Long Term Maintenance Dredging Management Plan for Port of Townsville and Port of Lucinda

POT- 2557

Revision: 2

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TABLES

FIGURES

DOCUMENT CONTROL SHEET

Revision No.	Effective Date	Comments
POT-2128	17/12/2018	First Published
1	12/03/2019	Administrative update (typos, alignments); modification of Figure 16 layout; addition of Figure 17b; addition of Contingency Planning to Section 5.3
2	11/03/2020	Reformatting and minor administrative updates following first informal review; addition of Social Values to Sections 3 and 12
3	11/09/2020	Update to new Port branding; modification of Section 1 in line with DTMR comments; updates following expiry of Section 19 Deed of Agreement and issue of master plan; addition of new research and monitoring results
POT-2557		2128 replaced with new POT number
1	24/06/2025	Formal five-year review
DRAFT	28/07/2026	DRAFT

1 INTRODUCTION

Port of Townsville Limited (Port) is a statutory Government Owned Corporation (GOC) established under the *Government Owned Corporations Act 1993* and the *Government Owned Corporations Regulation 2014*. The Port manages both the Port of Townsville and the Port of Lucinda (Figure 1).

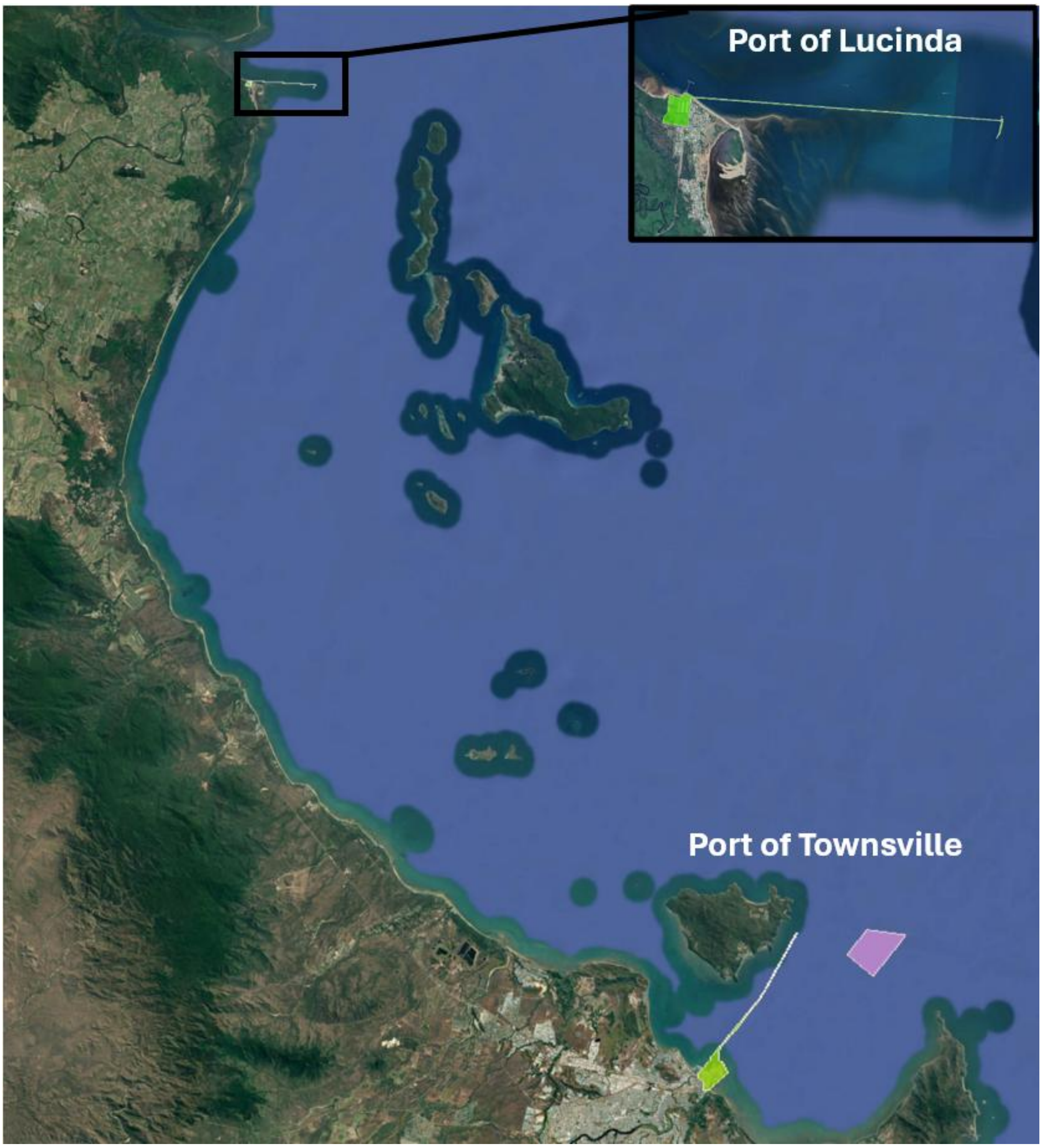


Figure 1: Port of Townsville and Port of Lucinda

Under the *Transport Infrastructure Act 1994*, the authorised functions of the Port are to establish, manage and operate efficient port facilities and services. This legislative responsibility extends to the provision of safe navigational access to marine facilities and infrastructure such as harbours, berths and channels under the Port's jurisdiction.

In order to comply with the *Transport Infrastructure Act 1994*, the Port's authority includes the power to dredge and otherwise maintain or improve navigational channels; and reduce or remove sediment accumulation that impedes navigation. For the Port of Townsville, this means routine maintenance dredging activities to remove natural accumulations of sediments within the port's underwater infrastructure.

The Port of Lucinda does not require maintenance dredging activities to meet the *Transport Infrastructure Act 1994*, due to the naturally deep-water characteristics of the bay in which the 5.6km long jetty and conveyer system; and loading wharf sits.

Both the Port of Townsville and the Port of Lucinda are considered World Heritage Area (WHA) Ports, being located within the Great Barrier Reef World Heritage Area (GBRWHA). However, neither are located within the Great Barrier Reef Marine Park (GBRMP) as there are Marine Park exclusion zones around each port.). This designation under Queensland State legislation, requires each WHA Port to have a *Long-Term Maintenance Dredging Management Plan,* (LTMDMP), as described under the Queensland Government's *Maintenance Dredging Strategy* (MDS).

The Port of Townsville also requires a *Long-Term Monitoring and Management Plan for Maintenance Dredging* under the Commonwealth Government's *Environment Protection (Sea Dumping) Act 1981* as a supporting document for an application for sea placement of maintenance dredge material.

This document – the *Long-Term Maintenance Dredging Management Plan* (LTMDMP), is intended to meet the requirements for both the State and Commonwealth (Cth) long-term maintenance dredging management plans. This *Long-Term Maintenance Dredging Management Plan, Revision 2* has been prepared to support the Ports 10-year maintenance dredging sea dumping permit application and associated consultation process with stakeholders.

This document is separated into two schedules for clarity, as different governmental requirements exist at the two World Heritage Area Ports:

- Schedule 1 is for the Port of Townsville (covering both State and Cth requirements for maintenance dredging, sea and land placement); and
- Schedule 2 is for the Port of Lucinda (covering State requirements only – noting that no maintenance dredging or sea/land placement activities occur at this port).

1.1 LTMDMP CONTEXT AND FRAMEWORK

The requirement of a LTMDMP has been implemented through the Queensland Department of Transport and Main Roads (DTMR) MDS (DTMR 2016). The use of the LTMDMP is expected to provide ports and regulators with a standardised, coherent document that ensures a leading practice, consistent, transparent, and accountable process has been applied to both the selection of maintenance dredging placement options (by ports), and the assessment of such options (by regulators); see Figure 2 which depicts the Long-Term Maintenance Dredging Management Framework.

The requirement for a long-term plan is also required under Cth legislation and was implemented under the objectives of the London Convention (*Convention on the Prevention of Marine Pollution by Dumping Wastes and Other Matters 1972*) and the *1996 Protocol to the London Convention*. These initiatives aimed to adopt a uniform approach to the placement of dredge material at sea in Australia by way of the Cth *Long-term Monitoring and Management Plan for Maintenance Dredging (LTMMP)*. The Cth LTMMP sets out a framework of specific measures for management, mitigation and monitoring of the impacts from maintenance dredging and placement activities. The Cth LTMMP also aims at providing ports with the opportunity to make available to the public their role as stewards for the marine environment.

This LTMDMP is intended to meet both the Queensland and Cth legislation requirements.

Figure 2: The Long-Term Maintenance Dredging Management Framework (DTMR 2016)

1.2 OBJECTIVES

The Port's objectives for this LTMDMP for the Port of Townsville and Port of Lucinda are:

a) Maintaining safe navigation for the continued operation of both ports;
b) Ensuring the Outstanding Universal Value (OUV) of the GBRWHA and sensitive receptors surrounding both the Port of Townsville and the Port of Lucinda are maintained;
c) Ensuring a transparent and robust long-term planning approach to the management of sediments within port infrastructure;
d) Continuing the long-term proactive and environmentally responsible management of maintenance dredging and material placement at the Port of Townsville:
e) Effectively communicate to stakeholders the measures and controls for managing maintenance dredging activities.

1.3 SCOPE

This document covers both the Port of Townsville and the Port of Lucinda, as both ports are owned by Port of Townsville Limited and both are World Heritage Area Ports. This document covers both maintenance dredging and placement activities.

The Port of Townsville

Routine maintenance dredging is undertaken regularly at the Port of Townsville, within the following areas:

- Sea Channel
- Platypus Channel
- Outer Harbour
- Inner Harbour (Including Berth 5 and ex Berths 6/7)
- Berths 1, 2, 3, 4, 8, 9, 10, and 11
- Townsville Marine Precinct (TMP)
- Ross River
- Ross Creek

Full details for the Port of Townsville can be found in Schedule 1. Section 2.4 outlines the navigational infrastructure and capacity diagrams for the Port of Townsville.

The Port of Lucinda

Maintenance dredging is not required at the Port of Lucinda due to the natural characteristics of the bay, including the 5.6km long jetty and conveyor system, which moves sugar from the terminal out to berthed ships, sitting in deep water (~14 meters). Whilst there is no requirement for dredging at this facility, this document outlines the values, considerations, and processes to be undertaken prior to any dredging being approved by both State and Cth Governments.

Full details for the Port of Lucinda can be found in Schedule 2. Section 11.4 outlines the navigational infrastructure and capacity of the Port of Lucinda.

1.4 REVIEW TIMEFRAME AND PROCESS

As per the LTMDMP Guidelines, the Port will formally review this document at the end of each 5-year period. The review will include:

- Engaging with stakeholders to discuss how the document is or is not meeting the objectives;
- Updating the document to include any new development approval permits, and reflect any relevant legislation updates;
- Incorporating research and monitoring updates, including any knowledge learnt from programs undertaken;
- Formally reviewing the Port's risk assessment, and updating any developments into the LTMDMP; and
- Incorporating the Sediment Sampling and Analysis Plan (SAP), every five years as per the National Assessment Guidelines for Dredging (2009).

The Port will undertake updates as required throughout the lifespan of the document, to ensure any results or changes (e.g. new beneficial reuse options/permit renewals etc.) are incorporated.

It is important to note that as per Ports permit SD2018/3942 Condition 9, any changes to the document need to be approved by the Minister for the Environment and Water (other than administrative changes as per Condition 11).

1.5 POLICY AND REGULATORY CONTEXT

The Port has several approvals to undertake maintenance dredging and placement activities within Cleveland Bay and on land, as listed in Table 1.

Table 1: Current Maintenance Dredging Approvals for the Port of Townsville

Permit Type	Relevant Legislation	Activity
Sea Dumping Permit No. SD2018/3942	*Environmental Protection (Sea Dumping) Act 1981*	Cth approval for Port of Townsville's placement of maintenance dredge material at sea in the designated and approved Dredge Material Placement Area (DMPA)
Environmental Authority (EA) No. EPPR00771113	*Environmental Protection Act 1994*	State Authority to undertake maintenance dredging in approved areas of the Port of Townsville
Operational Works (Tidal works) No. 1901-9462 SDA	*Planning Act 2016*	State Approval for Port of Townsville's placement of maintenance dredge material at sea in the designated and approved DMPA
Allocation of Quarry Material No. P-AQM-100833014	*Coastal Protection and Management Act 1995*	State Approval for Port of Townsville's maintenance dredge material to be placed on land

The Port does not currently hold any approvals to undertake maintenance dredging or placement activities at, or for, the Port of Lucinda.

1.5.1 MAINTENANCE DREDGE AND PLACEMENT LEGISLATION AND STATUTORY OBLIGATIONS

The following is the list of legislation and statutory obligations under which the Port currently operates for the purposes of maintenance dredging and placement activities:

International Legislation

1996 Protocol to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matters, 1972 (London Protocol)

- *Is a global convention aimed at the protection of the marine environment, promoting the sustainable use and conservation of marine resources. Under the Protocol, member nations may allow dumping of particular material, including dredge material, following an assessment of impacts.*

The Port (via the National EPA) sea placed dredge material volumes to the International Maritime Organisation (IMO) each year.

Commonwealth Legislation

Environment Protection (Sea Dumping) Act 1981

- *Implements Australia's obligations under the London Protocol. It applies to all vessels, aircraft and platforms in Australian Waters, and to Australian vessels/aircraft in any part of the sea.*

The Port is required to seek approval for the placement of dredge material at sea (in the designated DMPA) under this Act, from the National Environmental Protection Agency (formally Department of Climate Change, Energy, the Environment, and Water (DCCEEW)).

National Assessment Guidelines for Dredging (NAGD) 2009

- *Aims to provide a clear set of standards for assessment and permitting of dredge material proposed for sea placement.*

The Port uses these guidelines in determining the sediment suitability for sea placement development applications for maintenance dredge material to both State and Cth Governments.

Environment Protection and Biodiversity Conservation (EPBC) Act 1999

- *Provides a legal framework for the Australian Government to protect and manage internationally and nationally important flora, fauna, ecological communities, and heritage places, (Matters of National Environmental Significance (MNES)).*

Sea placement of maintenance dredge material for the Port does not trigger a referral under the EPBC Act, however, all considerations for MNES are incorporated in the Port's Environmental Management System (EMS). Considerations of World Heritage Values are an intrinsic part of the Port's risk assessment, including options and management controls.

Great Barrier Reef Marine Park Act 1975

- *Is an important piece of Cth legislation in providing long-term protection and conservation of the environment, biodiversity, and heritage values of the Great Barrier Reef (GBR).*

The Port's operational areas are not within the GBRMP for either the Port of Townsville or the Port of Lucinda; both exclusion zones do however directly boarder the GBRMP.

Aboriginal and Torres Strait Islander Heritage and Protection Act 1984

- *Is to protect areas and objects that are of particular significance to Aboriginal and Torres Strait Islander people.*

The Port has a Cultural Heritage Management Plan registered with the Queensland Department of Aboriginal and Torres Strait Island Partnerships.

Queensland State Legislation

Transport Infrastructure Act 1994 and Transport Infrastructure (Ports) Regulation 2016

- *Aims to establish a regime under which a ports system is provided and can be managed within an overall strategic framework.*

The Port is bound by this Act to establish, manage and operate effective and efficient port facilities and services at both the Port of Townsville, and the Port of Lucinda.

Sustainable Ports Development Act 2015

- *Aims to provide for the protection of the GBRWHA, through management of port-related development in and adjacent to the area.*

The Port of Townsville has been listed as a Queensland Priority Port, where master port planning is required to optimise the use of infrastructure and address operational, economic, environmental and community relationships as well as supply chains and surrounding land uses (as required under the Actions of the Reef 2050 Plan).

The Port of Lucinda has not been listed as a Priority Port, there are no changes to operational requirements, or the need for master planning.

Environmental Protection Act 1994 and Environmental Protection Regulation 2019

- *Is for the protection of Queensland's environment; with the objective to protect Queensland's environment while allowing for development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends (ecologically sustainable development).*

The Port holds an EA for a number of Environmentally Relevant Activities (ERAs) including ERA16d (maintenance) Dredging >1,000,000t/yr; as covered under this Act and Regulation.

The Port does not hold an ERA16d for the Port of Lucinda.

Planning Act 2016 and Planning Regulation 2017

- *Aims to provide for an efficient, effective, transparent, integrated, coordinated and accountable system of land use planning and development assessment to facilitate the achievement of ecological sustainability.*

The Port is bound by this Act for Development Applications for the placement of maintenance dredge material at sea (Tidal works).

Coastal Protection and Management Act 1995 and the Coastal Protection and Management Regulation 2017

- *Is to provide for the protection, conservation, rehabilitation and management of the coastal zone, including its resources and biological diversity.*

The Port is bound by this Act as the operational areas of both the Port of Townsville, and Port of Lucinda are within Coastal Management Districts. The Port is required to seek approval for the placement of maintenance dredge material on land (Allocation of Quarry Material) under this Act, to the Department of Environment, Tourism, Science and Innovation (DETSI).

Fisheries Act 1994 and Fisheries (General) Regulations 2019

- *Is to provide for the use, conservation and enhancement of the communities' fisheries resources and fish habitats.*

This Act provides the provisions about development offences against Fisheries resources (including unlawful marine plant disturbances) for the Planning Act 2016; (penalties for carrying out development without a permit; and penalties for non-compliance with particular development approvals).

Aboriginal and Torres Strait Islander Heritage and Protection Act 1984 Aboriginal Cultural Heritage Act 2003 (Qld)

- *Is to protect areas and objects that are of particular significance to Aboriginal and Torres Strait Islander people.*

The Port has a Cultural Heritage Management Plan registered with the Queensland Department of Aboriginal and Torres Strait Island Partnerships.

Marine Parks Act 2004 (Qld)

- *Is to provide for the conservation of the marine environment (which includes the declaration of marine parks).*

The Ports approved lawful structures for maintenance dredging and sea placement are not within the Queensland Marine Park, however, the edge of the DMPA boundary is directly adjacent to the Marine Park. The Port manages and mitigates the risk of maintenance dredging material placement having an impact on the Marine Park through operational controls.

Environmental Protection (Water and wetland) Biodiversity Policy 2019 (Qld)

- *Is to achieve the object of the Environmental Protection Act 1994 in relation to waters and wetlands.*

This policy identifies the environmental values for Queensland waters and wetlands to be enhanced or protected. It identifies management goals, water quality guidelines and objectives for the different water basins found in Queensland.

Other Relevant Governance

Maintenance Dredging Strategy (MDS)

- *Launched by the Queensland Government to address the requirements of the Reef 2050 Water Quality Action 16. The MDS aims to provide certainty to the ports industry and wider community that the economic and social contribution of ports is maintained while ensuring the continuing protection of Queensland's environmental assets.*

The Port has created this document (LTMDMP) to address the requirements of the MDS, for both the Port of Townsville and the Port of Lucinda.

Ports Australia Environmental Code of Practice for Dredging and Dredge Related Material, 2016

- *Sets out a series of environmental principles that Australian ports follow when undertaking dredging, and when reusing, relocating or disposing of dredge material.*

The Port follows the principles of this Code, given the outstanding ecological values of Cleveland Bay, and the greater GBRMP.

Port of Townsville's Dredge Material Placement Area (DMPA)

The DMPA is legislated over by both Queensland State and Cth legislation. The whole DMPA is defined to be within Australian Waters, and as such is regulated by the Cth National EPA. The section of the DMPA that lies within port limits is considered to be coastal waters, and as such is also regulated by the Queensland Government, under the *Environmental Protection Act 1994* (Figures 3 and 4).

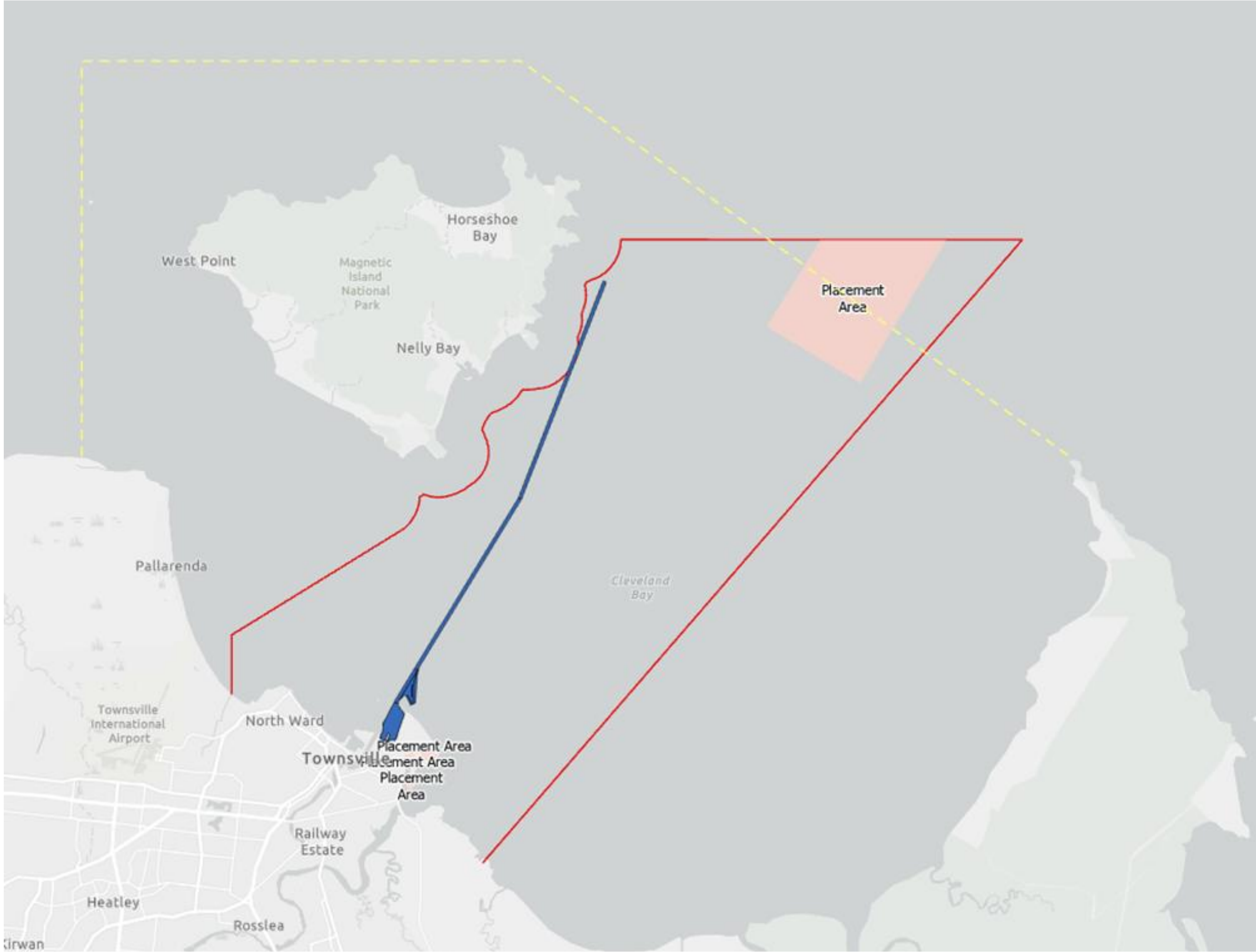


Figure 3: Port of Townsville, Port Limits within Cleveland Bay. Port Limits Shown in Yellow, Port Marine Park Exclusion Zone Shown in Red.

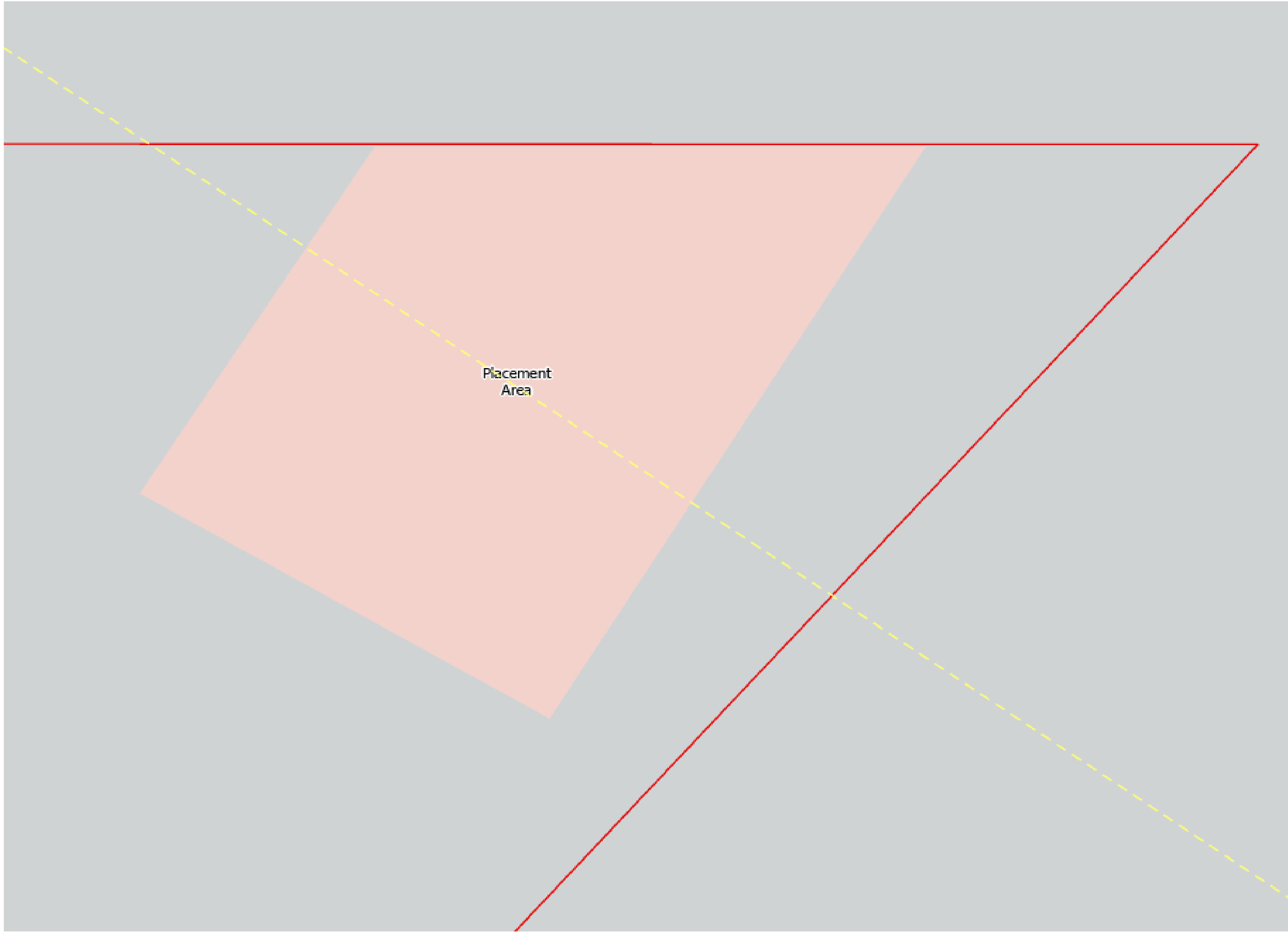


Figure 4: Cleveland Bay Maintenance Dredge Material Placement Area. Port Limits Shown in Yellow. Port Marine Park Exclusion Zone Shown in Red.

1.5.2 PORT GOVERNANCE

The Port is a Government Owned Corporation (GOC) established in its current form on the 1 July 2008 as per the *Commonwealth Corporations Act 2001* and the Queensland *Government Owned Corporations Act 1993*. Being a GOC, the Port has two Queensland Shareholding Ministers and a board of directors within its reporting structure. Figure 5 shows the current Port Governance Structure framework.

The Port has a Corporate Governance Manual which details the responsibility for fulfilling the legislative corporate governance obligations that rest with the Directors and Officers of the Port. Please refer to the Port website's Governance page for more detailed information on Corporate Governance, Roles and Responsibilities, and all associated documents, https://www.townsville-port.com.au/corporate/governance/.

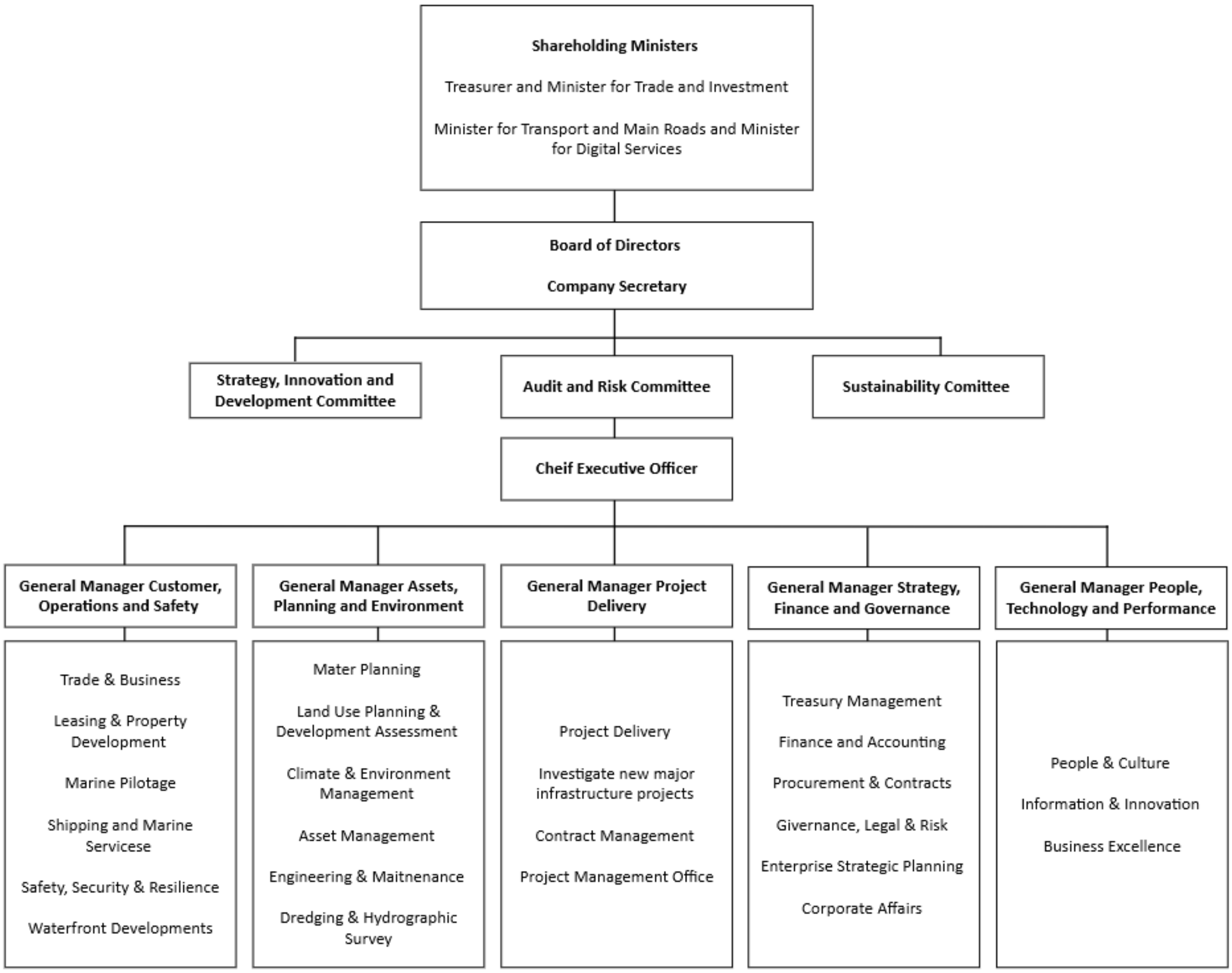


Figure 5: Port Governance Structure Flow Chart (Port of Townsville Annual Report 2023-2024)

The Port leases both land and infrastructure to different companies and industries to utilise and operate their businesses from. The responsibilities of Port customers, users, and leaseholders are to:

- Abide by the conditions of their lease;
- Act and undertake their business lawfully (including obtaining all relevant approvals for their work, including ERAs under State legislation);

- Abide by the *Environmental Protection Act 1994*; and
- Report all exceedances of regulated activity to their relevant authority and to the Port.

1.5.3 STAKEHOLDER CONSULTATION

Interested stakeholders will be given the opportunity to provide feedback on the LTMDMP through the official channels listed below.

Technical Advisory and Consultative Committee

Technical Advisory and Consultative Committees (TACCs) are an important consultative mechanism for maintenance dredging and dredge material placement activities. A TACC is intended to assist ports, other proponents and the Determining Authority (National EPA) to access local knowledge and reconcile various stakeholder interests (NAGD 2009). The TACC intends to:

- Provide continuity of direction and effort in protecting the local environment;
- Aid communication between stakeholders and provide a forum where points of view can be discussed and conflicts resolved;
- Assist in the establishment, as appropriate, of longer-term permitting arrangements, including reviewing the development and implementation of Sampling and Analysis Plans, Long Term Management Plans and research and monitoring programs;
- Review ongoing management of dredging and dumping activities in accordance with these Guidelines and permitting arrangements; and
- Make recommendations to the proponent and the Determining Authority as necessary or appropriate.

Port of Townsville first established a TACC in 1992 to assist in the management of dredging and dredged material placement activities within the Port of Townsville, both at sea (in the DMPA) and on land (within approved placement areas).

The current TACC member organisations are:

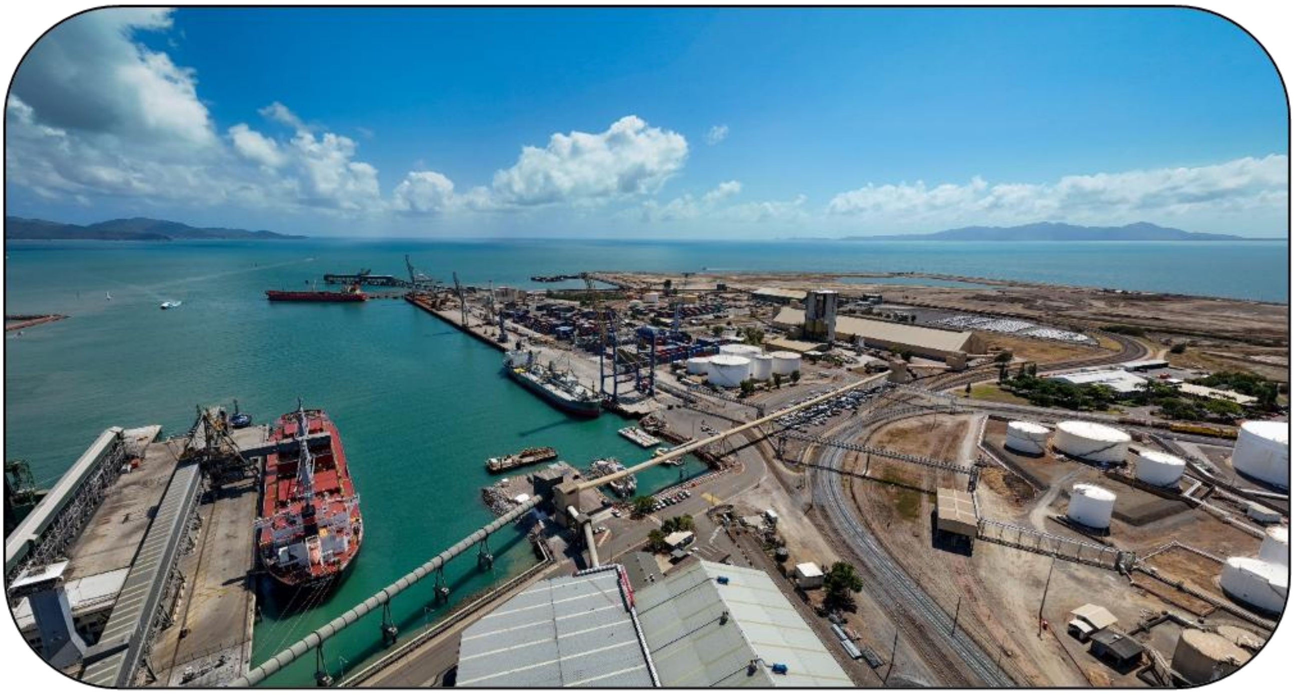
- Independent Chair
- Port of Townsville
- National Environmental Protection Agency (NEPA)
- Great Barrier Reef Marine Park Authority (GBRMPA)
- Department of Tourism, Environment, Science and Innovation (DETSI)
- Maritime Safety Queensland (MSQ)
- Department of Primary Industries (DPI)
- Townsville City Council (TCC)
- Chair of the Port of Townsville Planning and Environmental Working Group (PEWG)
- Department of State Development, Infrastructure and Planning (DSDIP – NQ SARA reps)
- Department of Transport and Main Roads (DTMR)
- Australian Institute of Marine Science (AIMS)
- Community member organisations appointed via Expression of Interest processes.

Other consultation

The Port is also committed to ongoing engagement with stakeholders via the existing pathways of the:

- Healthy Waters Partnership for the Dry Tropics;
- Community Liaison Group (CLG);
- Port Planning and Environment Working Group (PEWG);
- Port Advisory Body (PAB);
- Townsville Local Marine Advisory Committee (LMAC);
- Ports Australia; and
- Queensland Ports Association (QPA).

SCHEDULE 1 – PORT OF TOWNSVILLE



2 PORT LOCALITY, SETTING AND SHIPPING

2.1 LOCATION AND ENVIRONMENTAL SETTING

The Port of Townsville (19°15’S, 146°50’E) is situated in the centre of the growing city of Townsville, the leading population centre in tropical North-East Queensland, approximately 1,359 kilometres north of Brisbane, Queensland’s capital city. The Port is located in the south-west of Cleveland Bay, in between the mouths of Ross River and Ross Creek (Figure 6). Magnetic Island, a continental island located approximately 8km offshore, lies at the northern entrance to the bay.

Cleveland Bay is a naturally broad and shallow bay; it is bounded to the east and west by Cape Cleveland and Cape Pallarenda respectively, which are approximately 26km apart. The bay is a north facing, naturally turbid water body enhanced by significant sediment loads received from the Burdekin River catchment and maintains significant sediment mobility through natural re-suspension. Dominant winds from south to east means the bay is relatively protected from prevailing breezes (Kettle *et al.* 2002).

Figure 6: The Port of Townsville and shipping channels (green) and the designated material placement area for maintenance dredge material (pink) within Cleveland Bay.

2.2 PORT OF TOWNSVILLE OVERVIEW

The Port of Townsville was founded in 1864, born out of the need for a safe, close and obstacle-free access to the harbour by the pastoral (wool) industry of the day.

The Port of Townsville currently has eight (8) operational berths which service both imports and exports for Northern Queensland, including (imports) vehicles, fuel, furniture, electrical goods, cement, bitumen and minerals; and (exports) agricultural products, mineral concentrates, sugar, and cattle. The Port of Townsville also maintains an international cruise terminal and is critical to Defence operations (Port website 2020).

2.3 CURRENT AND FUTURE USES

Current uses

The Port of Townsville currently handles an average trade throughput of approximately 7 million tonnes a year. (Port of Townsville, Annual Reports can be found here: https://www.townsville-port.com.au/media-publications/publications/annual-reports/). This includes both imports and exports, and includes containerised cargo, dry bulk, liquid bulk, and break bulk. Cruise vessels and national and international Defence Force vessels are also regular visitors at the Port.

Trade commodities are likely to remain highly diverse due to the catchment and area the Port of Townsville supports. The port continues to promote trading opportunities with international partners to meet accelerating demand for minerals, energy, agricultural products and tourism experiences. Whilst the port is a multicommodity port, it is likely that containers, fuel and cars will continue to increase in response to the regional population demands, as well as an increase in the number of cruise ships visiting Townsville; with the port needing to be able to keep pace with the increasing demand as well as catering to increasing vessel size and vessels.

Future uses

Port Master Plan

The Port of Townsville was designated as a Priority Port in 2015, under the *Sustainable Ports Development Act 2015*. Under this Act, as a Priority Port, and as a port-related action of the *Reef 2050 Plan*, the Port of Townsville is required to undergo Master Planning. Master Planning is set out to support the sustainable development of critical economic infrastructure, such as the State's Priority Ports, in a way that will balance growth, job creation, environmental values, and community interests (DTMR, 2018). The Port of Townsville Master Plan was released in 2019 and can be found on the Port of Townsville website (https://www.townsville-port.com.au/doing-business/planning/priority-port-of-townsville-master-plan/)

The Priority Port of Townsville Master Plan includes a master planned area which encompasses a total area of about 16,500 hectares. The master planned area includes land and marine areas required for the efficient development and operation of the port. The inclusion of land and marine areas supports the management of potential impacts on the OUV of the GBRWHA and other environmental values that may occur as a result of port development and operations (Port website, 2021).

The Master Plan is supported by a Port Overlay. The Port Overlay for the Priority Port of Townsville is the regulatory instrument that implements the Master Plan for the master planned area. It provides requirements for land use planning and development decisions in the master planned area. The Port Overlay operates alongside existing planning instruments and only regulates development in the master planned area if additional requirements are necessary to implement the master plan. It has effect from 1 February 2021 (Port website 2021).

Long-term master planning provides a strategic and coordinated approach to managing port-related development and considers issues including marine and land-based impacts, as well as port and supply chain infrastructure optimisation. The Master Plan also supports opportunities for efficient use of existing capacity through multi-user access arrangements.

Port Expansion Project

The Townsville Port Expansion Project (PEP) is a long-term development plan and approval that includes channel widening, channel deepening, a new outer harbour incorporating an additional 6 berths and associated infrastructure. The PEP is to be constructed over a 30 year period to allow the port to meet growing trade demands and increasing ship sizes. This project went through an Environmental Impact Statement (EIS) process and approvals were granted by the State Government in 2017, and the Federal Government in 2018.

The first element of PEP was the Channel Upgrade (CU) project. This project saw the completion of the widening of the Platypus and Sea Channels to 245m at the inshore end and 130m at the seaward end, allowing vessels up to 300 meters in length to safely enter the port. The project also included the construction of a 62ha reclamation area, purpose built for the placement of capital dredge material removed as part of the CU project. Dredging for the project was completed in March 2024, whilst final construction works continued on the reclamation until March 2025.

More information on the CU project can be found on the Port of Townsville's website (https://www.townsville-port.com.au/projects-development/channel-upgrade/).

2.4 NAVIGATIONAL INFRASTRUCTURE

Routine maintenance dredging is undertaken regularly at the Port of Townsville in order to maintain effective and safe port operations. Maintenance dredging occurs within the following areas:

- Sea Channel
- Platypus Channel
- Outer Harbour
- Inner Harbour (including Berth 5 and ex Berths 6/7)
- Berths 1, 2, 3, 4, 8, 9, 10, and 11
- TMP
- Ross River
- Ross Creek

Figures 7 and 8 show the areas the Port of Townsville has been granted approvals for dredging, these areas are described as lawful structures, in which maintenance dredging can occur. Figure 8 and Table 2 list the approved depths in which maintenance dredging can occur to. Figure 8 also shows the location of the DMPA, in which the majority of maintenance dredge material is placed. For those areas of the port in which maintenance dredge material cannot be placed at sea, this material is placed on land, in the areas shown in Figure 9, this includes minor volumes at a local council land fill, under agreement with the council from time to time.

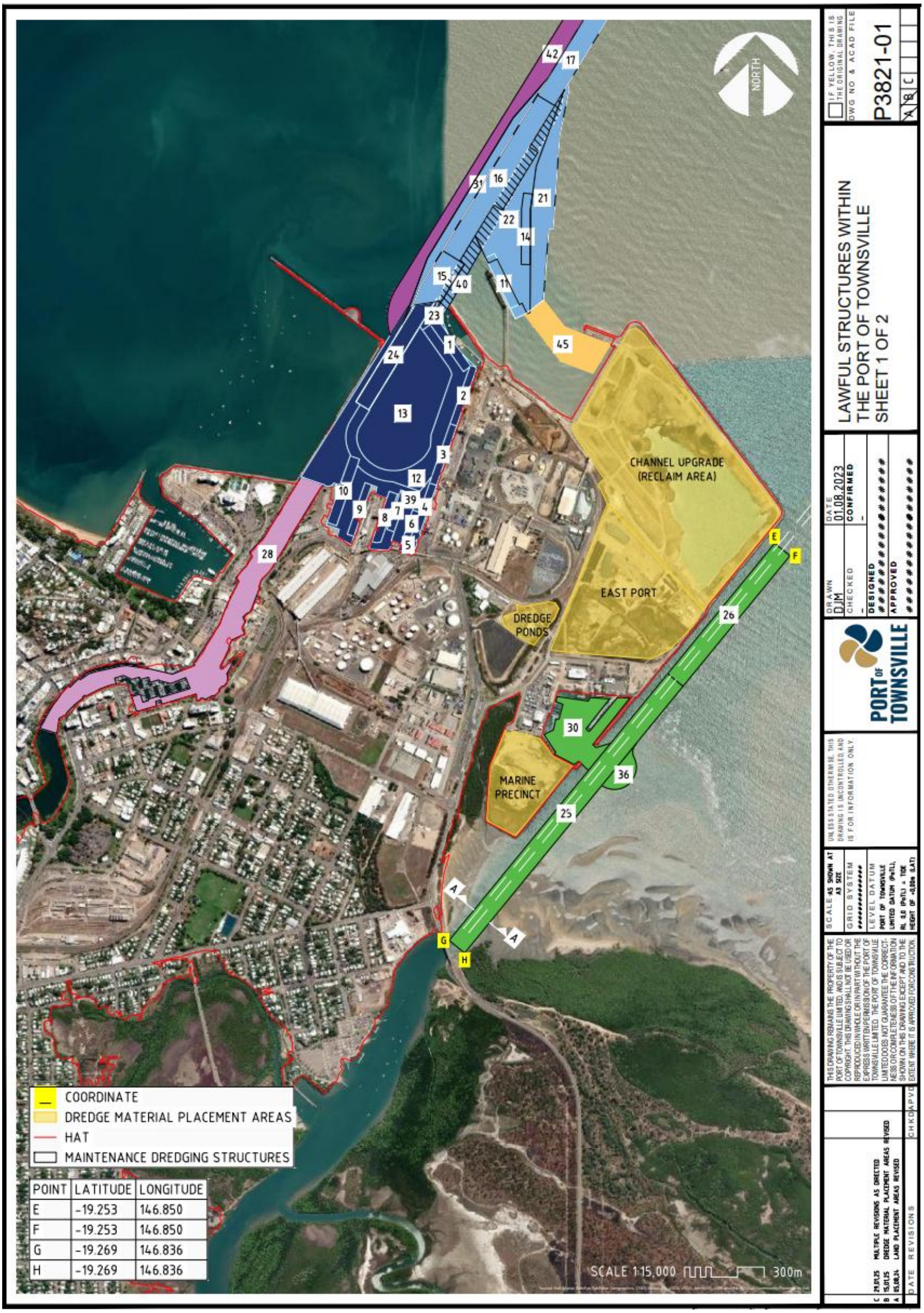
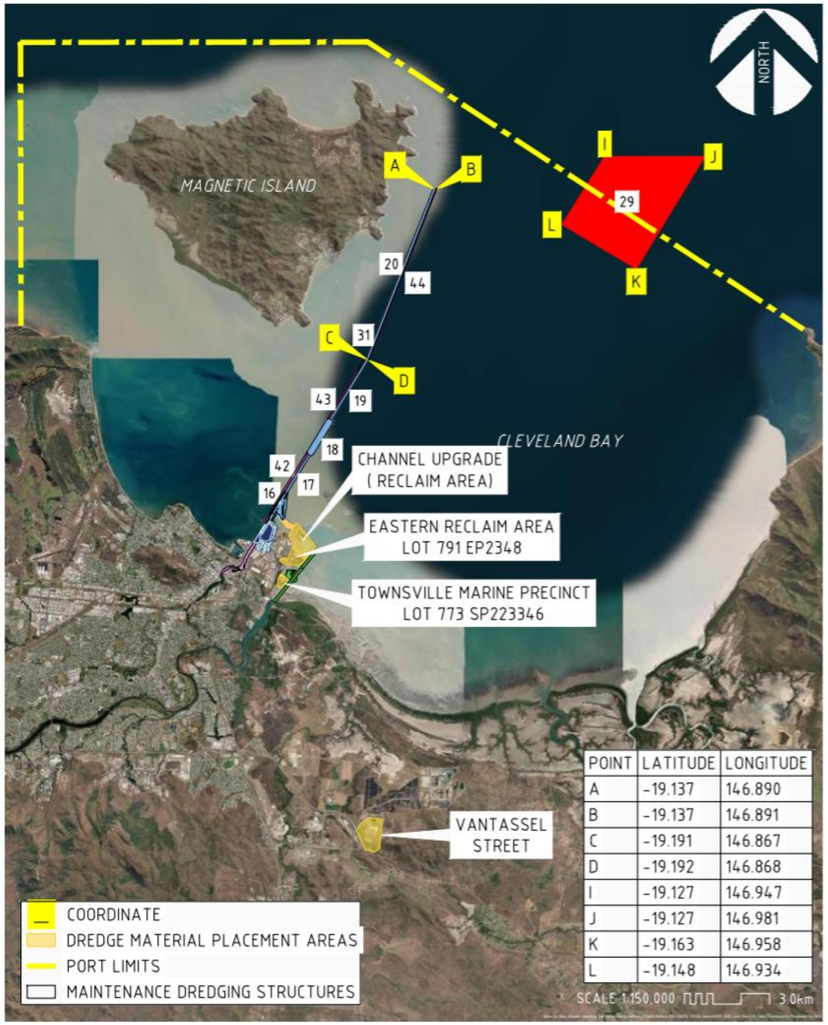
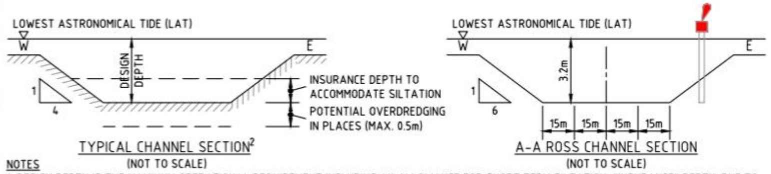


Figure 7: Lawful Structures within Port of Townsville



POINT	LATITUDE	LONGITUDE
A	-19.137	146.890
B	-19.137	146.891
C	-19.191	146.867
D	-19.192	146.868
I	-19.127	146.947
J	-19.127	146.981
K	-19.163	146.958
L	-19.148	146.934

ID	DESCRIPTION	DESIGN DEPTH (m, LAT[1])	DESIGN SOURCE
1	BERTH 1	-15.7[3]	SECTION 86 (DEH APPROVALS 803852, 804852)
2	BERTH 2	-15.7[3]	SECTION 86 (DEH APPROVALS 803852, 804852)
3	BERTH 3	-15.7[3]	SECTION 86 (DEH APPROVALS 803852, 804852)
4	BERTH 4	-15.7[3]	SECTION 86 (DEH APPROVALS 803852, 804852), SPCC01783811
5	BERTH 5	-15.7[3]	SECTION 86 (DEH APPROVALS 803852, 804852)
6	BERTH 6	-15.7[3]	SECTION 86 (DEH APPROVALS 803852, 804852)
7	BERTH 7	-15.7[3]	SECTION 86 (DEH APPROVALS 803852, 804852)
8	BERTH 8	-15.7[3]	SECTION 86 (DEH APPROVALS 803852, 804852)
9	BERTH 9	-15.7[3]	SECTION 86 (DEH APPROVALS 803852, 804852)
10	BERTH 10	-15.7[3]	SECTION 86 (DEH APPROVALS 803852, 804852)
11	BERTH 11	-14.1	LTDDMP (2008)
12	INNER HARBOUR SILT TRENCH	-15.7[3]	SECTION 86 (DEH APPROVALS 803852, 804852)
13	INNER HARBOUR SWING BASIN	-15.7[3]	SECTION 86 (DEH APPROVALS 803852, 804852)
14	OUTER HARBOUR ARRIVAL CHANNEL SILT TRENCH	-13.4	LTDDMP (2008)
15	PLATYPUS CHANNEL P15-CH1000	-15.7	SECTION 86 (DEH APPROVALS 803852, 804852)
16	PLATYPUS CHANNEL CH1000-P13	-13.2	LTDDMP (2008)
17	PLATYPUS CHANNEL P13-CH3500	-12.5	LTDDMP (2008)
18	PLATYPUS CHANNEL CH3500-CH5000	-14.7	SECTION 86 (DEH APPROVALS 803900, 1992)
19	PLATYPUS CHANNEL CH5000-P1	-12.5	LTDDMP (2008)
20	SEA CHANNEL	-12.4	LTDDMP (2008)
21	OUTER HARBOUR ARRIVAL CHANNEL	-12.8	LTDDMP (2008)
22	OUTER HARBOUR BASIN	-12.8	LTDDMP (2008)
23	INNER HARBOUR MISCELLANEOUS	-15.7	SECTION 86 (DEH APPROVALS 803852, 804852)
24	INNER HARBOUR APPROACH	-15.7	SECTION 86 (DEH APPROVALS 803852, 804852)
25	ROSS RIVER CHANNEL 1[4]	-3.2	SECTION 86 (DHM APPROVAL, FILE 14.9.8)
26	ROSS RIVER CHANNEL 2[4]	-2.7	SECTION 86 (DHM APPROVAL, FILE 14.9.8)
28	ROSS CREEK	-5.8	MAX. DEPTH JUNE 2009 +0.5m
29	SPOIL GROUND	N/A	SECTION 86 (DEH APPROVALS 803852, 804852)
30	MARINE PRECINCT STAGE 1	-3.0	SPCC00671010
31	NAVIGATION SAFETY CHANNEL WIDENING	-12.5	SPCC03347711
36	MARINE PRECINCT SWING BASIN	-3.0	SPCC00671010
39	BERTH 6/7 SWING BASIN	-15.7	SDA-0514-01086, SPDE02915611 and SPDE03347611
40	EASTERN ENTRANCE WIDENING	-13.6	2308-36219 SDA
42	PLATYPUS CHANNEL WESTERN WIDENING 1	-13.6	2103-21775 SDA
43	PLATYPUS CHANNEL WESTERN WIDENING 2	-13.6	2103-21775 SDA
44	SEA CHANNEL EASTERN WIDENING	-13.6	2103-21775 SDA
45	TUF DREDGE POCKET	-4.5	2103-21775 SDA



TYPICAL CHANNEL SECTION[2]
(NOT TO SCALE)

A-A ROSS CHANNEL SECTION
(NOT TO SCALE)

NOTES

1. DESIGN DEPTH IS THE MAXIMUM OPERATIONAL REQUIREMENT INCLUDING AN ALLOWANCE FOR SHORT TERM SILTATION, "INSURANCE" DEPTH. DUE TO TECHNICAL LIMITATIONS OF DREDGING EQUIPMENT, IT IS RECOGNIZED BY STATE AND COMMONWEALTH REGULATORS THE DESIGN DEPTH MAY BE EXCEEDED BY UP TO 0.5m IN SOME PLACES HOWEVER BEST EFFORTS WILL BE MADE TO ACHIEVE THE DESIGN DEPTHS STATED ON THIS MAP.
2. THE MINIMUM GRADE LIKELY NECESSARY FOR BATTERS IS 1:4 (APPROX. 14°).
3. ACTUAL DEPTH OF DREDGING CONSTRAINED TO LESS THAN -15.7m BY SUPPORT REQUIREMENTS OF ADJACENT WHARF STRUCTURES.
4. ROSS CHANNEL WIDTH REPRESENTS MAXIMUM WIDTH SHOWN BY LISTED DRAWINGS APPLIED UNIFORMLY ALONG LENGTH.

C	29.01.25	MULTIPLE REVISIONS AS DIRECTED		
B	15.01.25	DREDGE MATERIAL PLACEMENT AREAS REVISED		
A	22.08.24	DESIGN SOURCES ADDED TO ID 39		
	DATE	REVISIONS	CHKD	APVD

SCALE AS SHOWN AT A3 SIZE
GRID SYSTEM ##############
LEVEL DATUM PORT OF TOWNSVILLE LIMITED DATUM (PoTL). RL 0.0 (PoTL) = TIDE HEIGHT OF +0.00m (LAT)

UNLESS STATED OTHERWISE, THIS DRAWING IS UNCONTROLLED, AND IS FOR INFORMATION ONLY.

PORT OF TOWNSVILLE

DRAWN DJM | DATE 01.08.2023
CHECKED - | CONFIRMED -
DESIGNED #################
APPROVED #################

LAWFUL STRUCTURES WITHIN THE PORT OF TOWNSVILLE
SHEET 2 OF 2

IF YELLOW, THIS IS THE ORIGINAL DRAWING
DWG NO & ACAD FILE
P3821-02
A B C

Figure 8: Lawful Structures within the Port of Townsville Cleveland Bay

Table 2: Approved Design Depths for all Lawful Structures at the Port of Townsville

ID	Location	Design Depth (m, LAT)	Design Source
1	Berth 1	-15.7	Section 86 (DES approvals 803852, 804852)
2	Berth 2	-15.7	Section 86 (DES approvals 803852, 804852)
3	Berth 3	-15.7	Section 86 (DES approvals 803852, 804852)
4	Berth 4	-15.7	Section 86 (DES approvals 803852, 804852), SPCC0178311
5	Berth 5	-15.7	Section 86 (DES approvals 803852, 804852)
6	Berth 6/7	-15.7	Section 86 (DES approvals 803852, 804852), DA0170
8	Berth 8	-15.7	Section 86 (DES approvals 803852, 804852)
9	Berth 9	-15.7	Section 86 (DES approvals 803852, 804852)
10	Berth 10	-15.7	Section 86 (DES approvals 803852, 804852)
11	Berth 11	-14.1	LTDDMP (2008)
12	Inner Harbour Silt Trench	-15.7	Section 86 (DES approvals 803852, 804852)
13	Inner Harbour Swing Basin	-15.7	Section 86 (DES approvals 803852, 804852)
14	Outer Harbour Arrival Channel Silt Trench	-13.4	LTDDMP (2008)
15	Platypus Channel P15 – CH1000	-15.7	Section 86 (DES approvals 803852, 804852)
16	Platypus Channel CH1000 – P13	-13.2	LTDDMP (2008)
17	Platypus Channel P13 – CH3500	-12.5	LTDDMP (2008)
18	Platypus Channel CH3500 – CH5000	-14.7	Section 86 (DES approvals 803900, 1992)
19	Platypus Channel CH5000 – P01	-12.5	LTDDMP (2008)
20	Sea Channel	-12.4	LTDDMP (2008)
21	Outer Harbour Arrival Channel	-12.8	LTDDMP (2008)
22	Outer Harbour Basin	-12.8	LTDDMP (2008)
23	Inner Harbour (miscellaneous)	-15.7	Section 86 (DES approvals 803852, 804852)
24	Inner Harbour Approach	-15.7	Section 86 (DES approvals 803852, 804852)
25	Ross River Channel 1	-3.2	Section 86 (DHM Approval, File 14.9.8)
26	Ross River Channel 2	-2.7	Section 86 (DHM Approval, File 14.9.8)
28	Ross Creek	-5.8	Max. depth June 2009+0.5m
29	DMPA	N/A	SD2007/0602, Plan P1460/T1076
30	Marine Precinct Stage 1	-3.0	SPCC00671010
36	Marine Precinct Swing Basin	-3.0	SPCC00671010
39	Berth 6/7 Swing Basin	-15.7	SDA-0514-010086 (SPD-0914-011170)
40	Eastern Breakwater Widening	-13.6	SDA-0514-01086, SPDE02915611, SPDE03347611
42	Platypus Channel Western Widening 1	-13.6	2308-36219 SDA
43	Platypus Channel Western Widening 2	-13.6	2103-21775 SDA
44	Sea Channel Eastern Widening	-13.6	2103-21775 SDA
45	TUF Dredge Pocket	-4.5	2103-21775 SDA

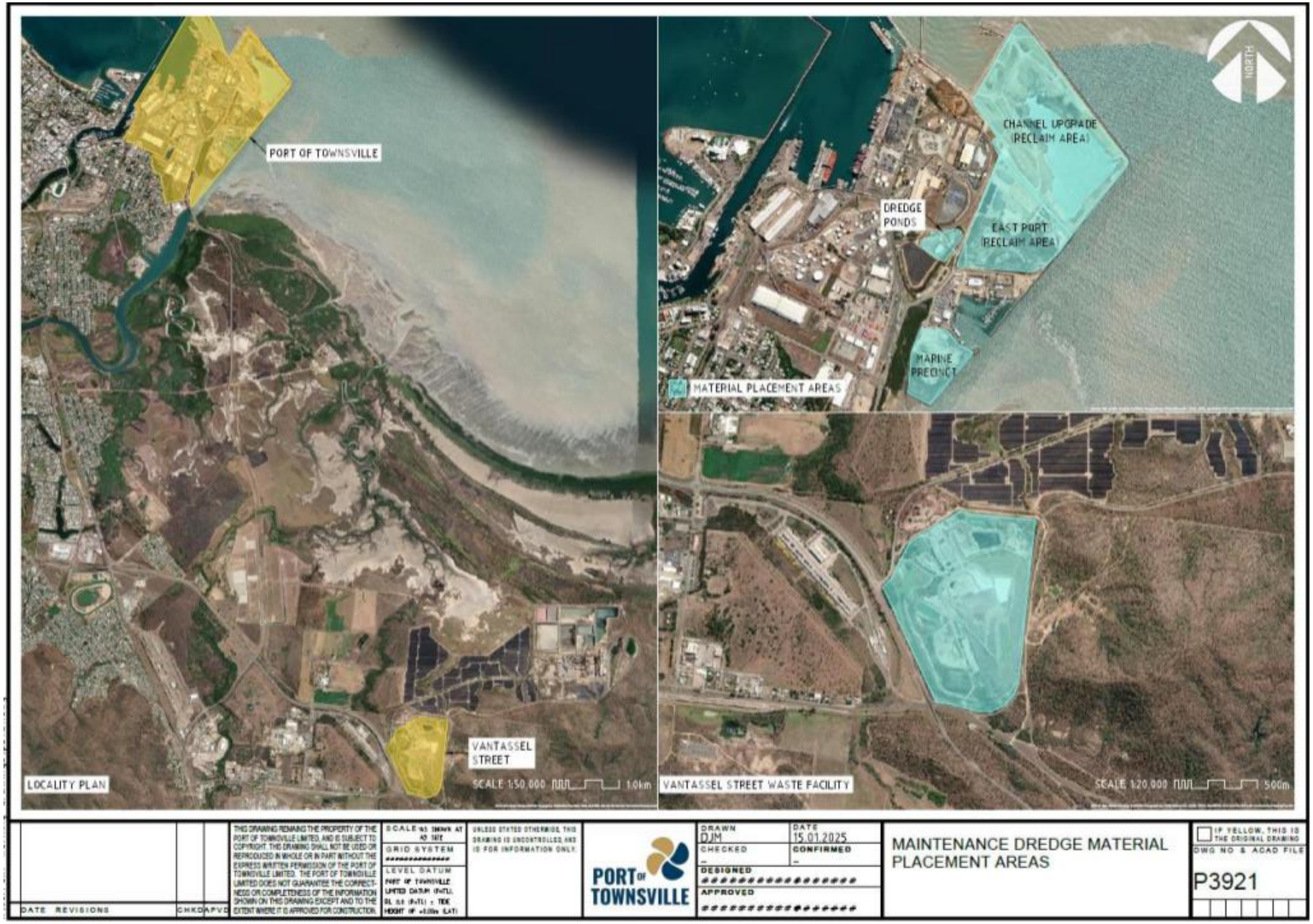


Figure 9: Onshore Maintenance Dredge Material Placement Areas (blue; DETSI Allocation Notice P-AMQ-1008333014)

Figures 10 and 11 are representative of the shape of the Platypus and Sea Channels and Ross River for optimum capacity for vessels entering and exiting the Port of Townsville.

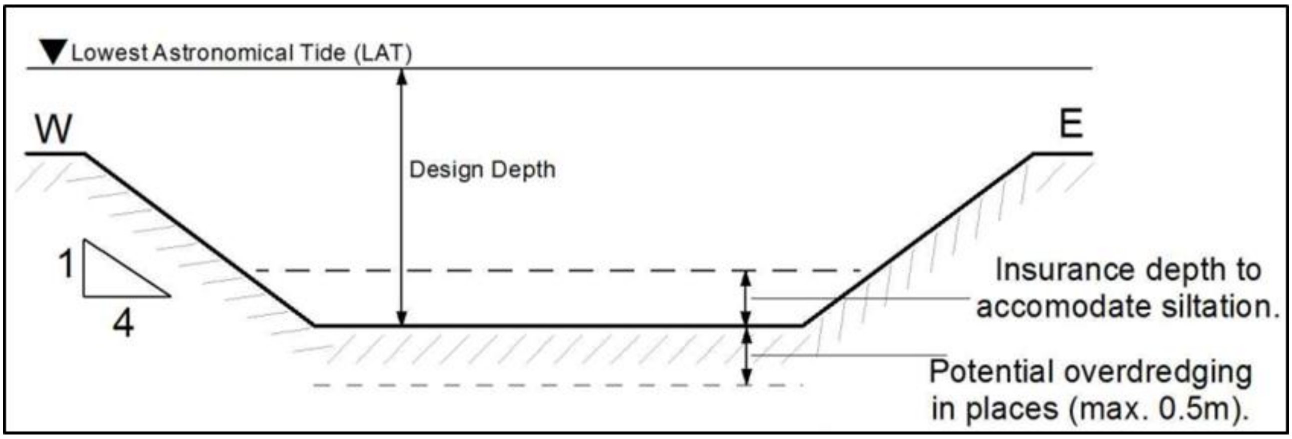


Figure 10: Platypus and Sea Channel Typical Cross Section

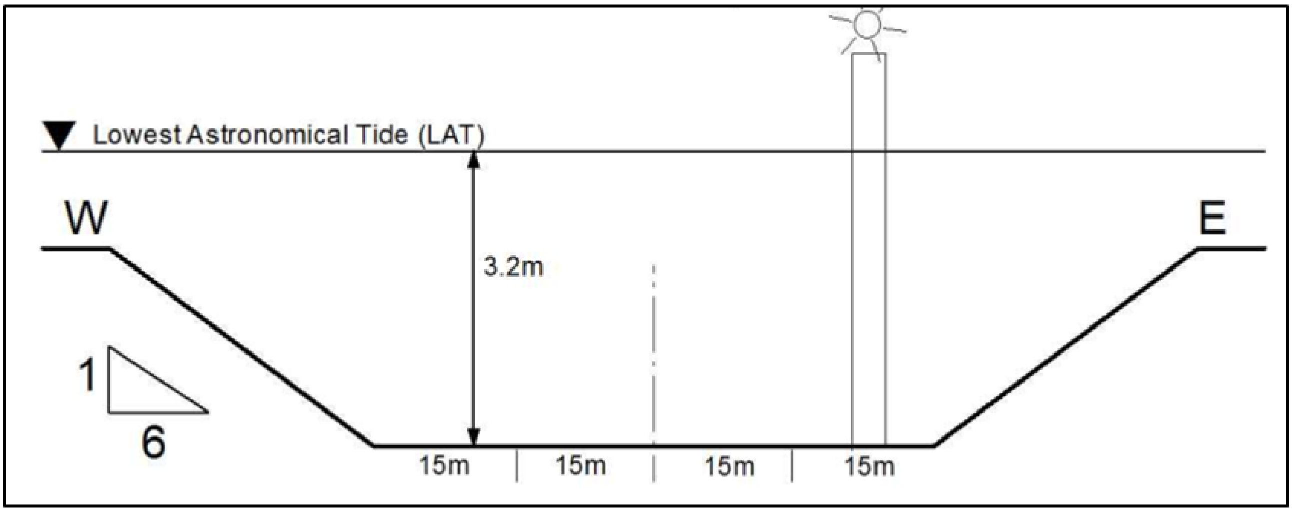


Figure 11: Ross River Channel Cross Section

3 PORT OF TOWNSVILLE ENVIRONMENTAL VALUES

The Port of Townsville has an Environmental and Social Values document (POT 1898) which provides a detailed assessment of the values of Cleveland Bay and is available on the Port of Townsville's website. The following section is a detailed snapshot of the Environmental and Social Values of Cleveland Bay.

3.1 ENVIRONMENTAL VALUES

3.1.1 CLIMATE AND COASTAL PROCESSES

Located within a dry tropical region, Townsville is characterised by a tropical, seasonal wet and dry climate. High humidity and frequent storms, with occasional cyclones, typically occur during the wet season (November to April). The dry season (May to October) produces mild and moderate temperatures. The temperature ranges from a mean maximum of 31.6°C in December to a mean minimum of 13.8°C in July. Relative humidity is highest in the morning and monthly averages range between 60% during September/October and up to 75% in the wet season (peaking in February). Average annual rainfall in Townsville is approximately 1,159mm, with the majority typically recorded during the wet season (December to March).

Cleveland Bay is a relatively low energy wave environment as it is sheltered from the predominant south-east waves by Cape Cleveland. Accumulated sediments make the bay relatively shallow, deepening to only 10 to 11m (below chart datum) along its northern aspect, and averages 2-6m across the bay. The coastline continues to be shaped by the prevailing waves at a slower rate, determined by the generally low energy waves and punctuated by the occasional higher energy cyclone waves that are able to penetrate across the bay onto the shoreline.

The Port of Townsville and surrounding coastal areas have been extensively modified over time. The port lands have been increased significantly by land reclamation and the placement of both maintenance and capital dredge material, dating back to the establishment of the Port in 1864. The surrounding waterways have also been modified. The Ross River has been dammed, along with the installation of three instream weirs, and Ross Creek has been shortened and no longer connects with the Ross River. The Strand Beach is a significant coastal feature located immediately west of the Port. It is a man-made public area which was redeveloped in 2000, with the construction of five beach units separated by artificial rocky headlands, to control the natural long-shore transport of sand. The Strand Beach has large grain-sized imported sands and steep beach fronts, again to minimise the loss of these constructed areas.

Climate change projections indicate that the region's future climate is likely to be characterised by:

- Increased average annual temperature and increased number of days with maxima over 35°C;
- Increased annual potential evaporation, and more drought-like conditions;
- Decreased frequency but increased severity of tropical cyclones;
- Increased average wind speeds; and
- Elevated sea level and increased frequency and height of storm surge.

Careful planning of the potential effects of natural events such as cyclones and floods including predicted climate change risks are a key consideration in port planning, design and operations.

3.1.2 ENVIRONMENTAL VALUES AND WATER QUALITY GUIDELINES

Environmental values and water quality objectives for Townsville's region waters are outlined in schedule 1 of the Environmental Protection (Water and Wetland biodiversity) Policy 2019, which aims to achieve the objectives in the *Environmental Protection Act (1994)* in relation to water and wetlands.

The Port of Townsville is located with the Ross River Basin, which includes all mainland waters (rivers, creeks, estuaries etc.) and coastal waters excluding those around Magnetic Island. Environmental values and water quality objectives are outlined in the *Ross River and Magnetic Island Environmental Value and Water quality objectives* document, found on the DETSI website: https://environment.qld.gov.au/management/water/policy/townsville. Waters within the Ross River basin are divided and assigned their own vales and objectives. For the Port of Townsville subzone, environmental values identified include aquatic resources, human consumer, primary and secondary recreation, visual recreation, industrial use and cultural and spiritual values. Water quality objectives are also defined for a number of physio-chemical and biological objectives to protect aquatic ecosystem values.

3.1.3 MARINE ECOSYSTEM VALUES CLEVELAND BAY

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:

- Corals which occupy only around 1% of the bay;
- Soft bottom communities, occupying over 85% of the bay;
- Intertidal and subtidal seagrass beds, are present in about 10% of the bay and provide food for the threatened dugong and turtles and are also a nursery for prawns and fish;
- Mangrove and saltmarsh communities, containing twelve species of mangrove and 15 species of saltmarsh, all of which:
    - 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; and
- Forested, brackish and freshwater swamps.

There has been a substantial amount of research on the marine ecology of Cleveland Bay and the surrounding GBR. The following sections provide a brief description of the major aspects of the marine ecosystem values of Cleveland Bay. All ecosystem values listed have been considered in the Ports risk assessment for maintenance dredging, outlined in section 6 of this document.

Reef Communities

Coral reef communities of hard and soft corals exist in Cleveland Bay and southern Halifax Bay as shallow fringing reefs around Magnetic Island; the reef platform at Middle Reef; and smaller, less developed nearshore patch reef areas (Virago Shoals) and to the north in Halifax Bay and its islands and shoals. 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 vary in the fringing reefs and is related to the physical characteristics of the substrate and energy environments. The Healthy Water Partnership for the Dry Tropics have created a StoryMaps that showcases the coral communities found within Cleveland Bay and Halifax Bay: https://storymaps.arcgis.com/stories/d3f1198f4f5b4c409895ae5f14aa9674.

Long term monitoring of coral reefs located within Geoffrey Bay and Middle Reef has been conducted by the Australian Institute of Marine Science through their Long term monitoring program and the Great Barrier Reef Monitoring Program. The status of coral at these two reefs can be found here: available here: https://www.aims.gov.au/research-topics/monitoring-and-discovery/monitoring-great-barrier-reef.

The Port of Townsville also established a coral monitoring program in 2020 as part of the CU project to inform management decisions during capital dredging and provide an informative dataset on coral habitat communities in Cleveland Bay. Monitoring was undertaken quarterly at 9 reefs between 2020 to 2024, reduced to biannual at five key locations from 2025. A summary of the monitoring locations along with the dominant corals recorded are listed in Table 3.

Table 3. Coral Monitoring Locations

Location	Dominant Coral	Time Period
Middle Reef	Acropora, Montipora, Dipsastraea, Porities	2020-current
Virago Shoal	Goniastrea, Montipora	2020-current
Florence Bay	Acropora, Montipora, Dipsastraea, Galaxea	2020-current
Geoffrey Bay	Acropora, Montipora, Porites	2020-current
Paluma Shoal	Montipora, Turbinaria	2020-current
Picnic Bay	Acropora, Montipora	2020-2024
Cockle Bay	Monitpora, Porites	2020-2024
Bay Rock	Acropora, Montipora, Soft Coral	2020-2024
Rattlesnake Island	Turbinaria, Acropora, Montipora	2020-2024

Typical of marine ecosystems, the results of the coral monitoring showed the state of coral communities are complicated in space, time, coral biology and significantly impacted by extreme weather events. Hard coral communities occurred at all nine sites and across the 5 years of monitoring, varying from a high of 84.1% (Middle Reef) to a low of 3.4% (Picnic Bay). Hard coral cover has remained relatively unchanged across Florence Bay, Geoffrey Bay, Virago Shoals and Paluma Shoals between June 2024 and November 2025, with Middle Reef hard coral cover declining between 2024 and 2025 largely attributed to Tropical Cyclone Kirrily.

In mid-2024, six of the nine coral monitoring sites (Virago Shoals, Paluma Shoals, Picnic Bay, Cockle Bay, Rattlesnake Island and Florence Bay) were dominated by algae; while two of the nine sites (Middle Reef and Geoffrey Bay) were dominated by hard coral and one site (Bay Rock) dominated by soft substrate and other invertebrate cover.

Across the five years of the Port's coral monitoring program, it was determined by the specialist contractor undertaking the program that the minor changes observed in corals were attributed to natural variability and extreme climate events. Tropical cyclone Kirrily in early 2024 had the most profound impact on corals at east facing reefs, with hard coral cover at Middle Reef significantly decreasing in early 2024, highlighting the impact cyclones and extreme weather can have on individual reefs.

Although changes were detected across time for coral health (e.g. coral bleaching, sediment deposition and partial mortality), these changes occurred across all sites indicating that the observed increase is likely attributable to broader temporal or environmental factors.

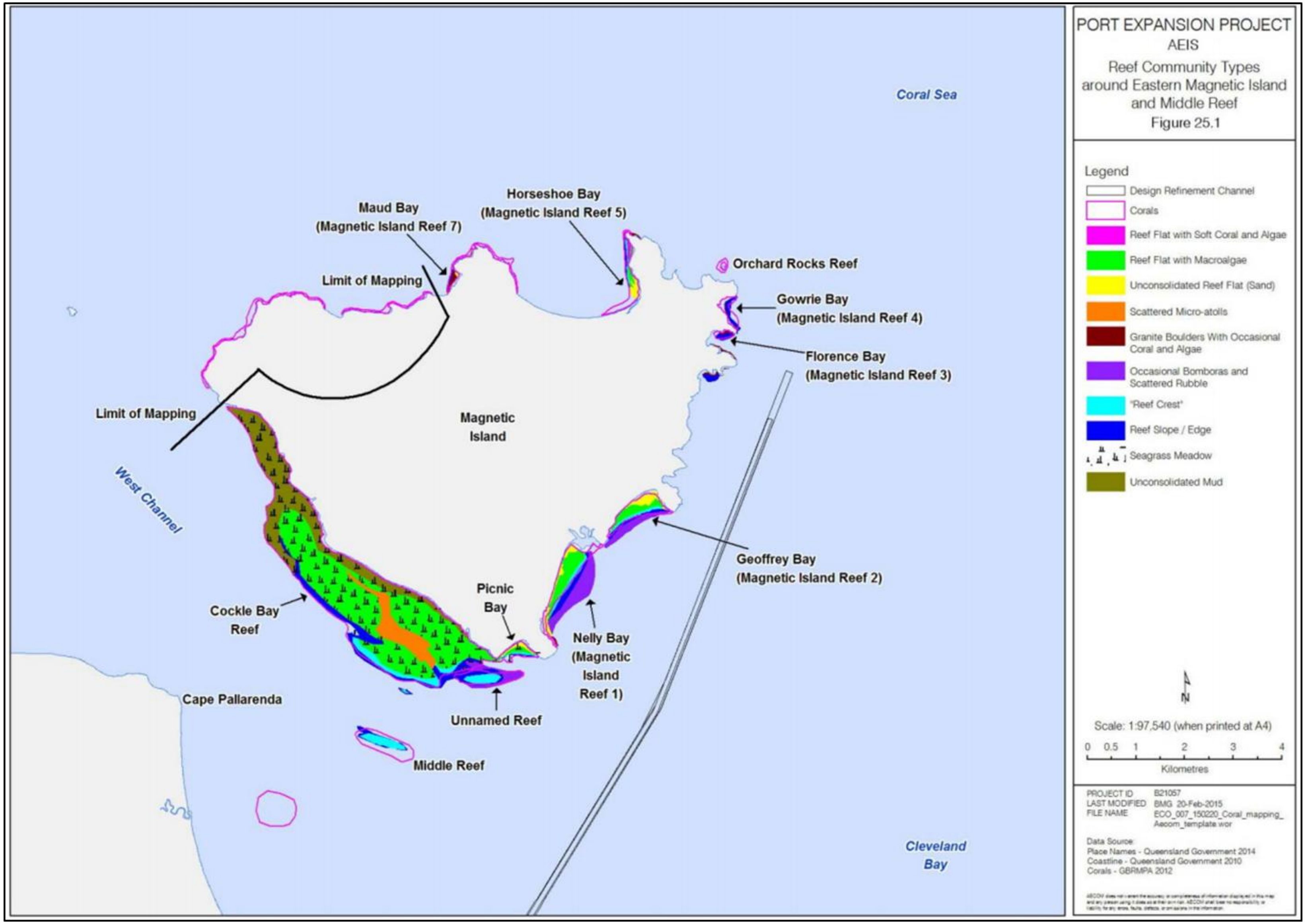


Figure 12: Reef Communities Around Magnetic Island (Extract from Port Expansion AIES, 2016)

Benthic Communities

Soft sediment communities dominate the seabed of Cleveland Bay (Kettle *et al*. 2001). The most common groups of benthic infauna present in the area include polychaetes, sipunculids, bryozoans and crustaceans such as amphipods and tanaids (Cruz Motta and Collins 2004). Benthic communities provide a number of ecosystem services including through bioturbation and a food source for many species of fish, including higher order consumers, which are also targets for recreational fishing.

A number of additional baseline studies have been undertaken as part of the PEP Environmental Impact Statement (EIS) (AECOM 2009) to characterise the benthic environments in and around the Outer Harbour, the entrance channels and at the approved DMPA. These studies characterised sediment type as well as epifauna and infauna communities in these areas. The study identified the range of habitats available in Cleveland Bay supporting different communities including:

- Breakwaters and revetments (intertidal and subtidal) providing hard substrates for algal and sponge dominated communities;
- Reef and coral communities in quiescent areas;
- Soft sediment habitats supporting epibenthic (organisms living on the seabed) and benthic (infauna living within the sea bed) throughout the Port and surrounding areas; and
- Mid-shore assemblages comprising of hydrozoans, sea pens, ascidians, and crinoids;

The study identified polychaetes, amphipods, bivalves, marine worms, crabs, isopods, ascidians, and brittle stars as the most abundant taxa across the study area. At the DMPA, abundance was dominated by polychaete worms and crustaceans noting that abundance. The study noted consistency in results across various assessments in the region indicating minimal long-term changes in the communities.

In 2025, the Port engaged GHD Pty Ltd to conduct a benthic survey of the DMPA and surrounds to determine the recovery of benthic communities and the sediment characteristics. Benthic communities in the DMPA and surrounding area were sampled, before and 5 weeks after dredging and placement activities building on similar studies conducted by GHD in 2020/2021 and in 2018.

The assessment of benthic communities is completed by collecting samples from the upper 10cm of sediment from the seabed at a number of locations within and surrounding the DMPA. From these samples the animals are examined and identified to family level. Family level identification provides a reliable measure of ecological condition, community structure, and potential environmental change while ensuring consistency with national benthic monitoring standards. The benthic organisms identified were typical of communities found in tropical, soft sediment environments.

The studies identified core 'influential' taxa including marine worms, crustacea, bivalves, and brittle stars that were present at the DMPA in both the 2020 and 2025 sampling events. These organisms are found in the area across time, throughout a range of potential influences including dredge placement activities and significant climatic events (including Tropical Cyclone Kimi, major flooding in Townsville and the Burdekin, and Tropical Cyclone Kirrily). The presence and prevalence of these taxa in samples collected from the DMPA and surrounds over the sampling events provides and indication of the resilience and stability of this cohort through time, likely supported by new individuals moving in from surrounding areas. The persistence of this cohort through time, including during the 2020/2021 survey and 2018 pilot study, and across Cruz's six events spanning 1998 – 2000 (Cruz, 2000), indicates that taxa within the cohort can be considered fully established foundation species.

Based on the data collected from these studies, as well as previous investigations of the region (Cruz , 2000; Cruz Motta and Collins 2004) GHD determined that dredge material placement at the DMPA does not appear to have a long-term effect on the benthic communities of the DMPA or surrounding area.

Seagrass communities

Seagrass meadows occur in parts of Cleveland Bay and provide both important habitat and food resources for a range of species of conservation significance, including dugong and turtles as well as assisting in stabilising sediment and trapping and recycling nutrients (Roelofs *et al*. 2003). With the exception of the DMPA, seagrass is not known to occur in the existing port infrastructure, although shallow water and intertidal seagrass beds can occur nearby (e.g. near the Ross River mouth and along The Strand). Seagrass beds are extensive in the eastern portion of Cleveland Bay, away from almost all of the City's development. Smaller beds occur across the Strand, Kissing Point, Pallarenda Beach, and some bays fringing Magnetic Island (Wells and Rasheed 2017). 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 4m in depth, between the mainland and Magnetic Island, and adjacent to Cape Cleveland (Lee Long *et al*. 1993).

A number of studies of the spatial and temporal distribution of seagrass in Cleveland Bay have been undertaken over the years, but most recently baseline and annual surveys of seagrass, commissioned by the Port, have been undertaken by JCU since 2007. The baseline surveys identified large and continuous seagrass meadows in Cleveland Bay, most commonly in lower intertidal and shallow sub-tidal areas. The best quality shallow seagrass meadows occur as shallow beds near Cape Cleveland, The Strand, Cape Pallarenda and around Magnetic Island. The dominant species in shallow waters include *Halophila ovalis*, *Halodule uninervis*, *Zostera muelleri* and *Cymodocea serrulata*. The reef flats surrounding Magnetic Island support areas of *Thalassia hemprichii*.

The distribution, extent and density of seagrass assemblages in near-shore areas can show great variation over a range of temporal scales (particularly seasonally and inter-annually) in response to variations in a range of environmental factors. In particular, changes in the light availability, that result from wave-driven bed sediment remobilisation and turbidity associated with catchment discharges, are key drivers of temporal change in seagrass meadows (Taylor and Rasheed 2009). Recent seagrass surveys conducted in Cleveland Bay continue to show a decline in seagrass biomass due to a range of cumulative climate events and system wide pressures across the Townsville Region and bay area over the past six years (2019-2024) (McKenna et al. 2025). However, seagrasses in the Townsville region still have satisfactory spatial coverage, good species composition and higher light requiring species in subtidal meadows providing a foundation for future recovery. The presence of dugong feeding trails also indicates ongoing ecological function (McKenna et al. 2025).

Cleveland Bay contains ephemeral deep-water seagrass beds. These deep-water meadows are typically patchy (non-contiguous, fragmented beds) with a sparse cover and low species richness. The deep-water meadows also show seasonal and inter-annual variability, with the surveys from 2007 to 2024 showing variability in meadow extent, with the largest meadow footprint recorded in 2019 (McKenna *et al*. 2024). The restricted deep-water meadows suggest that either the light environment has not improved enough, or that some other factor is more influential in meadow recover in deeper habitats (Wells and Rasheed 2017); including those attributed to effects derived from seasonal flooding.

From 2022-2026 the Port hosted the Healthy Waters Partnership for the Dry Tropics, and along with providing data for the Annual Report cards, the Port is supporting the creation of ArcGIS StoryMaps. The aim of the StoryMaps is to provide a platform to share knowledge on Cleveland Bay with the Townsville Community. The first ArcGIS StoryMap was release in 2022 and tells the story of the seagrass meadows in Cleveland Bay: https://storymaps.arcgis.com/stories/1955ed7dd4c440639bb34f8a430aa054

Mangrove Communities

Mangrove communities represent diverse communities growing in the intertidal zone of tropical to temperate coastal rivers, estuaries and bays (Lovelock 2003). They are most extensive in the south-east 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. Predominant threats to mangrove ecosystems arise from land use conflicts and local effects on water quality.

The occurrence of particular mangrove species is dependent on environmental factors such as salinity (Sam and Ridd 1998), nutrient availability (Walker and O'Donnell 1981), oxygen levels in the sediment and wave energy (Brinkman *et al*. 1997). At least seven direct studies have been undertaken on the mangroves of Cleveland Bay and twelve species of mangroves have been recorded.

Saltmarsh Communities

Cleveland Bay is also home to over 15 species of saltmarsh species. Saltmarshes are ecologically important habitats, as they link the marine environment to terrestrial, and provide habitat for both marine and terrestrial organisms (Goudkamp and Chin 2006).

Saltmarsh communities tend to occupy the areas of low energy, intermittent, tidal inundation, on sheltered soft substrates, and often occur behind mangrove communities (Creighton *et al*. 2015). Different saltmarsh community types produce different benefits to the ecosystem, including sediment trapping, nutrient cycling, dissipation of wave energy, fish and prawn nurseries, carbon sequestration, and feeding areas for birds (Creighton *et al*. 2015).

Distribution throughout the bay depends on the site microhabitat and seasonal influences from both land and sea direction. Saltmarshes play an important role in the ecosystem by providing organic matter, a rich supply of nutrients, and supporting a great diversity of both marine and terrestrial life (adapted from RIVER Group 2004).

Marine Megafauna

Cleveland Bay contains significant foraging grounds and habitat for numerous marine megafauna, including species listed as threatened, migratory or otherwise protected under the EPBC Act. This includes marine turtles, a key habitat area for dugongs as well as other cetaceans such as inshore dolphin species and migratory whales. Table 4 list the threatened marine megafauna species that have been observed within proximity of the Port, as listed under the *Nature Conservation (Animals) Regulation 2020* and the Cth EPBC Act.

Table 4: Threatened Megafauna of Cleveland Bay.

Species	State Nature Conservation Status	Cth EPBC Status
Loggerhead Turtle *Caretta caretta*	Endangered	Endangered
Leatherback Turtle *Dermochelys coriacea*	Endangered	Endangered
Olive Ridley Turtle *Lepidochelys olivacea*	Endangered	Endangered

Species	State Nature Conservation Status	Cth EPBC Status
Hawksbill Turtle *Eretmochelys imbricata*	Endangered	Vulnerable
Dugong *Dugong dugon*	Vulnerable	Marine, Migratory
Green Turtle *Chelonia mydas*	Vulnerable	Vulnerable
Flatback Turtle *Natator depressus*	Vulnerable	Vulnerable
Australian Snubfin Dolphin *Orcaella heinsohni*	Vulnerable	Vulnerable
Australian Humpback Dolphin *Sousa sahulensis*	Vulnerable	Vulnerable
Estuarine Crocodile *Crocodylus porosus*	Vulnerable	Marine, Migratory

Other commonly sighted native marine fauna in and around Cleveland Bay include Humpback Whales, and various species of sea snakes.

While six species of marine turtles are known to use Cleveland Bay as feeding grounds, Cleveland Bay, along with adjacent bays, is only known to represent a regionally important feeding area for the Green Turtle (*Chelonia mydas*) (PEP EIS, Section B6 2009). The port footprint is not an area of high utilisation for turtles (GHD 2012).

The waters of Cleveland Bay are entirely within a Declared Dugong Protection Area (DPA; designated as a zone A protection area) and dugongs are known to be relatively abundant in the bay. Megafauna monitoring undertaken by GHD for the TMP and Port Expansion Projects, (GHD 2009 and 2012), found that dugongs were found most often in areas with a greater concentration of seagrass in Cleveland Bay; including the meadows near the southern and eastern shores of the bay.

Boat-based and aerial marine megafauna surveys have been conducted in Cleveland Bay between 2008 and 2012. Turtles, dugongs, rays, sea snakes and dolphins were observed as part of these surveys. Both the Australian Snubfin Dolphin and the Indo-Pacific Humpback Dolphin were also observed as part of these surveys and were reported to be highly mobile, moving in and out of Cleveland Bay (noting that the Indo-Pacific Humpback Dolphin identification in Cleveland Bay has been revised to Australian Humpback Dolphin). Both of these vulnerable species are considered to be opportunistic generalist feeders on fish and cephalopods (octopus, squid etc.) from coastal, estuarine and nearshore reef habitats (PEP EIS, Section B6 2009).

As part of the environmental monitoring conducted for the CU Project, the Port of Townsville has partnered with Flinders University, Southern Cross University and Blue Planet Marine to monitor Snubfin and Australian Humpback dolphin populations, movements and use of Cleveland Bay and Southern Halifax Bay. The Annual dolphin surveys were completed across 2019-2024, with annual dolphin monitoring reports providing insight into these populations. This program was designed for the CU Project to establish baseline information and monitor and report on changes, beyond natural spatial and temporal variation, in the distribution, abundance, habitat use and behaviour of Australian snubfin and humpback dolphins. The reports can be found on the Port of Townsville website

(https://www.townsville-port.com.au/projects-development/channel-upgrade/environmental-monitoring/).
Across the six years of monitoring, snubfin and humpback dolphin estimated abundances have shown significant variability, particularly snubfin dolphins. There is uncertainty over the drivers for this variability, with it noted that ecological variables (food source, habitat quality, social structure), anthropogenic causes, or a combination of both could be resulting in the changing spatial distribution. Abundance and density of both species were consistently higher in inshore waters of both bays compared to offshore, reflecting both species' frequent use of shallow, nearshore habitats.

For snubfins, numbers in Cleveland Bay remained relatively stable from 2019-2021 (31–42 animals) before declining to near to zero from 2022-23 and then returning to levels similar to 2019-2021 in 2024. In contrast, snubfin dolphin populations in neighbouring Halifax Bay followed a completely opposite pattern, with abundance declining from 56 to 31 individuals between 2019–2021, then increasing to 111 in 2022 before deceasing again to 73 in 2023 and 60 in 2024. These patterns point to a temporary change in the distribution of snubfins from Cleveland Bay to Halifax Bay during 2022 and 2023 and a concurrent influx-sustained immigration into Halifax Bay.

In contrast, humpback dolphins exhibited an overall increase in abundance in both bays, although interannual variability was evident. In Cleveland Bay, the estimated abundance increased from 20 individuals in 2019 to 68 in 2024 (peaking at 81 in 2023). In Halifax Bay, which consistently supported the larger component of the population, abundance fluctuated, declining from 66 individuals in 2019 to 45 individuals in 2021 before increasing to 122 individuals by 2024. This pattern indicates short-term variability within a broader increasing trajectory. The simultaneous appearance of many newly identified humpback dolphins since 2022 suggests ongoing immigration, particularly into Halifax Bay between 2023 and 2024, and underscores the bay's connectivity with Cleveland Bay and adjacent regions.

Dolphin occurrence around the Port from land-based surveys closely mirrored the abundance and spatial-use patterns revealed by vessel surveys, with Humpback dolphins regularly recorded across the six years (with 2024 the peak of numbers) while snubfin dolphins were seen in 2019-2021 period before very limited sightings in 2022-23 followed by an increase in detections in 2024 similar to 2021.

Overall, the monitoring program findings when considered with historic abundance estimates, indicate that recent abundance changes reflect dynamic habitat use and interannual variability within the region, rather than definitive evidence of long-term population trends. Both species were estimated to have high biological survival rates, with the changes in population estimates driven by increased movement of individuals between the bays and no long-term change in population dynamics. The findings for humpback dolphins' algins with other healthy dolphin populations and suggests that humpback dolphins in the study area are not experiencing mortality pressures or population level declines from environmental variability or anthropogenic impacts.

Fish and Fisheries

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. Prawn trawling, coastal net setting and crab pot fishing occur on a commercial scale, in and beyond Cleveland Bay. The net and crab pot fisheries target species such as Mud Crabs, Barramundi, Threadfin Salmon, Grunter and Flathead.

Fish habitat areas (FHAs) have been established in Cleveland Bay (FHA-071), the Bohle River (FHA-027), and in Bowling Green Bay (FHA-007). These areas provide protection and breeding grounds for target indigenous, recreationally, and commercially important species (including Barramundi, Grunter, Mud Crabs and Prawns). While these species are highly mobile, it is recognised that the loss of important habitats such as for feeding, or breeding, including seagrasses, and reef and benthic habitat, may affect long-term stock levels and abundance. Commercial fishing has been restricted within parts of Cleveland Bay since the implementation of DPAs in 1998. Other limitations are placed on commercial and recreational fishing through the GBRMP boundaries and zoning maps and limited access within identified secure areas for shipping. No major aquaculture facilities are currently operating in the Cleveland Bay area.

Birds

Cleveland Bay is home to over 450 different species of birds, including migratory and coastal species, (DES Wildlife Online 2026). From the 451 species identified in and around the Townsville Region, 31 species were listed as Critically Endangered, Endangered or Vulnerable under the State's *Nature Conservation Act 1992*; of these 31 species 2 were listed as Critically Endangered, 11 as Endangered, and 14 as Vulnerable under the EPBC Act (Table 5)(DES Wildlife Online 2026).

Surrounding the Port of Townsville are terrestrial intertidal and inshore marine habitats used by a diverse range of birds, particularly at the mouth of the Ross River and intertidal flats extending southeast from the river mouth.

Table 5: Threatened Bird Species of Cleveland Bay

Species	State Nature Conservation Status	Cth EPBC Status
Red Goshawk *Erythrotriorchis Radiatus*	Endangered	Endangered
Beach Stone-Curlew *Esacus magnirostris*	Vulnerable	
Glossy black-cockatoo (northern) *Calyptorhynchus lathami erebus*	Vulnerable	
Southern Cassowary (southern population) *Casuarius casuarius (southern population)*	Endangered	Endangered
Greater Sand Plover *Charadrius leschenaultii*	Vulnerable	Vulnerable
Lesser Sand Plover *Charadrius mongolus*	Endangered	Endangered
Squatter Pigeon (southern subspecies) *Geophaps scripta scripta*	Vulnerable	Vulnerable
Gouldian Finch *Erythrura gouldiae*	Endangered	Endangered
Star Finch (eastern subspecies) *Neochmia ruficauda ruficauda*	Endangered	Endangered
Grey Falcon *Falco hypoleucos*	Vulnerable	Vulnerable
New Caledonian Fairy Tern *Sternula nereis exsul*	Endangered	

Species	State Nature Conservation Status	Cth EPBC Status
Southern Giant-Petrel *Macronectes giganteus*	Endangered	Endangered
Wedge-Tailed Shearwater *Ardenna pacifica*	Vulnerable	
Terek Sandpiper *Xenus cinereus*	Vulnerable	Vulnerable
Australian painted snipe *Rostratula australis*	Endangered	Endangered
Red Knot *Calidris canutus*	Vulnerable	Vulnerable
Western Alaskan Bar-Tailed Godwit *Limosa lapponica baueri*	Endangered	Endangered
Eastern Curlew Numenius madagascariensis	Critically Endangered	Critically Endangered
Curlew Sandpiper *Calidris ferruginea*	Critically Endangered	Critically Endangered
Great Knot *Calidris tenuirostris*	Vulnerable	Vulnerable
Masked Owl (northern subspecies) *Tyto novaehollandiae kimberli*	Vulnerable	Vulnerable
Black-Throated Finch (White-Rumped subspecies) *Poephila cincta cincta*	Endangered	Endangered
White-throated needletail *Hirundapus caudacutus*	Vulnerable	Vulnerable
Sooty Shearwater *Ardenna grisea*	Vulnerable	Vulnerable
Asian Dowitcher *Limnodromus semipalmatus*	Vulnerable	Vulnerable
Black-tailed Godwit *Limosa limosa*	Endangered	Endangered
Common Greenshank *Tringa nebularia*	Endangered	Endangered
Grey Plover *Pluvialis squatarola*	Vulnerable	Vulnerable
Lantham’s Snipe *Gallinago hardwickii*	Vulnerable	Vulnerable
Ruddy Turnstone *Arenaria interpres*	Vulnerable	Vulnerable
Short-Tailed Shearwater *Calidris acuminata*	Vulnerable	Vulnerable

The remaining 412 species are listed under the *Nature Conservation (Animals) Regulation 2020* as of Least Concern. However, of the 412 remaining, 53 species are listed as Special Least Concern, which (under the *Nature Conservation Animals Regulations 2020*), means there is an agreement to protect these species either under:

- The agreement called 'Agreement Between the Government of Australia and the Government of Japan for the Protection of Migratory Birds and Birds in Danger of Extinction and their Environment' signed in Tokyo on 6 February 1974; or
- The agreement called 'Agreement Between the Government of Australia and the Government of the People's Republic of China for the Protection of Migratory Birds and their Environment' signed in Canberra on 20 October 1986; or
- The convention called 'Convention on the Conservation of Migratory Species of Wild Animals' signed in Bonn on 23 June 1979.
- The agreement called 'Agreement Between the Government of Australia and the Government of the Republic of Korea on the Protection of Migratory Birds and Exchange of Notes' signed in Canberra on 6 December 2006.

Cleveland Bay has a diverse range of habitats and protected areas which are of international, national and state significance in supporting wading and migratory bird species (Driessen et al 2025). Areas of importance in the bay for migratory or coastal bird species are Magnetic Island, The Town Common, the Ross River sandspit, Cape Cleveland and the Ramsar listed Bowling Green Bay.

Clear mudflats within the bay provide suitable habitat for Radjah Shelducks, Black-Necked Storks, and White Rumped Swiftlets. The Ross River sandspit in the river's mouth supports a nationally significant proportion of several migratory shorebirds – Red-Necked Stint, Lesser Sand Plover, Eastern Curlews; as well as being home to Beach-Stone Curlews, Little Terns, Caspian Terns, Gull-billed Terns, and Silver Gulls. Magnetic Island also provides foraging habitat for migratory shorebirds, like the East Asian – Australasian Flyway (PEP CGER 2017).

Several targeted bird studies and surveys around the Port of Townsville have been undertaken for a number of projects. These include the Port Access Road project, TMP project and PEP.

Most recently, shorebird monitoring for the CU project has been undertaken on Port land (noting Port land was only temporary shorebird habitat) and the sand spit to the east of the mouth of Ross River during the shorebird migratory season (October to February) between 2018 and 2023-24 migration season. These surveys have been undertaken by NRA Environmental Consultants across low and high tides during the peak migratory period. Overall migratory shorebird species richness and abundance on the sand spit east of Ross River has remained relatively stable across the monitoring period, with the lowest annual abundance due to the temporary decrease in one species (Great Knot) before its numbers rebounded. Shorebird abundance on Port land has been variable and overall decreasing, likely attributable to external factors, surrounding habitat changes, as well as the progressive transformation of artificial habitat on Port land the shorebirds opportunistically were occupying. The decline was attributed to external factors also, with the migration of these species through a number of countries that have seen widespread habitat alteration. The annual summary reports providing insight into shorebird populations on the Ports website: (https://www.townsville-port.com.au/projects-development/channel-upgrade/environmental-monitoring/).

3.1.4 PROTECTED AREAS WITHIN CLEVELAND BAY

The Port of Townsville's Sea jurisdiction is within the GBRWHA, which is also a national heritage place. However, the Port and its marine infrastructure are in an exclusion zone from the Central region of the Cth GBRMP and the State GBR Coast Marine Park (Figure 13), but some port infrastructure boarders the marine park, e.g. the Sea Channel and the DMPA. Existing shipping channels accessing the Port of Townsville approach within approximately one kilometer of Bremner Point on Magnetic Island.

Some of the key conservation areas, as well as other features of the region as shown in Figure 13, include:

- The GBRWHA, a world and national heritage place;
- The GBRMP and the State GBR Coast Marine Park (including a number of different zones of protection) noting the area depicted with a red boundary is the port exclusion zone;
- Declared Dugong Protection Areas, in Cleveland Bay and around Magnetic Island;
- A declared FHA in the east of Cleveland Bay;
- The neighbouring Bowling Green Bay, a Ramsar listed wetland and major wetland area of significance to migratory and wading birds; and
- Magnetic Island National Park.

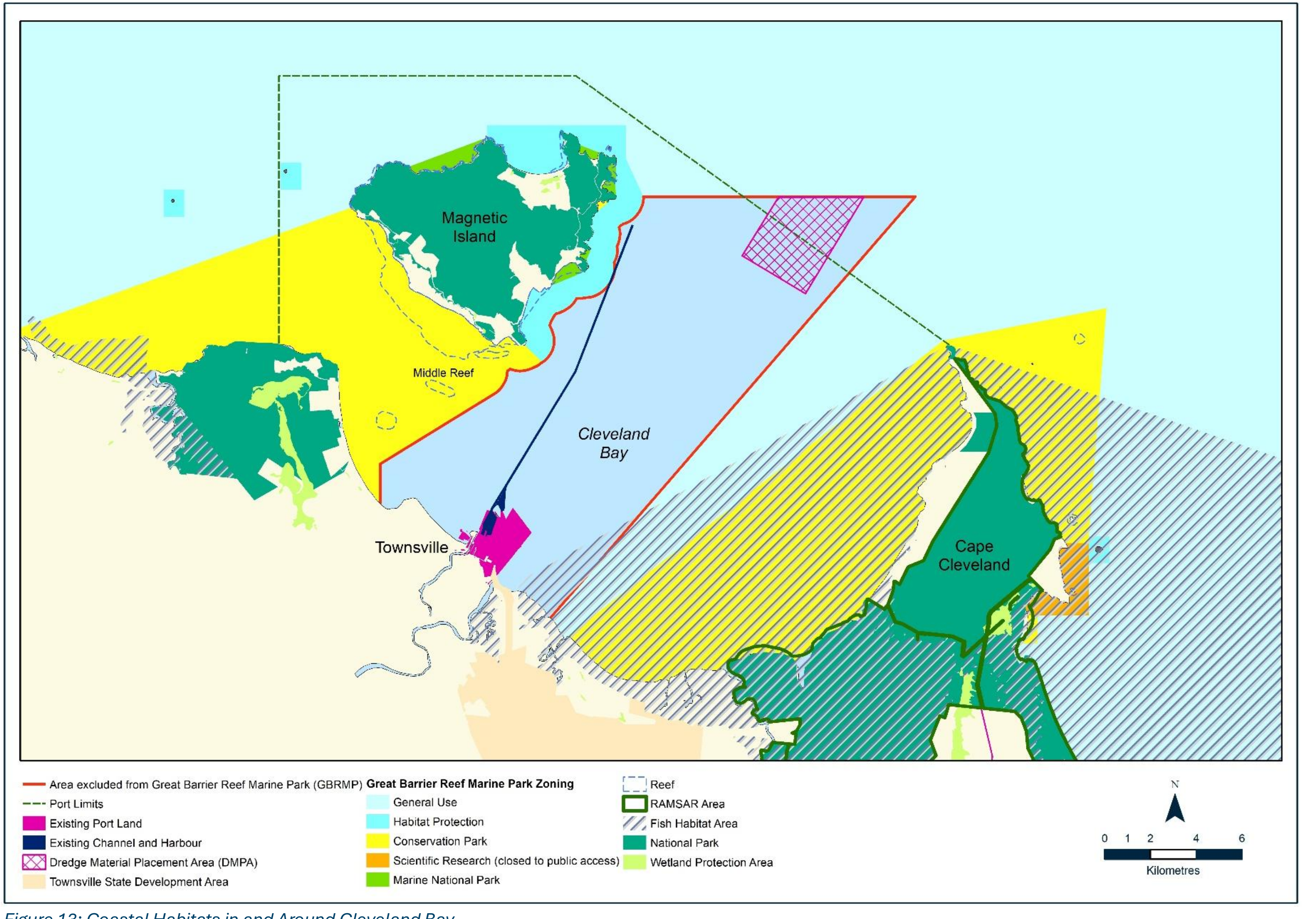


Figure 13: Coastal Habitats in and Around Cleveland Bay

3.2 SOCIAL VALUES

Land areas bounding Cleveland Bay contain tangible archaeological evidence for Aboriginal use and occupation and retain significant Aboriginal cultural heritage values. Traditional Owners have expressed a view that both land and sea country remain as a component of the region's Aboriginal cultural landscape. Two local communities, Gurambilbarra Wulgurukaba and Bindal, claim traditional ownership over Cleveland Bay. Recognition of Aboriginal cultural heritage values of the port area have been discussed through consultation with representatives of the Aboriginal parties. The Port is committed to working closely with the Traditional Owners and specific mitigation measures have been embodied in the Cultural Heritage Management Plan registered with the Department of Aboriginal and Torres Strait Islander Partnerships.

Cleveland Bay plays an important role in the daily social and economic life of the population of Townsville and its surrounding areas and impacts on both Townsville's productivity and livability. The catchments flowing into Cleveland Bay support many different land uses, including grazing on native pastures, residential and associated services, horticulture, aquaculture, waste treatment, industry, mining, Defence and tourism (Healthy Waters Partnership Dry Tropics 2018) . Magnetic Island, particularly, is an internationally acclaimed tourist destination and holiday location for locals. Established in 1864, the Port of Townsville has played a significant role in the development of Townsville and, more broadly, of Northern Queensland. A historic cultural heritage study indicated that there were no listed places of historic European heritage significance in the Port (AECOM 2009).

The area also provides for recreational activities, including bush walking, bird watching, swimming and snorkeling, camping, boating and fishing. The Healthy Waters Partnership Dry Tropics (2018) states the "community has strong and enduring connections to the water and relies on the numerous freshwater and estuarine systems, and Cleveland Bay, for its world-class experiences in fishing, diving, boating and swimming".

3.3 ECONOMIC VALUES

Founded in 1864, the Port of Townsville plays a significant role in the local, regional and State economy. Located close to the city of Townsville, the Port of Townsville handles more than 30 commodities, is the largest exporter in Australia of sugar, copper, lead, zinc and fertiliser; and services around 70% of Northern Australia's population. Other products imported and exported through the Port of Townsville include petroleum and bulk liquids, agricultural products and livestock, containerized cargo, vehicles, and minerals.

The Port is a key part of the supply chains, supporting mineral extraction/processing and agricultural production across north Queensland. In 2024–25, the Port handled almost 7 million tonnes of trade valued at more than $12 billion and helped to support the north Queensland economy. The Port also plays a key role in Defence and tourism by providing a world-class cruise ship terminal and modern berth facilities for the vessels.

Under the *Transport Infrastructure Act 1994*, the authorised functions of the Port are to establish, manage and operate efficient port facilities and services. This legislative responsibility extends to the provision of safe navigational access to marine facilities and infrastructure such as harbours, berths and channels under the Port's jurisdiction.

The Port of Townsville commissioned independent economic consultants, Create Advisory, to assess the economic implications of maintenance dredging and sea placement at the Port. The assessment compared three scenarios:

1. continued maintenance dredging with sea placement at the existing Dredge Material Placement Area (DMPA);
2. no maintenance dredging; and
3. land-based placement of dredged material following construction of new reclamation infrastructure.

The assessment found that ongoing maintenance dredging with sea placement at the existing DMPA:

- maintains safe navigational access;
- supports efficient Port operations;
- avoids additional supply chain costs;
- is the lowest-cost option for maintaining channel depths; and
- supports regional trade and economic activity.

The study found that ceasing maintenance dredging would progressively reduce channel depths, resulting in:

- increased vessel delays;
- use of smaller, less efficient vessels;
- diversion of trade to alternative ports;
- increased road and rail transport requirements; and
- higher supply chain costs for businesses and consumers.

Create Advisory estimated that the economic cost to Port users from ceasing maintenance dredging would exceed $1.045 billion over 20 years. This estimate relates only to the Port's eight largest commodity trades, and the actual costs could be higher.

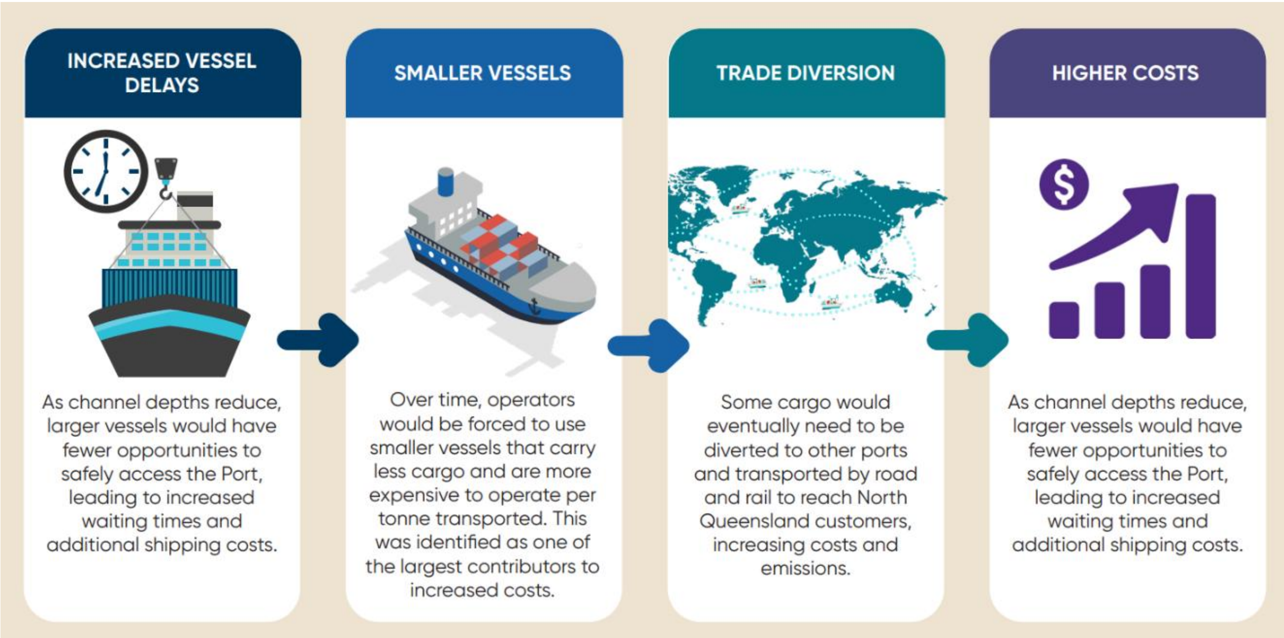


Figure 14. Direct and Indirect Costs of Cessation of Dredging

The study also considered land placement of dredged material as an alternative to sea placement. The assessment found that a land-based solution would:

- require significant new infrastructure;
- cost approximately $325 million to construct;
- take approximately 10 years to plan, approve and deliver;

- still expose the Port to many of the same impacts associated with stopping dredging during the development period; and
- require ongoing higher operating costs than sea placement.

The study found that land placement over the assessment period would still result in approximately $344 million in costs to Port users and $144 million in additional costs to the Port. The study also noted that no specific site for a land-based facility has been identified and no planning, approvals, community consultation or construction activities are currently underway.

The Independent economic assessment concluded:

- continued maintenance dredging with sea placement remains the most effective option for maintaining safe navigational access and supporting efficient Port operations;
- ceasing maintenance dredging could result in more than $1 billion in additional costs to Port users over 20 years;
- land placement would involve substantial costs, significant lead times and would not avoid many of the
- impacts associated with reduced channel depths; and
- the economic impacts would ultimately be borne by businesses, producers, consumers and communities across North Queensland through increased supply chain costs and reduced efficiency.

4 CONSULTATION AND KEY ISSUES

4.1 LONG-TERM MAINTENANCE DREDGING MANAGEMENT REQUIREMENTS AND ASSOCIATED ISSUES

Similar to all north facing bays in the GBR Lagoon, Cleveland Bay has naturally high turbidity levels, due to there being a deposition zone as currents flow past the tip of Cape Cleveland; and from regular and sustained resuspension from wind and wave action. This resuspension of sediments is the primary driver for the requirement for and volumes of routine maintenance dredging.

The key issues for the Port of Townsville are the generation of turbidity and its impacts upon the sensitive receptors found in the bay, including those of Magnetic Island.

Dredging and material placement, has occurred in Cleveland Bay since the Port was first established in 1864. Historically, placement within the bay had occurred near areas of high sensitivity, places like Middle Reef and Cockle Bay, and between Magnetic Island and Cape Pallarenda. These areas are shallow and have high resuspension values given their close proximity to shore. This method is no longer practiced, given its negative impact on the environment. The Port uses one placement area, the DMPA, which sits beyond the 10m contour line to limit resuspension and prevent material from being placed on or near corals and seagrass meadows.

Although Cleveland Bay is a naturally turbid bay, with resuspension occurring on more than a monthly basis throughout the year, many within the community, however, consider this turbidity to be generated by dredging. Dredging at the Port of Townsville occurs generally between a period of four to six weeks. As required, the dredge campaign may be split, depending on the scheduling of the Trailer Suction Hopper Dredge (TSHD) Brisbane and its work along the Queensland coastline, only then the campaigns are between two and three weeks each.

Over many years of sampling, monitoring, and modelling, the Port are confident that turbidity and dredge plumes (including those generated by placement activities) are only ever localised to the vicinity around the dredge, and then only move away to a distance of approximately 800m (from where it was first generated). Jones *et al*. (2020) observed that during maintenance dredging campaigns in Cleveland Bay, the turbidity may increase by 0.6-0.7 times the mean expected values at some of the Magnetic Island bays, but this is between two and five times lower than the effects of natural events caused by wind or waves. This study also included preliminary results of empirical measurements of elevated sediment accumulation rates caused by maintenance dredging using newly re-designed deposition sensors, which indicated that *"(1) high suspended sediment concentrations produced by dredging in a low energy water column is conducive to rapid settling and enhanced deposition and (2) the effects are quite localised*" (Jones *et al*. 2020).

The Port has also worked with the QPA on a study to address Water Quality Action 17 in the Reef 2050 Long Term Sustainability Plan. BMT WBM Pty Ltd prepared a quantitative sediment budget of the entire GBR and regions surrounding GBR ports, which is available on the Port's website. Comparing the relative mass of sediment resuspended naturally to that from maintenance dredging at a port scale shows that maintenance dredging contributes the equivalent of 2.9% of the annual natural resuspension as depicted in Figure 15 (BMT WBM 2018).

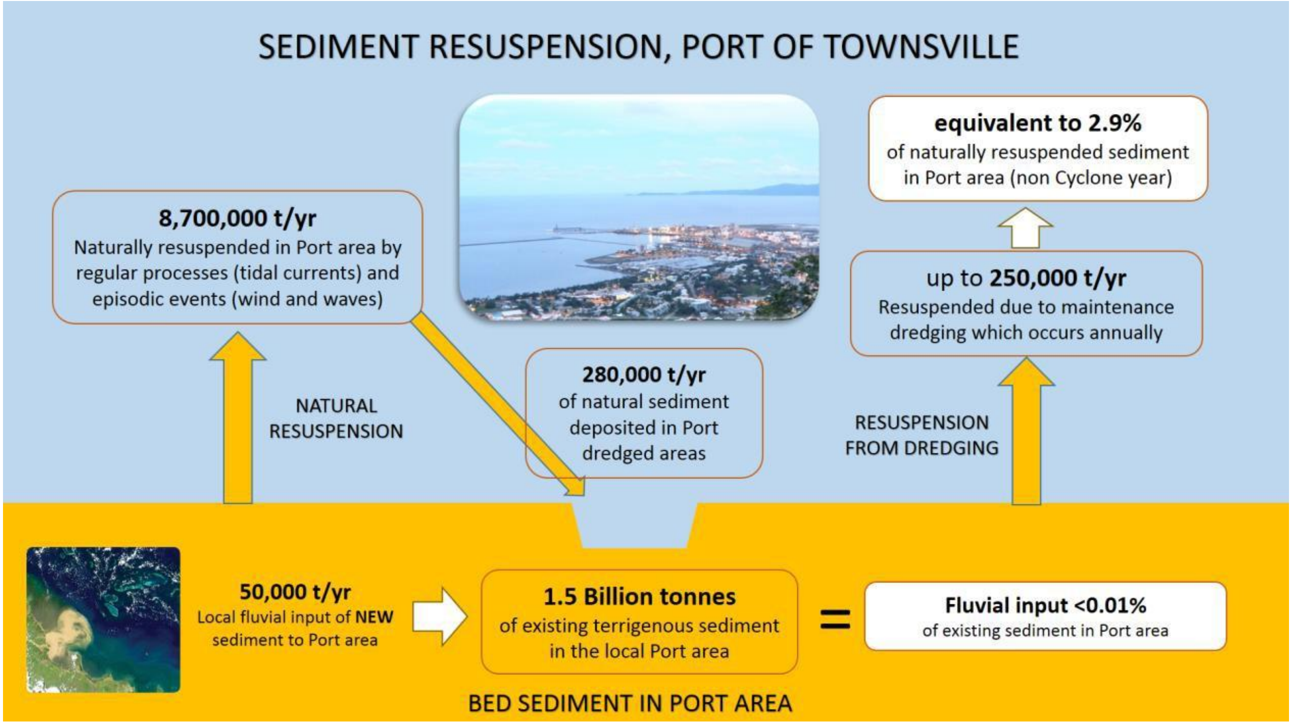


Figure 15: Quantitative Summary of Sediment Resuspension at Port of Townsville (BMT WBM 2018)

Although confidence in both the monitoring and modelling is high, the Port continues to undertake near real-time water quality monitoring of turbidity throughout the year, which includes during dredging and placement activities. This data is available on the Port's website: https://www.townsville-port.com.au/environment/monitoring/monitoring-in-cleveland-bay/.

4.2 STAKEHOLDER ENGAGEMENT -

The Port of Townsville recognises that maintenance dredging is a matter of strong interest to government, regulators, industry, community members and other stakeholders. Open and ongoing engagement is an important part of the Long-term Maintenance Dredging Management plan. .

How stakeholders have been engaged

Stakeholder engagement for this Long Term Maintenance Dredging Management Plan has occurred through a combination of formal consultation processes and ongoing engagement forums.

The Port engages regularly with stakeholders through established forums, including:

- the Technical Advisory and Consultative Committee (TACC);
- the Community Liaison Group (CLG);
- the Port Planning and Environment Working Group (PEWG);
- Port Advisory Body (PAB); and
- other government, industry and community engagement channels.

These forums provide opportunities for information sharing, discussion of community and environmental issues, and feedback on Port operations, including dredging activities.

When the LTMDMP was first developed in 2019, the Port undertook a public review process. Stakeholders were invited to read the draft Plan and provide written submissions. This process resulted in 11 submissions, containing a total of 129 individual comments.

In response to the public submissions received in 2019, the Port developed a Gap Analysis Action List. This list identified the key themes raised by stakeholders and committed to specific actions to address them. The action list was published on the Port's website to ensure transparency.

Actions taken in response to stakeholder feedback have included:

- investigating alternative dredge material placement area options;
- expanding the Plan to include social values and community considerations;
- improving explanations of sediment characteristics and dredging impacts; and
- formally documenting how stakeholders will continue to be engaged during future reviews of the Plan.

These actions have been progressively incorporated into subsequent versions of the LTMDMP and through the formal five-year review process completed in 2025. All actions identified in the original gap analysis have now been addressed and closed.

Consultation on this draft LTMDMP 2027-2037

This draft LTMDMP for the period 2027-2037 has been prepared to support the 10-year sea dumping permit application and associated consultation activities. This draft plan has been developed based on the previous LTMDMP 2019-2029 and updated to include recent studies and monitoring information. The draft plan is available during the formal consultation period for review and comments by stakeholders.
Following feedback from the consultation process, the 2027-2037 LTMDMP will be finalised and supplied as part of the supporting information to the 10-year sea dumping permit application.

Ongoing engagement and transparency

Stakeholder engagement does not end with the approval of this Plan by regulators. The Port is committed to ongoing, two-way engagement throughout the life of the LTMDMP. This includes:

- continuing discussions through established stakeholder forums;
- providing updates on dredging activity, monitoring results and research outcomes; and
- seeking feedback during formal review periods and when significant changes are proposed.

Through this approach, the Port aims to ensure that stakeholders are well informed, concerns are heard and considered, and dredging activities continue to be managed in a responsible, transparent and environmentally sound manner.

4.3 ACCESSIBILITY TO THE COMMUNITY OF REPORTS AND INFORMATION

The Port of Townsville website has a page dedicated to long-term maintenance dredging in order to host all the associated documents that accompany the LTMDMP. This page will remain operational for the duration of the Plan, being updated with relevant reviews; ensuring access and currency of reports and data. This webpage can be found on the Port of Townsville website: https://www.townsville-port.com.au/environment/dredging-management/.

Information about the Port of Townsville and other Queensland Ports annual maintenance dredging can be found on the DTMR website: Dredging (Department of Transport and Main Roads), which provides information on past maintenance dredging campaigns and the upcoming schedule for maintenance dredging campaigns for all GBR WHA Ports.

5 PORT SEDIMENT CHARACTERISTICS

5.1 PORT SEDIMENT

5.1.1 COASTAL PROCESSES AND SEDIMENT BEHAVIOUR

Cleveland Bay is a relatively low energy wave environment as it is sheltered from the predominant south-east waves by Cape Cleveland. Accumulated sediments make the bay relatively shallow, deepening to only 10 to 11m (below chart datum) along its northern aspect, and averages 2-6m across the bay. The coastline continues to be shaped by the prevailing waves at a slower rate, determined by the generally low energy waves and punctuated by the occasional higher energy cyclone waves that are able to penetrate across the bay onto the shoreline. The Healthy Waters Partnership for the Dry Tropics have created a story map that showcases the different hydrology and hydrodynamic processes within Cleveland Bay: https://storymaps.arcgis.com/stories/40fb1343dd8f4a8f9edc3b51e2346943.

South-easterly trade winds dominate the North Queensland coastline particularly in the dry season and are the driving force for waves within Cleveland Bay. Water motion within Cleveland Bay is dominated by the effects of refracted south-easterly generated waves (mostly 0.5-1.2m high, 4-6s period) and by semi-diurnal tidal currents, which reach speeds of 15-30cm/s during spring tides. A combination of the natural swell and wind-driven waves is capable of resuspending bed sediments and producing high turbidity conditions in Cleveland Bay. Wave-induced bed stress is the most significant long-term contributor to sediment resuspension and elevated suspended sediment concentrations within the water column.

North moving long-shore drift also adds to both the volume of sediments in the bay and the volume of sediments being suspended in the water column. Long-shore drift is created by tidal, wind-driven, and three-dimensional currents, which move sediments parallel to the shoreline, moving and resuspending sediment as the currents move north along the inner shelf and coastline. The establishment of the shipping channels (as opposed to on-going dredging and placement) has had the greatest effect on overall turbidity patterns in the Bay; reducing pre-development levels of turbidity in nearshore areas to the west of the Platypus Channel (as a result of the channels catching fine sediment that normally would re-suspend and travel from east to west across the Bay) (BMT WBM 2020).

Within the GBR inner-shelf region natural resuspension of sediment deposits by tidal currents and episodic wave events is the primary contributor to sediment suspended into the water column and it has been estimated that approximately 160 million tonnes of existing bed sediment are naturally resuspended per annum in this region. Low magnitude resuspension occurs regularly due to tidal currents and typical wind/wave conditions, while higher magnitude resuspension occurs episodically due to spring tide and/or high energy wind/wave events (on average 25 events per year lasting for 3 to 4 days though not simultaneous across the entire GBR) (BMT WBM 2018).

The derived GBR inner-shelf natural resuspension quantity is approximately 17-times higher than the input of new sediment from the catchment into the GBR. These natural resuspension processes are also the primary mechanism for sedimentation of port infrastructure. Due to their orientation, the port navigation channels intersect the natural inner- shelf longshore sediment transport pathways. Because they are deeper and calmer than the surrounding seabed and are less exposed to wave and current energy, sediment is more likely to settle and less likely to resuspend in the dredged channels than in adjacent areas of the seabed meaning that the sediment requires removal by maintenance dredging to ensure the dredged areas remain navigable. However, the quantities settling in port facilities and requiring maintenance dredging constitute less than 3% of the sediment being resuspended by currents and waves at a port scale (BMT WBM 2018).

5.1.2 BATHYMETRY

The seabed of Cleveland Bay, to the offshore boundary that encompasses Magnetic Island, is approximately 325km^2. Water depths in most of the bay are generally <10m with a large section (closer to shore) <4m (Figures 17 and 18). Port infrastructure is deeper with the Inner and Outer Harbour, Platypus and Sea Channels all dredged and maintained to varying depths, greater than 10m.

The Port employs an inhouse hydrographic surveyor who is responsible for completing surveys of the Ports underwater infrastructure required to be maintained for navigational safety. This includes the Platypus and Sea channels, Outer Harbour, Inner Harbour, Ross River and Ross Creek. Surveying occurs quarterly to monitor sedimentation in these areas and assist with planning maintenance dredging activities. The hydrographic surveyor also surveys the DMPA before and after a maintenance dredging campaign when placement at sea has occurred. Surveys are also conducted prior to a dredging campaign and immediately following a campaign. These surveys are used to provide information about channel depth for vessel movement and total sediment removed following a campaign.

The hydrographic surveyor is also responsible for surveying the Ports infrastructure following an extreme weather event (e.g cyclone or flood) to determine if excess sediment has been deposited into the port's underwater infrastructure. This information is required to determine if additional sediment is required to be dredged to re-establish safe navigation for arriving vessels after extreme weather events (see section 5.3.1 and 5.3.2 for more information about contingency dredge volumes and planning).

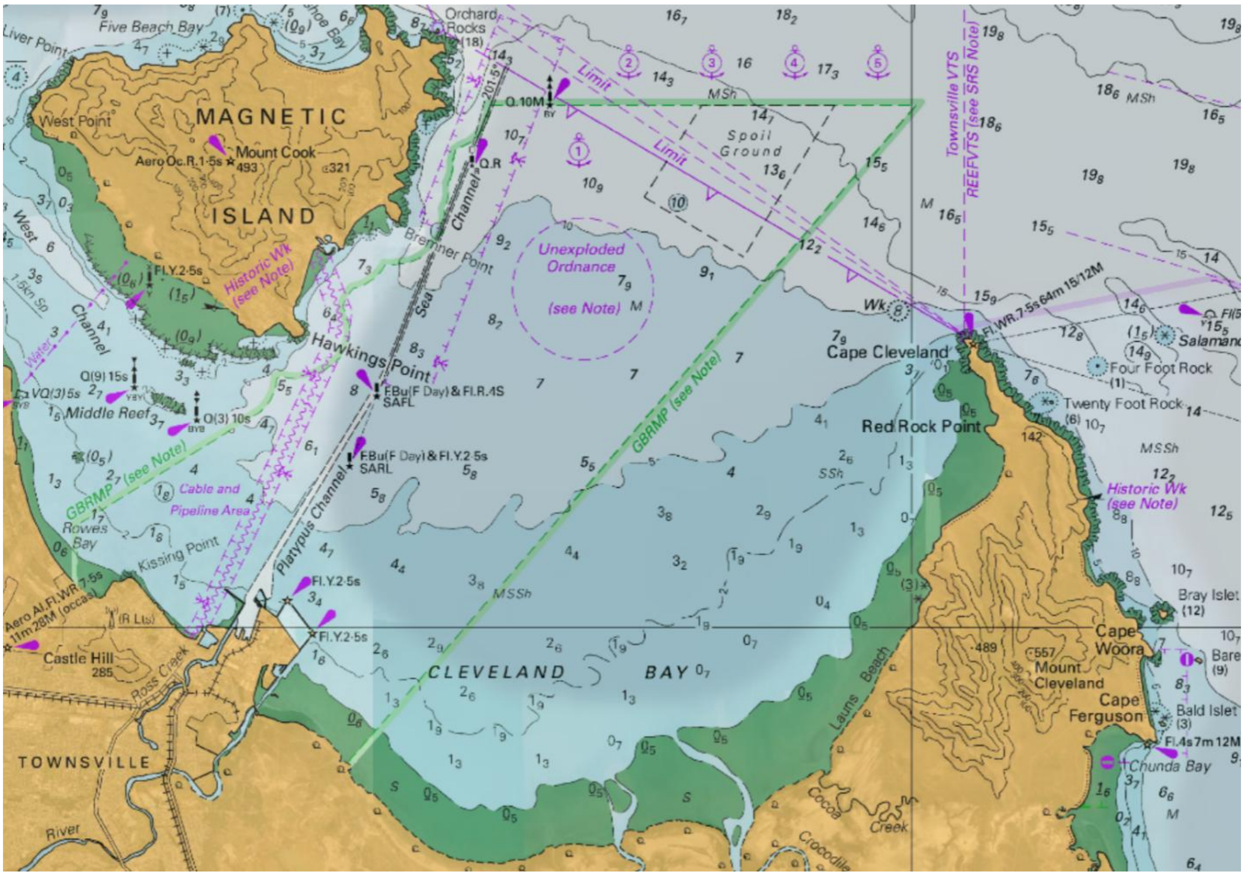


Figure 17. Bathymetry Chart of Cleveland Bay Aus 827 (2004)

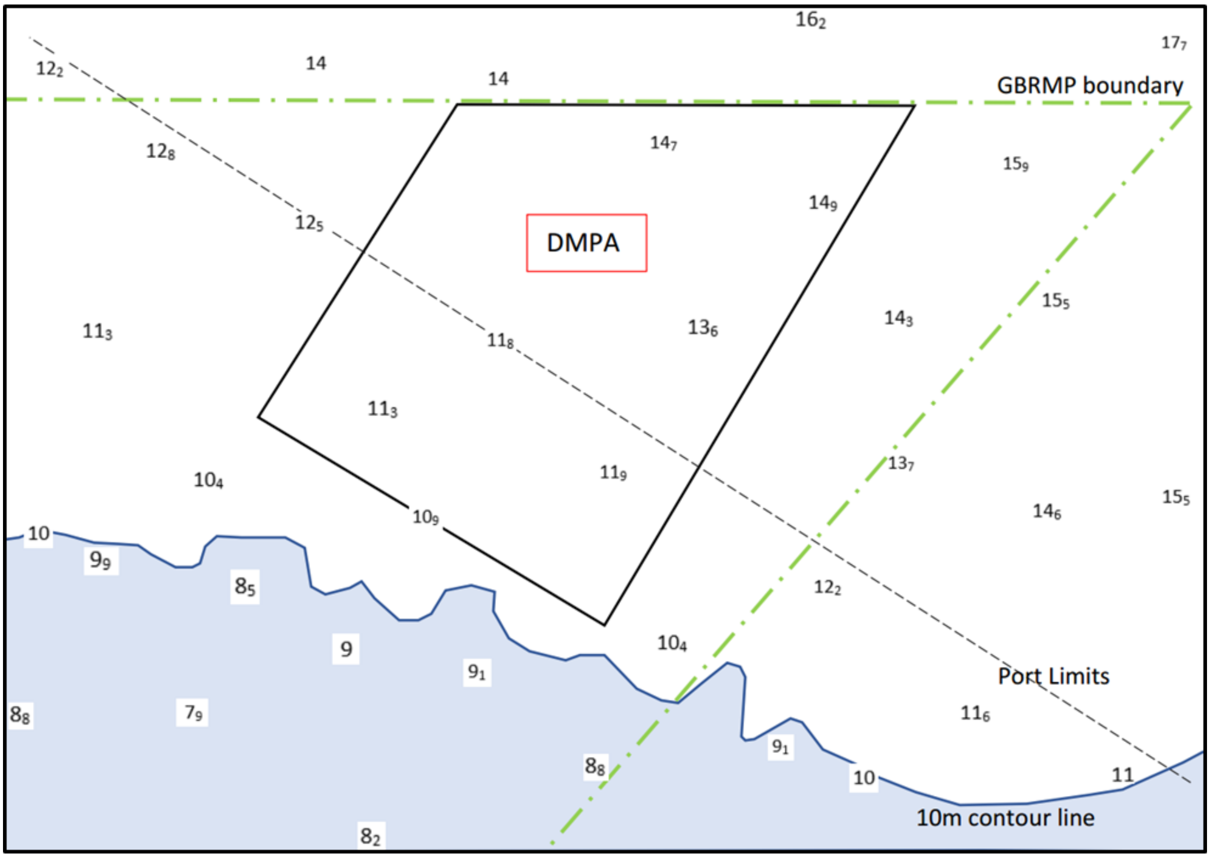


Figure 18: Bathymetry of the Maintenance Dredge Material Placement Area. Redrawn from Chart AUS 256 (27 June 2003).

5.1.3 SEABED SEDIMENT

The geology of the Townsville Region comprises Quaternary aged alluvium and colluvium sediments underlain by Late-Palaeozoic age granite. Sediments generally in Cleveland Bay are characterised as "slightly gravelly, muddy sand" and have a high content of fine fraction (silts and clay) material (Cruz Motta 2000). The soft, surface sediments are variable and are thought to arise from tidal and seasonal movement of the seabed sediments.

Golder Associates in 2008, undertook one study to define the sediments. The following broad material types were identified in the Outer Harbour basin and in the Platypus and Sea Channels:

- A surface layer of recent seabed sediments consisting of a mixture of very soft to soft silty clay to clayey silt with very loose and loose sand to silty sand to clayey sand. Shell fragments and organic materials commonly occur in this layer. The seabed sediments are easily identified by their dark hue and very soft and very loose nature. Preliminary investigations indicate that some of the surface materials are potential acid sulphate soils (PASS) and, due to their soft and compressible nature, are generally unsuitable for use as reclamation fill or as the foundation material for structures.
- A subsurface layer of geologically older stiff to hard clays and sandy clays and medium dense to very dense clayey sands and sands. These materials are much lighter in colour than the seabed sediments. The subsurface material was not identified as PASS and is considered suitable, although not ideal, as reclamation fill.

The surface layer has a thickness of approximately 1m to 1.5m in the Outer Harbour basin. A lesser thickness of the surface layer, typically in the order of 0.5m to 1m occurs in the Platypus and Sea Channels.

Every five years the Port undertakes a Sediment sampling and analysis plan (SAP) to characterise the sediments in maintenance dredging areas. This work is undertaken as per the NAGD (2009) to determine areas which can be approved for sea placement (in the Port's approved Dredge Material Placement Area (DMPA)). This recent work was undertaken in late 2021 by Hydrobiology on behalf of the port and found:

- The DMPA was sandy to sandy mud.
- The Platypus Channel contained predominately mud overlaying clay.
- The Sea Channel was predominately dense/hard clay.
- The Outer Harbour and Inner Harbour was predominately muds and overlaying hard clay.
- Ross River was coarse sand in the up-river sections to mud and sandy muds near the river mouth.
- Townsville Marine Precinct was predominantly muds overlaying hard clay; and
- Ross Creek was predominately sandy mud in the up-creek section to muds near the creek mouth.

The Port also undertakes twice-yearly sediment grab sampling to support the findings of the SAP.

5.1.4 DREDGE MATERIAL PLACEMENT AREA (DMPA)

In 2025 and in 2020/2021, the Port engaged GHD Pty Ltd to conduct a benthic study for the DMPA to determine the recovery of benthic community (discussed in section 3.1.2) and the sediment characteristics of the DMPA. Particle size distribution (PSD) was assessed across the DMPA and the surrounding vicinity before and after dredging activities.

The DMPA was dominated by sand and silt, however the sediment composition was different across the DMPA. Sites in the northern section of the DMPA had a higher fraction of silts and clays compared to southern section of the DMPA had a higher concentration of sand. Post placement of maintenance dredge materials in 2025, a higher concentration of silts was observed, likely attributable to the recent placement of dredged material. The sediment composition at sites surrounding the DMPA remained relatively stable with no significant changes. Figure 19 and Figure 20 demonstrate the analysed PSD pre and five weeks post the 2025 dredging campaign (including placement).

Based on the data collected from these studies, GHD determined that the changes in sediment composition within the DMPA for maintenance dredging does not result in a long-term effect on the sediment composition of the DMPA and surrounds.

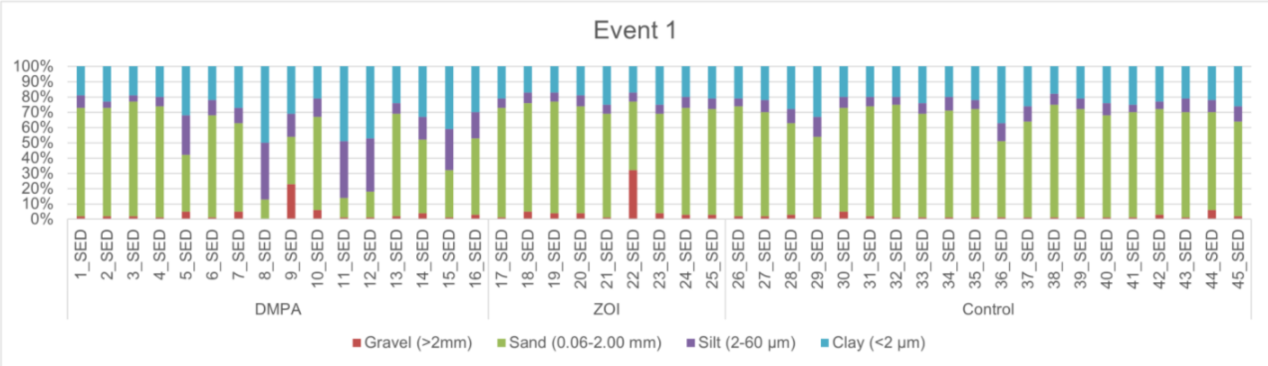


Figure 19. Pre Dredging and Placement (2025 Campaign) Particle Size Distribution for all sampled sites (GHD, 2026)

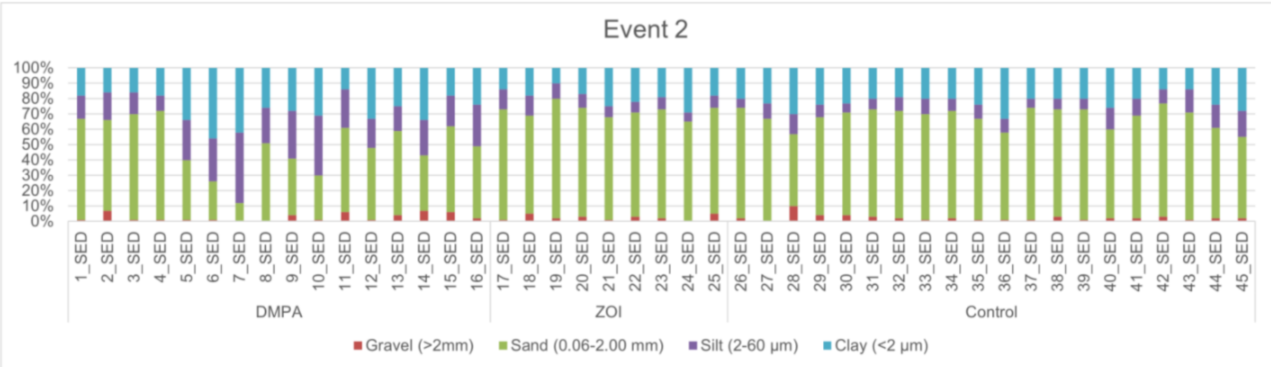


Figure 20. Five Weeks Post Dredging and Placement (2025 Campaign) Particle Size Distribution for all sampled sites (GHD, 2026)

5.1.5 SEDIMENT SOURCES

Cleveland Bay is located about 50km north of the Burdekin River, about halfway between the Burdekin and Herbert Rivers which provide the dominant sediment supply to the central GBR coast (Belperio 1983; Moss *et al.* 1993). At the coast, bedload sediment (predominantly sand) from these rivers and from the much smaller Haughton and Ross Rivers, moves northwards along the shoreline by long-shore drift processes. During summer floods, suspended loads of mud and fine sand are transported directly onto the inner shelf, where they either accumulate or are adverted back into the tidal mangrove systems which fringe the coastal plain (Belperio 1978 and 1983; Larcombe and Ridd 1994; Larcombe *et al.* 1995). Fabricius *et al.* (2014) demonstrated that river discharges significantly affect marine water clarity in shallow bays of the central GBR region at intra- and inter-annual time scales and that fine river-derived sediments remain available for resuspension for years after floods.

The Cleveland Bay catchment incorporates an area of 1,770km^2 and there are several significant watercourses (Table 6) discharging storm and surface water into Cleveland Bay and supplying some sediment to the beach system and further offshore during floods. The main watercourses, all of which influence Cleveland Bay locally, include:

- Ross River;
- Ross Creek;
- Three Mile Creek;
- Captains Creek;
- Sandfly Creek;

- Alligator Creek;
- Crocodile Creek; and
- Cocoa Creek.

Table 6: Drains and Creeks Discharging to Cleveland Bay (Townsville City Council Stormwater GIS Layer)

Cleveland Bay Section	Creeks	Drains
Rowes Bay / Pallarenda	2	12
The Strand	0	12
East of Port to Cape Cleveland	12	-
Ross River / Ross Creek	-	131
Magnetic Island	9	12

The Ross River discharges fine sediment next to the Port and the natural sediment transport processes in Cleveland Bay do allow some of this sediment supply to be transported around the Port and deposited in the Platypus Channel. However, sediment trapping by Ross River dam and other weirs, as well as the relatively small catchment size, limits the significance of this load when compared to the overall nearshore sediment transport which is supplied regionally by Burdekin River (BMT WBM 2018).

5.1.6 NATURAL SAND SUPPLY

Much of the land in the Cleveland Bay catchment has been cleared or modified of its remnant vegetation (GBRMPA 2014). The sediment yield of Ross River has been estimated at 330,000t/y (Belperio 1983), but this amount fluctuates depending upon climatic conditions and input sources. Changes in catchment drainage due to urbanisation and agriculture may lead to an increase in runoff, and in some cases soil erosion (Pringle 1989). It is noted that Ross River is heavily modified, which impacts the amount of material that is discharged into Cleveland Bay. Persson (1997) assessed anthropogenic activities disrupting the natural hydrodynamics and transport of coarse sediments and the related effect on channel morphology and sediment supply to Cleveland Bay. This study found that the Ross River Dam and three downstream weirs have reduced the delivery of coarse sediments to the coast, but the outcome for finer sediments is different, these smaller, more mobile sediments are kept within the suspension zone and pass over the weirs.

The Strand Beach is a manmade beach which can be considered as a "pocket" beach, except that it has an inadequate volume of sand within the headlands to maintain a beach along the full length of its foreshore. The existing alignment of Rowes Bay is in general far from a state of equilibrium, with respect to zero net movements of sand along the beach. In order for these beaches to remain in equilibrium and not undergo long-term erosion, Townsville City Council (TCC) undertakes an ongoing beach monitoring, and sand re-nourishment project to assist in the rehabilitation of beaches along Rowes Bay and Pallarenda.

5.1.7 CHEMICAL COMPOSITION

The sediment chemical composition is variable within Cleveland Bay. Calcium carbonate-rich sediments occur in the western section of the bay close to coral reef colonies formed on the fringes of Magnetic Island and Middle Reef, while the central section of the bay is characterised by terrigenous, muddy sand. Sources of terrigenous sediment to the bay include discharges of sediments from local creeks and rivers, as well as sediment inputs from the east coast long-shore drift (e.g. the Burdekin River) from the eastern section of the bay.

Coastal sediments are generally uncontaminated even with the strong industrial and coastal history of Townsville. Some locations may contain detectable hot spots, albeit below published guideline limits under the NAGD 2009. Due to the nature of the soft sediments, there is potential for acid sulphate soils (ASS) if oxidised. Results from the Port's long-term marine sediment monitoring indicate that the more industrialised areas of Ross Creek, the Port, and Ross River show higher levels of contaminants than the surrounding bay, with Ross Creek, in particular, being an upstream diffuse source of contaminants (Port 2014).

5.1.8 SOURCES OF CONTAMINANTS TO WATER AND SEDIMENT

Water quality in the bay is the result of a number of factors, particular the source of incoming waters, which include: the chemical and physical characteristics of historic contamination of water bodies, stormwater discharge and runoff from the wider catchment, groundwater impacts, as well as product handling operations and accidental spillage (both at the Port of Townsville, and from urban and industry inputs upstream of the bay). Townsville is a long-established township with a history of urbanisation and industrial activities in the Ross River and Ross Creek drainage systems.

Contaminants liberated by industrial activities may be transported by stormwater to the end of the catchment, port areas and Cleveland Bay, particularly during the wet season. Areas of potential contaminants in Townsville include refineries, manufacturing and repair facilities, old rail sidings, industrial areas, and urban inputs (including roads). Multiple industrial sites are licensed to discharge waste streams into Cleveland Bay east of Ross River (refineries, sewage treatment plant, meatworks etc.), and several landfills (both operating and rehabilitated) are also present in the Ross River catchment.

All material required to be removed as part of maintenance dredging is tested in accordance with the NAGD 2009. This document is a federal document that is also utilised by State regulators. Material approved for sea placement is placed in an approved DMPA as depicted in Figure 9; other material that cannot be placed at sea is placed on land (Figure 10).

5.1.9 HISTORY OF DREDGING AND PLACEMENT ACTIVITIES FOR THE PORT OF TOWNSVILLE

The Port of Townsville was established in 1864 for the purpose of development of pastoral properties in the North Queensland region. Ross Creek was chosen for the Ports location, however a sand bar at the mouth of Ross Creek and a rock bar inside allowed only shallow draught vessels to enter.

Between 1867 to 1868, the number of vessels entering Cleveland Bay doubled with the opening of Cape River Goldfield. By the late 1880's a new jetty and western breakwater were constructed to protect and prevent sand from moving into Ross Creek and provide a suitable harbour for vessels.

Dredging was first proposed in 1878 for the purpose of deepening the waters around the jetty, however dredging did not occur until 1883 with the construction of the Platypus channel. Capital and maintenance dredging continued from 1883 to dredge new underwater structures and maintain channel and berth depths. Much of this material was used as reclamation to expand Port lands (Figure 21), while some material was placed at sea. The Port continues to use capital dredge material for reclamation of port lands.

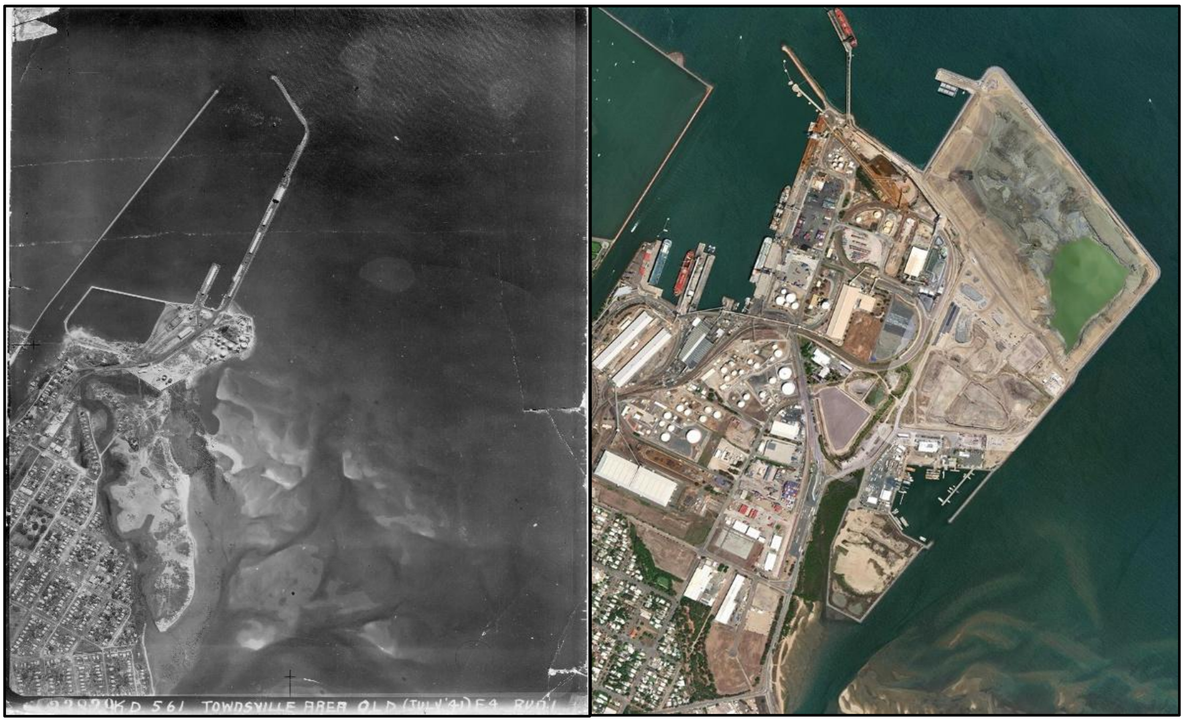


Figure 21: Aerial Photos Showing the Extent of Land Reclamation Activities from 1941 (Left) to 2024 (Right) Using Dredged Material.

In the 1960's, managed sea placement of dredge material (both capital and maintenance) began with the creation of the first DMPA Area (Figure 22; area 1). In the 1970's a deeper sea placement area was designated to improve retention rates of sediment placed (Figure 22; area 2) and was used until the early 1990's.

The DMPA was moved again following an assessment into the sediment retention rates of the current DMPA with the commencement of a capital dredging program. This assessment was a joint effort by the Port of Townsville (then the Townsville Port Authority), James Cook University, GBRMPA, Australian Institute of Marine Science (AIMS) and the Federal Government. It was concluded that by moving the DMPA into deeper waters, past the 11m contour line, the chance of long-term resuspension can be largely eliminated as wave induced resuspension is greatly reduced at depths below 10m (Townsville Port Authority, 1994). In 1992 the DMPA was moved to its new location (Figure 22; area 3).

This area remains the current DMPA for dredge material sea placement. The position of the DMPA also limits interference with shipping, commercial and recreational activities, and is clear of benthic sensitive receptors such as seagrass and coral.

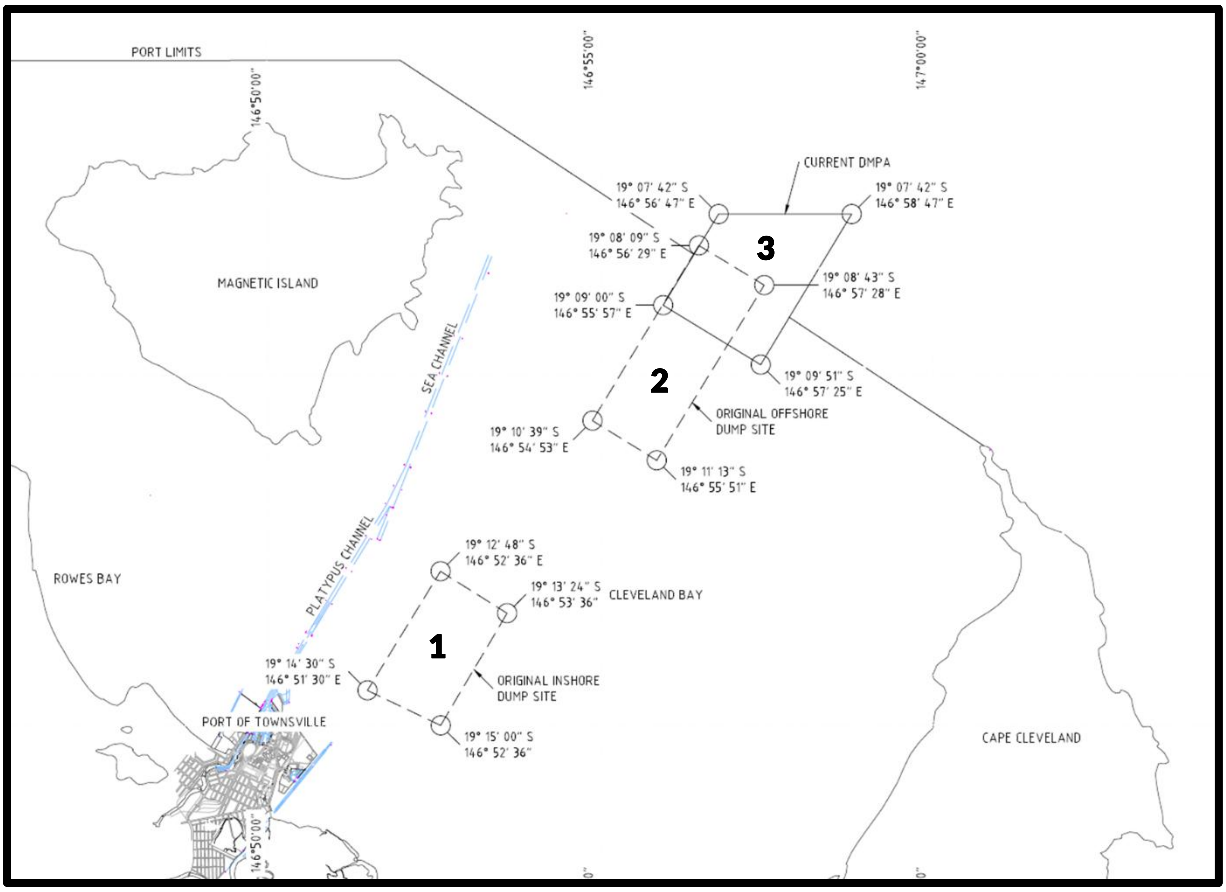


Figure 22: Historic Designated Sea Placement Areas Between 1960 to Current Day

In late 2025 and early 2026, the Port completed hydrographic surveys of the historic placement areas (areas 1 and 2) to determine if there had been a long-term change to the bathymetry of these areas following historic placement activities. Results from the survey showed that there is no difference in bathymetry within these areas when compared to the surrounding bathymetry of Cleveland Bay.

5.1.10 VOLUMES AND CHANGES IN QUALITY (OVER TIME)

Table 7 shows the list of dredging approvals granted to the Port since 1988 (including capital and maintenance dredging). The material quality has not changed, only material that has been fully assessed against the NAGD 2009 and approved for sea placement via the SAP from the National EPA and the Queensland Government is placed at sea.

Table 8 shows historic maintenance dredge volumes.

Table 7: Commonwealth Dredging Approvals Since 1988, for both Maintenance and Capital Dredging.

Permit number		Volume approved for Sea Placement (cubic metres)	Type	Duration
Variation 3 Variation 2 Variation 1 SD2018/3942	06/30/2025 30/09/2024 24/03/2022 23/05/2019	Variation 3 was a 12 month extension to the permit to 30 May 2026 Variation 2 to include the widened channel footprint created as part of the CU	Maintenance	6 years

Permit number	Volume approved for Sea Placement (cubic metres)	Type	Duration
	project. No change to permit volume Variation 1 to update SAP IR Results 3,700,000m^3 (plus 350,000m^3 cyclone contingency)		
Extension 03/04/2018 SD2016/3322 09/08/2016	Addition of 150,000m^3 1,075,000m^3	Maintenance	12 months 20 months
SD2015/2982 03/08/2015	600,000m^3 (plus 100,00m^3 cyclone contingency)	Maintenance	1 year
SD2012/2223 05/09/2014	600,000m^3 (plus 100,00m^3 cyclone contingency)	Maintenance	1 year
SD2011/1944 30/11/2011	1,303,000m^3	Capital Berth 12	5 years
SD2011/2042 29/09/2011	548,000m^3	Capital Navigational Channels	5 years
SD2011/1943 14/06/2011	96,000m^3	Capital Berths 8 and 10	5 years
3rd Extension 28/03/2013 2nd Extension 19/12/2012 1st Extension 28/09/2012 SD2007/0602 09/10/2007	2,750,000m^3	Maintenance	3 months 4 months 1 month 5 years
12/12/2002	236,380m^3	Maintenance Inner Harbour Only	1 year
2nd Extension 19/10/2006 1st Extension 17/02/2006 23/02/2001	3,500,000m^3	Maintenance	1 month 8 months 5 years
12/04/1999	118,000m^3	Maintenance Ross River, Outer Harbour, Berth 11	1 year
Extension 30/05/1997 31/05/2000	500,000m3 annually	Maintenance	3 months 3 years
31/05/1996	500,000m^3	Maintenance	1 year
24/02/1995	500,000m^3	Maintenance	1 year
21/10/1992	940,000m^3	Capital & Maintenance	1 year
30/04/1990	450,000 tonnes	Maintenance	1 year
31/05/1988	350,000 tonnes & 53,000 tonnes annually	Maintenance	1 year & 3 years

Table 8: Historic Dredging Volumes

Year	Historic Volume (m^3)
2007	117,454
2008	338,050
2009	612,284
2010	55,300
2011	809,135
2012	424,950
2013	369,684
2014	516,060
2015	700,000
2016	353,925
2017	487,750
2018	378,395
2019	999,382
2020	501,016
2021	269,236
2022	398,050
2023	333,499
2024	448,454
2025	348, 839

5.2 MINIMISATION OF SEDIMENT ACCUMULATION AND DREDGING NEEDS

Cleveland Bay is 25km wide between the tips of Cape Cleveland and Cape Pallarenda, and 22km long, between the tip of Magnetic Island and land just east of the Ross River (furthest point of land from the outer edge of the bay). The Port maintains two channels for safe navigation of vessels entering and exiting the Port. These two channels are 14km in total length (the Platypus Channel joins the Sea Channel) and are positioned to maximise the use of deep water, this path is the shortest path to deeper water at the edge of the bay.

Sediments that enter the bay, either move in from the south via long-shore drift or are naturally resuspended by the environmental conditions of the bay. A number of studies have been undertaken in regard to reducing the sediment build-up in the channels, as well as in the Outer and Inner Harbours, including for the PEP EIS. The PEP Harbour design was based on both engineering and environmental requirements, including maintenance dredging.

Maintenance dredging relocates sediments which has settled in port infrastructure to the DMPA, which is also situated within the active coastal sedimentary system. This maintains ongoing transport of sediment along natural sediment pathways, with maintenance dredge material gradually re-assimilating into the ambient coastal system from which it originated (BMT WBM 2018).

Minimising sediment from building up within the two channels could only effectively be achieved by installing a permanent sediment barrier, similar to a rock breakwater wall. This would need to run from the Outer Harbour out to beyond port limits; which is not a feasible outcome environmentally, operationally or economically. Port of Townsville has a narrow approach channel and PEP has a tapered channel to minimise dredge volumes.

The Port has investigated a number of Dynamic Under Keel Clearance Systems (DUKC) similar to that currently used at the Port of Brisbane. The DUKC system is a real-time aid to navigation program that aims to provide up to date channel depths, maximum drafts and tidal windows and can result in a reduction in maintenance dredging.

The port has been utilising silt trenches and bed leveling to help reduce sedimentation high spots.

5.3 MAINTENANCE DREDGING AND PLACEMENT REQUIREMENTS

For the period of this Long Term Maintenance Dredging Management Plan 2027-2037,it is estimated that in the order of a total of 5,650,000m^3 of material will be dredged. This volume is the maximum estimates currently forecast and is dependent on climatic conditions, infrastructure priorities of each year as well as the dredge availability and scheduling.

The Port typically undertakes approximately 450,000 m^3 of maintenance dredging each year. To ensure the permit application provides sufficient capacity for years with higher sediment deposition, including Ross River dredging and maintenance dredging associated with the widened shipping channel, the assessment was based on an upper annual dredging volume of 565,000 m^3. Over the 10-year permit period (2027–2037), this equates to 5,650,000 m^3 of maintenance dredging material. A further 350,000 m^3 contingency allowance is included to provide for additional dredging that may be required following extreme weather events such as cyclones or major floods. The total permit volume sought is therefore 6,000,000 m^3, with any contingency volume only to be used where necessary to restore safe navigation within the Port's channels, berths and harbour areas.

The predicted volumes also account for the sand removed from the Ross River Channel. Although this material meets the NAGD 2009, this material has traditionally been brought to land (used in some TMP reclamation), as land for onshore placement has become restricted, this material may require sea placement.

The permit application is based on an upper annual dredging volume rather than the average annual dredging requirement. This approach ensures the permit can accommodate variation in future sedimentation rates over the 10-year permit period without requiring additional permit amendments.

The proposed volume of dredge material to be placed at the Cleveland Bay DMPA as part of the Port's 10-year permit application for the period 2027-2037 is outlined in Table 9.

Table 9. Summary of Volumes for Dredging and Placement under new 10-year permit (2027-2037)

Purpose	Volume (in-situ cubic metres)
Upper annual maintenance dredging volume based on modelling#	565,000 m^3
Contingency volume for extreme weather events*	350,000 m^3
Total requirement for 10-year permit 2027-2037 (including contingency)	6,000,000 m^3

includes Ross River dredging and maintenance dredging associated with the widened channel from the Channel Upgrade project.
* to be used only if required following significant sedimentation events such as cyclones or floods during the permit period.

5.3.1 CONTINGENCIES

Due to its location in the tropics and the unpredictable nature of extreme weather events, the Port of Townsville also requires a contingency volume to enable reestablishment and safe operation of port infrastructure, after a cyclone or extreme weather event has passed through/near the region. Cyclones and flooding can have either a direct or indirect impact on sediment volumes within Cleveland Bay.

Cyclones that have a direct impact on the bay do so through storm surge, wind, increased wave energy and rain; as experienced by Tropical Cyclone Yasi in 2011. Tropical Cyclone Yasi crossed the Queensland coastline at Mission Beach as a severe Category 5 cyclone; despite the distance to the eye, Cleveland Bay was still heavily impacted by the cyclone – given the size of the storm. The wind and rain generated by this cyclone increased the sediment volume in the bay within days. Tropical Cyclone Yasi added 350,000m^3 back into port infrastructure, primarily the channels and around the Outer Harbour.

Cyclones that indirectly impact the bay are those that impact an area of the coastline south of Cleveland Bay generating an increase in the long-shore drift volumes. The extreme weather events in 2011 increased the sediment load of the long-shore drift, with increased volumes reaching the bay two years after. Additionally, large flooding events also increase the amount of sedimentation depositing in Port infrastructure due to increased riverine outflow depositing more sediment into the Bay, with recent flooding events doubling the amount of sedimentation entering Port infrastructure compared to a non-event year. Careful planning of the potential effects of natural events such as cyclones and floods including predicted climate change risks are a key consideration in port planning, design and operations.

As the intensity of tropical cyclones and other extreme weather events are predicted to increase over the coming years, the Port is allowing for at least one Tropical Cyclone or flood to directly impact port infrastructure over the coming 10 years. The predicted annual volume does not account for an extreme weather event or cyclone contingency, as these are unpredictable, and could occur on any year. Adding any contingency volumes to the predicted volume would only artificially inflate the total volume. Therefore, a 350,000m^3 extreme weather event contingency volume will sit outside of the stated maintenance dredging volume, to only be used in the event of a cyclone or extreme weather event impacting upon port infrastructure, in areas approved at the time, for unconfined sea placement.

5.3.2 CONTINGENCY PLANNING

Following an extreme weather event that has the potential to remobilise large volumes of sediment in Cleveland Bay, the Port undertakes bathymetric surveys to assess the depths of each area of port infrastructure. These surveys will determine the impact the event has had and the volume of material (if required) to be removed to reinstate declared depths back to be the pre-event declaration. Previous experience with sediment mobilised by strong winds and waves generated by extreme weather events (e.g. cyclones and floods), indicates that the most material infilling of maintenance dredge areas will occur in the Outer Harbour and the Platypus Channel; as well as the Ross River Channel if major flooding occurs.

On the basis of these surveys and in consultation with the Regional Harbour Master, the Port may be required to undertake emergency maintenance dredging to allow vessels access back into various areas of port infrastructure. The Port has included a contingency volume (350,000m^3) into this Plan, for the purposes of emergency dredging and sea placement activities, which may be required following an extreme weather event (cyclone or flood event). This volume is based on the approximate volume of material deposited in the Outer Harbour and navigational channels during previous severe weather events.

To meet legal obligations under State legislation (*Transport Infrastructure Act 1994*), the Port requires certainty that it can rapidly resume effective operations of the Port after being impacted by an extreme weather event. To do this, the Port also needs to ensure sediment quality is suitable for sea placement. The potential for contaminants at concentrations exceeding the NAGD 2009 to accumulate in maintenance dredge areas, (that are currently approved for unconfined sea placement) during an extreme weather event is considered low, as:

- Potential contaminant sources (including current DETSI licensed discharges, DETSI listed contaminated lands) are minor for Cleveland Bay compared to the amount of material being remobilised during a major cyclonic/weather event.
- The risk of flood waters mobilising contaminants not included in the approved SAP, is low. This is based on the known input areas both in and around Cleveland Bay. The majority of Townsville's industrial area is within the Bohle River catchment which discharges into Halifax Bay (to the north-west of Cleveland Bay); agriculture consists mostly of cattle grazing, again which discharges to Halifax and Bowling Green Bays (north and south respectively of Cleveland Bay); leaving mostly urban inputs to the Ross River and Ross Creek systems.
- During major flood events, any potential contaminants in the catchment, generally mobilise during the 'first flush.' However, they would be substantially mixed and diluted by the large quantities of freshwater flowing out of the river and dispersing throughout and across the whole of the bay via the flood plume.

Consultation with both the Queensland Government, and the Cth Government would occur in the event emergency maintenance dredging and the contingency volume is needed.

5.4 EXAMINATION OF REUSE AND DISPOSAL OPTIONS

The *1996 Protocol to the London Convention* requires consideration of alternative methods of dealing with waste, (the convention's definition includes dredge material). The Port gives due consideration to alternatives to sea placement, to ensure that the placement of dredge material has environmentally sound outcomes. Alternative placement and beneficial reuse options have been investigated and assessed in a number of internal and external studies undertaken over the last 20 years. The most recent being an external investigation undertaken by SKM (2013), on behalf of the GBRMPA, although it has also been reviewed for the PEP EIS (compiled by AECOM in 2009) and again reviewed in 2015 /2016 for the Additional Environmental Impact Statement (AEIS).

Alternative options for maintenance dredge material are primarily dictated by the sediment characteristics and dredging methodologies. The choice of dredge methodology is dictated by the scale of the operation, nature of the materials to be dredged, and other constraints that may reduce accessibility - such as limited water depths and dredging in operational port channels. The economic feasibility of options can also impact on their viability.

Maintenance dredge material at the Port of Townsville is usually dominated by the silt fraction, and therefore, there are fewer options than the coarser material that is found during capital dredging works.

The Port has considered the following options:

- Beneficial reuse – placement on land / reclamation
- Beneficial reuse – offsite reuse
- Beneficial reuse – treatment of sediments
- Beneficial reuse – beach re-nourishment
- Beneficial reuse – habitat restoration
- Beneficial reuse – disposal / capping at landfills

5.4.1 BENEFICIAL REUSE – PLACEMENT ON LAND/RECLAMATION

The main alternative strategy to the placement of the dredge material at sea is placement on land as part of Port land reclamation purposes. Historically, (since inception in 1864), the Port has reclaimed large areas of land using dredge material, with the majority of the current Port being built on reclaimed land. In the late 1970s to early 1980s, this resulted in the establishment of the East Port Area (100ha), which was historically available for land placement of dredged material but has recently been developed to meet growing trade demands. Currently, the Port utilises only the Townsville Marine Precinct area for placement of maintenance dredge material.

In 2013, SKM were commissioned by the GBRMPA to complete an independent review as a part of a response to the World Heritage Committee's request to Australia to undertake a strategic assessment. The primary aim of this assessment was to determine the likely impact of actions on MNES, as defined by the EPBC Act, the effectiveness of existing management arrangements, and the need for improved management strategies (SKM 2013). SKM (2013) determined that for the Port of Townsville, while at sea placement remained the most efficient option for placement of maintenance dredge material, reclamation is the primary option that could feasibly be considered for land-based placement of dredge material. All other land-based options are highly constrained due to a lack of available land and the nature of the sediments to be dredged, which is unsuitable for beach re-nourishment or construction purposes (GBRMPA, 2013).

Existing land placement options within the Port are limited with no new suitable available Port-owned land. The TMP is suitable for small dredge volumes only and lacks the space for placement of the annual maintenance dredge volumes and its dewatering requirements. While the CU Project (as part of the PEP) brought all capital dredge materials to land (Government mandated requirement), the remaining capacity of this reclamation area is prioritised for placement of capital dredge material as the capital material must come to land and the geotechnical properties of the material are more appropriate for land reclamation. While minor amounts of maintenance dredge material can be temporarily placed on the CU reclamation area, the priority for this area is to receive future capital dredge material from the PEP.

On average, the Port places approx. 10% of its maintenance dredging volume on land each year (including material that does and does not meet the NAGD 2009). However, to meet legislative changes made in 2015 to capital dredge placement, this maintenance dredge volume is likely to decrease for land placement, as it is necessary to give priority to land placement of capital dredge material. Maintenance dredge material that is currently brought to land that meets the NAGD 2009, will need to be beneficially reused or be placed at sea due to the limitation of land availability.

A range of factors come into consideration for placement on land, including the availability of suitable land, the size of the available land, tailwater management, ASS/PASS, and the management techniques and options, including transport of material to site, dewatering, handling and then the transport of material offsite, or long-term management onsite. These factors are complex and in most maintenance dredging scenarios, are too significant to overcome to make land placement a viable option.

The Port does not currently hold approvals for the establishment of a new land placement area, nor does it own suitable lands. Current land space is limited in close proximity to the Port, and any land that is close by is of insufficient capacity to cater for the annual volume of maintenance dredge material involved. The only location large enough for this dredging volume would be the *Townsville State Development Area* (TSDA), which is in a range of different ownerships. The TSDA is a Queensland State initiative to define an area of land dedicated for industrial development. It is situated at the junction of the national road network (Bruce and Flinders Highway), with direct connections to major rail networks and the Port of Townsville. The TSDA position is intended to be the preferred location in North Queensland for the establishment of industrial development of regional, state and national significance (Qld State Development 2022). Any utilisation of this land would require detailed consultation with the landowners as well as regulators, and new permits before land placement could occur.

Costs associated with handling this material on land are approximately 2-3 times higher than the cost of sea placement if an already established land placement area is used. Economic reviews of relative land placement costs indicate that land placement increases dredging related operating and capital costs by more than five times the cost of using the existing DMPA. These costs include the earthworks to construct settling ponds, sea wall construction, land preparation and infrastructure, the logistics of transporting material to placement site, and equipment needed to handle the material, once onsite. Further, there are costs for tailwater management and potential water treatment, costs to dewater and store the material, costs for ASS/PASS treatment, and costs for relocation of material offsite (once its been de-watered). Any of these additional costs would increase the cost of production and operations not only for the Port but for all companies operating out of the facility. These costs would be passed on to the consumer in order to maintain an effective port facility.

5.4.2 BENEFICIAL REUSE -OFFSITE REUSE

The Port aims to reuse dredge material wherever possible. However, the potential for reuse is primarily associated with coarser materials, i.e. sands are predominantly used for reclamation of land for infrastructure projects. The maintenance dredge material consists of muds, and silty sands to fine-grained sands, minor medium to coarse-grained sands and stiff clays. The beneficial reuse possibilities for maintenance material as offsite fill/construction material, or for use in soil products are limited primarily due to the material's low strength, high compressibility, salt content, and poor drainage characteristics when dredged and placed on land.

The characteristics of the maintenance material sediments (i.e. high fines content) make the material unsuitable for use as fill or other purposes. Most commercially available topsoils comprise of at least 70% to 80% sand by weight for adequate drainage requirements. The maintenance material the Port dredges from the majority of its maintenance areas would require blending with additional large quantities of sand, in order to be used as a soil product, e.g. topsoil. Consequently, for every 1.0m^3 of dredge material, around 3-4m^3 of clean sand would need to be blended with the dredge material, depending upon the density of the dredge material and sand. This would require between 2,400,000m^3 and 3,000,000m^3 of combined material to be relocated offsite annually, after a 600,000m^3 maintenance dredging campaign. The high salt water content of the dredge material also complicates its beneficial reuse possibilities; it requires dewatering operations and salt extraction treatment in the form of stockpiling for at least one wet season to reduce the salt levels; or would require a significant volume of freshwater. Using freshwater is a significant limitation to this process given the limited supply of water in Townsville. As the Port is located in the dry tropics, this option is unviable.

The costs associated for the treatment of this material would be significant, including the need for an extensive irrigation system to salt leach; as well as treating the significantly large volume of ASS/PASS.

Any beneficial reuse of maintenance dredge material needs to have the material dewatered first. Dewatering has its own problems. The availability of space to receive and dewater maintenance dredge material on/near port land is limited, making tailwater management difficult onsite. Historically land at the Port of Townsville has been used to dewater third party dredge material, before being removed by the third party, offsite. This may occur in future on a case-by-case basis.

TCC has raised concerns regarding the amount of potable water that would be required for extensive irrigation purposes in salt leaching, if this option was chosen, particularly given the history of water restrictions and limited rainfall in Townsville.

The Port has limited ability to treat, or cope with, the volumes of dredge material and dewatering issues involved with the reuse of dredge material for broad range applications (building purposes, bricks, etc.). The reused dredge material is generally of lower quality to existing onshore supplies for these materials, in comparison to other products already available in the Townsville area. The reused dredge material is also economically unviable and would trigger amendments to the Port's existing EAs; it would also trigger royalty charges to legally move the treated material offsite, and resolution of commercial competition with the local quarries be undertaken. This all further adds to its economic disadvantage.

The movement of large volumes of dredge material for beneficial reuse, particularly at distant mine sites, would require extensive transport capabilities either by truck or rail on both ends of the system. For example: to move dredge material from a 600,000m^3 dredging campaign off port lands, would require approx. 40,000 'B-double' truck movements each way to meet road and safety legislation. This equates to approximately 109 trucks heading into and out of the Port each and every day, 365 days a year.

This would not only add considerably to the costs of dredging but would also increase the amount of greenhouse gas emissions from truck exhausts being released into the environment; it would cause an adverse economic impact on road infrastructure; increasing heavy trucking volumes and associated road safety impacts, and amenity impacts, which would all adversely impact on the health and safety of motorists travelling on the same routes; and increase noise pollution to surrounding business and residents with the increase in truck breaking/engine reeving as they enter and exit the Port.

Significant environmental considerations at the placement site would also need to be assessed and managed, to ensure there were no unforeseen environmental impacts by placing maintenance dredge material at the selected site.

In late 2021, the Port collaborated with Atlas Soils, Townsville City Council, and James Cook University in a trial aimed at investigating the potential beneficial reuse of good-quality saline maintenance dredge material for non-saline soil applications. The Port contributed sand dredged from the Ross River navigational channel for this trial and Atlas Soils combined it with calculated volumes of other organic waste including coffee grounds, garden organics and mixed food resources. The sand was amalgamated with shredded terrestrial organic wastes in a bespoke shredding system, treated using a VRM BioLogik catalysts, and subsequently covered to undergo maturation as part of VRM Biologiks Groundswell® continuous fermentation process.

Over a six-month period, regular monitoring and analysis encompassed temperature fluctuations, conductivity levels, and the presence of microbiomes and macrobiomes to ascertain any reduction in conductivity or impacts on soil microbiomes. Detailed lab analysis was then undertaken against the AS4454 Australian Standard. Preliminary results have shown conductivity levels, at the end of the demonstration were within acceptable ranges of AS4454 and have demonstrated a substantial reduction across nearly all samples, ranging from a 2 to 6-fold decrease in salts. These findings have facilitated the application of the developed product, called HumiSoil® in restoring soils across a vast 92,000 tree stormwater offsets project in Townsville, accomplished in collaboration with Reef Assist Partners. Additionally, the trial successfully established field methods for rapid conductivity testing, paving the way for efficient assessments in similar contexts and promising future outcomes.

While the trial was successful, it is currently only suitable for small volumes of good-quality dredge material (e.g. sand). It is unlikely that all maintenance dredge material, which is a mix of muds, silty sands to fine-grained sands, minor medium to coarse-grained sands and stiff clays would be appropriate for use if a large-scale trial was conducted.

5.4.3 BENEFICIAL REUSE – TREATMENT OF SEDIMENT

As the amount of land available to receive dredge material becomes restricted, the Port has increasingly focused on bringing to land dredge material that is not suitable for ocean placement, for it to be appropriately managed. Methods to destroy, reduce or remove contaminants in maintenance dredge material is not necessarily an issue for the Port as contaminant concentrations are substantially below relevant guideline values for reuse on land, with the exception of ASS/PASS issues, and salinity.

The proportion of dredge material most useful for reuse is the sand fraction, which can be used in construction and beach re-nourishment projects. The proportion of sand in the soft, unconsolidated sediment proposed for maintenance dredging is small (estimated from bore logs to be less than 10% by weight). Therefore, this poses practical and economical challenges to physically separate fine and coarse-grained sediment. This would also result in a large quantity of fine-grained sediment with poor geotechnical capabilities and reduced self-buffering capacities for ASS considerations, which would remain onsite to be dealt with separately; meaning this increases the risk profile of material that remains on port lands.

5.4.4 BENEFICIAL REUSE – BEACH RE-NOURISHMENT

Beach re-nourishment is another possible beneficial reuse of dredge material. The high fines content of the maintenance dredge areas at the Port renders most of the proposed dredge material unsuitable for beach re-nourishment. The majority of the maintenance dredge material would not be stable under a moderate wave climate typical of the shallow waters of Cleveland Bay. In Townsville, TCC has State-imposed requirements on local beach re-nourishment approvals, as to the allowable grain size of material used for beach re-nourishment - to prevent erosion (particularly for the Strand and Rowes Bay Beaches). In the case of the Strand Beach, this is due to it being a completely man-made construction.

In 2019, following the Townsville floods that caused erosion of waterways and coastal areas, the Port entered into an agreement with Townsville City Council to supply material dredged from the mouth of Ross River for beach renourishment, which meets the state imposed requirements. Approximately

10,000-15,000m3 of sand was provided to council to restore approximately 800m of coastline at Rowes Bay.

The activity was well received by the community of Townsville and provided TCC with a cost-effective way to restore eroded coastlines using locally sourced material. The Port has now entered a 5-year agreement with TCC to continue to provide quality sand dredged from the Ross River for beneficial re-use to support Townsville's coastlines.

It should be noted that on selling this material introduces complications due to interactions with other local markets (competition), it requires royalties to be paid on its removal from Port lands. As such, beneficial reuse for community benefit of beach renourishment has been the main focus in recent years.

5.4.5 BENEFICIAL REUSE – HABITAT RESTORATION

Other possible beneficial reuse of dredge material includes habitat development/restoration and levee maintenance. A common form of habitat development using dredge material is the creation/restoration of tidal wetlands (SFBRWQCB 2000). However, no local habitat construction/rehabilitation projects or levee maintenance projects could be identified in which the dredge material would be beneficially reused. Additional State approvals including royalty payments would be required prior to this being a viable option, which further adds to its economic disadvantage compared to other material.

5.4.6 BENEFICIAL REUSE – DISPOSAL/CAPPING AT LANDFILLS

Rehabilitation and cover at existing landfills is also a possible beneficial reuse of dredge material. Contaminant concentrations in unconsolidated sediment residing in the maintenance dredge areas, are well below acceptable levels for disposal at a landfill and do not require treatment except to neutralise the acid generating potential of PASS, and the salt content of the material in some cases. Minor amounts of dredge material are currently approved to be placed at a local landfill - Vantassel Street Waste Disposal Site operated by TCC. However, the Council has previously indicated that the acceptance of maintenance dredge material for capping will not meet their requirements due to the physical properties of the dredge material. The Port continues to consult with TCC to explore re-use of maintenance dredge material for operational re-use.

Key implications for each of the alternatives are shown in Table 10. The Port continues to review land placement options and new opportunities as they arise.

Table 10: Key Implications for Each Maintenance Dredging/Placement Alternative.

Options	Key Implications				
	Human Health	**Environment**	**Operational**	**Cost**	**Legislative**
Not dredging	Increases risk to navigational safety and health of humans on vessels. Reduces cyclone resilience.	Increases greenhouse gases due to reliance on road, rail, and air transport for the movement of products, in order to continue the same level of support to the region.	Results in depth restrictions for vessels due to infilling of the channels, and ultimate cessation of commercial vessels to the Port.	Results in significant loss of revenue for the greater Townsville region, not just for the Port of Townsville. Adversely increases the cost of living in North Queensland as access to products and fuel decreases. Has significant direct and indirect impacts on employment (port employees, port users and customers, and companies that rely on imports/exports from the Port of Townsville).	Breach of Queensland's *Transport Infrastructure Act 1994.*
Installing sediment barrier devices (permanent hardstand structure), reducing dredge volumes.	Increased risk to navigational safety and health of humans on vessels as a permanent, hard structure, would pose a significant hazard, cutting the bay in half as it followed the Platypus and Sea Channels out to the end of Magnetic Island.	Significant environmental impacts during construction. Significant ongoing impacts by cutting the bay in half. Would significantly change the sedimentation characteristics of the bay. Would significantly impact upon sensitive receptors (permanent destruction). Would act as a barrier for marine fauna – preventing their movement between feeding/life cycle habitats. Would be reclamation by default and would reduce the marine area of the GBRWHA.	Would sit in some of the Anchorages beyond port limits, reducing their availability for vessels. Would need significant maintenance – removing sediment building up (otherwise the bay would become even more shallow), maintenance after severe weather events, maintenance on navigational lighting required the length of the barrier. May not actually prevent sediment build-up and would pose a risk during severe weather events being so close to the channels – the structure may fall into the channels and cause an obstruction to navigation and port operations.	Significant outlay of capital costs for quarry material, to build the wall. Operational costs for maintenance, especially after cyclones/severe weather events would be significant. Would require significant environmental offsets if it could actually be approved by State and Cth governments.	Works may fail to meet the EPBC Act. Other approvals needed would include those under: - The *Planning Act 2016* (which includes the *Coastal Protection and Management Act 1995, Fisheries Act 1994, Environmental Protection Act 1994).* - The *Environmental Offsets Act 2014*.
Land placement / reclamation (port land)	Increase safety risks due to a large area of waterlogged dredge ponds, and the ongoing management by port employees.	Creates PASS, tailwater management issues and greenhouse gas emissions from increases in plant & equipment.	Lack of availability of suitable nearby land to treat and store the material. Land is needed for placement of dredge material and to be available for long-term management of the area.	Increases cost of dredging by more than five times the cost of using the existing DMPA. Significant cost of purchasing suitable reclamation areas or new	The Port would need approvals under: - The *Planning Act 2016* (which includes the *Coastal Protection and Management*

<table>
<tr><th colspan="2" rowspan="2">Options</th><th colspan="5">Key Implications</th></tr>
<tr><th>Human Health</th><th>Environment</th><th>Operational</th><th>Cost</th><th>Legislative</th></tr>
<tr><td colspan="2"></td><td>Increases in land transport (truck/rail movements) due to the volume of maintenance material that would come to shore, and associated increases in road/rail accidents due to the increase in land transport.
Potential dust, noise, and air emission nuisance issues for the neighbouring residents of South Townsville; and increased risk to navigational safety within the bay due to floating pipelines used to transfer maintenance dredge material to shore.</td><td>Potentially reduces the marine area of the GBRWHA for any further reclamation, as there is no available land.
Does not decrease/change maintenance dredging impacts i.e. water quality, turbidity, disturbance to the seabed, transport and resuspension of contaminants, marine fauna strikes, and underwater noise remain as currently assessed.</td><td>Maintenance material on land reduces the available capacity for approved capital DMPAs.
Maintenance material has poor engineering qualities, making it not suitability for beneficial reuse without further treatment and stabilisation.</td><td>land near the Port, to place, treat and store the material.
Significant cost of clearing/preparing that land to ensure it is suitable to take the proposed material.
Significant cost of treating the maintenance material for PASS/ASS to ensure no further environmental impacts are created.</td><td>Act 1995, Fisheries Act 1994, Environmental Protection Act1994).
- The Environmental Offsets Act 2014.
- Potential assessment under the EPBC Act depending on location.
The Port would also need Land Owners Consent from DOR.</td></tr>
<tr><td>Beneficial reuse (i.e. on or offsite recycling for construction, fill, products, etc.)</td><td>With treatment</td><td>Limited risk due to low contaminant concentrations.
Increase in potential noise due to a mid-scale processing plant for onsite recycling.
Risks for land placement include:
- Navigation risk - long floating pipelines required to bring material to shore.
- Transport risks – increase in land transport, and increased accident risks.
- Dust, noise and air emissions nuisances for the neighbouring residents.</td><td>Creates PASS, salt content, tailwater management issues and greenhouse gas emissions from plant & equipment.
Does not decrease/change the maintenance dredging impacts and remain as currently assessed.</td><td>Land is needed for placement of dredge material, for treatment to address poor engineering qualities of the material before it can be reused into a usable by-product.
Contaminant treatment not required as concentrations below land-based acceptance levels.
ASS/PASS and salinity treatment needed before beneficial reuse could be an option.
New onsite processing requires new staff and ongoing maintenance of plant.</td><td>Increases cost for treatment, and treated material remains uneconomic compared to existing onshore supplies in the region.
Onsite processing is cost prohibitive to start-up and can be cost prohibitive for ongoing operational/maintenance costs.
Cost for royalties that may still be required to be paid on end-product (once maintenance dredge material has been processed and converted into a viable by-product).</td><td>The Port would need approvals under:
- The Planning Act 2016 (which includes the Coastal Protection and Management Act 1995, Fisheries Act 1994, Environmental Protection Act 1994).
The Port would also need Land Owners Consent from Department of Natural Resources and Mines, Manufacturing and Regional and Rural Development.</td></tr>
</table>

Options	Key Implications Human Health	Environment	Operational	Cost	Legislative
Without treatment			No local project could be identified to take maintenance dredge material, with its poor engineering qualities, ASS/PASS and salinity issues that all require treatment to prevent further impacts to the potential receiving environment/area.	Increase in costs for transportation out of the Townsville region (given no local project could be identified for reuse), cost to pay royalties in removing the material from Port lands. Maintenance dredge material generated at the Port of Townsville is uneconomic to reuse or recycle for construction, fill or any other product compared to existing onshore supplies.	
Beach re-nourishment	Limited risk due to low contaminant concentrations. If the material is barged to an appropriate area, this would create a hazard to navigation due to the volume of barge runs within the bay. Or if the material was bought to land, there would be an increase in land transport (truck/rail movements) to move the material to the designated location. This could then increase road/rail accidents due to the increase in land transport. Increases potential dust, noise, and air emission nuisance issues for neighbouring residents of any area identified for placement.	Creates PASS, salt content, tailwater management issues and greenhouse gas emissions from plant & equipment. Does not decrease/change maintenance dredging impacts, and they remain as currently assessed.	Majority of maintenance material is not suitable as it does not meet Queensland Government's conditions on beach re-nourishment approvals. The Port's maintenance material has poor engineering qualities that requires treatment before reuse and is not stable enough to remain onshore as beach re-nourishment.	Increase in costs for transportation to appropriate beaches, increase the cost to pay royalties in removing the material from Port lands; and it is uneconomic to use this material, given the quality and consistency of material available from other existing onshore supplies within the region. Increase cost or truck/barge movement to move material to the designated site.	Fails to meet requirements of Queensland's *Coastal Protection and Management Act 1995*. Other approvals needed would include those under: - The *Planning Act 2016* (which includes, *Fisheries Act 1994, Environmental Protection Act 1994); and* - Potentially the *Environmental Offsets Act 2014.*
Habitat restoration	Limited risk due to low contaminant concentrations. Increases in land transport (truck/rail movements) due to the volume of maintenance material that would come to	Creates PASS, salt content, tailwater management issues and greenhouse gas emissions from plant & equipment. Does not decrease/change maintenance dredging impacts,	No local project could be identified that would benefit from the maintenance material generated from Cleveland Bay. Poor engineering qualities of material require treatment before material	Increase in costs for transportation to appropriate areas of restoration; increase the cost to pay royalties in removing the material from Port lands; and it is uneconomic to use this	The Port would need approvals under: - The *Planning Act 2016* (which includes the *Coastal Protection and Management Act 1995, Fisheries Act 1994,*

Options	Key Implications				
	Human Health	Environment	Operational	Cost	Legislative
	shore. This then increases road/rail accidents due to the increase in land transport. Increases potential dust, noise, and air emission nuisance issues for the neighbouring residents of both South Townsville, and the area surrounding any habitat restoration.	and they remain as currently assessed.	could be utilised in habitat restoration projects. The material also requires dewatering prior to being moved to the designated site, along with treatment for ASS/PASS and salinity, depending on where habitat restoration may be required.	material, given the quality and consistency of material available from other existing onshore supplies within the region. Increase in cost to dewater the material and increase cost for truck movements to move the material to the designated site.	*Environmental Protection Act 1994).* Land Owners Consent may also be required from Department of Natural Resources and Mines, Manufacturing and Regional and Rural Development.
Landfill	Limited risk due to low contaminant concentrations. Increases in land transport (truck/rail movements) due to the volume of maintenance material that would come to shore. This then increases road/rail accidents due to the increase in land transport. Increases potential dust, noise, and air emission nuisance issues for the neighbouring residents.	Creates PASS, salt content, tailwater management issues and greenhouse gas emissions from plant & equipment. Does not decrease/change maintenance dredging impacts, and they remain as currently assessed.	Treatment required to address poor engineering qualities of the material. Treatment would also be required for ASS/PASS, salinity and dewatering prior to placement in landfill. Contaminant treatment not required as concentrations below land-based acceptance levels.	Council will not accept the volume of material generated, due to their site volume limitations. Landfill placement also increases cost for treatment, transportation and royalties.	The Port would need approvals under: - The *Planning Act 2016* (which includes the *Coastal Protection and Management Act 1995, Fisheries Act 1994, Environmental Protection Act 1994).* Land Owners Consent from TCC (and any other local council) for placement at an operating landfill facility.
Sea placement	Limited risk due to low contaminant concentrations. Minor navigational impacts from a TSHD, however, these are considered to be low, as the vessel highly manoeuvrable and scheduling of the Inner Harbour allows for dredging around ships berthing.	Results in limited short and long-term impacts at sea DMPA to water quality, removal of existing habitats, burial and smothering of organisms on the seafloor. Potential dredging impacts remain, including dredge plumes are localised to the source point. Placement in the DMPA is away from sensitive receptors in the bay and >6km from Magnetic Island.	Does not require any additional plant & equipment other than the dredge vessel. The TSHD is a fast, mobile vessel, which limits impacts to normal shipping and port operations.	No costs for treatment and transport beyond the normal running costs. No ongoing management. Significant input into monitoring and testing the associated parameters as required under permit conditions.	The Port needs approvals under: - The *Planning Act 2016* (which includes the *Coastal Protection and Management Act 1995, Fisheries Act 1994, Environmental Protection Act 1994);* - Cth's *Environment Protection (Sea Dumping) Act 1981; and* - Landowners consent from DOR for placement areas.

5.5 SELECTED FUTURE DREDGING AND PLACEMENT STRATEGY

Given the uncertainty of the timing of capital dredging works as part of PEP, the Port cannot accurately provide predictions on future maintenance dredging requirements beyond the scope of this 10-year plan. The first stage of PEP, the Channel Upgrade, was completed early 2024, however, additional stages of PEP are dependent upon supply, demand and funding. As discussed in Section 1.4, the Port also intends to undertake reviews throughout the lifespan of this document, to ensure any changed circumstances, e.g. additional stages of PEP, are incorporated into revisions of this Plan. What the Port can predict are the additional volumes required to maintain the CU area.

Placement of maintenance dredge material in the current DMPA by other operators within the Townsville area is possible in the future (subject to approvals) and the Port has considered the cumulative impacts of multiple operators within the DMPA. Due to its size and depth, the current DMPA has sufficient capacity to continue to place maintenance dredge material both from the Port and other operators.

5.5.1 ALTERNATIVE DMPA LOCATIONS REVIEW

As part of the Section 19 Deed of Agreement, Research and Monitoring Plan the Port had with the National EPA (formally DCCEEW) from 2015 to 2020, the Port started investigating alternative DMPA locations for future consideration. In late 2021 the Port engaged Wild Environmental Consultants to identify and undertake an analysis of the alternative location options for sea placement of the Port's maintenance dredging material. This included:

- Comparing and contrasting the identified alternative DMPA/s with the Port's existing DMPA (and a realigned layout of the existing DMPA), based on a desktop review of available information and consideration of relevant environmental, social, and economic factors.
- Provide recommendations for further studies to be undertaken in relation to any identified alternative DMPA/s, to support a final evaluation of their suitability by the Port, community stakeholders and regulatory agencies.

The analysis commenced by overlaying spatial data for values or the activities of other users that would clearly preclude the establishment of an alternative DMPA. Such areas included:

- Existing shipping channels, ship anchoring areas and pilot boarding areas, the use of which would be incompatible with dredge material placement activities on the basis of navigational safety and operational convenience. This information was supplemented with vessel traffic data from the Australian Maritime Safety Authority (AMSA) for the period 2017 to 2021, excluding October to March (when maintenance dredging activities are not conducted by the Port).
- Areas known to comprise marine habitats of environmental value that would be directly impacted by material placement activities (e.g., coral reefs, seagrass meadows).
- Areas where the placement of dredge material would not be permitted under existing legislative or policy arrangements or would be inconsistent with the purpose of a special management area. This included areas of the GBRMP where the placement of dredged material is prohibited under the provisions of a zoning plan, and other areas established to manage environmental values, including Ramsar sites, fish habitat areas and Dugong Protection Areas.

Areas considered unsuitable for dredge material placement activities were then mapped and designated as 'no go' areas. This process assisted the project team to identify areas that must be avoided, with the remaining parts of the study area available for the selection of potentially suitable alternative DMPAs.

Potentially suitable alternative DMPAs were selected for further assessment, considering other criteria that may influence the suitability of an area, including:

- Likely or known benthic habitat values, with a preference for soft bottom (sand or silt) substrates colonised by generalist epifaunal and infaunal assemblages.
- Bathymetry, with a preference for sites that were deep enough and large enough to provide sufficient storage volume of dredged material (6 million cubic metres over 10 years).
- Coastal processes, including the direction and intensity of prevailing water currents (tidal, wind driven and longshore drift) and bed shear stress (the force of water movement acting on the seabed, which may resuspend placed sediments). A preference was for areas with low bed shear stress, that would accommodate the retention of dredge material on the seabed and for areas where suspended sediment plumes would not be directed towards sensitive receptors such as coral reefs and seagrass beds.
- Existing use of waters and adjacent areas such as beaches by other stakeholders, including commercial fishers, passenger ferries, recreational fishers, the tourism industry, and traditional owners.
- Distance between the dredging location and the alternative DMPA, which influences the duration and cost of a dredging campaign, and the associated carbon emissions.

Potentially suitable alternative DMPAs were selected and evaluated through a multi-criteria analysis (MCA). The six potentially suitable alternatives DMPA's are shown in Figure 23. The analysis suggested that moving the DMPA from its current location to an alternative one could yield potential net benefits. The top three ranked locations were C, A, and E, in that order.

A Stakeholder Engagement Investigation in July 2023 was undertaken to complement this initial work, with the 2022 Options Analysis updated to include the results of the Stakeholder Engagement Investigation. In a community survey conducted as part of the 2023 analysis, Option C emerged as the preferred choice. However, the analysis also highlighted that relocating the DMPA might significantly impact Port operations, necessitating further investigation.

In 2024, Port of Townsville's investigations identified significant barriers to implementing the relocation of the DMPA to any of the top three ranked locations, (C, A and E). The increased distance to these locations would reduce the volume of maintenance dredge material that could be handled during the four weeks allocated for the annual dredging campaign, jeopardising the Port's ability to meet legal obligations for maintaining safe navigable channel depths. Consequently, these options are currently considered unviable and will not be progressed for further study at this time. A reconfiguration of the current DMPA was discussed with appropriate regulators in 2024, however there are significant additional approval requirements and supporting information needed as well as other considerations.

The Port has communicated these outcomes to the Community Liaison Group for Dredging on Magnetic Island and to the Technical Advisory and Consultative Committee for Maintenance Dredging and has updated stakeholder groups involved in the project on a 1:1 basis. We continuously review options for dredging and material placement to ensure best practice outcomes based on what is achievable balancing regulatory approval requirements and what is technically and economically feasible.

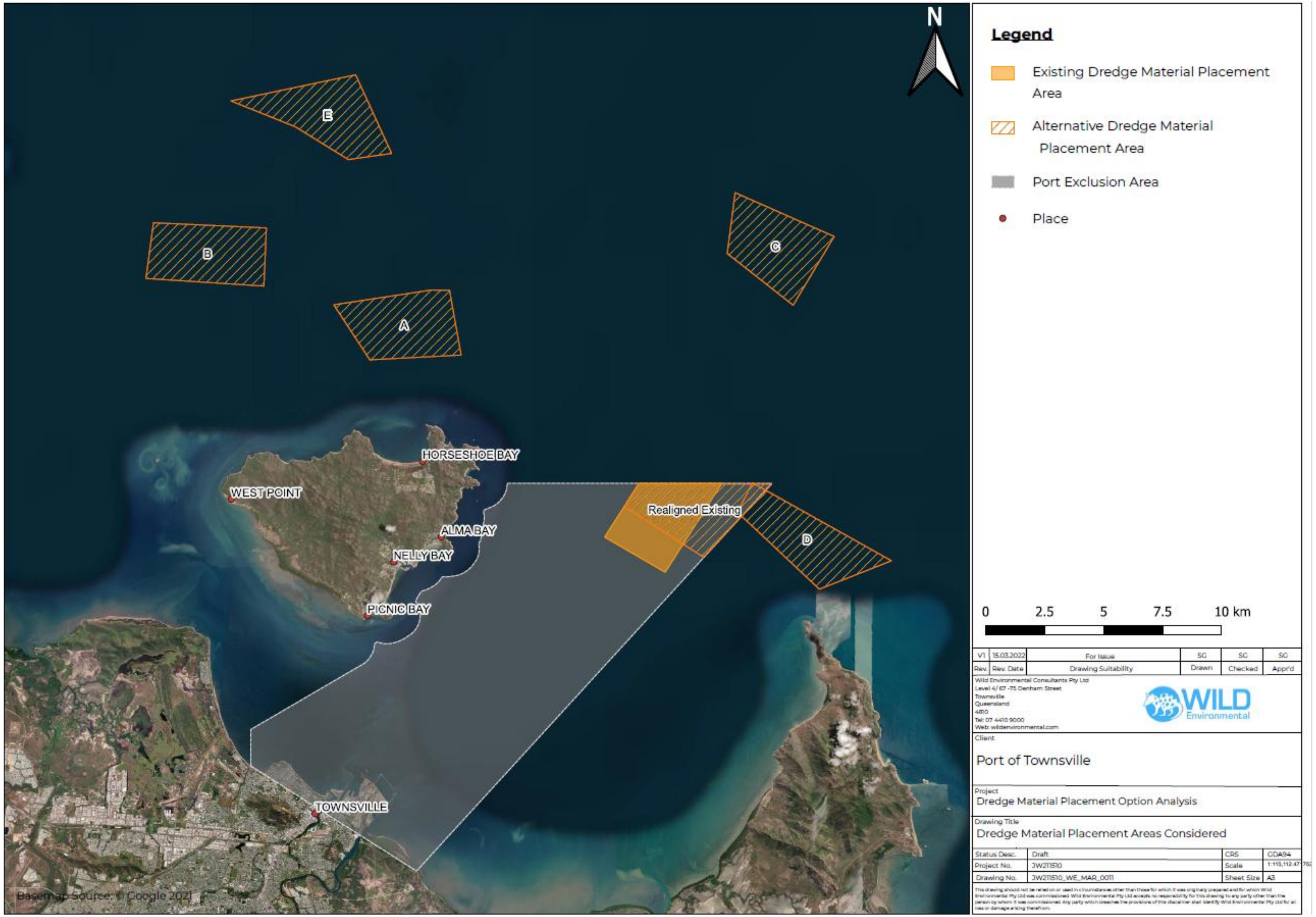


Figure 23: Location of Potential Alternate DMPA sites.

6 RISK ASSESSMENT FRAMEWORK

The Port is committed to the effective management of risks arising for the environment in which it operates. The Port's Risk Management Policy and Risk Management guidelines are consistent with the International Risk Management Standards (AS/NZ ISO 31000:2009). Figure 24 shows the risk assessment process.

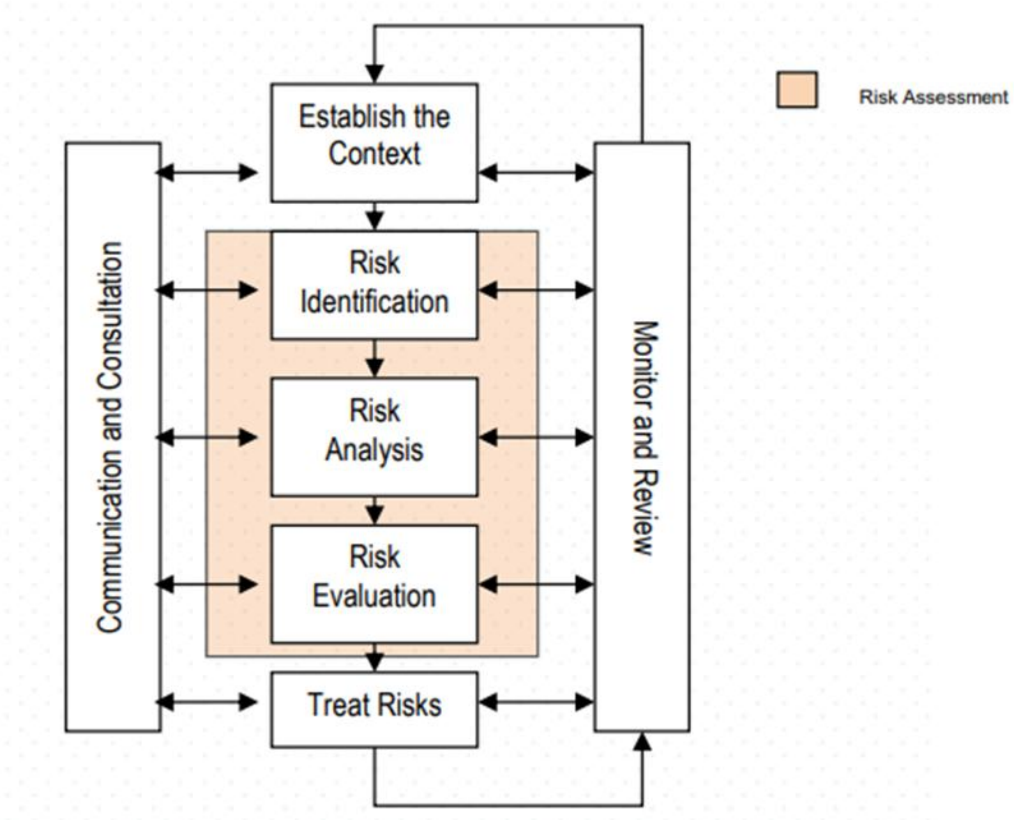


Figure 24: Risk Assessment Process

Under the *Transport Infrastructure Act 1994*, the Port is required to establish, manage and operate efficient port facilities and services. To comply with the *Transport Infrastructure Act 1994,* the Port must maintain navigable areas within the Port's jurisdiction to target operational design depths within the bounds of its approved maintenance areas (i.e. within the existing footprints). This, at the Port of Townsville, means regular maintenance dredging activities are required to remove natural accumulations of sediments within the existing port facilities. The Port undertakes maintenance dredging within:

- Sea Channel (only when deemed necessary)
- Platypus Channel (annually)
- Outer Harbour (annually)
- Inner Harbour (annually)
- Berth 5 and ex Berths 6/7 (only when deemed necessary)
- Berths 1, 2, 3, 4, 8, 9, 10, and 11 (annually)

- TMP (only when deemed necessary)
- Ross River, including TMP Swing Basin (only when deemed necessary)
- Ross Creek (only when deemed necessary)

Risks have been assessed initially on the basis of no management controls (inherent risk), then again following the introduction of management controls (residual risk).

Whilst all dredging equipment has been considered in this risk assessment, the risk scores are based on the most impacting dredge plant. For the Port of Townsville, this is the TSHD for plume generation, or a cutter suction dredge for land placement, as it can be assumed that environmental risks for other types of dredge equipment would be less given the location and scale of such activities. This assumption is supported by the finding of modelling of maintenance dredging at the Port of Townsville which has shown that the TSHD generates the most turbidity out of the dredging plant used at the Port of Townsville (in both dredging and sea placement).

By combining environmental monitoring data with advanced numerical modelling, potential impacts can be assessed across a range of operating and environmental conditions before activities occur. Modelling has been undertaken for maintenance dredging at the Port of Townsville, that considered the generation of turbidity in the water column as a result of:

- Turbidity generated by the dredge while operating (hopper overflow and propeller wash) and resuspension of dredge material that has been disturbed by the dredging process; and
- Deposition (e.g. sedimentation) of dredged sediment particularly on sensitive receptors.

Each dredging scenario was modelled under three different climate conditions:

- El Niño (dry conditions);
- La Niña (wet conditions); and
- Transitional (neutral) conditions.

The modelling investigation was undertaken for two different maintenance dredging campaigns volumes; an expected case of 400,000m^3 over 35 days and a worse case of 600,000 m^3 over 50 days. These volumes were selected based on a review of historic dredging campaigns undertaken by the Port and include predicted sedimentation and dredging requirements of the widened channel footprint following the completion of the CU project. The upper case is modelled to ensure that an assessment has been undertaken for a scenario where the Port needs to undertake emergency dredging (e.g. following a cyclonic event or similar) in addition to routine dredging. The modelling predicts the impacts, demonstrated through the following four zones of impact as described in Table 11.

Model assumptions were based on current maintenance dredging practices and operational records from previous dredging campaigns. The assessment assumed that maintenance dredging would primarily be undertaken using the TSHD Brisbane, with dredged material placed at the existing offshore Dredge Material Placement Area (DMPA). Dredging productivity, cycle times and operating patterns were based on actual dredge logs from previous campaigns to ensure the modelling reflected realistic operating conditions.

The model also incorporated dredging activities across all key maintenance dredging areas, including the Inner Harbour, Outer Harbour, Platypus Channel, Ross River and associated port infrastructure, based on expected dredging volumes over the permit period.

The current modelling framework was originally developed by specialist consultants BMT between 2012 and 2014 as part of the Port Expansion Environmental Impact Statement (EIS). The model underwent independent peer review as part of the development of the model and was also reviewed by specialists from the Australian Institute of Marine Science (AIMS) as part of the EIS assessment. It was calibrated and validated using field measurements of tides, currents and water levels collected within Cleveland Bay. In 2026, the model was further refined to support the new 10-year Sea Dumping Permit application. This update incorporated the latest scientific information, field data, industry guidance and modelling best practice.

The modelling was undertaken in accordance with the GBRMPA Hydrodynamic Modelling Guidelines (2012) as well as the West Australian Marine Science Institution (WAMSI) study. These guidelines ensure a detailed and rigorous process for the estimation of dredging plume release rates.

Modelled outcomes – water quality

The 2026 assessment of maintenance dredging impacts on sensitive receptors concluded:

- For all climate scenarios and modelled dredge cases, the model indicates a small, localised Zone of Low Impact within and directly adjacent to the Inner and Outer Harbour areas in the Port.
- Zones of Moderate and High impact are restricted to areas where dredging and placement occur.
- There is a predicted Zone of Influence extending along the mainland coast to the Ross River mouth and to areas near Cape Pallarenda. The Zone of Influence indicates that while there is some detectable increase in turbidity in these areas, water quality is predicted to remain within natural variability and therefore corals and seagrass are not predicted to be adversely affected.
- As the zones of impact for maintenance dredging under all climate scenarios are short-term in nature, and restricted to the immediate vicinity of dredging areas, the impacts from maintenance dredging year after year are not expected to have a cumulative effect.
- Given the short duration of maintenance dredging campaigns, the short-term nature of dredge plumes and the natural variability that characterises water quality in Cleveland Bay, annual maintenance dredging is not expected to result in measurable long-term impacts to sensitive marine environments.

Overall, the 2026 assessment reached a similar conclusion to the previous hydrodynamic assessment in 2014. Although dredging-related increases in turbidity may be detectable in some areas outside the Port, these increases are predicted to remain within the range of natural variability. Compared to the previous assessment there is some modelled reduction in the extent and magnitude of estimated turbidity impacts, due primarily to a reduction in the amount of Sea Channel dredging, as the 2026 modelling has more tailored dredge areas based on a revised assessment of the Port's maintenance dredging requirements in individual areas.

Table 11: Description of Impact Assessment Thresholds

Zone of Impact	Water quality (Turbidity)	Threshold Value
Zone of Influence	Extent of detectable plumes, with no predicted ecological impacts.	Dredging related turbidity exceeds 0.5 NTU above 50th percentile conditions and 2 NTU above 80th percentile conditions.
Zone of Low Impact	Excess turbidity may push total turbidity beyond natural variation, potentially resulting in sub-lethal impacts to ecological receptors with recovery time of approximately 6 months.	Excess turbidity greater than one standard deviation from the natural background mean for nearshore areas, and two standard deviations for offshore areas.
Zone of Moderate Impact	Excess turbidity likely to push total turbidity beyond natural variation, potentially resulting in sub-lethal impacts to ecological receptors and/or mortality with recovery time up to 24 months.	Excess turbidity greater than two standard deviations from the natural background mean for nearshore areas, and three standard deviations for offshore areas.
Zone of High Impact	Excess turbidity most likely to cause total turbidity to go beyond natural variation, (excluding extreme weather events) potentially resulting in mortality of ecological receptors with recovery greater than 24 months.	Excess turbidity greater than three standard deviations from the natural background mean for nearshore areas, and five standard deviations for offshore areas.
Noting: 20th percentile (low turbidity conditions – low wind and waves); 50th percentile (average conditions); and 80th percentile (high turbidity conditions – moderate to high wind and waves).		

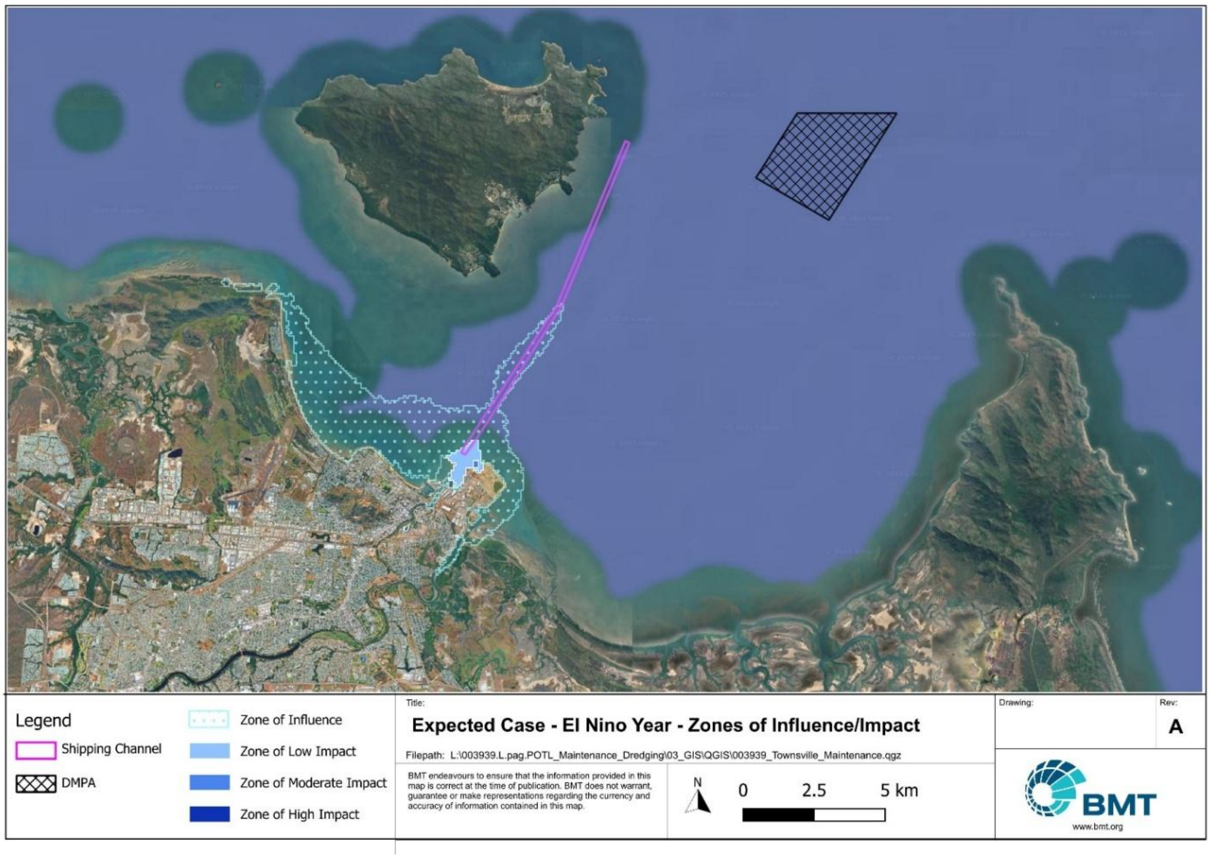


Figure 25. El Nino Year - Modelled Zone of Impact for a Typical Dredging Period

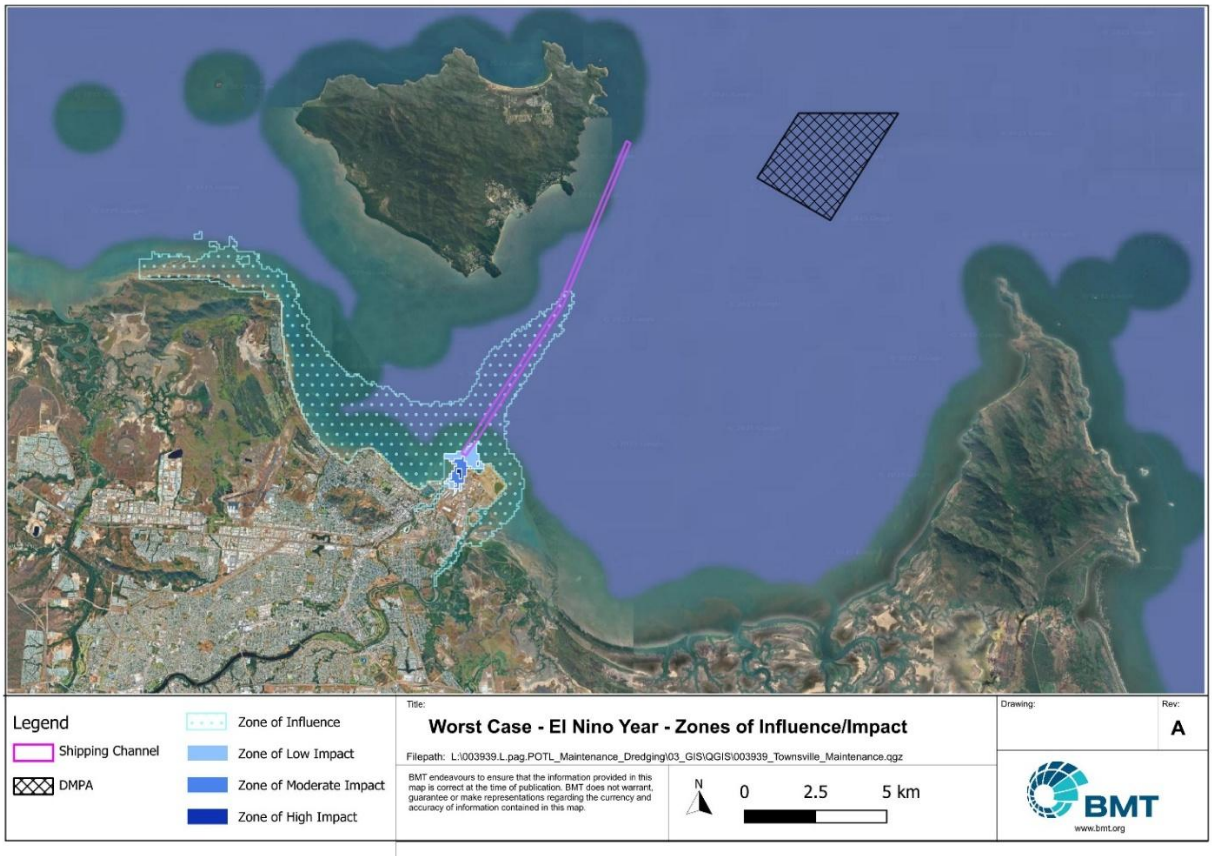


Figure 26. El Nino Year - Modelled Zone of Impact at Worst Case Scenario

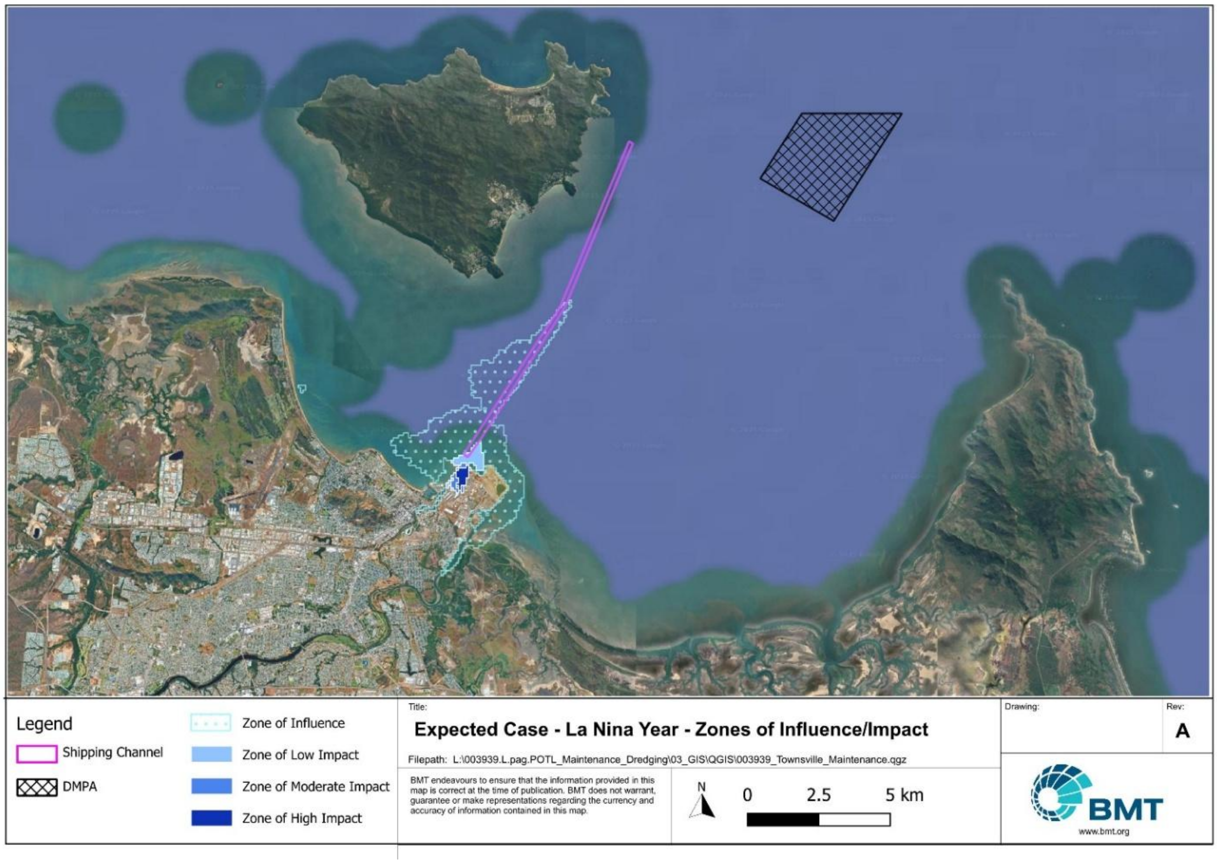


Figure 27. La Nina Year - Modelled Zone of Impact for a Typical Dredging Period

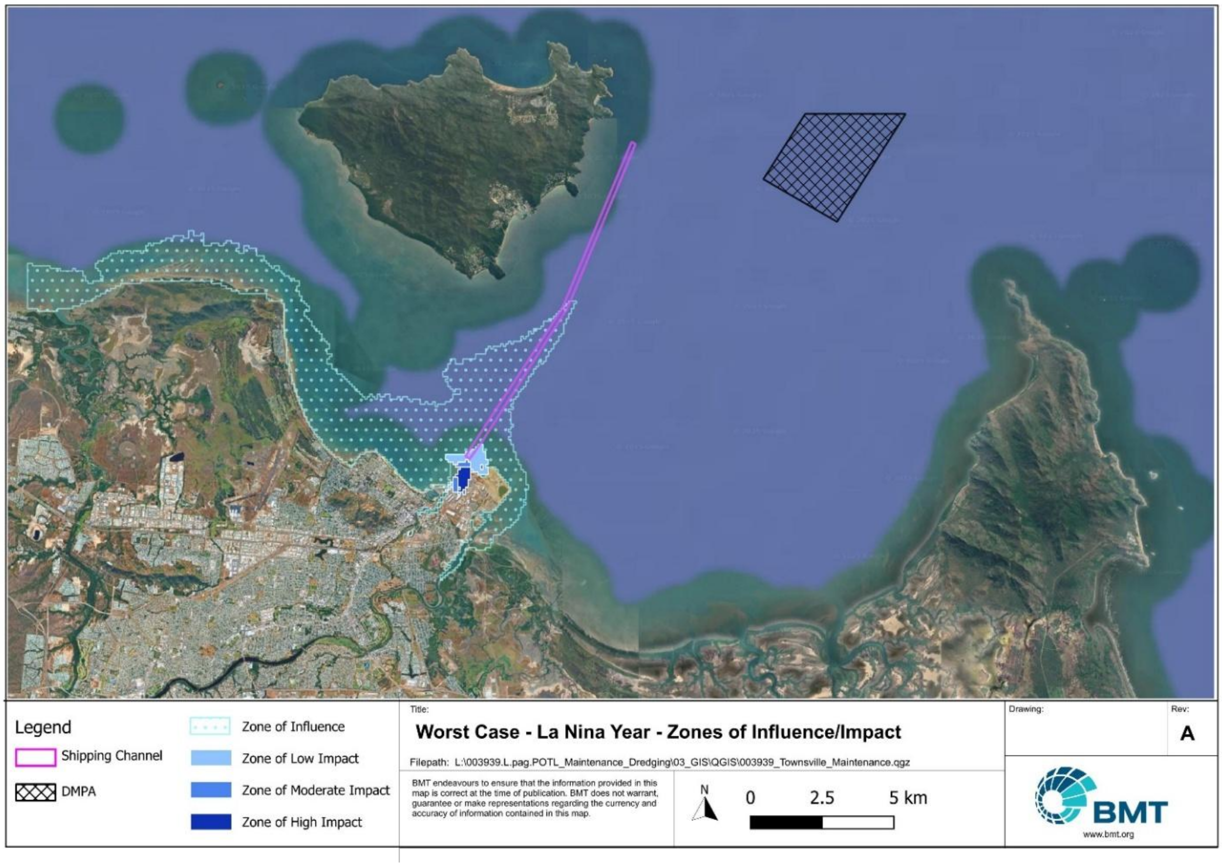


Figure 28. La Nina Year - Modelled Zone of Impact at Worst Case Scenario

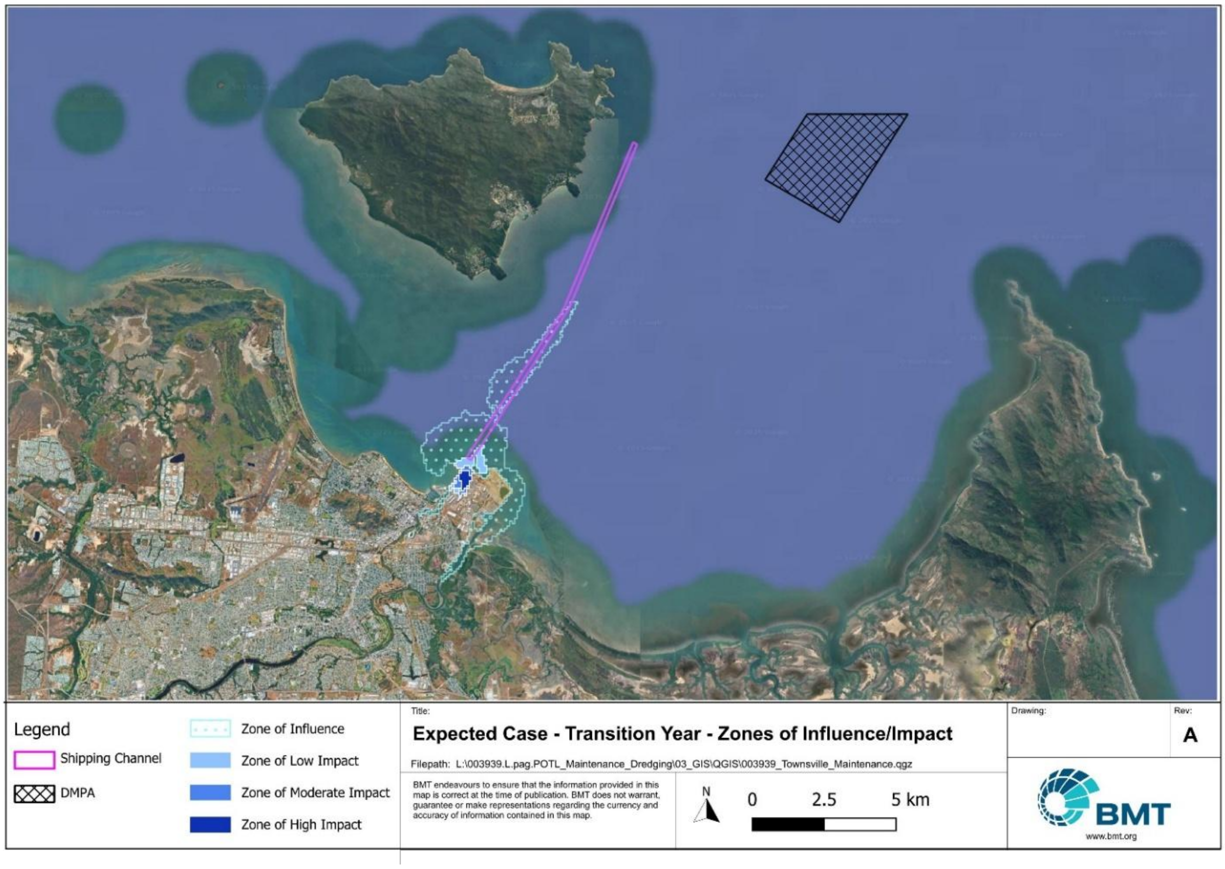


Figure 29. Transition Year - Modelled Zone of Impact for a Typical Dredging Period

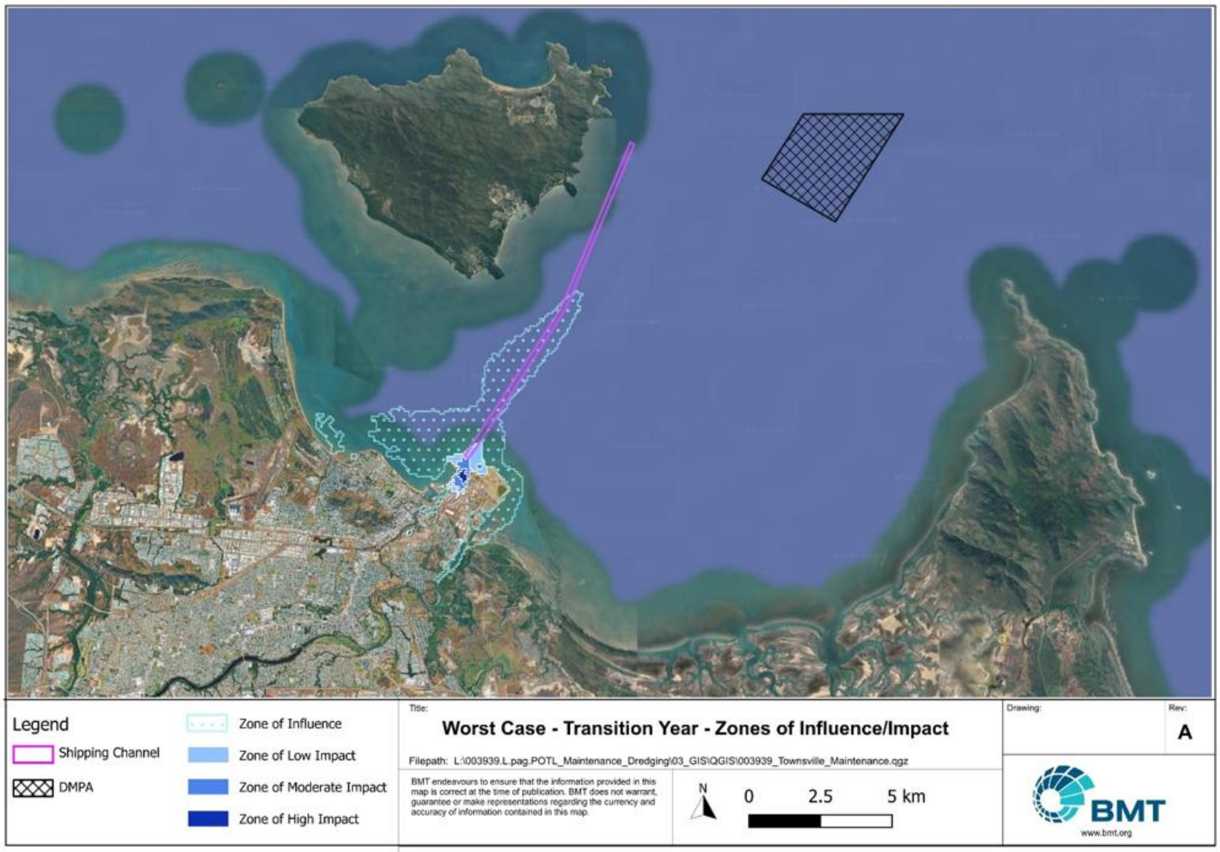


Figure 30. Transition Year - Modelled Zone of Impact at Worst Case Scenario

Modelled outcomes – sediment deposition

Results for sediment deposition were broadly similar across all modelled scenarios. The extents of the zones of influence and impact based on the sediment deposition rate are broadly similar across the different scenarios. The modelling predicts the impacts, demonstrated through the following four zones of impact as described demonstrated through Figure 31 to Figure 36.

Key findings include:

- Zones of Moderate and High Impact are largely restricted to active dredging and placement areas.
- Zones of Low Impact occur immediately adjacent to dredging and placement locations and may extend up to approximately 1.5 km from parts of the shipping channel in upper-case scenarios.
- No mapped coral habitats occur within any modelled Zones of Impact for sediment deposition.
- The majority of mapped seagrass habitats occur outside Zones of Impact. A small area of mapped seagrass offshore from The Strand overlaps a modelled Zone of Low Impact where any impacts are predicted to be minor, temporary and recoverable.

Overall, sediment deposition impacts are predicted to be localised and largely confined to dredging and placement areas, with no predicted impacts to mapped coral habitats and only a small area of seagrass predicted to experience minor, temporary and recoverable effects.

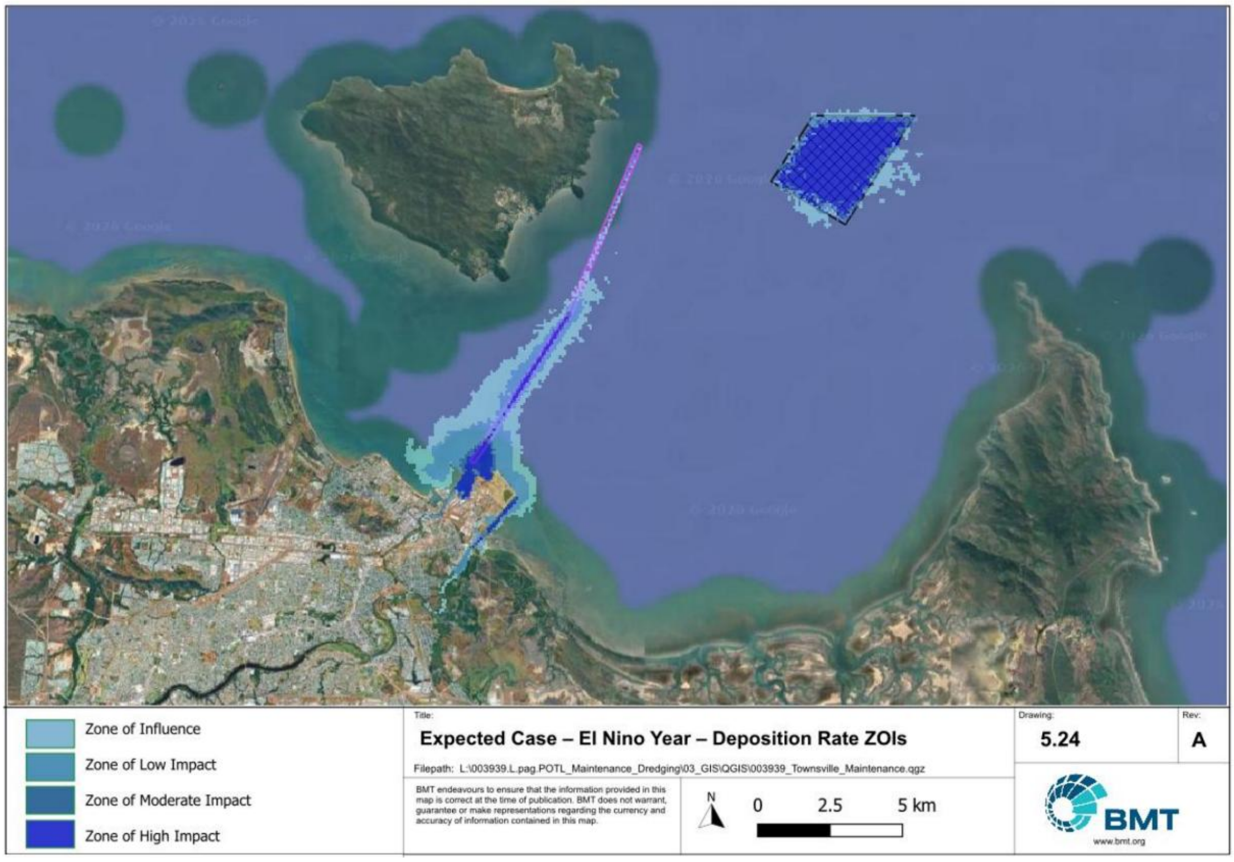


Figure 31. Deposition Rate ZOIs - Expected case - El Nino Year

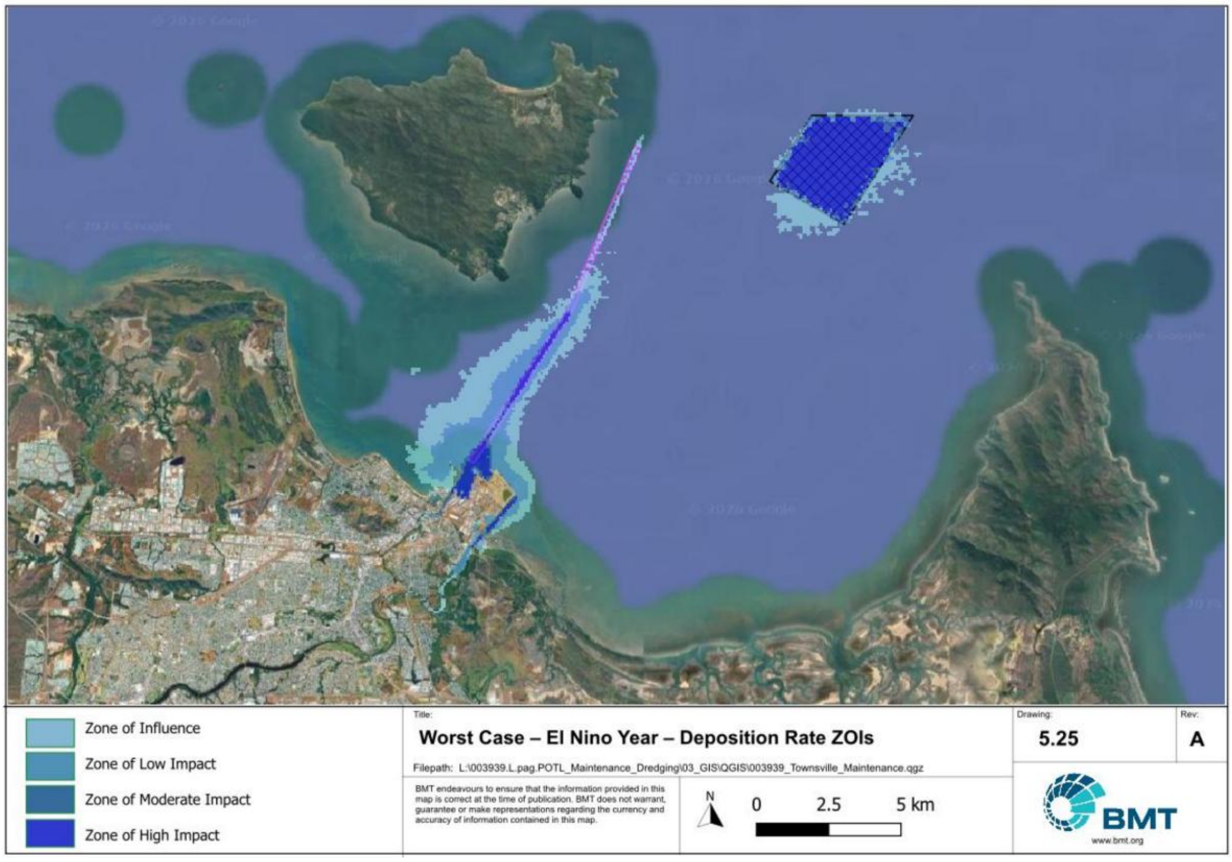


Figure 32. Deposition Rate ZOIs - Worst Case Scenario - El Nino Year

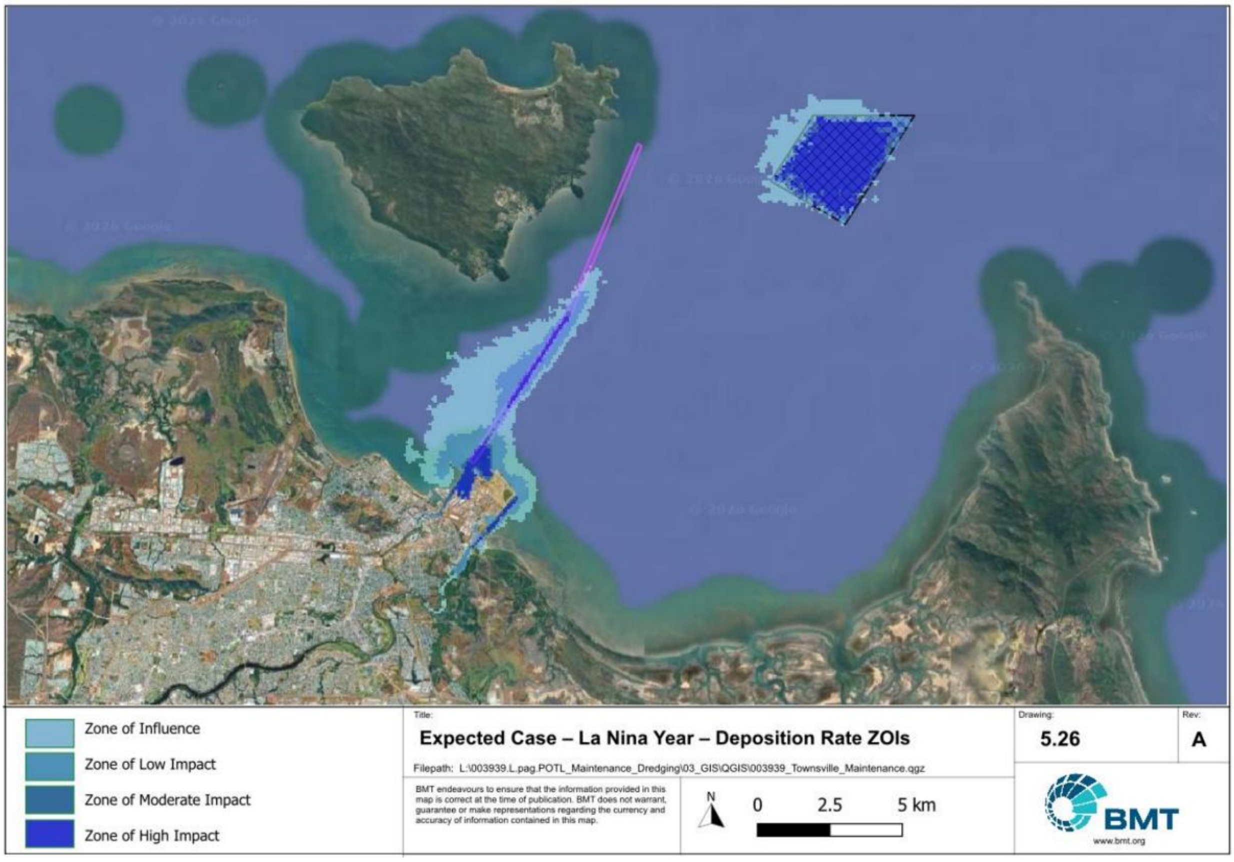


Figure 33. Deposition Rate ZOIs - Expected case – La Nina Year

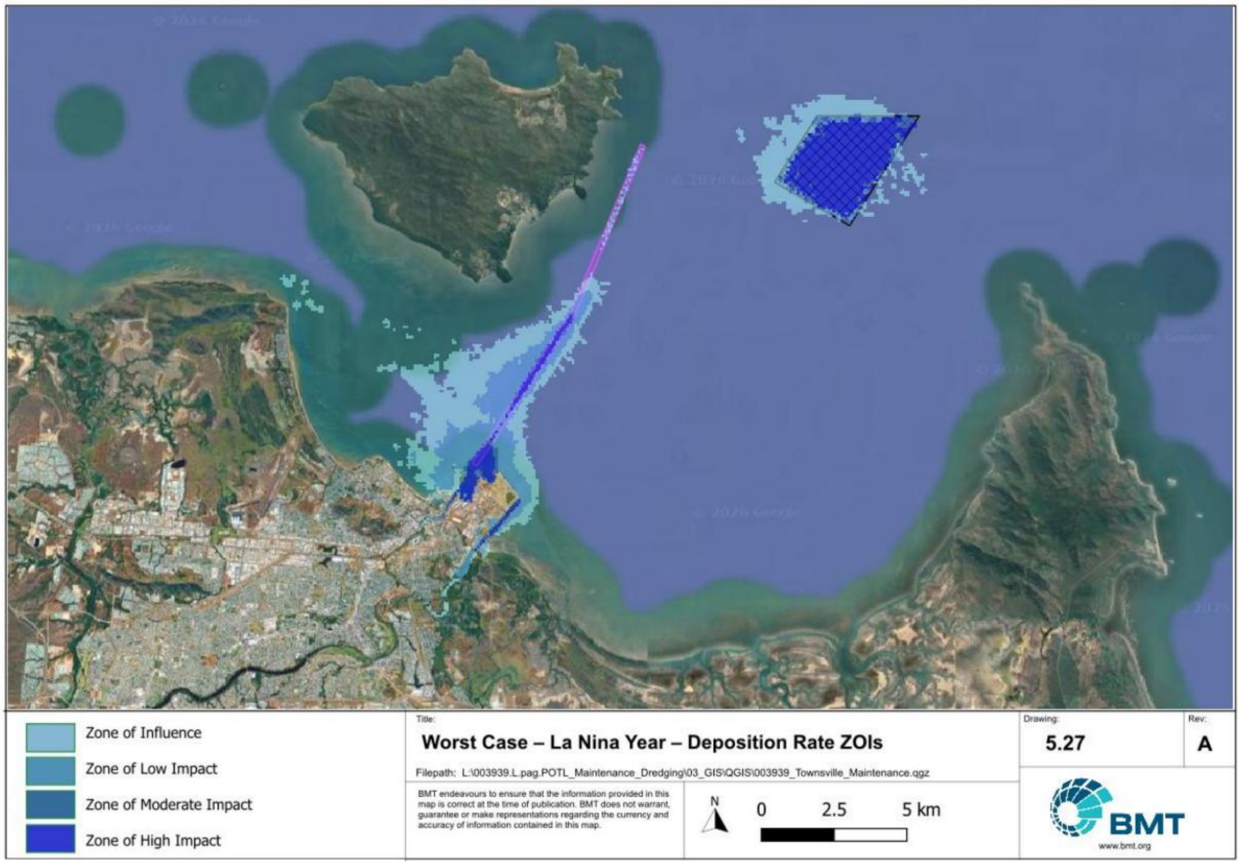


Figure 34. Deposition Rate ZOIs - Worst Case Scenario – La Nina Year

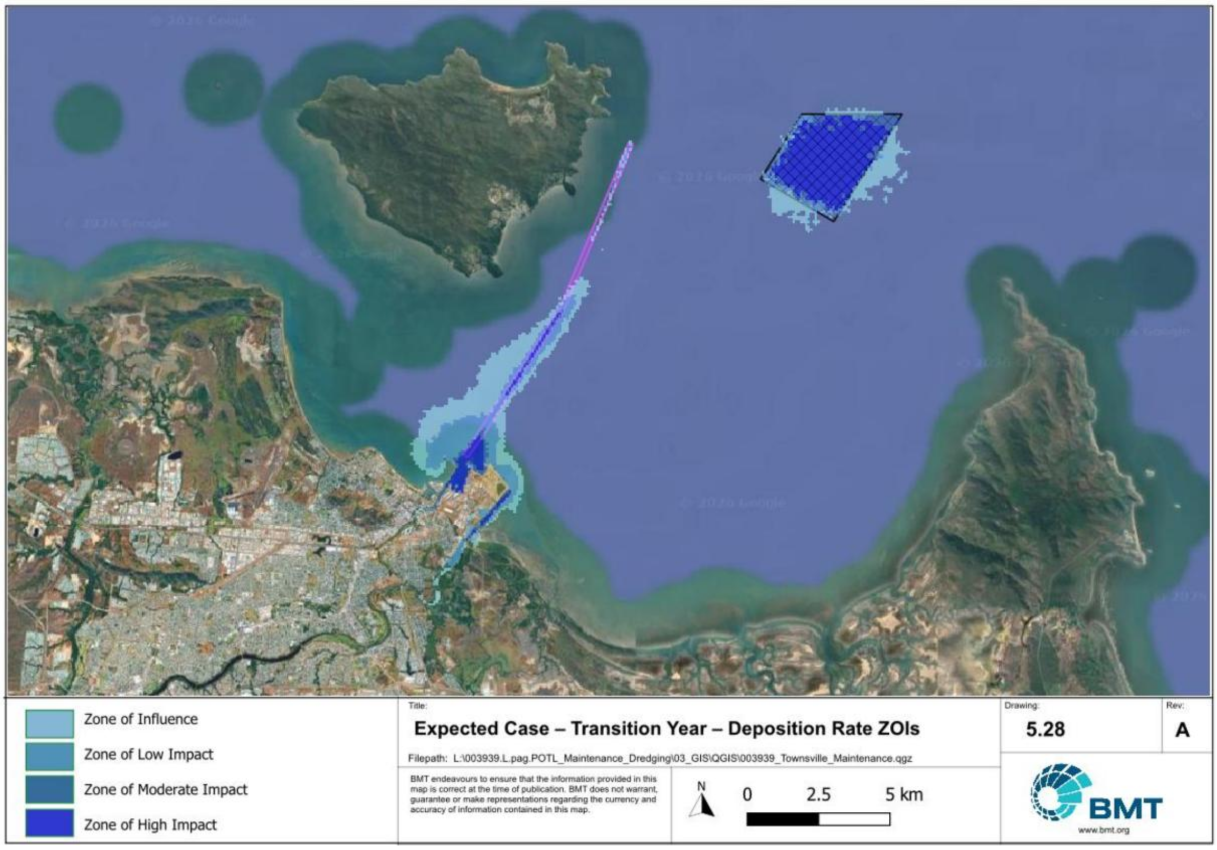


Figure 35. Deposition Rate ZOIs - Expected case – Transitional Year

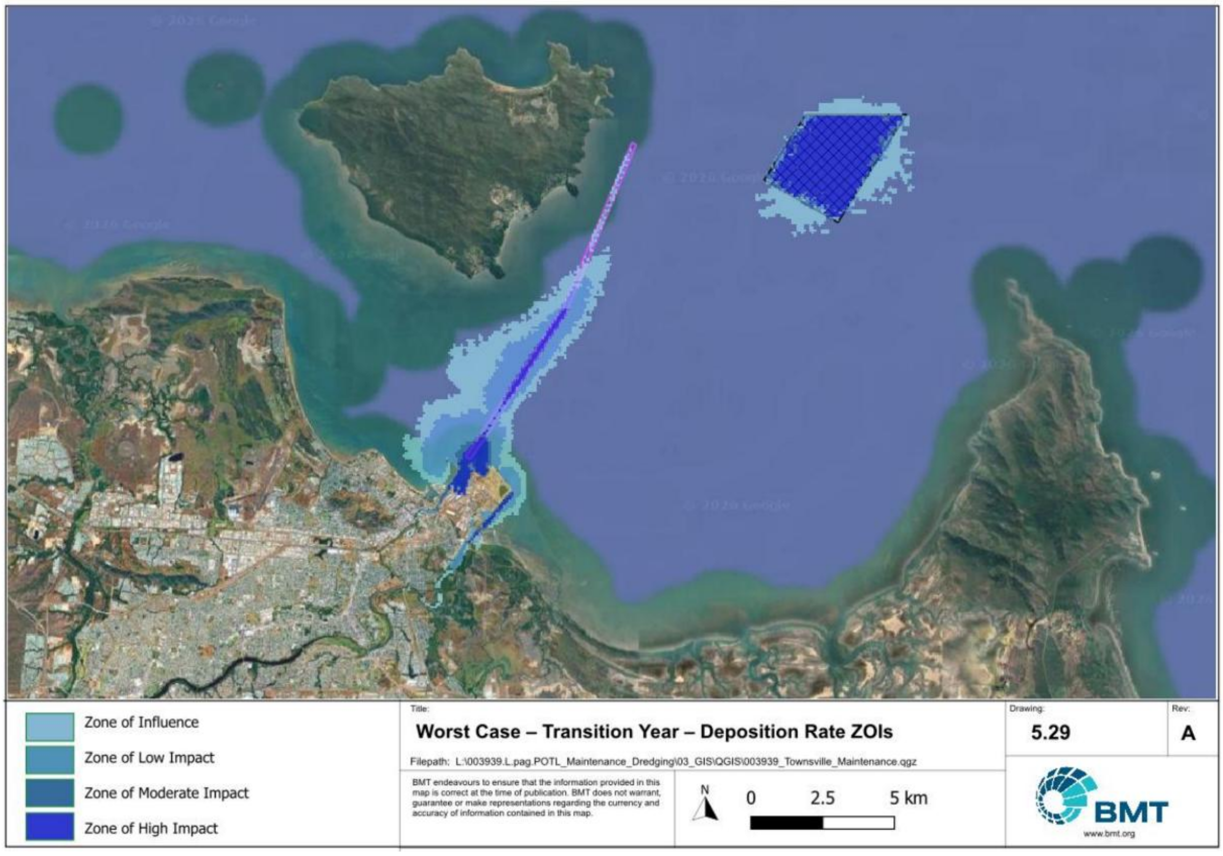


Figure 36. Deposition Rate ZOIs - Worst Case Scenario – Transitional Year

Risk Assessment

A comprehensive risk assessment covering all environmental, technical and operational, economic, social and cultural risk areas has been developed for the maintenance dredging activities at the Port of Townsville.

Table 12 is a high-level risk assessment, covering the key risk areas and areas of interest for maintenance dredging and placement activities within Cleveland Bay. This has been prepared using the GBRMPA risk assessment methodology (GBRMPA, 2017).

This risk assessment is reviewed annually in line with the preparation for scheduling maintenance dredging; and to incorporate any updates to the key risk areas for maintenance dredging and placement activities for the Port of Townsville. Updates may include changes to permits, lessons learnt from the previous campaign (including those from other ports), changes to key pieces of legislation, changes in risk ratings for marine biosecurity, etc.

Table 12: Risk Assessment for the Port of Townsville, to/from Maintenance Dredging Within Cleveland Bay

Issue	Potential Impact	Likelihood/ Consequence Inherent Risk	Controls	Likelihood / Consequence Residual Risk
ENVIRONMENTAL				**Using GBRMPA risk assessment**
Turbidity generated during dredging	Temporary covering of Sensitive receptors: Coral, seagrass and benthic communities	Possible / Moderate Medium	Previous in water monitoring around TSHD resulting in temporary turbidity plumes localised to source point, or within/directly adjacent to the channels. Maintenance dredge campaigns are of short duration (typically for 4 or 5 week period each year). Apply high standards of environmental management and well-maintained equipment. Voluntary avoidance of coral spawning period. Annual seagrass monitoring to review seagrass condition and resilience. Ambient water quality monitoring during the dredge campaign and dashboard available on the Port's website.	Unlikely / Insignificant Low
Turbidity generated during maintenance material placement in DMPA	Temporary covering of Sensitive Receptors: Coral, seagrass and benthic communities	Possible / Medium Low	Seagrass surveys undertaken to monitor extent of seagrass meadows in the bay, ephemeral deep-water seagrass is rarely found in or adjacent to the DMPA – notification to Qld Department of Primary Industries for placement as needed by marine plant disturbance accepted development requirements. Dredge Material Placement Area is 6km+ from sensitive receptors of the bay. The depth of the DMPA is beyond the 10m contour line to reduce re-suspension (average -12.5 m up to -16 m); The DMPA is 12km^2, with material placed across the whole site would register a minor change in depth (maximum of 4cm for a full campaign if placed in one area). Previous in-water monitoring around placement resulting in temporary turbidity plumes localised to source point and max distance of 800m away from point source. Benthic recovery monitoring resulted in limited changes in the seafloor profile for benthic communities, and recovery seen within 3 weeks of placement occurring.	Rare / Insignificant Low

Issue	Potential Impact	Likelihood/ Consequence Inherent Risk	Controls	Likelihood / Consequence Residual Risk
Underwater noise during dredging and placement	Masking megafauna communications; impacting on hunting behaviour	Possible / Moderate Medium	Maintenance campaigns are a short duration (typically for 4 or 5 week period. each year) using highly mobile and continuously moving vessel. All equipment is in good working order and maintained to operate efficiently. Comply with Qld government regulations for approach distances (caution & no approach zones) to limit close interactions with marine megafauna. Comply with Sea placement permit conditions to undertake visual observations for marine megafauna prior to commencement of placement activities.	Rare / Insignificant Low
Dredge vessel strike	Death/injury of protected megafauna species: Dolphins, whales, dugongs, crocodiles	Possible / Minor Low	*TSHD Brisbane* is a relatively shallow drafted vessel, that has a tall bridge tower – giving the Dredge Master and Fauna observer a clear view of the surrounding ocean. Dredge equipment is slow moving, allowing for most megafauna to be able swim away from and avoid the dredge. Vessels maintain the Queensland Government regulations for marine fauna approach zones to limit interactions with marine fauna. Comply with Sea placement permit conditions to undertake visual observations for marine megafauna prior to commencement of placement activities. A Dredge Environmental Management Plan is to be developed for review and acceptance by the Port prior to the arrival of the externally contracted dredge (which is to include consideration for marine fauna). Dredging only occurs in existing port infrastructure footprint, including the Sea and Platypus Channels. Sea placement activities only occurs in the designated and approved DMPA which is 6km+ from sensitive receptors.	Rare / Moderate Low
Dredge draghead entrains a turtle	Death/injury to turtles	Possible / Minor low	A Dredge Environmental Management Plan is developed for review and acceptance by the Port prior to the arrival of the externally contracted dredge (which is to include consideration for entrainment of turtles). Dredge dragheads have turtle diversion devices installed, designed to disturb (so they move away) any turtles in the path of the draghead. The suction of dragheads is only permitted to be turned on once the draghead is on the seafloor (i.e. not mid water column); and shut off before lifting off the seafloor again.	Possible / Insignificant Low

Issue	Potential Impact	Likelihood/ Consequence Inherent Risk	Controls	Likelihood / Consequence Residual Risk
Dredge draghead entrains other marine fauna	Death/ injury to other marine fauna: Fish, eels, rays or sea snakes	Unlikely / Insignificant Low	Dredge dragheads have turtle diversion devices installed, which will also act to disturb any other fauna on or close to the sea floor, near the draghead. The suction of dragheads only permitted to be turned on once the draghead is on the seafloor (i.e. not mid water column), and shut off before lifting off the seafloor again.	Rare / Insignificant Low
Introduced marine pests to Cleveland Bay from dredge vessel	Introduction of pest species to Cleveland Bay and/or Spreading marine pests from port infrastructure to the placement area	Possible / Moderate Medium	All vessels must comply with State and Cth Biosecurity Legislation (quarantine, ballast water management, inspections, and declarations). The Port has a marine biosecurity monitoring program (Q-SEAS). A Dredge Environmental Management Plan is developed for review and acceptance by the Port prior to the arrival of the externally contracted dredge, which is to include biosecurity obligations. Port of Brisbane undertakes opportunistic checks of the vessel and slips the vessel for detailed cleans (including niche areas) on a regular schedule. Introduced Marine Pest awareness is undertaken with Port employees, and opportunistic visual observations are undertaken on any equipment removed from the water to help identify any suspect biofouling. Assessment by a biofouling specialist to determine if white colonial sea squirt (WCSS) could survive transport to the DMPA in dredge material. Report findings report low risk of this occurring due to the nature of the WCSS and its preferred habitats. The Benthic recovery monitoring program (2025) did not identify any marine pest species occurring in the DMPA sediment samples.	Unlikely / Moderate Medium
Maintenance dredge material unauthorised for sea placement is placed at sea (in the DMPA)	Potential for environmental harm caused by sediments exceeding NAGD thresholds being placed in the DMPA	Possible / Moderate Medium	Project specific Dredge Management Plan is developed for review and acceptance by the Port prior to the arrival of the externally contracted dredge, which is to include designation of areas for dredging (i.e. No Dredge Zones for the TSHD). Upon completion of the SAP Implementation Report (as per the NAGD) new GIS layers are provided to the Dredge Operator to ensure the onboard navigation system contains the dredge area data. Pre-arrival management meetings are held to confirm the contractual arrangements for the specific campaign needs, including but not limited to: specified works agenda, scope, maps, approvals, communications process, dredge locations and volumes.	Possible / Minor low

Issue	Potential Impact	Likelihood/ Consequence Inherent Risk	Controls	Likelihood / Consequence Residual Risk
			Kick off meeting is held just prior to the dredge commencing its campaign in Townsville – re-affirming the agreed terms. Any amendments required to the specified dredge agenda (as agreed to by Port and dredge contractor in the kick-off meeting) are to be given in writing to the dredge contractor with enough time for the Dredge Master to review and confirm their onboard management plans allows for the changes (i.e. request not in contradiction to dredge procedures, permits, or authorised dredge areas etc.).	
Climate change impacts increasing or extending periods of stress on local sensitive receptors	Maintenance dredging placement potentially adding to climate stressors during the wet season on seagrass and corals	Likely / Major High	Following three years of coral bleaching due to the high sea temperatures in the wet season and the freshwater impacts from the 2019 floods – limiting maintenance dredging to the dry season will minimise adding to the stress on the system. There is an operational preference to avoid operating TSHD's in the cyclone season on the north coast of Queensland. Port of Townsville's preference is to head into the cyclone season with as much capacity as possible to provide the most flexibility to be operational within 24 to 48 hours after a cyclone or other severe weather event – therefore undertaking the main campaign in the dry season.iThe Port voluntary avoids coral spawning period. TSHD campaigns are generally for a short duration (usually 4 to 5 weeks) and occur annually. Sea placement activities occur only in the approved DMPA. This is 6km+ away from the closest corals and permanent seagrass meadows. The depth of the DMPA is beyond the 10m contour line to reduce re-suspension (average -12.5 m up to -16 m). In-water monitoring resulted in placement turbid plumes being registered for a maximum distance of 800m from point source and dissipating (back to background NTU levels) within approx. 90 minutes. Annual seagrass monitoring to review seagrass condition and resilience Ambient water quality monitoring during the dredge campaign and dashboard available on the Port's website.	Possible / Minor Low
Accidental release of hydrocarbons to marine environment	Potential for environmental harm by impacting water	Possible/minor	Vessel to only use biodegradable hydrocarbons as stated in their Environmental Management Plans where there is a risk of spill to water. Vessel check conducted to ensure that all machinery using hydrocarbons that may be exposed to water are biodegradable.	Unlikely/minor

Issue	Potential Impact	Likelihood/ Consequence Inherent Risk	Controls	Likelihood / Consequence Residual Risk
	quality and impact to marine fauna		Manual application of biodegradable grease to suction arm to prevent over greasing of machinery. Visual observations for hydrocarbon spills in water when vessel is operating. Emergency spill response plan in place, outlined in the Environmental Management Plan. Spill Kits on board in areas where spills have the potential to occur.	
OPERATIONAL AND TECHNICAL				**Using Port risk assessment**
Dredging or placement activity impedes commercial traffic	Temporary commercial disruptions to Commercial fleet Local and regional community	Unlikely / Minor Low	Temporary delays only (<hour) in production and operation for commercial operators. TSHD highly manoeuvrable, allowing for movement around other vessels. The commercial traffic for the Port of Townsville are responsible for following *the Port Procedures and information for Shipping – Port of Townsville* document, whilst working within Port limits. All Dredge Masters are responsible for maintaining close contact with Port Control, Vessel Traffic Services (VTS), and the Regional Harbour Master (RHM) whilst undertaking dredging and placement works at the Port of Townsville. A Temporary Notice to Mariners is to be issued by VTS/RHM before the Dredge arrives in Townsville, informing Mariners of the timing of the dredge. For dredging in the Ross River channel, a productive section of the navigational channel is to remain open to all vessel activity at all times.	Unlikely / Minor Low
Severe weather disrupts dredging resulting in a reduction of depth, restricting all shipping movements	Temporary disruption to Commercial fleet Local and regional community	Possible / Serious Medium	Temporary, short-term delays (days), disrupting all operations in and out of the Port. TSHD Brisbane protocol to assist with emergency dredging as needed. TSHD Brisbane can be mobilised and arrive in Townsville in a matter of days, it has high production rates to clear infrastructure, reducing further downturn for port operations. Port implements *POT 440 Emergency Response Plan Severe Weather Warnings* hydrographic surveys/soundings are to be undertaken as soon as practical, for the RHM to set the declared depths.	Unlikely / Serious Medium

Issue	Potential Impact	Likelihood/ Consequence Inherent Risk	Controls	Likelihood / Consequence Residual Risk
Dredging or placement activity impedes recreational traffic	Temporary disruption to Recreational fleet Local community	Unlikely / Minor Low	Temporary delays (<hour) in and out of Ross Creek by TSHD, or Ross River by cutter suction or grab dredge. Both mobile dredgers allowing movement around operations area.	Unlikely / Insignificant Low
Legislative changes restricting volumes permitted for sea placement – increasing the need for more land placement	Limited land available for placement of large volumes which would restrict dredging production. This would reduce the declared depths of seabed infrastructure causing navigation hazards, delays/stoppages in operations for commercial shipping, and transport network (loss of operation, loss of trade)	Possible/ Major Substantial	The Port of Townsville is responsible for undertaking adequate volume forecasting, to enable appropriate consideration of both State and Commonwealth Governments for the expectations around material volumes and development approvals; and in the Long-Term Maintenance Dredging Management Plan. Continue consultation with State and Commonwealth Governments, providing volume forecasting, sediment analysis and research and monitoring plans; and to manage expectations of maintenance dredging and placement requirements. The Port of Townsville revisits placement options for maintenance dredging material, including undertaking agreements with Townsville City Council for small volumes for beneficial reuse for beach renourishment; and with the Queensland State Government, in the event Townsville State Development Area requires maintenance dredge material.	Unlikely / Serious Medium
Vessel Interaction between maintenance dredge and capital dredge operations	Navigational safety; delays in operations; temporary disruptions for Commercial Fleet;	Likely / Serious Substantial	All vessels are responsible for following *the Port Procedures and information for Shipping – Port of Townsville* document, whilst working within Port limits. All Dredge Masters are responsible for maintaining close contact with Port Control, VTS, and the Regional Harbour Master whilst undertaking dredging and placement works at the Port of Townsville. Communications meetings organised to discuss vessel traffic management between the two operators; and positive communications encouraged to negate potential impacts.	Possible / Minor Medium

Issue	Potential Impact	Likelihood/ Consequence Inherent Risk	Controls	Likelihood / Consequence Residual Risk
	Navigational safety.			
Climate change impacts reducing availability of maintenance dredge windows due to other stressors on sensitive receptors	Restricted windows for maintenance dredging and sea placement. Restricting dredging production. Reducing declared depths and increasing navigational hazards.	Likely / Major High	Actively scheduling the TSHD campaign to occur between March and October allows for adequate time to complete the required campaign (duration and volumes). Revisiting placement options for maintenance dredging material at sea and on land. Strategic management of maintenance dredging requirements (monitoring siltation, targeting high silting areas first, bed leveling, maintaining silt trenches in high silt areas).	Possible / Serious Medium
Environmental Incident occurring in an approved maintenance dredge area contaminating the marine sediments and preventing the material from being placed at sea for at least 5 years (as per sampling under the NAGD for Sea Placement approvals)	Restriction of maintenance dredging to small scale grab dredge for material to be placed on land Loss of dredging production leads to shallow 'Declared Depths' which leads to smaller vessels using the berth (loss of operation, loss of trade); and navigational hazards	Likely / Serious Substantial	Stevedore licences and leases include environmental management provisions, and measures to avoid or minimise environmental harm. Stevedores and port users hold Environmental Authorities from the State Government as required for product handling. Operational Environmental Management Plans are required to be developed for review and acceptance by the Port prior to works commencing to avoid or minimise the potential for environmental harm. Marine sediment monitoring is conducted twice a year to monitor contaminant levels and trends in the berth pockets. Port maintenance dredging areas undergo SAP monitoring and analysis every 5 years as per the NAGD 2009.	Possible / Minor Medium

Issue	Potential Impact	Likelihood/ Consequence Inherent Risk	Controls	Likelihood / Consequence Residual Risk
			ECONOMIC	***Using port risk assessment**
Legislation changes increases the requirement for land placement of material currently authorised for sea placement - increasing the cost of maintenance dredging	Temporary loss of port access due to slow method of dredging for land placement (small scale grab dredging) Transport network and supply chain impacts due to increased cost in maintenance dredge for normal port operations (local and regional impacts)	Unlikely / Serious Medium	Continue consultation with State and Commonwealth governments, providing volume forecasting, sediment analysis and research and monitoring plans for awareness of Port needs. Ensure accurate volume forecasting is undertaken and communicated with both State and Commonwealth Governments to document expectations around material volumes, for future development approvals. Bathymetric survey undertaken to document sedimentation rates in Port infrastructure; and review for strategic management of the Ports seabed assets. Review beneficial reuse options for material placed on land, Continue discussions regards to moving maintenance material off site with DES, without the incursion of paying royalties for beneficial reuse of the material.	Unlikely / Minor low
Dredging or placement activity impedes commercial traffic	Financial loss in trade due to delays in shipping/commercial traffic in or out of the port	Possible / Minor Medium	Temporary delays (<hour) in production and operation for commercial operators. TSHD highly manoeuvrable, allowing movement around other vessels. All vessels operating in or for the port of Townsville are responsible for following *the Port Procedures and information for Shipping – Port of Townsville* document, whilst working with Port limits. The Dredge Master is responsible for maintaining close contact with Port Control, VTS, and the Regional Harbour Master (RHM) whilst undertaking dredging and placement works at the Port of Townsville. A Temporary Notice to Mariners is to be issued by VTS/RHM before the Dredge arrives in Townsville, informing Mariners of the timing of the dredge. For the Cutter Suction dredge in the Ross River channel, a productive section of the channel is to remain open to all vessel activity at all times.	Unlikely / Minor Low
Loss of infrastructure	Temporary, short term restricted	Possible / Major	Port of Townsville's preference is to head into the cyclone season with as much capacity as possible in the shipping channels, to provide the most flexibility to	Unlikely / Serious

Issue	Potential Impact	Likelihood/ Consequence Inherent Risk	Controls	Likelihood / Consequence Residual Risk
depth following a cyclone	access (weeks) to port for transport network and supply chains for local and regional communities across Northern and Central Queensland	Substantial	be operational within 24 to 48 hours after a cyclone or other severe weather event. Port implements *POT 440 Emergency Response Plan Severe Weather Warnings and* notifies the Port of Brisbane than emergency works may be required by the TSHD Brisbane. TSHD can arrive within days to undertaken emergency dredging, it has high production rates to clear infrastructure, reducing further downturn for port operations. TSHD Brisbane to return to maintenance dredging at Townsville as soon as hydrographic soundings have analysed, as critical infrastructure needs to get operational as soon as possible.	Medium
SOCIAL AND CULTURAL				***Using GBRMPA risk assessment**
Community disturbance by dredge (light, noise, fumes)	Short term (hours) localised impacts to within the vicinity of the dredge vessel. Short term loss of amenity for local community	Unlikely / minor Low	All equipment (noise reduction, lighting, combustion equipment) be regularly maintained as per manufacturers' specifications. Dredge vessels are to ensure that workplace Noise and vibrations are controlled and managed under existing occupational health and safety protocols. All noise from activities must not exceed the acoustic quality objectives specified in the *Environmental Protection Noise Policy 2008*. Exhaust stacks to be visually monitored to ensure no visual dark emissions; and appropriate adjustments of trim and ballast to ensure effective operation All complaints are to be investigated and reported on, regarding emissions produced by dredge vessels. Port manages the TSHD similarly to other contractors, and routinely audit and undertakes observations against environmental controls. Sound barriers installed around Cutter-suction booster pumps to direct noise away from the local residential areas, and surrounding environment.	Unlikely / Insignificant Low
Dredging or placement activity disrupts water traffic	Temporary disruption (<hours) for local recreational and/or commercial	Possible / Insignificant Low	TSHD vessel highly mobile in Cleveland Bay; for the Cutter Suction dredge in the Ross River channel, a productive section of the channel is to remain open to all vessel activity. Notice to Mariners issued by the Regional Harbour Master through VTS prior to Dredge arriving in Townsville.	Unlikely / Insignificant Low

Issue	Potential Impact	Likelihood/ Consequence Inherent Risk	Controls	Likelihood / Consequence Residual Risk
	vessels		Regular check in's with VTS and Port Control Tower of all vessels leaving the inner harbour / Ross creek ensuring clear passage. Port procedures manual is available online via Maritime Safety Queensland (MSQ) for all vessel operators to access (Port Procedures and Information for Shipping – Port of Townsville).	
Visual impact from dredging or placement	Temporary turbidity plume/s (<1.5 hours) localised to the source point, or within/ directly adjacent to, the channels or DMPA	Possible / Moderate Medium	Maintain a relevant Long-Term Maintenance Dredging Management Plan allowing for transparent and productive consultation with stakeholders, community, NGO's and local experts. Continue ambient and targeted monitoring programs within Cleveland Bay. Voluntarily avoid coal spawning timeframes be included in all dredge scheduling. Voluntarily avoid Magnetic Island Race week in dredge scheduling as far as practicable. Dredge material placement area is >6km from Magnetic Island. The depth of the DMPA is beyond the 10m contour line to reduce re-suspension (average -12.5 m up to -16 m). The DMPA is 12km^2, with material placed across the whole site. TSHD placement monitored resulting in temporary turbidity plumes localised to source point and max distance of 800m: limited changes in the seafloor profile for benthic communities – recovery seen within 3 weeks of placement occurring. Social media updates for community awareness of the upcoming dredge campaign.	Unlikely / Insignificant Low
Cultural heritage (indigenous and non-indigenous) impacted by dredging	Disturbance of cultural artefacts Impact on culturally important marine species for Local traditional owners	Possible / Moderate Medium	The Port of Townsville maintains a Cultural Heritage Management Plan, that sits with the State Government as required by the *Aboriginal Cultural Heritage Act 2003*. All Port personnel (employees and contractors) are required to undertake a site induction prior to commencing works, this induction includes Cultural Heritage, and reporting responsibilities if any items are found or uncovered on site. Marine megafauna risks addressed in Environmental section of this Risk Assessment. All dredge vessels are required to provide a Environmental Management Plan for review and approval, prior to any works being undertaken at the Port of Townsville.	Unlikely / Minor low

Issue	Potential Impact	Likelihood/ Consequence Inherent Risk	Controls	Likelihood / Consequence Residual Risk
			TSHD Brisbane operates using accurate hydrographic surveys of maintenance areas and is programmed with GPS positions to ensure the vessel stays within the approved maintenance dredge and placement areas (not disturbing new areas). Ambient and targeted monitoring programs continue (water quality, sediment, seagrass, light/PAR etc.), to monitor the health of the Bay, including culturally important marine fauna.	

7 IDENTIFICATION AND TREATMENT OF KEY RISKS

As identified in the risk assessment, the sensitive receptors of the bay are the key environmental concerns for maintenance dredging at the Port of Townsville. These concerns include impacts to coral and their spawning periods, the location of seagrass meadows and impacts from turbidity, and impacts to marine fauna within the bay.

To mitigate these impacts, adaptive measures are implemented by way of the scheduling of the TSHD Brisbane, and a detailed Dredge Environmental Management Plan (DMP) approved by the Port prior to the dredge arriving in Townsville:

- The scheduling of the TSHD is undertaken based on a risk assessment completed by each Queensland port which includes environmental windows to avoid. The Port is committed to limiting any impact maintenance dredging and placement activities have upon Cleveland Bay – which includes avoiding dredging during the coral spawning periods (October/November each year).
- To ensure specific operational controls for maintenance dredging and placement activities are considered/controlled in campaign-specific DMPs as drafted by the Port of Brisbane Corporation as owner and operator of the TSHD Brisbane – see Section 8.
- Where possible, for perception reasons, the Port requests dredging is avoided in school holidays mid-year (peak tourism season).

The treatment of key risks is also managed via research and monitoring. The Port has been undertaking research and monitoring programs to better understand and manage potential impacts the Port, our operations and maintenance dredging and placement activities has on the surrounding environment.

Section 9 of this LTMDMP has been updated with the Port' current research and monitoring programs.

Table 13 shows the historic ambient and targeted monitoring that has occurred within Cleveland Bay, by the Port since 2009.

Table 13: Historic Ambient and Targeted Research Program at the Port of Townsville.

Year	Benthic Fauna	Introduced Marine Pest (IMP)	Bioavailability/toxicity/ Elutriate Testing	Coral	Hydrocarbons	Hydrodynamics/Sediment characteristics	Marine Mega Fauna	Nutrients/ Pesticides / Herbicides	Photosynthetically Active Radiation (PAR)	Seagrass	TBT / Organic Carbon	Trace Metals	Turbidity (NTU)	Underwater noise	Shorebird
2025	✓	✓		✓		✓		✓	✓	✓		✓	✓		
2024		✓		✓			✓	✓	✓	✓		✓	✓	✓	✓
2023		✓		✓			✓	✓	✓	✓		✓	✓	✓	✓
2022		✓		✓			✓	✓	✓	✓		✓	✓	✓	✓
2021	✓	✓		✓			✓	✓	✓	✓		✓	✓	✓	✓
2020	✓	✓		✓			✓	✓	✓	✓		✓	✓		✓
2019	✓	✓		✓		✓	✓	✓	✓	✓		✓	✓		✓
2018	✓		✓			✓		✓	✓	✓	✓	✓	✓		✓
2017	✓		✓						✓	✓	✓	✓	✓		
2016	✓						✓		✓	✓		✓	✓		
2015	✓				✓		✓	✓	✓	✓		✓	✓		
2014				✓				✓		✓		✓	✓		
2013	✓			✓		✓		✓		✓		✓			
2012			✓	✓		✓	✓	✓		✓	✓	✓	✓	✓	
2011	✓		✓			✓	✓			✓	✓	✓		✓	
2010	✓		✓			✓	✓			✓	✓	✓			
2009			✓		✓	✓	✓			✓	✓	✓	✓		
2008	✓		✓		✓		✓	✓		✓	✓	✓	✓		
2007										✓		✓			
2006					✓			✓				✓	✓		
2005			✓			✓		✓			✓	✓			
2004			✓			✓		✓				✓			
2003			✓			✓					✓	✓			
2002			✓		✓	✓		✓			✓	✓			
2001	✓			✓		✓						✓			

✓ = *monitoring conducted.*

8 ENVIRONMENTAL MANAGEMENT

To manage the environmental risks associated with dredging and placement activities, the Port follows the recommended structure of the MDS (Figure 37), as well as Ports Australia's *Code of Practice for Dredging and Dredge Material Management* (Figure 38).

In following these structures, the Port reviews and approves the contracting dredge owner's DMP each year prior to the dredge vessel arriving in Townsville. This includes the TSHD Brisbane, owned by the Port of Brisbane Corporation, and cutter suction dredge or mechanical grab dredge, as contracted from time to time by the tender process.

The Port has a range of other small plant that are internally operated, primarily the mechanical dredge, however, there is also the potential for backhoe and suction dredges, though these are currently not utilised. The Port has a range of operational controls for the mechanical dredge and completed a full DMP for its operation and controls in 2021.

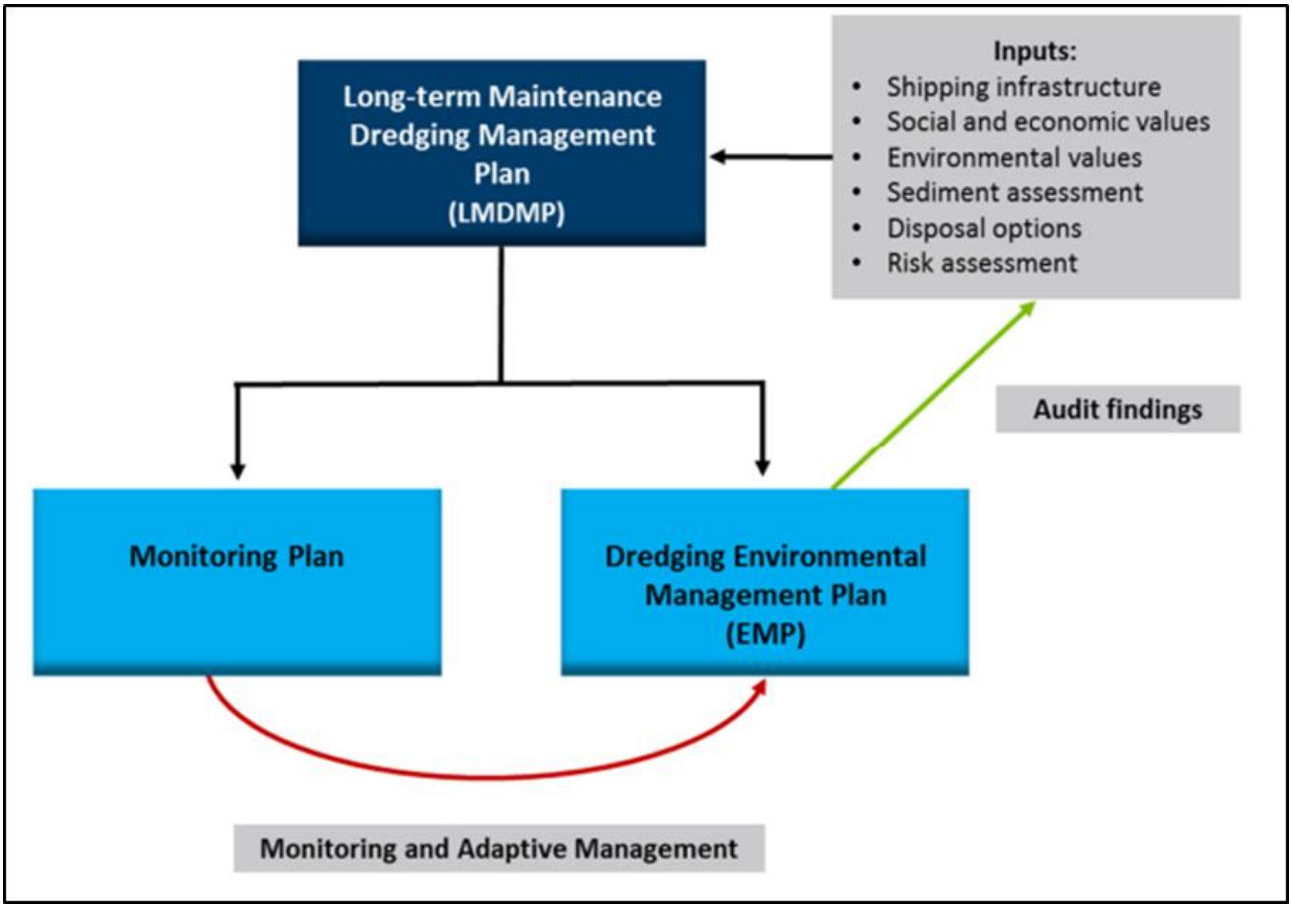


Figure 37: Dredge Management and Monitoring Elements (MDS 2016).

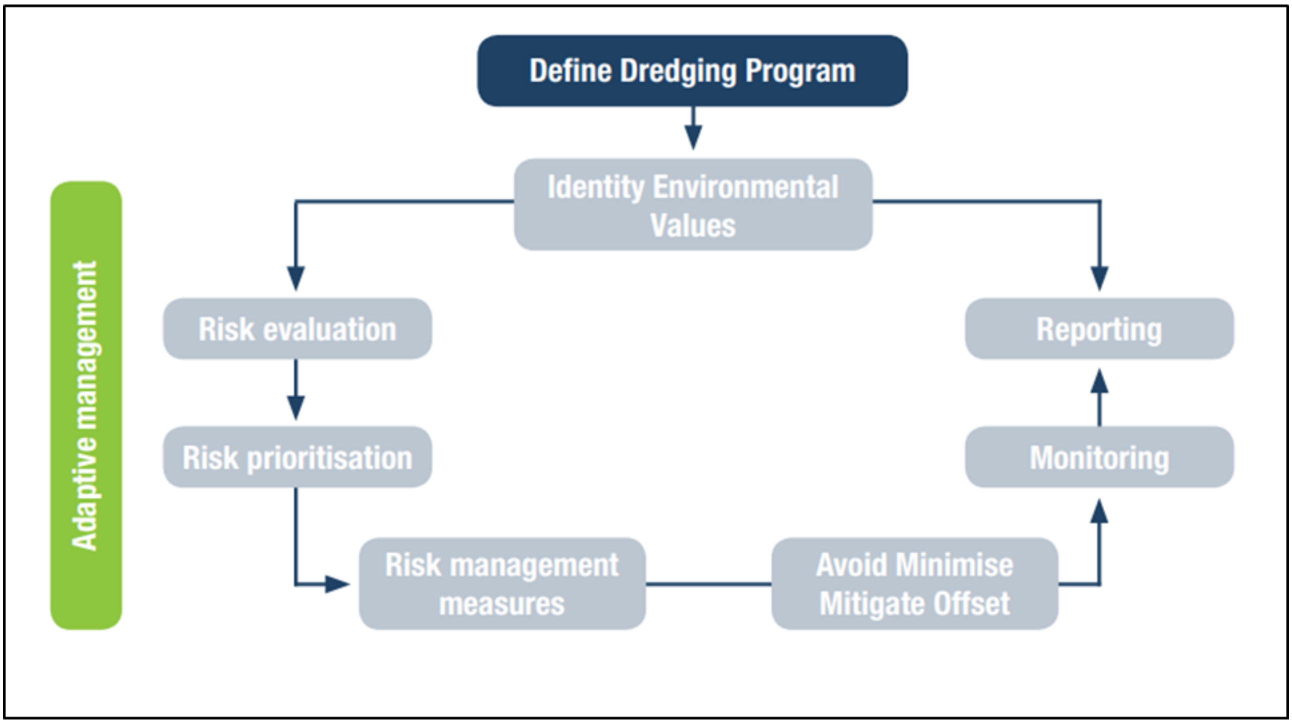


Figure 38: Application of Adaptive and Risk Assessment Management Process (Ports Australia 2016).

8.1 EXAMPLE DREDGE ENVIRONMENTAL MANAGEMENT PLAN

Whilst DMPs can vary per operator, structures usually are similar. The TSHD Brisbane's DMP has followed the following structure:

1. *Description of Port of Brisbane Corporation's use of TSHD Brisbane and requirement of the DMP as part of their EMS.*
2. *Description of the TSHD Brisbane*
3. *Location and description of the Port of Townsville*
4. *Description of the approved activity at the Port of Townsville*
5. *List of environmental legislation and approvals as applied to dredging at the Port of Townsville*
6. *Roles and responsibilities of key personnel associated with dredging at the Port of Townsville*
7. *The DMP (structure)*
8. *Management plans*
   - *Waste management*
   - *General and recycling wastes*
   - *Sewage treatment*
   - *Hazardous waste*
   - *Biosecurity*
   - *Emissions*
   - *Turbidity control*
   - *Protected marine fauna*

- *Cultural heritage*
- *Ballast water management*
- *Vessel washdown; and*
- *Bunkering of fuel*

9 *Incident reporting*

10 *Environmental monitoring*

- *Environmental complaints*
- *Dredge activity and observations*
- *Turbidity*
- *Cultural heritage*
- *Protected fauna*

11 *Emergency procedures*

12 *Emergency contact details*

The Port contracts maintenance dredging to the Port of Brisbane Corporation using the TSHD Brisbane. The main responsibility for following the DMP and the Port approval conditions lies with the TSHD Brisbane. The Port is however responsible for undertaking all pre, during and post hydrographic surveys, environmental monitoring (monitoring of marine fauna is the responsibility of the Dredge Master during dredging), auditing and reporting. The Port also has an oversight role for deviation from the DMP, and demonstration of all condition compliance, noting the Port of Brisbane Corporation is in charge of the plant.

8.2 TYPES OF EQUIPMENT USED FOR DREDGING AT THE PORT OF TOWNSVILLE

The methods for maintenance dredging are determined based on the volume and area to be dredged, equipment availability, and the placement method. The majority of maintenance dredging at the Port of Townsville is undertaken using a TSHD. A cutter suction dredge is utilised in shallower waters and smaller scale dredging works (e.g. spot removal, minor berth pocket dredging and areas inaccessible for TSHDs) may be undertaken using a mechanical grab dredge with a split hopper barge. The Port also maintains declared depths and vessel safety between dredging campaigns, and some works are supported by bed levelling. Operation of any dredging method could be carried out by a number of dredgers dependent on their availability and will be in accordance with a DMP developed by the dredging contractor for the specific dredging campaign, taking into account the requirements of the Port's Environmental Management Plan (EMP) guideline and any permits.

The production rates of each maintenance dredging option dictate the areas in which they operate for maximum efficiency. Further details of maintenance dredging methods are provided below.

8.2.1 TRAILER SUCTION HOPPER DREDGE

A TSHD is typically used for the Port's annual dredging campaign where significant volumes of material can be removed in relatively short periods in deeper waters with no or limited navigational impacts. Since 2001, the TSHD Brisbane has been used for the majority of dredging at the Port of Townsville (Figure 39). The TSHD Brisbane (84m long and ~3,500t displacement) is a relatively small TSHD, owned and operated by the Port of Brisbane Corporation. The TSHD Brisbane dredges at many Queensland ports, therefore maintenance dredging works at the Port of Townsville are scheduled dependent on the TSHD Brisbane's availability and may be influenced by dredging requirements at other Queensland ports.

Figure 39: Trailer Suction Hopper Dredge Brisbane.

Hydrographic survey information is loaded onto the TSHD Brisbane's onboard computer system and the vessel can operate in either automatic mode, where onboard computers control vessel dredge systems, or manually. The onboard computers also assist in accurately positioning the vessel by displaying a differentially corrected GPS position of the vessel track against intended dredge areas.

The vessel dredges sediment by lowering two suction heads (one on either side of the vessel) to the seafloor whilst steaming slowly (1-3 knots) ahead. Large onboard pumps draw water through the heads entraining sediments from the seafloor and depositing a mixture of water and sediments into the vessel's central hopper (Figure 40). The total volume of the hopper is 2,900m^3, but the effective capacity of the hopper is dependent upon the type of material being dredged, ranging from approx. 1,700m^3 for sands to approx. 2,800m^3 for fine silts. Once the hopper has reached optimum capacity for the type of material being dredged, the vessel steams to the DMPA.

During placement at sea, the material is generally "bottom discharged" by opening large valves in the floor of the hopper.

An environmental valve, or 'green valve' (Figure 41), is used in the dredging industry to reduce the surface turbidity during overflow of the hopper. While the green valve does not reduce the amount of sediment released from a dredge, it does reduce the extent of turbid dredge plumes in the water column and limits the mobility of dredge material.

The overflow from the TSHD consists of water, sediments and air. Without a green valve, the air in the overflow carries the sediment fines to the surface. Consequently, the sediment fines are dispersed over a much larger area increasing turbidity in the water column. With a green valve, the overflow is choked such that a constant fluid level is maintained in the hopper and, as a result, no air is taken down with the overflow water. This results in more sediment taken to the seabed and less sediment suspended in the water column as turbid plumes. The material on the seabed is less likely to become mobilised into areas of sensitive ecological receptors compared to material suspended in the water column.

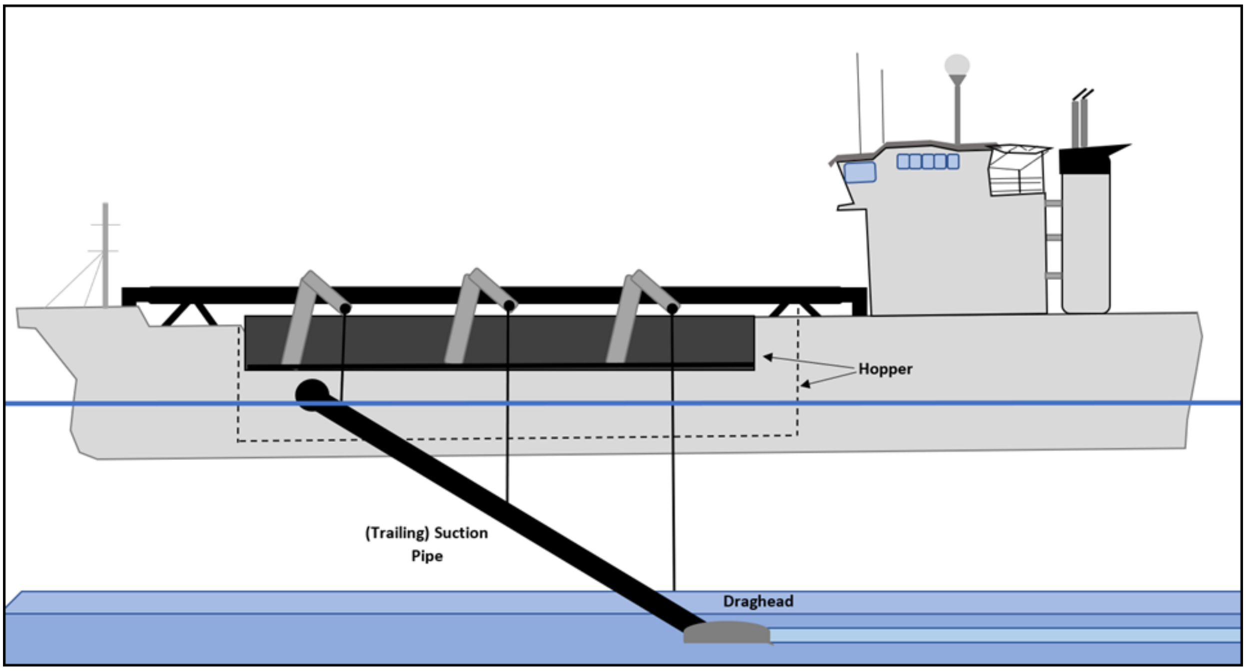


Figure 40: Trailer Suction Hopper Dredge, Working View.

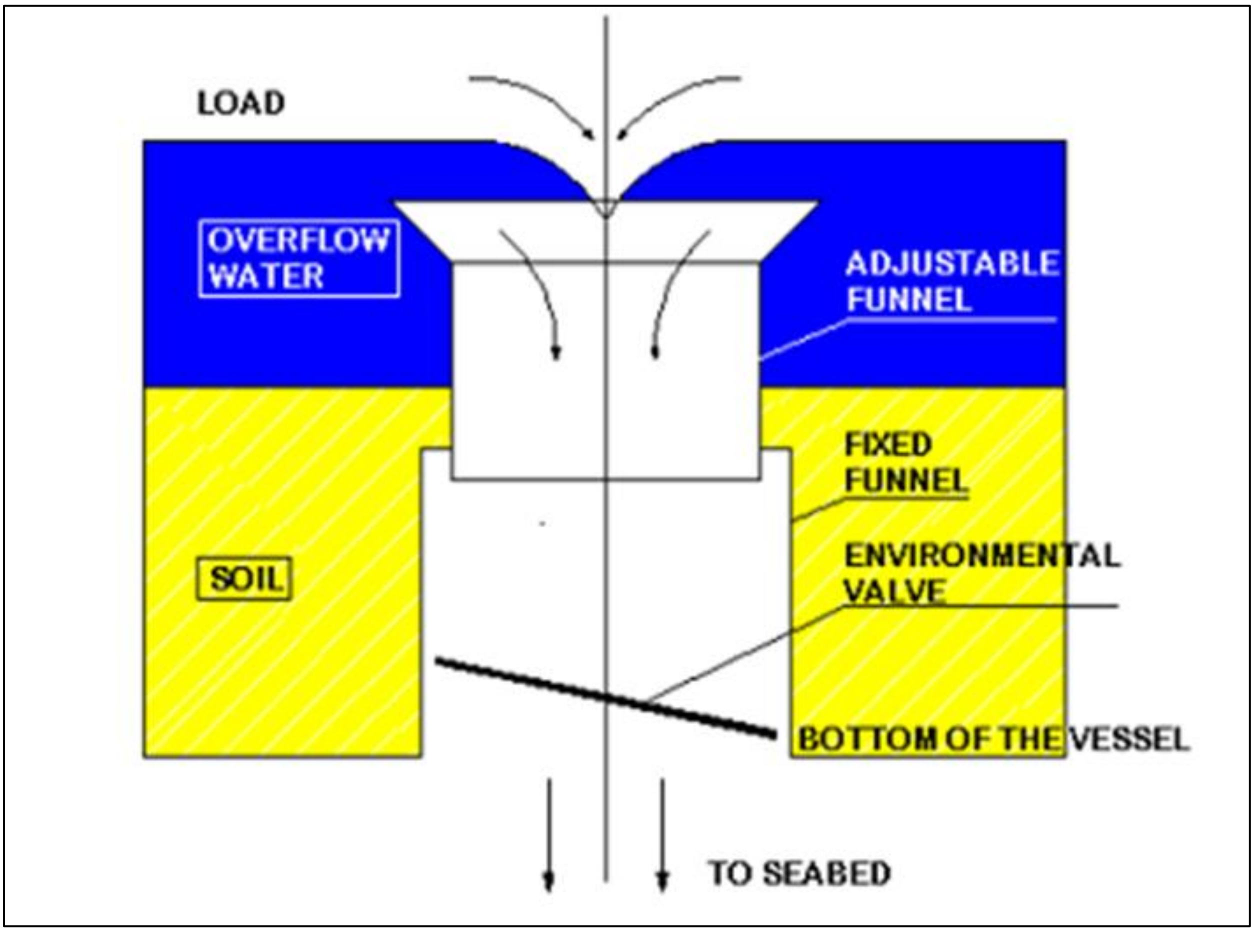


Figure 41: Diagram of an Environmental Valve or 'Green Valve'.

8.2.2 MECHANICAL GRAB DREDGE AND SPLIT HOPPER BARGE

A mechanical grab dredge and split hopper barge (Figure 42) is typically used for minor dredging work which generally only requires the removal of small volumes of material; in areas where larger dredging vessels are unable to access; and/or to remove material which does not meet NAGD 2009 requirements for sea placement and therefore, is required to be placed onshore. This method of dredging is slow and operation is often suspended due to commercial vessels requiring access to the Port's berths; once the berth is free operation can then again commence (which could be days or weeks depending on cargo). This material is then pumped to shore, rather than sea placement due to operational requirements.

Mechanical grab dredging is a labour intensive and slow method of dredging small volumes, the Port can average anywhere up to approximately 20,000m^3 a year, depending on the areas requiring dredging and previous scheduling. This method of dredging occurs opportunistically throughout the year when areas of port infrastructure are free from commercial/cargo vessels.

Management controls and mitigation actions designed to minimise environmental and operational impacts and to meet permit conditions, are documented via the Port's integrated management system. The Port also maintains management over tailwater although this is limited due to the slow scale of the mode of dredging.

Figure 42: Mechanical Grab Dredge and Split Hopper Barge.

8.2.3 CUTTER SUCTION DREDGE

A cutter suction dredge is generally made up of two parts: the lead cutter boat, and the suction pipe boat that locks into the lead boat. The dredge is equipped with a rotating cutter head, which is mounted to the head of the suction pipe (Figure 43). Maintenance material sediments are sucked up as they are cut, by the dredge pumps on board the tail boat and transported by floating pipeline, either to land or to a split hopper barge for sea placement. This type of dredge is a manually operated dredge that is fixed to the river bed via spud poles during cutting/suction works to stabilise and manoeuvre the dredge machinery.

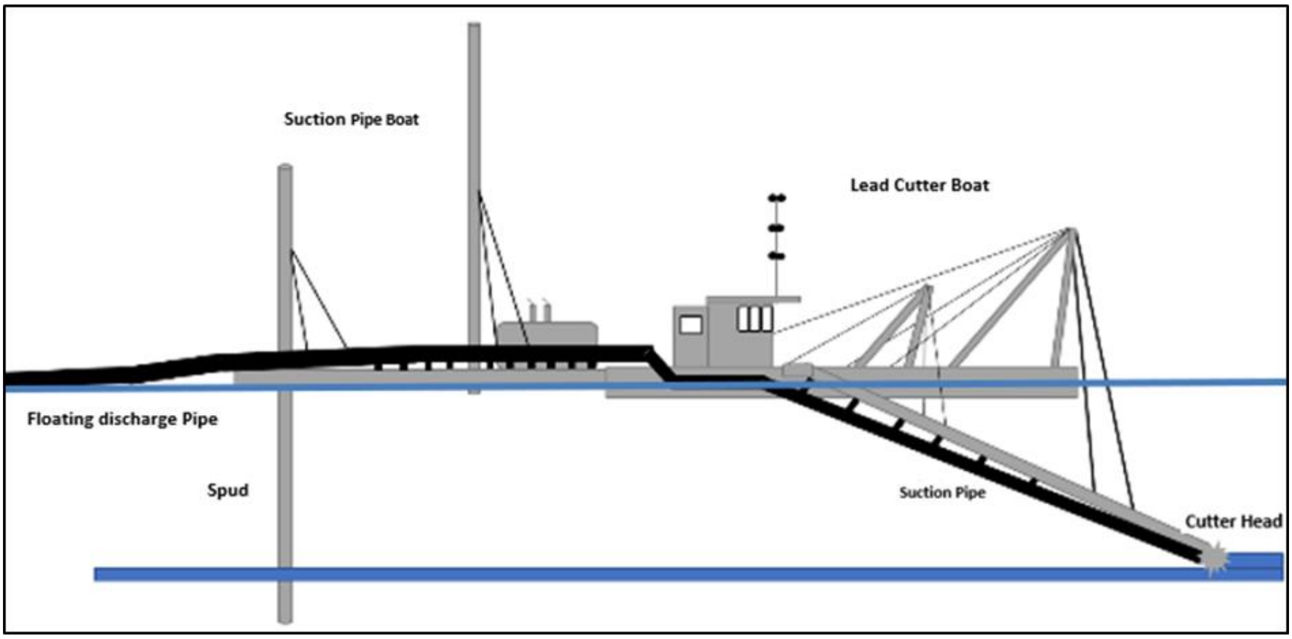


Figure 43: Cutter Suction Dredge, Working View.

8.2.4 SUCTION DREDGE

For operational purposes, occasionally different plant and equipment, such as small suction heads and barges, may need to be utilised, usually for small volumes or in areas inaccessible by other dredging equipment. This method relies purely on the water velocity to mobilise the sediment with material going into a barge and either transported to the sea DMPA for sea placement or pumped ashore to the land DMPAs for land placement.

8.2.5 BACKHOE/MECHANICAL DREDGING

A backhoe dredger consists of a long reach excavating unit mounted on a pontoon or secured barge, which is positioned by spuds (legs). After positioning, the pontoon is slightly raised from the water by winches to create additional downward spud pressure and reduce wave effects. The hydraulic backhoe is mounted at the lowest point of the pontoon to facilitate maximum dredging depth. The buckets and booms can be replaced or changed to suit the depth of dredging and type of materials to be dredged and this method can move stiff material. A backhoe dredger allows for a very targeted campaign and can achieve depths of -15.5m LAT with material going into a barge and either transported to the sea DMPA for sea placement or pumped ashore to the land DMPAs for land placement.

8.3 AFFILIATED WORKS AND MAINTENANCE DREDGING

8.3.1 SOUNDING

To ensure all maintenance dredging is undertaken only in approved areas, to approve depths, and within approved volumes, the Port undertakes hydrographic surveys (soundings) of the harbours, channels, berths, DMPA etc. These soundings are achieved by using both multibeam and single-beam echo sounder systems to produce accurate hydrographic data and sounding charts. The TSHD Brisbane uploads the pre-dredge soundings to align their onboard navigational positioning system. Soundings are undertaken after dredging has finished, to confirm depths, areas and volumes meet the approved limits (both State and Cth regulations).

8.3.2 BED LEVELLING

Bed levelling is a method used to support other forms of dredging, without the need to dredge. Bed levelling uses a beam to push peaks of sediment into lower areas and flattens out a berth or operational area.

The Port operates a bed leveller (a 16m work vessel pushing a 14.5 x 6m barge via a purpose-designed pushing frame) to assist in maintaining declared depths at berths and operational areas within the Port of Townsville (Figure 44). The barge machinery consists of a diesel powered hydraulic power pack, lifting derrick and winch gear, which supports and controls the depth of the beam. The barge is also fitted with a bow thruster to assist in turning the work vessel/barge in confined areas. All barge machinery may be remotely controlled via a radio on the work vessel. For larger areas, the Port will engage a contractor with bigger equipment to undertake the required bed leveling.

The bed leveller maintains depth by relocating and flattening sediment displaced by vessel and tide movements. Sediment is moved by lowering a steel beam (of various sizes) to the declared height of the area being worked. The work vessel then steers a predetermined course using the GPS plotter as a reference. The beam acts as a grader blade and pushes material from high peaks to lower areas, which is essential in maintaining declared depths close to design depths. Unlike the dredging methods described above, the bed levelling method does not entrain sediment into the dredging equipment.

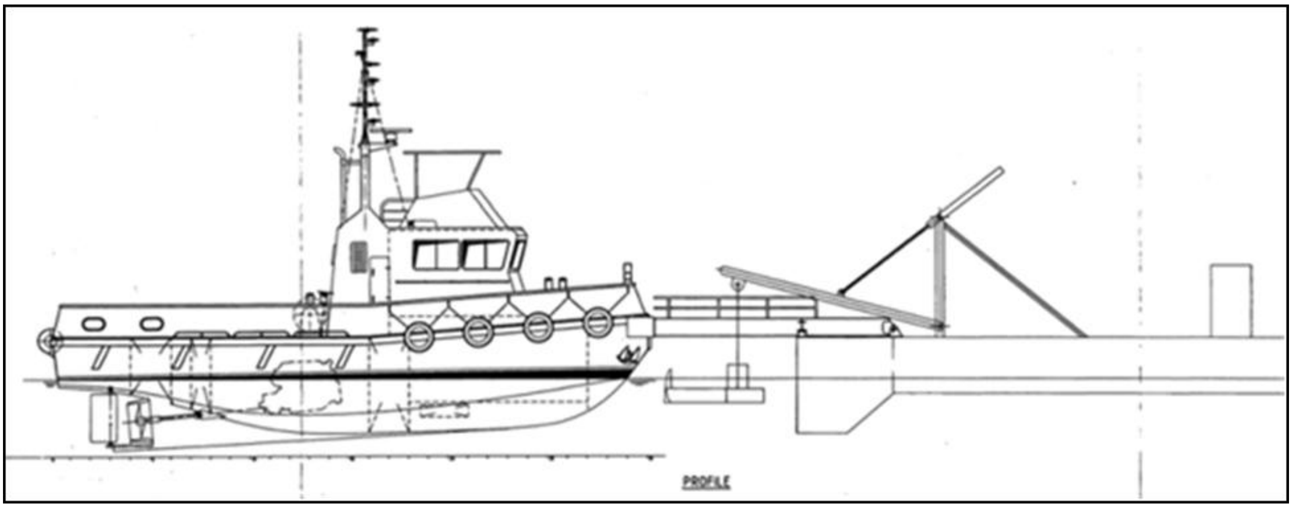


Figure 44: Bed levelling Equipment.

9 MONITORING FRAMEWORK

The Port undertakes a range of ambient, impact and real-time monitoring programs before, during and after maintenance dredging campaigns (Table 15). These are to ensure the health of Cleveland Bay remains high, whilst helping to identify, manage or reduce any detected impacts to sensitive receptors known within the bay, and around Magnetic Island. A number of these programs are conditioned by development approvals and not just for maintenance dredging. In 2025 the Port completed an independent review of its monitoring programs listed in Table 16, with recommendations from this review incorporated into the Ports management framework.

Table 14: Monitoring Programs at the Port of Townsville.

Monitoring Type	Description
Ambient monitoring **(PORT WIDE)**	The Port undertakes a number of ambient monitoring programs throughout the bay, and not just for maintenance dredging. These programs include marine water, marine sediment, air quality (and dust), biosecurity, light/PAR, seagrass, potable water, trade waste, groundwater and stormwater. These programs set out to understand and monitor not only the marine environment of Cleveland Bay but also how the Port may impact upon the surrounding environment.
Impact monitoring **(MAINTENANCE DREDGE CAMPAIGN-SPECIFIC)**	The Port has undertaken a number of impact monitoring programs, which required dredge plume monitoring, including plumes generated by placement activities. Impact monitoring is also undertaken by way of real-time water quality equipment positioned in the bay and through the use of satellite imagery (MODIS). The data captured by these buoys helps to identify direct and/or indirect impacts from maintenance dredging and placement activities on the sensitive receptors within the bay.
Real-time monitoring **(MAINTENANCE DREDGE CAMPAIGN-SPECIFIC)**	The Port has a number of real-time water quality buoys operating within Cleveland Bay. These include surface water quality buoys measuring turbidity and conductivity 1 meter below the waters surface, and benthic frames measuring turbidity, conductivity and light on the seafloor near sensitive receptors. Real time water monitoring is utilised for both ambient monitoring and impact monitoring – collecting data on turbidity and conductivity in different sections of the bay, as well as ecologically relevant monitoring of light availability for photosynthesis by corals and seagrasses. This data is used to monitor water quality during dredging and placement areas. A real-time water quality dashboard has been developed for these water quality buoys and a link has been placed on the Port website for public access.

The results of campaign-specific monitoring are reviewed after each campaign, with any impacts identified presented to the TACC, and then captured in the following year's campaign-specific DMP and environmental monitoring program.

Table 15: Research and Monitoring Programs 2027-2037.

Research and Monitoring Area		Objective	Methodology
Monitoring			
1	Monitoring of Turbidity and PAR near Sensitive Receptors	Assess contribution of maintenance dredging and dredge placement activities on turbidity and PAR levels	Turbidity and PAR monitors with data loggers on underwater benthic frames serviced on a regular basis by contractor with water quality grab samples taken to assist with calibration/verification of results
2	Ambient Monitoring of Turbidity, Temperature and Conductivity near Sensitive Receptors and in Cleveland Bay	Provide real-time data on turbidity, temperature and conductivity conditions to the public	Real time surface water quality sensors deployed on buoys/port infrastructure serviced on a regular basis with water quality grab samples taken to assist with calibration/verification of results
3	Ambient Monitoring of Various Water Parameters in Receiving Environment	Assess water quality conditions in receiving environment around the Port's receiving environment at different times and conditions	Periodic grab sampling of marine waters to assess physio-chemical, metallic and nutrient conditions
4	Ambient Monitoring of Marine Sediments in Receiving Environment	Assess marine sediment conditions in receiving environment around the Port's receiving environment at different times and conditions	Periodic Van Veen grab sampling of marine sediments to assess contaminant levels
5	Sediment Sampling and Analysis Plan (SAP)	Fulfil NAGD requirements	Marine sediment sampling by contractor in accordance with methodology specified in NAGD to assess suitability of maintenance dredge material for unconfined placement
6	Monitoring of Seagrass in Cleveland Bay	Assess any changes to seagrass distribution and diversity in Cleveland Bay	Surveys via helicopter, boat-based free-diving and boat-based CCTV camera-sled toes by contractor
7	Monitoring of Coral in Cleveland Bay	Assess any changes to coral distribution and diversity in Cleveland Bay	Surveys via boat-based free-diving and cameras by contractor

Research and Monitoring Area		Objective	Methodology
8	Marine Megafauna Monitoring around Dredging Equipment	Identify marine megafauna interactions with dredging equipment	On board observations by dredge vessels.
9	Aerial Review of Turbidity in Cleveland Bay	Using Satellite imagery to assess visible turbidity levels in Cleveland Bay and around DMPA	Assessment of current and historical Modis Satellite imagery and computer corrections by contractor
Research			
10	Ongoing Work to Support a DNA Library	Assess community composition of benthic fauna in Cleveland Bay	DNA analysis and compilation of library by contractor
11	Research into underwater noise levels if using dredge equipment other than TSHD Brisbane	Assess noise profile of new dredge vessel compared to TSHD Brisbane on underwater noise levels	Underwater noise monitoring during dredging and placement. Triggered by proposed use of new equipment

10 PERFORMANCE REVIEW

As described in Section 1.2, the Port's objectives for this LTMDMP are:

a) Maintaining safe navigation for the continued operation of both Ports;

b) Ensuring the OUV of the GBRWHA and sensitive receptors surrounding both the Port of Townsville and the Port of Lucinda are maintained;

c) Ensuring a robust, transparent long-term planning approach to the management of sediments within port infrastructure;

d) Continuing the long-term proactive and environmentally responsible management of maintenance dredging and material placement at the Port of Townsville;

e) Effectively communicate to stakeholders the measures and controls for managing maintenance dredging activities.

Performance indicators used to determine whether these objectives are being met and/or to better inform future risk assessments are:

- Routine maintenance dredge volumes do not exceed permit conditions.
- Incorporate information from the ambient and targeted monitoring and research projects into the risk assessment, decision making and scheduling when planning timing of dredge with Queensland Ports and Port of Brisbane Corporation.
- No material is placed at sea that has not been assessed against NAGD 2009 and approved for placement (noting a new SAP is required every 5 years).
- Demonstrated evidence that all dredging undertaken is done so under a relevant EMP or DMP.
- Full compliance with State and Cth approvals and reporting requirements including notification processes and volume reporting.
- Undertake a full review of the LTMDMP at 5 years and 10 years, and an annual review of the performance indicators to assess their effectiveness and relevance.

SCHEULE 2 – PORT OF LUCINDA

11 PORT LOCALITY, SETTING AND SHIPPING

11.1 LOCATION AND ENVIRONMENTAL SETTING

Port of Lucinda (18°31'S, 146°21'E) sits almost 100 kilometres north of Townsville, approximately 26km north-east of the township of Ingham. Lucinda is located within the Hinchinbrook Shire Council Region, and within the northern corner of Halifax Bay, east of the Herbert River mouth and Hinchinbrook Channel. The Port sits below Hinchinbrook Island (Figure 45).

The Port of Lucinda exports sugar grown and milled from the surrounding district (Victoria and Macknade Sugar Mills). It is equipped with onshore sugar handling and storage facilities, as well as a single trestle jetty and conveyor running out to an offshore berth and ship loader.

The jetty is one of the longest of its type in the world, extending 5.6 kilometres out to sea and dipping 1.2 metres over its length as it follows the curvature of the earth. Sugar takes 22 minutes to travel along the conveyor from the onshore storage sheds to the offshore ship loader.

The port terminal is operated by Sugar Terminals Limited.

Figure 45: Port of Lucinda in Halifax Bay.

11.2 PORT OF LUCINDA OVERVIEW

The Port of Lucinda was gazetted in 1892, born out of the need for an all tide access facility for the growing sugar cane industry's exports. The bulk terminal at Lucinda was opened in 1958, with the construction of a new L shaped concrete wharf with wooden piles (PCQ 2004). Due to the shallowing of the Hinchinbrook Channel, this inner wharf was no longer a long-term solution; in 1975 the construction of the (current) offshore jetty began, finishing in 1979. This 5.6km long jetty houses a conveyor system to move sugar out to the offshore berth. The berthing depth was designed at 14m deep, and due to the self-scouring nature of this area of the bay, the berth does not require maintenance dredging.

The Port of Lucinda has State designated Port Limits (Figure 46), which differ from the exclusion zone from the Cth Marine Park – see Figures 48 and 49 in Section 12.1.3.

The Port still maintains use of the inshore jetty, for public fishing and pilot boarding access. Directly adjacent the inshore wharf is a shallow water boat ramp currently in use by a barge operator to and from Palm Island.

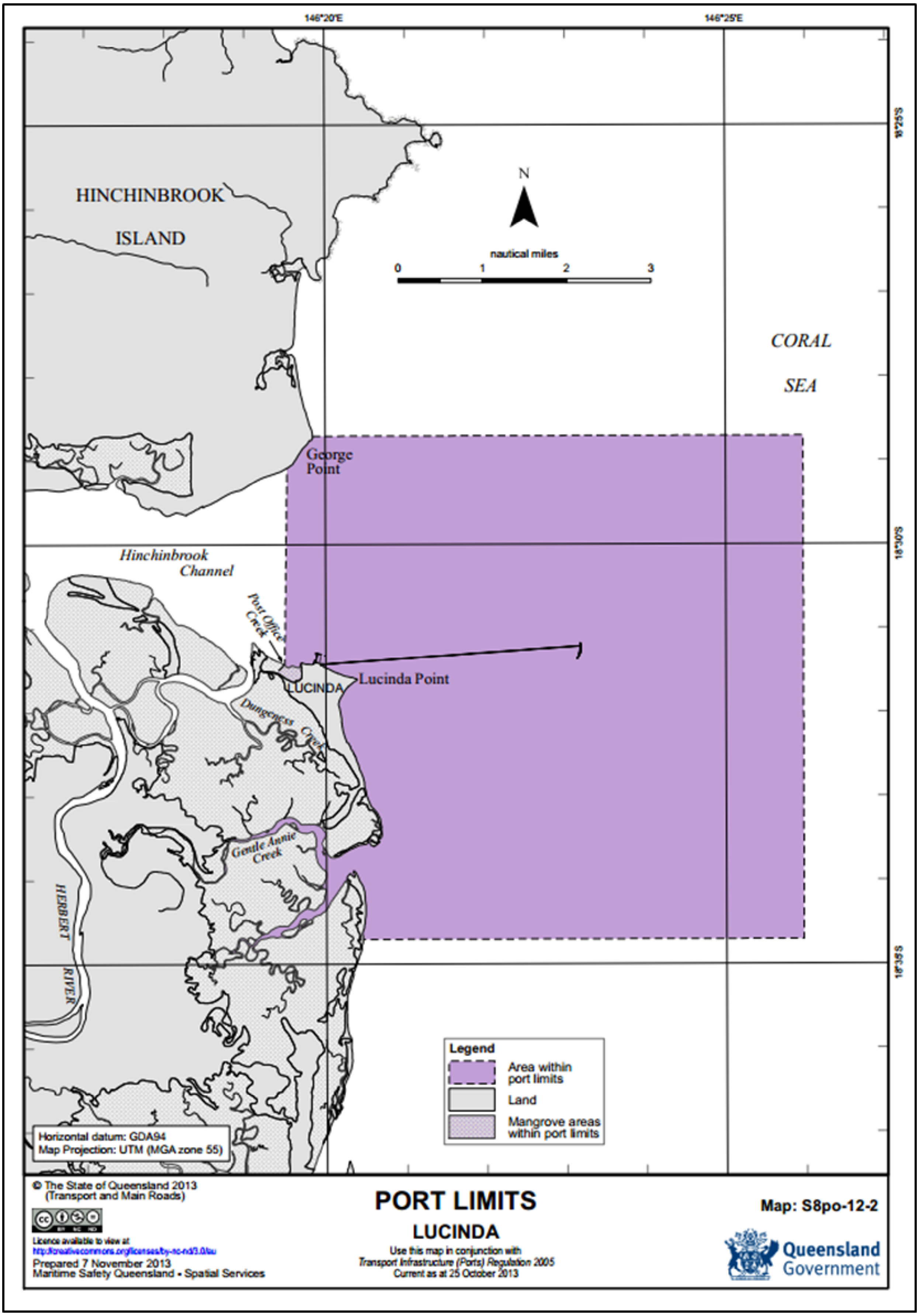


Figure 46: Port Limits at the Port of Lucinda.

11.3 CURRENT AND FUTURE USES

The Port of Lucinda currently handles an average trade throughput of approximately 550,000 tonnes a year of sugar export (Port 2024). There are two tenants at the port of Lucinda.

A barge operator maintains daily trips to and from Palm Island, mostly for services (waste, construction, vehicle access, etc) – all passenger transfers operate through Townsville.

As the Port of Lucinda has not been deemed a Priority Port, master planning is not required. The Port is reliant on the production of sugar from the surrounding cane farms and two sugar mills. There is no expected change of usage of this facility, as the conveyor, trestles and jetty are arranged for exports only; and the barge ramp is small shallow water facility, maintained by the Barge operator.

11.4 NAVIGATIONAL INFRASTRUCTURE

The Port of Lucinda operates via a 5.6km long jetty, with a 400m wharf located on its end. The jetty houses a conveyer belt that moves sugar from the three terminal sheds to ships berthed at the end. This jetty negates the need for any large vessel from entering the onshore facilities. Only the pilot vessels need to berth at the public (inner) wharf situated off the main port area.

12 PORT OF LUCINDA ENVIRONMENTAL VALUES

The Port of Lucinda is situated on the coastline east of the township of Ingham, in tropical North-East Queensland, approximately 1,473 kilometres north of Brisbane, Queensland's capital city. The Port is located in the north-east corner of Halifax Bay, near the mouth of the Herbert River and at the southern entrance to the Hinchinbrook Channel (Figure 47). The Palm Island Group sit at their closest point 16km from the main port lands. Pelorus Island is the Port's closest neighbouring island and the top most island in the Palm Island Group.

Halifax Bay is a naturally long, broad and turbid bay; it is bound to the south by Cape Pallarenda, and Hinchinbrook Island to the north, which are approximately 90km apart. The bay is mostly east facing, with limited shelter (except the Palm Islands in the north) making the bay on occasion a turbid water body, enhanced by the sediment load received from the multiple creek systems which dot the coastline of the bay (one river, two mangrove deltas, 10 named creeks, and multiple unnamed drainage lines).

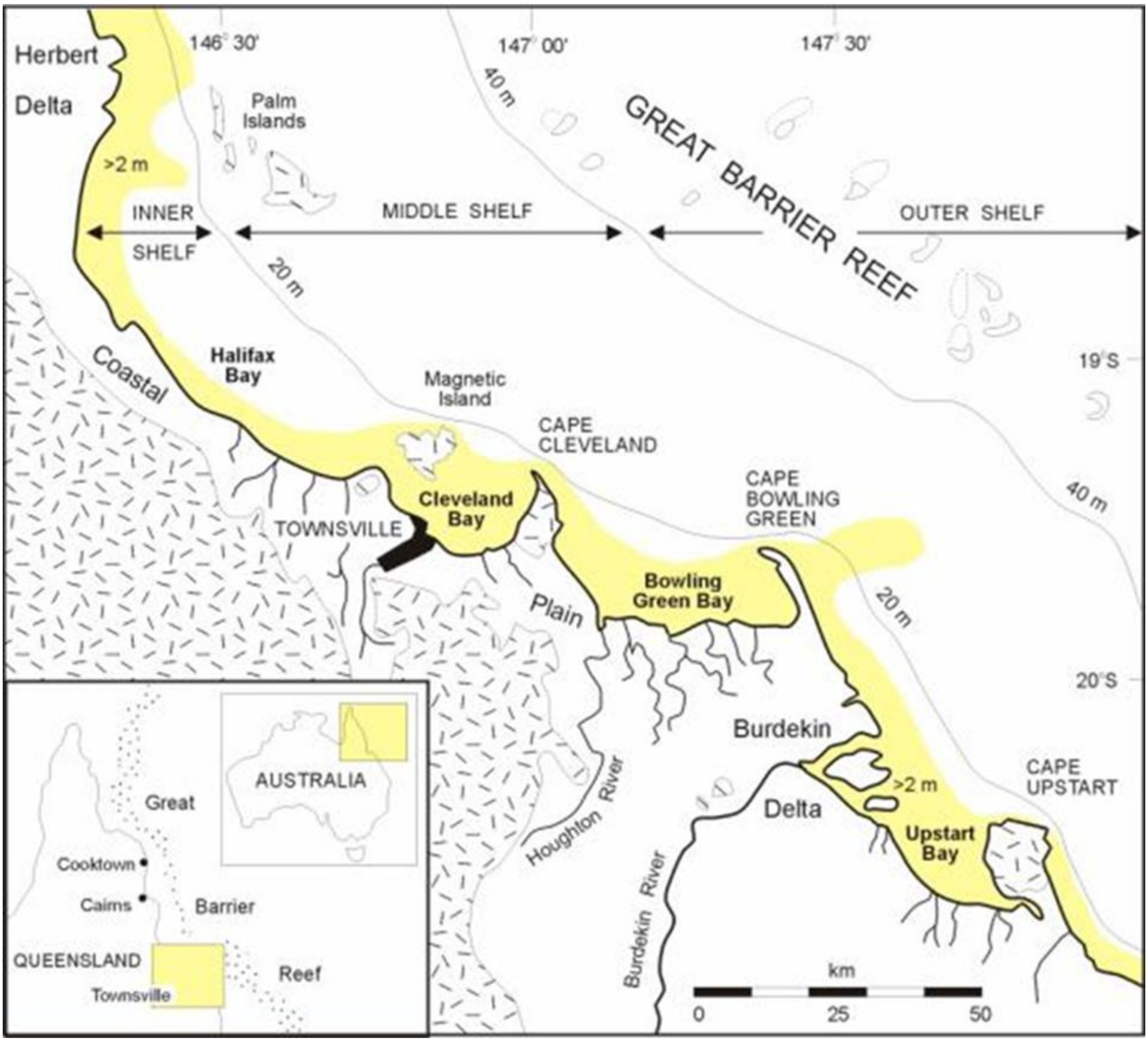


Figure 47: Regional Location Map Including Halifax Bay, North Queensland.

12.1 ENVIRONMENTAL VALUES

12.1.1 CLIMATE AND COASTAL PROCESSES

Located within the wet tropical region of Northern Queensland, Lucinda is characterised by a tropical, seasonal wet and dry climate. High humidity and frequent storms and occasional cyclones typically occur during the wet season (November to April). The dry season (May to October) produces mild and moderate temperatures. The temperature ranges from a mean maximum of 30°C in January to a mean minimum of 18°C in July. Relative humidity is highest in the mornings and average annual rainfall in Lucinda is approximately 1,056.2mm, with the majority typically recorded during the wet season (January to March).

Climate change projections indicate that the region's future climate is likely to be characterised by:

- Increased average annual temperature and increased number of days with maxima over 35°C;
- Decreased average annual rainfall, increased annual potential evaporation, and more drought-like conditions;
- Increased average wind speeds;
- Decreased frequency but increased severity of tropical cyclones; and
- Elevated sea level and increased frequency and height of storm surge.

Careful planning of the potential effects of natural events such as cyclones and floods including predicted climate change risks are a key consideration in port planning, design and operations.

Halifax Bay is a moderate wave energy environment as it is only sheltered from the predominant south-east waves by the Palm Island Group. The open expanse of the bay's outer edges makes the bay shallow only along the coastal beaches (1 to 5m below chart datum), deepening quickly out to 9m, and then out to 12 – 15m halfway between the coast and Palm Island. The coastline continues to be shaped by the prevailing waves at a slow rate, punctuated only by the energy from severe weather events that easily move across the bay onto the shoreline.

The Port of Lucinda and surrounding coastal areas remain relatively untouched. This is mainly due to the location of the main township, Ingham being located some 26km inland. Limited land available for residential areas also reduces coast modification – Taylors Beach to the south and Cardwell to the north are the two main coastal development areas of Halifax Bay. Long-shore drift that moves sediments north along the coastline, adds to the sediment loading at Lucinda Point. The 5.6km jetty ends offshore in deep water, meaning there is a limited need to manipulate the natural environment in order to operate a functioning port.

The Hinchinbrook Channel and Island are both protected areas, which also limits development along the coast.

12.1.2 MARINE ECOSYSTEMS VALUES OF HALIFAX BAY

Halifax Bay supports numerous rich and diverse coastal habitats with varying ecological sensitivities, typically abundant in north-east Australia's coastal wet tropics area, including:

- Corals;
- Soft bottom communities;

- Intertidal and subtidal seagrass beds are present in about 10% of the bay and provide food for the threatened dugong and turtles and are also a nursery for prawns;
- Extensive mangrove and saltmarsh communities, all of which:
    - 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; and
- Forested, brackish and freshwater swamps.

Reef Communities

Reef communities comprised of hard corals exist around all of the Palm Islands, as well as on the south-west side of Rattle Snake Island (known as Rattle Snake Island Reef), in the south of Halifax Bay. A large number of hard corals have been recorded in these communities, with 340 species recorded around the Orpheus Island dive sites. The distribution and abundance of coral species vary in the fringing reefs of the different islands and is related to the physical characteristics of the substrate and energy environments.

Coral cover, species diversity and aesthetic quality are generally considered higher in the fringing reefs on the north-western sides of each of the islands; which provided protected areas from the prevailing waves on the eastern sides. However, further out from Pelorus Island sits Bramble Reef (amongst other reefs) within the main GBR shelf.

The GBR experienced wide-ranging disturbances, most notably from marine heatwaves driven by climate change, leading to severe and widespread coral bleaching in the summer of 2023-24 (GBRMPA, 2025). Other impacts included cyclones, crown of thorn starfish outbreaks, freshwater inundation and coral disease. The most recent GBR outlook report indicates that corals remain vulnerable to climate change, crown-of-thorns starfish, reduced water quality in inshore areas and high ocean temperatures (GBRMPA 2024).

Seagrass Communities

A number of studies have been undertaken both within Halifax Bay and around the Port of Lucinda on the seagrass communities. In 1993 Lee Long *et al*. indicated spatial and temporal variations in seagrass density and species composition for the Hinchinbrook Region. PCQ 2004 also described dense seagrass communities in the lower intertidal and shallow areas of the port region, including the nearby Hinchinbrook Channel; at the time, the closest seagrass meadows to the offshore berth were located on part of the larger sandbank near Lucinda Point.

Mangrove Communities

Mangrove communities represent diverse communities growing in the intertidal zone of tropical to temperate coastal rivers, estuaries and bays (Lovelock 2003). Sixteen species of mangroves have been identified in the port area, with the most dominant species being *Cerips tagal* (PCQ 2004). They are most extensive in the Hinchinbrook Channel, the mouth of the Herbert River, and in the Halifax Bay Wetlands National Park.

The occurrence of particular mangrove species is dependent on environmental factors such as salinity (Sam and Ridd 1998), nutrient availability (Walker and O'Donnell 1981), oxygen levels in the sediment and wave energy (Brinkman *et al*. 1997).

Saltmarsh Communities

Halifax Bay is also home to saltmarsh species. Saltmarshes are ecologically important habitats, as they link the marine environment to terrestrial, and provide habitat for both marine and terrestrial organisms (Goudkamp and Chin 2006).

Saltmarsh communities tend to occupy the areas of low energy, intermittent, tidal inundation, on sheltered soft substrates, and often occur behind mangrove communities (Creighton *et al*. 2015). Different saltmarsh community types produce different benefits to the ecosystem, including sediment trapping, nutrient cycling, dissipation of wave energy, fish and prawn nurseries, carbon sequestration, and feeding areas for birds (Creighton *et al*. 2015).

Distribution throughout the bay depends on the site microhabitat and seasonal influences from both land and sea direction. Saltmarshes play an important role in the ecosystem by providing organic matter, a rich supply of nutrients, and support a great diversity of both marine and terrestrial life (adapted from RIVER Group 2004).

Marine Megafauna

Being home to the Wet Tropics World Heritage Area, Hinchinbrook Island National Park, the GBRMP and two declared FHAs, Halifax Bay is home to a diverse range of aquatic fauna, including whales, dolphins, turtles, and dugongs. PQC 2004 lists the area is home to a number of listed species, including Irrawaddy River Dolphin, Estuarine Crocodiles, Green and Loggerhead Turtles, Indo-Pacific Humpback Dolphins, and Dugongs. A comprehensive study undertaken by Queensland Parks and Wildlife services in 2002 found populations of both the Green Turtle and Loggerhead Turtle within the port area.

Fish and Fisheries

The mangroves, seagrasses, reef and soft bottom benthic communities present in Halifax Bay provide habitat for a variety of fish species. Fishing for target species is a common practice in Halifax Bay, where legal fishing can occur, which includes the Hinchinbrook Channel, for traditional owners, commercial and recreational fishers. Target recreational fishing species include Barramundi, Threadfin Salmon, Queenfish, Grunter, Flathead and Mud Crabs.

FHAs have been established in Halifax Bay and Hinchinbrook Island for many years. The Halifax Declared FHA was originally declared in 1983, with two redeclarations occurring in 1989, and again in 2003 to re-establish the cadastral boundaries. The Hinchinbrook Declared FHA was declared in 1971, followed by two redeclarations in 1983, and again in 1999 both to clarify and link to cadastral boundaries.

Declared FHAs provide protection and breeding grounds for target indigenous, recreational, and commercially important species (including Barramundi, Blue Salmon, Estuary Cod, Flathead, Grey Mackerel, Grunter, Prawns etc.). While these species are highly mobile, it is recognised that the loss of important habitats such as for feeding, or breeding, including seagrasses, reef and benthic habitat, may affect long-term stock levels and abundance.

12.1.3 PROTECTED AREAS WITHIN HALIFAX BAY

The Port of Lucinda's sea jurisdiction is within the GBRWHA, which is also a national heritage place. The Port and its marine infrastructure are all within an exclusion zone from the Cth GBRMP and the State GBR Coast Marine Park (Figure 48). However, there are areas that lie outside the exclusion zone but still remain within port limits (Figure 49).

Some of the key conservation areas, as well as other features of the region, include:

- The GBRWHA, a world and national heritage place;
- The GBRMP and the State GBR Coast Marine Park (including a number of different zones of protection);
- A Declared FHA Management A area within the Hinchinbrook Channel;
- A Declared FHA Management B area within Halifax Bay;
- The neighbouring Hinchinbrook Island National Park; and
- The Palm Island Group National Parks.

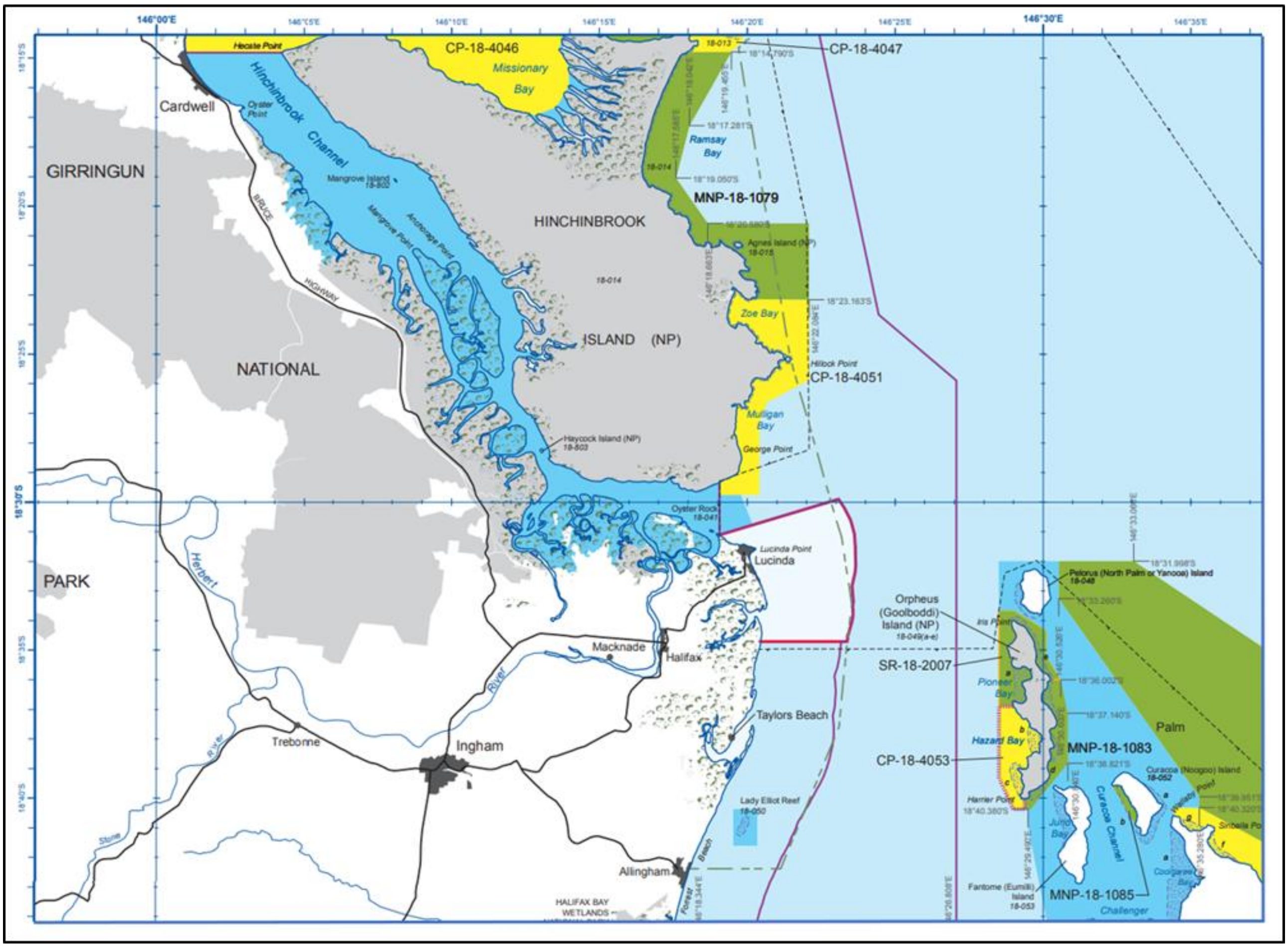


Figure 48: Great Barrier Reef Marine Park Boundaries/Zones Around the Port of Lucinda Exclusion Zone.

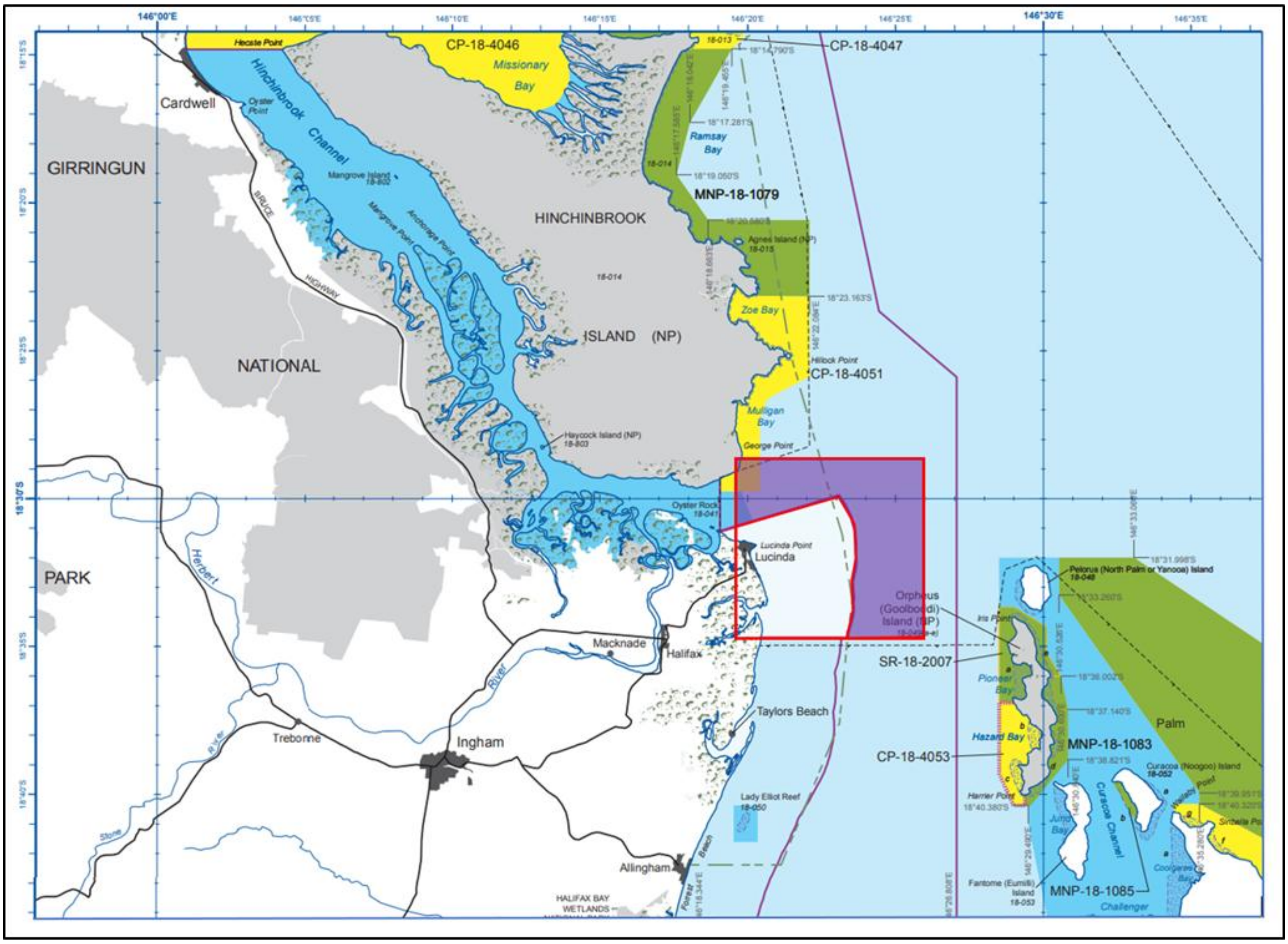


Figure 49: Port Limits and Port Exclusion Zone Overlay.

12.2 SOCIAL VALUES

Lucinda is located on the traditional lands of the Warrgamay people. Halifax Bay is central to the social life of Lucinda and provides recreational activities such as boating and fishing and is a magnet for anglers, with the old inshore jetty and park at the Port servicing as an important tourist attraction. The catchments flowing into Halifax Bay are primarily used for farming sugar cane, supported by the Port of Lucinda which is the world's longest offshore sugar loading facility (Terrain, 2016).

13 CONSULTATION AND KEY ISSUES

The berthing depth was designed at 14m deep, and due to the self-scouring nature of this area of the bay, the berth does not require maintenance dredging. The Port of Townsville website has a page dedicated to long-term maintenance dredging in order to host all the associated documents that accompany the LTMDMP.

This page will remain operational for the duration of the Plan, being updated with relevant reviews; ensuring access and currency of reports and data.

13.1 STAKEHOLDER ENGAGEMENT

The Port of Townsville recognises that maintenance dredging is a matter of strong interest to government, regulators, industry, community members and other stakeholders.

Open and ongoing engagement is an important part of the Long Term Maintenance Dredging Management Plan.

How stakeholders have been engaged

Stakeholder engagement for this Long Term Maintenance Dredging Management Plan has occurred through a combination of formal consultation processes and ongoing engagement forums.

The Port engages regularly with stakeholders through established forums, including:

- the Technical Advisory and Consultative Committee (TACC);
- the Community Liaison Group (CLG);
- the Port Planning and Environment Working Group (PEWG);
- Port Advisory Body (PAB); and
- other government, industry and community engagement channels.

These forums provide opportunities for information sharing, discussion of community and environmental issues, and feedback on Port operations, including dredging activities.

When the LTMDMP was first developed in 2019, the Port undertook a public review process. Stakeholders were invited to read the draft Plan and provide written submissions. This process resulted in two submissions with comments regarding the Port of Lucinda. One recognised the inclusion, the second provided formatting and information inclusion comments. These edits have been included in January 2020 as per the Gap Analysis Action List on the Port of Townsville website.

Consultation on this draft LTMDMP 2027-2037

This draft LTMDMP for the period 2027-2037 has been prepared to support the 10-year sea dumping permit application and associated consultation activities. This draft plan has been developed based on the previous LTMDMP 2019-2029 and updated to include recent studies and monitoring information. The draft plan is available during the formal consultation period for review and comments by stakeholders.
Following feedback from the consultation process, the 2027-2037 LTMDMP will be finalised and supplied as part of the supporting information to the 10-year sea dumping permit application.

Ongoing engagement and transparency

Stakeholder engagement does not end with the approval of this Plan by regulators. The Port is committed to ongoing, two-way engagement throughout the life of the LTMDMP. This includes:

- continuing discussions through established stakeholder forums;
- providing updates on dredging activity, monitoring results and research outcomes; and
- seeking feedback during formal review periods and when significant changes are proposed.

Through this approach, the Port aims to ensure that stakeholders are well informed, concerns are heard and considered, and dredging activities continue to be managed in a responsible, transparent and environmentally sound manner.

13.2 ACCESSIBILITY TO THE COMMUNITY OF REPORTS AND INFORMATION

The Port of Townsville website has a page dedicated to long-term maintenance dredging in order to host all the associated documents that accompany the LTMDMP.

This page will remain operational for the duration of the Plan, being updated with relevant reviews; ensuring access and currency of reports and data. This webpage can be found on the Port of Townsville website: https://www.townsville-port.com.au/environment/dredging-management/.

Information about the Port of Townsville and other Queensland Ports annual maintenance dredging can be found on the DTMR website: Dredging (Department of Transport and Main Roads), which provides information on past maintenance dredging campaigns and the upcoming schedule for maintenance dredging campaigns for all GBR WHA Ports.

14 PORT SEDIMENT CHARACTERISTICS

14.1 PORT SEDIMENT

A small number of targeted sediment characteristic studies have been undertaken within the lower half of Halifax Bay, over the past five decades. To date, studies around the northern section of the bay have not been identified (including around port infrastructure). As the Port does not require maintenance dredging, a SAP has not been necessary. Should any maintenance dredging be required, a full SAP will be undertaken, and relevant applications to both State and Cth Governments would be required. No approved placement areas (land or sea) exist for Lucinda.

14.2 MINIMISATION OF SEDIMENT ACCUMULATION AND DREDGING NEEDS

The Port of Lucinda jetty and berth structure are currently self-cleaning systems. The structure was constructed in an area that allows vessels to berth at the wharf without the need for maintenance dredging, and therefore there is currently no further need to minimise sediment accumulation and there are no dredging needs.

14.3 MAINTENANCE DREDGING AND PLACEMENT REQUIREMENTS

The Port of Lucinda does not undertake any maintenance dredging and as such has no material placement requirements. There are no approved placement areas in Lucinda. If dredging was ever required significant investigation and applications to relevant government regulators would be required.

14.4 EXAMINATION OF REUSE, RECYCLING AND DISPOSAL OPTIONS

Currently, the examination of the reuse of maintenance dredge material is not required as no maintenance dredging or placement activities are planned or approved for the Port of Lucinda. Should such works be required for approval, all reuse, recycle and disposal methods will be provided in a review of this LTMDMP prior to any applications to the State and Cth Governments.

14.5 SELECTED FUTURE DREDGING AND PLACEMENT STRATEGY

This currently is not applicable to the Port of Lucinda as no dredging approval is considered necessary at this point in time. Should maintenance dredging ever be considered for the Port of Lucinda, this LTMDMP will be updated to accompany applications to both State and Cth governments.

There are no future dredging or placement strategies currently proposed for the Port of Lucinda.

15 RISK ASSESSMENT FRAMEWORK

As dredging is not required at the Port of Lucinda, a risk assessment for maintenance dredging and placement activities is currently not required. Should at any point maintenance dredging be required for the Port of Lucinda, a risk assessment will be created to accompany a development approval for such works, including placement activities.

16 IDENTIFICATION AND TREATMENT OF KEY RISKS

As dredging is not conducted at the Port of Lucinda, the identification and treatment of key risks for maintenance dredging and placement activities is currently not required. Should maintenance dredging be required for the Port of Lucinda, the identification and treatment of key risks will be updated in this LTMDMP to accompany applications to both State and Cth governments.

17 ENVIRONMENTAL MANAGEMENT

The Port follows the recommended structure of the MDS (Figure 50) to manage the environmental risks associated with dredging and placement activities at the Port of Lucinda. Should the requirement for maintenance dredging be needed at the Port of Lucinda, the following structure will be implemented in order to comply with any conditions attached to an approval from State and/or Cth Governments.

The Port of Lucinda falls under the Port's EMS. Twice-yearly formal environmental observations are undertaken at the Port of Lucinda and monitoring as part of routine management is undertaken.

If maintenance dredging is ever approved for the Port of Lucinda, this section will be updated.

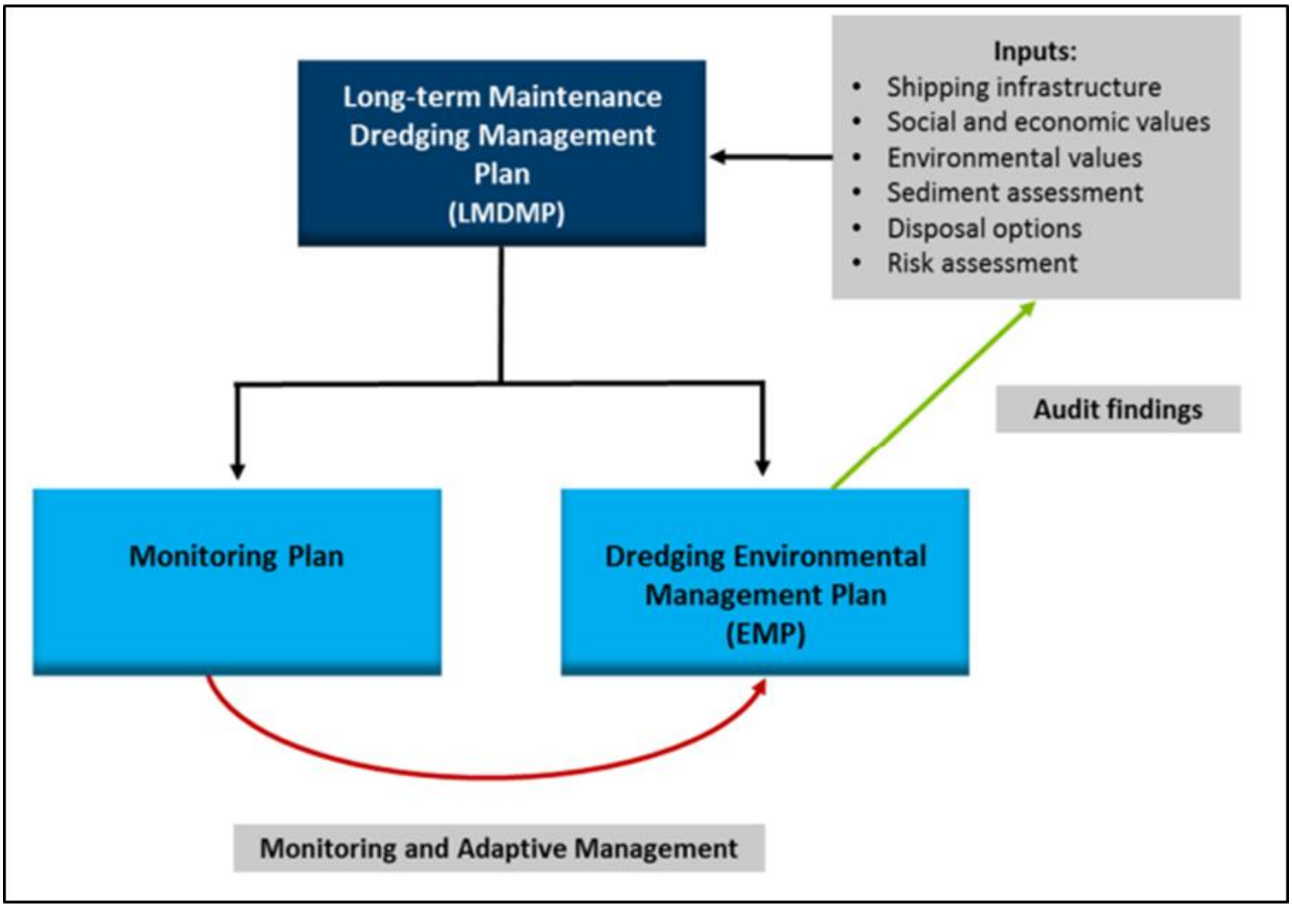


Figure 50: Dredge Management and Monitoring Elements (MDS 2016).

18 MONITORING FRAMEWORK

Currently, the Port undertakes some monitoring at the Port of Lucinda (Table 17). As maintenance dredging and placement activities do not occur at the Port of Lucinda, a detailed monitoring program for maintenance dredging is not required.

As mentioned in previous sections of this document, should any maintenance dredging and placement activities be proposed for the Port of Lucinda, an updated LTMDMP and a detailed monitoring program will accompany any approval sought from the State and Cth Governments.

Table 17. Monitoring Programs at the Port of Lucinda

Monitoring Type	Description
Ambient monitoring **PORT WIDE**	The Port undertakes some monitoring at the Port of Lucinda. Due to the lack of maintenance dredging, there is a low-risk profile (average of 15 vessels per year). Monitoring has included biosecurity, potable water, groundwater and stormwater, and targeted programs when required.
Impact monitoring **MAINTENANCE DREDGE CAMPAIGN-SPECIFIC**	Maintenance dredging is not approved or undertaken for the Port of Lucinda. Impact monitoring is not currently required, however, should any maintenance dredging be approved by State and Cth governments, impact monitoring will be implemented.
Real-time monitoring **MAINTENANCE DREDGE CAMPAIGN-SPECIFIC**	Currently, no real-time monitoring is undertaken at the Port of Lucinda, as no maintenance dredging is approved or undertaken. As above, should any maintenance dredging be approved by State and Cth governments, real-time monitoring would be implemented if required.

19 PERFORMANCE REVIEW

As described in Section 1.2 the Port's objectives for this LTMDMP are:

a) Maintaining safe navigation for the continued operation of both Ports;

b) Ensuring the OUV of the GBRWHA and sensitive receptors surrounding both the Port of Townsville and the Port of Lucinda are maintained;

c) Ensuring a robust, transparent long-term planning approach to the management of sediments within port infrastructure;

d) Continuing the long-term proactive and environmentally responsible management of maintenance dredging and material placement at the Port of Townsville;

e) Effectively communicate to stakeholders the measures and controls for managing maintenance dredging activities

Performance indicators used to determine whether these objectives are being met and/or to better inform future risk assessments for the Port of Lucinda are:

- Annual hydrographic surveys to determine any changes in the self-scouring nature of the berth.
- Annual reviews to be undertaken against the performance indicators, this review includes consolidation of the effectiveness and relevance of the performance indicators. This includes initiating an independent review of the LTMDMP if the annual reviews determine the performance indicators are not effective.
- Undertake a full review of the LTMDMP at the end of each 5-year period

Should any maintenance dredging be approved for the Port of Lucinda, the Port will implement the indicators as used for the Port of Townsville, these are:

- Routine maintenance dredge volumes do not exceed permit conditions.
- Incorporate information from the ambient and targeted monitoring and research projects into the risk assessment, decision making and scheduling when planning timing of dredge with Queensland Ports and Port of Brisbane Corporation.
- No material is placed at sea that has not been assessed against NAGD 2009 and approved for placement (noting a new SAP is required every 5 years).
- Demonstrated evidence that all dredging undertaken is done so under a relevant EMP or DMP.
- Full compliance with State and Cth approvals and reporting requirements including notification processes and volume reporting.
- Undertake a full review of the LTMDMP at 5 years and 10 years, and an annual review of the performance indicators to assess their effectiveness and relevance.

20 REFERENCE MATERIAL AND SUPPORTING DOCUMENTATION

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21 DEFINITIONS AND ACRONYMS

AEIS	Additional Environmental Impact Statement
AIMS	Australian Institute of Marine Science
AMSA	Australian Maritime Safety Authority
ASS/PASS	Acid Sulphate Soils / Potential Acid Sulphate Soils
CGER	Coordinator General Evaluation Report on the PEP EIS
CLG	Community Liaison Group
CoA	Commonwealth of Australia
CSIRO	Commonwealth Scientific and Industrial Research Organisation
Cth	Commonwealth
CU	Channel Upgrade
DCCEEW	(Cth) Department of Climate Change, Energy, the Environment and Water
DMP	Dredge Environmental Management Plan
DMPA	Dredge Material Placement Area
DOR	(QLD) Department of Resources
DPA	Dugong Protection Area

DTMR	(Qld) Department of Transport and Main Roads
DUKC	Dynamic Under Keel Clearance
EA	Environmental Authority
EIS	Environmental Impact Statement
EMP	Environmental Management Plan
EMS	Environmental Management System
EPBC	(Cth) *Environment Protection and Biodiversity Conservation Act 1999*
ERA	Environmentally Relevant Activity
FHA	Declared Fish Habitat Area
GBR	Great Barrier Reef
GBRMP	Great Barrier Reef Marine Park
GBRMPA	Great Barrier Reef Marine Park Authority
GBRWHA	Great Barrier Reef World Heritage Area
GOC	Government Owned Corporation
IMO	International Maritime Organisation
JCU	James Cook University
LMAC	(Townsville) Local Marine Advisory Committee
LTMDMP	Long-Term Maintenance Dredging Management Plan
LTMMP	Long-Term Monitoring and Management Plan for Maintenance Dredging
MCA	Multi Criteria Analysis
MDS	(QLD) Maintenance Dredging Strategy
MNES	Matters of National Environmental Significance
MSQ	Maritime Safety Queensland
NAGD	National Assessment Guidelines for Dredging 2009
National EPA	National Environmental Protection Agency (formally DCCEEW)
NGO	Non-Governmental Organisation
OUV	Outstanding Universal Value
PAB	Port Advisory Body
PEP	Port Expansion Project
PEWG	Planning and Environment Working Group
PIANC	Permanent International Association of Navigation Congresses
Port	Port of Townsville Limited
QPA	Queensland Ports Association
RHM	Regional Harbour Master
SAP	Sediment Sampling and Analysis Plan

SAP IR	Sediment Sampling Analysis Plan Implementation Report
TACC	Technical Advisory and Consultative Committee
TCC	Townsville City Council
TSDA	Townsville State Development Area
TMP	Townsville Marine Precinct
TSHD	Trailer Suction Hopper Dredge
WCSS	White Colonial Sea Squirt
WHA	World Heritage Area

22 RELATED DOCUMENTS

DOCUMENT NUMBER	DOCUMENT TITLE
POT 1569	Marine Water Monitoring Plan
POT 1791	Cleveland Bay Marine Water Quality Turbidity and Available Light Monitoring Plan
POT 1898	Environmental and Social Values Surrounding the Port of Townsville

23 DOCUMENT INFORMATION

DOCUMENT OWNER	Manager Climate and Environment
APPROVAL AUTHORITY	General Manager Assets, Planning, and Environment
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