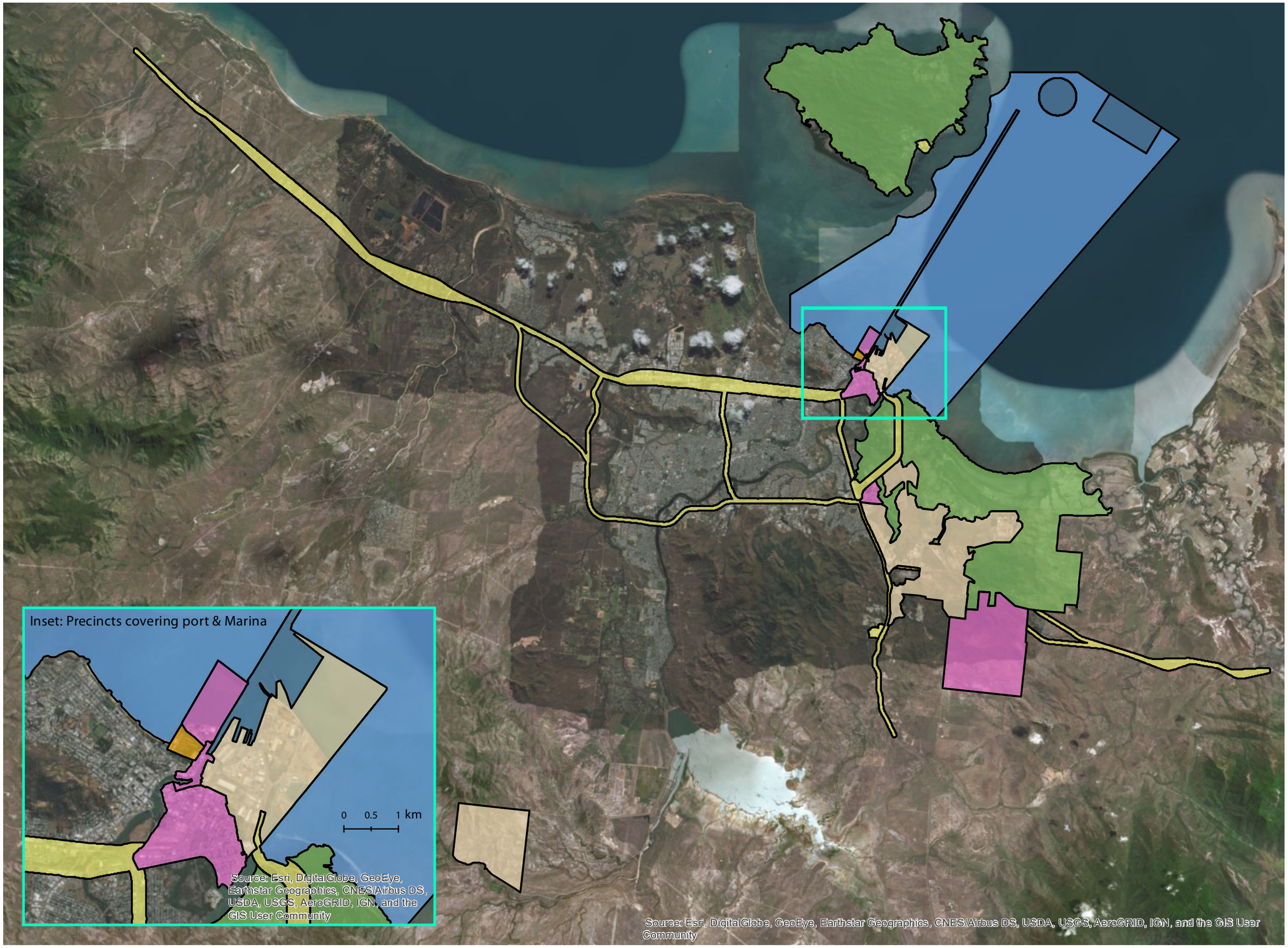
Queensland Government

3. PROPOSED MASTER PLANNED AREA DRAFT PRECINCTS



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Layer Sources: QLD GIS Layers (QLD Gov. Information Service 2016), Aerial (ArcGIS Basemap)

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LEGEND

- Proposed Master Planned Area

Draft Precincts

- Environmental Management precinct
- Infrastructure and Supply Chain Corridors precinct
- Interface precinct
- Marine Infrastructure precinct
- Marine precinct
- Marine services and recreation precinct
- Port Industry and Commerce precinct

PLAN ISSUE:

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A	10/08/2017	Preliminary Draft	MC	SM
D	6/04/2018	Ammended	MC	SM

0 2 4 6 8 10 km

Universal Transverse Mercator GDA 1994 MGA Zone 56 1:190,000 @ A3

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2. Risk assessment method

2.1. General method

A *Risk Assessment Methodology for Priority Port Master Planning* was developed to be used across the priority port master planning program. A detailed description of the methodology has been included as **Appendix A** with a summary of the key components provided in this section. The scope of this risk assessment is outlined in **Table 1**.

Table 1: Scope of Risk Assessment

Task #	Issue	Task Description
1	Identification of Environmental Values (EVs)	Identify and map the existing environmental, social, cultural values using the EBR prepared for the priority Port of Townsville covering both land and marine areas. EVs are defined under the EP Act as: a) a quality or physical characteristic of the environment that is conducive to ecological health or public amenity or safety; or b) another quality of the environment identified and declared to be an environmental value under an environmental protection policy or regulation. By definition EVs do not include economic or other social values outside amenity and public safety.
2	Gap Analysis	Analysis of gaps that exist in the understanding of EVs, impacts and mitigation within and surrounding the proposed MPA and identify any critical information required for completion of the risk assessment.
3	Identify Local Expression of OUV Attributes	Review and update the local expression of the OUV within the (GBRWHA) in accordance with the method for identifying the local expression of OUV within the GBRWHA (Adaptive Strategies 2017 and included in **Appendix A**).
4	Analysis of Impacts	Based on the growth scenarios identify existing and potential development activities for each of the draft precincts within the proposed MPA.
4a		Determine potential direct and indirect impacts of identified existing and potential development activities within the proposed MPA on EVs within each of the draft precincts.
5	Risk Assessment	Undertake a risk assessment of potential impacts to EVs in accordance with the priority port master planning risk assessment methodology.
5a		Propose objectives based on draft precincts for managing each of the potential impacts (either individually or as groups of impacts) on EVs within the proposed MPA.
7	Risk Management Requirements	Based on the assessment, suggest risk management measures in addition to existing planning and approval requirements. Describe how each of the suggested risk management measures are to be achieved. Risk management measures, including port overlay matters and PMMs, should also identify the entities that should be responsible for any suggested risk management requirements.
8	Stakeholder Engagement	Conduct series of workshops to test risk management requirements with key stakeholders and agency representatives (shareholding and regulatory), and revise Risk Assessment based on outcomes of workshops.

The scope was generally implemented using the following methodology:

1. EVs within and surrounding the proposed MPA were identified through a desktop review of all relevant documents, databases and mapping. The key information source utilised was the priority Port of Townsville Master Plan EBR with all information sources listed in **Appendix A**. EVs were then described for each MPA draft precinct and surrounding areas. Where the review identified gaps in data from the EBR or new data sources that were unavailable when the EBR was compiled (for example recent seagrass surveys) these layers were added as part of the risk assessment process.

2. Once the EVs were defined the environmental, social, and cultural values for the proposed MPA and surrounding areas Port of Townsville providing a local contribution to the OUV of the GBRWHA were identified using the *Method for identifying the local expression of Outstanding Universal Value within the Great Barrier Reef World Heritage Area*. The assessment included a local statement of integrity for the proposed MPA and surrounding areas.

3. Review of existing state and Federal legislation, state and local planning instruments, operational environmental management measures and approvals (including conditions) specifying management requirements within the proposed MPA and the surrounding areas so that additional management requirements can be identified through the risk assessment process.

4. Outline future development activities associated with the growth scenarios for each proposed MPA draft precinct from the EBR using the outcomes of the Infrastructure Study (GHD 2017).

5. Undertake a risk assessment of the potential impacts from prescribed growth scenarios associated with development activities within the proposed MPA on the environmental, social and cultural values within and surrounding the proposed MPA (and each draft precinct). The risk assessment steps include:

    a. Identification of potential impacts to the EVs

    b. Determination of the initial risk of each potential impact on the identified values. That is, the risk *without* implementation of existing statutory requirements, planning instruments, and operational environmental management measures, based on likelihood and consequence

    c. Determination of any existing statutory requirements, planning instruments, and operational environmental management measures relevant to controlling the initial risk considering any inconsistencies, information, and management gaps, and implementation timeframe gaps likely to occur over the master planning timeframe, and also considering security of non-statutory measures (i.e. voluntary) over the master planning timeframe, and

    d. Determination of the post management risk of each potential impact on the identified values (that is, the resulting risk *with* the implementation of existing statutory requirements, planning instruments, and operational environmental management measures) based on likelihood and consequence.

Following the completion of steps 1-5, the results of the Risk Assessment were presented for discussion at workshops in Brisbane and Townsville with key stakeholders. This process involved the following steps:

6. Summary of high risk impacts that cannot be managed to be less than high risk through existing statutory requirements, planning instruments, and operational environmental management measures.

7. Identification of additional management requirements for potential impacts so as to reduce the risk rating for that impact to less than high.

8. Proposed potential implementation mechanisms (e.g. planning and/or operational measures) and responsible entity/ies for implementing the risk management requirements through the port overlay, including PMMs.

9. Independent peer review prior to finalisation.

Following completion of the relevant workshops and stakeholder feedback, the contents of the risk assessment table were finalised, as well as confirmation of the required risk management measures. The list of stakeholders represented at the workshops is provided in **Appendix B**.

2.2. Risk assessment process

As identified in the *Risk Assessment Methodology for Priority Port Master Planning* (refer to Appendix A) the following Risk Matrix, and Likelihood and Consequence Guides were applied to all identified potential impacts (refer to **Tables 2-4**). The risk matrix was used to identify the severity of the activity with impacts rated as either positive, low, medium or high depending on the likelihood of the impact occurring and consequence of the impact if it occurs. Risk management measures including port overlay matters and PMMs are identified where a significant risk of adverse impact remains after existing management measures are implemented. Guidance on how to assess likelihood of occurrence and consequences are provided in **Tables 3 and 4**.

Table 2: Risk Matrix and Legend

	Positive	Low	Medium	High

Consequence						
	Extreme					
	High					
	Medium					
	Low					
	Positive					
		Rare	Unlikely	Possible	Likely	Almost Certain
		Likelihood				

Table 3: Likelihood Guide

Definition	Occurrence
Almost certain Is expected to occur as a result of the particular scenario being assessed	Conceivably a regular or unavoidable event
Likely Will probably occur as a result of the scenario being assessed	Expected to happen during the life of the master plan
Possible Might occur at some time under the particular scenario being assessed	A possible event during the life of the master plan
Unlikely Unlikely to happen under the particular scenario being assessed	Unlikely to happen over the life of the master plan
Rare May occur only in exceptional circumstances	Extremely unlikely to happen over the life of the master plan

Table 4: Consequence Guide

Definition	Environmental Values	Social Values	Cultural Heritage Values
Extreme	Impact is clearly affecting the nature of the ecosystem over a wide area. OR Impact is catastrophic and possibly irreversible over a small area or to a sensitive population or community. Recovery periods of greater than 20 years likely. OR Condition of an affected part of the ecosystem or local expression of a GBR OUV is irretrievably compromised	Permanent or long-term decline in social or community profile	Permanent alteration or loss of heritage values
High	Impact is significant at either a local or wider level or to a sensitive population or community Impacts of a temporary nature (0 – 10 years) to the local expression of a GBR OUV. If EVs are high, recovery periods of 10 - 20 years are likely	Prolonged negative impact to multiple community sectors or businesses with limited ability to adapt or recover (5+ years)	Restricted access and/or reduction to condition or quality of heritage value and appreciation
Medium	Impact is present at either a local level for a period of 0 - 10 years but would not affect local expression of a GBR OUV. If EVs are high, recovery periods of 0 - 10 years anticipated	Impact to multiple community sector or business for a period of 1-5 years	Temporary loss of access to heritage values Loss of appreciation of heritage value from nearby development or activity
Low	Impact is present but not to the extent that it would impair the overall condition of the ecosystem, OUV, sensitive population or community in the long term	Disruption to social amenity or demand on services for 1-12 months.	Minor disruption to access or appreciation of heritage values
Positive	Positive environmental outcomes	Positive social and community outcomes	Improved protection and opportunity to appreciate heritage values

3. Identification of environmental values

The EP Act defines an Environmental Value (EV) as:

a) a quality or physical characteristic of the environment that is conducive to ecological health or public amenity or safety; or
b) another quality of the environment identified and declared to be an environmental value under an environmental protection policy or regulation.

A desktop assessment of publicly available databases, reports and monitoring programs has been carried out to identify EVs within the proposed master planned area and surrounding areas. Key information sources included:

- Priority Port of Townsville Master Plan EBR
- Townsville Port Expansion Project Environmental Impact Statement (EIS) and Additional EIS (AEIS)
- Seagrass, coral, water quality and other data from monitoring programs conducted by the Port of Townsville
- MSES mapping and other state database searches
- EPBC Protected Matters Search
- Strategic Development Plan: Environmental Values Technical Report, June 2016, Sprott Planning and Environment (unpublished)
- POTL Air quality dashboard
- State Planning Policy Mapping (particularly Biodiversity
- Searches of threatened species listed under the NC Act
- TropWater Seagrass monitoring data for the Port of Townsville
- GBRMP Zoning Map 7 - Townsville (GBRMPA)
- Reports from the Port of Townsville, Reef 2050 Long-Term Sustainability Plan (Reef 2050), NQ Dry Tropics, GBRMPA and other sources where relevant to the site.

The Townsville City Plan Environmental overlays were also reviewed to ensure all areas of importance were identified. The overlay mapping generally follows the Regional Ecosystem and Watercourse mapping, identified under the *Vegetation Management Act 1999* (VM Act). This legislation has been reviewed and taken into consideration when identifying EVs that are of local environmental significance.

A complete list of information sources is provided as **Appendix C**.

3.1. Priority Port of Townsville master plan evidence base report

The EBR provides context to the priority Port of Townsville master planning process, including information on:

- Key environmental, social, and cultural values surrounding the port including OUV
- Land uses, sensitive uses, and infrastructure supporting the port
- Potential land use conflicts and infrastructure issues
- A preliminary master planned area boundary and draft precincts (to be further refined into a proposed MPA).

Many of the documents listed above and used to identify EVs for the Risk Assessment were reviewed as part of the EBR. In many cases the information used in the Risk Assessment has been sourced directly from the EBR.

The EBR also identified a preliminary MPA boundary including an outline of the draft precincts within the MPA. These draft precincts have been further refined through the master planning process and are shown on **Figure 3** and described in **Table 5**. The draft precincts have been used to categorise EVs for the Risk Assessment and allow for a more targeted review and consideration of activities with the potential to impact on the EVs within and surrounding the proposed MPA.

Table 5: Proposed master plan draft precincts

Precinct	Purpose	Description
Environmental Management (EM)	To limit development and manage EVs consistent with ESD principles.	Development in this precinct is not encouraged. Low impact development that supports the protection of the EVs of the area is preferred. Development is compatible with Traditional Owner access, but public access is limited.
Interface (I)	To manage interface issues between sensitive uses and port-related uses and development. New development will be required to mitigate any impacts from adjoining port operations or development	Development will not hinder the growth or development of port-related infrastructure and supply chain corridors and industry. Development appropriately manages port-related impacts on sensitive uses.
Infrastructure and supply chain corridors (ISCC)	To allow for aggregation and protection of critical on-land and marine infrastructure and supply chain functions to and from the port, as well as within the MPA.	Development includes defined corridors to accommodate existing and planned major roads, rail, conveyors, pipelines, power lines and other utilities that service multiple sites within the proposed MPA.
Port industry and commerce (PIC)	To allow for port operations, general and heavy industry, port-related commercial activities and related development.	Development is for port-related purposes, development for other purposes will be limited. Public access is generally limited in this area to the workforce, except where necessary to access public facilities. It may include undeveloped land that has been identified as having potential to house port-related development or infrastructure that supports transporting commodities to and from port areas. It may also accommodate other associated commercial development that supports port activities.
Marine (M)	To ensure port access to wharves, channels, anchorages and waterside areas and to provide for marine based port infrastructure	Development takes place in or over tidal waters for port-related purposes. Development includes actions necessary for the safety and efficiency of port operations.
Marine services and recreation (MSR)	To provide for coastal dependent development other than port infrastructure, including a range of maritime services, marina, related commercial activities and public use activities that in order to function must be located in tidal	Light industrial and commercial development that in order to function must be located in tidal waters or be able to access tidal water. Development that is compatible with port operations and infrastructure. Provides for commercial and recreational fishing and boating (where not restricted for safety or security reasons).

Precinct	Purpose	Description
	waters or be able to access tidal water	Development is located to provide direct public access to the harbour, such as boat ramps and public car parks. Residential and retail development is generally limited in this area.
Marine infrastructure (MI)	To provide for development and maintenance of existing and future port infrastructure, including berths, offshore disposal areas, anchorages and access channels.	Development required for ongoing port operations and expansion of infrastructure.

3.2. Risk assessment environmental values

Table 6 classifies and describes the EVs identified through the desktop review and utilised in the Risk Assessment. The spatial distribution of the EVs are shown on **Figures 4 to 10** and are identified in relation to the proposed MPA draft precincts as well as other key areas within and adjacent to the proposed MPA such as the TSDA and the TCWPDA.

The EVs utilised for the Risk Assessment generally correlate with those identified in the EBR however some have been removed, such as hazards, economy and labour, housing, education, and social infrastructure as the environmental risk assessment focuses on impacts on the natural environment, social and cultural heritage values.

Table 6: Environmental values identified within and surrounding the proposed master planned area

Category	Environmental Value	Description of Environmental Value	Precincts / Key Locations Within the proposed master planned area	Associated Plan and Data Source
Marine and Estuarine	Mangrove and Saltmarsh Communities	Mangroves and saltmarsh grow in the intertidal zone, typically within quiescent (calm) environments such as estuaries and bays. Mangroves and saltmarshes represent benthic primary producer habitats with high conservation values as they provide a nursery and shelter for fish, mud crabs and prawns, trap tide borne sediments and help control coastal erosion and provide vital protection from strong winds, tidal surges and heavy rainfall associated with cyclones. There are 12 species of mangrove recorded in the proposed MPA and surrounds. The Queensland Herbarium Regional Ecosystem (RE) Description Database has been used to map mangrove and saltmarsh communities for the purpose of this study (REs 11.1.1, 11.1.2 and 11.1.4). All mangrove and saltmarsh REs are classified as least concern under the VM Act; however, all marine plants are protected under Section 123 of the *Fisheries Act 1994* regardless of RE status.	Precincts – Mainland and Magnetic Island Environmental management, Infrastructure and supply chain corridors, Port industry and commerce Other Locations – Ross Creek, Ross River, Black River, Cleveland Bay (eastern shoreline), TSDA, Chunda Bay, Magnetic Island, Saunders Beach and adjacent to the esplanade.	Refer to **Figure 4** Inferred from regional ecosystem mapping and descriptions databases version 10 using REs classified as Estuarine Wetlands.
	Coral Reefs	Reef habitats in Cleveland Bay include shallow fringing reefs and rocky shores around Magnetic Island, the well-developed reef platform of Middle Reef and smaller, less developed reef areas between the mainland and Magnetic Island (e.g. Virago Shoal). Although the corals only occupy approximately 1% of Cleveland Bay, they are of high biodiversity significance around Magnetic Island and form part of an extensive system of nearshore reefs within the Coastal Central Reefs Bioregion Coral cover, species diversity and aesthetic quality is generally considered higher in the fringing reefs on the northern side of Magnetic Island (Horseshoe Bay) than in other fringing reefs. Reefs have been mapped using the Commonwealth Government's GBR Reef mapping.	Precincts – No reefs occur within any of the MPA draft precincts however a number are located adjacent to Marine and Marine infrastructure precincts in Cleveland Bay. These include fringing reefs around Magnetic Island, Middle Reef, and others between the mainland and Magnetic Island including Cockle Bay Reef and Virago Shoal.	Refer to **Figure 4** Reefs and Shoals Queensland (Great Barrier Reef Basemap)
	Seagrass and Macroalgae	Seagrass meadows occur in nearshore and deep-water of Cleveland Bay and are considered to be among the largest in the central Queensland coast. They are present in approximately 10% of the bay and occur extensively in the eastern portion of Cleveland Bay with smaller beds occurring off the Strand, Kissing Point, Pallarenda Beach and some bays fringing Magnetic Island. Seagrass provides food for dugong and turtles and is also a nursery for prawns. Recent annual seagrass surveys (2015 and 2016) indicated that most meadows were considered to be in a satisfactory condition with the dominant species recorded as *Halophila ovalis, Halodule uninervis, Zostera capricorni*, and *Cymodocea serrulata* in shallow waters and *Thalassia hemprichii* on reef flats surrounding Magnetic Island. Seagrass extent has been mapped using TropWATER's composite of 2007 - 2016 annual survey data. All habitats examined from 2007 through 2016 are represented. Seagrass extent and density can change seasonally and between years therefore the full extent of seagrasses observed over this period is shown as well as the extents from the latest surveys in 2016. EIS studies found that macroalgae are abundant throughout the region and are generally associated with coral reef, rocky substrates and seagrass communities. Sargassum was particularly abundant at east coast reefs, but less so at the northern and the southern reefs. *Laurencia* and *Lobophora* were found in moderate abundance, varying among locations.	Precincts – within and adjacent to the Marine and Interface precincts and adjacent to the mainland Environmental management precinct. Other locations - Cleveland Bay off the Strand, Kissing Point, Pallarenda Beach, Shelley Beach and bays of Magnetic Island.	Refer to **Figure 4** TropWATER Townsville 2007 – 2016 composite seagrass extent and 2016 survey extents. AECOM (2013) Townsville Port Expansion Project Environmental Impact Statement. Port of Townsville Limited.
	Non-Vegetated Benthic Communities	Soft-sediment habitats can include both vegetated (seagrass and macroalgae) and non-vegetated habitats. Benthic habitat and communities were assessed as part of the PEP. The PEP EIS identified that the benthic habitat was comprised of silty-sands occurred over a majority of the higher energy outer harbour. In sheltered and/or deeper areas, such as quiescent waters and deeper dredged areas of the harbour like the swing basins, the benthic habitat was comprised of muddy sands and silts. This study suggested that epibenthic communities had a sparse cover across the PEP study area and surrounds, varying in community structure between offshore and nearshore environments. Macrobenthos communities (also differing between nearshore and offshore areas) were dominated by polychaete worms, amphipods, decapod crustaceans and numerous other invertebrate taxa within the PEP study area.	Non-vegetated benthic communities are present in tidal waters outside of any other mapped benthic habitat such as seagrass and coral reefs.	AECOM (2013) Townsville Port Expansion Project Environmental Impact Statement. Port of Townsville Limited.
	Marine Megafauna	Cleveland Bay and the waters around Magnetic Island are an important habitat for sea turtles, dugongs and nearshore dolphin species with other marine megafauna such as whales favouring offshore waters.	Precincts - Some low density turtle nesting beaches within the Magnetic Island Environmental management precinct.	Refer to **Figure 5** Dataset compiled from the following sources:

Category	Environmental Value	Description of Environmental Value	Precincts / Key Locations Within the proposed master planned area	Associated Plan and Data Source
		Six turtle species have been recorded in the proposed MPA, with the green turtle being the most abundant and accounting for approximately 90% of turtles observed within Cleveland Bay. The '*Recovery Plan for Marine Turtles in Australia 2017-2027*' confirms that Cleveland Bay does not represent a critical turtle nesting area, with only low densities occurring on a number of sandy beaches on Magnetic, Herald and Rattlesnake Islands, The Strand beach and the Australian Institute of Marine Science (AIMS) beach at Cape Cleveland Bay. The Australian snubfin dolphin, Indo-Pacific and Australian humpback dolphin, common dolphin and the bottlenose dolphin are known or likely to occur within the proposed MPA. Australian snubfin dolphins and Indo-Pacific humpback dolphins occur nearshore and in shallow-water habitat opportunistically feeding on fish, with the Australian snubfin dolphin also feeding on cephalopods. Dugongs are herbivores and feed selectively on dominant seagrass species. As Cleveland Bay is a regionally important habitat for this species it has been designated as a Dugong Protection Area (DPA), as has Bowling Green Bay. The primary feeding areas, and where dugongs were mostly observed in the area, are the dense nearshore meadows in eastern portion of the Cleveland Bay-Magnetic Island DPA. Humpback whales have been recorded in Cleveland Bay although other species of whales and dolphins are known to favour deeper offshore waters. Megafauna habitat is represented through other mapping layers such as seagrass beds. The Cleveland Bay-Magnetic Island DPA is also highlighted through the EV mapping.	Dolphin species are likely to utilise Cleveland Bay in areas within the Marine Precinct. The Cleveland Bay-Magnetic Island DPA is located within the Marine and Marine infrastructure precincts.	GHD (2008a). Townsville Port Authority Long Term Dredging and Disposal Management Plan Report. Prepared for the Port of Townsville Limited by GHD Pty Ltd. GHD (2009) Townsville Marine Precinct Project Environment Impact Statement. Report prepared for Port of Townsville Corporation. GHD (2011) Port of Townsville Limited Report for Port Expansion – Benthic Ecology and Fisheries Resources Report. October 2011. Report prepared for Port of Townsville Corporation. GHD (2012) Port of Townsville Limited Report for Port Expansion Project: Marine Megafauna. Prepared for the Port of Townsville Limited by GHD.
	Fish and Fisheries	Fish Habitat Areas (FHA) have been established in Cleveland Bay and in the nearby Bohle River and Bowling Green Bay. They provide habitats for a wide range of fish and shellfish of direct economic significance. The FHAs provide protection to sustaining fish stocks while also acting as breeding grounds for target species such as barramundi, grunter, mud crabs and prawns. Fisheries habitat also includes Wetlands, Mangroves and Seagrass areas. Wetlands are located in the Townsville Town Common Conservation Park and west of Cungulla near the Bowling Green Bay Conservation Park. The main precincts for Mangroves are Mainland and Magnetic Island Environmental Management Areas, Infrastructure and supply chain corridors, Port industry and commerce. Seagrass meadows occur in nearshore and deep-water of Cleveland Bay and are considered to be among the largest in the central Queensland coast. For further detail, refer to specific EV descriptions.	Precincts – The Cleveland Bay FHA is located within and adjacent to the Marine and Mainland Environmental management precincts. FHAs are also located east of the proposed MPA in Bowling Green Bay and west of the MPA at Townsville Town Common Conservation Park (the Bohle River FHA).	Refer to **Figure 6** Queensland fish habitat area - instream structure inventory Data
	Listed Threatened and Migratory Species	Searches were carried out using the EPBC Act Protected Matters Search Tool (PMST) and NC Act wildlife online database for threatened and migratory species known to occur within the proposed MPA (**Appendix C**). The searches identified 12 marine and estuarine threatened species protected by state or Commonwealth legislation and a further 8 migratory marine species. The likelihood of these species occurring within the proposed MPA based on a desktop assessment of potential habitat is included in **Appendix D**. Cleveland Bay supports habitats for migratory or transient threatened or protected marine fauna including whales, dugongs, dolphins and marine turtles. These animals have different likelihoods of occurring in the proposed MPA with only a few species having been observed. A number of migratory marine (5) and wetland (33) bird species were identified by the PMST as likely to occur within the proposed MPA. Surveys of the Eastern Access Corridor and the site of the bridge over Ross River (NRA, 2005) identified the following migratory shorebirds species as present during the survey: Redneck Stint, Great Knot, Sharp-tailed Sandpiper, Bar-tailed Godwit, Great Sand Plover and Eastern Curlew. Favoured use areas appear to be the South Bank beach and a sand bar south of the entrance channel to Ross River. In 2012, the red-necked stint (*Calidris ruficollis*) and lesser sand plover (*Charadrius mongolus*) were recorded in nationally significant abundances on the port's eastern reclamation area. AECOM (2013) reported that the Sooty Oystercatcher, among other species, is known to use existing POTL breakwaters and revetments for roosting, while other migratory birds use the POTL eastern reclamation for foraging. It was also reported that newly reclaimed areas are likely to enhance opportunistic foraging opportunities in emplaced marine sediments and roosting along greater lengths of breakwater and revetments.	Precincts – Threatened and migratory species may utilise areas within the Marine, Marine infrastructure and Marine and mainland Environmental management Precincts.	AECOM (2013) Townsville Port Expansion Project Environmental Impact Statement. Port of Townsville Limited. EPBC Act Protected Matters Search Tool (PMST) and NC Act wildlife online database. Natural Resource Assessment Environmental Consultants (NRA) (2005). Enertrade North Queensland Gas Pipeline Black-throated Finch Studies (Post Construction). Unpublished report prepared for Enertrade, Brisbane. Townsville PEP EIS and AEIS.

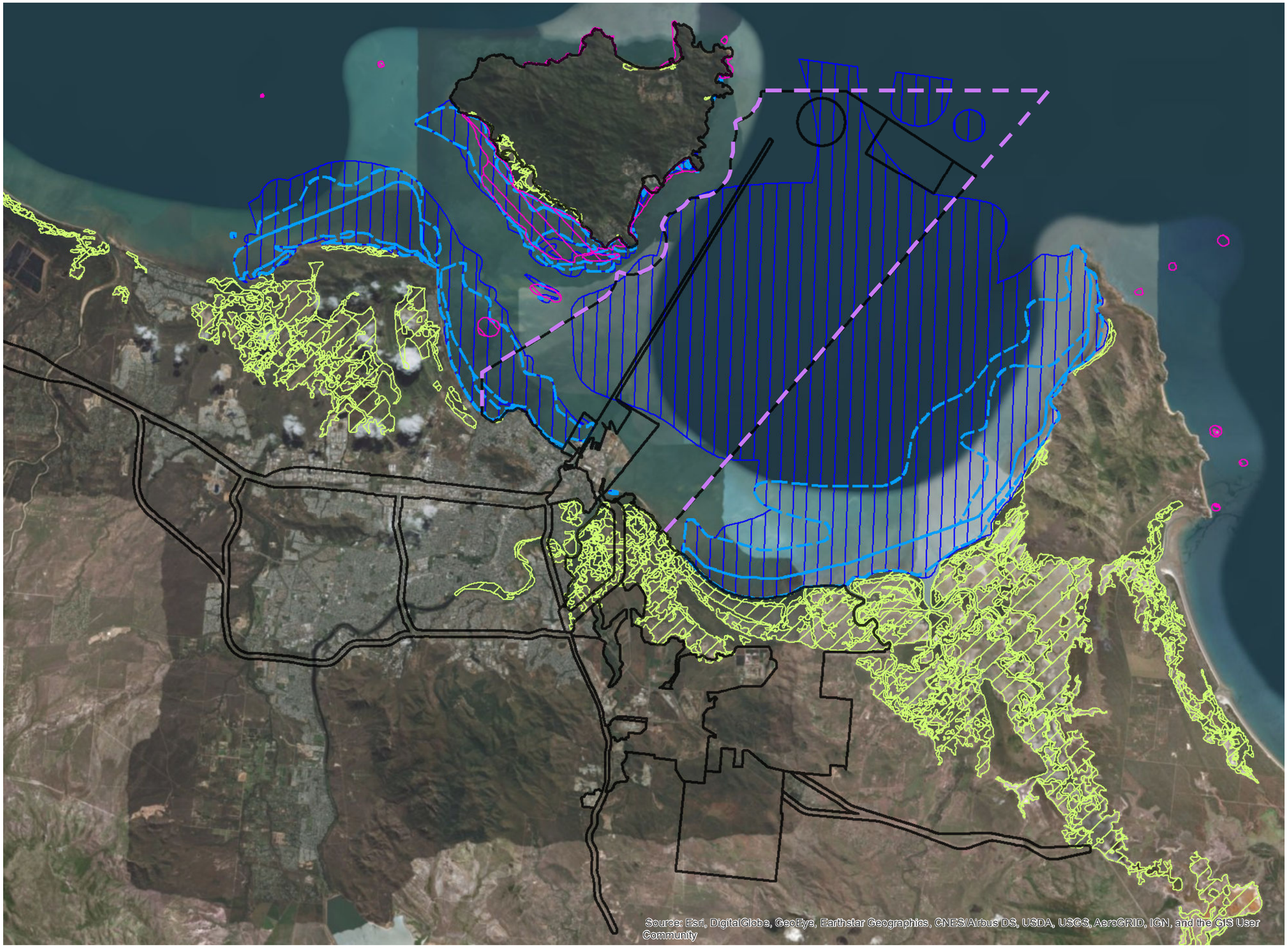
Category	Environmental Value	Description of Environmental Value	Precincts / Key Locations Within the proposed master planned area	Associated Plan and Data Source
		Habitat for threatened and migratory species, such as turtles, dugongs and dolphins, is not specifically mapped and is associated with other EVs addressed in this table such as mangroves and seagrass, and Marine Megafauna.		
	Marine Water Quality	The *Ross River Basin and Magnetic Island Environmental Values and Water Quality Objectives* identify Cleveland Bay and other offshore marine areas near the port as having the following environmental values: ▪ Aquatic Ecosystems ▪ Human Consumer ▪ Primary and Secondary Recreation ▪ Visual Recreation; and ▪ Cultural and Spiritual Values. The waters around the port are also identified as having Industrial uses. Cleveland Bay is considered to be a 'slightly to moderately' disturbed open coastal system in the Central Coast region (DEHP, 2009). Turbid fresh water and nutrients flow into Cleveland Bay via numerous creeks and rivers with highest flows occurring during summer. The principal factor controlling suspended sediment in Cleveland Bay is the wind regime and ensuing waves and swells. The near-shore waters of Cleveland Bay are frequently turbid with ambient total suspended solids (TSS) levels for the Eastern Near Shore Seagrass Meadows, the Strand and the outer harbour exceeding the Queensland Water Quality Guidelines (PoTL, 2014). Ambient TSS in the greater Cleveland Bay area is within the Queensland Water Quality Guidelines. Long-term POTL monitoring data indicates that the median concentrations for total nitrogen and phosphorus are compliant with the Queensland Water Quality Guidelines. However, AECOM (2013) report that data from GHD (2009) in-situ grab sampling monitoring indicated high nutrient concentrations in the existing recreational boat moorings of the Ross River. These elevated levels were considered to be related to anthropogenic influences. This is similarly the case for oil and grease concentrations which are also elevated in Ross River potentially due to recreational boat mooring.	Precincts – Marine, Marine infrastructure and Environmental management	AECOM (2013) Townsville Port Expansion Project Environmental Impact Statement. Port of Townsville Limited. GHD (2009) Townsville Marine Precinct Project Environment Impact Statement. Report prepared for Port of Townsville Corporation. *Ross River Basin and Magnetic Island Environmental Values and Water Quality Objectives* (DEHP 2009)
Terrestrial	Remnant Vegetation	Based on REs mapped under the VM Act, the proposed MPA is comprised of 376 REs, of these, 55 have been identified as 'endangered' or 'of concern'. These occur largely outside of built up areas such as urban or industrial land uses and commonly within specific protected environmental areas. The Queensland Herbarium RE Description Database has been used to map remnant vegetation throughout the proposed MPA	Precincts - Mapped REs are located throughout the Magnetic Island and mainland Environmental management, Infrastructure and supply chain, Port industry and commerce and Interface precincts. These are predominantly Least Concern communities. Aside from a small patch of Of Concern within the Infrastructure and supply chain and Interface precincts all Of Concern or Endangered vegetation located within and surrounding the proposed MPA is within the Environmental management precincts and protected areas.	Refer to **Figures 7 and 8** Regional ecosystem mapping and descriptions databases version 10
	Threatened Flora and Fauna	The proposed MPA contains a number of habitats that support mammals, reptiles, and substantial bird populations, including the migratory birds that fly through the coastal plain on their annual journey along the East Australian Flyway. The predominant areas of bird habitation are located on the sandspit on the eastern bank of Ross River. The Town Common is also a known migratory bird habitat area. Although the landside port area does not generally support critical terrestrial fauna habitat, avifauna (birds) may visit the coastal zone and use nearby shoreline and littoral habitats. Marine birds frequently occur at the port, while feeding, resting or overflying from one habitat to another. Nearby intertidal shores are known for shorebird occurrence, providing a key roosting and feeding habitat. Many of those bird species that occur are listed as threatened or migratory species. A number of migratory and marine bird species have been recorded foraging and/or roosting on the mudflat and sandbank habitats in proximity to the port (AECOM 2013). In 2012, the red-necked stint (*Calidris ruficollis*) and lesser sand plover (*Charadrius mongolus*) were recorded in nationally significant abundances on the port's eastern reclamation area. The proposed MPA contains several locations that provide habitat to the EPBC listed endangered Blackthroated Finch (southern) (*Poephila cincta cincta*). This includes an area that coincides with the Bohle Plains Industrial Land Investigation Area.	Precincts – Essential habitat is mapped within and adjacent to the Magnetic Island and mainland Environmental management, Infrastructure and supply chain and Port industry and commerce and Interface precincts. Regional Ecosystems associated with the TEC are mapped within the Magnetic Island and mainland Environmental management Areas. Many potential habitats are found throughout the proposed MPA including coastal zone, shoreline, and littoral habitats, the port, intertidal shores, and sand spit on the eastern bank of Ross River.	Refer to **Figure 7** Vegetation Management Essential Habitat map version 4.37. AECOM (2013) Townsville Port Expansion Project Environmental Impact Statement. Port of Townsville Limited.

Category	Environmental Value	Description of Environmental Value	Precincts / Key Locations Within the proposed master planned area	Associated Plan and Data Source
		That land may provide significant potential nesting habitat and habitat for other threatened species such as the vulnerable Squatter Pigeon (southern subspecies) (*Geophaps scripta scripta*) and critically endangered Bare-Rumped Sheathtail Bat (*Saccolaimus saccolaimus nudicluniatus*). The presence of preferred habitat for these species may limit the area's suitability for future industrial development. Searches were carried out of the EPBC Act Protected Matters Search Tool (PMST) and NC Act wildlife online database for threatened and migratory species known to occur within the proposed MPA (**Appendix C**). The searches identified 6 plant, 14 bird, 10 mammal and 2 reptile terrestrial threatened species. The likelihood of these species occurring within the proposed MPA based on a desktop assessment of potential habitat is included in **Appendix D**. The PMST also identified one threatened ecological community (TEC) as having the potential to be present within the proposed MPA - *Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions* – which is listed as endangered under the EPBC Act. Listing advice from the Threatened Species Scientific Committee for this TEC identifies potential species associated with a number of mapped REs, some of which are located within the proposed MPA. A number of threatened plant species are also known to occur within this TEC. Essential habitat for terrestrial flora and fauna protected under the NC Act is associated with certain REs as well as recent sightings. This mapping has been used to identify habitat for threatened species within the proposed MPA.		
	Palustrine Wetlands	Palustrine wetlands are vegetated, non-riverine or non-channel systems. They include billabongs, swamps, bogs, springs, soaks etc. They include a range vegetation communities including grasses and sedges, coastal heaths and Melaleuca and Eucalypt dominated floodplains. Wetlands provide habitat for a broad range of species including aquatic and terrestrial species including frogs and migratory birds. The largest areas of palustrine wetlands located within the proposed MPA are located in the Townsville Town Common Conservation Park and west of Cungulla near the Bowling Green Bay Conservation Park. A number of smaller wetland areas are located within the Mainland Environmental management precinct and on Magnetic Island.	Precincts – small patches of Palustrine wetland are mapped within the Magnetic Island and Mainland Environmental management areas.	Refer to **Figure 7** Vegetation Management wetlands map version 2.43
	Freshwater and Groundwater Quality	Water quality in the Townsville area is influenced by a number of factors. This includes land uses (i.e. agricultural, urban and industrial) and catchment management practices and existing contamination of surface water bodies and groundwater. A water quality improvement plan (WQIP) prepared by Gunn and Manning (2010), assessed catchment water quality and identified water quality improvements within the Black Ross (Townsville) area. This includes the Black River and Ross River catchments which cover most waterways within the Townsville City Local Government Area (LGA) including Magnetic Island. The most significant land use within this catchment area is grazing on native pastures, followed by urban land uses including heavy industry uses and conservation and natural environments. Groundwater beneath Townsville City and its surrounds, including Townsville Town Common Conservation Park and Bluewater Creek near the coastline, are located within high salinity alluvial deposits. Groundwater in other areas near the coast (i.e. Bowling Green Bay) and at Ross Lake are located in coastal and floodplain zones with low salinity. Groundwater in floodplains inland are sodic with low to moderate salinity, while groundwater beneath mountains are located in tropical alluvium with low to very low salinity.	NA	Gunn and Manning (2010) Black Ross (Townsville) Water Quality Improvement Plan: Improving Water Quality from Creek to Coral, Townsville City Council - Creek to Coral, Townsville.
Protected Areas	Protected Areas	There are a number of features within the proposed MPA which, while not providing on ground physical EVs, are of importance due to Commonwealth, state or local administrative documents placing a high level of protection over them. These include the GBRWHA and GBRMP (Cwlth) and the Great Barrier Reef Coastal Marine Park (Qld) (GBRCMP) and the Bowling Green Bay Ramsar Wetland. On land a number of Conservation Areas such as National Parks, state forests and reserves are located within the proposed MPA. These areas are generally associated with larger patches of remnant vegetation.	Precincts – the GBRWHA affects all precincts on the seaward side of low water mark. No precincts are located within the GBRMP or the GBRCMP. Bowling Green Bay Ramsar Wetland is located on the eastern side of Cape Cleveland. National Parks are located within the Magnetic Island Environmental management precinct with a number of reserves also located within the mainland Environmental management and interface precincts. Specific protected environmental areas include state and national parks and other reserves including	Refer to **Figures 9 and 10** GIS layers taken from various sources including: Protected Areas of Queensland Great Barrier Reef Marine Parks Boundaries

Category	Environmental Value	Description of Environmental Value	Precincts / Key Locations Within the proposed master planned area	Associated Plan and Data Source
			Magnetic Island, Paluma Range, and Bowling Green Bay National Parks; Cape Pallarenda, Townsville Town Common Conservation Park, Stuart Creek Nature Refuge, Cape Pallarenda Regional Park and Magnetic Island's Horseshoe Bay Lagoon Conservation Park.	
Acoustic and Ambient Amenity	Air Quality	The Department of Environment and Science (DES) rate Townsville's air quality as very good based on data from 2004. AECOM (2013) indicate that the quantity of greenhouse gas emissions or future emissions from POTL do not trigger the *National Greenhouse and Energy Reporting Act 2007* and are considered minimal in the context of Australian corporations. POTL carry out regular air quality monitoring as part of their Boundary Air Quality Monitoring Plan. The monitoring program has been designed to characterise air quality in the environment surrounding the port in order to determine the potential exposure of sensitive receptors to dust and air contaminant emissions that could be attributed to port operations. Parameters monitored include Total Suspended Particles, Total Insoluble Matter and lead. All parameters monitored are well below relevant guidelines and recommended levels set out by the World Health Organisation, the DES and the Environmental Protection (Air) Policy (2008) (Air EPP).	Receptors sensitive to noise include dwellings, libraries and educational institutions, childcare centres and kindergartens, outdoor school playground areas, medical institutions, commercial and retail activities, protected areas, marine parks and passive parks and gardens.	AECOM (2013) Townsville Port Expansion Project Environmental Impact Statement. Port of Townsville Limited.
	Noise	The existing ambient acoustic environment at the port was assessed by AECOM (2013) and is characterised by noise from both port and urban traffic from Townsville and noise from port activities, such as the heavy vehicle movements and unloading/loading of goods and commodities. Impacts to the ambient levels may be associated from increased development, i.e. port development including piling and rock breaking.		
	Vibration	The vibration information available is reported by AECOM (2013) whom conservatively estimate the existing background vibration environment at the port as a Peak Particle Velocity vibration level lower than 0.10 mm/s. At the port, vibrations sources include heavy vehicles and overhead crane movements and the impact of items being unloaded from ships onto the wharves. In the wider proposed MPA, vibrations may result from heavy vehicle movements and industrial activity such as quarrying.		
Social Amenity Sites	Social Amenity Sites and Use	The Townsville City Plan (3.4.4 Element - Strong and connected community) identifies areas of high scenic amenity which include the following: ▪ Mountainous backdrops, including Mount Elliot, Mount Cleveland, the Pinnacles, Many Peaks Range and Hervey Range to Paluma ▪ Significant hills and ridgelines within and framing urban areas, including Castle Hill, Mount Stuart and Mount Louisa ▪ Coastal headlands, foreshores and waters, including The Strand, Magnetic Island, Cape Pallarenda, Cape Cleveland, Cleveland Bay and Halifax Bay. The Port of Townsville is highly visible from several of the higher value scenic amenity viewpoints, including Castle Hill, The Strand, Cape Pallarenda, Picnic Bay and Nelly Bay on Magnetic Island, and along the ferry route between Townsville and Magnetic Island. Recreational fishing is also considered an important social value for the Townsville community.	High scenic amenity: Castle Hill, The Strand, Mount Stuart, Cape Pallarenda, Nelly Bay, Horseshoe Bay, the Picnic Bay Jetty and viewpoints along the ferry route to Magnetic Island. Lower scenic amenity: land in the vicinity of the port. Mountainous backdrops, including Mount Elliot, Mount Cleveland, the Pinnacles, Many Peaks Range, and Hervey Range to Paluma Coastal headlands, foreshores and waters, including The Strand, Magnetic Island, Cape Pallarenda, Cape Cleveland, Cleveland Bay, and Halifax Bay.	Townsville City Plan
Cultural Heritage	Aboriginal Cultural Heritage	The Indigenous heritage of Townsville spans for thousands of years. Traditional custodians of the Townsville land include the Bindal and Wulgurukaba Peoples. The Gurambilbarra Wulgurukaba People have recently filed a native title claim with the National Native Title Tribunal (QC2016/007) over a substantial portion of the proposed MPA. The Bindal People #2 have also filed a native title claim (QC2016/005) within the proposed MPA, south of the Ross River. The study by Bird and Heim (2009) presents the results of an Aboriginal cultural heritage investigation for the proposed Port of Townsville Marine Precinct and Port Expansion Projects. The key outcomes of the study include: ▪ Ross River and Ross Creek are integral components of the Aboriginal creation story ▪ The areas in the vicinity of the Port of Townsville and the Townsville SDA were used traditionally for camping, foraging, and for other cultural purposes as meeting places and places where corroborees were held ▪ Tangible archaeological evidence in the form of shell middens, stone artefact scatters, rock shelters with paintings, scarred trees, ceremonial sites and a burial ground are contained on land areas in the vicinity of the Port of Townsville	Environmental Management - TSDA, Sandfly Creek, South Bank of Ross River, Muntalunga Range, Lagoons and Wetlands, and Magnetic Island	Bird (2006). Cultural Heritage Desktop Investigation, Townsville Industrial Land Suitability Study (Townsville State Development Area – TSDA), Stage 1. Bird & Heim (2009). Indigenous Cultural Heritage Report, Port of Townsville Limited (POTL), Townsville Marine Precinct and Port Expansion Projects.

Category	Environmental Value	Description of Environmental Value	Precincts / Key Locations Within the proposed master planned area	Associated Plan and Data Source
		The desktop study of the TSDA by Bird (2006) identified five zones of cultural heritage value, four of which related to Aboriginal cultural heritage. These are: 1. Sandfly Creek coastal areas - The hinterland beach ridges of the North of the TSDA contain the Sandfly Creek Aboriginal burial ground with very high cultural heritage significance. 2. South bank of Ross River - The beach ridges and dune extending south from the Ross River have a high level of cultural significance to the Traditional Owners. Evidence suggested that Aboriginal people historically occupied the area and the potential exists for additional unrecorded cultural sites to occur. 3. Stuart Creek and surrounds - The channel and banks of Stuart Creek along the western side of the TSDA contains several World War II sites, including army camps and building foundations (non-indigenous). 4. Muntalunga Range - reported to contain at least one site of significance, and has a high potential for additional Aboriginal cultural heritage site to occur. 5. Lagoons and wetlands - The lagoons and wetlands that occur across the TSDA were utilised by Aboriginal people during prehistoric and historic times, however the archaeological potential of these areas is considered low. 6. Magnetic Island – reported to contain number of sites that are of significance to the Wulgurukaba People		
	Non-Aboriginal Cultural Heritage	Searches of the Commonwealth, state and local heritage register and databases confirmed that there are 539 places of heritage significance in the proposed MPA. Search outcomes are summarised below: ▪ The Great Barrier Reef is the only place on the World Heritage List. It is also on the National Heritage List and the Commonwealth Heritage List. The GBRWHA extends seaward of the low tide mark along the coastline. ▪ 84 locations are listed on the Queensland Heritage Database. ▪ 454 locations are on the local heritage register of TCCI, which was informed by Brannock (2011). Search of the Australian National Shipwrecks Database maintained under the requirements of the *Historic Shipwrecks Act 1976* listed 10 shipwreck locations within about 5 kilometres of the port, including in Ross River and Ross Creek and in the Port of Townsville inner harbour. The ongoing presence of shipwrecks within the inner port, Ross River and Ross Creek is unknown, but seems unlikely given the disturbance that has occurred. The channel and banks of Stuart Creek along the western side of the Townsville SDA is the site of several World War II sites, including Army camps and building foundations. The area was identified as having a high level of significance and research potential.	Precincts – Infrastructure and supply chain Corridors, Environmental management and Port industry and commerce precincts.	National Heritage List Commonwealth Heritage List Queensland Heritage Register Townsville City Plan (local heritage)
Magnetic Island National Park	Magnetic Island - recreational and tourism	Magnetic Island is a significant location for recreation and tourism within the proposed MPA as a result of its natural values. The bays, beaches and vegetated peaks provide opportunities for the Townsville community and visitors to the area to experience the EVs within the Magnetic Island National Park and surrounding land and marine areas.	Precincts – Environmental Management	NA

4. MARINE VALUES SUMMARY (ECOLOGICAL AREAS)



NOTES
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Layer Sources: QLD GIS Layers (QLD Gov. Information Service 2016), Aerial (Google 2017)

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LEGEND

- Proposed Master Planned Area
- Townsville baseline coastal seagrass meadows (2016)
- Seagrass meadows (2007 - 2016)
- Reefs and shoals
- Mangroves and saltmarshes (protected under S123 of the Fisheries Act 1994)
- GBR Marine Park boundary (Note - Commonwealth and State Marine Parks share same boundary)

PLAN ISSUE:

Issue	Date	Description	Drawn	Checked
A	10/08/2017	Preliminary Draft	MC	SM
D	6/04/2018	Ammended	MC	SM

0 2 4 6 8 km

Universal Transverse Mercator GDA 1994 MGA Zone 56 1:150,000 @ A3

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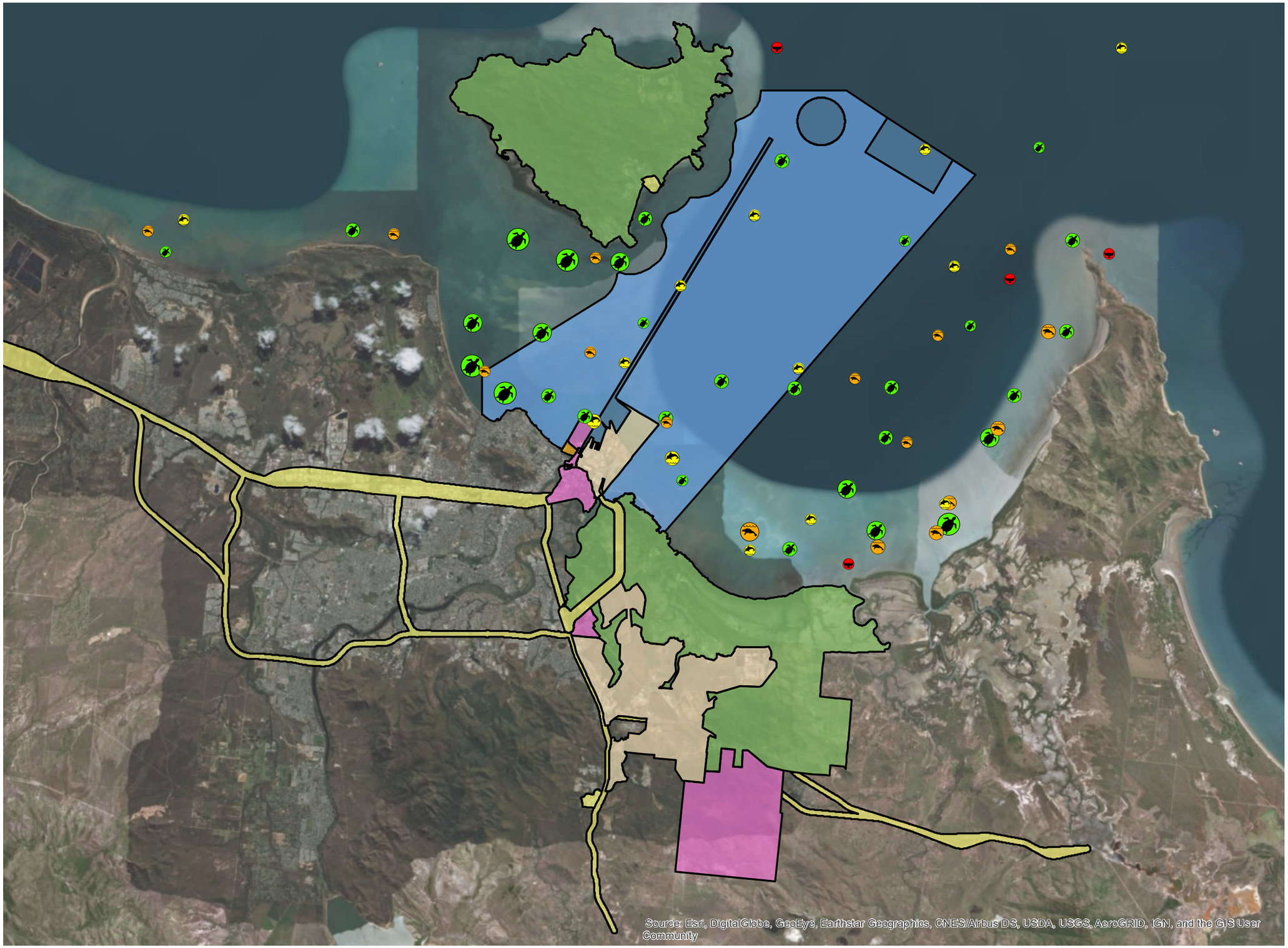
PORT OF TOWNSVILLE

Address - Port of Townsville, Townsville 6/04/2018 8671 E 04 Marine values

Queensland Government

5. MARINE MEGA FAUNA



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LEGEND

Proposed Master Planned Area

Survey data (2008 - 2012)

Species (number of data records)

- Dolphin (1 to 5)
- Dolphin (6 to 10)
- Dugong (1 to 5)
- Dugong (6 to 10)
- Dugong (11 to 15)
- Turtle (1 to 5)
- Turtle (6 to 10)
- Turtle (11 to 15)
- Whale (1 to 5)

Draft Precincts

- Environmental Management precinct
- Infrastructure and Supply Chain Corridors precinct
- Interface precinct
- Marine Infrastructure precinct
- Marine precinct
- Marine services and recreation precinct
- Port Industry and Commerce precinct

PLAN ISSUE:

Issue	Date	Description	Drawn	Checked
A	22/02/2018	Preliminary Draft	MC	SM
E	3/07/2018	Ammended	MC	SM

0 2 4 6 8 km

Universal Transverse Mercator GDA 1994 MGA Zone 56 1:150,000 @ A3

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NOTE: The number of animals observed during each data record has not been accounted for in this plan

PORT OF TOWNSVILLE

Address - Port of Townsville, Townsville 3/07/2018 8671 E 06 Marine EVs Benth megafauna C

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6. FISH HABITAT AREAS

NOTES
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Layer Sources: QLD GIS Layers (QLD Gov. Information Service 2016), Aerial (ArcGIS basemap)

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LEGEND

- Proposed Master Planned Area
- Fish Habitat Area
- Vegetation Management Watercourses v1.3 (SO >= 4)

Draft Precincts

- Environmental Management precinct
- Infrastructure and Supply Chain Corridors precinct
- Interface precinct
- Marine Infrastructure precinct
- Marine precinct
- Marine services and recreation precinct
- Port Industry and Commerce precinct

PLAN ISSUE:

Issue	Date	Description	Drawn	Checked
A	10/08/2017	Preliminary Draft	MC	SM
D	6/04/2018	Preliminary Draft	MC	SM

0 2 4 6 8 km

Universal Transverse Mercator GDA 1994 MGA Zone 56 1:150,000 @ A3

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PORT OF TOWNSVILLE

Address - Port of Townsville, Townsville 6/04/2018 8671 E 05 FHA B

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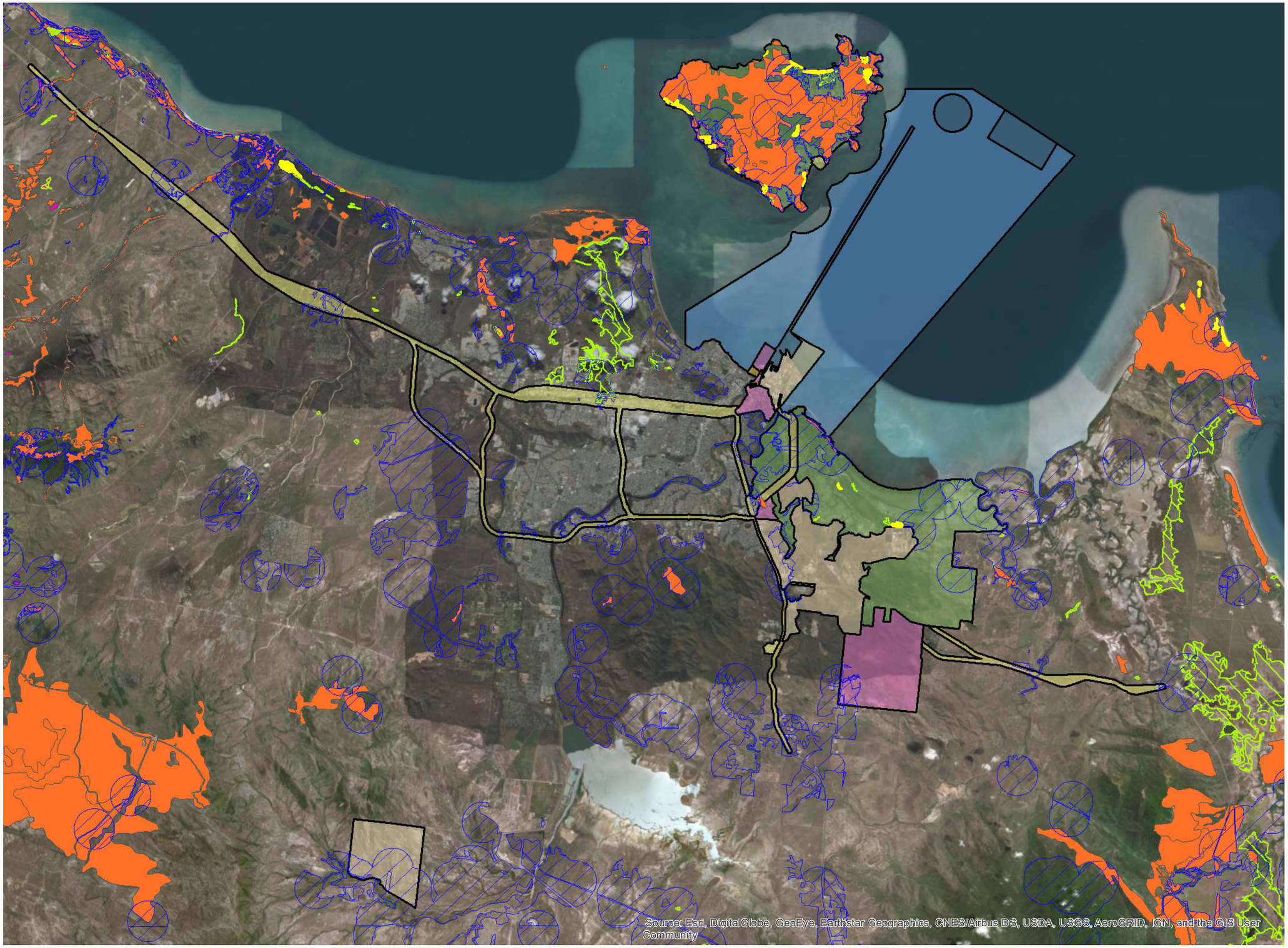
7. TERRESTRIAL VALUES SUMMARY (ECOLOGICAL AREAS)



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Layer Sources: QLD GIS Layers (QLD Gov. Information Service 2016), Aerial (ArcMap Base Map)

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LEGEND

- Proposed Master Planned Area
- EPBC Threatened Ecological Communities
- Vegetation Management - Wetlands
- Vegetation Management - Essential Habitat

Regional Ecosystems

Vegetation Management status

- Category A or B area containing endangered regional ecosystems
- Category A or B area containing of concern regional ecosystems

Draft Precincts

- Environmental Management precinct
- Infrastructure and Supply Chain Corridors precinct
- Interface precinct
- Marine Infrastructure precinct
- Marine precinct
- Marine services and recreation precinct
- Port Industry and Commerce precinct

PLAN ISSUE:

Issue	Date	Description	Drawn	Checked
A	10/08/2017	Preliminary Draft	MC	SM
E	4/07/2018	Ammended	MC	SM

0 2 4 6 8 10 km

Universal Transverse Mercator GDA 1994 MGA Zone 56 1:190,000 @ A3

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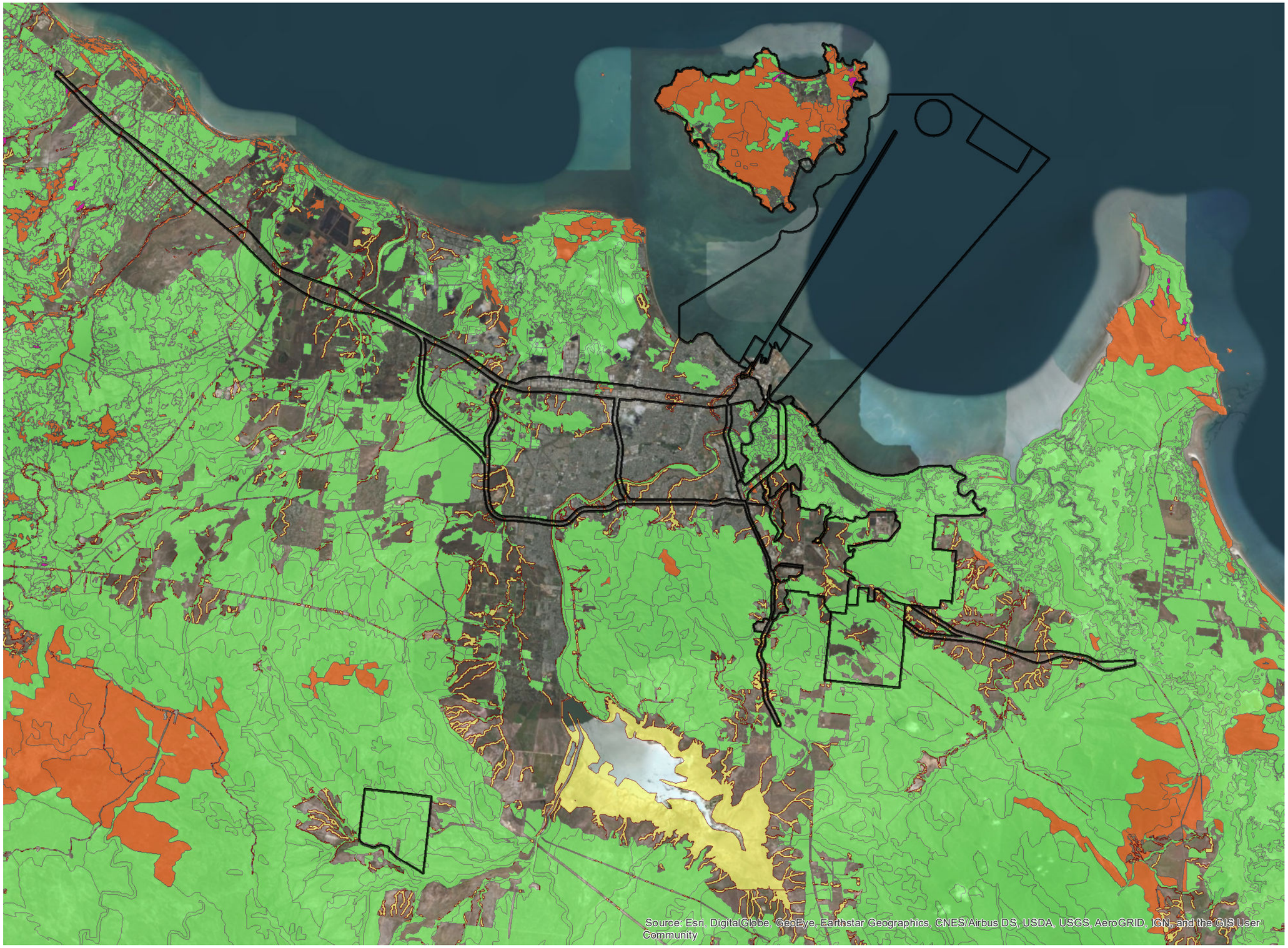
PORT OF TOWNSVILLE

Address - Port of Townsville, Townsville 4/07/2018 8671 E 07 Terrestrial EVs C

Queensland Government

8. TERRESTRIAL VALUES SUMMARY (ECOLOGICAL AREAS - REGIONAL ECOSYSTEMS)



NOTES
This plan was prepared as a desktop assessment tool.
The information on this plan is not suitable for any other purpose.
Property dimensions, areas, numbers of lots and contours and other physical features shown have been compiled from existing information and may not have been verified by field survey. These may need verification if the development application is approved and development proceeds, and may change when a full survey is undertaken or in order to comply with development approval conditions. No reliance should be placed on the information on this plan for detailed design or for any financial dealings involving the land. Saunders Havill Group therefore disclaims any liability for any loss or damage whatsoever or howsoever incurred, arising from any party using or relying upon this plan for any purpose other than as a document prepared for the sole purpose of accompanying a development application and which may be subject to alteration beyond the control of the Saunders Havill Group. Unless a development approval states otherwise, this is not an approved plan.

Layer Sources: QLD GIS Layers (QLD Gov. Information Service 2016), Aerial (Google 2017)

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LEGEND

Proposed Master Planned Area

Regional Ecosystems mapping

Category A or B area containing endangered regional ecosystems

Category A or B area containing of concern regional ecosystems

Category A or B area that is a least concern regional ecosystem

Category C area containing endangered regional ecosystems

Category C area containing of concern regional ecosystems

Category C area that is a least concern regional ecosystem

Regulated Vegetation

Category R area - *Reef regrowth watercourse vegetation*

PLAN ISSUE:

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A	10/08/2017	Preliminary Draft	MC	SM
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0 2 4 6 8 10 km

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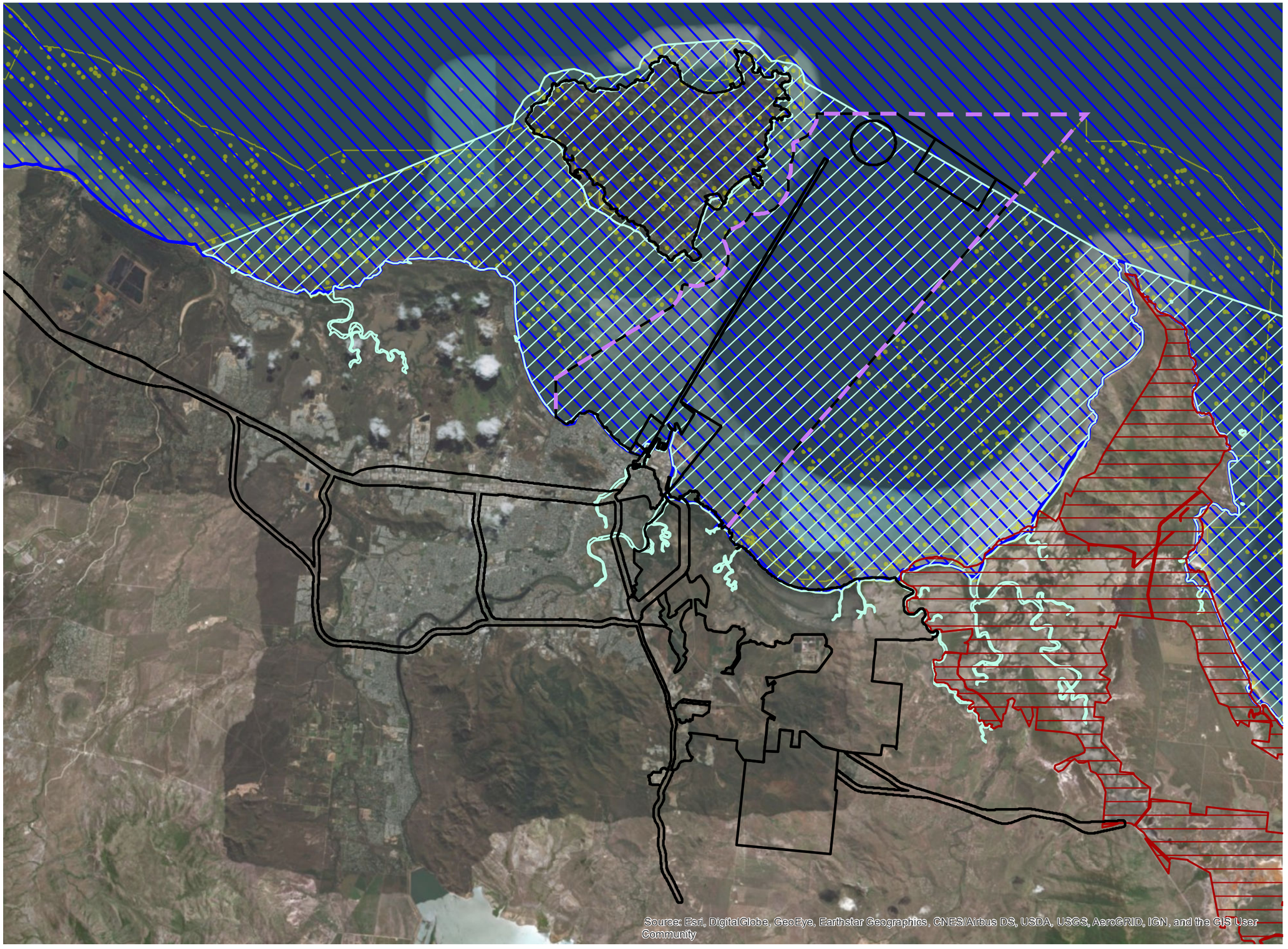
9. MARINE PROTECTED AREAS



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LEGEND

- Proposed Master Planned Area
- Great Barrer Reef Marine Park zoning boundary - State
- GBR Marine Park boundary (Note - Commonwealth and State Marine Parks share same boundary)
- Ramsar wetland
- Dugong Protection Areas
- World Heritage Area

PLAN ISSUE:

Issue	Date	Description	Drawn	Checked
A	10/08/2017	Preliminary Draft	MC	SM
D	6/04/2018	Ammended	MC	SM

0 2 4 6 8 km

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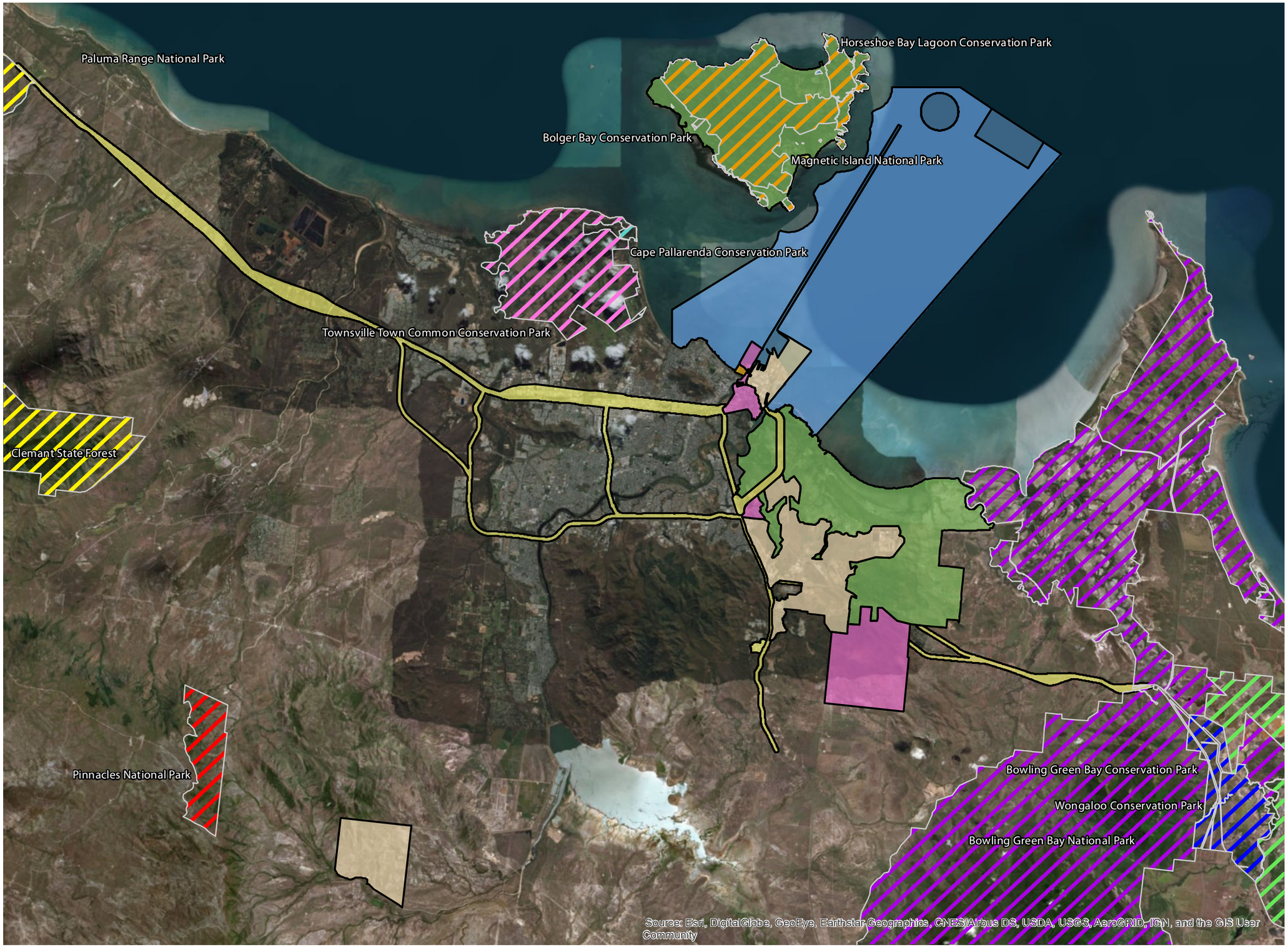
10. TERRESTRIAL PROTECTED AREAS



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LEGEND

- Proposed Master Planned Area

Draft Precincts

- Environmental Management precinct
- Infrastructure and Supply Chain Corridors precinct
- Interface precinct
- Marine Infrastructure precinct
- Marine precinct
- Marine services and recreation precinct
- Port Industry and Commerce precinct

Protected Areas Estate

- Bolger Bay Conservation Park
- Bowling Green Bay Conservation Park
- Bowling Green Bay National Park
- Cape Pallarenda Conservation Park
- Clemant State Forest
- Horseshoe Bay Lagoon Conservation Park
- Magnetic Island National Park
- Pinnacles National Park
- Townsville Town Common Conservation Park
- Wongaloo Conservation Park

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Note: Protected Areas Estate includes National Parks, Conservation Parks and State Forests

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0 2 4 6 8 10 km

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3.3. Outstanding Universal Value

Using the methodology developed to determine the local expression of OUV (Adaptive Strategies 2017) an analysis was undertaken as part of the EBR (Advisian, 2016) to identify the presence and local expression of OUV within the priority Port of Townsville proposed MPA and surrounds. The EBR analysis has been used as the basis for the current OUV assessment in this risk assessment with updates made to reflect new information identified through identification of EVs as well as recent changes made to the OUV methodology to incorporate a local statement of integrity.

For a World Heritage Property to be considered to have OUV, it must:

- Meet one or more of the ten World Heritage criteria listed in the Guidelines (UNESCO 2016)
- Meet the conditions of integrity and/or authenticity (noting that authenticity is not relevant to the GBR as a natural area)
- Have an adequate protection and management system.

3.3.1 World Heritage Criteria

For a property to be listed, it must meet one or more of the following World Heritage criteria:

- Criterion (i) represent a masterpiece of human creative genius
- Criterion (ii) exhibit an important interchange of human values, over a span of time or within a cultural area of the world, on developments in architecture or technology, monumental arts, town-planning or landscape design
- Criterion (iii) bear a unique or at least exceptional testimony to a cultural tradition or to a civilization which is living or which has disappeared
- Criterion (iv) be an outstanding example of a type of building, architectural or technological ensemble or landscape that illustrates (a) significant stage(s) in human history
- Criterion (v) be an outstanding example of a traditional human settlement, land-use, or sea-use which is representative of a culture (or cultures), or human interaction with the environment especially when it has become vulnerable under the impact of irreversible change
- Criterion (vi) be directly or tangibly associated with events or living traditions, with ideas, or with beliefs, with artistic and literary works of outstanding universal significance. (The Committee considers that this criterion should preferably be used in conjunction with other criteria)
- Criterion (vii) contain superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance
- Criterion (viii) be outstanding examples representing major stages of earth's history, including the record of life, significant on-going geological processes in the development of landforms, or significant geomorphic or physiographic features
- Criterion (ix) be outstanding examples representing significant on-going ecological and biological processes in the evolution and development of terrestrial, fresh water, coastal and marine ecosystems and communities of plants and animals.
- Criterion (x) contain the most important and significant natural habitats for in-situ conservation of biological diversity, including those containing threatened species of OUV from the point of view of science or conservation.

The GBRWHA meets four of the ten World Heritage criteria: Criterion (vii), Criterion (viii), Criterion (ix) and Criterion (x).

The analysis of the local expression of the OUV criteria determined the level of contribution of local environmental attributes to the OUV of the World Heritage Area (WHA). The assessment of contribution utilised information on local presence and assessed the importance in the context of the World Heritage listing criteria. From this a determination of contribution to OUV has been made at one of four levels:

- Not present
- Minor contribution: The attribute is present however it occurs in low abundance or singularly and:
  - is not essential to the sustainability of the attribute (e.g. substantial breeding population)
  - is not recognised as a key feature of the GBRWHA
  - is not included in the retrospective statement of OUV
  - is not iconic, unique or a high quality example of the attribute.
- Moderate contribution: The attribute occurs in moderate abundance or across a moderately large area but are not the prime occurrence or representation of the attribute within the GBR. The attribute does however represent a feature for which the GBR was listed as World Heritage.
- Significant contribution: The attribute represents locally important examples of the attribute relative to the nature of the attribute across the GBR. Such an attribute may be specifically referred to within the retrospective statement of OUV or defined by other legislation, planning instrument or values assessment (e.g. GBR Outlook Report). The occurrence of the attribute locally is a prime example of the features mentioned in the retrospective statement of OUV.

The local expression of the OUV in the proposed MPA and surrounding areas is summarised in **Table 7** and is based on the assessment carried out in section 8 of the EBR as well as additional information obtained through desktop assessment and stakeholder consultation.

Table 7: Summary of local expression of OUV within and surrounding the proposed master planned area

Category	Local attribute	Relevant OUV criteria and contribution classifications[1]				Key environmental values
		vii[2]	viii[3]	ix[4]	x[5]	
Coral reefs	String of reef structures including fringing reefs	**Min**	**Mod**	**Min**	-	Coral reefs are present fringing Magnetic Island and between Magnetic Island and Townsville.
	Hard and soft corals	**Mod**	-	-	-	Reef communities comprised of hard corals exist around Magnetic Island, at Middle Reef and at Virago Shoal (located between Magnetic Island and Cape Pallarenda). The Cockle Bay reefs, located on the south-western side of Magnetic Island, are characterised by species adapted to high siltation and turbidity associated with the coastal processes of Cleveland Bay.
	Coral species diversity and extent	-	**Mod**	-	**Mod**	Extensive hard coral reef communities exist around Magnetic Island, at Middle Reef and at Virago Shoal. Cleveland Bay also supports a network of nearshore reefs, which have different levels of inter-connectivity and habitat structure. Based on mapping from the GBRMPA, the total area of reef habitat in Cleveland Bay is approximately 987 hectares.

Category	Local attribute	Relevant OUV criteria and contribution classifications[1]				Key environmental values
		vii[2]	viii[3]	ix[4]	x[5]	
	Coral spawning	**Min**	-	-	-	Annual coral spawning occurs at these sites, generally in October. The size and density of inshore reefs does not result in the mass spawning events more commonly associated with mid shelf and outer reefs.
Fish	Significant spawning aggregations of many fish species	**Min**	-	-	-	Cleveland Bay provide habitat for a variety of fish species. Protected fish habitat areas have been established in Cleveland Bay and in the nearby Bohle River and Bowling Green Bay
Marine megafauna	Dugong	-	-	-	**Sig**	Cleveland Bay is recognised as dugong habitat and is a declared Dugong Protection Area (DPA). The Bay is thought to be an important dugong habitat at a regional scale as it contains some of the most extensive and diverse seagrass meadows in north Queensland.
	Species of whales	-	-	-	**Min**	Humpback whale adults and calves have occasionally been recorded within the coastal waters of Cleveland Bay, usually during August- September.
	Migrating whales	**Min**	-	-	-	Humpback whale adults and calves have occasionally been recorded within the coastal waters of Cleveland Bay, usually during August-September.
	Species of dolphins	-	-	-	**Mod**	A number of dolphin species are known or likely to occur in Cleveland Bay, including: Australian snubfin dolphin, Indo-Pacific humpback dolphin, Common dolphin and the Bottlenose dolphin.
Marine turtles	Breeding colonies of marine turtles	**Min**	-	-	**Min**	A number of species of sea turtles, including the endangered Loggerhead, Leatherback and Olive ridley species, frequent Cleveland Bay and surrounding beaches. Green turtles are the most common. Magnetic Island beaches are known to be regular nesting sites for Green turtles, however, the density is low in comparison the other sites within the GBR
	Green turtle breeding	**Min**	-	-	**Min**	
	Nesting turtles / Turtle rookeries	**Min**	-	-	**Min**	
Seagrass and macroalgae	Seagrass	**Sig**	-	-	**Sig**	Cleveland Bay contains some of the most extensive and diverse seagrass meadows in north Queensland. Eight species of seagrass have been recorded in Cleveland Bay with the most extensive beds located in the eastern portion of Cleveland Bay, with smaller beds occurring off the Strand, Kissing Point, Pallarenda Beach and some bays fringing Magnetic Island.
	Beds of *Halimeda* algae	-	-	**Min**	-	Halimeda beds occur around Cockle Bay (southern Magnetic island), but at the time of

Category	Local attribute	Relevant OUV criteria and contribution classifications[1]				Key environmental values
		vii[2]	viii[3]	ix[4]	x[5]	
						2012 reef surveys, were not found to be significant
Shorebirds and migratory seabirds	Breeding Colonies of seabirds	**Min**	-	-	-	A variety of seabirds are present in the marine areas, however, large colonies of nesting seabirds don't occur within or surrounding the proposed MPA.
	Diversity of shorebirds and migratory birds	**Sig**	-	-	**Sig**	Shorebirds frequently occur within the proposed MPA, while feeding, resting or overflying from one area to another. Intertidal areas provide foraging habitat for many species of wading birds and migratory bird species, particularly the east bank of Ross River and at Cape Cleveland.
Flora, fauna and ecological communities	Plant species diversity and endemism	-	-	-	**Min**	There is only very minor representation of plant species of conservation significance present within the proposed MPA, including several threatened mangrove species and *Croton magneticus*, which is recorded from Magnetic Island. One threatened ecological community (TEC) has the potential to be present within the proposed MPA - Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions – which is listed as endangered under the EPBC Act. Mapping suggests it is present on Magnetic Island and the TSDA.
	Vegetated mountains	**Min**	-	-	-	Rugged mountains rise abruptly from the coastal plain and include the mountains of Castle Hill and Mount Stuart, as well as the landform of Magnetic Island.
	Mangroves	-	**Min**	-	-	Substantial mangrove stands occur in Cleveland Bay and around Magnetic Island. The Bowling Green Bay Ramsar wetland is located to the south of Townsville. The site is significant for its extensive and diverse complex of coastal wetlands which are mostly coastal plain covered in tidal mudflats, mangrove forest and salt marshes.
	Mangrove species diversity	-	-	-	**Sig**	
	Vast mangrove forests	**Sig**	-	-	-	
Continental islands	Continental islands and green vegetated islands	**Mod**	**Min**	-	-	Magnetic Island is a continental island with rocky granite headlands, sandy bays, covered with open eucalypt woodlands and surrounded by coral reefs.
	Vegetation of the continental islands	**Mod**	-	**Min**	-	
Geomorphology	Spectacular sandy beaches	**Min**	-	-	-	Magnetic Island has a number of sandy beaches and bays.

Category	Local attribute	Relevant OUV criteria and contribution classifications[1]				Key environmental values
		vii[2]	viii[3]	ix[4]	x[5]	
	Coral Reefs	-	-	**Min**	-	Fringing coral reefs, Magnetic Island and coastal areas represent geomorphic processes, including ancient volcanic activity.
	Connectivity: cross-shelf, longshore and vertical	-	-	**Min**	-	The offshore areas of Cleveland Bay form part of the larger longshore connections within the GBR lagoon.
	Processes of geological and geomorphic evolution		**Min**			Townsville is underlain by Quaternary-age alluvium and colluvium sediments, which in turn overlie basement geology comprising Late-Palaeozoic age Granite. The near surface lithology comprises Holocene sediments more than 12,000 years old, including silts, mud and sand described as coastal tidal flats, mangrove flats and saltpans.
	Unique and varied seascapes and landscapes		**Min**			Cleveland Bay provides a variety of seascapes and landscapes including open water, continental islands, sand beaches, mudflats, mangroves and vegetated hills and headlands.
Marine and terrestrial fauna	Diversity supporting marine and terrestrial fauna species (global conservation significance)	-	-	-	**Mod**	Cleveland Bay, Magnetic Island and surrounding areas provide habitat for a large range of species and ecosystems, the most notable being the habitats of the Bowling Green Bay Ramsar wetland area and the migratory birds that use this area.
Total species diversity	Marine diversity and including molluscs, fish, sponges and many others	-	-	**Mod**	-	Common benthic flora and fauna are present in the marine areas. The intertidal areas are a key habitat for many species of invertebrates (e.g. crabs, shell fish, worms).

1 Min - Minor
Mod - Moderate
Sig - Significant
2 vii - Aesthetic values and superlative natural phenomena
3 viii - Ongoing geological processes
4 ix - Ecological and biological processes
5 x - Biodiversity conservation

The evaluation of key attributes expressed within and surrounding the proposed MPA determined that there are several attributes present that provide a moderate or significant contribution to the OUV. These attributes are:

Significant contribution

- Important populations of migratory shorebirds occurring in wetland and intertidal and roosting locations primarily within the Bowling Green Bay Ramsar wetland and areas east of the Ross River.
- Substantial quantity **and** species diversity of mangrove stands occur in Cleveland Bay and around Magnetic Island that provide nursery habitat for many fish and invertebrate species as well as nesting habitat for birds and animals. A total of 12 species of mangrove have been recorded
- Cleveland Bay contains some of the most extensive and diverse seagrass meadows in north Queensland. Eight species of seagrass have been recorded in Cleveland Bay

- Cleveland Bay is recognised as dugong habitat and is a declared Dugong Protection Area.

Moderate contribution

- The broader areas of Cleveland Bay, Magnetic Island and Cape Cleveland provide a contribution to the superlative natural beauty of the WHA
- Magnetic Island is a notable example of a green vegetated island
- Intertidal areas are a key habitat for many species of invertebrates (e.g. crabs, shell fish, worms) adding to the total species diversity of the WHA
- The reef communities comprised of hard corals around Magnetic Island, at Middle Reef and at Virago Shoal contribute to OUV as do the intertidal areas, which are a key habitat for many species of invertebrates (e.g. crabs, shell fish, worms)
- A number of dolphin species are known or likely to occur in Cleveland Bay, including: Australian snubfin dolphin, Indo-Pacific humpback dolphin, Common dolphin and the Bottlenose dolphin.

The findings indicate that the OUV of the GBRWHA is expressed within the priority Port of Townsville proposed MPA through the presence of important populations of shorebirds and occurrences of mangroves, seagrass and to a lesser extent coral reefs and island and seascapes.

3.3.2 Local contribution to the OUV

A particular attribute may be present in a particular location and be of importance due to its locally high value in terms of representation, appreciation or biological contribution; while in another area the same attribute may be of lower value as it does not provide the same ecological function, representation of heritage values or amenity. The influences of human appreciation, geography, climatic distribution, geology, oceanography and ecological life cycles all influence where and at what level a particular attribute may contribute to OUV in a particular location. For the purposes of maintaining integrity of the property all of the attributes identified as providing a local expression of the OUV have relevance, however, it is primarily those that contribute significantly that will be most important in terms of maintaining the OUV of the GBR.

As identified in Table 7, five attributes present in the study area that provide a significant contribution to the OUV are:

- Important populations of migratory shorebirds occurring in wetland and intertidal and roosting locations primarily within the Bowling Green Bay Ramsar wetland and areas east of the Ross River. Nearby intertidal shores are known for shorebird occurrence, providing a key roosting and feeding habitat. Many of those bird species that occur are listed as threatened or migratory species
- Substantial mangrove stands occur in Cleveland Bay and around Magnetic Island that provide nursery habitat for many fish and invertebrate species as well as nesting habitat for birds and animals. The mangrove communities provide vital protection from strong winds, tidal surges and heavy rainfalls associated with cyclones and also trap tide-borne sediments and help control coastal erosion
- A high diversity of mangroves have also been identified within the proposed MPA. A total of 12 species of mangrove have been recorded
- Cleveland Bay contains some of the most extensive and diverse seagrass meadows in north Queensland. Eight species of seagrass have been recorded in Cleveland Bay with the most extensive beds located in the eastern portion of Cleveland Bay, with smaller beds occurring off the Strand, Kissing Point, Pallarenda Beach and some bays fringing Magnetic Island. The seagrass habitats within this region are of high

ecological significance and provide a regionally important foraging habitat for threatened species such as dugongs and turtles and economically important fishery species

- Cleveland Bay and Bowling Green Bay are recognised as dugong habitat and declared Dugong Protection Areas (DPAs). Cleveland Bay is thought to be an important dugong habitat at a regional scale.

Maintaining these attributes along with the ecosystem process that support them is essential to maintaining the local integrity of the WHA.

3.3.3 Statement of Integrity

The GBR was inscribed on the World Heritage List in 1981 in recognition of its OUV. The World Heritage Committee listed the GBR as it met four of the natural criteria as outlined in sections 3.3.1.

At the time of listing the GBR was recognized for its unparalleled size and current good state of conservation across the property. At the time of inscription it was felt that to include virtually the entire GBR within the property was the only way to ensure the integrity of the coral reef ecosystems in all their diversity. Despite ongoing pressures the GBR maintains these values to the present day.

The GBR was nominated on the basis of management for conservation and reasonable multiple use, and the inscription recognises long standing uses. This include port operations and shipping; commercial, recreational and Indigenous fisheries; recreation; tourism; and activities on islands, coastal lands and catchments within, adjacent to or discharging into the waters of the GBR.

The Port of Townsville

The GBRWHA includes waters seaward of the low water mark, including those within the Port of Townsville, however, the port is located outside of the Queensland and Commonwealth marine park boundaries. The area of the port within the WHA constitutes less than 0.1% of the total 348,000 square kilometres of the GBRWHA.

The port is located within a diverse region containing a range of urban communities, major industrial precincts and EVs of international importance. The port was established in the 19th century and was a major trading port at the time the GBR was included in the list of World Heritage properties in 1981. While the area is a long established operating industrial area and port as well as a large city, the proposed MPA and surrounding areas contain many natural environmental features of varying value and condition.

3.3.4 Potential for Alteration or loss of integrity

The potential for the integrity of the WHA to be altered or lost locally due to additional infrastructure proposed at the priority Port of Townsville is considered extremely low. The basis for this is outlined below against the key considerations relating to integrity - which concern integrity as a measure of wholeness and intactness.

Includes all elements necessary to express its Outstanding Universal Value

- The Port of Townsville was established well before the GBR was included on the list of World Heritage properties. The ports maritime areas were recognised as forming part of the WHA in the retrospective statement of OUV.
- The function and use of the port areas will remain substantially the same.

- The risk assessment process will identify master planning outcomes that are unlikely to alter ecosystem functions and connections; recognising that existing environmental approval processes and approvals will ensure impacts are appropriately considered.
- Attributes making a significant contribution to the local expression of OUV will be maintained and protected through identified master planning objectives.
- The overall diversity of the property will not be affected.

Is of adequate size to ensure the complete representation of the features and processes which convey the property's significance

- The World Heritage boundary is established at the low water mark. The master plan will not alter the World Heritage boundary in any substantial manner. Small areas of land reclamation may occur primarily to ensure capital dredged material is reused and is not disposed of at sea.
- The extent of the priority port within the WHA will not increase aside from widening and deepening of the existing navigation channels and associated reclamation areas.

Suffers from adverse effects of development and/or neglect

- Land and maritime use of the area is not altering significantly – specific areas have been designated for port-related activities, avoiding where possible environmental values
- A specific Environmental management precinct has been identified over the mainland of Magnetic Island to identify potential impacts from port-related development
- While a large marine precinct is proposed, infrastructure within the WHA is proposed to be kept to smaller Marine infrastructure and Marine services and recreation precincts. Current and future development within these precincts would include:
    - Marine service and recreation - To provide for coastal dependent development other than port infrastructure, including a range of maritime services, marina, related commercial activities and public use activities that in order to function must be located in tidal waters or be able to access tidal water
    - Marine infrastructure - To provide for development and maintenance of existing and future port infrastructure, including berths, offshore disposal areas, anchorages and access channels.

  All development will be required to be appropriately designed and located to manage potential impacts on EVs within and surrounding the proposed MPA. Many of the habitats that support OUV attributes occur in the Marine precinct where limited development would occur therefore reducing the potential to impact on OUV attributes.
- The master plan would not alter the need to conduct detailed environmental impact assessment for any proposed development. Any development that may impact significantly on World Heritage values will still be required to be assessed and approved by the Commonwealth Minister for the Environment under the EPBC Act, as has recently been the case with the Townsville PEP. Impacts to the integrity of the WHA would form part of any such assessment

- The master plan will include an EMF to identify EVs and, where necessary, adaptively control any related impacts. Additionally, a number of measures have been identified to improve environmental outcomes relating to monitoring and maintenance of EVs contributing to the OUV which are likely to be controlled and conditioned by existing regulatory processes; however, they can apply to all environmental values
- The port overlay provides a potential avenue for risk management measures outlined in section 7 of this document.

4. Port growth scenarios

4.1. Growth scenarios identification

An analysis of infrastructure and supply chain requirements associated with future port development has been carried out by GHD as part of the master planning process. The scope of this assessment included:

- Review of existing infrastructure and supply chain activities/industries currently supported at the priority Port of Townsville
- Analysis of current and future trade growth through the port and the development of three trade growth scenarios out to 2050
- Assessment of future infrastructure and supply chain requirements under each trade growth scenario.

Assumptions used in the development of each scenario, modelled additional throughput resulting from each growth scenario and likely additional infrastructure requirements to meet demand in each growth scenario are outlined in **Table 8**. Additional infrastructure requirements have been separated into marine and land based infrastructure to assist in the assessment of environmental risk. Refer to GHD (2017) for further information.

It should be noted that the growth scenarios represent a range of development scales and are not intended to predict specific infrastructure requirements or economic growth. The purpose of using a range of scenarios is to determine the type, scale and form of impacts so that the likelihood of risk can be assessed and that the point at which mitigation may be required can be determined.

4.2. Activities Resulting in Impacts

The growth scenarios may result in the following overarching development types that have the potential to impact on EVs:

Marine

- Construction of the reclamation area including rock revetments to create bunds
- Dredging associated with widening and deepening of the Platypus and Sea Channels
- Placement of dredged material in bunded areas as reclamation fill
- Release of tailwater into the marine environment from reclamation areas
- Construction of additional berths and breakwater including capital dredging to provide access
- Construction of a new cruise ship terminal on the northern side of Ross Creek and associated dredging.

Land

- Commencement of operations of the POTL Granitevale quarry to supply rock for new port infrastructure
- New development at the port
- Additional land requirements in the TSDA to support storage of break bulk cargoes as well as dry and liquid bulk cargos including the potential for pipelines/conveyors within the TEARC alignment
- Duplication of the TPAR to accommodate increased traffic between the TSDA and port
- Construction and operation of the TEARC.

It is noted that marine infrastructure requirements do not exceed those proposed by the Townsville PEP aside from additional dredging and infrastructure for a new cruise ship terminal if required. Environmental risks associated with these activities are addressed in section 6 of this report.

Table 8: Summary of Growth scenarios

Growth Scenario	Growth Assumptions	Modelled Throughput	Infrastructure Requirements
1	▪ Growth in the Port's existing trade (exports and imports) ▪ Development of the currently known North West Minerals Province (NWMP) projects (including phosphate and excluding coal and uranium), northern Queensland irrigated agriculture projects and ethanol plant projects; ▪ Part capture of contestable agricultural export and household goods import container trades; ▪ The Townsville nickel refinery remains closed; ▪ Magnetite remains uneconomical to export; ▪ Central Galilee Basin coal development starts with fuel and project cargo routed via the Port of Townsville.	Maximum port throughput of 10.2 million tonnes per annum (mtpa) comprising: ▪ Liquid Bulk 2.1 mtpa; ▪ Dry Bulk 6.2 mtpa; ▪ Break-bulk 0.5 mtpa; ▪ Containers 1.2 mtpa (or 112,000 TEU); ▪ Livestock (Cattle) 0.2 mtpa.	Additional infrastructure requirements resulting from growth scenario 1 include: <u>Marine</u> ▪ Capital dredging for widening of the existing Platypus and Sea Channels ▪ Storage of capital dredged material within a new reclamation ▪ Construction of the reclamation area <u>Land</u> ▪ Use of TSDA land for storage of empty containers ▪ Increased usage of the TPAR to transport materials between the TSDA and port ▪ Granitevale quarry to commence operations to supply rock for reclamation revetment walls
2	▪ Further growth in the port's existing trade (exports and imports); ▪ Further development of currently known NWMP projects (including phosphate and excluding coal and uranium), northern Queensland irrigated agriculture projects and ethanol plant projects; ▪ Further part capture of contestable agricultural export and household goods import container trades; ▪ The Townsville nickel refinery re-opens; ▪ Existing stock-piled magnetite becomes economic to export;	Maximum port throughput of 18.4 mtpa comprising: ▪ Liquid Bulk 2.4 mtpa; ▪ Dry Bulk 13.6 mtpa; ▪ Break-bulk 0.5 mtpa; ▪ Containers 1.7 mtpa (or 186,000 TEU); ▪ Livestock (Cattle) 0.2 mtpa.	Additional infrastructure requirements resulting from growth scenario 2 include: <u>Marine</u> ▪ Capital dredging for widening of the existing Platypus and Sea Channels ▪ Construction of additional berths and associated capital dredging of a berth pocket to facilitate shipping access ▪ Construction of the reclamation area (increased area compared to scenario 1 to accommodate additional dredge material) ▪ Storage of capital dredged material within a new reclamation area ▪ Construction of a breakwater to protect the new berths <u>Land</u> ▪ Granitevale Quarry to commence operations to supply rock for breakwater, reclamation revetment walls and berths

Growth Scenario	Growth Assumptions	Modelled Throughput	Infrastructure Requirements
	▪ Central Galilee Basin coal development is expanded with two mines being supplied with fuel and project cargo via the Port of Townsville.		▪ Additional land requirements in the TSDA to support storage of break bulk cargoes ▪ Duplication of the TPAR to accommodate increased traffic between the TSDA and port ▪ TEARC to become operational
3	Scenario 3 adds additional dry bulk exports routed through the Port of Townsville to scenario 2. It has the following overall assumptions: ▪ Up to a combined 10 mtpa of additional dry bulk export projects are assumed to occur together with some additional export liquid bulk.	Maximum port throughput of 28.3 mtpa comprising: ▪ Liquid Bulk 2.8 mtpa; ▪ Dry Bulk 23.1 mtpa; ▪ Break-bulk 0.5 mtpa; ▪ Containers 1.7 mtpa (or 186,000 TEU); ▪ Livestock (Cattle) 0.2 mtpa.	Additional infrastructure requirements resulting from growth scenario 3 include: <u>Marine</u> ▪ Capital dredging for widening and deepening of the existing Platypus and Sea Channels ▪ Construction of new berths (in addition to Growth Scenario 2) and associated capital dredging of berth pockets to facilitate access ▪ Construction of a new cruise ship terminal on the northern side of Ross Creek and associated dredging. ▪ Construction of the reclamation area (increased area compared to scenario 2 to accommodate additional dredge material) ▪ Storage of capital dredged material within a new reclamation ▪ Construction of a breakwater to protect the new berths <u>Land</u> ▪ Granitevale quarry to commence operations to supply rock for breakwater, reclamation revetment walls and berths ▪ Additional land requirements in the TSDA to support storage of break bulk cargoes as well as dry and liquid bulk cargos including the potential for pipelines/conveyors within the TEARC alignment ▪ Duplication of the TPAR to accommodate increased traffic between the TSDA and port ▪ TEARC to become operational

5. Existing requirements and management measures

Queensland's ports operate within a comprehensive regulatory framework and must satisfy a number of local, state and Commonwealth government planning and other regulatory requirements. Master planning is just one component of the regulatory and compliance framework in which ports operate and is intended to complement this system, rather than remove or duplicate any existing processes.

A review of existing statutory requirements, planning instruments, and operational environmental management measures considered relevant to controlling risks to EVs was carried out. This review also considered inconsistencies, information and management gaps, and implementation timeframe gaps likely to occur over the master planning timeframe.

5.1. Environmental assessment framework

5.1.1 Sustainable Ports Development Act 2015

The Ports Act establishes a legislative framework to balance the protection of the GBR with the development of the state's major bulk commodity ports. Through the Ports Act the Queensland Government is implementing key port-related actions of the Reef 2050 Plan, a joint Australian and Queensland Government plan to manage the long-term protection of the GBR.

The Ports Act responds to United Nations Educational, Scientific and Cultural Organisation World Heritage Committee's (UNESCO WHC) recommendation on the GBR, ensuring the OUV of the GBRWHA is an intrinsic consideration in future port development.

The purpose of the Ports Act is to provide for the protection of the GBRWHA through the management of port-related development in and adjacent to the area. This is achieved through the following measures:

- concentrating port development in the GBRWHA to the priority ports
- mandating the preparation of master plans and port overlays for each priority port to establish a long-term vision for future port development
- restricting capital dredging for the development of new or expanded port facilities to within regulated port limits of the priority ports
- prohibiting sea-based disposal of capital dredged material from port-related development within the GBRWHA and Commonwealth and state marine parks
- mandating the beneficial reuse of port-related capital dredged material.

The Ports Act provides requirements for the content of the master plan, which include the long-term state interests, strategic vision, objectives and desired outcomes. The proposed MPA identifies land and marine areas critical to the effective operation of the port network and manages future port-related development and the protection of the GBRWHA.

5.1.2 Commonwealth and state environmental impact assessment processes

Commonwealth and state environmental impact assessment processes under the EP Act, the *State Development and Public Works Organisation Act 1971* (SDPWO Act) and the EPBC Act currently provide for rigorous assessment of major projects to ensure development occurs in a sustainable manner and unacceptable impacts on EVs do not occur. Project approval requirements almost always include the implementation of environmental monitoring, management and offset arrangements.

The EP Act also provides a framework for regulating environmentally relevant activities (ERAs) through a permit and licensing system. This system ensures ERAs manage, enhance or protect EVs through conditions or enforcement processes.

The Air EPP (2008), Noise EPP (2008) and Water EPP (2009) outline thresholds, indicators and objectives for enhancing or protecting environmental values, as well as providing a framework for consistent and informed decisions about managing ongoing environmental impacts.

5.1.3 State and local planning processes

The Planning Regulation 2017 identifies that certain development must be assessed against the State Development Assessment Provisions (SDAP) to ensure impacts on matters including transport corridors, coastal development, native vegetation, marine plants and fish habitat areas are subject to rigorous assessment and conditioning before commencing.

In addition to SDAP requirements there are a range of planning instruments that apply to port-related development within the proposed MPA including:

- The Townsville City Plan *under the Planning Act 2016*
- The TCWPDA Development Scheme under the *Economic Development Act 2012*
- The TSDA Development Scheme under the SDPWO Act
- The Port of Townsville Land Use Plan (POTLUP) under the *Transport Infrastructure Act 1994*.

These instruments regulate the location and types of development in selected areas to ensure efficient land use and infrastructure optimisation to avoid or minimise environmental impacts in accordance with the avoid-mitigate-offset environmental hierarchy.

All environmental legislative requirements will continue to apply to development proposals in the MPA.

5.1.4 Cumulative impact assessment and management

The management of system-wide cumulative impacts on the GBR is important to ensure continuous improvement in managing threats to the OUV of the WHA. The protection of the GBR and cumulative impact management is a central concept in the Queensland environmental assessment and planning systems including through environmental impact assessment processes, and state and local planning processes. In addition, most significant port-related development projects will require referral and assessment under the EPBC Act which includes the assessment of cumulative impacts.

The Ports Act manages the cumulative impact of port development on the GBR at a strategic level by limiting port development across the GBRWHA to four priority ports. The MPA can also be used to limit cumulative impacts by

using a precinct based approach to concentrate port-related development in locations that avoid areas of environmental significance and buffer sensitive receptors from port-related development.

5.1.5 Summary

A number of instruments are currently in place that provide a general framework for assessing and managing environmental impacts, such as the Townsville City Plan, Great Barrier Reef Marine Park Zoning Plan and various Commonwealth and state legislation. Any development that may impact significantly on MNES will continue to be required to be assessed and approved by the Commonwealth Minister for the Environment under the EPBC Act.

Other instruments manage specific areas within the proposed MPA, such as the POTLUP (administered by POTL), the TSDA Development Scheme (administered by Department of State Development, Manufacturing, Infrastructure and Planning) and the TCWPDA Development Scheme (administered by Economic Development Queensland and TCC through delegated powers).

Commonwealth and state legislation applicable to the priority Port of Townsville proposed MPA is summarised in **Table 9** along with how these will minimise environmental risks associated with the future development of the Port of Townsville. Planning instruments specific to land within the proposed MPA such as the Townsville City Plan, TSDA Development Scheme and POTLUP are summarised in **Table 10**.

Where legislation and planning instruments within the existing environmental assessment framework will mitigate risks to EVs associated with the port growth scenarios a specific management measure is noted within the 'management measures' column of Tables 9 and 10. These measures will be utilised as 'existing management requirements' in the risk assessment process (Section 6 of this document).

5.2. Approved Projects

A number of projects considered in the port growth scenarios have gained approval through local, state and Commonwealth environmental assessment processes outlined in section 5.1. Specific projects include:

- The Townsville Port Expansion Project
- Townsville Port Access Road
- Granitevale Quarry.

Approvals for these projects impose conditions to minimise, avoid and offset impacts to EVs. The most relevant conditions have been identified and will be utilised as 'existing management requirements' in the risk assessment process (Section 6 of this document).

5.2.1 Townsville Port Expansion Project

POTL has proposed an expansion of the Port of Townsville to accommodate future trade growth to 2040. The Townsville PEP involves channel deepening, widening, and development of a new outer harbour, wharves, reclamation, and associated infrastructure to support new berths.

The PEP has been assessed under separate Commonwealth and state environmental assessment processes, both requiring the development of an EIS. The Commonwealth EIS focuses on addressing significant impacts on MNES and the OUV of the GBRWHA as these matters are regulated by the EPBC Act.

An Additional Information to the Environmental Impact Statement (AEIS) dated October 2016 was prepared in response to submissions and the request to provide further clarification on matters raised during the public consultation period of the EIS.

The objectives of the EIS and AEIS are to provide:

- An understanding of the project and existing environmental, social and economic values and potential impacts that may occur and measures to be adopted to mitigate potential adverse impacts
- A framework for assessing impacts of the project in view of legislative and policy provisions
- A mechanism for sustainable environmental outcomes, including control measures and strategies to be implemented during the construction and operational phases through environmental management plans (EMPs).

EPBC Act Approval

MM1 – Referral and controlled action assessment under the EPBC Act

MM2 – Offset must be provided under the EPBC Act for any significant residual impact on MNES

The port expansion was approved under section 130(1) and 133 of the EPBC Act on 2 February 2018. The EPBC Act approval is subject to a range of conditions that must be implemented to comply with the approval, including environmental offsets. Management and monitoring requirements of most relevant to the risk assessment from the evaluation report include:

<u>Dredge Management Plan</u>

MM3 – EPBC Act approval conditions for the PEP require approval and implementation of a Dredge Management Plan

A Dredge Management Plan (DMP) must be submitted for approval by the minister before each stage of dredging. The DMP must include the following measures:

- Objectives and criteria to:
    - avoid or minimise disturbance to seagrasses and corals;
    - avoid or minimise impacts to marine fauna from dredge vessels;
    - avoid or minimise the uncontrolled release of dredged material into the marine environment;
    - avoid the release of potentially contaminated sediments into the marine environment;
    - manage risks associated with extreme weather events; and
    - avoid vessel accidents and oil spills.
- A program to monitor water quality before, during and after dredging to validate predicted impacts including the outcomes of dredge plume and coastal processes modelling.
- A seagrass and coral monitoring program to assess the condition of communities with the potential to be affected by dredging. The program must continue after dredging has ceased to detect lethal or sub-lethal impacts.
- A peer reviewed adaptive management program to monitor and manage impacts from dredging. This must include measures to modify dredging activities to avoid impacts to corals or seagrass.

<u>Construction Environmental Management Plan</u>

MM4 – EPBC Act approval conditions for the PEP require approval and implementation of a Construction EMP

A CEMP must be submitted for approval by the Minister including measures to mitigate impacts to MNES resulting from construction of the reclamation area. The CEMP must include management measures to avoid and minimise impacts to MNES, as well as programs for monitoring the integrity of the reclamation area and tailwater.

Marine Environmental Management Plan

MM5 - EPBC Act approval conditions for the PEP require approval and implementation of a MEMP

A Marine Environmental Management Plan (MEMP) must be submitted for approval by the Minister including measures to mitigate impacts to MNES resulting from any activities in the marine environment. This includes management measures to mitigate impacts from noise, artificial light, vessel strike, invasive marine species, vessel accidents, pile driving operations, storm-water runoff, chemical and fuel management, and accidental release of waste and/or other contaminant spills as well as a program to monitor invasive marine species.

Inshore Dolphin Monitoring Plan

MM6 - EPBC Act approval conditions for the PEP require approval and implementation of an Inshore Dolphin Monitoring Program

An IDMP) must be submitted for approval by the minister. The IDMP must include the following measures:

- Baseline information on the distribution, abundance and habitat use of listed dolphin species in Cleveland Bay and adjacent non-impacted sites;
- A monitoring program to measure and detect changes to the population and behaviour of listed dolphin species throughout construction, pile driving operations and dredging activities, and a sufficient period of time post construction; and
- Develop monitoring methodologies that allow for the monitoring of listed dolphin species in Cleveland Bay and nearby non-impacted control site(s), over sufficiently long-term timescales to be able to determine trends.

Offset Management Strategy

MM7 - EPBC Act approval conditions for the PEP require approval and implementation of an Offset Management Strategy

An Offset Management Strategy (OMS) is required to compensate for residual significant impacts of the action and to achieve a net benefit to the outstanding universal value of the GBRWHA. The OMS will include details on:

- How the person taking the action will achieve a reduction of sediment entering the marine environment from the Burdekin, Ross and Black river basins, based on the amount of fine sediment released into the surrounding environment from the dredging program and/or impacts to on sensitive habitat sites, including seagrasses or corals
- Details of how the person taking the action will compensate for the loss if residual impacts to listed dolphin species in Cleveland Bay from the proposed action are identified, and
- Details of how the person taking the action will compensate for the loss if seagrasses are identified in the dredge footprint or reclamation area.

It is noted that all of the above management measures are specifically required to address management and offsetting of impacts to MNES.

Statement of Reasons

In February 2018 the then Commonwealth Department of Environment and Energy (now Department of the Environment) released a statement of reasons (SOR) to support its decision to approve the PEP with conditions having considered all matters required to be considered under the EPBC Act. The SOR outlined that the PEP would not have unacceptable impacts on MNES provided that the activities were undertaken in accordance with the conditions of approval and consistent with the mitigation and offset measures.

Coordinator General's Evaluation Report

The PEP was approved with conditions by the Coordinator-General (CG) on 29 September 2017. A detailed breakdown of the assessment process and imposed conditions is provided in the Coordinator-General's Evaluation Report (CGER) on the EIS.

The CG identified a number of management measures which POTL will be required to implement to comply with the approval. Management and monitoring requirements of most relevance to the risk assessment from the evaluation report include:

- Once construction has been completed ongoing uses and development of the reclamation area will be regulated by the POTLUP. Specific management requirements of the land use plan are outlined in **Table 10**.
- Tailwater releases from the reclamation area are to be managed through the project's Environmental Authority (EA) conditions which include a Tailwater Management Plan. Measures include only allowing releases from a single controlled discharge point and continuous monitoring for physical water quality parameters such as pH.

MM8 – CG approval conditions for the PEP requires a Tailwater Management Plan including allowing releases from a single controlled discharge point and continuous monitoring

- Establishment of a Technical Advisory Committee (TAC) to oversee dredging works for the project. The TAC would include subject matter experts to review water quality and ecosystem health data with responsibility for setting water quality objectives, including thresholds and limits, and determining management responses.
- A model validation water quality monitoring program is to be implemented following the commencement of capital dredging and tailwater discharge to validate model findings.
- A Marine Megafauna Management Plan (MMMP) must be developed in consultation with DES and an appropriately qualified underwater noise consultant. Specific management measures to be implemented through the MMMP include:
    - Maintaining a fauna lookout while dredging
    - A 300 metre exclusion zone around any fauna spotted
    - Use of turtle deflectors on the draghead of the trailing suction hopper dredger (TSHD)
    - Limited use of light during night works
    - Gradual commencement ('ramp up') of water based noise activities such as pile driving.

MM9 – CG approval of the Port Expansion Project requires a MMMP including measures to reduce the risk of interaction with marine megafauna.

- A reactive water quality monitoring program will be implemented during dredging to monitor water quality near sensitive receptors such as coral reefs. The monitoring program will be reviewed and endorsed by the TAC and include:

- Appropriate triggers and corrective actions to sensitive coral and seagrass ecosystems
- A water quality monitoring program to ensure the water quality is maintained below levels at which adverse effects on marine and coastal ecosystems may occur
- A benthic monitoring program to detect impacts to coral, seagrass and benthic ecosystems and track recovery following dredging activities.

MM10 – CG approval conditions require a reactive water quality monitoring program to be implemented to enable management actions to be identified which will ensure water quality is maintained so adverse effects on marine and coastal ecosystems are avoided.

A further recommendation from the CG is for POTL to work with TCC to identify any impacts to coastal processes and beach systems and the need for any beach nourishment and coastal protection works.

It is noted that offsets are not specified by a condition of the CGER however it should also be noted that the Commonwealth Department of the Environment (DOE) has considered offsets as part of the assessment of impacts to MNES. The CG ER recommends that offsets are imposed through conditions for future state applications subsequent to the AEIS so as there is no overlap with Commonwealth requirements.

PEP - Environmental management framework

MM11 – Implementation of PEP environmental management framework

An EMF has been developed for the PEP to deliver the successful implementation of management and mitigation measures, and appropriate monitoring and assessment of onsite environmental management. The intent of the framework is to achieve successful whole-of-project environmental performance. Through the framework POTL are required to implement a number of plans and controls to manage all stages of the PEP project. Plans to be implemented include the following:

- Construction Environmental Management Plan (CEMP)
- Operational Environmental Management Plan (OEMP)
- Dredge Management Plan (DMP)
- Maritime Operations Management Plan, and
- Vessel Traffic Management Plan.

The three Management Plans (MPs) of most relevance to the risk assessment are the CEMP, OEMP and DMP. Each of these MPs identify specific environmental management procedures related to the construction and operation of the PEP. It is noted that these plans will be updated to reflect the conditions from the CGER and EPBC Act approval. Key management measures outlined in these documents are summarised below.

Construction Environmental Management Plan

Environmental value	Management measure
Marine Ecology	▪ Implement light management procedures to reduce light spill to the marine environment ▪ Implement waste management procedures ▪ Implement control measures to reduce the likelihood and impact of contaminant spills ▪ Implement control measures to reduce the likelihood and impact of turbidity ▪ Manage pile driving operations to reduce the likelihood of impacts on marine megafauna, such as soft-start procedures and employing observation/exclusion zones

Environmental value	Management measure
Terrestrial Ecology	▪ Enforce site speed limits to reduce fauna collision ▪ Limit unnecessary vehicle use near sensitive areas to prevent disturbance to sensitive receptors ▪ Implement procedures on the handling and reporting of injured fauna ▪ Maintain plant equipment and machinery ▪ Orientate light and noise emitting equipment away from foreshore ▪ Implement control measures to manage noise risks to fauna outside of the Port ▪ Implement weed and animal pest management on site
Air Quality, Noise and Vibration	▪ Implement Reactive Monitoring Program and trigger values ▪ Reduce fuel combustion emissions through management measures such as turning engines off while parked on site, regular tuning, modifying or maintaining equipment, plant and machinery to reduce visible smoke and emissions, etc ▪ Implement dust control measures including erecting localised windbreak barriers on activities, using water sprays on stockpiled and disturbed areas, using a wheel wash, covering vehicle loads, etc ▪ Stabilise vacant land areas ▪ Maintain vacant fill areas between PEP development stages so as to minimise dust nuisance ▪ Proactively notify any affected residents and commercial operators of planned construction activities ▪ Restrict piling activities to prescribed daytime work hours ▪ Implement strategies to avoid megafauna interactions e.g. undertake visual monitoring during piling activities, soft starts etc. ▪ Consider noise mitigation when operating construction equipment ▪ Install an acoustic enclosure around noisy plant if it is fixed in a stationary location for one week or longer and likely to adversely affect sensitive receptors ▪ Operate a complaints management system
Visual Amenity	▪ Manage lighting and design to reduce light spill from the site in so far as consistent with existing operational Health and Safety and Land Use codes ▪ The new site will be fenced and access controlled in a similar manner to the existing port access arrangements ▪ Maintain a high standard of site cleanliness and presentation ▪ Progressive stabilisation of reclaimed land and reducing disturbed and exposed areas
Cultural Heritage (Aboriginal and Non-Aboriginal	▪ Engage in ongoing consultation with Aboriginal parties in accordance with the Cultural Heritage Management Plan ▪ Cease work immediately if any cultural heritage sites, materials or values are discovered during development

Operational Environmental Management Plan

Environmental Value	Management Measure
Marine Ecology	▪ Implement stormwater and waste management measures ▪ Implement light management procedures to reduce light spill to the marine environment ▪ Manage any spills of dangerous goods in accordance with relevant incident / emergency plans ▪ Include new operational areas in routine monitoring programs
Terrestrial Ecology	▪ Implement control measures to reduce the likelihood and impact of pests ▪ Manage lighting to reduce light spill away from foreshore

Environmental Value	Management Measure
	▪ Put in place and enforce site speed limits to reduce the risk of fauna collision ▪ Maintain plant equipment and machinery in good working order to reduce potential noise impacts from equipment running inefficiently
Air Quality, Noise and Vibration	▪ To reduce fugitive dust clean up spills of dry products, contain potentially dust generating cargos in common user areas and implement appropriate controls to prevent material being tracked onto sealed roads. ▪ To reduce fuel combustion emissions turn engines off while parked on site, regularly tune, modify or maintain equipment, plant and machinery to reduce visible smoke and emissions and manage vehicle movement. ▪ Where possible undertake noisy activities during daytime working hours to reduce any offsite impacts ▪ Incorporate operational Noise Management into site-specific EMP's to ensure that port operators are aware of the need to control environmental noise to sensitive receptors ▪ Equipment management includes equipment has high-quality mufflers installed, equipment is well maintained and fitted with adequately maintained silencers, machines that are used intermittently are shut down in the intervening periods and silencers and enclosures are kept intact
Visual Amenity	▪ Manage lighting to reduce direct light spill from the site ▪ Implement the waste, water quality, air quality and ecological management measures
Cultural Heritage (Aboriginal and European)	▪ Engage in ongoing consultation with Aboriginal parties in accordance with the CHMP_ ▪ Cease work immediately if any cultural heritage sites, materials or values are discovered during development and notify parties.

Dredge Management Plan

Environmental value	Management measure
Marine Ecology	▪ Marine mammal and turtle observation and response procedures including the application of a 300 metre exclusion zone will be implemented during dredging activities. Dredging operations shall be stopped when marine megafauna are observed within 300 metres of the operating dredge until the animals have moved further than 300 metres or have not been sighted for 15 minutes. ▪ A lookout will be maintained for cetaceans while the dredge sails between the dredging and reclamation areas. In the event that a cetacean is sighted, vessel speed and direction will be adjusted to avoid impact on the observed individual (within the safety constraints of the vessel). ▪ Marine mammal and turtle observation during night dredging will be undertaken using appropriate lighting. ▪ Turtle deflectors will be mounted on the draghead of the TSHD. ▪ TSHD dredge pumps will only be started when the draghead is close to the seafloor (not while lowering pipe). ▪ The TSHD dredge pump will be stopped as soon as possible after the completion of dredging. ▪ Light levels from the dredging works will be limited to those lights that are necessary for the safe operation of the vessel, for spotting marine megafauna at night, and the health and safety of those on board. ▪ Any injury to marine megafauna shall be recorded and reported immediately ▪ The preferred time to undertake capital dredging of the channels is in the autumn and winter months from April to September. The months of October through to the end of March are

Environmental value	Management measure
	proposed to be avoided in terms of TSHD capital dredging of the channels for the following reasons: o to minimise impacts to key coral spawning periods in the region and identified spawning periods for Magnetic Island corals after the full moon in October o to limit impacts to seagrass during a potentially important period for growth; and o to reduce impacts to corals that may have lower resilience in the summer months (due to the greater frequency of extreme weather events).
Marine Water Quality	▪ Design and implement a Reactive Dredging Monitoring Program including suspended sediment, seagrass and coral monitoring. Management of the dredging will respond to the results of real time monitoring with responses to exceedances including modifying the timing of dredging, relocating the location of dredger and suspending dredging until results fall to within acceptable limits. ▪ Design and implement a tailwater monitoring program ▪ If turbidity/TSS exceeds the performance criteria in the tailwater ponds, the control measures on site will be promptly reviewed to ensure that all reasonable and practicable measures are being taken in terms of both pond operation and the hydrologic and sediment loading on the tailwater ponds
Air Quality, Noise and Vibration	▪ Ensure that engines and equipment on board the dredge are properly maintained in good working order ▪ Maintain and operate all equipment on board the dredge in a safe and efficient manner

5.2.1 Townsville Port Access Road

The TPAR connects the Bruce Highway and Flinders Highway (Stuart Bypass) to the Port. The TPAR passes through areas of high ecological significance including wetland and mangrove habitat.

The TPAR was approved under the EPBC Act on 22 November 2007 (EPBC 2003/1011). The EPBC Act approval is subject to a range of conditions that must be implemented to comply with the approval. Construction of the TPAR was completed in 2010 however as noted in the port growth scenarios (section 4) there is potential for this road to be duplicated. Because of this a number of the management and monitoring requirements are still relevant to the assessment. These include:

- The requirement for a design plan identifying how the alignment will maintain stream flows and fish passage and minimise impacts on vegetation and breeding/roosting sites of listed threatened and migratory species. The plan also had to identify how runoff from the road and bridges would be captured and treated to avoid indirect impacts.
- Creation of a Biodiversity Management Plan to establish and manage a 530 hectare reserve in the intertidal areas surrounding the TPAR. The reserve is required to be protected for conservation purposes in perpetuity.

The above plans ensure the TPAR corridor was sited and designed to minimise impacts to EVs and that future infrastructure must remain within the corridor to avoid impacts on conservation areas that must be protected in perpetuity.

MM12 - EPBC Act approval conditions for the TPAR required the alignment to minimise impacts on vegetation and habitat of listed threatened and migratory species, manage runoff to avoid indirect impacts and protect surrounding intertidal areas in perpetuity as a conservation reserve.

5.2.2 Granitevale Quarry

Rock required for the construction of revetment walls associated with expansion of the port will be sourced from the Granitevale Quarry, which is located at Pinnacles, approximately 30 kilometres south west of the Port of Townsville. POTL has obtained all relevant approvals from Commonwealth, state and local Governments to commence and operate the quarry. The conditions of the approval specify a number of management measures to protect EVs within and surrounding the site. These include:

- Implementation of several management plans, including:
  - Site Based Management Plan
  - Weed Management Plan
  - Bushfire Management Plan
  - Environmental Management Plan (Construction)
  - Quarry Design and Planning Report
  - Revegetation and Remediation Plan
  - Stormwater and Erosion Sediment Control Plan
  - Stormwater Quality Management Plan
  - Black-throated Finch Management Plan.
- Vegetation Clearing restrictions and conservation of an area along Central Creek
- Transportation of material to the port must be carried out along the haulage route specified under the approval which generally follows an unsealed council road, Riverway Drive, the Bruce Highway and the TPAR.

The strict conditions and management requirements imposed on quarry operations will ensure risk of impact to EVs are avoided and minimised.

MM13 – Approval conditions for the Granitevale Quarry restrict vegetation clearing, require habitat for listed species to be retained and require implementation of several management plans.

5.3. Ongoing Operations

There are a number of activities with the potential to impact on EVs within and surrounding the MPA that are carried out as part of day to day operations of the port. In particular annual maintenance dredging and use of anchorages may result in short term impacts to a number of values. These are activities described below as well as relevant documents managing implementation.

5.3.1 Maintenance Dredging

To keep the channel passable, the Port of Townsville has been carrying out maintenance dredging at least once a year since 1883 to allow continued shipping access. Maintenance dredging is different to capital dredging, which involves the excavation of previously undisturbed areas of sea bed to expand or create new shipping channels, berths or swing basins. Maintenance dredging involves the removal of sediments that have built up in existing channels, berths, approaches, and associated swing basins. It is a vital component of operations in most Queensland ports. By law, the POTL is required to maintain a safe shipping channel into the waters off Townsville to ensure an

efficient port services the community of the region. If dredging was not allowed to happen, ships would be prevented from accessing the port and operations would stop.

All maintenance dredging activities are highly regulated and require compliance with a number of codes and guidelines prior to receiving approval from the relevant state and Commonwealth departments. Two recent documents of most relevance to maintenance dredging at the Port of Townsville are the Environmental Code of Practice for Dredging and Dredged Material Management and the *Maintenance Dredging Strategy for Great Barrier Reef World Heritage Area Ports* (2016).

In August 2016, Ports Australia released the *Environmental Code of Practice for Dredging and Dredged Material Management*. The code was developed by Ports Australia in consultation with members (including POTL), port customers, regulators and associated industry representatives. Ports Australia members have endorsed the principles contained in the code and are committed to conducting activities consistent with the code when planning and undertaking dredging programs. These principles reflect the principles of ecologically sustainable development as outlined in the EPBC Act.

The DTMR also released the *Maintenance Dredging Strategy for Great Barrier Reef World Heritage Area Ports* in 2016. The Strategy has been developed in consultation with the port authorities, environmental groups and regulators from the Queensland and Australian Governments and is aimed at improving transparency and consistency, and better managing the impacts of maintenance dredging. Key principles guiding the future implementation of maintenance dredging in the GBRWHA include:

- GBRWHA ports will develop Long-term Maintenance Dredging Management Plans (LMDMPs)
- GBRWHA ports will include future maintenance dredging requirements in port infrastructure planning to ensure relevant EVs and potential impacts are properly understood, and to assist in minimising the need for maintenance dredging
- Maintenance dredging will be limited to that required to maintain the approved dimensions of port infrastructure to ensure efficient shipping access and the optimisation of port operations
- An increase in channel or berth dredging areas and depths will only occur as a result of approved capital dredging following assessment of implications of future maintenance dredging needs and placement options
- LMDMPs include an assessment of beneficial reuse options for dredged material management to determine if viable opportunities exist
- Applications to place material at sea will continue to abide by existing National Assessment Guidelines for Dredging 2009 (or any subsequent versions) and regulatory processes
- GBRWHA ports will apply adaptive management strategies and continual improvement processes to ensure that leading practice management is maintained.

The Port of Townsville's approved offshore Dredged Material Placement Area (DMPA) is the current site for the placement of maintenance dredged material has been in use for more than 40 years. It is located to the east of Magnetic Island and north-west of Cape Cleveland, outside of the GBRMP. The DMPA will continue to be used for maintenance dredged material placement as part of the ongoing operations of the Port of Townsville, subject to Commonwealth and state approvals. It is noted that it is anticipated annual maintenance dredging volumes will increase by 14% as a result of the proposed port expansion.

MM14 - Maintenance dredging and dredge material disposal is managed through Long-term Maintenance Dredging Management Plans and in accordance with permits conditions issued under Sea Dumping Act and GBRMP Act (where jurisdictionally relevant).

5.3.2 Anchorages

There are 13 Port of Townsville anchorage positions identified in the Port Procedures and Information for Shipping – Port of Townsville (MSQ, 2016). One of these anchorages is located within the port limits, while the remaining twelve are located in a cluster immediately outside the port limits.

The GBRMPA Environmental Management Strategy: Identification of Impacts and Proposed Management Strategies associated with Ship Anchorages in the Great Barrier Reef World Heritage Area Environmental Management Strategy identified several management options specific to the Port of Townsville. These were:

- Continue current practices of ship anchoring
- Improve current anchorage management practices to protect EVs
- Consider implementing designated anchorage areas, particularly recognising that future ship call growth will be possibly underpinned by bulk carriers requiring anchorage
- Investigate impacts of ship anchorages on aesthetic values at the Port of Townsville
- The extent to which the existing controls could be applied to manage risk was reviewed and evaluated by stakeholders.

The strategy found the current practices of ship anchoring were considered to have minimal future impact for the environment and other users beyond that which has already occurred. Future need for additional anchorages at the Port of Townsville is considered low. However, if additional anchorages are required in the future they will be identified and managed in accordance with the environmental management strategy.

5.3.3 Port operational environmental management

POTL operates under an Environmental Management System (EMS) accredited to International Organisation for Standardisation (ISO) 14001:2015 which is an internationally recognised externally audited EMS standard. The EMS is the system through which POTL controls its activities, products and services that have the potential to cause environmental impacts. POTL also has an Environmental Policy which outlines what the port intends to achieve through the implementation and ongoing improvement of its performance via the EMS.

The EMS is an important tool that assists POTL to monitor and continuously improve its environmental performance and ensure compliance with legislative requirements. The EMS helps structure the integration of environmental management into daily operations, long term strategic planning as well as linkage to other management systems (e.g. the Quality and Safety Management Systems). It provides for a robust system to consistently quantify, monitor and control impacts and ensures legislative compliance and maintenance for recordkeeping.

POTL also undertakes seagrass, air and water quality monitoring to ensure compliance with legislative requirements and to protect sensitive environments around the port. These programs also allow the port to better understand and enhance their knowledge of our surrounding environment and review and improve environmental management measures.

Table 9: Summary of the key existing statutory requirements

Legislation	Summary of Relevance to MPA	Environmental Values Protected	Management Measures
Commonwealth Legislation			
Environment Protection and Biodiversity Conservation Act 1999	An action which has, will have or is likely to have an impact on a MNES will require some level of impact assessment under the EPBC Act.	Relevant MNES are; • GBRMP • GBRWHA • GBR National Heritage Place • Listed wetlands of international importance • Listed threatened and migratory species (including habitats)	**MM1 – Referral and controlled action assessment under the EPBC Act** Requirement to assess development under the EPBC Act to show significant impacts to MNES will be avoided, minimised and offset. Assessment must address direct, indirect and cumulative impacts associated with the development. Approvals may be granted under the EPBC Act subject to conditions. If the development will have a serious or irreversible impact on MNES it may be considered clearly unacceptable and not granted approval. **MM2 – Offset must be provided under the EPBC Act for any significant residual impact on MNES** Impacts to MNES that can't be avoided are required to be offset using the EPBC Environmental Offsets framework.
Environment Protection (Sea Dumping) Act 1981	A Sea Dumping Permit is required to authorise the disposal of all dredged material at sea unless it has a beneficial use (i.e. reclamation or habitat creation).	All marine and estuarine environmental values	**MM15 – Permit for dredged material disposal at sea under the *Environment Protection (Sea Dumping) Act 1981*** All disposal of dredged material in Commonwealth waters requires assessment and approval under the Sea Dumping Act. For maintenance dredging there are requirements to apply for annual or long-term sea dumping permit for dredged material disposal including detailed assessment of potential impacts to the disposal site and areas influenced by sediment plumes from dredging and disposal. Permit conditions require Dredge Management Plans, water quality monitoring programs and other measures.
Historic Shipwrecks Act 1976	Protection of historic shipwrecks that are registered or are at least 75 years old	Non-Indigenous cultural heritage – e.g. historic shipwrecks	**MM16 – Review and assess impacts to historic shipwrecks under the *Historic Shipwrecks Act 1976*** Potential impacts to heritage values need to be addressed in any approval required within the marine precinct.
Protection of the Sea (Prevention of Pollution from Ships) Act 1983	Discharge of waste into the ocean from ships. Implements the MARPOL Convention and is given effect in Queensland by the *Transport Operations*	All marine and estuarine environmental values	**MM17 – Discharge of any waste into the ocean must meet the requirements of the Protection of the Sea (Prevention of Pollution from Ships) Act 1983 and the *Transport Operations (Marine Pollution) Act 1995* (Qld)**

Legislation	Summary of Relevance to MPA	Environmental Values Protected	Management Measures
	(Marine Pollution) Act 1995 (Qld) (TOMP Act)		The TOMP *Act* prescribes marine pollution controls and Prevention documentation. The Australian Maritime Safety Authority administers the Protection of the Sea legislation and is responsible for ensuring industry's compliance with it.
Biosecurity Act 2015	Regulates all international vessels and goods entering Australian territory (12 nautical miles offshore). Vessels subject to biosecurity control must only enter Australia at ports that have been determined as first points of entry.	All marine and estuarine environmental values	**MM18 - All international vessels must undertake, record and prove that all cargo and ballast water is low risk to address the *Biosecurity Act 2015*.** Biosecurity officers audit Maritime Arrival Reporting including details of cargo, vessel movements, and the management of all ballast water.
State Legislation			
State Development and Public Works Organisation Act 1971	If the project/activity is declared a Coordinated Project, an EIS or impact assessment report (IAR) is required and the project approved by the Coordinator-General.	All environmental values	**MM19 – EIS assessment and approval requirements under the SDPWO Act** Requirement to prepare EIS under the SDPWO Act in accordance with EIS Terms of Reference (ToR). EIS/IAR assessment and approval conditions requiring management plans, offsets (where required) and other measures. Assessment must address direct, indirect and cumulative impacts associated with the development.
	The SDPWO Act establishes the TSDA Development Scheme as a statutory instrument to regulate development within its boundaries.	Addressed in Table 10.	Addressed in Table 10.
Planning Act 2016	Forms the overarching framework for Queensland's planning and development system and sets out categories of assessable development. The Planning Act (PA) gives effect to a range of planning instruments such as, the State Planning Policy, Regional Plans and local planning instruments. The PA is supported by the Planning Regulation 2017 that provides detailed guidance regarding the application of the PA.	All environmental values	**MM20 – Impacts would require assessment and approval against the relevant State codes** The SDAP defines the state's interest in development assessment and contains the matters considered when assessing a development application. When submitting an application, the applicant is required to demonstrate how it complies with the applicable state code(s) in SDAP. A number of State codes may apply to areas within and adjacent to the MPA, including: ▪ State code 8 – Coastal development and tidal works ▪ State code 9 - Great Barrier Reef wetland protection areas ▪ State code 11 – Removal, destruction or damage of marine plants

Legislation	Summary of Relevance to MPA	Environmental Values Protected	Management Measures
			▪ State code 12 - Development in a declared fish habitat area ▪ State code 14 - Queensland heritage ▪ State code 16 – Native vegetation clearing ▪ State code 22 – Environmentally relevant activities
	Townsville City Plan applies as a local planning instrument under the PA. TCC is the Assessment Manager for assessable development within the TCC local government area	Addressed in Table 10.	Addressed in Table 10.
Sustainable Ports Development Act 2015	Restricts new port development to within proposed MPA which cannot include the GBRMP. Restricts capital dredging for development of new or expansion of existing port facilities to within the proposed MPA. Prohibits the sea-based placement of dredged material within the GBRWHA generated by port-related capital dredging Mandates the beneficial reuse of port-related capital dredging (e.g. land reclamation)	All marine and estuarine environmental values	**MM21 – Master planned areas and precincts ensure direct impacts to significant EVs are minimised and/or avoided.** Capital dredging restrictions and beneficial reuse of dredged material mandated within the Ports Act
	Requires the preparation and implementation of a master plan through the port overlay	All	PMMs and port overlay requirements.
Transport Infrastructure Act 1994	Establishes the regulatory framework under which port authorities plan for future development of strategic port	Air, noise and water quality	Addressed in Table 10.

Legislation	Summary of Relevance to MPA	Environmental Values Protected	Management Measures
	land (SPL) and the identification of port limits. Port land use plans (LUP) are required for all port authorities for the planning and development of SPL and provides the regulatory tool for development assessment of future activities on SPL. The LUP must identify the current and future SPL and proposed which involves integrating port facilities and valuable features, relevant to LUP, including environmental values.		
Aboriginal Cultural Heritage Act 2003	Establishes a 'duty of care' to take all reasonable and practicable measures to avoid harm to Aboriginal cultural heritage. Establishes a cultural heritage register and database to collect and register information about sites, items, places and values. Cultural Heritage Management Plan (CHMP) approval is a statutory requirement for projects in certain instances (e.g. project that requires approval under another Act, and that Act requires an environmental assessment or EIS).	Aboriginal cultural heritage values	**MM22 – A CHMP is required to address impacts to Aboriginal Cultural Heritage** CHMP required as part of EIS process under the EPBC Act, SDPWO Act and EP Act Required to be addressed as part of development assessment process where CHMP is stipulated as being required or chief executive of ACH Act is triggered as a concurrence agency **MM23 – Duty of care to avoid impacts on Aboriginal Cultural Heritage** Obligation on all persons to ensure compliance with the Cultural heritage 'duty of care' under section 23(1) at all times.
Biosecurity Act 2014	The *Biosecurity Act 2014* establishes a framework to regulate and control invasive plants and animals. Under the	Terrestrial and marine flora and fauna	**MM24 – Landowners must minimise the risks associated with invasive plants and animals under their control to meet the *Biosecurity Act 2014 (Qld)*** The Act categorises restricted matters (restricted plants and animals) into the following:

Legislation	Summary of Relevance to MPA	Environmental Values Protected	Management Measures
	act, land owners are responsible for taking all reasonable and practical steps to minimise the risks associated with invasive plants and animals under their control. This is known as the general biosecurity obligation (GBO).		▪ Category 1: must be reported to an inspector within 24 hours (includes Red Imported Fire Ants, amongst others) ▪ Category 2: must be reported within 24 hours to Biosecurity Queensland on 13 25 23. ▪ Category 3: must not be distributed either by sale or gift,or released into the environment. ▪ Category 4: must not be moved. ▪ Category 5: must not be kept. ▪ Category 6: must not be fed (animals). ▪ Category 7: Must be euthanised (animals).
Breakwater Island Casino Agreement Act 1984	Oversaw the reclamation and construction of the existing land peninsulas that contain The Ville Hotel and Casino Complex, the Townsville Entertainment Centre and the Mariner's North and marina facilities. Under the original Act, rights were also provided to the Breakwater Island Trust to obtain a further development lease, to later reclaim the area for development. Various further developments have been proposed, including most recently the Townsville Ocean Terminal.	Air, noise	Development is required to achieve building and design controls
Coastal Protection and Management Act 1995	Protection, conservation rehabilitation and management of the coastal zone, including its resources and biological diversity. Approval also required for coastal assessable development through the PA (e.g. tidal/prescribed tidal works, works completely or partly within in a Coastal Management District, Allocation of Quarry Material).	Social and Aboriginal and Torres Strait Islander cultural heritage values All marine and estuarine environmental values	**MM25 – Assessment against State Code 8: Coastal development and tidal works including capital dredging** Assessment against State Code 8 of the SDAP. Approval conditions requiring MPs and other management measures including offsets. Allocation of quarry material (dredged material) assessed under CPM Act.

Legislation	Summary of Relevance to MPA	Environmental Values Protected	Management Measures
Environmental Offsets Act 2014	Prescribes that the significant residual impacts of particular activities on prescribed environmental matters are to be addressed through the provision of environmental offsets. Applies to all assessable development under the SDAP and planning schemes.	All terrestrial and marine and estuarine EVs identified as a prescribed environmental matter	**MM26 – An offset must be provided under the *Environmental Offsets Act 2014* for any impacts to MLES or MSES resulting in a significant residual impact** Offsets must be provided for significant residual impacts to prescribed environmental matters as either Financial settlement offsets; Proponent-driven offsets (land-based offsets and/or deliver of actions in Direct Benefit Management Plans); or a combination of the above
Environmental Protection Act 1994	Establishes a general environmental duty to prevent and minimise environmental harm. Environmental Authority (EA) required to authorise the undertaking of an ERA (agricultural ERA, resource activity or prescribed activity). Establishes a Suitable Operator Register of persons or corporations who have been registered by DES as being suitable to carry out an ERA.	All terrestrial and marine and estuarine EVs affected by the development application	**MM27 – Assessment and approval of EAs and ERAs under the EP Act including meeting model operating conditions** All EAs and ERAs requires assessment of potential impacts to environmental values including MSES. Approval conditions require Management Plans, environmental monitoring and other management measures. Payment of financial assurance where an activity will result in significant disturbance of land. Many common ERAs such as extractive activities, have model operating conditions which aim to ensure the surrounding environment is protected from impact.
	Environmental Protection Policies (EPPs) (i.e. noise, air and water) provide a framework for assessing a project's compliance and minimising impacts on environmental values	Air and water quality, noise and vibration	**MM28 – Development must meet the requirements of the Noise, Air and Water EPPs** Approval conditions requiring Management Plans and other management measures.
	Assessment and management of contaminated land and approval needed to remove and dispose of contaminated soil	Terrestrial environmental values	**MM29 – Environmental impact assessment of disposal of contaminated material including dredged material under the *EP Act*** Assessment of applications for disposal permit with approval conditions requiring Management Plans and other measures.
Fisheries Act 1994	Management, use, development and protection of fish habitats and resources. Approval required for constructing or raising a waterway barrier (temporary or	Mangrove and Saltmarsh Communities Protected Areas – Fish Habitat Areas Fish and Fisheries	**MM30 – Assessment against State Code 11: Removal, destruction or damage of marine plants and 12: Development in declared fish habitat area** Development application for operational works assessed against State codes 11 and 12. Assessment must show a functional requirement for the development to be located in fish

Legislation	Summary of Relevance to MPA	Environmental Values Protected	Management Measures
	permanent), removal, destruction or damage of marine plants; works in a Fish Habitat Area (FHA) and aquaculture operations.	Seagrass and Macroalgae	habitat. Approval conditions requiring Management Plans and other management measures, including the provision of offsets (where required).
Forestry Act 1959	Management and use of state forests, including the management of pests, weeds and bushfire issues	Protected Areas	State forest management plan
Marine Parks Act 2004 (Qld)	The *Marine Parks Act 2004* provides a framework for the creation of marine parks and the protection of marine species. The Act creates zoning plans for multiple-use management and a permit system for activities within marine parks such as collecting marine products or commercial whale watching. The GBR Coast Marine Park was created under this Act. The GBR Coast Marine Park complements (in adjacent state waters) the GBR Marine Park created under the *Great Barrier Reef Marine Park Act 1975*.	All marine environmental values, including Protected Areas Mangrove and saltmarsh communities Seagrass and Macroalgae	**MM31 – Assessment of impacts to the GBR Coast Marine Park under the *Marine Parks Act 2004 (Qld)*** Depending on the zoning a permit may be required for activities such as: ▪ tourism activities ▪ construction of jetties and pontoons ▪ installation, operation and repair of structures ▪ any work such as repairs to structures ▪ dredging and dumping ▪ anchoring and mooring for an extended period Depending on the type of permit required the action may require environmental impact assessment and/or show a public benefit before it can be approved.
Nature Conservation Act 1992	Conservation, protection or management of wildlife, habitat or areas to ensure the survival of viable populations particularly endangered, vulnerable and near threatened (EVNT) species, and to identify and reduce or remove the effects of threatening processes.	Terrestrial threatened flora and fauna Protected areas	**MM32 – Permit must be obtained under the *NC Act* to remove any EVNT species** Clearing application assessed under NC Act. Clearing of EVNT species requires an Impact Management Plan, offsets (where applicable) and other measures before a permit can be obtained. Exempt clearing notifications assessed in accordance with NC Act Flora Survey Guidelines.

Legislation	Summary of Relevance to MPA	Environmental Values Protected	Management Measures
	Establishes mapped high risk 'Flora Survey Trigger Areas' in accordance with NC Act Flora Survey Guidelines. Approval required to clear native vegetation, tamper with an animal breeding place, interfere with a cultural or natural resource in a protected area or erecting a structure in a protected area.		
Queensland Heritage Act 1992	Provides for the conservation of Queensland's cultural heritage for the benefit of the community and future generations. Regulates development affecting the cultural heritage significance of state and local heritage places and as well as the provision of heritage management plans and agreements	Non-Indigenous cultural heritage values	**MM33 – Permit required for impacting on areas of non-indigenous heritage under the *Queensland Heritage Act 1992*** Development involving or adjacent to a State Heritage Place requires assessment against State Code 14 and approval conditions requiring non-Indigenous cultural heritage protection and management measures
Regional Planning Interests Act 2014	Regulates 'resource' and 'regulated' activities (as defined under the Act) to ensure the protection of areas of Queensland that are of regional interest, including living areas in regional communities, high quality agricultural areas, strategic cropping land and regionally important environmental areas	Social amenity	NA – the requirements do not apply until a regional plan is finalised. The North Queensland Regional Plan is currently being prepared.
Transport Operations (Marine Pollution) Act 1995	Regulates marine pollution from ships in Queensland's coastal waters. The Act is administered by Maritime Safety Queensland (MSQ) and complements the *Protection of the Sea (Prevention of*	Marine water quality Threatened flora and fauna	**MM34 – All ships operating in Queensland's coastal waters must carry pollution prevention documentation and cannot discharge pollutants.** All ships operating in Queensland's coastal waters must carry the applicable marine pollution controls and prevention documentation (for example, the Queensland Coastal Contingency

Legislation	Summary of Relevance to MPA	Environmental Values Protected	Management Measures
	Pollution from Ships) Act 1983, which regulates marine pollution in Australian waters.		Action Plan). It is an offence to discharge pollutants (either deliberately or negligently) into coastal waters with severe penalties applying.
Transport Operations (Marine Safety) Act 1994	Specifies that, unless a current pilotage exemption certificate is held by the master of a ship, pilotage is compulsory for: A ship that is 50 metres or more; A vessel towing another vessel where the combined length of the vessels is 50 metres or more; A ship whose owner or master asks for the services of a pilot; or A ship whose master is directed by the Harbour Master to use the services of a pilot. Anchorage limits and locations are designated on the Port navigational charts and the ship arrival limit without a pilot is six nautical miles radius from the Fairway Buoy. Maritime Safety Queensland directs the ship master to the appropriate anchorage.	Marine water quality Threatened flora and fauna	**MM35 – Pilotage is compulsory for ships longer than 50 metres or at the Harbour Masters discretion** Pilotage requirements are compulsory in some instances but at the discretion of the harbour master.
Various Road and Rail Transport Laws governing the transport of dangerous goods including: *Transport Operations (Road*	There are state/national requirements for transporting dangerous goods – e.g. Australian Dangerous Good Code covers national standards and requirements for transporting dangerous goods by road and rail. The code is given legal force in each Australian state and territory by each jurisdiction's dangerous goods transport laws.	All terrestrial and marine and estuarine EVs identified as a prescribed environmental matter	**MM36 - Various transport legislation requiring management of the transport of dangerous goods by road and rail** Consignors are responsible for choosing and hiring a prime contractor to transport dangerous goods by road. They need to make sure goods are packed and marked correctly, tell the prime contractor the goods are classified as dangerous and give the driver a completed and accurate dangerous goods transport document. The prime contractor is responsible for transporting dangerous goods by road and for reporting any dangerous incidents during the transport, loading or unloading of dangerous goods.

Legislation	Summary of Relevance to MPA	Environmental Values Protected	Management Measures
Use Management) Act 1995 *Transport Operations (Road Use Management-Dangerous Goods) Regulation 2008* *Transport Infrastructure Act 1994 (Chapter 14 - Transporting dangerous goods by rail)* *Transport Infrastructure (Dangerous Goods by Rail) Regulation 2008*			Packers, loaders, vehicle owners and drivers all have legal responsibilities to meet when handling and transporting dangerous goods. These include: ▪ General principles for safe route selection ▪ Select major roads ▪ Avoid heavily populated/congested areas ▪ Avoid water catchment and environmentally sensitive zones ▪ Avoid tunnels and restricted routes
Vegetation Management Act 1999	The VM Act regulates the clearing of remnant vegetation, essential habitat and wetlands associated with remnant vegetation in a manner that conserves and manages vegetation communities (i.e. regional ecosystems).	Remnant vegetation Threatened flora and fauna habitat	**MM37 - Assessment against State Code 16: Native vegetation clearing** Development applications resulting in clearing regional ecosystems are assessed against State Code 16 of the SDAP. Applications must show proposed clearing is for a relevant purpose under the VM Act. Approval conditions requiring Management Plans and other management measures including offsets.
Water Act 2000	Regulates the sustainable management of non-tidal waters and other resources. Works in a watercourse, lake or spring; taking or interfering with water within	Palustrine wetlands Remnant vegetation	**MM38 – Application and approval under the *Water Act 2000* for works that impact on a defined watercourse** Water Act application and approval conditions requiring Management Plans and other measures.

Legislation	Summary of Relevance to MPA	Environmental Values Protected	Management Measures
	defined watercourses are assessable development The *Water Act* regulates the undertaking of works that involve the removal of vegetation, excavating or placing fill in a defined watercourse, lake or spring (i.e. Riverine Protection Permit)		Riverine Protection Permit application and approval conditions requiring MPs and other measures.

Table 10: Summary of the key existing planning instruments

Planning Instrument	Summary of Relevance to MPA	Environmental Values Protected	Management Measures
Townsville City Plan	The Townsville City Plan provides a framework for managing development and sets out TCCs intention for the future development over a 25 year planning horizon. The planning scheme seeks to advance state and regional strategies, including state planning policies, through more detailed local responses, taking into account the local context. Of particular significance to this study is the support/protection of infrastructure corridors (freight routes etc) and industrial uses from urban encroachment/impacts through the overlays (noise corridors) provided by the scheme.	Social (in relation to material change in use), terrestrial and marine EVs identified as Matters of Local Environmental Significance (MLES) by the planning scheme. Land uses surrounding the Port from indirect impacts associated with port operations including air quality, noise and vibration.	**MM39 – Development within areas covered by the Townsville City Plan will require assessment against the Coastal Environment, Cultural Heritage and Natural Assets Overlays** Development assessment process includes consideration of EVs through planning scheme provisions and Imposes conditions requiring Management Plans and other measures including offsets. Impacts to MLES within the TCC area are addressed through a number of overlay codes including the Coastal Environment, Cultural Heritage and Natural Assets Overlays. These overlays protect a number of environmental features not already protected through Commonwealth and state requirements, including: ▪ Biodiversity values and ecological processes; ▪ Significant species and ecological communities; ▪ Ecological corridors and habitat connectivity; ▪ Riparian and buffer areas for wetlands and waterways; ▪ Heritage places; ▪ Coastal environments. The City Plan follows an avoid, minimise or offset framework to protect these values in development assessment. Approved development is subject to a number of environmental management requirements include construction EMPs (CEMPs), vegetation management plans, fauna management plans and rehabilitation plans.
Townsville State Development Area Development Scheme	Development within the TSDA must be assessed against the TSDA Development Scheme. The TSDA contains several precincts which can be broadly	Palustrine Wetlands Mangrove and Saltmarsh Remnant vegetation	**MM40 – Development within the TSDA requires assessment against the TSDA Development Scheme**

Planning Instrument	Summary of Relevance to MPA	Environmental Values Protected	Management Measures
	broken into land for port-related industry, other industry, transport corridors and support and environmental conservation. These precincts generally align with the proposed Port Industry and commerce, infrastructure and supply chain and environmental management area precincts of the MPA. To obtain an approval from the Coordinator-General, a proponent must make a written application in accordance with section 84AA of the SDPWO Act and the development scheme. Depending upon the nature of the proposed use, applications will follow one of two development assessment processes, significant or minor. The CG decides the assessment process to be used for an application based on the level of impacts that may result from it (i.e. if there is potential for substantial impact on one or more EVs the significant impact process will be used).	Threatened flora and fauna habitat Marine water quality	Assessment criteria for an application within the TSDA is outlined in the TSDA Development Scheme. The criteria address all key environmental impacts including emissions, visual impact, contaminated land, acid sulfate soils, climate change, water quality, EVs and offsets. The development scheme makes allowance for state planning instruments to be addressed in development assessment. Approval conditions requiring MPs and other management measures including offsets.
Port of Townsville Land Use Plan	The POTL holds the responsibility of the "Assessment Manager" under the Planning Act 2016 for all development that occurs on Strategic Port Land (SPL). The POTL prepared and published a Land Use Plan (LUP) in January 2013, as a framework for the assessment of development on SPL. The LUP is required to be reviewed (at a minimum) every eight years to ensure that the Port is appropriately planned, developed, and managed to meet the POTL's intentions for future development. The LUP applies to all SPL, including all ramps and waterways within SPL boundaries.	All marine and estuarine EVs (indirectly). Land uses surrounding the Port from indirect impacts associated with port operations including air quality, noise and vibration.	**MM41 – Development within the Port of Townsville SPL will require assessment against the relevant planning codes and guidelines** The POTLUP Planning Codes and Guidelines provide Performance Outcomes and Acceptable Solutions for development, to ensure it meets the overall purpose and outcomes of the Zones and Precincts and the strategic outcomes of the LUP. The Planning Codes and Guidelines include specific assessment criteria under planning codes – Port Code and Tidal Works Code, and planning guidelines for Acid Sulfate Soils, Environmental Management Plan (covering both CEMPs and operational EMPs), Landscaping, and Stormwater Management. The POTLUP identifies zones and precincts within the Port lands and then stipulates the purpose, outcomes,

Planning Instrument	Summary of Relevance to MPA	Environmental Values Protected	Management Measures
	A requirement of the LUP is to include measures that will help achieve the desired environmental outcomes for the land. This is implemented through the Port of Townsville Planning Codes and Guidelines document. It is noted that the Planning Codes and Guidelines are not statutory components of the Land Use Plan, they are supporting documents to be read in conjunction with the Land Use Plan to assess whether a proposed development complies with the provisions of the Land Use Plan. The Land Use Plan is located within Port industry and commerce and Marine infrastructure precincts of the proposed MPA.		preferred use, and applicable planning codes for each precinct/zone. **MM42 – Impacts associated with existing and future uses within the Port of Townsville Land Use Plan are managed by the Port's environmental management system** A review of the Port of Townsville and key environmental issues relevant to the port and the planning for the port found that existing operational areas of the port are highly regulated and covered by either existing approvals (and environmental licences), or under the EMS operated and managed by the PoTL, which is certified and compliant with AS/NZS ISO 14001:2004. Approval conditions requiring MPs and other management measures including offsets.
Townsville City Waterfront PDA Development Scheme	The Townsville City Waterfront PDA Development Scheme is applicable to all development on land and water within the boundaries of the PDA, which covers the eastern and western banks of Ross River from the breakwater marina to Townsville Railway Station. The PDA is located within Infrastructure and supply chain and interface precincts of the MPA. The PDA is separated into areas for development, pedestrian and vehicle movement and public interaction with the waterfront. Natural assets are identified within the PDA as areas of high and very high environmental values. While not mapped under any state or Commonwealth databases these areas protect existing mangrove and intertidal vegetation.	Mangrove and Saltmarsh and marine plants. Land uses near the Port within the PDA from indirect impacts associated with port operations including air quality, noise and vibration.	**MM43 – Development within the Townsville City Waterfront PDA requires assessment against the Development Scheme** The PDA requires development to enhance and manage areas of natural assets to provide a net environmental benefit, including the use of compensatory offsets, to important ecosystem services and the enjoyment of the inner city natural environment. In the very high environmental value area development must avoid disturbances and improve the environmental value of the asset. Approval conditions requiring MPs and other management measures including offsets.

6. Risk Assessment

The risk assessment examines the possible development activities identified in the growth scenarios and the likelihood and consequence of resulting impacts on the environmental, social, and cultural values within each MPA precinct. The process is carried out using the following steps:

- Development types with the potential to result in impacts on EVs are identified through an assessment of likely growth scenarios for the Port (refer to section 4)
- An initial risk ranging from low to high is determined for each of the potential impacts based on likelihood and consequence using the Tables 2 to 4 in Section 2.2. This assessment considered the risk level assuming an absence of implementation of any statutory requirements, planning instruments, and operational environmental management measures
- The post-management risk for each of the potential impacts on the identified values was assessed after considering existing statutory requirements, planning instruments, and operational environmental management measures
- If the risk to EVs is still considered high or medium after implementation of existing management requirements additional measures are considered to minimise or offset the remaining risk. This includes PMMs and measures that could be implemented through the port overlay or other instruments such as the TSDA Development Scheme. Additional considerations identified through the risk assessment process are described in further detail in section 7 of this document.

The results of the risk assessment for growth scenario 1, 2 and 3 are presented in **Tables 11, 12 and 13** respectively.

6.1. Relationship to the Port Expansion Project EIS Impact Assessment

A requirement of the EIS process is that potential impacts that may occur as a result of the proposal including normal on-site day-to-day activities during the construction and/or operation of the facilities are assessed. The impact assessment for the PEP EIS utilises a risk-based approach to identify the significance of impacts on the surrounding environment. While the process employed is similar to the master plan risk assessment there are a number of factors that may result in differences in outcomes between the two studies. These include:

- The EIS assesses specific activities associated with the PEP based on the detailed description of infrastructure proposed, dredging volumes and project specific modelling. The infrastructure requirements in the growth scenarios used to inform the risk assessment describes general requirements for port growth but does not specify locations or engineering requirements. While the PEP has been used to inform the likely location of future infrastructure by necessity the master plan risk assessment addresses impacts at a broader level and takes a precautionary approach to assessing the likelihood of impacts occurring.
- The master plan risk assessment includes activities not covered by the PEP EIS. For example the EIS does not contemplate development within the TSDA or additional infrastructure requirements connecting the port and TSDA. Cumulative impacts resulting from these activities may increase potential risk on EVs.

While EIS reports relating to the PEP were reviewed as part of the characterisation of EVs within and surrounding the proposed MPA, consideration of the assessment of impact assessment components was avoided to ensure the independence of the current risk assessment process.

6.2. Existing Management Requirements

The three growth scenarios (refer to section 4) identified a number of overarching development types that have the potential to impact on EVs. The key impacting activities are listed below:

Marine

- Construction of the reclamation area including rock revetments to create bunds
- Dredging associated with widening and deepening of the Platypus and Sea Channels
- Placement of dredged material in bunded areas as reclamation fill
- Release of tailwater into the marine environment from reclamation areas
- Construction of additional berths and breakwater including capital dredging to provide access
- Construction of a new cruise ship terminal on the northern side of Ross Creek and associated dredging.

Land

- Commencement of operations of the POTL Granitevale quarry to supply rock for new port infrastructure
- New development at the port
- Additional land requirements in the TSDA to support storage of break bulk cargoes as well as dry and liquid bulk cargos including the potential for pipelines/conveyors within the TEARC alignment
- Duplication of the TPAR to accommodate increased traffic between the TSDA and port
- Construction and operation of the TEARC.

Through review of the existing legislative and planning framework, and approval conditions for projects considered in the port growth scenarios, a number of existing management measures have been identified that will mitigate the potential risks to EVs in and surrounding the proposed MPA from the key impacting activities associated with future development. These measures have been identified throughout section 5 of this document and are listed below. These measures are used throughout the risk assessment with additional risk management measures (including PMMs) only contemplated where the residual risk is not reduced to low.

Table 11 – Existing management measures

Existing Management Measures
MM1 – Referral and controlled action assessment under the EPBC Act
MM2 – Offset must be provided under the EPBC Act for any significant residual impact on MNES
MM3 – EPBC Act approval conditions for the PEP require approval and implementation of a Dredge Management Plan
MM4 – EPBC Act approval conditions for the PEP require approval and implementation of a Construction EMP
MM5 - EPBC Act approval conditions for the PEP require approval and implementation of a Marine Environmental Management Plan MM6 - EPBC Act approval conditions for the PEP require approval and implementation of an Inshore Dolphin Monitoring Program
MM7 - EPBC Act approval conditions for the PEP require approval and implementation of an Offset Management Strategy
MM8 – CG approval of the Townsville PEP requires a Tailwater Management Plan including allowing releases from a single controlled discharge point and continuous monitoring
MM9 – CG approval conditions for the PEP require a Marine Megafauna Management including measures to reduce the risk of interaction with marine megafauna

Existing Management Measures
MM10 – CG approval conditions require a reactive water quality monitoring program to be implemented to enable management actions to be identified which will ensure water quality is maintained so adverse effects on marine and coastal ecosystems are avoided MM11 – Implementation of PEP environmental management framework MM12 - EPBC Act approval conditions for the TPAR required the alignment to minimise impacts on vegetation and habitat of listed threatened and migratory species, manage runoff to avoid indirect impacts and protect surrounding intertidal areas in perpetuity as a conservation reserve MM13 – Approval conditions for the Granitevale Quarry restrict vegetation clearing, require habitat for listed species to be retained and require implementation of several management plans MM14 - Maintenance dredging and dredge material disposal is managed through Long-term Maintenance Dredging Management Plan and in accordance with permits conditions issued under *Sea Dumping Act* and GBRMP Act (where jurisdictionally relevant) MM15 – Permit for dredged material disposal at sea under the *Environment Protection (Sea Dumping) Act 1981* MM16 – Review and assess impacts to historic shipwrecks under the *Historic Shipwrecks Act 1976* MM17 – Discharge of any waste into the ocean must meet the requirements of the Protection of the Sea (Prevention of Pollution from Ships) Act 1983 and the *Transport Operations (Marine Pollution) Act 1995 (Qld)* MM18 - All international vessels must undertake, record and prove that all cargo and ballast water is low risk to address the *Biosecurity Act 2015*. MM19 – EIS assessment and approval requirements under the *State Development and Public Works Organisation Act 1971* MM20 – Impacts would require assessment and approval against the relevant State codes MM21 – Master plan areas and precincts ensure direct impacts to significant EVs are minimised and/or avoided. MM22 – A CHMP is required to address impacts to Aboriginal Cultural Heritage MM23 – Duty of care to avoid impacts on Aboriginal Cultural Heritage MM24 – Landowners must minimise the risks associated with invasive plants and animals under their control to meet the *Biosecurity Act 2014 (Qld)* MM25 – Assessment against State Code 8: Coastal development and tidal works including for capital dredging MM26 – An offset must be provided under the *Offsets Act 2014* for any impacts to MLES or MSES resulting in a significant residual impact MM27 – Assessment and approval of EAs and ERAs under the EP Act including meeting model operating conditions MM28 – Development must meet the requirements of the Noise, Air and Water EPPs MM29 – EIS of disposal of contaminated material including dredged material under the EP Act MM30 – Assessment against State Code 11: Removal, destruction or damage of marine plants and 12: Development in declared fish habitat area MM31 – Assessment of impacts to the GBRCMP under the *Marine Parks Act 2004 (Qld)* MM32 – Permit must be obtained under the NC Act 1992 to remove any EVNT species MM33 – Permit required for impacting on areas of non-indigenous heritage under the *Queensland Heritage Act 1992* MM34 – All ships operating in Queensland's coastal waters must carry pollution prevention documentation and cannot discharge pollutants

Existing Management Measures
MM35 – Pilotage is compulsory for ships longer than 50 metres or at the Harbour Masters discretion. MM36 Various transport legislation requiring management of the transport of dangerous goods by road and rail MM37 - Assessment against State Code 16: Native vegetation clearing MM38 – Application and approval under the *Water Act 2000* for works that impact on a defined watercourse MM39 – Development within areas covered by the Townsville city plan will require assessment against the Coastal Environment, Cultural Heritage and Natural Assets Overlays MM40 – Development within the TSDA requires assessment against the Development Scheme MM41 – Development within the Port of Townsville SPL will require assessment against the relevant planning codes and guidelines MM42 – Impacts associated with existing and future uses within the Port of Townsville Land Use Plan are managed by the Port's environmental management system MM43 – Development within the Townsville City Waterfront PDA requires assessment against the Development Scheme

Table 12: Scenario 1 risk assessment

Scenario 1	Infrastructure Requirements							
	Marine 1. Capital dredging for widening of the existing Platypus and Sea channels 2. Construction of the reclamation area 3. Storage of capital dredged material within a new reclamation area 4. Periodic maintenance dredging to allow continued shipping access				**Land** 1. Use of TSDA land for storage of empty containers 2. Increased usage of the TPAR to transport materials between the TSDA and port 3. Port of Townsville Quarry to commence operations to supply rock for reclamation revetment walls			
Description of Activity	**Precincts Affected**	**Environmental Value at Risk**	**OUV (Y/N)**	**Potential Impacts to Value**	**Initial Risk** (likelihood x consequence)	**Existing Management Requirements**	**Revised Risk** (likelihood x consequence)	**Risk Management Measure**
Marine								
1. Capital dredging for widening of the existing Platypus and Sea channels ▪ Dredging will be undertaken using a Trailer Suction Hopper Dredge (TSHD) and a mechanical dredger (backhoe and/or grab dredgers). ▪ The material dredged using the TSHD will typically comprise soft marine sediments and clayey sands ▪ Material will be transferred to the reclamation area by pumping in a slurry form through floating and fixed pipelines. ▪ The mechanical dredger will be used to relocate approximately 2.4 million m3.	Marine Marine infrastructure Environmental management (Magnetic Island) Interface precinct	Seagrass and Macroalgae	Y	Direct disturbance within the dredge area	**Medium (almost certain x medium)**	MM3 – EPBC Act approval conditions for the PEP require approval and implementation of a Dredge Management Plan MM7 - EPBC Act approval conditions for the PEP require approval and implementation of an Offset Management Strategy MM10 – CG approval conditions require a reactive water quality monitoring program to be implemented to enable management actions to be identified which will ensure water quality is maintained so adverse effects on marine and coastal ecosystems are avoided	**Low (almost certain x low)**	Not required
				Loss or significant degradation of value within port area, local environs or regionally due to indirect impacts from dredge plumes resulting in: ▪ Increased sedimentation and turbidity ▪ Decreased water quality ▪ Decreased light attenuation ▪ Release of pollutants into water column	**Medium (possible x medium)**	MM3 – EPBC Act approval conditions for the PEP require approval and implementation of a Dredge Management Plan MM7 - EPBC Act approval conditions for the PEP require approval and implementation of an Offset Management Strategy MM10 – CG approval conditions require a reactive water quality monitoring program to be implemented to enable management actions to be identified which will ensure water quality is maintained so adverse effects on marine and coastal ecosystems are avoided	**Low (unlikely x low)**	Not required
▪ Hopper barges will transport the material to the outer harbour where they will be mechanically unloaded into the reclamation area using conventional earthmoving plant		Reef Communities	Y	Loss or significant degradation of value within port area, local environs or regionally due to Indirect impacts from dredge plumes resulting in: ▪ Increased sedimentation and turbidity ▪ Decreased water quality ▪ Decreased light attenuation ▪ Release of pollutants into water column	**Medium (possible x medium)**	MM3 – EPBC Act approval conditions for the PEP require approval and implementation of a Dredge Management Plan MM5 - EPBC Act approval conditions for the PEP require approval and implementation of a MEMP MM6 - EPBC Act approval conditions for the PEP require approval and implementation of an Inshore Dolphin Monitoring Program MM7 - EPBC Act approval conditions for the PEP require approval and implementation of an Offset Management Strategy MM10 – CG approval conditions require a reactive water quality monitoring program to be implemented to enable management actions to be identified which will ensure water quality is maintained so adverse effects on marine and coastal ecosystems are avoided	**Low (unlikely x low)**	Not required
		Marine megafauna	Y	Marine megafauna, in particular dugongs, have been identified as providing a significant contribution to the local expression of the OUV within Cleveland Bay. Direct mortality and/or injury as a result	**Medium (possible x medium)**	MM9 – CG approval conditions for the PEP require a MMMP including measures to reduce the risk of interaction with marine fauna	**Low (unlikely x medium)**	Not required

Scenario 1	Infrastructure Requirements							
	Marine 1. Capital dredging for widening of the existing Platypus and Sea channels 2. Construction of the reclamation area 3. Storage of capital dredged material within a new reclamation area 4. Periodic maintenance dredging to allow continued shipping access				**Land** 1. Use of TSDA land for storage of empty containers 2. Increased usage of the TPAR to transport materials between the TSDA and port 3. Port of Townsville Quarry to commence operations to supply rock for reclamation revetment walls			
Description of Activity	**Precincts Affected**	**Environmental Value at Risk**	**OUV (Y/N)**	**Potential Impacts to Value**	**Initial Risk** (likelihood x consequence)	**Existing Management Requirements**	**Revised Risk** (likelihood x consequence)	**Risk Management Measure**
				of vessel strike and/or dredging activity has the potential to impact on OUV at the regional scale.				
				Increase in noise, vibration and/or lighting resulting in a short term disruption to behaviour/life-cycle of mega fauna	**Low (likely x low)**	MM5 - EPBC Act approval conditions for the PEP require approval and implementation of a MEMP MM9 – CG approval conditions for the PEP require a MMMP including measures to reduce the risk of interaction with marine fauna	**Low (possible x low)**	Not required
		Fish and Fisheries	N	Loss or significant degradation of fisheries habitat within port area, local environs or regionally from dredge plumes resulting in: ▪ Increased sedimentation and turbidity ▪ Decreased water quality ▪ Decreased light attenuation ▪ Release of pollutants into water column	**Low (likely x low)**	MM3 – EPBC Act approval conditions for the PEP require approval and implementation of a Dredge Management Plan MM10 – CG approval conditions require a reactive water quality monitoring program to be implemented to enable management actions to be identified which will ensure water quality is maintained so adverse effects on marine and coastal ecosystems are avoided	**Low (possible x low)**	Not required
		Marine and Estuarine Protected Areas – GBRWHA and GBRMP	NA	Indirect impacts on protected areas from dredge plumes resulting in: ▪ Increased sedimentation and turbidity ▪ Decreased water quality ▪ Decreased light attenuation ▪ Release of pollutants into water column	**Low (almost certain x low)**	MM3 – EPBC Act approval conditions for the PEP require approval and implementation of a Dredge Management Plan MM10 – CG approval conditions require a reactive water quality monitoring program to be implemented to enable management actions to be identified which will ensure water quality is maintained so adverse effects on marine and coastal ecosystems are avoided	**Low (almost certain x low)**	Not required
		Mangrove and Saltmarsh Communities	Y	Suspended sediment from dredge plumes accumulate in sensitive areas including beaches and intertidal areas of Magnetic Island. Modelling carried out for the AEIS found accumulation of dredged sediment is unlikely to occur on Magnetic Island beaches.	**Low (unlikely x medium)**	MM3 – EPBC Act approval conditions for the PEP require approval and implementation of a Dredge Management Plan MM10 – CG approval conditions require a reactive water quality monitoring program to be implemented to enable management actions to be identified which will ensure water quality is maintained so adverse effects on marine and coastal ecosystems are avoided While not a management measure the CGER and EPBC Act conditions of approval specify a model validation water quality monitoring program is to be implemented to validate model findings and provide increased confidence in management measures involving modelling.	**Low (unlikely x medium)**	Not required
		Marine Water Quality	N	Dredge plumes resulting in increased sedimentation and turbidity in the water column casing local scale temporary reduction in water quality	**Low (almost certain x low)**	MM10 – CG approval conditions require a reactive water quality monitoring program to be implemented to enable management actions to be identified which will ensure water quality is maintained so adverse effects on marine and coastal ecosystems are avoided	**Low (almost certain x low)**	Not required

Scenario 1	Infrastructure Requirements							
	Marine 1. Capital dredging for widening of the existing Platypus and Sea channels 2. Construction of the reclamation area 3. Storage of capital dredged material within a new reclamation area 4. Periodic maintenance dredging to allow continued shipping access				**Land** 1. Use of TSDA land for storage of empty containers 2. Increased usage of the TPAR to transport materials between the TSDA and port 3. Port of Townsville Quarry to commence operations to supply rock for reclamation revetment walls			
Description of Activity	**Precincts Affected**	**Environmental Value at Risk**	**OUV (Y/N)**	**Potential Impacts to Value**	**Initial Risk** (likelihood x consequence)	**Existing Management Requirements**	**Revised Risk** (likelihood x consequence)	**Risk Management Measure**
2. Construction of the reclamation area ▪ The creation of perimeter revetment structures will create a confined area for the placement of capital dredged material ▪ Dredging of soft marine sediments from the area of the revetment and the placement of the core, filter material, and armour rock. This material will be removed by a mechanical dredger. ▪ Construction of revetments will consist of rock-fill bunds and rock armour layers. Material will be placed where previously dredged. ▪ Geotextile will be placed on the lee face of the bund wall. The purpose of the geotextile is to reduce migration of the fine sediment in the dredged material through the bund.	Marine infrastructure Port industry and commerce Environmental management (Magnetic Island)	Fish and Fisheries	N	Mortality and/or injury as a result of becoming trapped within the reclamation area	**Medium (likely x medium)**	MM4 – EPBC Act approval conditions for the PEP require approval and implementation of a CEMP MM5 - EPBC Act approval conditions for the PEP require approval and implementation of a MEMP	**Low (unlikely x medium)**	Not required
				Smothering of benthic habitat under the revetment wall	**High (almost certain x extreme)**	MM4 – EPBC Act approval conditions for the PEP require approval and implementation of a CEMPMM5 - EPBC Act approval conditions for the PEP require approval and implementation of a MEMP MM7 - EPBC Act approval conditions for the PEP require approval and implementation of an Offset Management Strategy for species habitat removed	**Low (almost certain x low)**	Note: Direct impacts from the reclamation cannot be avoided, however offset requirements under the EPBC Act will compensate for any residual adverse impact.
				Localised turbidity plumes from placement of rock armouring and core material	**Low (possible x low)**	MM4 – EPBC Act approval conditions for the PEP require approval and implementation of a CEMP MM5 - EPBC Act approval conditions for the PEP require approval and implementation of a MEMP MM10 – CG approval conditions require a reactive water quality monitoring program to be implemented to enable management actions to be identified which will ensure water quality is maintained so adverse effects on marine and coastal ecosystems are avoided	**Low (unlikely x low)**	Not required
		Marine megafauna	Y	Direct mortality and/or injury as a result of vessel strike and construction activities (rock dumping, etc)	**Medium (possible x high)**	MM4 – EPBC Act approval conditions for the PEP require approval and implementation of a CEMP MM5 - EPBC Act approval conditions for the PEP require approval and implementation of a MEMP MM9 – CG approval conditions require a MMMP including measures to reduce the risk of interaction with marine fauna	**Low (rare x high)**	Not required
				Increase in noise, vibration and disruption to behaviour/life-cycle Increase in lighting resulting in disruption to behaviour/life-cycle	**Low (possible x low)**	MM4 – EPBC Act approval conditions for the PEP require approval and implementation of a CEMP MM5 - EPBC Act approval conditions for the PEP require approval and implementation of a MEMP MM9 – CG approval conditions require a MMMP including measures to reduce the risk of interaction with marine fauna	**Low (unlikely x low)**	
		Seagrass and Macroalgae	Y	Localised turbidity plumes from placement of rock armouring and seepage of turbid water through the reclamation wall	**Low (possible x low)**	MM4 – EPBC Act approval conditions for the PEP require approval and implementation of a CEMP MM10 – CG approval conditions require a reactive water quality monitoring program to be implemented to enable management actions to be identified which will ensure water quality is maintained so adverse effects on marine and coastal ecosystems are avoided	**Low (unlikely x low)**	Not required

Scenario 1	Infrastructure Requirements							
	Marine 1. Capital dredging for widening of the existing Platypus and Sea channels 2. Construction of the reclamation area 3. Storage of capital dredged material within a new reclamation area 4. Periodic maintenance dredging to allow continued shipping access				**Land** 1. Use of TSDA land for storage of empty containers 2. Increased usage of the TPAR to transport materials between the TSDA and port 3. Port of Townsville Quarry to commence operations to supply rock for reclamation revetment walls			
Description of Activity	**Precincts Affected**	**Environmental Value at Risk**	**OUV (Y/N)**	**Potential Impacts to Value**	**Initial Risk** (likelihood x consequence)	**Existing Management Requirements**	**Revised Risk** (likelihood x consequence)	**Risk Management Measure**
		Mangrove and Saltmarsh Communities	Y	Changes to coastal processes resulting in erosion and accretion of sediments in new areas including beaches and intertidal areas of Magnetic Island	**Low (unlikely x medium)**	MM10 – CG approval conditions require a reactive water quality monitoring program to be implemented to enable management actions to be identified which will ensure water quality is maintained so adverse effects on marine and coastal ecosystems are avoided While not a management measure the CGER and EPBC Act conditions of approval specify a model validation water quality monitoring program is to be implemented to validate model findings and provide increased confidence in management measures involving modelling. Ongoing monitoring of The Strand for coastal processes is also proposed as part of the AEIS	**Low (unlikely x medium)**	Not required
		Marine and Estuarine Protected Areas – GBRWHA	NA	Smothering of benthic habitat under the revetment walls	**High (almost certain x extreme)**	MM4 – EPBC Act approval conditions for the PEP require approval and implementation of a CEMP MM5 - EPBC Act approval conditions for the PEP require approval and implementation of a MEMP MM7 - EPBC Act approval conditions for the PEP require approval and implementation of an Offset Management Strategy	**Low (almost certain x low)**	Note: Direct impacts from the reclamation can't be avoided, however offset requirements under the EPBC Act will compensate for any residual adverse impact.
				Changes to coastal processes indirectly impacting on areas outside of the MPA. Note: AEIS modelling identified that direct changes to hydrodynamic conditions are restricted to the area immediately adjacent to the proposed reclamation area.	**Low (unlikely x medium)**	MM4 – EPBC Act approval conditions for the PEP require approval and implementation of a CEMP MM5 - EPBC Act approval conditions for the PEP require approval and implementation of a MEMP While not a management measure the CGER and EPBC Act conditions of approval specify a model validation water quality monitoring program is to be implemented to validate model findings. Ongoing monitoring of The Strand for coastal processes is also proposed as part of the AEIS.	**Low (unlikely x medium)**	Not required
				Operational impacts from noise and light on bird species	**Medium (likely x medium)**	MM4 – EPBC Act approval conditions for the PEP require approval and implementation of a CEMP MM5 - EPBC Act approval conditions for the PEP require approval and implementation of a MEMP	**Low (unlikely x medium)**	Not required
		Listed migratory and threatened species	Y	Temporary displacement of migratory birds from the revetment walls at the port from nearby areas such the Town Common from indirect impacts such as noise, light and dust.	**Low (possible x low)**	MM4 – EPBC Act approval conditions for the PEP require approval and implementation of a CEMP MM5 - EPBC Act approval conditions for the PEP require approval and implementation of a MEMP	**Low (unlikely x low)**	Not required

Scenario 1	Infrastructure Requirements							
	Marine 1. Capital dredging for widening of the existing Platypus and Sea channels 2. Construction of the reclamation area 3. Storage of capital dredged material within a new reclamation area 4. Periodic maintenance dredging to allow continued shipping access				**Land** 1. Use of TSDA land for storage of empty containers 2. Increased usage of the TPAR to transport materials between the TSDA and port 3. Port of Townsville Quarry to commence operations to supply rock for reclamation revetment walls			
Description of Activity	**Precincts Affected**	**Environmental Value at Risk**	**OUV (Y/N)**	**Potential Impacts to Value**	**Initial Risk** (likelihood x consequence)	**Existing Management Requirements**	**Revised Risk** (likelihood x consequence)	**Risk Management Measure**
		Aboriginal Cultural Heritage	N	Direct impacts on cultural heritage values within the reclamation area	**Medium (possible x medium)**	MM22 – A CHMP is required to address impacts to Aboriginal Cultural Heritage MM23 – Duty of care to avoid impacts on Aboriginal Cultural Heritage	**Low (unlikely x medium)**	Not required
3. Storage of capital dredged material within a new reclamation area ▪ Dredged material will be transferred to the reclamation area by pumping in a slurry form through floating and fixed pipelines or transported by hopper barge and unloaded using earthmoving equipment. ▪ Excess water will be managed in a tailwater pond prior to releasing it to the sea at a location on the eastern revetment. ▪ Ongoing operation of the reclaimed area for port uses.	Marine Marine infrastructure Port industry and commerce	Seagrass and Macroalgae	Y	Turbidity plumes associated with release of tailwater from the eastern revetment	**Low (likely x low)**	MM3 – EPBC Act approval conditions for the PEP require approval and implementation of a Dredge Management Plan MM4 – EPBC Act approval conditions for the PEP require approval and implementation of a CEMP MM8 – CG approval of the Port Expansion Project requires a Tailwater Management Plan including allowing releases from a single controlled discharge point and continuous monitoring MM10 – CG approval conditions require a reactive water quality monitoring program to be implemented to enable management actions to be identified which will ensure water quality is maintained so adverse effects on marine and coastal ecosystems are avoided	**Low (unlikely x low)**	Not required
				Operational impacts such as surface water runoff, chemical spills and dust/air quality	**Medium (possible x medium)**	MM1 – Referral and controlled action assessment under the EPBC Act MM17 – Discharge of any waste into the ocean must meet the requirements of the *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* and the *Transport Operations (Marine Pollution) Act 1995 (Qld)* MM20 – Impacts would require assessment and approval against the relevant State codes MM25 – Assessment against State Code 8: Coastal development and tidal works including for capital dredging MM28 – Development must meet the requirements of the Noise, Air and Water EPPs MM31 – Assessment of impacts to the GBR Coast Marine Park under the *Marine Parks Act 2004 (Qld)* MM34 – All ships operating in Queensland's coastal waters must carry pollution prevention documentation MM41 – Development within the POTLUP will require assessment against the relevant planning codes and guidelines MM42 – Existing and future uses within the POTLUP are regulated by the Port's environmental management system	**Low (unlikely x medium)**	Not required
		Fish and Fisheries	N	Smothering of benthic habitat under the reclamation area	**High (almost certain x extreme)**	MM4 – EPBC Act approval conditions for the PEP require approval and implementation of a CEMP MM5 - EPBC Act approval conditions for the PEP require approval and implementation of a MEMP MM7 - EPBC Act approval conditions for the PEP require approval and implementation of an Offset Management Strategy for species habitat removed	**Low (almost certain x low)**	Note: Direct impacts from the reclamation cannot be avoided, however offset requirements under the EPBC Act will compensate for any residual adverse impact.

Scenario 1	Infrastructure Requirements							
	Marine 1. Capital dredging for widening of the existing Platypus and Sea channels 2. Construction of the reclamation area 3. Storage of capital dredged material within a new reclamation area 4. Periodic maintenance dredging to allow continued shipping access				**Land** 1. Use of TSDA land for storage of empty containers 2. Increased usage of the TPAR to transport materials between the TSDA and port 3. Port of Townsville Quarry to commence operations to supply rock for reclamation revetment walls			
Description of Activity	**Precincts Affected**	**Environmental Value at Risk**	**OUV (Y/N)**	**Potential Impacts to Value**	**Initial Risk** (likelihood x consequence)	**Existing Management Requirements**	**Revised Risk** (likelihood x consequence)	**Risk Management Measure**
				Operational impacts such as surface water runoff, chemical spills and dust/air quality	**Medium (possible x medium)**	MM1 – Referral and controlled action assessment under the EPBC Act MM17 – Discharge of any waste into the ocean must meet the requirements of the *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* and the *Transport Operations (Marine Pollution) Act 1995 (Qld)* MM20 – Impacts would require assessment and approval against the relevant State codes MM25 – Assessment against State Code 8: Coastal development and tidal works including for capital dredging MM28 – Development must meet the requirements of the Noise, Air and Water EPPs MM31 – Assessment of impacts to the GBR Coast Marine Park under the *Marine Parks Act 2004 (Qld)* MM34 – All ships operating in Queensland's coastal waters must carry pollution prevention documentation MM41 – Development within the POTLUP will require assessment against the relevant planning codes and guidelines MM42 – Existing and future uses within the POTLUP are regulated by the Port's environmental management system	**Low (unlikely x medium)**	Not required
	Marine megafauna	Y	Direct mortality and/or injury as a result of vessel strike and construction activities (rock dumping, etc)	**Medium (possible x high)**	MM9 – CG approval conditions require a MMMP including measures to reduce the risk of interaction with marine fauna MM4 – EPBC Act approval conditions for the PEP require approval and implementation of a CEMP MM5 - EPBC Act approval conditions for the PEP require approval and implementation of a MEMP MM7 - EPBC Act approval conditions for the PEP require approval and implementation of an Offset Management Strategy for habitat removed	**Low (rare x high)**	Not required
	Protected Areas – GBRWHA	Y	Smothering of benthic habitat under the reclamation area within the WHA	**High (almost certain x extreme)**	MM4 – EPBC Act approval conditions for the PEP require approval and implementation of a CEMP MM5 - EPBC Act approval conditions for the PEP require approval and implementation of a MEMP MM7 - EPBC Act approval conditions for the PEP require approval and implementation of an Offset Management Strategy	**Low (almost certain x low)**	Note: Direct impacts from the reclamation cannot be avoided, however offset requirements under the EPBC Act will compensate for any residual adverse impact.
	Listed migratory and threatened species	Y	Indirect impacts such as noise, light and dust resulting in temporary displacement of migratory birds from the revetment walls at the port and nearby areas such the Town Common from	**Low (possible x low)**	MM4 – EPBC Act approval conditions for the PEP require approval and implementation of a CEMP MM5 - EPBC Act approval conditions for the PEP require approval and implementation of a MEMP	**Low (unlikely x medium)**	Not required

Scenario 1	Infrastructure Requirements							
	Marine 1. Capital dredging for widening of the existing Platypus and Sea channels 2. Construction of the reclamation area 3. Storage of capital dredged material within a new reclamation area 4. Periodic maintenance dredging to allow continued shipping access				**Land** 1. Use of TSDA land for storage of empty containers 2. Increased usage of the TPAR to transport materials between the TSDA and port 3. Port of Townsville Quarry to commence operations to supply rock for reclamation revetment walls			
Description of Activity	**Precincts Affected**	**Environmental Value at Risk**	**OUV (Y/N)**	**Potential Impacts to Value**	**Initial Risk** (likelihood x consequence)	**Existing Management Requirements**	**Revised Risk** (likelihood x consequence)	**Risk Management Measure**
4. Maintenance dredging ▪ Generally carried out using a TSHD. ▪ The material dredged will typically comprise soft marine sediments. ▪ Dredged material transported to the DMPA through TSHD hopper bottom released.	Marine Marine infrastructure	Seagrass and Macroalgae	Y	Dredge plumes resulting in: ▪ Increased sedimentation and turbidity ▪ Decreased water quality ▪ Decreased light attenuation	**Medium (possible x medium)**	MM14 - Maintenance dredging and dredge material disposal is managed through LMDMP's and in accordance with permits conditions issued under *Sea Dumping Act* and *GBRMP Act* (where jurisdictionally relevant) MM15 – Permit for dredged material disposal at sea under the *Environment Protection (Sea Dumping) Act 1981* MM16 – Review and assess impacts to historic shipwrecks under the *Historic Shipwrecks Act 1976* MM17 – Discharge of any waste into the ocean must meet the requirements of the Protection of the Sea (*Prevention of Pollution from Ships) Act 1983* and the *Transport Operations (Marine Pollution) Act 1995 (Qld)* MM18 - All international vessels must undertake, record and prove that all cargo and ballast water is low risk to address the Biosecurity Act 2015. MM20 – Impacts would require assessment and approval against the relevant State codes MM25 – Assessment against State Code 8: Coastal development and tidal works including for capital dredging MM26 – An offset must be provided under the *Offsets Act 2014* for any impacts to MLES or MSES resulting in a significant residual impact MM27 – Assessment and approval of EAs and ERAs under the EP Act including meeting model operating conditions MM28 – Development must meet the requirements of the Noise, Air and Water EPPs MM29 – Environmental impact assessment of disposal of contaminated material including dredged material under the EP Act MM31 – Assessment of impacts to the GBR Coast Marine Park under the *Marine Parks Act 2004 (Qld)* MM34 – All ships operating in Queensland's coastal waters must carry pollution prevention documentation and cannot discharge pollutants.	**Low (unlikely x low)**	Not required
		Reef Communities	Y	Dredge plumes resulting in: ▪ Increased sedimentation and turbidity ▪ Decreased water quality ▪ Decreased light attenuation	**Medium (possible x medium)**		**Low (unlikely x low)**	Not required
		Marine megafauna	Y	Direct mortality and/or injury as a result of vessel strike and/or dredging activity Increase in noise, vibration resulting in a disruption to behaviour/life-cycle Increase in lighting resulting in disruption to behaviour/life-cycle	**Medium (possible x medium)**		**Low (unlikely x medium)**	Not required
		Marine and Estuarine Protected Areas – GBRWHA and GBRMP	NA	Dredge plumes resulting in: ▪ Increased sedimentation and turbidity ▪ Decreased water quality ▪ Decreased light attenuation	**Low (almost certain x low)**		**Low (almost certain x low)**	Not required
		Fish and Fisheries	N	Dredge plumes resulting in: ▪ Increased sedimentation and turbidity ▪ Decreased water quality ▪ Decreased light attenuation	**Low (likely x low)**		**Low (unlikely x low)**	Not required
		Mangrove and Saltmarsh Communities	Y	Suspended sediment from dredge plumes accumulate in sensitive areas including beaches and intertidal areas of Magnetic Island	**Low (unlikely x low)**		**Low (unlikely x low)**	Not required
		Marine Water Quality	N	Dredge plumes resulting in increased sedimentation and turbidity	**Low (almost certain x low)**		**Low (almost certain x low)**	Not required

Scenario 1	Infrastructure Requirements							
	Marine 1. Capital dredging for widening of the existing Platypus and Sea channels 2. Construction of the reclamation area 3. Storage of capital dredged material within a new reclamation area 4. Periodic maintenance dredging to allow continued shipping access				**Land** 1. Use of TSDA land for storage of empty containers 2. Increased usage of the TPAR to transport materials between the TSDA and port 3. Port of Townsville Quarry to commence operations to supply rock for reclamation revetment walls			
Description of Activity	**Precincts Affected**	**Environmental Value at Risk**	**OUV (Y/N)**	**Potential Impacts to Value**	**Initial Risk** (likelihood x consequence)	**Existing Management Requirements**	**Revised Risk** (likelihood x consequence)	**Risk Management Measure**
Terrestrial								
1. Use of TSDA and Port land for storage of empty containers ▪ The scale of port-related activities may vary from several hectares to several hundred hectares for a large logistics precinct or large industrial plant. ▪ The TSDA has capacity for up to 1,500 ha for industrial land within the Port Industry and Commerce precinct. ▪ Preparation of land for storage would require significant earthworks including cut and fill to create pads for construction, retaining walls and stormwater treatment devices. ▪ Ongoing operation of this land would include activities such as loading and unloading of containers and additional traffic movements.	Port industry and commerce (Port and TSDA) Infrastructure and supply chain corridors Environmental management (Mainland)	Remnant Vegetation	N	Direct clearing of least concern and of concern remnant vegetation	**Medium (almost certain x medium)**	MM1 – Referral and controlled action assessment under the EPBC Act MM2 – Offset must be provided under the EPBC Act for any significant residual impact on MNES MM20 – Impacts would require assessment and approval against the relevant State codes MM21 – Master plan areas and precincts ensure direct impacts to significant EVs are avoided. MM26 – An offset must be provided under the *Offsets Act 2014* for any impacts to MLES or MSES resulting in a significant residual impact MM37 - Assessment against State Code 16: Native vegetation clearing MM40 – Development within the TSDA requires assessment against the Development Scheme	**Low (almost certain x low)**	Not required
		Threatened Flora and Fauna (Terrestrial)	N	Direct clearing of fauna habitat within the Port industry port and commerce precinct	**Medium (possible x medium)**	MM1 – Referral and controlled action assessment under the EPBC Act MM2 – Offset must be provided under the EPBC Act for any significant residual impact on MNES MM20 – Impacts would require assessment and approval against the relevant State codes MM21 – Master plan areas and precincts ensure direct impacts to significant EVs are avoided. MM26 – An offset must be provided under the *Offsets Act 2014* for any impacts to MLES or MSES resulting in a significant residual impact MM32 – Permit must be obtained under the NA Act to remove any EVNT species MM37 - Assessment against State Code 16: Native vegetation clearing MM40 – Development within the TSDA requires assessment against the Development Scheme	**Low (unlikely x medium)**	Not required
				Indirect impacts on a TEC in the Environmental management precinct (Mainland) through stormwater runoff and other vectors	**Low (possible x low)**	MM1 – Referral and controlled action assessment under the EPBC Act MM2 – Offset must be provided under the EPBC Act for any significant residual impact on MNES MM20 – Impacts would require assessment and approval against the relevant State codes MM24 – Landowners must minimise the risks associated with invasive plants and animals under their control to meet the *Biosecurity Act 2014 (Qld)* MM26 – An offset must be provided under the *Offsets Act 2014* for any impacts to MLES or MSES resulting in a significant residual impact MM27 – Assessment and approval of EAs and ERAs under the EP Act including meeting model operating conditions	**Low (unlikely x low)**	Not required

Scenario 1	Infrastructure Requirements							
	Marine 1. Capital dredging for widening of the existing Platypus and Sea channels 2. Construction of the reclamation area 3. Storage of capital dredged material within a new reclamation area 4. Periodic maintenance dredging to allow continued shipping access				**Land** 1. Use of TSDA land for storage of empty containers 2. Increased usage of the TPAR to transport materials between the TSDA and port 3. Port of Townsville Quarry to commence operations to supply rock for reclamation revetment walls			
Description of Activity	**Precincts Affected**	**Environmental Value at Risk**	**OUV (Y/N)**	**Potential Impacts to Value**	**Initial Risk** (likelihood x consequence)	**Existing Management Requirements**	**Revised Risk** (likelihood x consequence)	**Risk Management Measure**
						MM28 – Development must meet the requirements of the Noise, Air and Water EPPs MM40 – Development within the TSDA requires assessment against the Development Scheme		
		Listed Migratory and Threatened Species	Y	Indirect impacts on a migratory and wader bird habitat in the Environmental management precinct (Mainland) through stormwater runoff and other vectors	**Medium (possible x medium)**	MM1 – Referral and controlled action assessment under the EPBC Act MM2 – Offset must be provided under the EPBC Act for any significant residual impact on MNES MM24 – Landowners must minimise the risks associated with invasive plants and animals under their control to meet the *Biosecurity Act 2014 (Qld)* MM27 – Assessment and approval of EAs and ERAs under the EP Act including meeting model operating conditions MM28 – Development must meet the requirements of the Noise, Air and Water EPPs MM40 – Development within the TSDA requires assessment against the Development Scheme	**Low (unlikely x medium)**	Not required
				Temporary disturbance of migratory and wader bird species during construction periods due to noise and lighting	**Low (possible x low)**	MM1 – Referral and controlled action assessment under the EPBC Act MM28 – Development must meet the requirements of the Noise, Air and Water EPPs MM40 – Development within the TSDA requires assessment against the Development Scheme	**Low (unlikely x low)**	Not required
				Disturbance to migratory and wader bird species during operations due to noise and lighting	**Medium (possible x medium)**	MM1 – Referral and controlled action assessment under the EPBC Act MM28 – Development must meet the requirements of the Noise, Air and Water EPPs MM40 – Development within the TSDA requires assessment against the Development Scheme	**Low (unlikely x medium)**	Not required
		Mangrove and Saltmarsh Communities	Y	Indirect impacts on mangrove communities in the Environmental management precinct (Mainland) through stormwater runoff and other vectors	**Medium (possible x medium)**	MM1 – Referral and controlled action assessment under the EPBC Act MM24 – Landowners must minimise the risks associated with invasive plants and animals under their control to meet the *Biosecurity Act 2014 (Qld)* MM27– Assessment and approval of EAs and ERAs under the EP Act including meeting model operating conditions MM28 – Development must meet the requirements of the Noise, Air and Water EPPs MM40 – Development within the TSDA requires assessment against the Development Scheme	**Low (unlikely x medium)**	Not required

Scenario 1	Infrastructure Requirements							
	Marine 1. Capital dredging for widening of the existing Platypus and Sea channels 2. Construction of the reclamation area 3. Storage of capital dredged material within a new reclamation area 4. Periodic maintenance dredging to allow continued shipping access				**Land** 1. Use of TSDA land for storage of empty containers 2. Increased usage of the TPAR to transport materials between the TSDA and port 3. Port of Townsville Quarry to commence operations to supply rock for reclamation revetment walls			
Description of Activity	**Precincts Affected**	**Environmental Value at Risk**	**OUV (Y/N)**	**Potential Impacts to Value**	**Initial Risk** (likelihood x consequence)	**Existing Management Requirements**	**Revised Risk** (likelihood x consequence)	**Risk Management Measure**
[redacted]				Direct impacts (clearing) of mangrove communities in the Environmental management precinct (Mainland)	**Medium (possible x high)**	MM1 – Referral and controlled action assessment under the EPBC Act MM2 – Offset must be provided under the EPBC Act for any significant residual impact on MNES MM21 – Master plan areas and precincts ensure direct impacts to significant EVs are avoided. MM26 – An offset must be provided under the Environmental *Offsets Act 2014* for any impacts to MLES or MSES resulting in a significant residual impact MM30 – Assessment against State Code 11: Removal, destruction or damage of marine plants and 12: Development in declared fish habitat area MM40 – Development within the TSDA requires assessment against the Development Scheme	**Low (rare x high)**	Not required
		Palustrine Wetlands	N	Indirect impacts wetlands in the Environmental management precinct (Mainland) through stormwater runoff and other vectors	**Low (possible x low)**	MM1 – Referral and controlled action assessment under the EPBC Act MM8 – Impacts would require assessment and approval against the relevant State codes MM27– Assessment and approval of EAs and ERAs under the EP Act including meeting model operating conditions MM28 – Development must meet the requirements of the Noise, Air and Water EPPs MM40 – Development within the TSDA requires assessment against the Development Scheme	**Low (unlikely x medium)**	Not required
[redacted]		Air Quality and Noise	N	Increased dust impacts on surrounding areas resulting in reduced air quality	**Low (possible x low)**	MM28 – Development must meet the requirements of the Noise, Air and Water EPPs MM40 – Development within the TSDA requires assessment against the Development Scheme	**Low (unlikely x low)**	Not required
				Increase in noise and disruption to behaviour/lifecycle of terrestrial and intertidal fauna	**Low (possible x low)**	MM1 – Referral and controlled action assessment under the EPBC Act MM15 – Development must meet the requirements of the Noise, Air and Water EPPs MM40 – Development within the TSDA requires assessment against the Development Scheme	**Low (unlikely x low)**	Not required
		Protected Areas – GBRWHA GBRMP	Y	Indirect impacts on the GBRWHA in the Environmental management precinct (Mainland) through stormwater runoff and other vectors	**Medium (possible x medium)**	MM1 – Referral and controlled action assessment under the EPBC Act MM8 – Impacts would require assessment and approval against the relevant State codes MM27– Assessment and approval of EAs and ERAs under the EP Act including meeting model operating conditions MM28 – Development must meet the requirements of the Noise, Air and Water EPPs MM40 – Development within the TSDA requires assessment against the Development Scheme	**Low (unlikely x medium)**	Not required

Scenario 1	Infrastructure Requirements							
	Marine 1. Capital dredging for widening of the existing Platypus and Sea channels 2. Construction of the reclamation area 3. Storage of capital dredged material within a new reclamation area 4. Periodic maintenance dredging to allow continued shipping access				**Land** 1. Use of TSDA land for storage of empty containers 2. Increased usage of the TPAR to transport materials between the TSDA and port 3. Port of Townsville Quarry to commence operations to supply rock for reclamation revetment walls			
Description of Activity	**Precincts Affected**	**Environmental Value at Risk**	**OUV (Y/N)**	**Potential Impacts to Value**	**Initial Risk** (likelihood x consequence)	**Existing Management Requirements**	**Revised Risk** (likelihood x consequence)	**Risk Management Measure**
		Freshwater and Groundwater Quality	N	Indirect impacts through the release of contaminants or turbid water	**Low (possible x low)**	MM1 – Referral and controlled action assessment under the EPBC Act MM8 – Impacts would require assessment and approval against the relevant State codes MM27– Assessment and approval of EAs and ERAs under the EP Act including meeting model operating conditions MM28 – Development must meet the requirements of the Noise, Air and Water EPPs MM40 – Development within the TSDA requires assessment against the Development Scheme	**Low (unlikely x medium)**	Not required
				Groundwater drawdown as a result of significant earthworks				
				Indirect impacts of dust resulting in reduced water quality.				
		Indigenous Cultural Heritage	N	Direct impacts on cultural heritage sites during vegetation clearing and land disturbance	**Medium (possible x medium)**	MM21 – A CHMP is required to address impacts to Aboriginal Cultural Heritage MM22 – Duty of care to avoid impacts on Aboriginal Cultural Heritage	**Low (unlikely x medium)**	Not required
2. Increased usage of the TPAR to transport materials between the TSDA and port ▪ In its current design (one-lane each way), if used primarily for port-related freight vehicles, the TPAR has an existing capacity of around 19,200 freight vehicle movements per day. ▪ Currently heavy vehicles and local traffic utilise approximately 12% of this capacity.	Infrastructure and supply chain Corridors	Air Quality and Noise	N	Increased dust impacts on surrounding areas resulting in reduced air quality	**Low (possible x low)**	MM1 – Referral and controlled action assessment under the EPBC Act MM12 - EPBC Act approval conditions for the TPAR required the alignment to minimise impacts on vegetation and habitat of listed threatened and migratory species, manage runoff to avoid indirect impacts and protect surrounding intertidal areas in perpetuity as a conservation reserve. MM20 – Impacts would require assessment and approval against the relevant State codes MM27– Assessment and approval of EAs and ERAs under the EP Act including meeting model operating conditions MM28 – Development must meet the requirements of the Noise, Air and Water EPPs	**Low (unlikely x low)**	Not required
				Increase in noise and disruption to behaviour/lifecycle of terrestrial and intertidal fauna	**Medium (possible x medium)**		**Low (unlikely x low)**	Not required
				Indirect impacts on a Migratory and wader bird habitat, mangroves and other receptors in the Environmental management precinct (Mainland) through stormwater runoff and other vectors	**Medium (possible x medium)**		**Low (unlikely x medium)**	Not required
		Mangrove and Saltmarsh Communities	Y	Indirect impacts on mangrove communities in the Environmental management precinct (Mainland) through stormwater runoff and other vectors	**Medium (possible x medium)**	MM1 – Referral and controlled action assessment under the EPBC Act MM12 - EPBC Act approval conditions for the TPAR required the alignment to minimise impacts on vegetation and habitat of listed threatened and migratory species, manage runoff to avoid indirect	**Low (unlikely x medium)**	Not required

Scenario 1	Infrastructure Requirements							
	Marine 1. Capital dredging for widening of the existing Platypus and Sea channels 2. Construction of the reclamation area 3. Storage of capital dredged material within a new reclamation area 4. Periodic maintenance dredging to allow continued shipping access				**Land** 1. Use of TSDA land for storage of empty containers 2. Increased usage of the TPAR to transport materials between the TSDA and port 3. Port of Townsville Quarry to commence operations to supply rock for reclamation revetment walls			
Description of Activity	**Precincts Affected**	**Environmental Value at Risk**	**OUV (Y/N)**	**Potential Impacts to Value**	**Initial Risk** (likelihood x consequence)	**Existing Management Requirements**	**Revised Risk** (likelihood x consequence)	**Risk Management Measure**
				Increased dust impacts on surrounding areas resulting in reduced water quality.	**Low (possible x low)**	impacts and protect surrounding intertidal areas in perpetuity as a conservation reserve. MM27– Assessment and approval of EAs and ERAs under the EP Act including meeting model operating conditions MM28 – Development must meet the requirements of the Noise, Air and Water EPPs MM40 – Development within the TSDA requires assessment against the Development Scheme	**Low (unlikely x low)**	Not required
3. Port of Townsville Quarry to commence operations to supply rock for reclamation revetment walls ▪ Material for revetment wall will be sourced predominantly from POTL's Granitevale quarry or another approved quarry ▪ Material will be trucked to the site where the rock material will be placed using existing roads	Infrastructure and supply chain Corridors Port industry and commerce	Air Quality and Noise	N	Increased dust impacts on surrounding areas resulting in reduced air quality	**Low (possible x low)**	MM13 – Approval conditions for the Granitevale Quarry restrict vegetation clearing, require habitat for listed species to be retained and require implementation of several management plans	**Low (unlikely x low)**	Not required
		Remnant Vegetation	N	Direct clearing of least concern and of concern remnant vegetation within the Port industry and commerce and Infrastructure and supply chain precincts	**Medium (almost certain x medium)**		**Low (almost certain x low)**	Not required
				Indirect impacts to remnant vegetation adjacent the quarry through stormwater runoff and other vectors	**Low (possible x low)**		**Low (unlikely x low)**	Not required
		Threatened Flora and Fauna (Terrestrial)	Y	Impact to potential Black-throated Finch habitat	**Medium (possible x medium)**		**Low (unlikely x medium)**	Not required

Table 13: Scenario 2 Risk Assessment

Scenario 2	Infrastructure Requirements							
	Marine 1. Capital dredging for widening of the existing Platypus and Sea channels 2. Construction of the reclamation area (increased area compared to scenario 1 to accommodate additional dredged material) 3. Storage of capital dredge material within a new reclamation area 4. Construction of additional berth and associated capital dredging of berth pocket to facilitate access 5. Construction of a breakwater to protect the new berths 6. Periodic maintenance dredging to allow continued shipping access				**Land** 1. Port of Townsville Quarry to commence operations to supply rock for breakwater, reclamation revetment walls and berths 2. Additional land requirements in the TSDA to support storage of break bulk cargoes 3. Duplication of the TPAR to accommodate increased traffic between the TSDA and Port and/or TEARC to become operational			
Description of Activity	**Precincts Affected**	**Environmental Value at Risk**	**OUV (Y/N)**	**Potential Impacts to Value**	**Initial Risk** (likelihood x consequence)	**Existing Management Requirements**	**Revised Risk** (likelihood x consequence)	**Risk Management Measure**
Marine								
1. Capital dredging for widening of the existing Platypus and Sea channels	Capital dredging will not change from scenario 1 requirements. Refer to **Table 12** for detailed risk assessment.							
2. Construction of the reclamation area (increased area compared to scenario 1 to accommodate additional dredge material)	While the size of the reclamation area will increase compared to scenario 1 the construction methodology and types of impact will be the same. Refer to **Table 12** for detailed risk assessment.							
3. Storage of capital dredge material within a new reclamation area	While the size of the reclamation area will increase compared to scenario 1 the methodology for disposal of dredged material and types of impact will be the same. Refer to **Table 12** for detailed risk assessment.							
4. Maintenance Dredging	Maintenance dredging will not change from scenario 1 requirements. Refer to **Table 12** for detailed risk assessment.							
5. Construction of additional berths and associated capital dredging to facilitate access ▪ Dredging to provide access to the berths including deepening of the existing outer harbour basin area and dredging of the basin area and pockets for each berth. ▪ Dredging will be carried out using a large mechanical dredger, with the dredged material placed in hopper barges and transported to the reclamation area.	Marine Marine infrastructure Port industry and commerce	Seagrass and Macroalgae	Y	Loss or significant degradation of value within port area, local environs or regionally due to Indirect impacts from dredge plumes resulting in: ▪ Increased sedimentation and turbidity ▪ Decreased water quality ▪ Decreased light attenuation Release of pollutants into water column	**Medium (possible x medium)**	MM3 – EPBC Act approval conditions for the PEP require approval and implementation of a Dredge Management Plan MM7 - EPBC Act approval conditions for the PEP require approval and implementation of an Offset Management Strategy MM10 – CG approval conditions require a reactive water quality monitoring program to be implemented to enable management actions to be identified which will ensure water quality is maintained so adverse effects on marine and coastal ecosystems are avoided	**Low (unlikely x low)**	Not required
		Reef Communities	Y	Loss or significant degradation of value within port area, local environs or regionally due to Indirect impacts from dredge plumes resulting increased sedimentation and turbidity ▪ Decreased water quality ▪ Decreased light attenuation ▪ Release of contaminants into water column Dredge areas are further from known coral reefs compared to dredging in Platypus and Sea Channels	**Low (unlikely x medium)**	MM3 – EPBC Act approval conditions for the PEP require approval and implementation of a Dredge Management Plan MM7 - EPBC Act approval conditions for the PEP require approval and implementation of an Offset Management Strategy MM10 – CG approval conditions require a reactive water quality monitoring program to be implemented to enable management actions to be identified which will ensure water quality is maintained so adverse effects on marine and coastal ecosystems are avoided	**Low (unlikely x low)**	Not required

▪ The wharf structure will most likely be designed and constructed as a conventional reinforced concrete deck that is supported on steel piles.		Marine megafauna	Y	Marine megafauna, in particular dugongs, have been identified as providing a significant contribution to the local expression of the OUV within Cleveland Bay. Direct mortality and/or injury as a result of vessel strike and/or dredging activity has the potential to impact on OUV at the regional scale.	**Medium (possible x medium)**	MM9 – CG approval conditions for the PEP require a MMMP including measures to reduce the risk of interaction with marine fauna MM3 - EPBC Act approval conditions for the PEP require approval and implementation of a MEMP MM7 - EPBC Act approval conditions for the PEP require approval and implementation of an Offset Management Strategy for species habitat removed	**Low (unlikely x medium)**	Not required
				Increase in noise, vibration and/or lighting resulting in a short term disruption to behaviour/life-cycle of mega fauna	**Low (likely x low)**	MM3 - EPBC Act approval conditions for the PEP require approval and implementation of a MEMP MM9 – CG approval conditions for the PEP require a MMMP including measures to reduce the risk of interaction with marine fauna	**Low (possible x low)**	Not required
▪ Piles will be installed by impact hammer. The expected duration of piling for a single berth is 20 weeks.		Fish and Fisheries	N	Loss or significant degradation of fisheries habitat within port area, local environs or regionally from dredge plumes resulting in: ▪ Increased sedimentation and turbidity ▪ Decreased water quality ▪ Decreased light attenuation ▪ Release of pollutants into water column	**Low (likely x low)**	MM3 – EPBC Act approval conditions for the PEP require approval and implementation of a Dredge Management Plan MM10 – CG approval conditions require a reactive water quality monitoring program to be implemented to enable management actions to be identified which will ensure water quality is maintained so adverse effects on marine and coastal ecosystems are avoided	**Low (possible x low)**	Not required
		Marine and Estuarine Protected Areas – GBRWHA and GBRMP	NA	Indirect impacts on protected areas from dredge plumes resulting in: ▪ Increased sedimentation and turbidity ▪ Decreased water quality ▪ Decreased light attenuation ▪ Release of pollutants into water column	**Low (almost certain x low)**	MM3 – EPBC Act approval conditions for the PEP require approval and implementation of a Dredge Management Plan MM10 – CG approval conditions require a reactive water quality monitoring program to be implemented to enable management actions to be identified which will ensure water quality is maintained so adverse effects on marine and coastal ecosystems are avoided	**Low (almost certain x low)**	Not required
		Mangrove and Saltmarsh Communities	Y	Suspended sediment from dredge plumes accumulate in sensitive areas including beaches and intertidal areas of Magnetic Island. Modelling carried out for the AEIS found accumulation of dredged sediment is unlikely to occur on Magnetic Island beaches.	**Low (unlikely x medium)**	MM3 – EPBC Act approval conditions for the PEP require approval and implementation of a Dredge Management Plan MM10 – CG approval conditions require a reactive water quality monitoring program to be implemented to enable management actions to be identified which will ensure water quality is maintained so adverse effects on marine and coastal ecosystems are avoided While not a management measure the CGER and EPBC Act conditions of approval specify a model validation water quality monitoring program is to be implemented to validate model findings. Ongoing monitoring of The Strand is also proposed as part of the AEIS the CGER and EPBC Act conditions of approval specify a model validation water quality monitoring program is to be implemented to validate model findings.	**Low (unlikely x medium)**	Not required
		Marine Water Quality	N	Dredge plumes resulting in increased sedimentation and turbidity in the water column causing local scale temporary reduction in water quality	**Low (almost certain x low)**	MM10 – CG approval conditions require a reactive water quality monitoring program to be implemented to enable management actions to be identified which will ensure water quality is maintained so adverse effects on marine and coastal ecosystems are avoided	**Low (almost certain x low)**	Not required

6. Construction of a breakwater to protect the new berths ▪ Removal of soft marine sediments from the area of the breakwater and the placement of the core, filter material, and armour rock. Marine sediments will be removed by a mechanical dredger.	Marine Marine infrastructure Port industry and commerce	Fish and Fisheries	N	Smothering of benthic habitat under the revetment wall	**High (almost certain x high)**	MM4 – EPBC Act approval conditions for the PEP require approval and implementation of a CEMP MM5 - EPBC Act approval conditions for the PEP require approval and implementation of a MEMP MM7 - EPBC Act approval conditions for the PEP require approval and implementation of an Offset Management Strategy for species habitat removed	**Low (almost certain x low)**	Note: Direct impacts from the reclamation cannot be avoided, however offset requirements under the EPBC Act will compensate for any residual adverse impact.
				Localised turbidity plumes from placement of rock armouring and core material	**Low (possible x low)**	MM4 – EPBC Act approval conditions for the PEP require approval and implementation of a CEMP MM5 - EPBC Act approval conditions for the PEP require approval and implementation of a MEMP MM10 – CG approval conditions require a reactive water quality monitoring program to be implemented to enable management actions to be identified which will ensure water quality is maintained so adverse effects on marine and coastal ecosystems are avoided	**Low (unlikely x low)**	Not required
▪ The breakwater will consist of a rock-fill wall and rock armour layers. Material will be placed where previously dredged.		Marine megafauna	Y	Marine megafauna, in particular dugongs, have been identified as providing a significant contribution to the local expression of the OUV within Cleveland Bay. Direct mortality and/or injury as a result of vessel strike and/or dredging activity has the potential to impact on OUV at the regional scale.	**Medium (possible x medium)**	MM5 - EPBC Act approval conditions for the PEP require approval and implementation of a MEMP MM9 – CG approval conditions for the PEP require a MMMP including measures to reduce the risk of interaction with marine fauna MM7 - EPBC Act approval conditions for the PEP require approval and implementation of an Offset Management Strategy for species habitat removed	**Low (unlikely x medium)**	Not required
				Increase in noise, vibration and/or lighting resulting in a short term disruption to behaviour/life-cycle of mega fauna	**Low (likely x low)**	MM5 - EPBC Act approval conditions for the PEP require approval and implementation of a MEMP MM9 – CG approval conditions for the PEP require a MMMP including measures to reduce the risk of interaction with marine fauna	**Low (possible x low)**	Not required
		Seagrass and Macroalgae	Y	Localised turbidity plumes from placement of rock armouring and core material	**Low (possible x low)**	MM3 – EPBC Act approval conditions for the PEP require approval and implementation of a Dredge Management Plan MM7 - EPBC Act approval conditions for the PEP require approval and implementation of an Offset Management Strategy MM10 – CG approval conditions require a reactive water quality monitoring program to be implemented to enable management actions to be identified which will ensure water quality is maintained so adverse effects on marine and coastal ecosystems are avoided	**Low (unlikely x low)**	Not required

		Mangrove and Saltmarsh Communities	Y	Changes to coastal processes resulting in erosion and accretion of sediments in new areas including beaches and intertidal areas of Magnetic Island Note: AEIS modelling identified that direct changes to hydrodynamic conditions are restricted to the area immediately adjacent to the proposed reclamation area.	**Low (unlikely x medium)**	MM3 – EPBC Act approval conditions for the PEP require approval and implementation of a Dredge Management Plan MM10 – CG approval conditions require a reactive water quality monitoring program to be implemented to enable management actions to be identified which will ensure water quality is maintained so adverse effects on marine and coastal ecosystems are avoided While not a management measure ongoing monitoring of The Strand is proposed as part of the AEIS.	**Low (rare x medium)**	Not required
		Marine and Estuarine Protected Areas – GBRWHA	NA	Smothering of benthic habitat under the breakwater	**High (almost certain x high)**	MM4 – EPBC Act approval conditions for the PEP require approval and implementation of a CEMPMM5 - EPBC Act approval conditions for the PEP require approval and implementation of a MEMP MM7 - EPBC Act approval conditions for the PEP require approval and implementation of an Offset Management Strategy for species habitat removed	**Low (almost certain x low)**	Note: Direct impacts from the reclamation cannot be avoided, however offset requirements under the EPBC Act will compensate for any residual adverse impact.
				Changes to coastal processes indirectly impacting on areas outside of the MPA. Note: AEIS modelling identified that direct changes to hydrodynamic conditions are restricted to the area immediately adjacent to the proposed reclamation area.	**Low (likely x low)**	MM3 – EPBC Act approval conditions for the PEP require approval and implementation of a Dredge Management Plan MM10 – CG approval conditions require a reactive water quality monitoring program to be implemented to enable management actions to be identified which will ensure water quality is maintained so adverse effects on marine and coastal ecosystems are avoided While not a management measure ongoing monitoring of The Strand is proposed as part of the AEIS.	**Low (likely x low)**	
Terrestrial								
1. Port of Townsville Quarry to commence operations to supply rock for breakwater, reclamation revetment walls and berths	While the extent and intensity of works will increase under Scenario 2 construction and operation of the quarry and types of impact will be the same. Refer to Table 12 for detailed risk assessment.							
2. Additional land requirements in the TSDA and the Port to support storage of break bulk cargoes	While the extent of land use will increase under Scenario 2 types of impact will be the same. Refer to Table 12 for detailed risk assessment.							
3. **Duplication of the TPAR to accommodate increased traffic between the TSDA and Port and/or TEARC to become operational** ▪ Duplication of the TPAR from single to dual carriage	Port Industry and Commerce (Port and TSDA) Infrastructure and supply	Remnant Vegetation	N	Direct clearing of least concern and of concern remnant vegetation within the Infrastructure and supply chain precinct.	**Medium (almost certain x medium)**	MM1 – Referral and controlled action assessment under the EPBC Act MM2 – Offset must be provided under the EPBC Act for any significant residual impact on MNES MM12 - EPBC Act approval conditions for the TPAR required the alignment to minimise impacts on vegetation and habitat of listed threatened and migratory species, manage runoff to avoid	**Low (almost certain x low)**	Not required
		Threatened Flora and Fauna (Terrestrial)	N	Indirect impacts on a TEC in the Environmental management precinct (Mainland) through stormwater runoff and other vectors	**Low (possible x low)**		**Low (unlikely x low)**	Not required

▪ Construction of the TEARC within the ISCC precinct and other areas within and outside of the TSDA	chain corridors Environmental management (Mainland)			Direct impacts (clearing) of TECs in the Environmental management (Mainland) and Infrastructure and supply chain precincts	**Low (unlikely x medium)**	indirect impacts and protect surrounding intertidal areas in perpetuity as a conservation reserve. MM20 – Impacts would require assessment and approval against the relevant State codes MM21 – Master plan areas and precincts ensure direct impacts to significant EVs are avoided. MM24 – Landowners must minimise the risks associated with invasive plants and animals under their control to meet the *Biosecurity Act 2014 (Qld)* MM26 – An offset must be provided under the *Offsets Act 2014* for any impacts to Matters of Local Environmental Significance MLES or MSES resulting in a significant residual impact MM27 – Assessment and approval of EAs and ERAs under the EP Act including meeting model operating conditions MM28 – Development must meet the requirements of the Noise, Air and Water EPPs MM29 – Environmental impact assessment of disposal of contaminated material including dredged material under the EP Act MM - Assessment against State Code 16: Native vegetation clearing MM38 – Application and approval under the *Water Act 2000* for works that impact on a defined watercourse MM40 – Development within the TSDA requires assessment against the Development Scheme	**Low (rare x medium)**	Not required
		Listed Migratory and Threatened Species	Y	Indirect impacts on a migratory and wader bird habitat in the Environmental management precinct (Mainland) through stormwater runoff and other vectors	**Low (possible x low)**		**Low (unlikely x low)**	Not required
				Temporary disturbance of migratory and wader bird species during construction periods due to noise	**Low (possible x low)**		**Low (unlikely x low)**	Not required
				Disturbance to migratory and wader bird species during operations due to lighting	**Medium (possible x medium)**		**Low (unlikely x medium)**	Not required
		Palustrine Wetlands	N	Indirect impacts wetlands in the Environmental management precinct (Mainland) through stormwater runoff and other vectors	**Low (unlikely x medium)**		**Low (rare x medium)**	Not required
		Mangrove and Saltmarsh Communities	Y	Direct impact on mangrove and saltmarsh communities through clearing for the duplication and associated activities within the Infrastructure and supply chain precinct.	**High (almost certain x high)**		**Low (almost certain x low)**	Note: EPBC Act approval required protection of a conservation area in perpetuity to offset direct impacts associated with the TPAR corridor
				Indirect impacts on mangrove communities in the Environmental management precinct (Mainland) through stormwater runoff and other vectors	**Medium (possible x medium)**		**Low (unlikely x medium)**	
		Air Quality and Noise	N	Increased dust impacts on surrounding areas resulting in reduced air quality	**Low (possible x low)**		**Low (unlikely x low)**	Not required
				Increase in noise and disruption to behaviour/lifecycle of terrestrial and intertidal fauna	**Low (possible x low)**		**Low (unlikely x low)**	Not required
				Indirect impacts on a Migratory and wader bird habitat, mangroves and other receptors in the Environmental management precinct (Mainland) through stormwater runoff and other vectors	**Low (possible x low)**		**Low (unlikely x low)**	Not required
		Protected Areas – GBRWHA	NA	Indirect impacts on the GBRWHA in the Environmental management precinct (Mainland) through stormwater runoff and other vectors	**Medium (possible x medium)**		**Low (unlikely x medium)**	Not required

[redacted]		Indigenous Cultural Heritage	N	Direct impacts on cultural heritage sites during vegetation clearing and land disturbance	**Medium (possible medium)** x	MM22 – A CHMP is required to address impacts to Aboriginal Cultural Heritage MM23 – Duty of care to avoid impacts on Aboriginal Cultural Heritage	**Low (unlikely medium)** x	Not required
		Fish and Fisheries	N	Change to tidal flows as a result of construction of linear infrastructure (blocking existing fish passage or altering flow paths and additional stormwater runoff)	**Medium (possible medium)** x	MM12 - EPBC Act approval conditions for the TPAR required the alignment to minimise impacts on vegetation and habitat of listed threatened and migratory species, manage runoff to avoid indirect impacts and protect surrounding intertidal areas in perpetuity as a conservation reserve. MM20 – Impacts would require assessment and approval against the relevant State codes	**Low (unlikely medium)** x	Not required

Table 14: Scenario 3 Risk Assessment

Scenario 3	Infrastructure Requirements							
	Marine 1. Capital dredging for widening and deepening of the existing Platypus and Sea channels 2. Construction of the reclamation area (increased area compared to scenario 1 to accommodate additional dredge material) 3. Storage of capital dredge material within a new reclamation area 4. Construction of new berths (additional to Growth Scenario 2) and associated capital dredging of berth pocket to facilitate access 5. Construction of a new cruise ship terminal on the northern side of Ross Creek and associated dredging. 6. Construction of a breakwater to protect the new berths 7. Periodic maintenance dredging to allow continued shipping access				**Land** 1. Port of Townsville Quarry to commence operations to supply rock for breakwater, reclamation revetment walls and berths 2. Additional land requirements in the TSDA to support storage of dry or liquid bulk cargoes as well as dry and liquid bulk cargos including the potential for pipelines/conveyors within the TEARC alignment 3. Duplication of the TPAR to accommodate increased traffic between the TSDA and Port and/or TEARC to become operational			
Description of Activity	**Precincts Affected**	**Environmental Value at Risk**	**OUV (Y/N)**	**Potential Impacts to Value**	**Initial Risk** (likelihood x consequence)	**Existing Management Requirements**	**Revised Risk** (likelihood x consequence)	**Risk Management Measure**
Marine								
1. Capital dredging for widening and deepening of the existing Platypus and Sea channels	While the amount of capital dredging will increase from scenarios 1 and 2, impacts associated with dredging will not change from scenario 1. Refer to **Table 12** for detailed risk assessment.							
2. Construction of the reclamation area (increased area compared to scenarios 1 and 2 to accommodate additional dredge material)	While the size of the reclamation area will increase compared to scenarios 1 and 2 the construction methodology and types of impact will be the same. Refer to **Table 12** for detailed risk assessment.							
3. Storage of capital dredge material within a new reclamation area	While the size of the reclamation area will increase compared to scenarios 1 and 2 the methodology for disposal of dredge material and types of impact will be the same. Refer to **Table 12** for detailed risk assessment.							
4. Construction of additional berths and associated capital dredging to facilitate access	While scenario 3 includes the construction of additional berths than scenario 2 the type and extent of impact would be similar, in particular as implementation the berths are likely to be staged over several years. Refer to **Table 13** for detailed risk assessment.							
5. Maintenance Dredging	While the amount of maintenance dredging will increase from scenarios 1 and 2, impacts associated with dredging will not change from scenario 1. Refer to **Table 12** for detailed risk assessment.							
6. Construction of a new cruise ship terminal on the northern side of Ross Creek and associated dredging. ▪ Creation of new berth operating as cruise ship terminal. ▪ Involves separating the Ross Creek / Magnetic Island ferry traffic from commercial shipping at the start of Platypus Channel.	Interface Marine infrastructure Marine Port industry and commerce	Seagrass and Macroalgae	Y	Direct disturbance within the dredge area and loss or significant degradation of value within port area, local environs or regionally due to indirect impacts from dredge plumes resulting in: ▪ Increased sedimentation and turbidity ▪ Decreased water quality ▪ Decreased light attenuation ▪ Release of pollutants into water column	**Low (possible x low)**	MM1 – Referral and controlled action assessment under the EPBC Act MM2 – Offset must be provided under the EPBC Act for any significant residual impact on MNES MM15 – Permit for dredged material disposal at sea under the *Environment Protection (Sea Dumping) Act 1981* MM16 – Review and assess impacts to historic shipwrecks under the *Historic Shipwrecks Act 1976* MM17 – Discharge of any waste into the ocean must meet the requirements of the *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* and the *Transport Operations (Marine Pollution) Act 1995 (Qld)* MM18 - All international vessels must undertake, record and prove that all cargo and ballast water is low risk to address *the Biosecurity Act 2015.*	**Low (unlikely x low)**	Not required
		Reef Communities	Y	Loss or significant degradation of value within port area, local environs or regionally due to Indirect impacts from dredge plumes resulting in: ▪ Increased sedimentation and turbidity ▪ Decreased water quality ▪ Decreased light attenuation ▪ Release of pollutants into water column	**Low (unlikely x medium)**		**Low (unlikely x low)**	Not required

				Dredge areas are further from known coral reefs compared to dredging in Platypus and Sea Channels		MM19 – EIS assessment and approval requirements under the SDPWO Act MM22 – A CHMP is required to address impacts to Aboriginal Cultural Heritage MM23 – Duty of care to avoid impacts on Aboriginal Cultural Heritage MM26 – An offset must be provided under the *Offsets Act 2014* for any impacts to MLES or MSES resulting in a significant residual impact MM27 – Assessment and approval of EAs and ERAs under the EPA including meeting model operating conditions MM28 – Development must meet the requirements of the Noise, Air and Water EPPs MM29 – Environmental impact assessment of disposal of contaminated material including dredged material under the EPA		
		Marine megafauna	Y	Direct mortality and/or injury as a result of vessel strike and/or dredging activity	**Medium (possible x medium)**		**Low (unlikely x medium)**	Not required
				Increase in noise, vibration and disruption to behaviour/life-cycle	**Low (likely x low)**		**Low (likely x low)**	Not required
		Fish and Fisheries	N	Indirect impacts from dredge plumes resulting in: ▪ Increased sedimentation and turbidity ▪ Decreased water quality ▪ Decreased light attenuation ▪ Release of pollutants into water column ▪ Temporary impacts on fish passage	**Low (likely x low)**		**Low (likely x low)**	Not required
		Marine and Estuarine Protected Areas – GBRWHA and GBRMP	NA	Indirect impacts from dredge plumes resulting in: ▪ Increased sedimentation and turbidity ▪ Decreased water quality ▪ Decreased light attenuation ▪ Release of pollutants into water column	**Medium (almost certain x medium)**	MM31 – Assessment of impacts to the GBR Coast Marine Park under the *Marine Parks Act 2004 (Qld*) MM33 – Permit required for impacting on areas of non-indigenous heritage under the *Queensland Heritage Act 1992* MM34 – All ships operating in Queensland's coastal waters must carry pollution prevention documentation and cannot discharge pollutants offshore. MM35 – Pilotage is compulsory for ships longer than 50 metres or at the Harbour Masters discretion. MM41 – Development within the POTLUP will require assessment against the relevant planning codes and guidelines MM43 – Development within the TCWPDA requires assessment against the Development Scheme	**Low (almost certain x low)**	Not required
		Mangrove and Saltmarsh Communities	Y	Suspended sediment from dredge plumes accumulate in sensitive areas including beaches and intertidal areas of Magnetic Island	**Low (unlikely x medium)**		**Low (unlikely x low)**	Not required
		Air Quality and Noise	Y	Emissions from cruise ships using the terminal have the potential to impact on human health through the release of pollutants (i.e. sulphur)	**Low (unlikely x medium)**		**Low (rare x medium)**	Not required
7. Construction of a breakwater to protect the new berths	Construction of the breakwater and associated impacts are identical to those outlined for scenario 2. Refer to **Table 13** for detailed risk assessment.							
Terrestrial								
1. Port of Townsville Quarry to commence operations to supply rock for port infrastructure	While the extent and intensity of works will increase under Scenario 3 construction and operation of the quarry and types of impact will be the same. Refer to **Table 12** for detailed risk assessment.							
2. Additional land requirements in the TSDA to support storage of dry bulk cargoes	Port Industry and Commerce (Port and TSDA) Infrastructure and supply chain corridors Environmental management (Mainland)	Remnant Vegetation	N	Direct clearing of least concern and of concern remnant vegetation	**Medium (almost certain x medium)**	MM1 – Referral and controlled action assessment under the EPBC Act MM2 – Offset must be provided under the EPBC Act for any significant residual impact on MNESMM7 – EIS assessment and approval requirements under the *State Development and Public Works Organisation Act 1971* MM19 – EIS assessment and approval requirements under the SDPWO Act MM20 – Impacts would require assessment and approval against the relevant State codes	**Low (almost certain x low)**	Not required
		Threatened Flora and Fauna (Terrestrial)	N	Direct clearing of fauna habitat within the Port industry and commerce precinct Indirect impacts on a TEC in the Environmental management precinct (Mainland) through stormwater runoff and other vectors	**Medium (possible x medium)**		**Low (unlikely x medium)**	Not required

		Listed Migratory and Threatened Species	Y	Indirect impacts on a migratory and wader bird habitat in the Environmental management precinct (Mainland) through runoff and other vectors Temporary disturbance of migratory and wader bird species during construction and operation periods due to noise and dust Disturbance to migratory and wader bird species during operations due to lighting	**Medium (possible x medium)**	MM22 – A CHMP is required to address impacts to Aboriginal Cultural Heritage MM23 – Duty of care to avoid impacts on Aboriginal Cultural Heritage MM24 – Landowners must minimise the risks associated with invasive plants and animals under their control to meet the *Biosecurity Act 2014 (Qld)* MM26 – An offset must be provided under the *Offsets Act 2014* for any impacts to MLES or MSES resulting in a significant residual impact MM27 – Assessment and approval of EAs and ERAs under the EP Act including meeting model operating conditions MM28 – Development must meet the requirements of the Noise, Air and Water EPPs MM29 – Environmental impact assessment of disposal of contaminated material including dredged material under the EP Act MM30 – Assessment against State Code 11: Removal, destruction or damage of marine plants and 12: Development in declared fish habitat area MM32 – Permit must be obtained under the NC Act to remove any EVNT species MM33 – Permit required for impacting on areas of non-indigenous heritage under the *Queensland Heritage Act 1992* MM36 Various transport legislation requiring management of the transport of dangerous goods by road and rail MM37 - Assessment against State Code 16: Native vegetation clearing MM38 – Application and approval under the *Water Act 2000* for works that impact on a defined watercourse MM39 – Development within areas covered by the Townsville City Plan will require assessment against the Coastal Environment, Cultural Heritage and Natural Assets Overlays MM40 – Development within the TSDA requires assessment against the Development Scheme MM43 – Development within the TCWPDA requires assessment against the Development Scheme	**Low (rare x medium)**	NA
		Mangrove and Saltmarsh Communities	Y	Indirect impacts on mangrove communities in the Environmental management precinct (Mainland) through runoff and other vectors Indirect impacts on mangroves from air quality issues such as dust particulates. Direct impacts (clearing) of mangrove communities in the Environmental management precinct (Mainland)	**Medium (possible x medium)**		**Low (unlikely x medium)**	NA
		Palustrine Wetlands	N	Indirect impacts wetlands in the Environmental management precinct (Mainland) through water runoff or releases and other vectors	**Low (possible x low)**		**Low (unlikely x low)**	NA
		Air Quality and Noise	N	Increased dust impacts in surrounding areas resulting in reduced air quality Increase in noise and disruption to behaviour/lifecycle of terrestrial and intertidal fauna	**Medium (possible x medium)**		**Low (rare x medium)**	NA
		Protected Areas – GBRWHA	Y	Indirect impacts on the GBRWHA in the Environmental management precinct (Mainland) through water runoff or releases and other vectors	**Medium (possible x medium)**		**Low (unlikely x medium)**	NA
		Freshwater and Groundwater Quality	N	Indirect impacts through the release of contaminants or turbid water Groundwater drawdown as a result of significant earthworks	**Medium (possible x medium)**		**Low (unlikely x medium)**	NA
		Indigenous Cultural Heritage	N	Direct impacts on cultural heritage sites during vegetation clearing and land disturbance	**Low (possible x low)**		**Low (unlikely x low)**	NA
3. Duplication of the TPAR to accommodate increased traffic between the TSDA and Port and/or TEARC to become operational	Works and impacts associated with duplication of the TPAR or implementation of the TEARC are identical to those outlined for scenario 2. Refer to **Table 13** for detailed risk assessment.							

7. Risk assessment conclusion

7.1. Relationship to the port master plan

Port master plans are strategic documents implemented through the Ports Act by the port overlay. The port overlay does not exist in isolation and will operate in conjunction with existing planning instruments to guide future port-related development for the proposed master planned area.

The master plan is intended to complement the existing regulatory system and does not remove current processes. Additional regulation through the port overlay to guide port-related development outcomes will only occur where a gap is identified in the existing regulatory framework that would impact delivery of master plan outcomes.

The risk assessment process carried out this gap analysis through the following steps:

- Identified EVs within and surrounding the priority Port of Townsville draft master plan area (MPA) **(section 3)**
- Outlined projected growth scenarios representing a range of development scales for the proposed MPA and identified the key impacting activities associated with these scenarios **(section 4)**
- Detailed review of existing regulatory and planning instruments as well as conditions of approval for projects that have been or will be implemented within the draft MPA **(section 5)**
- Assessed the ability for the existing instruments to manage risks to EVs associated with the key impacting activities **(section 6)**.

7.2. Assessment outcomes

The risk assessment found that the existing regulatory and planning instruments and approval conditions for the Townsville PEP, TPAR and the Granitevale Quarry effectively manage potential impacts to EVs from the projected growth scenarios. The risk assessment found residual risk for all potential impacts to be low. This outcome is partially achieved through the implementation of the MPA draft precincts, which avoid direct and indirect impacts to a number of EVs. These areas could be further refined to avoid impacts to EVs.

A number of modifications could be made to the MPA draft precincts to further minimise potential risks to EVs and ensure the master plan focuses on key port issues. Proposed changes are summarised below:

- Removal of the Granitevale Quarry as a draft Port industry and commerce precinct due to the nature of its future operation if required for port construction projects as opposed to daily port operations. The quarry has gained all necessary Federal, state and local approvals and will be managed in accordance with the approval conditions.
- Removal of the Elliot Springs as a draft Interface precinct as this development is now an approved area of residential development with impacts on EVs addressed through previous assessment. Growth scenarios do not contemplate interactions with this precinct aside from the potential to add traffic to the TPAR which can be addressed through other means.
- Changes to the Infrastructure and supply chain corridor precinct between the TSDA and port so that it aligns more closely with the TSDA Development Scheme's Materials Transportation and Services Corridor

precinct boundary. This area is crucial to the ongoing development of the port area as well as containing areas of significant ecological value and should be protected and managed through the master plan.

- Removal of Magnetic Island as a draft Environmental management precinct as no port-related development is anticipated to occur or impact on mainland Magnetic Island.
- Minor changes to the Environmental management and Port industry and commerce precincts to avoid the Environmental management precinct overlaying existing industry areas.

Proposed changes are shown on **Figure 11**.

The preparation of the draft master plan, will further analyse the land use planning provisions of the Townsville City Plan, TSDA Development Scheme, TCWPDA Development Scheme and POT LUP. This will identify whether additional development controls may be required to address inconsistencies in managing the interface of land uses with port operational areas, including consideration of whether a PMM is required

7.3. Draft Environmental Management Framework

7.3.1 Summary of function

The Ports Act establishes a legislative framework for the development of an EMF for a priority port. The EMF describes the interaction of port-related development with environmental values, with a particular focus on the local expression of the OUV of the GBRWHA.

The function of the EMF includes:

- Identifying and mapping EVs in the proposed MPA and surrounding areas
- Identifying any potential impacts that development in the proposed MPA may have on the OUV of the GBRWHA and other EVs
- Stating the objectives and management measures for managing the impacts that have been identified.

Due to the comprehensive nature of existing statutory requirements and operational environmental management measures that are implemented within the proposed MPA, limited additional management measures have been identified for inclusion in the EMF.

The minimisation of impacts from development within the MPA will be achieved by implementing the environmental management hierarchy of avoid, mitigate and/or offset. In the first instance, development should avoid any potential impacts on environmental values. Where avoidance is not practicable (within the context of the principles of ESD), mitigation measures are implemented to reduce the extent, severity and/or duration of potential impacts on EVs as a result of the development. If a development, after applying all practicable avoidance and mitigation measures, results in a significant residual impact on an environmental value, an offset may be required in accordance with commonwealth and state legislation and policies.

7.3.2 Draft EMF objectives

Draft EMF objectives have been identified for each of the MPA draft precincts to minimise potential impacts from development, including the OUV of the GBRWHA, MNES and MSES. The Draft EMF objectives identify targets to inform environmental management within the proposed MPA and contribute to achieving the master plan's strategic vision, objectives, desired outcomes and state interests.

The recommended EMF objectives for each of the master planned area precincts are outlined below.

Environmental management precinct

- Avoid, minimise and offset potential impacts (direct, indirect and cumulative) on EVs from development within and adjacent to the mainland precinct. Particular attention must be given to:
    - Addressing the potential for cumulative impacts on EVs from multiple developments within the Port industry and commerce precinct areas
    - Early detection and amelioration of impacts on mangrove and saltmarsh communities
    - Avoiding direct impacts on threatened ecological communities under the EPBC Act and Endangered and Of Concern Regional Ecosystems under the VM Act
    - Conservation of habitat for threatened and migratory species under the EPBC Act and NC Act

- Avoid, minimise and offset potential impacts (direct, indirect and cumulative) on EVs from development within the proposed master planned area on Magnetic Island precinct. Particular attention must be given to early detection of indirect impacts on mangrove and saltmarsh communities.

Port industry and commerce precinct

- Avoid, minimise and offset potential impacts (direct, indirect and cumulative) from development within the precinct on the following environmental values:
    - threatened ecological communities under the EPBC Act
    - regional ecosystems under the VM Act
    - threatened and migratory species under the EPBC Act and NC Act
    - seagrass meadows and deep water seagrass meadows
    - mangroves and other intertidal marine plants
    - migratory shorebird habitat and populations
    - marine fauna
    - freshwater, marine water and ground water quality
    - palustrine wetlands
    - cultural heritage values
    - reef communities

- Increase the understanding of the importance of habitat for the long-term conservation of species protected under the EPBC Act, NC Act, marine plants and fish.

- Maintain appropriate access to areas that provide Indigenous cultural heritage values and natural scenic amenity values to residents, recreational users and tourists that contribute to the OUV of the GBRWHA.

- Development should address the potential for cumulative impacts resulting from the development, other existing developments and known potential future developments (i.e. those currently within a local, state or commonwealth assessment process) located within the MPA.

Infrastructure and supply chain corridors precinct

- Support development within the precinct that operates efficiently and effectively, in a manner that appropriately balances industrial, commercial, recreational and cultural activities, and potential impacts from development on the OUV of the GBRWHA and other environmental values.

- Infrastructure within the corridor connecting the port and TSDA should be consolidated and co-located where possible to minimise clearing requirements.

- Ongoing operation of private infrastructure by proponents should be managed so that transport of materials does not impact on sensitive receptors through air quality, noise and stormwater impacts.

- Avoid, minimise and/or offset potential impacts (direct, indirect and cumulative) from development within the precinct on the following environmental values:
    - mangroves and other intertidal marine plants
    - migratory shorebird habitat and populations
    - marine and fresh water quality and flows –
    - cultural heritage values

- Development should address the potential for cumulative impacts resulting from the development, other existing developments and known potential future developments (i.e. those currently within a local, state or commonwealth assessment process) located within the MPA.

Interface precinct

- Ensure that development within the precinct incorporates design measures and other controls that minimise noise, light, visual amenity and air quality impacts from adjoining port and industrial land uses.

- Development within the MPA must address the potential for cumulative impacts resulting from the development, other existing developments and known potential future developments (i.e. those currently within a local, state or commonwealth assessment process) located within the MPA.

Marine infrastructure precinct

- Maintain port access to and continued development of shipping channels and waterside areas in a manner that appropriately balances industrial, commercial, recreational and cultural activities and potential impacts on the OUV attributes of the GBRWHA and other environmental values.

- Avoid, minimise and offset (direct, indirect and cumulative) potential impacts from development within the precinct on the following environmental values:
    - seagrass meadows and deep water seagrass meadows
    - mangroves and other intertidal marine plants
    - migratory shorebird habitat and populations
    - marine fauna
    - marine water quality
    - cultural heritage values

- Increase the understanding of the presence and contribution of attributes that contribute to the local expression of the OUV of the GBRWHA, and habitat value for other EPBC Act and NC Act species and marine plants.

- Development should address the potential for cumulative impacts resulting from the development, other existing developments and known potential future developments (i.e. those currently within a local, state or commonwealth assessment process) located within the MPA.

Marine precinct

- Avoid direct impacts from development within the precinct on environmental values

- minimise indirect and cumulative impacts from development within the precinct on the following environmental values:
    - seagrass meadows and deep water seagrass meadows
    - mangroves and other intertidal marine plants
    - migratory shorebird habitat and populations
    - marine fauna
    - marine water quality
    - cultural heritage values
    - reef communities

- Increase the understanding of the presence and contribution of attributes that contribute to the local expression of the OUV of the GBRWHA, and habitat value for other EPBC Act and NC Act species and marine plants.

- Development should address the potential for cumulative impacts resulting from the development, other existing developments and known potential future developments (i.e. those currently within a local, state or commonwealth assessment process) located within the MPA.

Marine services and recreation precinct

- minimise indirect and cumulative potential impacts from development within the precinct on the following environmental values:
    - mangroves and other intertidal marine plants
    - migratory shorebird habitat and populations
    - marine fauna
    - marine water quality

- Maintain safe access to the waterfront and harbour for commercial operations, residents, recreational users and tourists.

Figure 11: **Proposed revised master planned area draft precincts**

Appendices

Appendix A – Risk Assessment and Local Expression of OUV Methodologies

Appendix B – Stakeholder workshop attendees

Appendix C – Information Sources

Appendix D – NC Act and EPBC Act searches

Appendix E – Protected Species Likelihood of Occurrence Schedule

Appendix A

Risk Assessment and Local Expression of OUV Methodologies

Attachment 1

Risk Assessment Methodology
Priority Port Master Planning
Prepared for Department of State Development

November 2016

Risk assessment methodology

The risk assessment methodology for each priority port will include the following:

- the identification of risk management requirements, which may include PMMs, is triggered when a High risk to an environmental, social or cultural value due to a potential impact cannot be reduced to a Medium or Low risk through existing statutory requirements, planning instruments and operational environmental management measures. That is, post application of existing management measures, risk remains High. Management may also be required where existing statutory requirements, planning instruments and operational environmental management measures do not apply and cannot be used for controlling risk.

- where a risk cannot be controlled and remains High, and relates to an environmental value, the management requirement can be described as a PMM. PMMs will, therefore, be management requirements that relate to potential high risk impacts on the OUV of the GBRWHA and other environmental values within, and surrounding, the master planned area.

- recognition that the use of existing statutory requirements, planning instruments and operational environmental management measures to reduce a High risk to a Medium or Low risk may require a coordinated approach agreed amongst relevant stakeholders (e.g. a Code) and that this could be incorporated into the EMF and/or port overlay.

Environmental values are defined by the Environmental Protection Act 1994 to be:

> *(a) a quality or physical characteristic of the environment that is conducive to ecological health or public amenity or safety; or*
> *(b) another quality of the environment identified and declared to be an environmental value under an environmental protection policy or regulation.*

The objective for undertaking the risk assessment process is to determine which future port related activities are likely to result in potentially high environmental, social and cultural risks that are uncontrolled by existing statutory requirements, planning instruments and operational environmental management measures and hence need prescribed management requirements to reduce risk.

The range of existing statutory requirements, planning instruments and operational management measures that should be considered as part of the risk assessment process can be broadly classified according to implementation method as:

- Commonwealth and Queensland government environmental approval processes
- Statutory land use approval processes (i.e. LUP, SDA Development Scheme etc.)
- Existing operational management (e.g. environmental monitoring, management plans)

The steps to achieve identification of risk management requirements, including the risk assessment process, are shown in Figure 1.

1. Identify and map the environmental values within each of the master plan precincts

2. Define the priority port-specific environmental, social and cultural values and identify which of those contribute to the OUV of GBRWHA, for the values within and surrounding the master planned area based on the DSD OUV methodology

3. Identify future development activities associated with the growth scenarios for each master plan precinct

4. Undertake a risk assessment of the potential impacts associated with development activities from prescribed growth scenarios on the environmental, social and cultural values within each master planned area precinct (and surrounding areas where relevant). The risk assessment steps include;

    a. Identify potential impacts to the values defined in Step 2 for each of the activities defined by Step 3. Appendix A provides a master list of direct and indirect impacts and some examples (but not all) of associated construction and operational development activities.
    b. Determine the risk of each potential impact on the identified values with out the implementation of existing statutory requirements, planning instruments and operational environmental management measures based on likelihood and consequence (see Tables 2 – 6). Defined as **initial risk.**
    c. Determine what, if any, existing statutory requirements, planning instruments and operational environmental management measures are relevant to controlling the identified initial risk. This should assess whether inconsistencies, information and management gaps, and implementation timeframe gaps are likely to occur during the implementation of existing statutory requirements, planning instruments and operational management measures over the master planning timeframe. It should also give regard to security of non-statutory measures (i.e. voluntary) over the master planning timeframe.
    d. Determine the risk of each potential impact on the identified values with the implementation of existing statutory requirements, planning instruments and operational environmental management measures based on likelihood and consequence (see Tables 2 – 6). Defined as **post management risk**. This needs to also consider how existing management measures could be applied to potential changes in the identified values over the 30 year planning horizon.
    e. Present the results consistent with the format provided in Table 5.

5. Summarise which impacts are High risk and cannot be managed to be less than High risk through existing statutory requirements, planning instruments and operational environmental management measures.

6. Identify risk management requirements for potential impacts so as to reduce the risk rating for that impact to less than High.

7. For those risk management requirements, identify which, if any, relate to controlling risk of impact to environmental values and, therefore, are likely to require a PMM.

8. Propose the potential implementation mechanism (e.g. planning and/or operational measures) and responsible entity/ies (including advisory agencies) for implementing the risk management requirements, including PMMs.

In assessing consequences using Table 4, it should be recognised that the assessment relates to the potential impacts at the time at which the risk assessment was conducted. An updated assessment would be required as part of the future Master Plan review process.

The output of this risk assessment is considered to be a list of;

- risks that are recognised as likely to occur due to the different growth scenarios and identification of the existing statutory requirements, planning instruments and operational environmental management measures that can manage those risks,

- a list of values which, under specific growth scenarios and at time of assessment, are considered to be at High risk of impact and for which adequate controls are not available through existing management statutory requirements, planning instruments and operational environmental management measures,

- a list of risk management requirements, which may include PMMs, considered relevant to reduce post management risk to less than High.

The risk management requirements and risk conclusions will be considered in the preparation of the master plan and priority port overlay for the master planned area in accordance with the Ports Act.

Figure 1: Environmental management and risk assessment framework

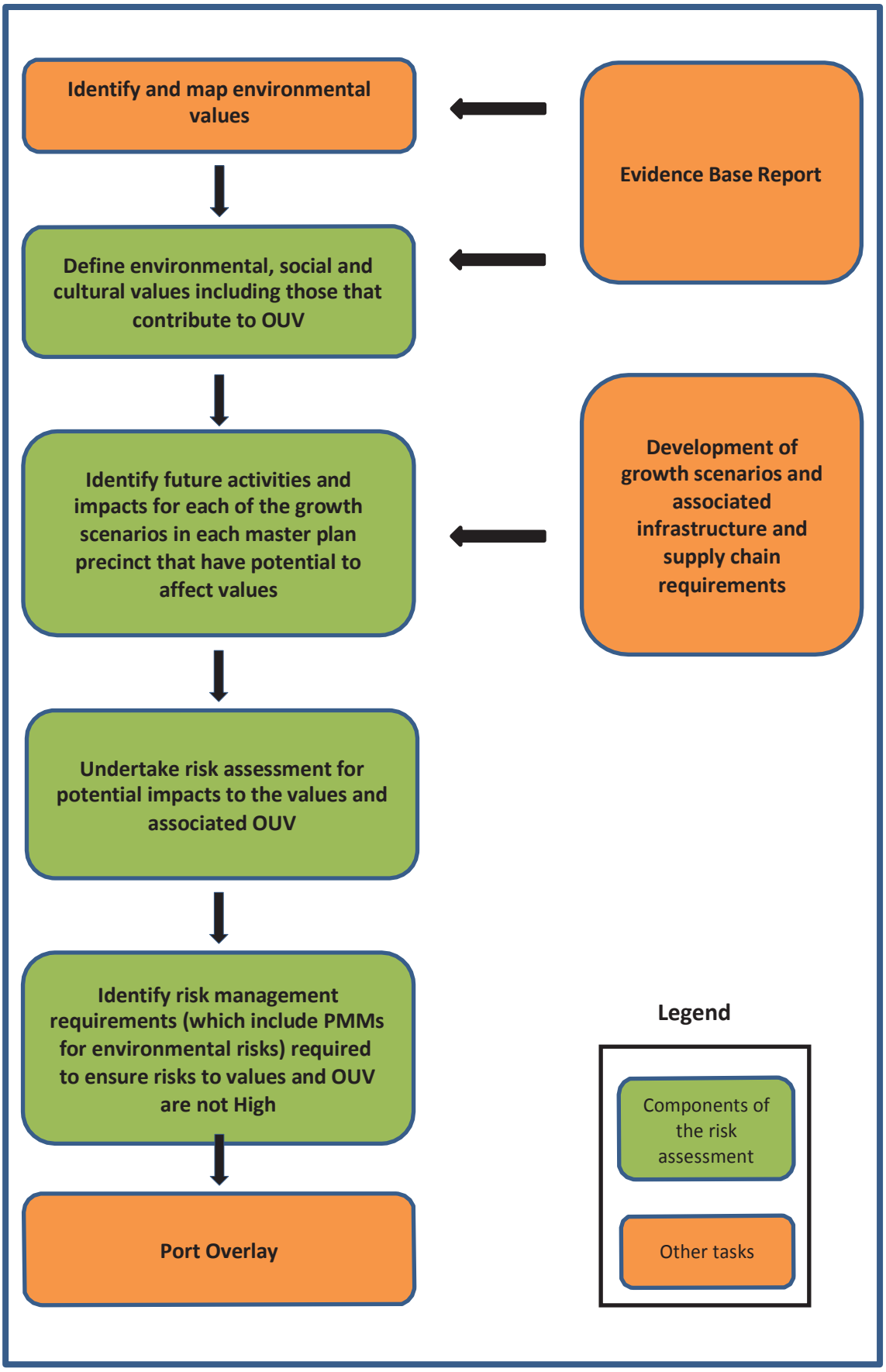

Table 2: Risk matrix

Positive	Low	Medium	High

CONSEQUENCE						
	Extreme					
	High					
	Medium					
	Low					
	Positive					
		Rare	Unlikely	Possible	Likely	Almost certain
		LIKELIHOOD				

Table 3: Likelihood guide

Definition	Occurrence
Almost certain Is expected to occur as a result of the particular scenario being assessed	Conceivably a regular or unavoidable event
Likely Will probably occur as a result of the scenario being assessed	Expected to happen during the life of the Master Plan
Possible Might occur at some time under the particular scenario being assessed	A possible event during the life of the Master Plan
Unlikely Unlikely to happen under the particular scenario being assessed	Unlikely to happen over the life of the Master Plan
Rare May occur only in exceptional circumstances	Extremely unlikely to happen over the life of the Master Plan

Table 4. Consequence guide

Definition	Environmental values	Social values	Cultural heritage values
Extreme	Impact is clearly affecting the nature of the ecosystem over a wide area OR Impact is catastrophic and possibly irreversible over a small area or to a sensitive population or community. Recovery periods of greater than 20 years likely OR Condition of an affected part of the ecosystem or local expression of a GBR OUV is irretrievably compromised	Permanent or long term decline in social or community profile	Permanent alteration or loss of heritage values
High	Impact is significant at either a local or wider level or to a sensitive population or community Impacts of a temporary nature (0 – 10 years) to the local expression of a GBR OUV. If environmental values are high, recovery periods of 10 - 20 years are likely	Prolonged negative impact to multiple community sectors or businesses with limited ability to adapt or recover (5+ years)	Restricted access and/or reduction to condition or quality of heritage value and appreciation
Medium	Impact is present at either a local level for a period of 0 - 10 years but would not affect local expression of a GBR OUV. If environmental values are high, recovery periods of 0 - 10 years anticipated	Impact to multiple community sector or business for a period of 1-5 years	Temporary loss of access to heritage values Loss of appreciation of heritage value from nearby development or activity
Low	Impact is present but not to the extent that it would impair the overall condition of the ecosystem, OUV, sensitive population or community in the long term	Disruption to social amenity or demand on services for 1-12 months.	Minor disruption to access or appreciation of heritage values
Positive	Positive environmental outcomes	Positive social and community outcomes	Improved protection and opportunity to appreciate heritage values

Table 5: Format to be adopted for presenting risk assessment (with example text)

Description of Scenario: xx	**Infrastructure requirements** Port of xxx peak throughput ~xx Mtpa xx new terminals/stockpile areas Existing road and rail sufficient Existing water and electricity supply arrangements sufficient Two new berths – dredging required					**Land and maritime use** Existing shoreline land use on SPL, approximately xx ha for stockpiles and infrastructure xx berths adjacent to xxx Offshore anchorage area designated eastwards of operational port area, within GBRMP		
Development type	**Value**	**OUV (Y/N)**	**Development activities**	**Potential impact to value**	**Initial Risk**	**Management measure**	**Post management risk**	**Risk management requirement**
Construction of new reclamation areas to accommodate dredged material	Seagrass Mangroves	Y	Reclamation Vegetation clearing (e.g. mangroves)	Direct loss, fragmentation or degradation of vegetated habitat Altered coastal processes and morphology Altered hydrodynamics and hydrology	Likely x High = **High**	Commonwealth controlled action under the EPBC Act and SDPWO Act EIS assessment and approval process with conditions Development approvals under Planning Act GPC LUP approval requiring appropriate management measures	Likely x Low = **Low**	Adherence to existing assessment and approval processes

Infrastructure construction on Facing Island	Rare or threatened terrestrial vegetation communities	Y	Construction of new infrastructure (water, power)	Adverse effects to listed species or communities of conservation significance from direct or indirect impacts)	Likely x High = **High**	While provisions may exist to control risk under Land Act triggering these requires amendment of existing land use planning schemes of relevance to site. As such, risk is considered uncontrolled.	Likely x High = **High**	Management requirement to prepare a Land Management Plan for Facing Island to support amendment the GPC LUP for SPL and GRC Planning Scheme under the SP Act and/or Planning Act to address environmental risks
Development of new industry on coastal lands with associated marine infrastructure	List them	Y	Vegetation clearing (e.g. mangroves)	Unintended impacts to various values resulting from an uncoordinated approach to assessing and approving development applications for new development	Likely x High = **High**	Trigger/need for consistent and considered assessment of holistic impact potential across multiple DAs lacking – needs a new management requirement	Likely x High = **High**	Management requirement to develop a new Priority Port of Gladstone Environmental Impact Assessment Guideline which shall include the minimum requirements for development applications to address. Guideline to be applicable for an EIS prepared under the EPBC Act, SDPWO Act, EP Act and/or the Planning Act 2016.

Table 6: Risk response

Risk category	Risk response
High	An event at this level would have a significant impact on identified values, potentially leading to loss of the local expression of OUV. A new specific risk management requirement is needed to reduce risk. If the requirement relates to controlling risk to an environmental value, then the requirement can be described as a PMM. New risk management requirements need to have known reliability for proposed use, monitored in an ongoing manner and be incorporated into the EMF and/or port overlay.
Medium	Impacts at this level may lead to a degradation of values in either the short or long term but can be managed through existing statutory requirements, planning instruments and operational environmental management measures. Existing measures and any associated stakeholder coordination or monitoring requirements should be identified and incorporated into the EMF and/or port overlay.
Low	Should only require mitigation if an increase in the level of impact is detected.
Positive	Positive consequences should be encouraged but are not a trade-off for impacts.

Appendix A

List of potential direct and indirect impacts to values and some examples of associated impacting development activities.

Environmental value impacts*	Some examples of development activity
Direct loss, fragmentation or degradation of habitat and supported biota	Vegetation clearing, reclamation, residential development, construction of infrastructure, dredging
Disturbance or displacement of fauna or migratory patterns causing loss or alteration of local biodiversity (e.g. behavioural changes affecting nesting)	Vehicle movements, reclamation, dredging
Fauna injury/strike/mortality	Operation of construction machinery and vessels, construction of fencing, increased vehicular traffic, capital and maintenance dredging
Introduction of weeds and/or pest species	Construction operations, maintenance works, dredging
Altered hydrodynamics and hydrology	Dredging, reclamation, catchment modification, flow diversion
Altered coastal processes and morphology	Dredging, reclamation
Degraded marine and freshwater surface water quality	Oil spills, shipping accidents, release of wastes or pollutants, dredging, disturbance of Potential Acid Sulfate Soils, additional point source inputs
Degraded groundwater water quality	Excavation of Potential Acid Sulfate Soils, dewatering of groundwater
Degraded sediment and land quality	Excavation of Potential Acid Sulfate Soils, additional point source inputs, release of wastes or pollutants
Degraded air quality	Stockpile operation, increased vehicular traffic, industrial development, construction
Altered light environment	Construction of coastal development and infrastructure, increased shipping
Increased noise and/or vibration	Increased shipping, increased traffic, industrial development, residential development
Adverse effects to listed species or communities of conservation significance	Vegetation clearing, reclamation, industrial development
Changes in landscape character affecting aesthetics	Reclamation, construction, obstruction of views or excavation activities
Social value impacts	
Changes in landscape character affecting aesthetics or liveability	Reclamation, construction, industrial development, altering views, lighting or place character
Increased pressure on community infrastructure or use of natural environment	Residential or camp development
Increased demands on emergency services, police, fuel supplies and other community service industries	Residential or camp development, industrial development, construction of infrastructure
Adverse effects to residential real estate market	Industrial development
Loss of access or disruption to travel	Construction/operational traffic, industrial facility establishment, water space use conflict
Increase local labour force participation and local skills capacity	Residential or camp development, industrial development
Increase in crime	Residential development
Altered socio-economic profile of community	Industrial development, construction of infrastructure
Expansion of existing services and attraction of new enterprises to the region	Industrial development, construction of infrastructure

Cultural heritage value impacts	
Direct loss or damage to indigenous cultural sites	Reclamation, residential or camp development, industrial development
Loss of remnant vegetation and significant trees	Catchment modification, residential or camp development, industrial development
Loss of restrictions on access to cultural sites	Residential or camp development, industrial development
Alteration of land or seascapes	Reclamation, catchment modification, industrial development

**** = Environmental impacts may relate to marine, freshwater or terrestrial ecosystems***

Appendix B

Stakeholder Workshop Attendees

Brisbane - 5/9/17
Department of Agriculture and Fisheries
Department of Environment and Heritage Protection
Department of Infrastructure, Local Government and Planning
Department of National Parks, Sport and Recreation
Department of State Development
Department of Transport and Main Roads
Port of Townsville Ltd
Office of the Coordinator-General
Queensland Treasury

Townsville - 12/9/17
Department of Agriculture and Fisheries
Department of Infrastructure, Local Government and Planning
Department of Natural Resources and Mines
Department of State Development
Department of Transport and Main Roads
Maritime Safety Qld
Port of Townsville Ltd
Townsville City Council

Appendix C

Information Sources

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Appendix D

NCA and EPBC Searches

Australian Government
Department of the Environment and Energy

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

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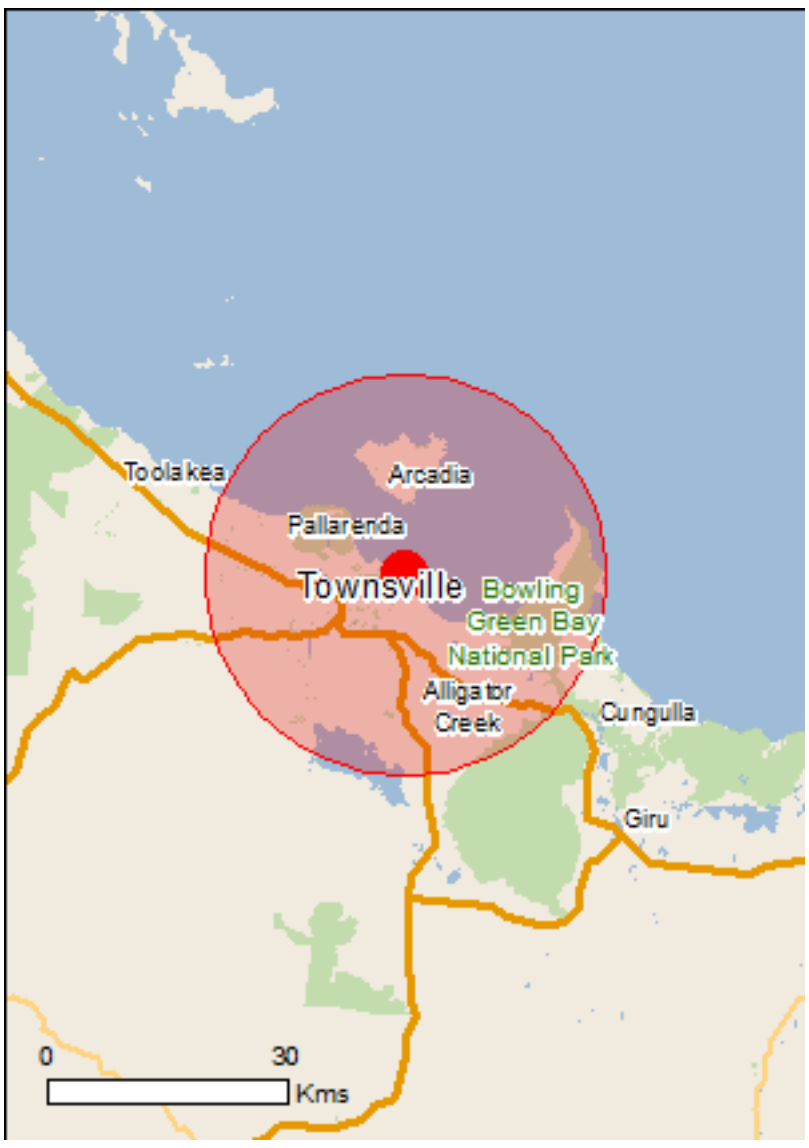

This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

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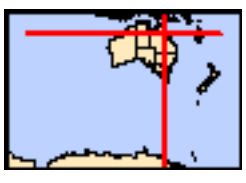

Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	1
National Heritage Places:	1
Wetlands of International Importance:	1
Great Barrier Reef Marine Park:	15
Commonwealth Marine Area:	1
Listed Threatened Ecological Communities:	1
Listed Threatened Species:	45
Listed Migratory Species:	67

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	13
Commonwealth Heritage Places:	None
Listed Marine Species:	111
Whales and Other Cetaceans:	12
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	12
Regional Forest Agreements:	None
Invasive Species:	39
Nationally Important Wetlands:	5
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

World Heritage Properties [Resource Information]

Name	State	Status
Great Barrier Reef	QLD	Declared property

National Heritage Properties [Resource Information]

Name	State	Status
Natural		
Great Barrier Reef	QLD	Listed place

Wetlands of International Importance (Ramsar) [Resource Information]

Name	Proximity
Bowling green bay	Within Ramsar site

Great Barrier Reef Marine Park [Resource Information]

Type	Zone	IUCN
Conservation Park	CP-19-4059	IV
Conservation Park	CP-19-4060	IV
Conservation Park	CP-19-4057	IV
Conservation Park	CP-19-4058	IV
General Use	GU-16-6004	VI
Habitat Protection	HP-19-5162	VI
Habitat Protection	HP-19-5163	VI
Habitat Protection	HP-19-5161	VI
Marine National Park	MNP-19-1090	II
Marine National Park	MNP-19-1092	II
Marine National Park	MNP-19-1094	II
Marine National Park	MNP-19-1089	II
Marine National Park	MNP-19-1091	II
Marine National Park	MNP-19-1093	II
Scientific Research (closed to public access)	SR-19-2008	IA

Commonwealth Marine Area [Resource Information]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside the Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area. Generally the Commonwealth Marine Area stretches from three nautical miles to two hundred nautical miles from the coast.

Name
EEZ and Territorial Sea

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions	Endangered	Community likely to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Roosting known to occur

Name	Status	Type of Presence
		within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Roosting known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Erythrotriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat known to occur within area
Fregetta grallaria grallaria White-bellied Storm-Petrel (Tasman Sea), White-bellied Storm-Petrel (Australasian) [64438]	Vulnerable	Species or species habitat likely to occur within area
Limosa lapponica baueri Bar-tailed Godwit (baueri), Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat likely to occur within area
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Bar-tailed Godwit (menzbieri) [86432]	Critically Endangered	Species or species habitat may occur within area
Neochmia ruficauda ruficauda Star Finch (eastern), Star Finch (southern) [26027]	Endangered	Species or species habitat likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Poephila cincta cincta Southern Black-throated Finch [64447]	Endangered	Species or species habitat known to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Tyto novaehollandiae kimberli Masked Owl (northern) [26048]	Vulnerable	Species or species habitat known to occur within area
Mammals		
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat may occur within area
Dasyurus hallucatus Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu] [331]	Endangered	Species or species habitat known to occur within area
Hipposideros semoni Semon's Leaf-nosed Bat, Greater Wart-nosed Horseshoe-bat [180]	Vulnerable	Species or species habitat may occur within area
Macroderma gigas Ghost Bat [174]	Vulnerable	Breeding likely to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Petauroides volans Greater Glider [254]	Vulnerable	Species or species habitat known to occur within area
Petrogale sharmani Mount Claro Rock Wallaby, Sharman's Rock Wallaby [59281]	Vulnerable	Species or species habitat may occur within area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT) Koala (combined populations of Queensland, New	Vulnerable	Species or species

Name	Status	Type of Presence
South Wales and the Australian Capital Territory) [85104]		habitat known to occur within area
Pteropus conspicillatus Spectacled Flying-fox [185]	Vulnerable	Species or species habitat likely to occur within area
Rhinolophus robertsi Large-eared Horseshoe Bat, Greater Large-eared Horseshoe Bat [87639]	Vulnerable	Species or species habitat may occur within area
Saccolaimus saccolaimus nudicluniatus Bare-rumped Sheath-tailed Bat, Bare-rumped Sheathtail Bat [66889]	Vulnerable	Species or species habitat known to occur within area
Xeromys myoides Water Mouse, False Water Rat, Yirrkoo [66]	Vulnerable	Species or species habitat may occur within area
Plants		
Cajanus mareebensis [8635]	Endangered	Species or species habitat may occur within area
Dichanthium setosum bluegrass [14159]	Vulnerable	Species or species habitat known to occur within area
Eucalyptus paedoglauca Mt Stuart Ironbark [56188]	Vulnerable	Species or species habitat known to occur within area
Marsdenia brevifolia [64585]	Vulnerable	Species or species habitat known to occur within area
Myrmecodia beccarii Ant Plant [11852]	Vulnerable	Species or species habitat likely to occur within area
Omphalea celata [64586]	Vulnerable	Species or species habitat likely to occur within area
Tephrosia leveillei [16946]	Vulnerable	Species or species habitat likely to occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Denisonia maculata Ornamental Snake [1193]	Vulnerable	Species or species habitat may occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Egernia rugosa Yakka Skink [1420]	Vulnerable	Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Breeding likely to occur within area

Name	Status	Type of Presence
[Natator depressus](#)		
Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Sharks		
[Carcharodon carcharias](#)		
White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
[Pristis pristis](#)		
Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat known to occur within area
[Pristis zijsron](#)		
Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
[Rhincodon typus](#)		
Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
[Anous stolidus](#)		
Common Noddy [825]		Species or species habitat likely to occur within area
[Apus pacificus](#)		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
[Fregata ariel](#)		
Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat known to occur within area
[Fregata minor](#)		
Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat known to occur within area
[Sternula albifrons](#)		
Little Tern [82849]		Species or species habitat may occur within area
Migratory Marine Species		
[Anoxypristis cuspidata](#)		
Narrow Sawfish, Knifetooth Sawfish [68448]		Species or species habitat likely to occur within area
[Balaenoptera edeni](#)		
Bryde's Whale [35]		Species or species habitat may occur within area
[Balaenoptera musculus](#)		
Blue Whale [36]	Endangered	Species or species habitat may occur within area
[Carcharodon carcharias](#)		
White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
[Caretta caretta](#)		
Loggerhead Turtle [1763]	Endangered	Breeding likely to occur within area
[Chelonia mydas](#)		
Green Turtle [1765]	Vulnerable	Breeding known to occur within area
[Crocodylus porosus](#)		
Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Dugong dugon Dugong [28]		Species or species habitat known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Lamna nasus Porbeagle, Mackerel Shark [83288]		Species or species habitat may occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Breeding likely to occur within area
Manta alfredi Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray [84994]		Species or species habitat likely to occur within area
Manta birostris Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Orcaella brevirostris Irrawaddy Dolphin [45]		Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Pristis pristis Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat known to occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Breeding known to occur within area
Migratory Terrestrial Species		
Cuculus optatus Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat known to occur within area
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat known to occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Motacilla flava Yellow Wagtail [644]		Species or species habitat known to occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Arenaria interpres Ruddy Turnstone [872]		Foraging, feeding or related behaviour known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Roosting known to occur within area
Calidris alba Sanderling [875]		Foraging, feeding or related behaviour known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Calidris ruficollis Red-necked Stint [860]		Roosting known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Roosting known to occur within area
Charadrius bicinctus Double-banded Plover [895]		Foraging, feeding or related behaviour known to occur within area
Charadrius dubius Little Ringed Plover [896]		Foraging, feeding or related behaviour known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Roosting known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Roosting known to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Foraging, feeding or related behaviour known to occur within area
Gallinago megala Swinhoe's Snipe [864]		Roosting likely to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area

Name	Threatened	Type of Presence
Limicola falcinellus Broad-billed Sandpiper [842]		Foraging, feeding or related behaviour known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Roosting known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting known to occur within area
Numenius phaeopus Whimbrel [849]		Roosting known to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Philomachus pugnax Ruff (Reeve) [850]		Foraging, feeding or related behaviour known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area
Pluvialis squatarola Grey Plover [865]		Roosting known to occur within area
Tringa brevipes Grey-tailed Tattler [851]		Roosting known to occur within area
Tringa glareola Wood Sandpiper [829]		Roosting known to occur within area
Tringa incana Wandering Tattler [831]		Foraging, feeding or related behaviour known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Roosting known to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Defence - AMAROO - MAGNETIC ISLAND
Defence - Commonwealth Centre
Defence - DEFENCE COMMUNITY ORGANISATION
Defence - JEZZINE BARRACKS - TOWNSVILLE
Defence - LAVARACK BARRACKS - TOWNSVILLE
Defence - Mount Stuart Close Training Area
Defence - NORTH WARD TRAINING DEPOT - TOWNSVILLE
Defence - ROSS ISLAND BARRACKS

Name
Defence - TOWNSVILLE - AP28 TACAN
Defence - TOWNSVILLE - AP37 NAVAID
Defence - TOWNSVILLE - AP40 BOHLE RIVER TRANS STATION
Defence - TOWNSVILLE - AP7 SPORTS GROUND
Defence - TOWNSVILLE - RAAF BASE

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Anous stolidus Common Noddy [825]		Species or species habitat likely to occur within area
Anseranas semipalmata Magpie Goose [978]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Breeding known to occur within area
Ardea ibis Cattle Egret [59542]		Breeding likely to occur within area
Arenaria interpres Ruddy Turnstone [872]		Foraging, feeding or related behaviour known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Roosting known to occur within area
Calidris alba Sanderling [875]		Foraging, feeding or related behaviour known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Calidris ruficollis Red-necked Stint [860]		Roosting known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Roosting known to occur within area
Charadrius bicinctus Double-banded Plover [895]		Foraging, feeding or related behaviour known to occur within area
Charadrius dubius Little Ringed Plover [896]		Foraging, feeding or related behaviour known to occur within area

Name	Threatened	Type of Presence
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Roosting known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Charadrius ruficapillus Red-capped Plover [881]		Roosting known to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Roosting known to occur within area
Cuculus saturatus Oriental Cuckoo, Himalayan Cuckoo [710]		Species or species habitat known to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat known to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat known to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Foraging, feeding or related behaviour known to occur within area
Gallinago megala Swinhoe's Snipe [864]		Roosting likely to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Heteroscelus brevipes Grey-tailed Tattler [59311]		Roosting known to occur within area
Heteroscelus incanus Wandering Tattler [59547]		Foraging, feeding or related behaviour known to occur within area
Himantopus himantopus Black-winged Stilt [870]		Roosting known to occur within area
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat known to occur within area
Limicola falcinellus Broad-billed Sandpiper [842]		Foraging, feeding or related behaviour known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Roosting known to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat known to occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat known to occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting known to occur within area
Numenius phaeopus Whimbrel [849]		Roosting known to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Philomachus pugnax Ruff (Reeve) [850]		Foraging, feeding or related behaviour known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area
Pluvialis squatarola Grey Plover [865]		Roosting known to occur within area
Recurvirostra novaehollandiae Red-necked Avocet [871]		Foraging, feeding or related behaviour known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
Sterna albifrons Little Tern [813]		Species or species habitat may occur within area
Stiltia isabella Australian Pratincole [818]		Foraging, feeding or related behaviour known to occur within area
Tringa glareola Wood Sandpiper [829]		Roosting known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Roosting known to occur within area
Fish		
Acentronura tentaculata Shortpouch Pygmy Pipehorse [66187]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Campichthys tryoni Tryon's Pipefish [66193]		Species or species habitat may occur within area
Choeroichthys brachysoma Pacific Short-bodied Pipefish, Short-bodied Pipefish [66194]		Species or species habitat may occur within area
Choeroichthys suillus Pig-snouted Pipefish [66198]		Species or species habitat may occur within area
Corythoichthys amplexus Fijian Banded Pipefish, Brown-banded Pipefish [66199]		Species or species habitat may occur within area
Corythoichthys flavofasciatus Reticulate Pipefish, Yellow-banded Pipefish, Network Pipefish [66200]		Species or species habitat may occur within area
Corythoichthys intestinalis Australian Messmate Pipefish, Banded Pipefish [66202]		Species or species habitat may occur within area
Corythoichthys ocellatus Orange-spotted Pipefish, Ocellated Pipefish [66203]		Species or species habitat may occur within area
Corythoichthys paxtoni Paxton's Pipefish [66204]		Species or species habitat may occur within area
Corythoichthys schultzi Schultz's Pipefish [66205]		Species or species habitat may occur within area
Cosmocampus darrosanus D'Arros Pipefish [66207]		Species or species habitat may occur within area
Doryrhamphus excisus Bluestripe Pipefish, Indian Blue-stripe Pipefish, Pacific Blue-stripe Pipefish [66211]		Species or species habitat may occur within area
Festucalex cinctus Girdled Pipefish [66214]		Species or species habitat may occur within area
Halicampus dunckeri Red-hair Pipefish, Duncker's Pipefish [66220]		Species or species habitat may occur within area
Halicampus grayi Mud Pipefish, Gray's Pipefish [66221]		Species or species habitat may occur within area
Halicampus nitidus Glittering Pipefish [66224]		Species or species habitat may occur within area
Halicampus spinirostris Spiny-snout Pipefish [66225]		Species or species habitat may occur within area
Hippichthys cyanospilos Blue-speckled Pipefish, Blue-spotted Pipefish [66228]		Species or species habitat may occur within area
Hippichthys heptagonus Madura Pipefish, Reticulated Freshwater Pipefish [66229]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Hippichthys penicillus Beady Pipefish, Steep-nosed Pipefish [66231]		Species or species habitat may occur within area
Hippocampus bargibanti Pygmy Seahorse [66721]		Species or species habitat may occur within area
Hippocampus kuda Spotted Seahorse, Yellow Seahorse [66237]		Species or species habitat may occur within area
Hippocampus planifrons Flat-face Seahorse [66238]		Species or species habitat may occur within area
Hippocampus zebra Zebra Seahorse [66241]		Species or species habitat may occur within area
Micrognathus andersonii Anderson's Pipefish, Shortnose Pipefish [66253]		Species or species habitat may occur within area
Micrognathus brevirostris thorntail Pipefish, Thorn-tailed Pipefish [66254]		Species or species habitat may occur within area
Nannocampus pictus Painted Pipefish, Reef Pipefish [66263]		Species or species habitat may occur within area
Solegnathus hardwickii Pallid Pipehorse, Hardwick's Pipehorse [66272]		Species or species habitat may occur within area
Solenostomus cyanopterus Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183]		Species or species habitat may occur within area
Solenostomus paradoxus Ornate Ghostpipefish, Harlequin Ghost Pipefish, Ornate Ghost Pipefish [66184]		Species or species habitat may occur within area
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
Trachyrhamphus bicoarctatus Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within area
Trachyrhamphus longirostris Straightstick Pipefish, Long-nosed Pipefish, Straight Stick Pipefish [66281]		Species or species habitat may occur within area
Mammals		
Dugong dugon Dugong [28]		Species or species habitat known to occur within area
Reptiles		
Acalyptophis peronii Horned Seasnake [1114]		Species or species habitat may occur within area
Aipysurus duboisii Dubois' Seasnake [1116]		Species or species habitat may occur within area
Aipysurus eydouxii Spine-tailed Seasnake [1117]		Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Aipysurus laevis Olive Seasnake [1120]		Species or species habitat may occur within area
Astrotia stokesii Stokes' Seasnake [1122]		Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Crocodylus porosus Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Disteira kingii Spectacled Seasnake [1123]		Species or species habitat may occur within area
Disteira major Olive-headed Seasnake [1124]		Species or species habitat may occur within area
Enhydrina schistosa Beaked Seasnake [1126]		Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Hydrophis elegans Elegant Seasnake [1104]		Species or species habitat may occur within area
Hydrophis mcdowelli null [25926]		Species or species habitat may occur within area
Hydrophis ornatus Spotted Seasnake, Ornate Reef Seasnake [1111]		Species or species habitat may occur within area
Lapemis hardwickii Spine-bellied Seasnake [1113]		Species or species habitat may occur within area
Laticauda colubrina a sea krait [1092]		Species or species habitat may occur within area
Laticauda laticaudata a sea krait [1093]		Species or species habitat may occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Breeding likely to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Pelamis platurus Yellow-bellied Seasnake [1091]		Species or species habitat may occur within area

Whales and other Cetaceans		[Resource Information]
Name	Status	Type of Presence
Mammals		
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat may occur within area
Delphinus delphis Common Dophin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Orcaella brevirostris Irrawaddy Dolphin [45]		Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Breeding known to occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area

Extra Information

State and Territory Reserves	[Resource Information]
Name	State
Bolger Bay	QLD
Bolger Bay	QLD
Bowling Green Bay	QLD
Bowling Green Bay	QLD
Cape Pallarenda	QLD
Endeavour Creek	QLD
Horseshoe Bay	QLD
Horseshoe Bay Lagoon	QLD
Magnetic Island	QLD
Magnetic Island	QLD

Name	State
Stuart Creek	QLD
Townsville Town Common	QLD

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Gallus gallus Red Junglefowl, Domestic Fowl [917]		Species or species habitat likely to occur within area
Lonchura punctulata Nutmeg Mannikin [399]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Pavo cristatus Indian Peafowl, Peacock [919]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Frogs		
Rhinella marina Cane Toad [83218]		Species or species habitat known to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Lepus capensis Brown Hare [127]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Acacia nilotica subsp. indica Prickly Acacia [6196]		Species or species habitat may occur within area
Annona glabra Pond Apple, Pond-apple Tree, Alligator Apple, Bullock's Heart, Cherimoya, Monkey Apple, Bobwood, Corkwood [6311]		Species or species habitat likely to occur within area
Cabomba caroliniana Cabomba, Fanwort, Carolina Watershield, Fish Grass, Washington Grass, Watershield, Carolina Fanwort, Common Cabomba [5171]		Species or species habitat likely to occur within area
Cryptostegia grandiflora Rubber Vine, Rubbervine, India Rubber Vine, India Rubbervine, Palay Rubbervine, Purple Allamanda [18913]		Species or species habitat likely to occur within area
Dolichandra unguis-cati Cat's Claw Vine, Yellow Trumpet Vine, Cat's Claw Creeper, Funnel Creeper [85119]		Species or species habitat likely to occur within area
Eichhornia crassipes Water Hyacinth, Water Orchid, Nile Lily [13466]		Species or species habitat likely to occur within area
Hymenachne amplexicaulis Hymenachne, Olive Hymenachne, Water Stargrass, West Indian Grass, West Indian Marsh Grass [31754]		Species or species habitat likely to occur within area
Jatropha gossypifolia Cotton-leaved Physic-Nut, Bellyache Bush, Cotton-leaf Physic Nut, Cotton-leaf Jatropha, Black Physic Nut [7507]		Species or species habitat likely to occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area
Parkinsonia aculeata Parkinsonia, Jerusalem Thorn, Jelly Bean Tree, Horse Bean [12301]		Species or species habitat likely to occur

Name	Status	Type of Presence within area
Parthenium hysterophorus Parthenium Weed, Bitter Weed, Carrot Grass, False Ragweed [19566]		Species or species habitat likely to occur within area
Prosopis spp. Mesquite, Algaroba [68407]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Vachellia nilotica Prickly Acacia, Blackthorn, Prickly Mimosa, Black Piquant, Babul [84351]		Species or species habitat likely to occur within area
Reptiles		
Hemidactylus frenatus Asian House Gecko [1708]		Species or species habitat likely to occur within area
Lepidodactylus lugubris Mourning Gecko [1712]		Species or species habitat likely to occur within area
Ramphotyphlops braminus Flowerpot Blind Snake, Brahminy Blind Snake, Cacing Besi [1258]		Species or species habitat likely to occur within area

Nationally Important Wetlands [Resource Information]

Name	State
Bowling Green Bay	QLD
Burdekin - Townsville Coastal Aggregation	QLD
Great Barrier Reef Marine Park	QLD
RAAF Townsville	QLD
Ross River Reservoir	QLD

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-19.25444 146.8351

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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Queensland Government

Wildlife Online Extract

Search Criteria: Species List for a Specified Point
Species: All
Type: All
Status: Rare and threatened species
Records: All
Date: All
Latitude: -19.2653
Longitude: 146.8389
Distance: 25
Email: sammaynard@saundershavill.com
Date submitted: Monday 10 Jul 2017 16:30:49
Date extracted: Monday 10 Jul 2017 16:40:03

The number of records retrieved = 44

Disclaimer

As the DSITIA is still in a process of collating and vetting data, it is possible the information given is not complete. The information provided should only be used for the project for which it was requested and it should be appropriately acknowledged as being derived from Wildlife Online when it is used.

The State of Queensland does not invite reliance upon, nor accept responsibility for this information. Persons should satisfy themselves through independent means as to the accuracy and completeness of this information.

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Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	amphibians	Microhylidae	*Cophixalus mcdonaldi*	Mount Elliot nurseryfrog		V		7/1
animals	birds	Accipitridae	*Erythrotriorchis radiatus*	red goshawk		E	V	2
animals	birds	Burhinidae	*Esacus magnirostris*	beach stone-curlew		V		59
animals	birds	Cacatuidae	*Calyptorhynchus lathami erebus*	glossy black-cockatoo (northern)		V		1
animals	birds	Cacatuidae	*Lophochroa leadbeateri*	Major Mitchell's cockatoo		V		1
animals	birds	Charadriidae	*Charadrius leschenaultii*	greater sand plover		V	V	36
animals	birds	Charadriidae	*Charadrius mongolus*	lesser sand plover		E	E	38
animals	birds	Columbidae	*Geophaps scripta scripta*	squatter pigeon (southern subspecies)		V	V	3
animals	birds	Estrildidae	*Poephila cincta cincta*	black-throated finch (white-rumped subspecies)		E	E	65
animals	birds	Estrildidae	*Erythrura gouldiae*	Gouldian finch		E	E	1
animals	birds	Falconidae	*Falco hypoleucos*	grey falcon		V		1
animals	birds	Procellariidae	*Macronectes giganteus*	southern giant-petrel		E	E	4
animals	birds	Procellariidae	*Ardenna pacifica*	wedge-tailed shearwater		V		6
animals	birds	Psittacidae	*Cyclopsitta diophthalma macleayana*	Macleay's fig-parrot		V		3
animals	birds	Rostratulidae	*Rostratula australis*	Australian painted snipe		V	E	12
animals	birds	Scolopacidae	*Calidris tenuirostris*	great knot		E	CE	63
animals	birds	Scolopacidae	*Calidris canutus*	red knot		E	E	16
animals	birds	Scolopacidae	*Numenius madagascariensis*	eastern curlew		E	CE	260
animals	birds	Scolopacidae	*Limosa lapponica baueri*	Western Alaskan bar-tailed godwit		V	V	117
animals	birds	Scolopacidae	*Calidris ferruginea*	curlew sandpiper		E	CE	17
animals	birds	Tytonidae	*Tyto novaehollandiae kimberli*	masked owl (northern subspecies)		V	V	1
animals	mammals	Balaenopteridae	*Megaptera novaeangliae*	humpback whale		V	V	15
animals	mammals	Delphinidae	*Sousa sahulensis*	Australian humpback dolphin		V		10/10
animals	mammals	Delphinidae	*Orcaella heinsohni*	Australian snubfin dolphin		V		50/26
animals	mammals	Dugongidae	*Dugong dugon*	dugong		V		11/1
animals	mammals	Emballonuridae	*Saccolaimus saccolaimus nudicluniatus*	bare-rumped sheathtail bat		E	V	1/1
animals	mammals	Emballonuridae	*Taphozous australis*	coastal sheathtail bat		NT		1
animals	mammals	Phascolarctidae	*Phascolarctos cinereus*	koala		V	V	85
animals	reptiles	Cheloniidae	*Natator depressus*	flatback turtle		V	V	4
animals	reptiles	Cheloniidae	*Chelonia mydas*	green turtle		V	V	17
animals	reptiles	Cheloniidae	*Eretmochelys imbricata*	hawksbill turtle		E	V	2
animals	reptiles	Crocodylidae	*Crocodylus porosus*	estuarine crocodile		V		16/2
animals	reptiles	Elapidae	*Acanthophis antarcticus*	common death adder		V		6
animals	reptiles	Scincidae	*Lampropholis mirabilis*	saxicoline sunskink		NT		16/4
plants	higher dicots	Acanthaceae	*Graptophyllum excelsum*			NT		1/1
plants	higher dicots	Apocynaceae	*Marsdenia brevifolia*			V	V	2/2
plants	higher dicots	Elaeocarpaceae	*Dubouzetia saxatilis*			V		5/5
plants	higher dicots	Euphorbiaceae	*Croton magneticus*			V		11/9
plants	higher dicots	Mimosaceae	*Senegalia albizioides*			NT		1/1
plants	higher dicots	Myrtaceae	*Eucalyptus paedoglauca*	Mt. Stuart ironbark		V	V	11/11
plants	higher dicots	Myrtaceae	*Sannantha papillosa*			E		8/8
plants	higher dicots	Solanaceae	*Solanum sporadotrichum*			NT		3/3
plants	higher dicots	Sparrmanniaceae	*Corchorus hygrophilus*			V		5/5
plants	monocots	Poaceae	*Paspalidium udum*			V		3/2

Queensland Government Wildlife Online - Extract Date 10/07/2017 at 16:40:03

CODES

I - Y indicates that the taxon is introduced to Queensland and has naturalised.

Q - Indicates the Queensland conservation status of each taxon under the *Nature Conservation Act 1992.* The codes are Extinct in the Wild (PE), Endangered (E), Vulnerable (V), Near Threatened (NT), Least Concern (C) or Not Protected ( ).

A - Indicates the Australian conservation status of each taxon under the *Environment Protection and Biodiversity Conservation Act 1999.* The values of EPBC are Conservation Dependent (CD), Critically Endangered (CE), Endangered (E), Extinct (EX), Extinct in the Wild (XW) and Vulnerable (V).

Records – The first number indicates the total number of records of the taxon for the record option selected (i.e. All, Confirmed or Specimens).
This number is output as 99999 if it equals or exceeds this value. The second number located after the / indicates the number of specimen records for the taxon.
This number is output as 999 if it equals or exceeds this value.

Appendix E

Protected Species Likelihood of Occurrence Schedule

HABITAT ASSESSMENT FOR LISTED EPBC SPECIES

Matters of National Environmental Significance			
World Heritage Properties	Great Barrier Reef	Declared Property	Site located approximately 7 kilometers directly south of the Port of Townsville. The site is approximately 5 kilometers south west of Cleveland Bay in the Coral Sea.
National Heritage Properties	Great Barrier Reef	Listed Place	Site located approximately 7 kilometers directly south of the Port of Townsville. The site is approximatley 5 kilometers south west of Cleveland Bay in the Coral Sea.
Wetlands of International Importance	Bowling Green Bay	Within Ramsar Site	Site is located approximately 10km west of the closest point to Bowling Green Bay.
Listed Threatened Ecological Communities			
Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions		Endangered	This Threatened Ecological Community is listed as a community likely to occur within the area.
Birds			
Calidris canutus	Red Knot, Knot	Endangered	In Australasia the Red Knot mainly inhabit intertidal mudflats, sandflats and sandy beaches of sheltered coasts, in estuaries, bays, inlets, lagoons and harbours; sometimes on sandy ocean beaches or shallow pools on exposed wave-cut rock platforms or coral reefs. They are occasionally seen on terrestrial saline wetlands near the coast, such as lakes, lagoons, pools and pans, and recorded on sewage ponds and saltworks, but rarely use freshwater swamps. They rarely use inland lakes or swamps **Suitable habitat exists within environmental management precincts**
Calidris ferruginea	Curlew Sandpiper	Critically Endangered	Curlew Sandpipers mainly occur on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and also around non-tidal swamps, lakes and lagoons near the coast, and ponds in saltworks and sewage farms. They are also recorded inland, though less often, including around ephemeral and permanent lakes, dams, waterholes and bore drains, usually with bare edges of mud or sand. **Suitable habitat occurs within the study area however no sites of national or international importance are located in the region**
Calidris tenuirostris	Great Knot	Critically Endangered	In Australasia, the species typically prefers sheltered coastal habitats, with large intertidal mudflats or sandflats. This includes inlets, bays, harbours, estuaries and lagoons. They are occasionally found on exposed reefs or rock platforms, shorelines with mangrove vegetation, ponds in saltworks, at swamps near the coast, saltlakes and non-tidal lagoons. The Great Knot rarely occurs on inland lakes and swamps **Suitable habitat occurs within the study area however no sites of national or international importance are located in the region**
Charadrius leschenaultii	Great Sand Plover	Vulnerable	This species is almost entirely coastal, inhabiting littoral and estuarine habitats. They mainly occur on sheltered sandy, shelly or muddy beaches with alrge intertidal mudflats or sandbanks, as well as sandy estuarine lagoons, and inshore reefs, rock platforms, small rocky islands or sand clays on coral reefs. Although suitable habitats are present along the coastal fringe there are only low potential for this species which is primarily only recorded in southern Australia and rarely found above tropic of Capricorn. **Potential habitat exists within the study area.**
Charadrius mongolus	Lesser Sand Plover	Endangered	This species usually occurs in coastal littoral and estuarine environmnets. It inhabits large intertidal sandflats or mudflats in sheltered bays, harbours and estuaries, and occasionally sandy ocean beaches, coral reefs, wave-cut rock platforms and rocky outcrops. known to occur within the higher value estuarine and marine habitats. **Suitable habitat occurs within the study area however no sites of national or international importance are located in the region**
Erythrotriorchis radiatus	Red Goshawk	Vulnerable	No confirmed local records of this uncommon species. A wide ranging and highly mobile species generally observed over eucalypt habitats. Due to the scarcity of this species and lack of local records its occurrence is highly unlikely. The proposed actions will result in a minor loss of habitat for the species and its prey. No notable impact will result. **Species is unlikely to occur in the study area.**
Fregetta grallaria grallaria	White-bellied Storm-Petrel	Vulnerable	The white-bellied storm-petral occurs across sub-tropical and tropical waters in the Tasman Sea, Coral Sea and possible the central Pacific Ocean. In the non-breeding season, it reaches and forages over near-shore waters along the continental shelf of mainland Australia. It breeds on offshore islets and rocks in the Lord Howe Island Group and nests in crevices between large volcanic rocks an din burrows excavated in banks. **Species is unlikely to occur in study area.**
Limosa lapponica baueri	Black-tailed Godwit	Vulnerable	The Bar-tailed Godwit is found mainly in coastal habitats such as large intertidal; sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays. A common summer migrant that is known to be present within marine habitats particularly tidal flats in the local area. **May utilise the TSDA for short term roosting to avoid seasonal storms and events.**
Limosa lapponica menzbieri	Northern Siberian Bar-tailed Godwit	Critically Endangered	Potential habitat for this species is mapped along the entire coastline of Australia. **Potential habitat exists within the study area.**
Neochmia ruficauda ruficauda	Star Finch	Endangered	The Star-finch occurs mainly in grasslands and grassy woodlands that area located close to water bodies of fresh water. This species has been recorded from damp grasslands, sedgelands or grassy woodlands near permanent water or areas of regular inundation. Occasionally individuals have been reported in disturbed habitat and suburban araes. **Species is not expected to occur or be reliant on the study area.**
Numenius madagascariensis	Eastern Curlew	Critically Endangered	The Eastern Curlew is typically found in coastal regions across all Australian states and territories. It takes an annual migratory flight to Russia and north-eastern China to breed, arriving back home to Australia in August to feed on crabs and molluscs in intertidal mudflats. **May utilise the TSDA for periods of the year.**
Poephila cincta cincta	Southern Black-throated Finch	Endangered	The Black-throated Finch (southern) occurs mainly in grassy, open woodlands and forests, typically dominated by *Eucalyptus* , *Corymbia* and *Melaleuca* , and occasionally in tussock grasslands or other habitats (for example freshwater wetlands), often along or near watercourses, or in the vicinity of water. It occurs at two general locations: in the Townsville region, where it is considered to be locally common at a few sites around Townsville and Charters Towers; and at scattered sites in central-eastern Queensland (between Aramac and Great Basalt Wall National Park). It has been absent from Brisbane and its surrounds since the 1930s. **Species is not expected to occur or reliant on the study area.**
Rostratula australis	Australian Painted Snipe	Endangered	The Australian Painted Snipe is usually found in shallow inland wetlands, either freshwater or brackish, that are either permanently or temporarily filled. The species has a scattered distribution throughout many parts of Australia, with a single record from Tasmania. **Potential habitat exists within the study area.**
Tyto novaehollandiae kimberli	Masked Owl	Vulnerable	This species has been recorded from riparian forest, open forest, melaleuca swamps and the edges of mangroves, as well as along the margins of sugar cane fields. **Species is a potential rare visitor to the study area**
Sharks			
Carcharodon carcharias	Great White Shark	Vulnerable	Great White Sharks can be found from close inshore around rocky reefs, surf beaches and shallow coastal bays to outer continental shelf and slope areas. They also make open ocean excursions and can cross ocean basins (for instance from South Africa to the western coast of Australia and from the eastern coast of Australia to New Zealand). Great White Sharks are often found in regions with high prey density, such as pinniped colonies. **Species may pass through or utilise areas adjacent to the study area.**
Pristis pristis	Freshwater Sawfish	Vulnerable	In northern Australia, this species appears to be confined to freshwater drainages and the upper reaches of estuaries, occasionally being found as far as 400 km from the sea . There are few reports of adult individuals at sea, with only a few records of fish greater than 3 m in total length from the Pilbara coast, and one individual from Cape Naturaliste. **Species unlikely to occur in study area**

Pristis zijsron	Green Sawfish	Vulnerable	The Green Sawfish inhabits muddy bottom habitats and enters estuaries. It has been recorded in inshore marine waters, estuaries, river mouths, embankments and along sandy and muddy beaches. Its habitat is heavily fished and often subject to pollution, habitat loss and degradation from coastal, riverine and catchment developments. Green Sawfish have been recorded in very shallow water (<1 m) to offshore trawl grounds in over 70 m of water. **Species has the potential to utilise inshore areas of the study area.**
Rhincodon typus	Whale Shark	Vulnerable	The Whale Shark is an oceanic and coastal, tropical to warm-temperate pelagic shark. It is often seen far offshore, but also comes close inshore and sometimes enters lagoons of coral atolls. The Whale Shark is generally encountered close to or at the surface, as single individuals or occasionally in schools or aggregations of up to hundreds of sharks. **Species is unlikely to occur in the study area.**
Mammals			
Balaenoptera musculus	Blue Whale	Endangered	Blue whale habitat is variable between the two subspecies found in Australian waters. The Antarctic blue whale tends to remain at higher latitudes and migrate to lower latitudes for feeding, breeding and calving during the Australian summer, whilst some remain within the Antarctic waters year-round. In comparison, the pygmy blue whale habitat is more diverse, expanding throughout the Indian Ocean, with individuals moving between Australia and the warmer waters of Indonesia. **May migrate offshore of the study area**
Dasyurus hallucatus	Northern Quoll	Endangered	The Northern Quoll is known to occur as far south as Gracemere and Mr Morgan, south of Rockhampton and as far north as Cooktown. The species occupies rocky areas, eucalypt forest and woodlands, rainforests, sandy lowlands and beaches, shrubland, grassland and desert. **Species is unlikely to occur.**
Hipposideros semoni	Semon's Leaf-nosed Bat, Greater Wart-nosed Horseshoe-bat	Vulnerable	This species is found in tropical rainforest, monsoon forest, wet sclerophyll forest and open savannah woodland.Daytiemn roost sites include tree hollows, deserted buildings in rainforests, road culverts and shallow caves amongst granite boulders or in fissures. They rpefer rainforest and are more likely to be tree-dwelling than cave dwelling. **Species is unlikely to occur.**
Macroderma gigas	Ghost Bat	Vulnerable	This species is found in the northern regions of Australia, including northern Western Australia, northern regions of the Northern Territory and north Queensland. It has been mapped along the north-eastern coastline of Queensland. **Species is likely to occur within the site.**
Megaptera novaeangliae	Humpback Whale	Vulnerable	The eastern Australian Humpback whale migrate in close proximity to the coast of Australia on their way to and from their winter breeding areas. As with the western Australian population, the eastern Australian population also tend to migrate further offshore during their northward migration. Three major aggregation areas have been previously identified for the eastern Australian population in Queensland around the southern end of the Great Barrier Reef, Hervey Bay and in the Gold Coast region. **May migrate offshore of the study area**
Petauroides volans	Greater Glider	Vulnerable	The Greater Glider is primarily folivorous, with a diet mostly comprising eucalypt leaves, and occasionally flowers. It is typically found in highest abundance in taller, montane, moist eucalypt forests with relatively old trees and abundant hollows. This species favours forests with a diversity of eucalypt species due to seasonal variation in its preferred tree species. In southern Queensland, greater gliders require at least 2-4 live den trees for every 2ha of suitable forest. **Some habitat may occur within the TSDA**
Petrogale sharmani	Mount Claro Rock Wallaby	Vulnerable	Species known range is within and around the Paluma Range National Park, inland of Townsville **Species is unlikely to occur**
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)	Koala (combined populations of QLD, NSW and the ACT)	Vulnerable	They are found in a range of habitats, from coastal islands and tall eucalypt forests to low woodlands inland. Very few koala food trees were idnetifie dthrouughout the survey and habitat to support this species. **Unlikely to occur on site.**
Pteropus conspicillatus	Spectacled Flying-fox	Vulnerable	The Spectacled Flying-Fox is associated primarily with rainforest and sometimes with Mangroves copntaining Black Flying-foxes Roosts are always found within 6km of rainforest. **Unlikely to occur on site.**
Rhinolophus robertsi	Large-eared Horseshoe Bat	Vulnerable	The Large-eared Horseshoe Bat only occurs in northern Queensland, from the Iron Range southwards to Townsville and west to the karst regions of Chillagoe and Mitchell-Palmer. This species may occur south of Townsville. This species favours lowland rainforest, gallery forest-lined creeks within open eucalypt forest, *Melaleuca* forest with rainforest understorey, open savannah woodland and tall riparian woodlands. They are also found roosting in caves and underground mines, however they are not obligate cave- or mine-dwellers. **Species may occur within the site.**
Saccolaimus saccolaimus nudicluniatus	Bare-rumped Sheathtail Bat	Vulnerable	Species generally roosts in camps in trees adjacent to larger permanent watercourses than those which occur onsite. There is no suitable roosting habitat on site and no camps are currently active in the vicinity. However this species is likely to forage on site when eucalyptus and melaleuca species are flowering and particularly during winter when these provide important resources for this species. It is a common species in SEQ and there is unlikely to be any notable loss of resources or significant impact on the species long term viability with the retention of all mature remnant communities. **Unlikely to occur on site.**
Xeromys myoides	Water mouse, False Water Rat	Vulnerable	Habitat includes mangroves and associated saltmarsh, sedgelands, clay pans, hetahlands and freshwater wetlands. **Unlikely to occur on site.**
Reptiles			
Caretta caretta	Loggerhead Turtle	Endangered	This species is a marine reptile spending most of there lives in the open ocean and in shallow waters. **Species may occur offshore of the Port**
Chelonia mydas	Green Turtle	Vulnerable	Green turtles move across three habitat types, depending on their life stage. They lay eggs on beaches. Mature turtles spend most of their time in shallow, coastal waters with lush seagrass beds. Adults frequent inshore bays, lagoons and shoals with lush seagrass meadows. **Species has the potential to occur in the study area.**
Denisonia maculata	Ornamental Snake	Vulnerable	The Ornamental Snakes preferred habitat is within woodlands and open forests associated with moist areas, particularly gilgai mounds and depressions in Queensland regional ecosystem landzone 4, but also on lake margins and wetlands. **Species is unlikely to occur.**
Dermochelys coriacea	Leatherback Turtle	Endangered	This species can be found primary in the open ocean. They follow their jellyfish prey throughout the day resulting in turtles preferring deeper water in the day time and shallower water at night. Its favored breeding beaches are mainland sites facing deep water and they seem to avoid those sites potected by coral reefs. **Species may occur offshore of the Port**
Egernia rugosa	Yakka Skink	Vulnerable	The Yakka Skink is known to occur in open dry sclerophyll forest, woodland and scrub. They hide in amongst dense ground vegetation, in hollow logs, under tree roots an dunder rocks. **Species is unlikely to occur.**
Eretmochelys imbricata	Hawksbill Turtle	Vulnerable	Adult Hawksbill sea turtles are primarily found in tropical coral reefs. They are usually seen resting in caves and ledges in and around these reefs trhoughout the day. They inhabit open ocean, lagoons and mangrove swamps in estuaries. **Species may occur offshore of the Port**

Lepidochelys olivacea	Olive Ridley Turtle	Endangered	Most observations are typically within 15 km of mainland shores in protected, relatively shallow marine waters. **Species may occur offshore of the Port**
Natator depressus	Flatback Turtle	Vulnerable	Usually found in bays, shallow, grassy waters, coral reefs, estuaries and lagoons. **Species has the potential to occur in the study area.**
Plants			
Cajanus mareebensis		Endangered	Usually found in the Cape (Far northern Queensland) and inland of Townsville. **Species is unlikely to occur.**
Dichanthium setosum	Bluegrass	Vulnerable	Often found in moderately disturbed areas such as cleared woodland, grassy roadside remnants and highly disturbed pasture. Often collected from disturbed open grassy woodlands on the northern tablelands where the area has been grazed, nutrient-enriched and water-enriched. **Species is likely to occur.**
Eucalyptus paedoglauca	Mt Stuart Ironbark	Vulnerable	Previously found on the outskirts of Townsville in isolated patches. **Species has the potential to occur within the site.**
Marsdenia brevifolia		Vulnerable	Occurring in north and central Queensland at coastal towns (Townsville, Springsure and north of Rockhampton), with an isolated population at West Point on Magnetic Island. *M. brevifolia* is typically found in eucalypt woodland or open forest. **Species is likely to occur within the site.**
Myrmecodia beccarii	Ant Plant	Vulnerable	The ant plant occurs in coastal woodland and mangrove between Cooktown and Ingham in Queensland. **Species is likely to occur within the site.**
Omphalea celata		Vulnerable	The species may be found in coastal areas between Townsville and north of Rockhampton. **Species has the potential to occur in the study area.**
Tephrosia leveillei		Vulnerable	This species has been recorded in six isolated locations in north-east Queensland, north and north-west of Townsville. Little is known about the species, including its population size. **Species has the potential to occur, however the occurrence is unlikely.**