

Long Term Management Plan for Maintenance Dredging and Disposal:

Port of Karumba Entrance Channel

2022-2032

13 June 2022

Port of Karumba

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1. INTRODUCTION

This document describes the long-term environmental management arrangements for maintenance dredging of the Port of Karumba entrance channel and placement at sea by Far North Queensland Ports Corporation Ltd (FNQPC), trading as Ports North, for the period 2022 to 2032.

This Long Term Management and Monitoring Plan (LTMMP) for Dredging and Disposal supports the application to the Commonwealth Department of Agriculture, Water and the Environment (DAWE) for a long-term Sea Dumping Permit for maintenance dredging under the *Environment Protection (Sea Dumping) Act 1981* (Sea Dumping Act) for the same period.

Since completion of the capital dredging to establish the channel in 1996, maintenance dredging has been undertaken for the Port of Karumba navigational channel, and the material has been placed offshore. As a Port Authority, under the *Transport Infrastructure Act 1994*, Far North Queensland Ports Corporation Ltd, (trading as Ports North) has obligations which include the requirement to undertake maintenance dredging to fulfil its function to provide and operate effective and efficient port facilities and services. To meet this legislative obligation, it is necessary to have in place ongoing approvals that allow the ability to dredge and otherwise maintain or improve navigational channels to ensure safe navigation within the port channels.

It builds on the previous LTMMP (2013-2023), which was successfully implemented over that period.

The *Sea Dumping Act* implements Australia's obligations under the *1996 Protocol to the Convention on the Prevention of Marine Pollution by Dumping Wastes and other Matter, 1972* (the London Protocol). The Australian Government developed the *National Assessment Guidelines for Dredging* (NAGD; Commonwealth of Australia, 2009) to set out the framework for the environmental impact assessment and permitting of the ocean disposal of dredged material. The NAGD identifies that the DAWE may grant long-term permits for maintenance dredging on the following basis:

- An assessment of the applicant's ability to meet their obligations under the *Sea Dumping Act* and any permit granted;
- Establishment of a Technical Advisory and Consultative Committee (TACC) for long-term management; and
- Development and implementation by the applicant of a satisfactory long term Management Plan for loading and placement activities.

This LTMMP documents a systematic approach to implementation of best practice environmental management of the maintenance dredging aspect of the Port of Karumba operations by Ports North and outlines general environmental stewardship initiatives to address requirements in the Guidelines for Long Term Permits issued by DAWE and the NAGD. This document is to be subject to review and continual improvement over the life of this plan and the corresponding Sea Dumping Permit.

In addition, and although Karumba is not a Queensland Priority Port, for consistency purposes, the LTMMP considers the Queensland Maintenance Dredging Strategy framework for Great Barrier Reef World Heritage Area Ports, as shown in **Figure 1-1**.



Figure 1-1 Queensland Maintenance Dredge Framework (Queensland Department of Transport and Main Roads, 2016)

1.1 Port of Karumba

The Port of Karumba is located within the Norman River in the southeast corner of the Gulf of Carpentaria. The port facilities are situated approximately 6 km upstream of the entrance channel at the mouth of the Norman River. The entrance channel to the port extends approximately 9.5 km northwest from the mouth of the river. A general overview of the port is provided in **Figure 1-4**.

Broad intertidal sand flats extend for distances of 3 km to 10 km from the shoreline to shallow subtidal areas on both sides of the mouth of the Norman River, through which the entrance channel traverses. The intertidal and subtidal zones remain turbid throughout the year and sediments within these areas are highly mobile, making up the majority of maintenance material within the entrance channel.

The Port of Karumba has been servicing the remote Gulf communities since the late 1800's. In 1996 the current entrance channel to the port was developed to provide reliable access to the Port of Karumba. This channel was developed over two capital dredging campaigns (1996 and 1998) and has been maintained on a regular basis typically every two years, ever since.

Ports North, which took over port management from Ports Corporation Queensland (PCQ) in July 2009, will continue the program of dredging the entrance channel to maintain a navigable depth of -3.6m LAT.

1.1.1 Operations

Ports North manages around 67 ha of strategic port land (SPL) at the Port of Karumba, which includes a series of small land parcels, some undeveloped, extending from the high water of the

Norman River landward to adjacent Yappar Street. The port provides for general cargo, fuel, fisheries products, and the export of live cattle. The main port user is New Century Resources (NCR), which exports lead and zinc from the Century Mine Facilities at Lawn Hill. NCR took over operation of the mine from MMG in 2017, and re-started operations after a closure through processing tailings to capture remnant minerals including zinc. Ports North undertake maintenance dredging activity to ensure the port remains accessible, and so as to ensure continued efficient and economical operations of NCR as the main port user that requires optimum channel conditions.

A graph showing throughput at the Port of Karumba between 2014 and 2019 is provided in **Figure 1-2**. An average of 60 ships visits the Port of Karumba each year, making it a relatively low throughput port.

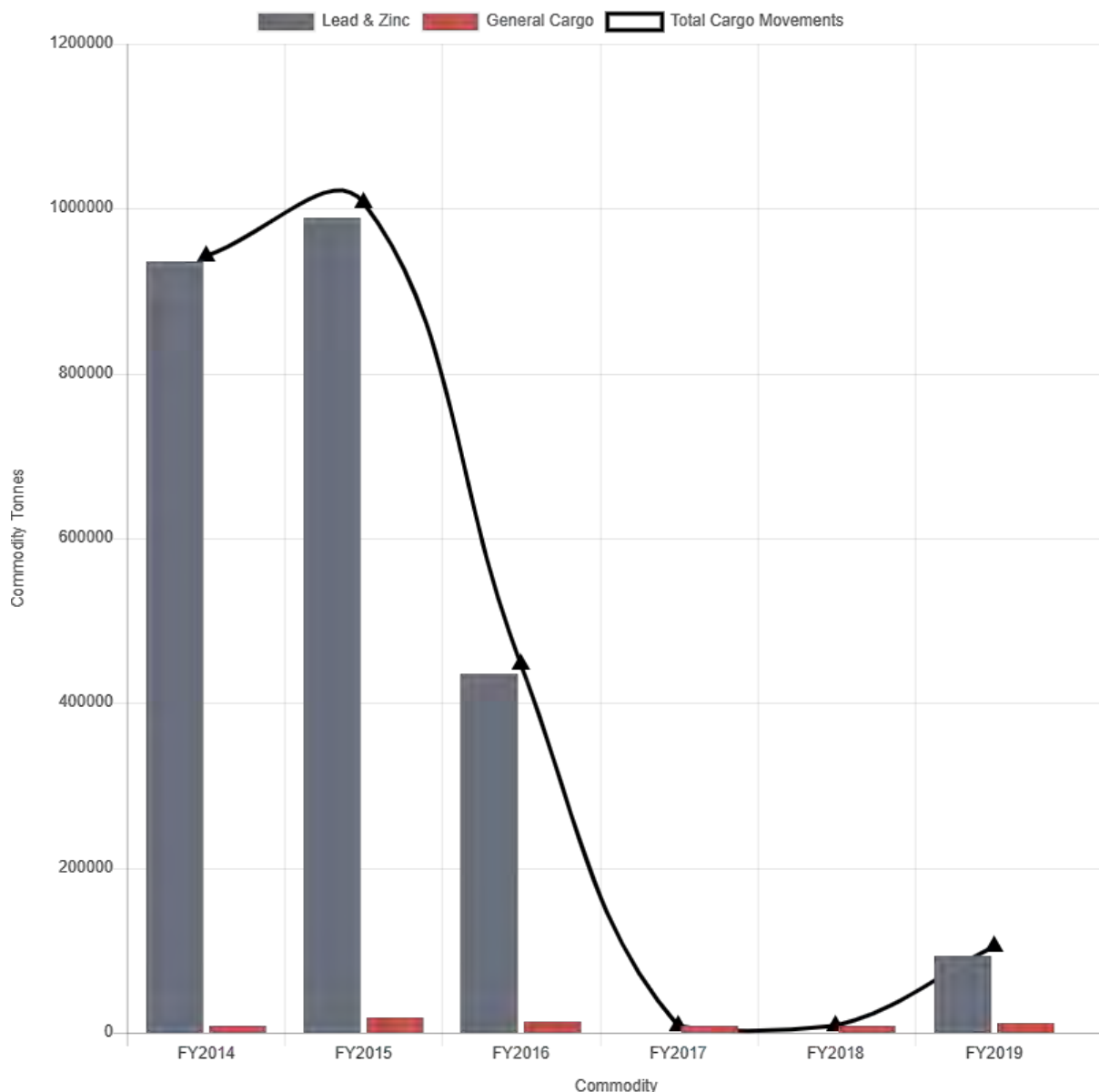


Figure 1-2 Port of Karumba Trade Throughput 2014 to 2019 (Ports North, 2020)

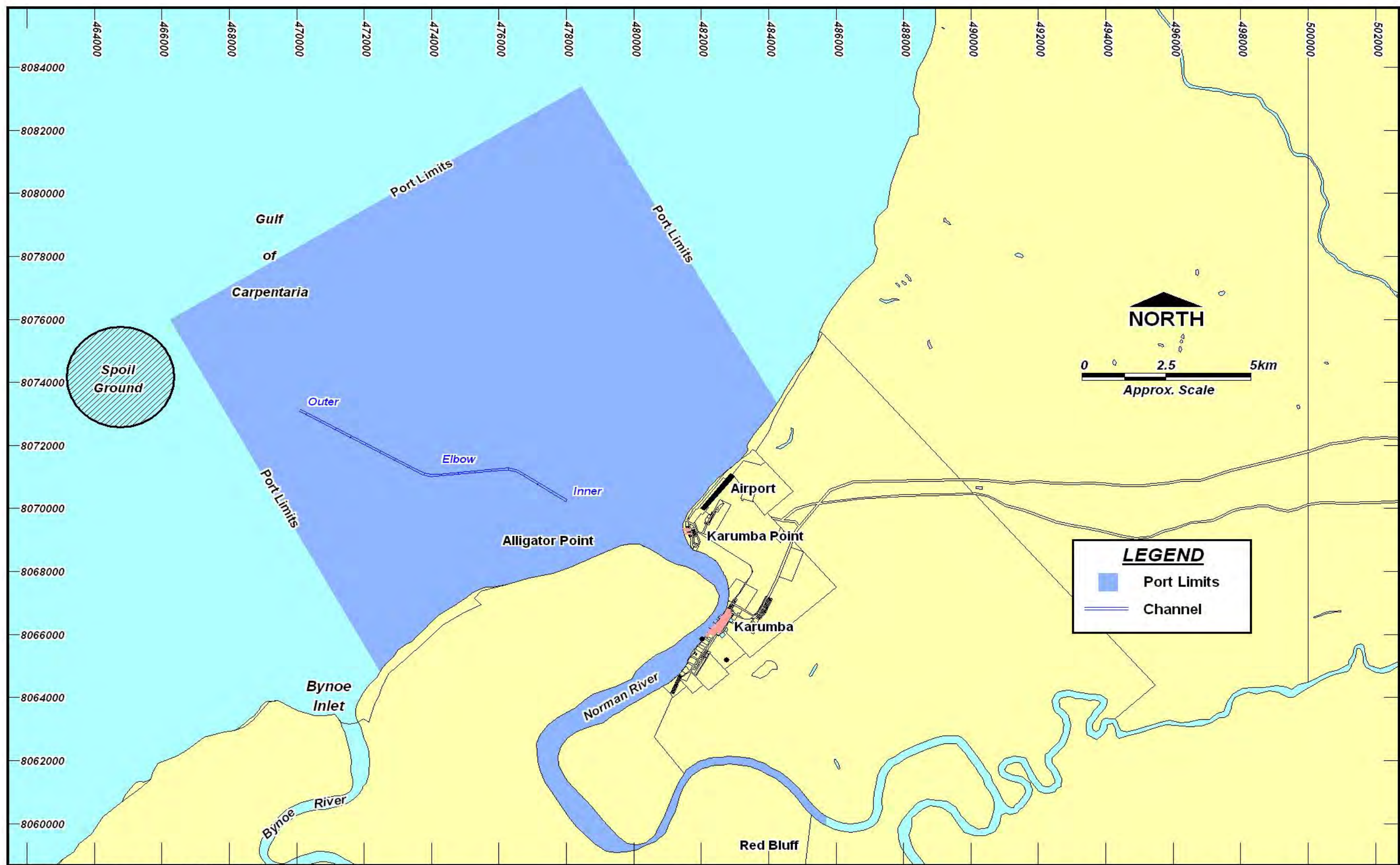
The Port of Karumba is an important component for transport logistics between the Gulf of Carpentaria, via sealed roads, to central northwest Queensland via Mt Isa, Cairns and Townsville. These linkages are vitally important for the commercial fishing industries, which utilise transshipment services through Karumba for the large northern prawn fishery. The port also handles key equipment and fuel for mining and other activities around the Gulf of Carpentaria, eastern Northern Territory and western Cape York.

The port infrastructure includes a dredged entrance channel, two recreational boat ramps, the NCR bulk loading operation, minor wharves for handling of fishing fleet, live cattle, and coastal supply freight barges and their associated cargo and associated loading/unloading facilities. Depths at facilities within the Norman River remain at a natural depth of between -3 and -6m LAT, some shipping movements along the channel by transshipment vessels are tidally dependant.

Government agencies that undertake port related activities include Queensland Transport / Maritime Safety Queensland (MSQ), the Australian Maritime Safety Authority (AMSA), and the Australian Quarantine and Inspection Service (AQIS).



Figure 1-3 View of the NCR facility on the Norman River



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Port of Karumba

Figure 1-4 Port limits, Entrance Channel and Placement Area Location

1.2 LT MMP Development Process

The first long term management plan for maintenance dredging was prepared in 2013, and has been used to successfully manage dredging activities at Karumba since that time. Implementation of a LT MMP allows a structured approach to environmental management of the dredging and disposal aspect of port operations, and summarises initiatives Ports North implements to manage and monitor the actions it takes to ensure environmental stewardship of the port area.

The Guidelines for Long Term Permits (the Guidelines) issued by DAWE (2012) and the NAGD identifies that (long term) management plans should generally include the following information:

- Overall management framework – describe how the plan integrates with the overall management framework
- Context – put the proposal in the context of the local environment, including history of dredging and dredge material placement at the site
- Description of the project – provide information on dredging and disposal for the term of the plan or permit, including the location, staging, and timing of activities
- Information on approvals – provide details of any approvals, relevant conditions and any other statutory requirements
- Description of the existing environment – characterise the dredging and placement sites and adjacent areas, including its water column, sediments, biota, resources and other uses (existing and potential) of the area
- Description of the material for placement – provide a summary of sediment types, their status relevant to the values in these Guidelines
- Description of potential impacts – address both potential short-term and long-term impacts and any uncertainties regarding the predicted impacts
- Management strategies and actions – describe strategies and actions to mitigate impacts – including specific and auditable measures; performance indicators; monitoring requirements; corrective actions; and responsibilities and timing for management and monitoring activities
- Contingency arrangements – identify corrective actions and contingency plans should undesirable or unforeseen impacts occur
- Auditing outcomes - the results of any auditing undertaken during the implementation of the LT MMP
- Continuous improvement – identify opportunities for continuous improvement to prevent, minimise or mitigate environmental impacts in the long term
- Auditing requirements and reporting – outline reporting and documentation standards, timing and responsibility of any auditing or reporting; and
- Review of management plan – make provisions for a review of the management plan, including consultation with the TACC, to ensure it remains current.

These information requirements form the framework for this LT MMP document. The relationship of this document and its key components is demonstrated in **Figure 1-5**.

Inclusion of guidance for the TMR Queensland Maintenance Dredging Strategy also requires consideration for the following components which have also been reflected in this document:

- Operational strategies to avoid or minimise the quantity of maintenance dredging undertaken
- Consider the options to beneficially re-use dredge material
- Review options for land-based disposal before considering at sea placement. This is a similar hierarchical approach undertaken in the NAGD.

In order to ensure transparency, stakeholder understanding and acceptance of the environmental management of the dredging and disposal, both the LT MMP and final reports on monitoring programs derived from it are to be made available through the Ports North website located at www.portsnorth.com.au, and any approved revisions updated accordingly.

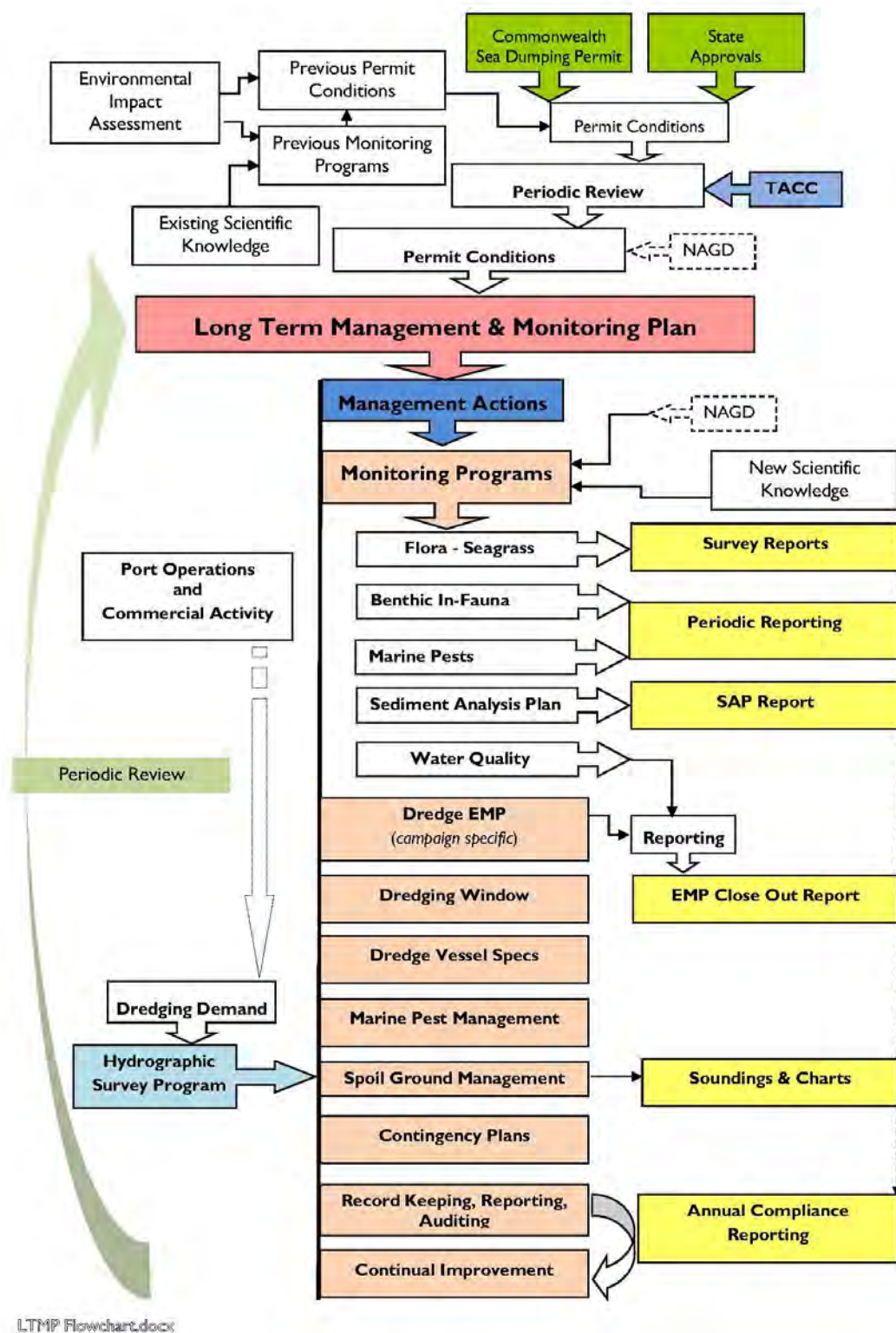


Figure 1-5 Document Relationships and Management Framework

1.3 Objectives of the LTMMMP

The primary objectives of this LTMMMP for maintenance dredging and disposal at the Port of Karumba are:

- Providing a transparent long-term framework for maintenance dredging and material placement at the Port of Karumba over the next 10 years, whilst recognising the existing proactive and environmentally responsible management approach
- Maintaining the safe navigation of the port
- Review the potential environmental impacts of maintenance dredging and placement activity over the timeframe of the previous LTMMMP
- Reviewing whether there are viable alternatives to dredging and the placement of material at sea
- Applying continual improvement practices in the management of sediment and dredging actions
- To facilitate long term port development and associated management plans and support a transparent process of monitoring and compliance to environmental responsibilities
- Provide transparency to stakeholders regarding dredging and disposal management via operation of the Technical Advisory and Consultative Committee (TACC).

2. MANAGEMENT FRAMEWORK

The NAGD recognises the strong association between dredging and the economic viability of many of Australia's port developments and on-going trade opportunities. The coordinated and timely approach to environmental investigations, permitting, management and approvals is considered important to maximising economic opportunity, whilst maintaining sustainability of our coastal resources.

While the NAGD provides for the continued case-by-case assessment of individual dredging proposals, it also considers the long term management of on-going dredge and disposal requirements as a jointly valuable outcome for Port operators and the environment.

2.1 Port of Karumba Management Responsibilities

Under the Queensland *Transport Infrastructure Act 1994*, Ports North is required to establish, manage and operate effective and efficient port facilities and services. The legislative responsibility extends to the provision of safe navigational access to marine facilities under the Ports North jurisdiction.

Ports North also has a key role in ensuring that services and facilities are provided for existing and potential customers that are reliable, efficient and competitive. This means that Ports North must adopt a strategic long-term approach to provide ports services, channel infrastructure, and to pursue mechanisms that provide certainty in ensuring Ports North meets its statutory responsibilities.

Ports North also needs to ensure that dredging and dredge material management of the Port of Karumba is undertaken proactively and in accordance with relevant State and Commonwealth statutory requirements, whilst ensuring certainty and sustainability in the long-term management of the port.

Ports North has developed this LTMMMP for maintenance dredging and disposal for the ten-year Sea Dumping Permit for the term of 2022 to 2032 fulfilling the goals of the strategic resources planning for the Port, while facilitating the ongoing protection of the marine environment and recognising the requirements of associated stakeholders and interested parties.

2.2 Ports North Environment Policy

Ports North maintains an Environment Policy (the Policy) which reflects the organisations corporate commitment to environmental management in all aspects of business and operations. The Policy outlines environmental objectives which must be adhered to by all staff and contractors. The Policy guides actions by Ports North staff and appointed contractors, including those for dredging services, and contract documents reflect the requirement for the objectives of the Environment Policy be adhered to at all times.

2.3 Environmental Management System (EMS)

Ports North maintains an Environmental Management System (EMS) that is implemented to be consistent with ISO14001:2004, which covers the activities under Ports North direct operational control at the Port of Karumba. The EMS outlines all aspects of environmental management across Ports North's operations at each of the nine port locations. The EMS covers Ports North's activities and operations only, while port users, tenants or casual berth users may have their own management systems and plans in place however Ports North does not have operational control of these management actions.

2.4 Environmental Management Plan (EMP)

An Environmental Management Plan for Port of Karumba is maintained by Ports North, which identifies environmental values of the Port, and management measures to ensure that impacts of routine port operations and potential risk of contamination to the natural environment are minimised over the long term. The EMP details port monitoring, management and mitigation strategies, and sets out the general requirement on long term or established operators on Strategic Port Land to implement individual site based operational environmental management plans, including detailed stormwater management plans to minimise pollution or contamination to the port catchment.

2.5 Ports North Roles and Responsibilities

The approvals for this maintenance dredging project include a range of conditions which must be complied with. Some of these conditions relate to operational activities while others relate to broader management issues, environmental monitoring, and reporting. Contract negotiations between dredging contractors and Ports North will clarify responsibility for compliance with the various conditions applicable to dredge operation and management.

2.5.1 General Responsibilities

Ports North, a government owned corporation, has a Board of Directors that oversees the governance and direction of the organisation.

Ports North is responsible for the maintenance of port facilities including shipping channels and berth pockets as the declared port authority for the Port under the Queensland *Transport Infrastructure (Ports) Regulation 2016*. As such, Ports North is the holder of any permits related to maintenance dredging at the Port and is responsible for compliance with these. This includes responsibility for achieving the objectives of this LTMMMP.

The port undertakes comprehensive consultation with affected and interested stakeholders in relation to port operation and maintenance dredging as detailed in **Section 2.9**. This has included meetings of the Technical Advisory and Consultative Committee (TACC) (at least annually), where an outline of permits and long-term plan, and dredging program status have been provided, and feedback from these forums informed development of this LTMMMP. The TACC has provided feedback on key items on which they consider important, during past and the more recent engagement on the LTMMMP process. The TACC will be involved in future consultation on the document as well as its implementation (see **Section 2.9**).

Ports North have a stated policy to manage the operation of its ports, in a pro-active manner to minimise any environmental impacts from port operations or new developments. Ports North have a structured environmental program that involves environmental assessment, monitoring, protection, and rehabilitation. It strives for continual improvement in the control of port and port user activities to maintain a healthy port environment. Independent experts are typically engaged to provide input to and review management approaches, including LTMMMP's. The detailed environmental policy, procedures, and practices are documented in the port's Environmental Management System (EMS), which is based on the international standard ISO 14001. The EMS includes a process for regular internal reviews and audits.

Ports North has responsibilities conferred on it by State legislation (*Transport Infrastructure Act 1994* and *Transport Operations (Marine Pollution) Act 1994*) for the safe and efficient management of the port and its infrastructure, and for managing pollution from shipping activities.

2.5.2 Responsibilities for Maintenance Dredging

Conduct of the regular hydrographic survey program rests with Ports North's surveyor, who, in liaison with the Regional Harbour Master (RHM) considers the outcomes of periodic surveys of the channel, to inform the General Manager (GM) Planning & Infrastructure on the likely need for maintenance works. Overall supervision of the dredging or bed-levelling contract between Ports North and the contractor is managed by the GM Planning & Infrastructure. The Hydrographic Surveyor oversees the day to day supervision of the contract over campaign for the channel.

Oversight of the port's environmental management requirements, inclusive of approvals compliance, EMP, and the monitoring programs rests with the Environment Manager. The Environment Manager also facilitates stakeholder engagement in regards to approval agencies, and to interested and affected parties in conjunction with staff from the Corporate Services section. The TACC is managed and meetings facilitated by the Environment Manager.

Port Operations staff and the Port Pilots engage regularly with the various levels of port customers and users.

2.5.3 Port Users

The port acts as Assessment Manager for any assessable development proposed on strategic port land. However, port activities carried out by either port users or operators must also comply with all relevant government legislation and gain approvals from State agencies for activities that may pollute e.g. boat maintenance, chemical storage, or mineral handling.

The key State legislation for protection of the environment is the Queensland *Environment Protection Act 1994 (the Act)*. The Queensland Department of Environment and Science (DES) are responsible for ensuring compliance with this Act. Ports North strongly promote the need for environmental compliance to all tenants, through their Environmental Management System and regular tenant compliance audits.

2.6 Dredging and Placement Legislative Framework

The Port of Karumba and its offshore dredged material placement area (DMPA) lie within Queensland State coastal waters (within 3nm of the territorial baseline) and Commonwealth waters (essentially from the territorial baseline at high-water mark, to 200nm offshore). Dredging and the subsequent disposal of dredged material are therefore controlled under both Queensland and Commonwealth legislation. The following sections outline the legislative framework for dredging and sea disposal of dredged material at the Port of Karumba.

2.6.1 Commonwealth Responsibilities

ENVIRONMENT PROTECTION (SEA DUMPING) ACT 1981

The placement of dredge material at sea in Australian waters is regulated by the Commonwealth under the *Environment Protection (Sea Dumping) Act 1981 (Sea Dumping Act)*. Australian waters extend from the low water mark to the outer edge of the Exclusive Economic Zone (EEZ), to those parts of the continental shelf that are beyond the limit of the EEZ and waters above the Australian continental shelf beyond the limit of the EEZ.

DAWE administers the *Sea Dumping Act* and issues permits for all sea placement activities from vessels, aircraft and platforms in Australian waters, and all placement activities from Australian vessels and aircraft anywhere at sea, with the exception of the Great Barrier Reef Marine Park, where the Great Barrier Reef Marine Park Authority has delegated responsibility. Since the *Sea Dumping Act* has jurisdiction to the low water mark, a permit from the DAWE is required for sea placement.

Maintenance dredging is to be conducted under Sea Dumping Permit SD2022/4019, expiring on 2 June 2032 (attached in **Appendix 2**). Any dredging activity in 2022 will be undertaken under this new permit and this LTMMMP will apply.

ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999 (EPBC ACT)

For all sea placement activities that are the subject of a permit application under the *Sea Dumping Act*, DAWE will make a determination (in accordance with Section 160 of the *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)*) whether approval is also required under the *EPBC Act*. The Minister will consider whether the action will have significant impact on the environment. The *EPBC Act* promotes the conservation of biodiversity by providing strong protection for:

- Listed species and communities (this includes listed threatened species and ecological communities, listed migratory species and listed marine species);
- Cetaceans (all whales, dolphins and porpoises) in Commonwealth waters and outside Australian waters;
- Protected areas (World Heritage properties; RAMSAR wetlands; Biosphere reserves; Commonwealth reserves; and conservation zones); and
- Commonwealth marine waters.

An examination of any EPBC Matters of relevance to maintenance dredging at Karumba is included in **Section 6.11**.

2.6.2 State Responsibilities

COASTAL PROTECTION AND MANAGEMENT ACT 1995 AND STATE COASTAL MANAGEMENT PLAN

The Queensland State Coastal Management Plan, (the State Plan) has been developed under the *Coastal Protection and Management Act 1995* (the *Coastal Act*). The State Plan describes how the coastal zone and its resources are to be managed. The 'Coastal Zone' is defined as: coastal waters - Qld waters to the limit of the Highest Astronomical Tide - HAT), and all areas to the landward side of coastal waters in which there are physical features, ecological or natural process that affect, or potentially affect, the coast or coastal resources.

The area affected by the loading and placement of dredged material at the Port of Karumba is covered under the State Plan as it is partially located within 3 nm (approx. 5.5 kms) of the territorial baseline. The State Plan outlines management policies for Extractive Industry/Dredging (2.1.6/2.1.8 State Plan) and aims to achieve the best environmental outcome for the placement of dredge material.

Regional Coastal Management Plans (Regional Plans) are also required as part of the Coordinated Management objective of the State Plan. Four regional plans have been prepared and there is no plan for the Gulf of Carpentaria, or part thereof.

The *Queensland Coastal Protection and Management Act 1995* require that coastal development applications be assessed under the Planning Act 2016. Maintenance dredging is currently undertaken under Tidal Works Development Permit 2202-27298, as provided in **Appendix 3**.

ENVIRONMENTAL PROTECTION ACT 1994

Port authorities are required to obtain an environmental licence for the environmentally relevant activity for extractive industry and screening (ERA 16) under the *Environmental Protection Act 1994* (Qld) (*EP Act*). An Environmental Authority to undertake an Environmental Relevant Activity (for ERA 16) was granted in April 2022, and is attached in **Appendix 4**.

FISHERIES ACT 1994

If dredging or material placement activities involve the removal or disturbance of marine plants or works within a declared fish habitat area, approvals under the provisions of the *Fisheries Act 1994* are required. *The Act* provides for the protection, management and conservation of Queensland's recreational and commercial fishery resources. Activities which involve disturbance to marine plant or declared fish habitat areas require an application to be assessed under the *Planning Act 2016*. The presence of marine flora in surveys have not confirmed a presence of marine plants within the areas subject to dredging or material placement activities, and hence the requirement for an approval for removal or disturbance of marine plants under the *Fisheries Act 1994* is not applicable.

TRANSPORT INFRASTRUCTURE ACT 1994

This Act establishes a regime under which a port system is provided and can be managed (amongst other things). Functions and powers of Port Authorities are defined within the *Transport Infrastructure Act 1994* including power to maintain port infrastructure, such as dredging of channels, to remove shoals and requires the Port Authority to dispose material to an approved location.

The *Transport Infrastructure Act 1994* also establishes the structure for management of Strategic Port Land (SPL), Land Use Plans, and the role as land manager for activities on SPL, as well as offence provisions via Port Notices.

2.7 Existing Approvals and Conditions

SEA DUMPING PERMIT

The history of approved Sea Dumping Permits at the Port of Karumba is provided below and includes a combination of long-term and annual permits for capital and maintenance dredging activities. Note that FNQPC took over management of the Port of Karumba in 2009, and therefore, details of Sea Dumping Permit numbers prior to 2008 have not been provided.

- The first permit was granted on 25 June 1996, which was for the first stage of capital dredging of the channel. The permit expired on 25 September 1998.
- The second permit was granted on 24 June 1997 for 1,200,000 m³, which was for the secondary stage of capital dredging of the channel. The permit expired on 30 September 2000.
- The third permit was granted for 2,250,000 m³ on 11 May 2000 for maintenance dredging of the channel. This permit expired on 30 September 2005. Dredging under this permit was completed in 2000, 2002 and 2004.
- SD2006/0034 - the fourth permit was granted on 31 July 2006 for 650,000 m³ maintenance dredging of the channel for a period of one (1) year.
- SD2007-0662 - the fifth permit was granted on 1 May 2008 for 700,000 m³ maintenance dredging of the channel for a period of one (1) year.
- SD2010/1482- the sixth permit was issued on 29 April 2010 for 450,000 m³ maintenance dredging for a period of one (1) year.
- SD2010/1482 was varied on 28 April 2011 for a one year extension for the 2011 campaign of up to 550,000 m³.
- Sea Dumping Permit 2011/1882 – issued on 8 March 2013 for 3,600,000 m³ maintenance dredging for a period of ten (10) years.

The one year Sea Dumping Permit issued for the 2010 campaign for maintenance dredging in Karumba was varied for one year to allow for the 2011 campaign and subsequently expired on 28 April 2012. Bed-Levelling works were implemented in place of the 2012 dredging campaign, and hence a Sea Dumping Permit for 2012 was not required.

This LTMMMP should be applied in conjunction with conditions of approval as outlined within the Sea Dumping Permit issued under the *Commonwealth Environment Protection (Sea Dumping) Act 1981*.

A renewal process was commenced in late 2021, earlier than the full ten-year permit term, so as to ensure that a new Sea Dumping Permit (SD2022-/4019) accommodates the capital and ongoing maintenance of an amended channel alignment and establishment of a navigational corridor near Elbow Bank. This renewal was resolved in advance of the 2022 campaign and this LTMMMP approved during granting of the new permit, provided at **Appendix 2**.

OPERATIONAL WORKS APPROVAL UNDER THE COASTAL ACT

An approval under *Section 86* of the repealed Queensland *Harbours Act 1955* for establishment of the Karumba channel, was issued by the State on 24 June 1996 and amended on 30 September 1996. This approval is a deemed approval under the *Coastal Act*. The placement area is also included within this approval which permits the placement of material at the existing placement area and sets a number of conditions, which were addressed and implemented by PCQ during dredging campaigns (including contingency events). A copy of the approval can be found at **Appendix 5**.

ENVIRONMENTAL AUTHORITY UNDER THE ENVIRONMENTAL PROTECTION ACT

The *Environmental Protection Act 1994* and *Environmental Protection Regulation 2008* require that maintenance dredging conducted by Queensland Port Authorities is subject to an approval for Environmentally Relevant Activity (ERA) 16 Extractive or Screening Activities.

Approval and licence condition requirements for the Port of Karumba were completed on 21 April 2010. Permit conditions for maintenance dredging included the set of standard conditions and one specific condition for the 2010 campaign. A requirement was also included for Ports North to develop an 'Integrated Environmental Management System' (IEMS) as defined under the *EP Act* as:

"A system for the management of the environmental impacts of the carrying out of the activity or activities."

This LTMMMP is developed and implemented to address the IEMS requirements and contains a monitoring plan which outlines the environmental monitoring requirements under the permit. The former DES confirmed that monitoring requirements will be based on existing environmental monitoring programs in place by Ports North.

State approvals for Environmentally Relevant Activities (ERAs) require that a Development Approval is in place for the site (Lot/Plan) of the activity, and that the activity is conducted by a Suitable Operator. Due to the nature of maintenance dredging activities for Queensland ports, and the length of this permit term, the appointed dredging contractor may change due to commercial arrangements. Therefore, a requirement of that dredging contract will be for the selected dredging contractor to hold the relevant and valid Registration Certificate for the period of proposed dredging.

2.8 Summary of Approvals

Ports North maintains the following approvals for the maintenance dredging at Port of Karumba (**Table 2-1**).

Table 2-1 Approvals

Approval Number	Title and	Act	Approval Date
Sea Dumping Permit SD2022-4019		<i>Environment Protection (Sea Dumping) Act 1981</i>	2 June 2022
Decision Notice for Development Permit – SARA 2202-27298 Operational Works for Tidal Works		<i>Coastal Protection and Management Act 1995</i>	11 May 2022
Environmental Authority P-EA-100241989		<i>Environmental Protection Act 1994</i>	Issued 28/4/2022, Date of Effect 11 May 2022

2.9 Technical Advisory and Consultative Committee

Under the NAGD the development of a Technical Advisory and Consultative Committee (TACC) is required to assist in the consultation process for a long-term Sea Dumping Permit application and the implementation of a Long Term Management and Monitoring Plan for dredging and offshore material disposal. Appendix C of the NAGD states that “A TACC is intended to assist ports and other proponents and the Determining Authority to access local knowledge and reconcile various stakeholder interests”.

The Port of Karumba TACC was formed in 2013 and will continue in its role for duration of this current LTMMMP.

TACC meetings are convened at least once per year and prior to each anticipated dredging campaign, prior to the dredging being undertaken, or at any such time that a matter requiring technical guidance on matters of interest to the TACC is required.

As described in Appendix C of the NAGD (2009), function of the TACC at Karumba is intended 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 reviewing the development and implementation of Sampling and Analysis Plans (SAPs), Long Term Management Plans and research and monitoring programs;
- Review ongoing management of dredging and placement activities in accordance with the NAGD and permitting arrangements.

The TACC may also convene subordinate advisory groups, as necessary, to address particular technical issues or to facilitate prompt resolution of a particular issue.

Key areas of involvement of the Karumba TACC have included (and will continue to include):

- Participation in formal structure of meetings, including distribution of meeting invitations, request for agenda items, circulation of agenda, appointment of a chairperson/facilitator for each meeting, recording of minutes, circulation of final meeting minutes and action items
- Review and comment on the updated LTMMMP;
- Liaison prior to, during and after each dredging campaign to discuss and review the proposed program, including environmental monitoring programs, protective measures and the ongoing monitoring of environmental condition indicators within the Port.
- Provision of feedback and discussion of the LTMMMP during the course of the long-term Sea Dumping Permit to ensure it remains current to regulators and the community.
- Provision of technical advice to DAWE and Ports North on their given area of expertise (e.g. DAF, CSIRO, or DES), into the assessment process for any request to vary the LTMMMP or Permit Conditions.

The Port of Karumba TACC is to consist of representatives (**Table 2-2**):

Table 2-2 Representatives of TACC

Organisation	Representative and Contact Details
Ports North	General Manager Planning & Infrastructure, Hydrographic Surveyor, Manager Sustainability and External Policy, Environment Manager
Department of Agriculture, Water and Environment (DAWE)	Director, Ports and Marine Section Environment and Assessment Branch

New Century Resources (NCR)	Environmental Supervisor
CSIRO Marine Research	Marine Ecologist
Queensland Department of Environment and Science (DES)	Principal Environment Officer - Cairns
Carpentaria Shire Council	Chief Executive Officer
Maritime Safety Queensland (MSQ)	Regional Harbour Master
Queensland Department of Agriculture and Fisheries (DAF)	Principal Scientist
Northern Gulf Catchments Natural Resource Management Group	Chief Executive Officer
Port Advisory Group - commercial fishing - community - other commercial port users	Facilitated by Ports North General Manager Operations

Stakeholders noted above are the key stakeholders with an interest in long term management of the Port of Karumba in respect of dredging, and other organisations will be invited to contribute on specific issues as they are identified and suitable representatives are confirmed via the TACC forum.

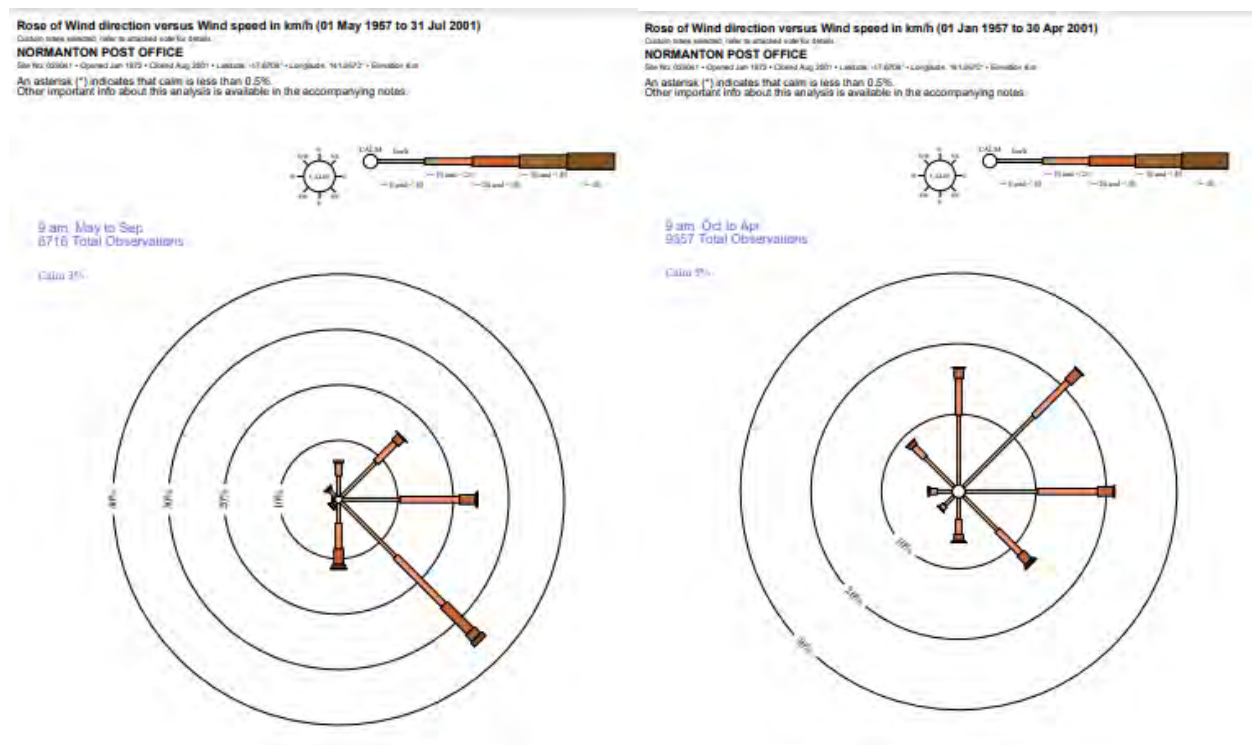
Any variations or updated versions of the LTMMMP are to be provided to the TACC and DAWE to approve in writing prior to implementation. An updated version of the LTMMMP is to be made available and uploaded to Ports North's website (www.portsnorth.com.au) within the timeframe outlined in DAWE guidelines on LTMMMP development and management.

3. CHARACTERISATION OF THE EXISTING ENVIRONMENT

3.1 Climate and Coastal Conditions

Karumba is situated on the Norman River in the southeast section of the Gulf of Carpentaria. The average annual rainfall at Karumba is 890mm (Bureau of Meteorology, 2021) and the area experiences a tropical monsoonal climate with a pronounced wet season from December to March, with generally dry conditions for the remainder of the year. The cyclone season in the region extends from December to April and severe cyclones, with a central pressure less than or equal to 970hPa, pass within 100 km of Karumba at a frequency of once every 40 years based on Bureau of Meteorology (BOM) data.

Karumba typically experiences relatively strong south-easterly winds in the dry season and light northeast to north-westerly onshore winds in the wet season with **Figure 3-1** below showing wet and dry season 9am observations at nearby Normanton.



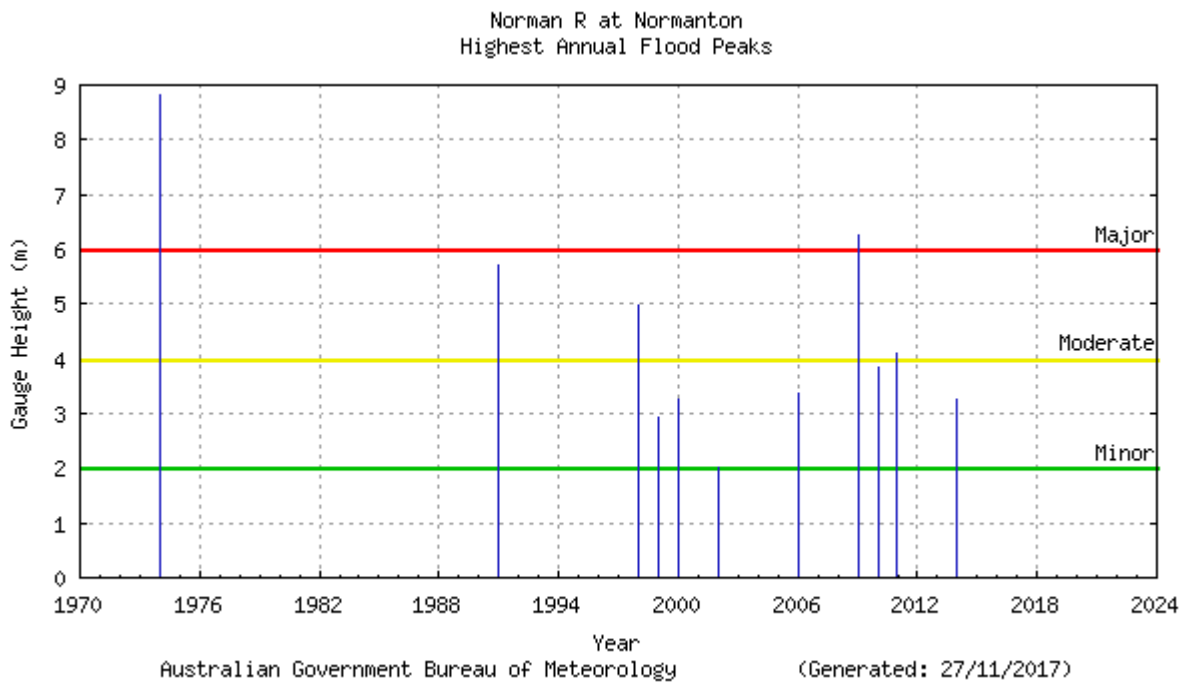


Figure 3-2 Flood Records for the Norman River at Normanton (records between 1970 and 2017)

3.2 Matters of National Environmental Significance

Coastal areas surrounding Karumba include salt flats, mangrove communities, extensive intertidal flats and shallow subtidal seagrass beds. These habitats are highly productive and support a high diversity of animals and plants including some species that are valuable to commercial fisheries and some which have high conservation value. The distribution of the key environmental values at Karumba is illustrated in **Figure 3-5**.

There are no listed World Heritage Areas or conservation reserves within or near the port area. There are also no listed RAMSAR wetlands, however, the Southern Gulf Aggregation wetlands, which are listed on the Directory of Important Wetlands, extend along the coastal fringes around the port area.

There are no threatened ecological communities in the area recorded in the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) database. However, there are a large number of recorded threatened and migratory species known to frequent the region. Refer to **Appendix 1**. For full species listing and names in the EPBC database search, which identifies twenty threatened species could occur in the dredge footprint and DMPA:

- Six bird species (including the Critically Endangered curlew sandpiper (*Calidris ferruginea*), eastern curlew (*Numenius madagascariensis*) and great knot (*Calidris tenuirostris*));
- One mammal species (the blue whale (*Balaenoptera musculus*));
- Six species of reptile (all turtle species) seven species of shark (including the Critically Endangered spartooth shark (*glyphis glyphis*)).

There are 49 migratory species currently noted in the database as likely to occur within the dredge footprint and DMPA. There are 81 listed Marine Species.

The footprint is listed as a Biologically Important Area for the green turtle (*Chelonia mydas*) and Lesser Frigatebird (*Fregata ariel*). The lower Gulf of Carpentaria is mapped as breeding habitat for the lesser frigatebird, whilst the mouth of the Norman River (over existing seagrass beds) is mapped as a foraging area for the green turtle.

Assessment of these matters and the likely effects of dredging campaigns (Refer to Section 6.5) indicate that impacts on matters of National Environmental Significance (MNES) are low and an EPBC Referral is not required under the *EPBC Act*. This is supported by *EPBC Act* Significant Impact Guidelines 1.1 (Commonwealth of Australia, 2009), which states that:

“Dredging to maintain existing navigational channels would not normally be expected to have a significant impact on the environment where the activity is undertaken as part of normal operations and the disposal of spoil does not have a significant impact.”

Previous Sea Dumping Permit applications (i.e. 2008, 2010 campaigns) have not triggered *EPBC Act* referral.

3.3 Matters of State Environmental Significance

There is a Fish Habitat Area approximately 15 km to the south of works, at the mouth of the Bynoe River. The banks of the Norman River are mapped as wildlife habitat for endangered, vulnerable species, special least concern species. These include the estuarine crocodile (*Crocodylus porosus*), a number of shorebird species and the Australian Humpback Dolphin (*Sousa sahalensis*) which are threatened under the *Nature Conservation Act 1992*. Small areas of remnant regulated vegetation (Category B and essential habitat) are found in coastal locations. Most of the terrestrial environment is also mapped as High Ecological Significance Wetlands All MSES are shown in **Figure 3-3** and **Figure 3-4**.



LEGEND

- | | |
|---|--|
|  DMPA |  Declared Fish Habitat Area |
|  Port Limits |  Dredge Footprint |
|  High Ecological Significance Wetlands |  Proposed Channel Corridor |

Title:

MSES Wetlands and Fish Habitat Areas at Port of Karumba

BMT endeavours to ensure that the information provided in this map is correct at the time of publication. BMT does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.



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3-3

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LEGEND

- | | |
|--|---|
|  DMPA |  Proposed Channel Corridor |
|  Port Limits |  Regulated Vegetation Essential Habitat |
|  Dredge Footprint |  Regulated Vegetation Category B Endangered/Of Concern |

Title:

MSES Regulated Vegetation at Port of Karumba

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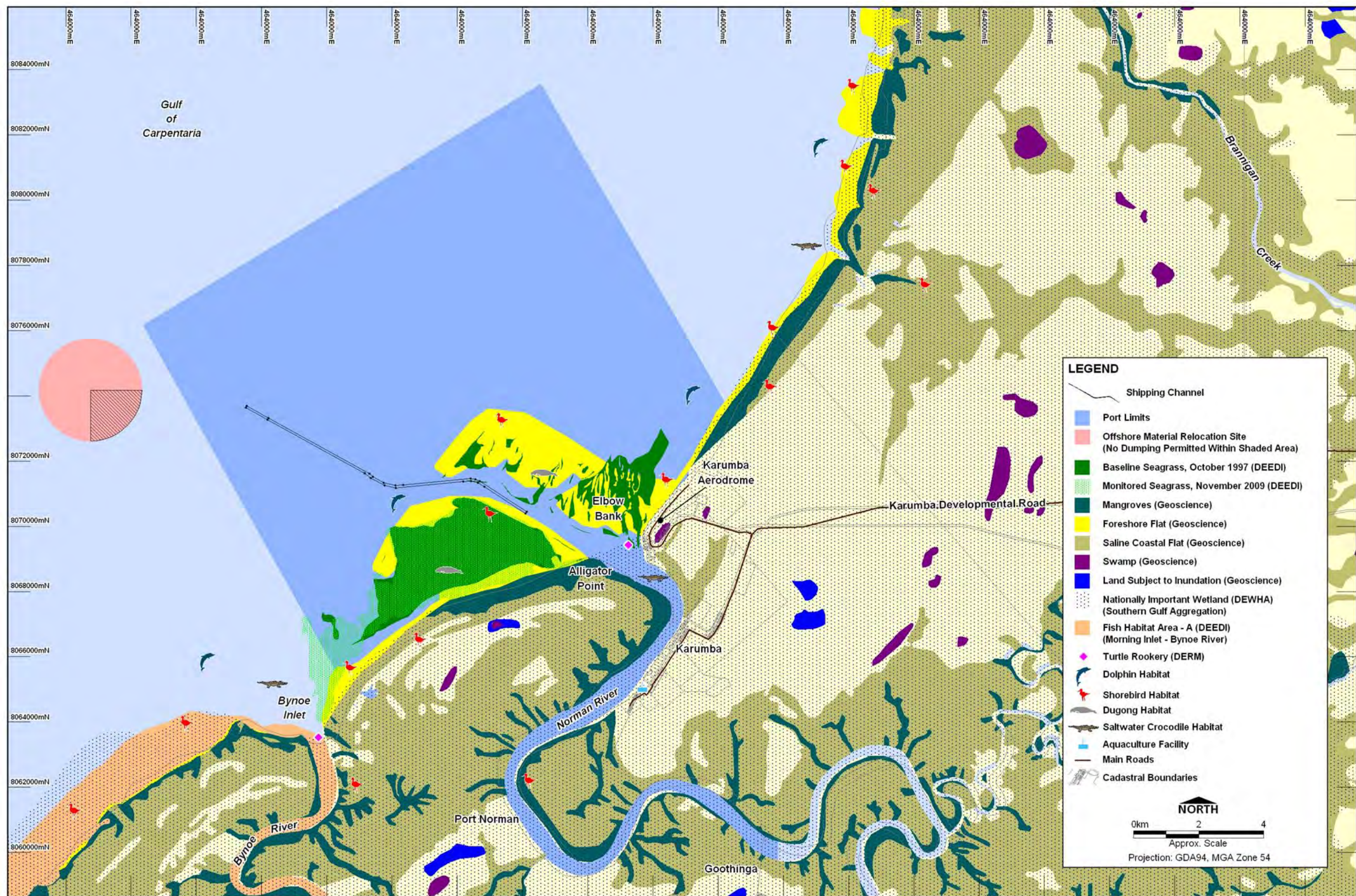


Figure 3-5 Coastal Resources in the Vicinity of the Port of Karumba

3.4 Heritage

3.4.1 Indigenous

No areas of cultural significance have been identified in the assessment process for previous approvals and no further items have been identified for the purposes of this application. The areas to be impacted by routine maintenance dredging works will have similar impact to previous dredging campaigns. The Gkuthaarn and Kukatj People have native title over land in the southern part of the Gulf of Carpentaria, encompassing the southern banks of the Norman River, and extending to the low water mark (QUD29/2019). There is no known indigenous cultural heritage items or places present within the project footprint.

Indigenous cultural values of the Karumba area are generally understood to be confined to seasonal use of some areas for hunting, fishing and gathering zones. Contemporary indigenous use of the entrance channel is considered minimal.

3.4.2 European heritage

Karumba has had a varied past, with areas of contemporary importance including;

- Its role as one of the most important 'gateways' for European settlement of the Gulf in the early 1800's
- A base for Catalina Flying Boats and extensive use by allied forces during second world war
- As a major base for prawn trawlers during the 1970's
- Its role as a significant live cattle export, and since late 1990's, for bulk minerals export, and
- More recently as a fishing, holiday destination as well as ongoing general supply port for inland communities.

These historical connections provide important links with the past and are worthy of recognition of the role of this town as the dominant southern gulf port.

There is one shipwreck noted within the national shipwreck database; the Rockhampton which caught on fire at the mouth of the Norman River in 1885. It was 'blown up' later that year as it was becoming a navigational hazard. There has been no evidence of remains of the Rockhampton during previous maintenance dredging.

There have been no specific issues of cultural or indigenous cultural heritage discussed by the TACC in the past five years. Heritage issues are to be addressed via consultation with applicable stakeholder groups via TACC representative organisations.

3.5 Marine Habitats

The Port of Karumba and the broader southern Gulf of Carpentaria comprise a wide range of tropical estuary and near shore habitats, including; mangroves, seagrass, intertidal mud/sand flats, salt pans/marsh, and subtidal soft sediment. Detailed marine monitoring of the region has been completed by CSIRO, AIMS and Fisheries Queensland over past years to determine marine resource condition and trends, as well as determining economic considerations for the Gulf prawn fishery. The distribution of key habitats and communities within the study area are well known and outlined further below.

3.5.1 Mangroves

Extensive mangrove communities occur along the foreshore around the mouth of the Norman River, and extend a significant distance along the shoreline and up the river. Mangroves are a key feature of the Gulf of Carpentaria coastline. It is unlikely that this habitat type will be exposed to potential impacts from routine maintenance dredging as they are outside the dredging footprint,

and have a significantly lower susceptibility to impacts from turbid plumes or sedimentation, due to adaption features which suit them to high sediment load locations such as the southern Gulf.

Mangroves are the primary vegetation type along the more protected shorelines of the mouths and banks of the Norman and Bynoe Rivers, often extending for several kilometres upstream (refer **Figure 3-5**). They also form a fringe of coastal vegetation on accreting shorelines immediately behind the lower sand flats to the north and to the west of the mouth of the Norman River within the Port limits. Mangrove habitats are a significant and ecologically important feature of the transition from shallow coastal gulf waters, to the arid terrestrial inland. Mangroves form a well-developed community and the coastal fringe of mangroves is dominated by *Avicennia marina*, whereas the tidal creeks behind the coastal fringe typically support a variety of mangrove species.

Extensive saltpan and wetland areas are located in and around the Port of Karumba some of which are listed on the Register of the National Estate as the *Southern Gulf Plains*. The size of these wetland areas is extremely dynamic, expanding and contracting due to the extremes of the wet and dry seasons.

3.5.2 Seagrass

Seagrass beds occur at the mouth of the Norman River and on the northern and southern banks of the channel (refer **Figure 3-5**). The most abundant seagrass area in the Port is located on Alligator Banks, which is located outside the mouth of the Norman River and south of the channel. **Figure 3-6** shows the historical and current extent of seagrass coverage.

Seagrass has been monitored annually at Karumba since 1994. Monitoring at Karumba is part of a network of long term seagrass monitoring sites that have been established at various port locations throughout Queensland to assist port managers in the planning and development of port operations to achieve minimal impacts on the marine environment and fish habitats. The programs are also “*used as an indicator of overall marine environmental health of ports and as an example of international best practice in the management of port environments*” (Unsworth *et al.*, 2009). The most recent monitoring was undertaken in 2021 by JCU, and the summary report is provided in **Appendix 6**.

Seagrasses on Alligator Bank have varied considerably in density over the period of monitoring with the majority of changes linked to regional and local climate variations” (Unsworth *et al.*, 2009).



LEGEND

- | | |
|------------------------------------|---------------------------------|
| Proposed Dredge Area | Karumba Seagrass 2020 (JCU) |
| Existing Channel | Monitored Seagrass 2009 (DEEDI) |
| Seagrass Composite 1994-2018 (JCU) | Baseline Seagrass 1997 (DEEDI) |
| Karumba Seagrass 2021 (JCU) | |

Title:

Historical Seagrass Mapping

BMT endeavours to ensure that the information provided in this map is correct at the time of publication. BMT does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.



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Prolonged wet season flooding in 2009-2011 and 2018-2019 did see substantial seagrass losses, caused by persistent turbid plumes that reduced light levels (JCU, 2021, Shepherd *et al.*, 2020, Van De Wetering *et al.*, 2019). Recovery did occur after 2009 through the seedbank and surviving plants. Seagrass meadow condition is also improving after a deterioration in 2018-19. The latest survey (JCU, 2022) has rated seagrass as being in 'very good' condition, with an increase in above-ground biomass.

Seagrass growth is broadly favourable in good weather conditions, where there is an absence of major flow events in the Norman River.

It was concluded in the latest seagrass monitoring conducted at the end of 2021, and reports (JCU, 2022) that Karumba seagrasses have been resilient to past maintenance and capital dredging and no changes to existing dredging practices were recommended.

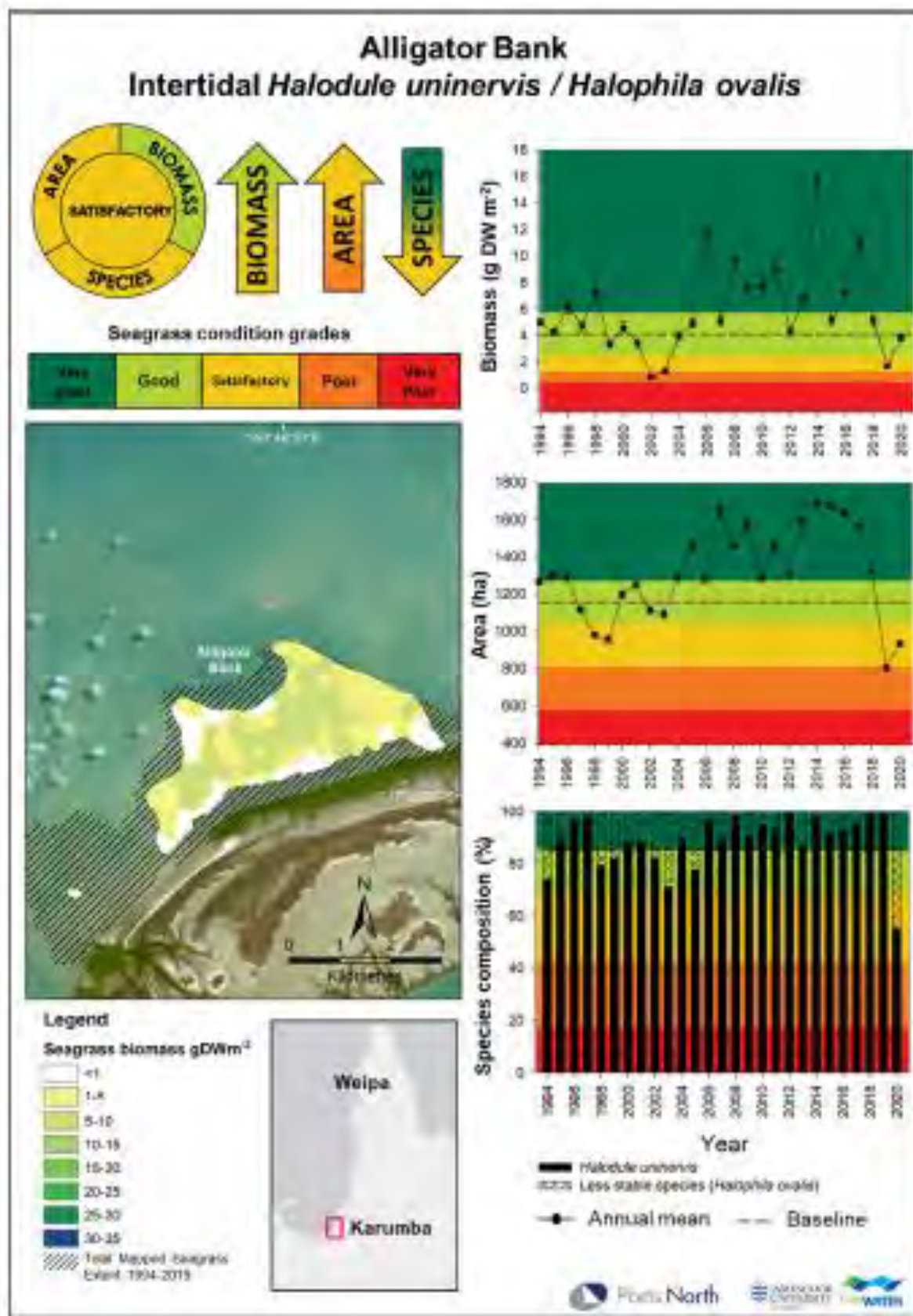


Figure 3-7 Fluctuations in Alligator Bank Seagrass Biomass, Extent and Species Composition between 1994 and 2021 (JCU, 2022)

3.5.1 Intertidal Sand and Mud Flats

Broad intertidal sand flats extend for distances of 3 km to 10 km from the shoreline to shallow subtidal areas on both sides of the mouth of the Norman River. Sparse populations of gastropod molluscs live on the surface sediments of these flats.

During the dry season, up to 30 to 40 metres of mud banks along the edges of the Norman and Bynoe rivers may be exposed during spring low tides. Juvenile prawns are abundant over the riverbanks during ebb flows. Gastropod molluscs and crabs may be present on the upper banks adjacent to mangroves, whilst mudskippers and other species of gobies are present on lower sections.

Previous sampling events from the banks of the Norman River have found that sediment is largely dominated by crabs, amphipods, and polychaete worms.

The intertidal habitats provide habitat for a high diversity of birds including migratory waders. These sand and mudflats provide important feeding and roosting habitat and represent a readily accessible area frequented by scientists and the general public as an educational and recreational resource. These sand and mud flats will not be directly disturbed during maintenance dredging activity.

3.5.2 Subtidal Soft Sediment

The subtidal soft sediment habitat is largely undescribed within the existing literature even though it is the dominant habitat within the port area. High turbidity and low light regimes preclude the establishment of significant subtidal marine communities such as reef, algae, or seagrass beds.

Surveys of the channel area focused on the bend area subject to the channel re-alignment in 2009-10 and aimed to determine the types of sediment and status (presence or absence) of significant benthic flora or fauna of this section of the channel. Findings of those surveys indicated a predominance of underlying consolidated clays with overlying sandy silts and an absence of significant benthic habitat (WorleyParsons, 2010).

3.6 Marine Fauna

A variety of marine fauna has been observed in the Karumba region. Dugongs have been regularly observed in aerial surveys of the area and their feeding trails have been noted throughout local seagrass beds (including during the most recent 2020 seagrass survey), whilst sea turtles, including green, loggerhead, flatback, hawksbill and Olive Ridley turtles, have been recorded from the southern Gulf of Carpentaria and are likely to inhabit coastal waters around Karumba.

3.6.1 Turtles

The Recovery Plan for Marine Turtles in Australia (Commonwealth of Australia, 2017) maps known breeding areas for marine turtles; both the flatback and olive ridley turtles are known to breed on the western side of Cape York. **Figure 3-8** and **Figure 3-9** show known turtle nesting sites for these species.

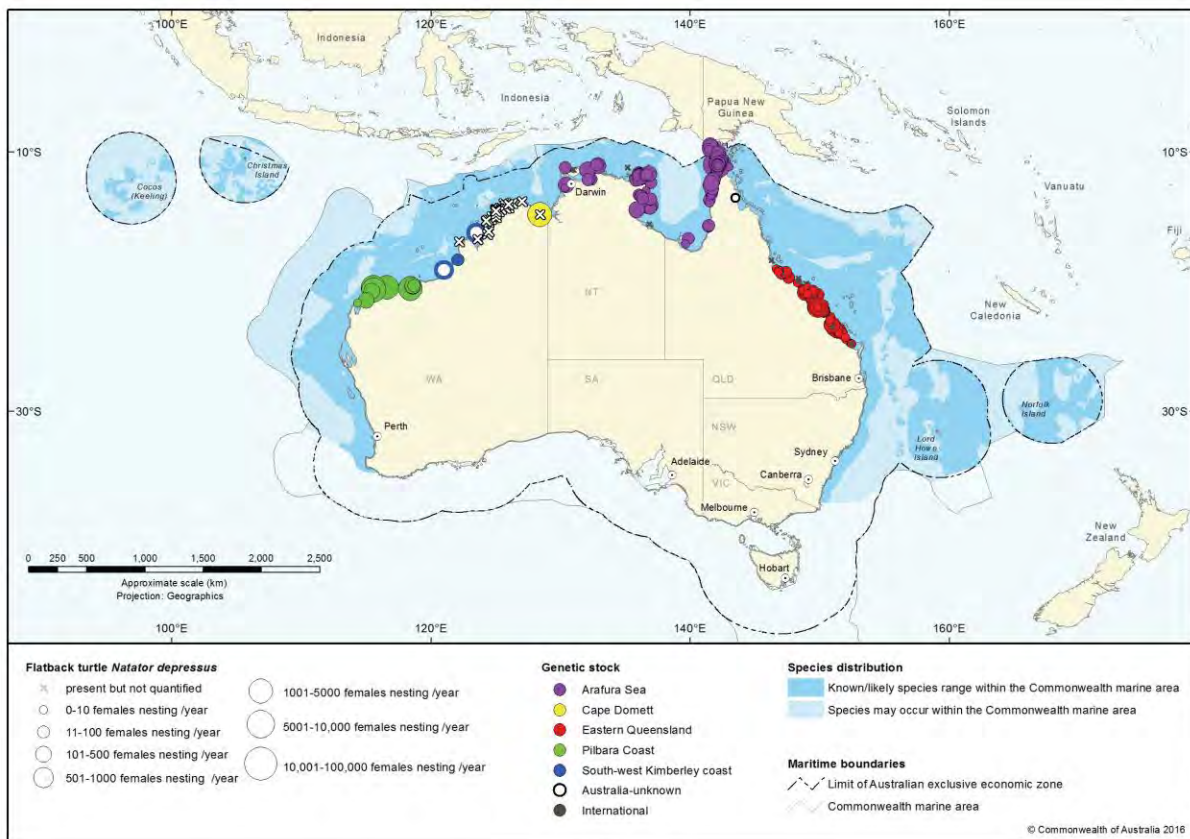


Figure 3-8 Flatback Turtle Nesting Sites (Source: Recovery Plan for Marine Turtles in Australia, 2017)

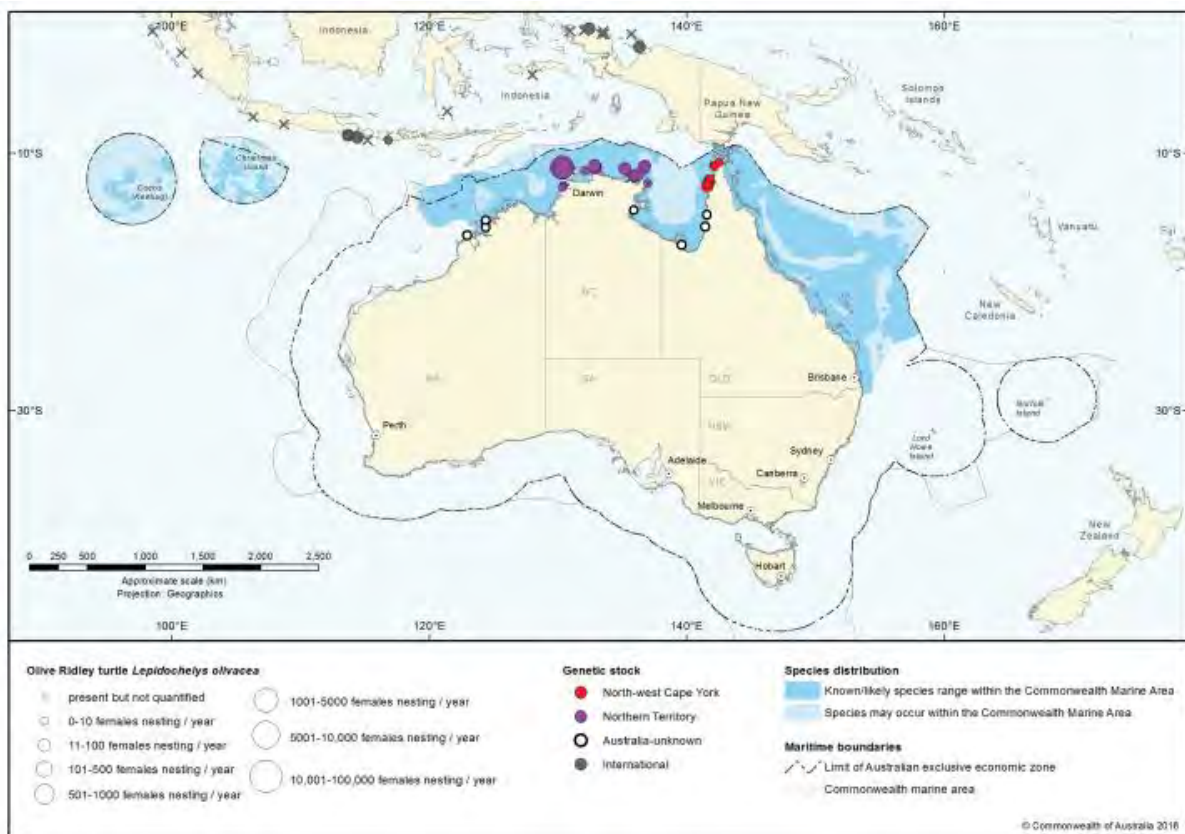


Figure 3-9 Olive Ridley Turtle Nesting Sites (Source: Recovery Plan for Marine Turtles in Australia, 2017)

For both species, the Wellesley Islands, approximately 100 km to the north-west of Karumba, and beaches to the north, closer to Kowanyama are known nesting sites. Wellesley Island is listed as an area critical to the survival of the Flatback Turtle (and a 60 km area radius surrounding it) Karumba is not identified as providing habitat critical to the survival of marine turtles.

3.6.2 Dugong

Dugong are listed as Vulnerable species under the Queensland *Nature Conservation Act 1992* and occur the length of the Queensland coastline. The distribution of seagrass is heavily associated with the presence of seagrass communities (SPRAT Database, 2021); dugong feeding tracks have been regularly observed at the Alligator Banks seagrass meadow at the mouth of the Norman River (JCU, 2021). **Figure 3-10** identifies Karumba as being a high dugong density area, although in general, the northern and western areas of the Gulf of Carpentaria are more likely to provide important habitat for dugongs, where seagrass meadows are more extensive.

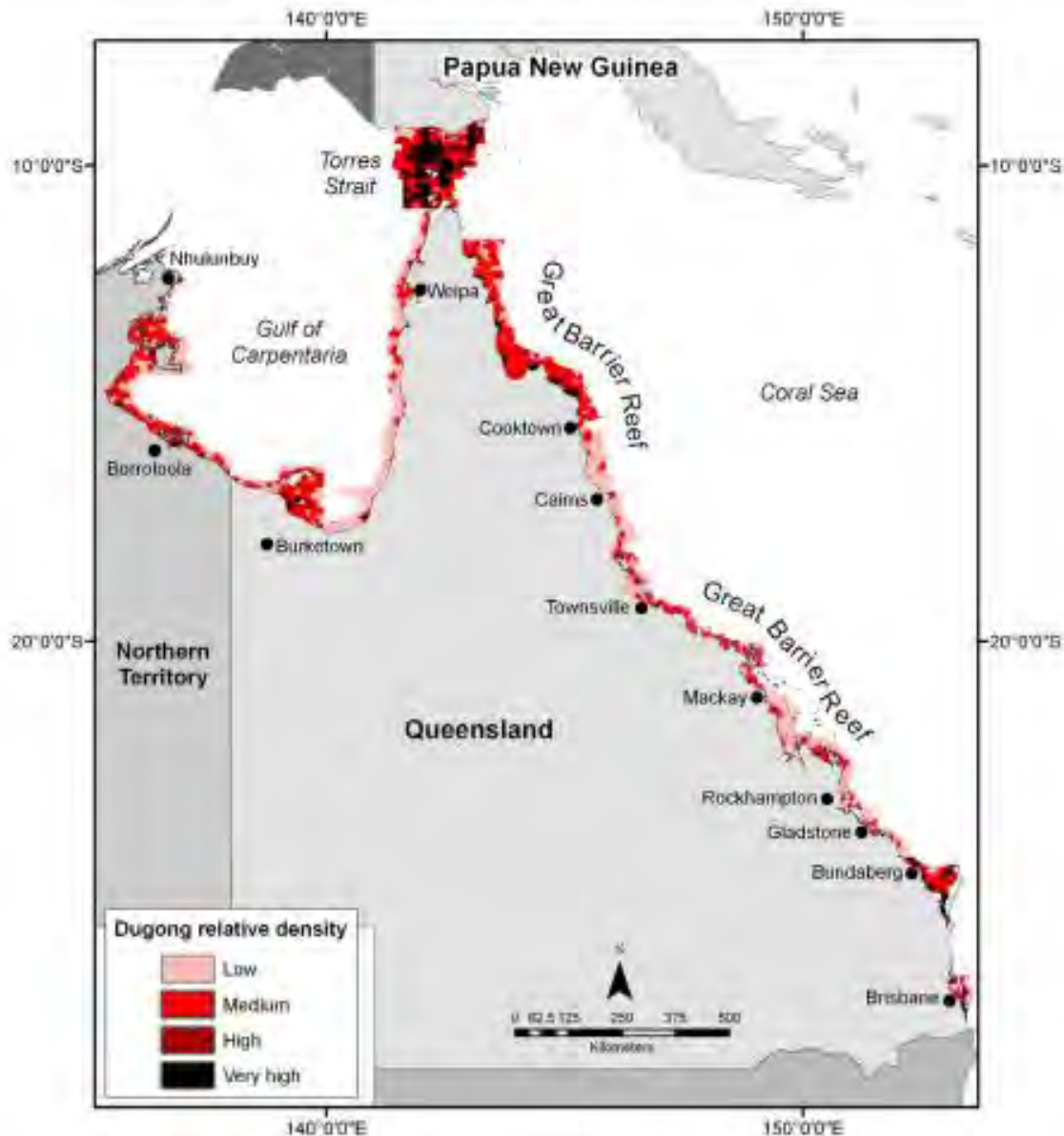


Figure 3-10 Dugong Distribution and Relative Density in Northeast Australia (Grech,A, Sheppard, J and Marsh, H. 2011)

3.6.3 Dolphins

Dolphins have been sighted in the entrance channel and it is possible that inshore species such as Australian Snub-fin Dolphin, Indo-Pacific Humpback and Bottlenose dolphins inhabit coastal and estuarine areas, including port waters, near Karumba.

Interactions between dredging operations and large marine fauna have not been a significant management issue for past campaigns at Port of Karumba, with only one event recorded during the 2010 campaign, involving a strike by the TSHD *Brisbane* whilst it was outside the channel and not during the action of dredging. The type of marine animal involved in that event was not able to be determined and could have been a log, marine debris or one of a number of potential large species known to occur in the Karumba area, however, was recorded and investigated as an un-verified marine animal strike via the dredging contractors EMP process.

3.7 Fisheries and Aquaculture

Commercial, Aboriginal subsistence and recreational fishing is conducted in the waters of the southeast Gulf of Carpentaria and in the Norman and Bynoe rivers. Commercial fisheries include prawn trawling, coastal net, and line fishing and crab pot fisheries. Trawling is not permitted in the waters of either the Norman or the Bynoe rivers.

Coastal and estuarine species targeted by commercial fishers and Aboriginal communities engaged in traditional subsistence fishing include barramundi, threadfin salmon and mud crabs. Barramundi are taken in gill nets and by line along the tidal reaches of rivers and on the coastal flats, except during the summer closure between November and February. At the start of each wet season, maturing males migrate down the rivers to spawn with resident females in outer estuaries and over tidal flats outside river mouths. Juvenile barramundi, which develop from larvae about 28 days after hatching, migrate up the rivers and creeks where they spend the first three to five years of their life. Larvae and juveniles feed on plankton whilst adults feed on prawns and fish. A barramundi stock farm is also operating in Karumba.

Two species of threadfin salmon, king, and blue salmon are taken in the Gulf. King salmon comprises the second largest catch after barramundi which spawn near the mouths of estuaries and possibly further offshore. King salmon feed on a variety of prey including prawns, lobsters, crabs, octopus, squid, and fish.

Mud crabs inhabit the mud banks and mangrove fringes along creeks and rivers where they feed on worms, bivalve and gastropod molluscs and other crabs. Mud crabs are also caught for commercial or recreational purposes.

In addition to species commonly taken by commercial fishers, recreational fishers also target grunter, mackerel, flathead, bream, and queenfish. Most recreational fishing takes place around Karumba and in the lower reaches of the Norman River, although in recent years, the fishery has moved further offshore. The recreational fishery is of high commercial importance to the local community with around 25,000 tourists, with a primary purpose of fishing, visiting Karumba each year. Aboriginal fishing activities are usually conducted closer to the communities to the north and to the west of Karumba, as well as further upstream near Normanton.

Four species of prawns, the banana, brown tiger, blue endeavour and the blue-leg king prawn, are fished commercially in the southeast Gulf. These species spawn offshore and give rise to larvae that migrate into 'nursery' grounds, usually seagrass beds or mangrove areas, in shallow coastal areas where they feed and grow. After three months in these nursery grounds, juveniles migrate offshore into the fishing grounds where they feed and grow for at least another three months before attaining commercial size.

Of the local species, banana prawns are the most dominant in the Karumba area, attributing to 99 % of all juveniles sampled within the Norman River (Dames & Moore and WBM 1996). Banana prawns spawn offshore during two peak periods (Autumn – March to April, and Spring – September to November), following which the larvae migrate toward the estuary areas, including those within the Norman River system, in the subsequent season (i.e. winter and summer). Once in the estuary, juveniles remain close to the water's edge along the mangrove lined mud banks, with 80 % of the prawns located within two metres of the waterline (Dames & Moore and WBM 1996). Following a period of one to four months, the juveniles migrate back to the spawning grounds over a period of months (Rothlisberg *et al.* 1985).

Whilst the spring spawning season has been identified as the dominant of the two, with higher numbers of juveniles inhabiting the inshore areas over the ensuing months of summer, the breeding cycle nonetheless highlights the continuous movement of different prawn cohorts across the port area throughout the year.

During the Environmental Impact Assessment (EIA) process for development of the channel, knowledge provided by CSIRO on patterns of prawn migration led to Sea Dumping Permit conditions which include a period where dredging was permitted, to minimise potential impacts to the peak time in prawn movement. Hence a "Dredging Window" was established, which restricts

dredging activity to the period between 1 May and 30 September. It is proposed to continue this dredging window.

Advice provided by CSIRO (refer Appendix 7) supports continuation of managing dredging activity to occur in the lower risk periods and recommends a dredging window for activity between 1st May and 30th September of each year.

3.8 Water and Sediment Quality

The waters offshore from Karumba are generally very turbid. Due to the relatively shallow water depths, fine silts are continually mobilised and remain in suspension. Turbidity is also increased from freshwater runoff from the Norman and Bynoe rivers and hence is particularly high during the wet season.

Ports North have undertaken routine sediment testing within the channel in accordance with the NAGD prior to maintenance dredging campaigns and have not detected elevated levels of lead or zinc, indicating a low occurrence of sediment or contaminant transport from the inner port to the entrance channel dredging area.

Detailed information regarding water and sediment quality within the channel is presented in **Section 5**.

4. DREDGING NEED AND PLACEMENT OPTIONS

4.1 History of Dredging Works

The Port of Karumba has been servicing the remote Gulf communities since the late 1800's. In 1996 the current entrance channel to the port was developed and extends for a distance of approximately 9.5 km offshore. This channel was developed over two capital dredging campaigns. In 1996 the small trailer suction hopper dredge "*Pelican*" with a hopper capacity of 965 m³ removed 730 individual loads, representing a campaign of 183,000 m³ to achieve a change in channel depth from 1.1. down to 2.0m Lowest Astronomical Tide (LAT). In 1998, a total of 1,004,000 m³ was removed under a second capital dredging campaign to take the channel close to 3.5 m LAT. The channel has been maintained generally on a biennial basis since this campaign. Dredge material from each of these campaigns was placed in the Port of Karumba's approved placement area 6 km north-west of the seaward end of the channel (Hillman & Raaymakers, 1997).

Dredging has been undertaken by the *TSHD Brisbane* over the last ten years; the *THSD Brisbane* undertakes all maintenance dredging in Queensland ports, under the direction of the Queensland Department of Transport and Main Roads and to address operational depth requirements for the main port user's export operations.

Routine maintenance dredging of the entrance channel has been required approximately every two years to remove accumulated sediments and maintain navigable depths.

The previous 10-year Sea Dumping Permit (2013-2023) allowed for up to 3,000,000 in-situ m³ to be placed at sea. This equates to an average of 300,000 in-situ m³ annually. However, to date, a total of 907,122m³ of material has been placed at the DMPA during that period, as described in **Table 4-1**.

Table 4-1 indicates an average maintenance dredging campaign is around 317,675 in-situ m³ with a maximum campaign of 544,200 in-situ m³. Over the last ten-year period (2011-2021), the average has been lower, at approximately 196,170 in-situ m³. This lower figure is attributable to the greater use of bed levelling to manage sediment loads, the temporary halting of zinc exports and also their ability to operate with reduced navigable depths for a period of operation. In addition, the Harbour Mast approved a new navigable area in deeper waters outside the maintained channel, to avoid the migrating sand bank.

During the period where zinc exports were not occurring, the sand bar was enabled to migrate freely; this necessitated a further revision of the position of the navigable channel with aims to reduce the extent of dredging required to maintain navigable depths.

Dredging requirements are heavily influenced by flooding events in the Norman River Catchments; major floods occurred in 2010 and 2018 which required significant dredging events to respond to the resulting accumulation of sediment within the channel.

The combined influences of flood events, operational needs, and the migrating sand bar indicate that dredge volumes at Karumba have been highly variable over the past period and differed to the forecast within the previous LTMMP.

Figure 4-1 indicates those past volumes and statistics for evaluation of future dredging requirements.

Table 4-1 Previous Maintenance Campaign Volumes

Year	Dredge Vessel	Dredging Type	Volume (in-situ cu. m)
1996	Pelican	Capital	185,000
1998	Orwell	Capital	1,004,000
2000	Orwell	Capital	454, 000
2002	Brisbane	Maintenance	513,000
2004	Brisbane	Maintenance	395, 000
2006	ECM	Bed-levelling	399,000
2008	Brisbane	Maintenance	466,200
2009	Pacific Conquest	Bed-levelling	-
2010	Brisbane	Maintenance	544,200
2011	Brisbane	Maintenance	269,900
2012	Pacific Conquest	Bed levelling	-
2013	Pacific Conquest	Bed levelling	-
2014	Brisbane	Maintenance and bed levelling	120,924
2016	Brisbane	Maintenance and bed levelling	45,262
2018	Brisbane	Maintenance and bed levelling	508,841
2019	Brisbane	Maintenance and bed levelling	131,930
2020	Pacific Conquest	Bed levelling	-
2021	Brisbane	Maintenance and bed levelling	100,165

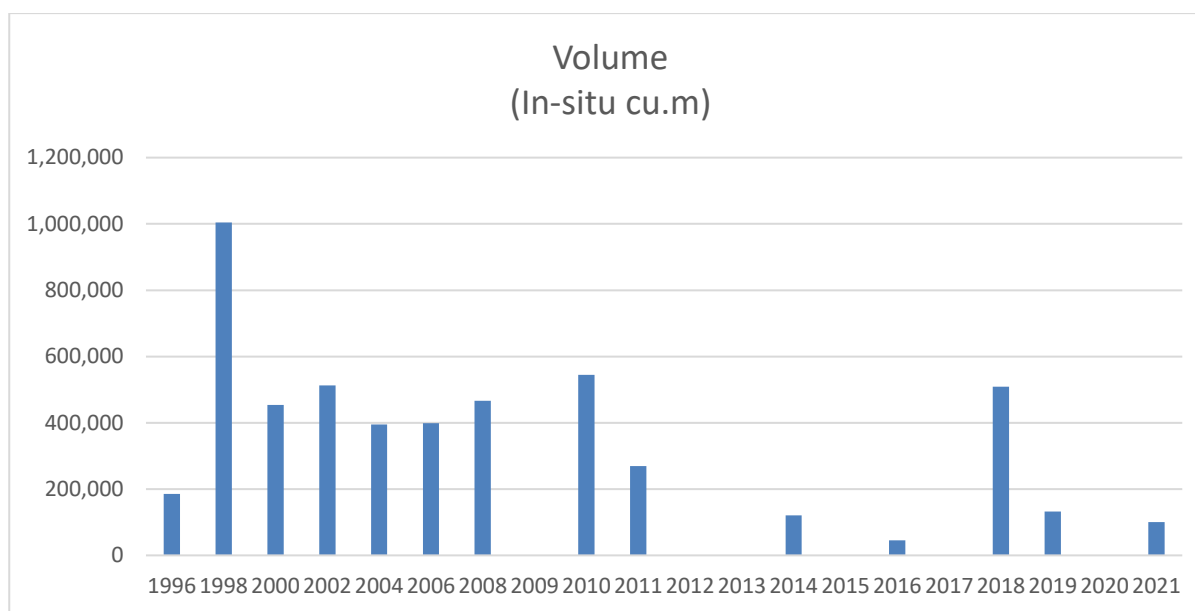


Figure 4-1 Maintenance Dredging Volumes at the Port of Karumba

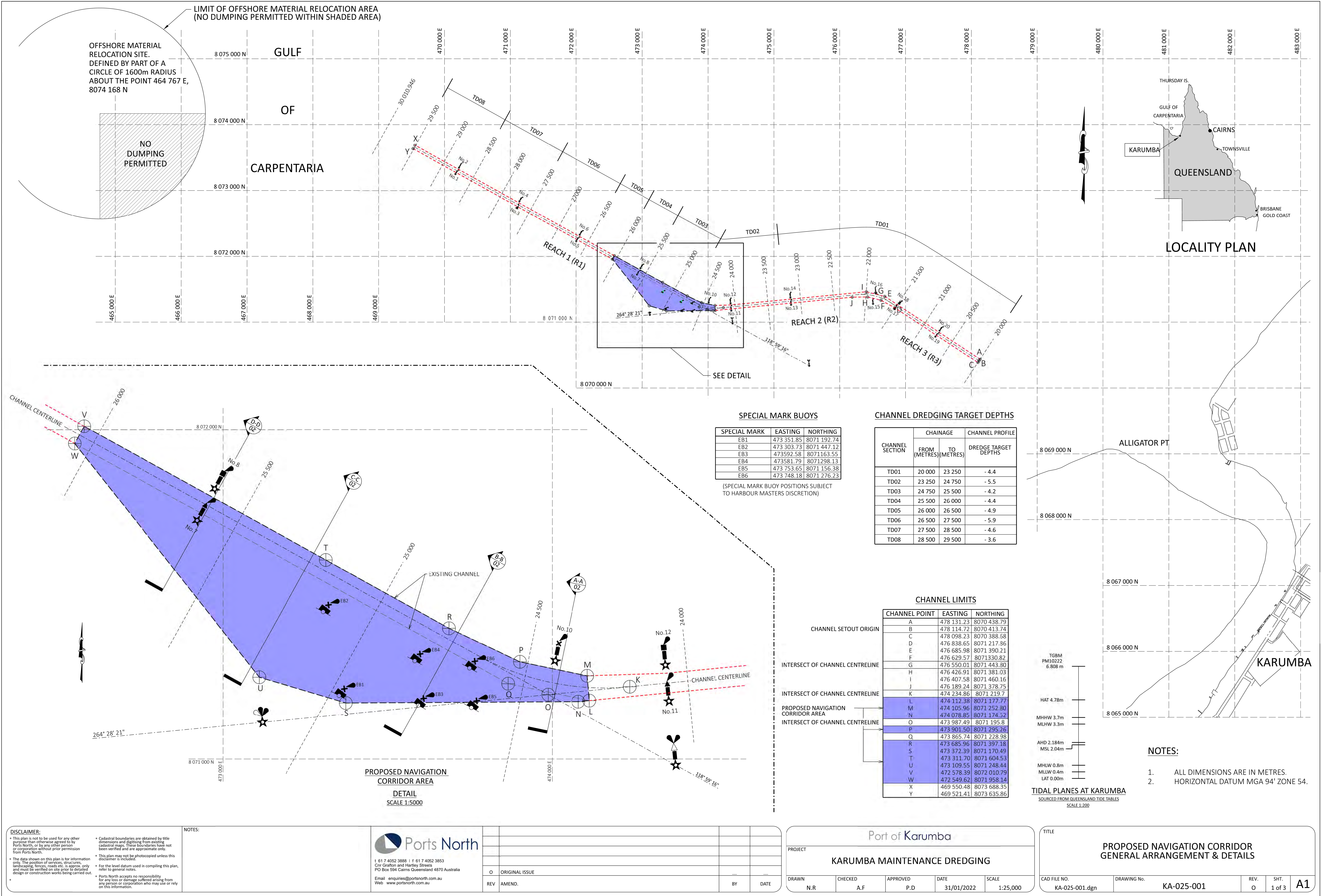
4.2 Channel Alignment

Since establishment of the channel in the mid 1990's, alignment has been refined on two occasions and process enacted for further refinement for the term of this plan and permit period, with context outlined in the following summary,

As a result of the extreme flooding activity during early 2009, deposition of sediment within the channel adjacent to Beacon No. 10, and the predicted ongoing encroachment of Elbow Bank led to a review of channel alignment in that section by Ports North during 2009 and mid-2010. Outcomes of an assessment of dredging activity and hydrographic surveys identified that by re-aligning a portion of the channel to naturally deeper water, the need for excessive dredging activity adjacent to Beacon No. 10 may be minimised. Development Approval was granted by the former DERM on 6 May 2010 for the revised alignment.

In recent years the bathymetry within and surrounding the Port of Karumba channel has continued to change, with a large sand bar having formed immediately adjacent to the channel. The dynamism of the channel is a result of extreme weather events and flooding. This has created significant challenges in effectively maintaining channel depths and has resulted in increasingly larger maintenance dredge volumes being required to maintain these depths.

Accordingly, in late 2021, Ports North pursued amendment of approvals to accommodate a more flexible arrangement with respect to the channel alignment at the Elbow Bend. Specifically, Ports North sought approval for an overall navigation corridor within which the marked channel is positioned by mobile buoy markers at the direction of the Regional Harbour Master, as shown in **Figure 4-2**. This is expected to reduce the overall volume of material that needs to be dredged each year, reducing disturbance to the surrounding environment.



4.3 Evaluation of the Need for Dredging and Opportunities to Reduce Dredge Volume

The need for maintenance dredging of navigation channels arises periodically due to sedimentation of existing channels. Declared operational depths are determined for various channels, and these depths are routinely monitored via hydrographic surveys. When the channel depth approaches the minimum operational depth (via sedimentation), the need for maintenance dredging arises. In the case of the Port of Karumba, sedimentation may either be a gradual and predictable process, or may be rapid and unpredictable, as is the case when flood events lead to sudden sedimentation of port berths and channels.

Ports North has a requirement to discharge obligations placed upon it under the *Queensland Transport Infrastructure Act 1994*, including maintenance of navigable depths and safe port operations. The need for maintenance dredging is assessed by Ports North's Surveyor in conjunction with Maritime Safety Queensland and subsequently the General Manager Planning and Infrastructure will review routine hydrographic surveys (Refer **Section 2.5** for description of responsibilities) to determine the requirement for a dredging campaign.

Yearly planning of the channel maintenance dredging campaigns is based on post wet season (or "pre-dredge") hydrographic surveys and a calculation, from this, the volumes required for removal to achieve the target channel depths.

The units of volume generated are therefore "in-situ" cubic metres, and all volumes presented in this document are "in-situ" cubic metres unless stated otherwise.

4.4 Estimated Dredging and Sea Placement Requirements (2022-2032)

A review of the past volumes suggests that based on the observed unpredictable climate influences, the resultant high degree of variability of siltation, and corresponding impact on dredging campaign required to achieve channel design, there needs to be a degree of flexibility in the permit volume to accommodate these dredge volume variabilities previously experienced.

Ports North sought approval for an upper limit of 2, 550,000 in-situ m³ over the next ten year period, comprising:

- 2,237,300 m³ of maintenance dredging from the entrance channel and amended navigational corridor, and;
- 250,000 m³ allowance for contingency/emergency dredging in the event of a cyclone or flood event, and;
- 62,700 m³ of capital dredging material from the amended navigational corridor

These volumes are a reduction on the previous permit term and considers the continued active management of the migrating sand bar to reduce dredge volumes.

This reduced volume requirement (in comparison to that in the previous Sea Dumping Permit) is due to a number of factors including:

- A review of dredging volumes over the previous ten years
- The greater use of bed levelling to reduce dredging requirements wherever possible
- Operational controls around vessel movement i.e. limiting access on low tides etc.
- The introduction of a variable navigational area so that dredging of the moving sand bar is avoided or minimised.

Because of the high degree of variability in dredge volumes (heavily weather related) and some unknowns around the continued operational needs of NCR, there is some contingency required in the volumetric limit. Whilst the full allowance for 2013-2023 has not been utilised, this was due largely to operational factors associated with operation of the NCR facility. Should their operational requirements change, this has a direct impact on the need for dredging. Ports North will continue to minimise dredging volumes wherever possible, as further described in **Section 4.5**.

4.4.1 Emergency Dredging

Approval was sought to dispose to a volume of up to 250,000 in-situ m³ over the permit term, to allow for any extreme weather events that causes sedimentation of the channel and subsequent loss of navigable depth in the period prior to next scheduled campaign. Therefore, based on frequency of need for emergency dredging, one event is predicted in the next ten-year period, and an allowance of 250,000 in-situ m³ is identified. The need for emergency dredging will be assessed in light of other channel management options, such as bed levelling, and changes to vessel loading which may reduce the need for dredging. No emergency dredging has been required over the last ten year planning period.

The timing for flood or storm surge that triggers a need for emergency dredging is uncertain, but is most likely to occur during or immediately following the summer or early autumn wet season when monsoonal activity is greatest and after all possible sediment inflows due to wet season extreme weather events have concluded.

It is possible, but highly unlikely, that major weather events of sufficient intensity so as to cause acute sedimentation of the channel, could occur during the dry season. Need for emergency dredging is therefore most probable within the latter stage of the seven month no-dredging period (February, March or April inclusive). This timing however coincides with loggerhead turtle nesting season (October to February inclusive) and prawn migration in the area. Should the need for emergency dredging be identified during that period, Ports North will, via the TACC, identify any technical ecological issues and consult with DAWE.

Therefore, there is a very low probability of the need for emergency dredging (i.e. a volume significantly above forecast annual amount) within the preferred non-dredging period (October to April inclusive) and a much higher probability that such dredging would be delayed and included within the normal “dredging period” of 1 May to 30 September of a given year.

It is expected that it would take at least 5-7 days for a dredge to be mobilised to site. During this time, Ports North would liaise with DAWE, the Regional Harbour Master, and TACC to establish dredging requirements and any specific measures to be undertaken to mitigate potential impacts to turtles nesting and prawn migration.

Management process for potential emergency dredging during the non-dredging period is outlined further in **Section 7.3**

4.4.2 Total Maintenance Dredging Requirements

Estimated dredging and disposal need is therefore 2,237,300 in-situ m³ over the next ten (10) years as shown in **Table 4-2**. This volume caters for the establishment of the navigational area, which extends the position of the current navigational channel to the south, and is intended to reduce the amount of maintenance dredging required.

Table 4-2 Estimated Maintenance Dredging/Spoil Disposal Quantities

Operational case	Volume (in-situ m ³)
Maintenance dredging	2,237,300
Capital Dredging	62,700
Emergency Dredging – allow additional dredging volume within 10 year permit period to respond to extreme weather	250,000
Total requirement for 10 year permit period	2,550,000 in-situ m³

4.5 Minimisation of Sediment Accumulation and Dredging Needs

The 1996 *Protocol to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972* (the London Protocol) requires consideration of measures to prevent, reduce, and where practical avoid the relocation of dredge material at sea. Ports North therefore aim to reduce their maintenance dredging requirements as much as possible and will only undertake dredging when necessary.

Several studies have been undertaken in relation to reducing the sediment build up in port limits at various ports throughout Australia and internationally. A number of strategies to minimise maintenance dredging activities are listed below and are currently utilised at Queensland ports:

- **Channel design and alignment:** Ports North closely monitor and observe the build up of natural sediment at Karumba including the migrating sand bank within the existing navigational channel. For this reason, approval has been sought for an amended flexible channel alignment that can be altered to align with naturally deeper waters, thus reducing dredge volumes.
- **Hydrographic and bathymetric surveys:** repeat hydrographic and bathymetric surveys ensure that maintenance dredging is focused on the areas where sedimentation has occurred, and that maintenance dredging is only undertaken when and where it is required. Regular hydrographic and bathymetric surveys have been carried out prior to and following each dredge campaign at Karumba.
- **Bed levelling:** bed levelling is used to level out high points in a channel and, therefore, help to reduce the frequency of maintenance dredging, or improve the efficacy of the other dredging equipment. Bed levelling has been undertaken in preference to dredging on a number of occasions at Karumba (Refer to **Table 4-1** for further information)
- **Shipping Simulation:** fine tuning the specification of vessels and sailing conditions through computer simulation in conjunction with Maritime Safety Queensland (MSQ), pilots and shipping companies to resolve the parameters within which certain vessels can utilise a channel and facilities of set dimensions. This may reduce the need certain aspects of either maintenance quantum or frequency or future capital works.
- **Tidal windows:** maximising vessel movements through shallower areas during higher stages of the tide to ensure sufficient under keel clearance. This approach can result in operational inefficiencies and has the potential to result in safety and environmental implications if not managed correctly.
- **Port Management:** ports will typically manage their infrastructure and operations to minimise the requirement for future maintenance dredging including working with port tenants and customers.

Maintenance dredging has been required generally every one to two years at the Port of Karumba since the channel was first formed in 1996. Ongoing annual maintenance dredging will continue to be required to maintain the full functionality and safety of the port and entrance channels for shipping.

In terms of vessel safety, loss of depth within the channels due to siltation has a significant impact on the draft of vessels that are able to transit and navigate efficiently and safely within to and from the port. The volume of material to be dredged cannot be reduced further without compromising the navigational safety of the port. As a result, proposed volumes are required to be removed to enable the port to continue operating safely and to maintain the declared navigational depth.

Reducing the frequency of dredging is not feasible and would result in the operating depth of channels not being able to be confirmed and assured by MSQ. Larger vessels would also subsequently not be permitted to enter or exit the port or else restricted to specified tidal windows.

To meet obligations under the Queensland *Transport Infrastructure Act 1994*, Ports North also requires certainty that it can rapidly resume effective operations of the port after being impacted by

an extreme weather event. For this reason, in addition to an annual quantity, a contingency allocation is identified as part of long-term maintenance dredging permits to allow for post-event dredging and placement response.

Without maintenance dredging, the existing channel would not be maintained to its current design depth and would reduce the accessibility of large vessels entering and berthing at the Port of Karumba. The reduction in ship movements in and out of the port would result in direct impacts to the ability of current port users to operate from Karumba.

In recent years, dredging at Karumba has been dictated by the needs of NCR; they are presently using a vessel custom-built for the shallow waters of the Norman River to load export material; this is then transferred to export ships anchored further out in the Gulf of Carpentaria. This has significantly reduced the depth (and hence volume) of maintenance dredging, with dredging not always required to the full declared depth. Maintenance dredging volumes have been further reduced by the use of bed levelling for a number of years; this process moves the shallower ridges of deposited material into deeper areas, thus prolonging the need for dredging. Evidence to-date indicates that this practice has been successful, both in being cost-effective and in having minimal environmental impacts due to the short term of operations typically being less than a week of disturbance, and as a successful alternative to the action of dredging under certain conditions.

Dredging frequency has been variable, and has reflected operational requirements such that, while NCR were not operating, dredging frequency was further reduced, to align with that lack of need. Should exports from Karumba cease or reduce further, the need for dredging will be reconsidered as necessary.

Alternatives (including those used at overseas ports such as sediment bypassing, side casting, and interception structures) to either bed-levelling, or dredging, are very limited. While possible in small marinas and boat harbours, the volumes of material regularly deposited within the maintenance channel is not suited to such structures.

While the consideration of options to minimise the need for dredging will remain one of the ongoing continual improvement actions of this LTMMP, the ability to influence the accumulation within the port channel. The need for intervention has, and will therefore, need to continue in the form of maintenance dredging.

The need for dredging has been the subject of ongoing assessment as per the prior long-term management plan and supervision by the TACC.

4.6 Examination of Reuse, Recycle and Placement Options

Australia's obligations under the 1996 Protocol to the *Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 1972* (the London Protocol) requires consideration of alternatives to sea placement as well as minimising pollution caused by ocean placement.

All alternatives to ocean disposal need to be evaluated, including environmental, social, and economic impacts of each disposal option. The NAGD identifies important elements for assessing disposal options are:

- Are there opportunities to beneficially use or recycle such materials?
- If they have no beneficial use, can they be treated to destroy, reduce, or remove the hazardous constituents?
- If hazardous constituents are destroyed, reduced or removed, do the materials have beneficial uses?
- What are the comparative risks to the environment and human health of the alternatives?
- What are the costs of the alternatives?

All maintenance dredging material from the navigational channel has been placed at a marine based DMPA. In the context of the Port of Karumba, previous extensive monitoring of Entrance Channel sediments has not identified any sediment contamination issues. Sediments have always been identified as suitable for sea disposal at the screening level of assessment. Anthropogenic contaminants are either below detection or well below screening levels. These reflect a catchment with minimal industrial or urban disturbance or contaminant inputs.

A review of potential reuse options was examined in the previous LTMMMP, and it was concluded that at sea placement was the most viable disposal option, for the following reasons:

- The type of material within Karumba (Refer to **Section 5**) precludes the potential for reuse due to both the composition of the material, generally being fine sediments, and lack of demand for material within the region. There are limited beneficial use options in the Karumba region given its remoteness and hence general lack of development in the area.
- Material is generally unsuitable for beach nourishment due to the fine silt content, and the small numbers of potential nourishment areas are not capable of taking all the volume over the life of the Permit/Plan. There is limited demand for additional land in via reclamation at Karumba.
- Reclamation works would most likely have a negative environmental impact, given that the Karumba-Norman River intertidal area supports extensive wetland, mangrove and seagrass communities.

As part of preparing this LTMMMP, potential reuse options were re-examined.

2021 Analysis

In revisiting the findings of previous assessment assessments as part of this LTMMMP, there are no apparent improvements in sediment quality and/or processing that would lead to further opportunities for re-use or otherwise lessen the prospective challenges associated with land-based placement.

Option 1: land placement for the purposes of beach nourishment or erosion management

Carpentaria Shire Council have undergone a two-year assessment of Coastal Hazards for Carpentaria Shire (Carpentaria Shire Council, 2021) involving extensive technical investigations and community consultation.

Some erosion is occurring around Karumba Point (at the mouth of the Norman River) and will likely be exacerbated by more frequent storm tide inundation with climate change. At that time, the

erosion was being managed through coastal protection structures and vegetation management, however Council continues to monitor erosion. Nourishment has occurred at this location in the past, but in small volumes. Ports North will continue to liaise with Council to review their need for sand, but the volume required would not be sufficient to take the volume of dredge material generated by maintenance dredging activity. Nor is the material of sufficient quality (fines content is too high) to be suitable for nourishment purposes.

No other erosion protection or beach nourishment requirements were identified in the study.

Option 2: Land placement (above high water mark) for commercial or industrial use including treatment and prospective re-use of treated material for construction fill

Ports North liaise regularly with existing and potential port users; at present, there has been no demand for fill material at Karumba. There are no or limited sites available at the port or in the local region for reclamation. There is no specific demand for additional port facilities identified by Ports North in the 10 year planning horizon.

The majority of land within the port boundary is already developed, and there is not sufficient space available to place fill material at this point in time. The quality of the material is such that it would also not be suitable for use as fill material without significant additional treatment i.e. amelioration with other soils, extensive dewatering. A very large site would be required to take ongoing maintenance volume as well as bulking water required to pump dredge material to its containment area.

Furthermore, the placement of material on land will require construction of a bunded area, which can create flooding issues within coastal plains for adjoining properties. It would also necessitate the treatment of acidic material and the release of tailwater into the Norman River. Placement areas can also create nuisance noise, odour and dust issues for adjoining lands. There are large areas of marine plants on the banks of the Norman River that may also be disturbed if material is placed to land.

There are no quarries, voids or landfills within the vicinity of Karumba that would be able to take the maintenance material (the nearest facility is near Normanton, approximately 35 km away).

Significant additional cost would be involved in reclamation rock revetment, bunds and containment, and management of dredge tailwater. Significant time (decades) and cost would be involved in treatment of the placed material to a future development standard. Re-use of the dried material as construction fill may be logistically possible but noting that the material has naturally poor engineering qualities and potential applications. As such, it would not ever become economically viable until all land based raw materials and recycled products became exhausted.

Option 3: Reuse for Habitat Restoration or Creation Purposes

There are extensive areas of marine wetlands along the coastline of Karumba, that are in good condition at present and are largely within protected areas (i.e. reserves, High Ecological Significant Wetlands, Fish Habitat Areas etc), making it challenging to gain approvals for any disturbance of surrounding vegetation and land. Karumba is small town with a population of around 500 people; the main industry within the area is tourism and fishing. There is therefore minimal disturbance to habitats within proximity to Karumba and no opportunities for habitat restoration have been identified at this time.

Creation of offshore islands and bird/mangrove habitats have been dismissed on the basis of their impacts/displacement of existing extensive habitat values and noting these constructed islands have the same, environmental, operational, and economic costs of a reclamation for port purposes.

SUMMARY

Based on the previous studies and the re-assessment of land-based placement and beneficial re-use of dredge sediment, it continues that there do not appear to be any appropriate or practical alternatives to the use of an offshore placement site for the type of material, its physical properties, volume and frequency of maintenance dredging material that will be generated over the ten-year term for the Port of Karumba.

4.7 Alternative Ocean-Based Placement Options

The preferred offshore placement option was assessed during the Environmental Impact Assessment process that led to construction of the channel and selection of the existing spoil ground in 1996. This disposal option was considered to have the least potential to exert any risk to human health or the environment. All alternatives are predicted to cause unacceptable loss, alteration and disturbance to local littoral or terrestrial habitats. The placement area has been successfully used for all previous maintenance dredging and associated monitoring has not identified any evidence that dredge plumes and the relocation of dredge material has caused unacceptable impacts on water quality, ecologically significant habitats, trawling areas or commercially important fish species.

The existing site has successfully been utilised in all previous maintenance dredging programs since 1996. Conclusions outlined in the LTMMMP 2013-2023 in regards to future capacity of the DMPA remain valid, as placement activity in the past period has been significantly lower than anticipated. Regular review of the pre and post placement hydrographic surveys is undertaken so as to ensure schedule for each campaign utilises a placement sequence to ensure even spread across the usable three sectors and avoidance of the shallower inshore quadrant.

In preparing the Application and drafting of the LTMMMP for the term, a review of all the Post Dredge DMPA surveys between 2002 and 2021 was completed and the following observations noted;

- The earliest DMPA Post Dredge survey was 2002 (**Figure 4-3**) following completion of the channel development works, and for comparison the most recent survey following the 2021 maintenance dredging campaign (**Figure 4-4**).
- Attention is drawn to around the periphery of the circle as well as the adjacent seabed, it can be seen that the seabed depths and contours are very consistent over this 19 year period. This is interpreted as indicating that no dredge material has migrated beyond the bounds of the DMPA.
- The last survey completely covering the DMPA was the 2014 Post Dredge survey. Looking specifically in the south-east quadrant, there were a number of shoal depths present on the 2002 Post Dredge survey in the range of -4.0m to -4.3m. These shoal depths have been consistently reported in each subsequent Post Dredge survey up until 2014. From this it is concluded that;
 - the DMPA is very retentive as no appreciable loss of depth has occurred in this quadrant, and,
 - the consistency in depths and the pattern of depth contours indicates that no further dumping occurred in this quadrant following the 2002 channel development works.
- Between 2002 – 2021, a steady accumulation of material consistent with dredge campaigns has been recorded in the north-east quadrant of the DMPA. This reflects the apparent choice of the dredge operator to favour the quadrant given its proximity to the end of the channel. There has also been some accumulation of dredge material in the south-west quadrant, however not to the extent of the north-east quadrant.
- The north-west quadrant appears to be largely unused with a high correlation in depths between 2002 – 2021.

Regarding future capacity of the existing DMPA, assuming an average placed depth of 1m over the 3 quadrants currently in use, gives a remaining capacity of approximately 8M cu.m., and this is comfortably well in excess of the forecast total amount anticipated to be placed over the 10 year permit term.

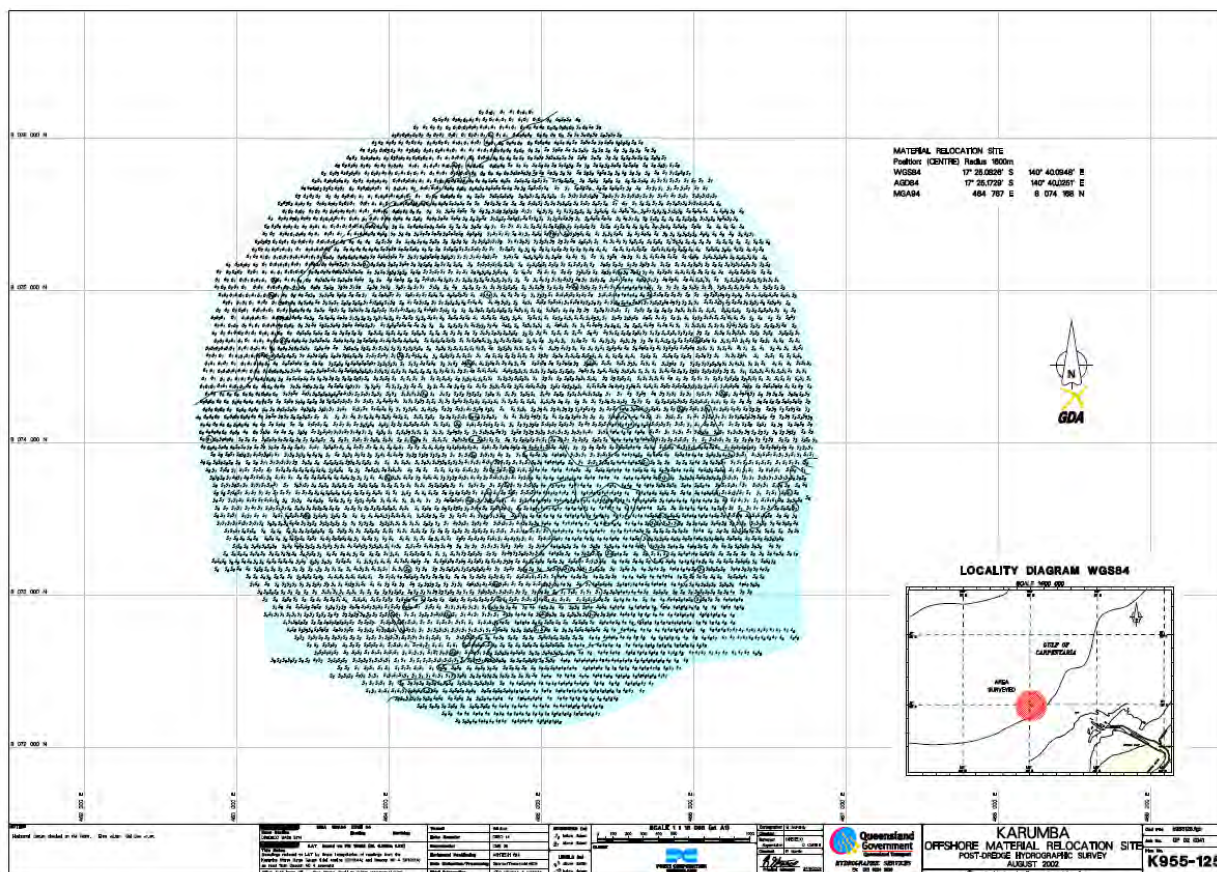
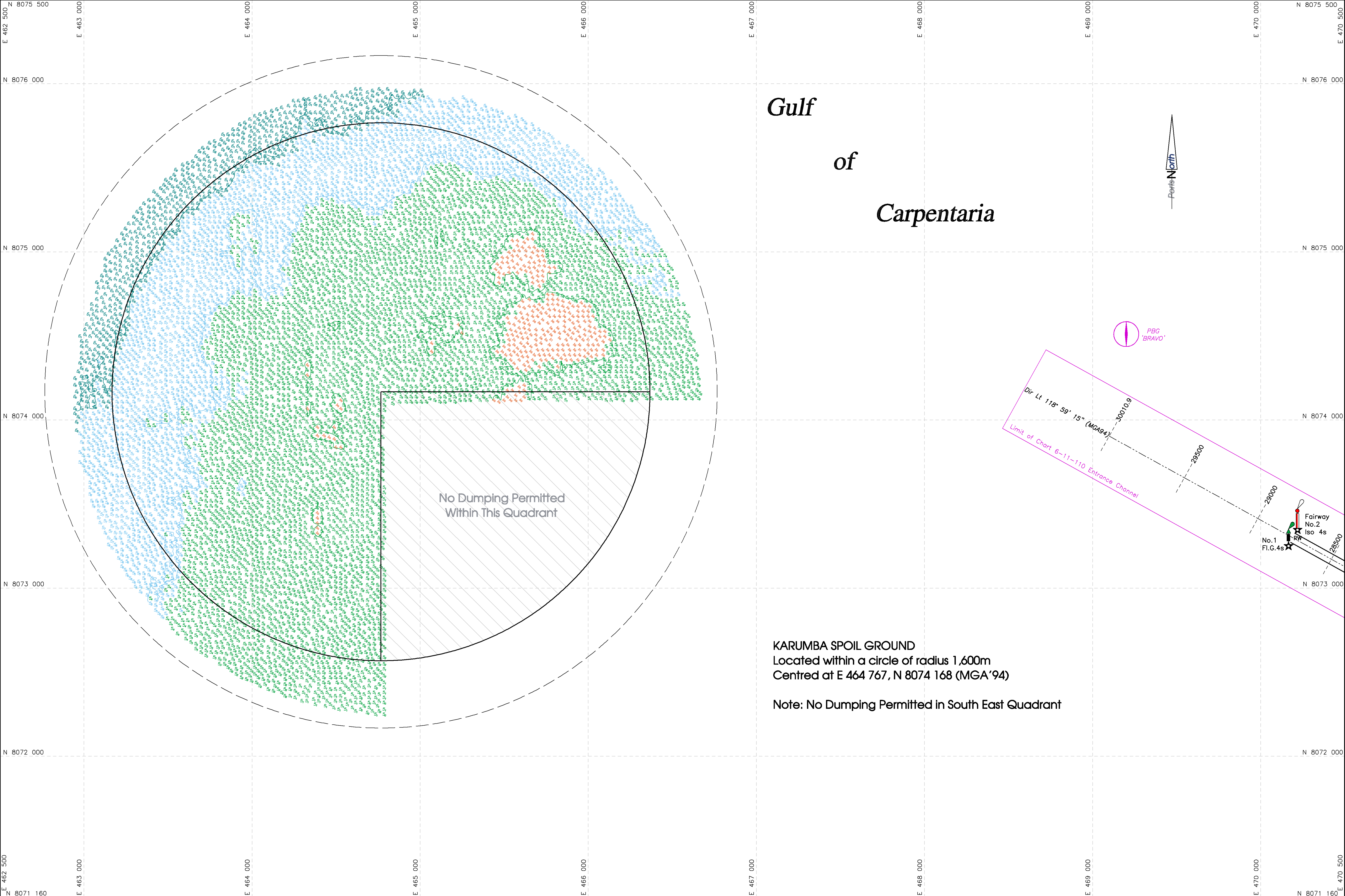


Figure 4-3 2020 DMPA Post Dredge Survey



KARUMBA SPOIL GROUND
Located within a circle of radius 1,600m
Centred at E 464 767, N 8074 168 (MGA '94)

Note: No Dumping Permitted in South East Quadrant

Tidal Notes
Soundings were reduced by direct application of geoidal corrections observed at:
Karumba Bar Tide Gauge No 071007A located at No 4 Beacon
MGA94 Zone 54 Location East 471 137.0, North 8072 838.0

Survey History
Sounding lines run on 16/06/2021.
Soundings shown are shoal biased on a 25m radius derived from
1.0m MBES data set. Post dredge spoil ground 16062021-1m cubed surface.pls
provided by Aquamap

Spoil Ground Dimensions
Centre: E464 767
N 8074 168
Diameter: 3,200m

Depth Ranges	4.0m - 4.4m	red
	4.5m - 4.9m	orange
	5.0m - 5.4m	green
	5.5m - 5.9m	lt. blue
	6.0m - 6.4m	teal
	6.5m - 6.9m	dk. blue
	7.0m - 20.0m	black

Horizontal Datum	Map Grid of Australia (MGA94) Zone 54
Base Station	Connection to Datum: PM76321 East 462 974.313 North 8 066 902.646 (1st Order)
Base Station	PM 164068 (Front Lead)
Base Station	474 374.626 8 070 980.329
Vertical Datum	Lowest Astronomical Tide (Karumba)
Vertical Datum	Connection to Datum: PM 164068 RL 7.88 LAT (4th Order)
Depth Uncertainty	0.15m
Horizontal Uncertainty	0.5m
See Scale	See Ships Log

Vessel	Echo
Echo Sounder	R2Sonic 2024 (200kHz)
Heavemeter	Applanix POS MV
Horizontal Positioning	Applanix POS MV
Data Collection/Processing	QINSy/Qimera
Tidal Reference Station	Karumba 071004A

SOUNDINGS (m)	2s below datum
	2s above datum
LEVELS (m)	5s above datum
	5s below datum

SCALE 1 : 10,000 AT A1

CLASS C

Ports North

Hydro. Surveyor	M.Fitzpatrick(CPHS1)
Survey Date	See Notes
Plan By	Rob Harris
Plan Date	11/10/2021
Drawn by	Aquamap
Approved	Original signed & filed
Rob Harris	11/10/21
SSS(Aus) CPHS 2	Date

KARUMBA SPOIL GROUND
HYDROGRAPHIC SURVEY
Post Dredge Survey - June 2021

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Project File: 6-11-111.pro

Plan No. 6-11-111

Material generated from the routine maintenance dredging works is proposed to be disposed at the existing approved placement area. This site is located to the west of the Port/channel in approximately 5 metres depth (refer **Figure 1-4**).

The centre of the existing placement area is located directly west of the outer end of the channel. Its boundary is circular, with a radius of 1,600 m centred on the following coordinate (eastings and northings referenced to the MGA GDA94 projection, Zone 54):

464 767 **E**, 8 074 168 **N** or Latitude/Longitude 140° 40' 5.72" **E**, and -17° 25' 4.94" **S**

The placement area covers an area of over 8 million m². Due to shallow depths in the area, Ports North does not place material in the south-eastern quadrant of the placement area due to the natural shallow profile and to ensure the material is evenly distributed. This management measure has been continually implemented in previous campaigns and Ports North is aware of this restriction. This restriction reduces the useful area of the placement area, however it is predicted the rest of the site has adequate capacity for the term of this LTMMP in the absence of any future extreme events or change to seafloor bathymetry profile that give cause to a reduction in such capacity.

The area where the placement area is situated continues to have a natural seabed level of approximately -4.8 m to -6.4 m below LAT, deepening toward the northwest.

The selection of the placement area was based on a consideration of the following factors during the initial capital project (Dames & Moore, WBM 1996) and included:

- The characteristics of the dredged material and the material at the placement area site;
- Proximity to areas of environmental significance;
- Minimising impacts on marine habitats and fauna, including seagrasses and benthic infauna;
- Logistic and economic considerations, including optimisation of dredge cycle times; and
- Safety considerations in the operation of dredging equipment at the placement area.

Monitoring undertaken during the previous ten years (refer to **Section 3**) does not indicate any adverse environmental impacts beyond the placement site boundary; it is therefore considered reasonable to continue to use the existing site rather than disturb a new area.

4.8 Summary of Placement Options

The offshore placement option is preferred due to nil contamination of the material and minimal human or environmental impact compared to onshore disposal. Due to the nature and quality of the material to be dredged, there are no social, economic or environmental feasible options for beneficial reuse. Ocean disposal was assessed as the most sustainable management option for material during the Environmental Impact Assessment and approval process for the capital program in 1996 to develop the channel. Given that the nature and quality of the material has not changed significantly, and demand for reclaimed land or other uses at Karumba has not changed, these conclusions are still valid.

Port of Karumba and the surrounding region is generally pristine, identifiable by intact remnant vegetation, extensive wetlands and surrounded by areas with low rural impacts, therefore the demand for restoration or environmental enhancement is nil. Any such activities are more likely to have a deleterious impact to existing habitats, fisheries resources, or terrestrial ecosystems.

Table 4-3 below provides a summary assessment of alternative placement options.

Table 4-3 Summary of Alternative Placement Options

		Beneficial Reuse				Land Disposal				Reclamation				Ocean Disposal				Sub Tidal Dispersion-SideCast				Beach Nourishment																																																																																																																																																																																																																																				
Aspects	Impacts	Consequence	Probability		Risk	Impacts	Consequence	Probability		Risk	Impacts	Consequence	Probability		Risk	Impacts	Consequence	Probability		Risk	Impacts	Consequence	Probability		Risk																																																																																																																																																																																																																																	
Water	discharge during dewatering large volume of dewatering required saline discharge or need for additional salt drying area	M	VH	3	H	turbid run of, saline discharge	M	VH	3	H	turbid, saline discharge - less ability to control discharge	M	H	3	H	short term water column effects in a turbid adapted environment if uncontaminated material-nil WQ issues	L	VH	2	M	turbidity effects, broad zone of impact, less controlled placement	VH	VH	4	VH	discharge of large volumes of turbid water into intertidal zone -	M	H	3	H																																																																																																																																																																																																																												
Groundwater	salinity impacts if not appropriately managed	H	H	3	H	salinity increase unless lined drying area	H	H	3	H	likely to only affect tidal regime	L	L	I	L	Nil	L	L	I	L	nil	L	L	I	L	Nil	L	L	I	L																																																																																																																																																																																																																												
PASS/ASS	inputs to neutralise PASS required- cost	M	H	3	H	acid discharge-neutralise metals release from soil profile cost-treatment required	M	M	2	M	potential PASS/ASS mud waves - design response other effects as per Land Disposal	M	H	2	M	dilution, PASS not oxidised	L	H	I	L	minimal risk of oxidising PASS to ASS	L	H	I	L	higher risk of oxidising PASS to ASS than reclamation as its harder to apply consistent treatment	M	H	2	M																																																																																																																																																																																																																												
Flora	land clearing required to establish site	VH	VH	4	VH	vege clearing required impacts to coastal wetlands Permanent loss	VH	VH	4	VH	vege loss to intertidal zone, mangroves etc	VH	VH	4	VH	potential impacts to seagrass - nil if spoil ground is >1.5m depth -depends on optimal site selection	L	L	I	L	dispersal will be within zone likely to shade seagrass	VH	VH	4	VH	impacts to seagrass as works within 1.5m	VH	H	4	VH																																																																																																																																																																																																																												
Fauna	impacts to fauna at site of processing plant-permanent loss	M	VH	4	VH	disturbance or permanent loss of species and habitat	VH	VH	4	VH	disturbance to intertidal zone and transient mega fauna impacts to areas for migratory waders	VH	VH	4	VH	temporary disturbance to mega fauna (turtles, dugong) nil impact to intertidal waders temporary impact to fisheries resources	L	L	I	L	extensive turbid plumes, moderate duration shading/loss of clarity	M	VH	3	H	intertidal habitat disturbance/loss for migratory waders sp of con signif	H	VH	4	VH																																																																																																																																																																																																																												
Coastal Zone	long term loss of land adjacent to coastal zone	M	VH	3	H	removal of material from coastal zone process affect coastal wetlands	L	VH	3	H	changes to current patterns, scouring blocking natural sediment transition along and down shore	VH	M	3	H	maintains sediment within the coastal zone cycle for re- distribution	+VH	VH	I	L	maintains sediment within the coastal zone cycle for re distribution high potential for material returning to channel	+VH	VH	I	L	maintains sediment within the coastal zone cycle for re-distribution, high potential for material returning to channel	H	VH	4	VH																																																																																																																																																																																																																												
Air	emissions during processing	L	M	2	M	emissions during pumping/earthworks distance to disposal site governs emissions/cost odour if stagnant, anoxic	L	M	I	L	fuel emissions during transfer process by barge or earthmoving equip	L	M	I	L	minimal time in transit by most efficient transport mode -therefore efficient dredge mgt as it minimises emissions and transit costs	+VH	H	I	L	low emission from dredge plant	L	H	3	H		L	M	2	M																																																																																																																																																																																																																												
Noise	emissions due earth moving equipment and additional industrial facility	L	H	3	H	from earth works equip - if nearby sensitive receptors	L	H	3	H	from earth works equip - if nearby sensitive receptors	L	H	3	H	little impact to people, temporary underwater noise to marine fauna	L	L	I	L	little impact to people, temporary underwater noise to marine fauna	L	L	I	L	plant and equipment working on foreshore	L	M	2	M																																																																																																																																																																																																																												
Resource Use	high - large inputs of vehicle/plant emissions to manufacture or transport outgoing product	M	H	3	H	pump ashore fuel use transport emissions and fuel use to get earthmoving equip to region	M	H	3	H	geofabric or imported rock required for containment structure, fuel use to get it there	M	H	3	H	efficient use of dredge	L	L	I	L	greater pumping = fuel use	M	M	3	M	pump ashore fuel use-depends on distance/method	M	H	2	M																																																																																																																																																																																																																												
Marine Biota	nil	L	L	I	L	minimal disturbance except pipeline route/footprint	L	L	I	L	some loss of intertidal biota Mangrove loss-reduced fisheries productivity	M	H	2	M	some initial permanent loss at spoil ground, recolonisation during inter-campaign time - inshore nutrient rich spoil -pulse promotes succession of biota	M	H	3	H	broad impact to seafloor - much wider impact than spoil ground	VH	VH	4	VH	large impact to intertidal zone - permanent loss	VH	VH	4	VH																																																																																																																																																																																																																												
Social	additional industrial land use required, increased traffic/freight, additional industry/jobs	+H	M	2	M	traffic impacts - additional short term jobs during site prep	+H	M	2	M	restrictions to foreshore visual amenity reduced gain of usable land at above sea level	+H	H	2	M	minimal disturbance to boat traffic, short term visual impact of vessel or plume	L	L	I	L	extensive turbid plumes, moderate duration visual impact	L	M	2	M	restrictions on access reduced visual amenity-turbid plumes - rock groynes nil demand	H	VH	4	VH																																																																																																																																																																																																																												
Predicted Env Risk				3	H				3	H				3	H				I	L				3	H				3	H																																																																																																																																																																																																																												
Economic Ranking relative estimate compared to Ocean Disposal	>OD times ??? Establishing whole new industries				4	VH	OD times 4				3	H	OD times 3				3	H	OD cost				I	L	Similar to OD				2	M	slightly less than reclaim				2	M																																																																																																																																																																																																																						
Environmental + Economic				3.5	H				3	H				3	H				I	L				2.5	M				2.5	M																																																																																																																																																																																																																												
Notes and Justifications	nil existing or foreseeable demand					minimal demand at present for additional fill, no existing landfill site identified or facility available					cost dependent on pumping/transfer method and distance from source to site,					Existing arrangement, most consistent lowest impact option across each aspect and potential impact as well as social, human health and economic criteria					Similar potential aspects and impact to ocean disposal, but greater probability of broad scale impacts to marine environment due turbid plume promulgation					Nil demand or need for this s type of activity at this Port - major disturbance to existing generally intact coastal zone																																																																																																																																																																																																																																
<div><div><div>Environmental Risk Matrix</div><div><table><tr><th colspan="2" rowspan="2"></th><th colspan="8">Consequence</th></tr><tr><th colspan="4">< Negative</th><th colspan="4">Positive >></th></tr><tr><th rowspan="4">Probability</th><th>L</th><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><th>M</th><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><th>H</th><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><th>VH</th><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><th colspan="2">Rank Weightings</th><th>VH</th><th>H</th><th>M</th><th>L</th><td colspan="22"></td></tr><tr><th colspan="2"></th><td>4</td><td>3</td><td>2</td><td>1</td><td colspan="22"></td></tr><tr><td colspan="2"></td><td colspan="10">Lowest Ranking is best Env outcome</td><td colspan="16"></td></tr></table></div></div></div>																														Consequence								< Negative				Positive >>				Probability	L																														M																														H																														VH																														Rank Weightings		VH	H	M	L																									4	3	2	1																									Lowest Ranking is best Env outcome																									
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All dredging under the proposed LTMMP will be confined to the channel area illustrated in **Figure 4-5** and **Figure 4-6** are all situated on unallocated state land.

No dredging is proposed for the inner port areas, such as in the vicinity of the New Century Resources (NCR) ship loader wharf, which is located approximately 6 km from the entrance channel in a naturally deep section of the Norman River that is maintained by natural scouring activity and is between -4 and -12 m LAT.

General Location of area to be dredged - Port of Karumba Channel



Figure 4-5 Locations to be Dredged-within Channel relative to Karumba and Norman River

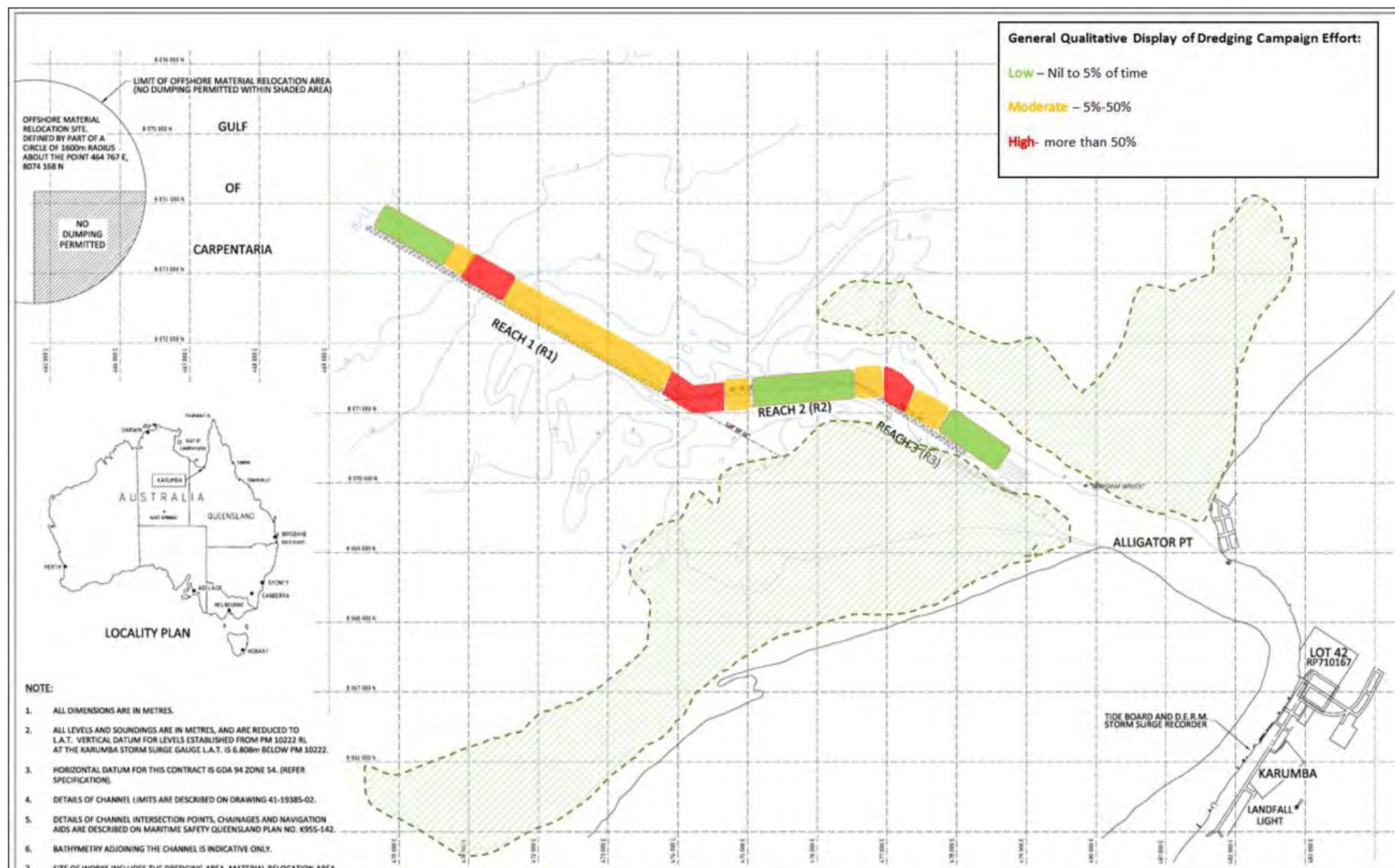


Figure 4-6 Priority Areas For Dredging – Port of Karumba Entrance Channel

4.9 Dredge and Placement Methods

Methods for dredging at Port of Karumba are intended to continue in a similar way to past campaigns, namely the use of a trailing suction hopper dredger, (TSHD) such as the dredge "*Brisbane*," or similar vessel for dredging and placement of material at sea. The dredge would remove the material directly into its hopper and then cart the material to the placement site for disposal. An example of the typical TSHD operation based on the vessel "*Brisbane*" is outlined below.

Typical operation of a trailing suction hopper dredger involves material to be dredged being removed through two suction heads, which are lowered into position on either side of the vessel. As the vessel steams slowly at around 1 – 3 knots, large pumps draw water through the heads, which entrain the sediment and transport the water/sediment mixture aboard into a central collection hopper. Whilst the suction heads are fitted with high-pressure water jets, which can be used to agitate consolidated sediment, they are rarely required for maintenance dredging.

The sediment/water mix ratio of material delivered to the central hopper is typically quite low. Whilst it varies depending on the type of sediment being dredged, the sediment concentration is generally in the order of 10 – 30 % solids. To maximise dredge spoil capacity, the large volumes of water are managed using a central column weir, which is incorporated into the hopper. This arrangement allows excess water to decant from the sediment and overflow to discharge. The capacity of the hopper is therefore dependant on the design capacity of the vessel, and sediment type – with volumes (including both sediment and water) approximating 2,800 m³ for fine silts and 1,700 m³ for sands (of a maximum hopper capacity of 2,900m³) for a dredge such as the *Brisbane*. Considering that more water is held in the silt matrix than sands, the dry weight cubic metres of sand able to be practically collected in each load is therefore generally greater than that in silts.

Once the dredge has filled its hopper with dredged material from the channel, the vessel will then relocate the material to the placement area. Upon entering the designated area for placement, the dredge would typically slow whilst material is being placed, however, a minimum steaming speed is required to maximise agitation within the hopper and clear dredged material, which would not otherwise be affected if the dredge were to remain stationary.

Each material placement is manually logged using both satellite navigation and standard bridge equipment, and is electronically fixed using a differentially corrected global positioning system (GPS). The electronic track plot marks the start of the placement process (hopper open), and the end of the process (hopper closed). This track usually shows an arc, which the dredge follows to ensure that all dredged material is placed within the designated spoil ground boundary.

During the dredging works, electronic logs of each placement event will be maintained. These logs will be retained by Ports North. At the completion of the project, these logs will be reported to the relevant government agencies to demonstrate compliance with permit conditions.

TSHD's undertaking dredging works at the Port of Karumba will include the following minimum specifications to minimise environmental impact from dredging and disposal:

- Central weir discharge system;
- Below keel discharge point;
- Turtle exclusion devices fitted;
- Low wash hull design; and
- Electronic positioning and recording system.

The dredge placement procedures and associated monitoring arrangements are developed by the dredging contractor to at least comply with the EMP measures for TSHD dredging as outlined in

Appendix 8. The documents prepared by the contractors will be reviewed for compliance with EMP requirements by Ports North prior to each campaign.

4.10 Proposed Schedule

4.10.1 Maintenance Dredging

Past dredge campaigns at Karumba have been conducted within a five month “Dredging Window” of 1 May to 30 September. This management constraint was established as an outcome of the original Port of Karumba EIS, as a mechanism to avoid dredging impacts during the prawn migration period based on advice from CSIRO who had identified the critical period for prawn migration from October to January in the Norman River.

CSIRO, is also a stakeholder representative on the Karumba dredging TACC which is consulted prior to and during each campaign (refer to **Section 2.9**).

It is proposed to continue this dredging window for the ten year period. Ports North is committed to ensuring that the standard dredge window is endorsed for the routine maintenance dredging works at the Port of Karumba.

Routine maintenance dredging has, and will continue to be scheduled to occur after the conclusion of the wet season at approximately the end of April each year, when possible inflows of sediments have concluded. Routine maintenance dredging can occur between 1 May and 30 September each year. This period is also consistent with the “dredging window” to protect marine resources from possible effects of dredging.

Ports North forecasts that the annual window for dredging between May and September is acceptable and a workable arrangement, given the practicalities of the wet season dictating that conditions could be unsuitable for dredging outside this period. The need for dredging outside this window is not considered a necessity for the Port under existing operational requirements.

A typical annual campaign is forecast to take approximately 3 weeks, or a biennial campaign of 6 weeks duration. Interim bed levelling or drag barring campaigns of approximately 1 to 2 weeks duration could also be implemented dependant on nature of event causing loss of channel depth.

5. CHARACTERISATION OF THE DREDGE AND DISPOSAL SITES

For the various Sea Dumping Permit and State approvals and conditioned monitoring requirements there have been requirements to undertake a range of environmental monitoring activities during and after each dredging campaign. The primary focus of these monitoring programs is to either provide baseline data and/or to assess the risk of impacts associated with dredging activities.

The following sections provide a summary of the relevant data collected to date, which is relevant to the LTMMP. The following studies have provided the primary sources for this information (**Table 5-1**).

Table 5-1 Previous Monitoring Programs

Topic	Study	Year
Water Quality	Karumba Dredging Program: Environmental site Supervision Report (EPA)	2000
	Port of Karumba maintenance dredging 2004 monitoring report (PCQ)	2004
	Turbidity monitoring of maintenance dredging Karumba 2002 (WBM)	2002
Sediment Sampling	Karumba maintenance dredging sediment sampling and analysis plan (GHD)	2002
	Survey of potential contamination of dredge material – Port of Karumba: Report on May and June 2002 survey (GHD)	2002
	Background surveys for polycyclic aromatic hydrocarbons at the Port of Karumba (GHD)	2002
	Sediment sampling – Port of Karumba: Report on February 2004 survey (GHD)	2004
	Port of Karumba Maintenance Dredging: Sediment Characterisation Report (Worley Parsons)	2009

	Port of Karumba Sediment Characterisation Report (Ports and Coastal Environmental Pty Ltd)	2015
	Port of Karumba Sediment Characterisation Report (Ports and Coastal Environment Pty Ltd)	2020
	Port of Karumba Sediment Sampling Report (BMT)	2022
Marine Pests	Survey of the Port of Karumba: Port marine baseline surveys and surveys for introduced marine pests (Neil <i>et al.</i>)	2001
Seagrass and other Habitat Monitoring	Seagrass monitoring report 2008 (Unsworth <i>et al.</i>)	2009
	Port of Karumba Long Term Seagrass Monitoring Report. November 2009 (Unsworth & Rasheed)	2010
	Port of Karumba Long-term Seagrass Monitoring, November 2011. DEEDI Publication, Fisheries Queensland, Cairns (Carter, A.B <i>et al.</i>).	2012
	Port of Karumba Long-term Annual Seagrass Monitoring 2021. James Cook University (JCU) (Scott, A.S & Rasheed, M.A)	2020
	Port of Karumba Long-term Annual Seagrass Monitoring 2022. (JCU) (Scott, A.S, McKenna, S, & Rasheed, M.A)	2021
Benthic Fauna	Benthic Infauna Survey (Ports and Coastal Environmental Pty Ltd),	2020

5.1 Sediment Quality

Entrance channel in addition to the initial investigations that were undertaken to characterise the nature of the capital material to be dredged in developing the channel, sediment sampling and analysis was undertaken in 2000, 2002, 2004, 2009, 2015 and 2020 as preparation for maintenance dredging campaigns. These investigations were undertaken in accordance with approved sediment sampling and analysis plans (SAPs). A thorough review of the results of these sediment quality investigations is provided in the sections below.

PHYSICAL CHARACTERISTICS

Entrance channel sediments were characterised during the preparation of the Karumba dredging environmental impact assessment (EIA) (Dames & Moore and WBM, 1996). In the EIA, it was reported that principal sedimentation would be due to the lateral inflow of fine silty sediments mobilised from the surrounding shallow sub tidal regions by wave action. Fluvial material transported downstream from the Norman River catchment was expected to comprise only a minor component of the material, as is the lateral inflow of coarser material from the intertidal banks.

Physical characterisation of the sediments was completed by Parry & Munksgaard (2000) who identified that the sediments within the Norman River and the channel are dominated by homogeneous silt and clay sized sediments with occasional lenses of fine sand a few centimetres thick. Findings of the 2009 Sediment Analysis Plan determined that there is a trend for decreasing sand content from inshore to offshore and a corresponding increasing trend of clay and silt content. The particle size distribution (PSD) analysis of 11 sites along the channel identified that the five inshore sites were relatively consistent in particle size distribution being dominated by medium grain sands (**Figure 5-1**). The outer three sites were dominated by clay and silts.

The latest 2020 sampling found that the channel contained between 60-80% clay material, with a sand content of between 20-40%. Sand was mostly distributed at the mouth of the Norman River, with clays and silts dominating the outer parts of the channel.

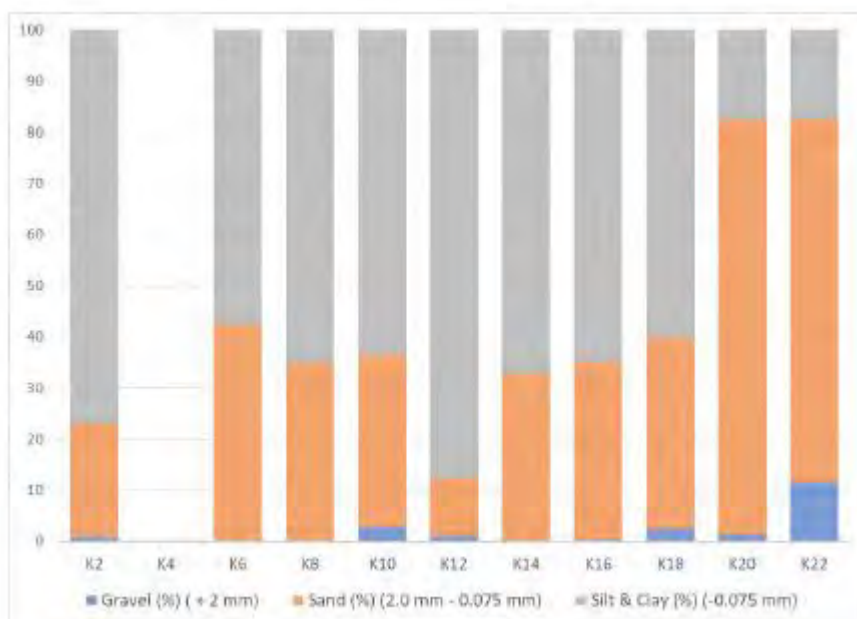


Figure 5-1 Percentage Sediment Particle Size Distribution (%) from the Karumba Channel (K20-22 are at the mouth of the river) (Source: Ports and Coastal Environmental Pty Ltd, 2020).

CHEMICAL CHARACTERISTICS

SAP's undertaken since 2004 have consistently identified a lack of detectable contaminants within sediment samples. A summary of findings from each major test event is provided below.

2004

During the SAP completed in 2004, sediment samples from 22 sites along the entrance channel were tested for trace metals, organotins and PAHs. Samples were taken from up to three horizons (0-0.5m; 0.5-1.0m; and >1.0m) and submitted for analyses. The results indicated:

- There were no detectable concentrations of Tributyltin (TBT) above PQL;
- Concentrations of all metals were below the relevant screening levels in all samples. 95%UCL of the means for metals were well below screening levels; and
- There were no detectable concentrations of PAHs above respective PQLs.

2009

A revised sampling protocol based on the NAGD, 2009 was approved for implementation during 2009 at eleven (11) sites using a 1m piston core or a van-Veen grab sampler when sediment was unsuitable for retention in the piston core. Sampling and analysis at the eleven sites identified the following;

- Tributyl-tin was below detection limits at all sites;
- Arsenic was detected in eight of the 11 sites below NAGD screening levels. The three most inshore sites had no detection of arsenic. Arsenic showed a trend of increasing in concentration moving offshore and correlated with change in fraction size;
- Cadmium was below detection levels at all sites;
- Chromium, lead, and zinc were above detection limits in all samples, but below respective NAGD screening levels. Each of these metals shows a general trend of increasing concentration moving offshore;
- Copper was above detection limits at nine of the 11 sites and nickel was above detection limits at 10 of the 11 sites. All detections were below the respective NAGD screening levels. Both metals show a general trend of increasing concentration moving offshore; and
- Mercury was below detection limits in all but two sites. Detections were below the NAGD screening level.

The material was considered clean under the NAGD, and suitable for unconfined ocean disposal.

2015

Sediment were analysed for metals, tributyltins (TBT, DBT and MBT), moisture and particle size (PSD). Given the homogenous nature of the materials, sediments were sampled over a surface interval of 0-1.0m from eleven locations.

All metals analytes (individual and 95% UCL) remained compliant to the adopted NAGD sediment screening criteria. Sites screened for TBT also reported concentrations below the limits of reporting.

2020

As per the approved SAP, analysis included:

- Particle Size Distribution (PSD);
- Moisture Content;
- Total Organic Carbon (TOC);
- Trace Metals (As, Cd, Cr, Cu, Pb, Ni, Zn, Hg); and
- Organotins (MBT, DBT, TBT);

TBT analytes remained below the laboratory limits of detection for the majority of samples, with an isolated TBT result of 2.7 µgSn/kg being recorded from K6. With a corresponding low TOC value this was adjusted to 5.4 µgSn/kg TBT (TOC normalised). Despite this isolated result, the Karumba Channel remains below the NAGD screening criteria of 9 µgSn/kg.

Assessment of the QAQC samples from this location (QAQC1 and QAQC2) also failed to record TBT above the LOR (0.5ugSn/kg). Given this finding the identification of TBT from K6 is considered to represent an isolated paint flake or similar within the sediment matrix, with the result not being replicated in the subsequent QAQC samples. TBT also remained absent from all other sampling locations and QAQC samples.

In accordance with the NAGD (2009), the sediments within the Karumba entrance channel remain below the TBT trigger criteria.

All metals analytes assessed under this investigation reported 95% UCL concentrations below the nominated screening criteria as presented within the NAGD (p37). In addition, all individual metals remained below the screening criteria. In accordance with the NAGD (2009), the sediments within the Karumba entrance channel remain free of metals contamination.

2022

Sediment testing was also undertaken in February 2022 as per the approved SAP, which included an analysis of the following:

- Particle Size Distribution (PSD);
- Moisture content
- Total Organic Carbon (TOC)
- Metals and metalloids (Al, Sb, As, Cd, Cr, Cu, Co, Fe, Pb, Mn, Hg, Ni, Se, Ag, V, Zn)
- Nutrients (Ammonia, Nitrate and Nitrite, Nitrogen, Phosphorous)
- Organotins (TBT)
- Other contaminants including organophosphorus pesticides, carbamates, herbicides, fungicides and other pesticides
- Acid Sulfate Soils (ASS)

Key findings of the study indicated the 95% UCL for all metals/ metalloids were below NAGD (2009) screening levels. Antimony, cadmium, silver and mercury had concentrations less than the LOR.

All nutrients except for total kjeldahl nitrogen, total nitrogen, total phosphorous and total organic carbon were below the LOR in all samples. There are no relevant guideline values for nutrients in marine sediment. All other contaminants were recorded below the LOR. Therefore, sediments within the Karumba entrance channel remain free of contamination and suitable for offshore placement.

There are no actual acid sulfate soils present in the sediment, however potential acid sulfate soils are likely to be present which would require lime treatment if the material were to be placed onshore. As the material is intended to be placed offshore, lime treatment will not be required.

5.1.1 Placement Area

Testing of placement area sediments has been limited primarily to that associated with the dredging EIA (Dames & Moore and WBM, 1996) and is described in further detail in the two following sections.

PHYSICAL CLASSIFICATION

In preparation for the dredging EIA, van Veen grab samples were collected from three locations at the placement area for particle size distribution analysis. At each location, two replicate samples were collected and the results of the analyses are provided below in **Table 5-2**. Based on these results, it is evident that the sediments at the placement area are predominantly clay silts (mud), with a minor sand/gravel fraction.

Table 5-2 Particle Size Distribution of Placement area Sediments

(Dames & Moore and WBM 1996)

Sample	Size fraction (%)		
	Gravel/Sand > 0.06 mm	Silt 0.06 - 0.002 mm	Clay < 0.002 mm
OR1	8.8	55.2	36.0
	9.0	55.8	35.2
OR2	10.1	51.5	38.4
	42.7	20.7	36.6
OR3	8.2	48.7	43.1
	11.3	55.1	33.6
Average	15.0	47.8	37.2

CHEMICAL COMPOSITION

In preparation for the dredging EIA, a sediment quality investigation was undertaken, which collected van Veen grab samples from three locations within the current placement area. These samples were then analysed for total organic carbon (TOC), total carbonate and trace metals. The results of this investigation are provided below in **Table 5-3**, which demonstrate that no results exceeded the relevant NODGDM (now NAGD) Screening Levels.

Table 5-3 Measured Metals Concentrations of Placement Area Sediments

(Dames & Moore and WBM, 1996)

Sample	Analyte (mg/kg)											
	Cr mg/kg	Cu mg/kg	Zn mg/kg	Ni mg/kg	Cd mg/kg	Pb mg/kg	Fe mg/kg	Al mg/kg	Se mg/kg	As mg/kg	Hg mg/kg	Mn mg/kg
Screening Level	80	65	200	21	1.5	50	-	-	-	20	0.15	-
OR 1.1	18	11	33	15	0.2	13	17 500	12 900	< 0.2	1.3	< 0.2	310
OR 1.3	15	9	23	12	0.2	10	14 400	11 000	< 0.2	1.2	< 0.2	170
OR 2.1	23	16	39	20	0.4	16	21 100	18 000	< 0.2	1.4	< 0.2	320
OR 2.3	17	11	29	15	0.3	13	14 800	13 600	< 0.2	0.9	< 0.2	230
OR 3.1	17	12	29	15	0.2	11	14 400	13 200	< 0.2	1.4	< 0.2	180
OR 3.3	18	11	29	16	0.3	12	16 000	13 900	< 0.2	0.5	< 0.2	230
Average	18.0	11.7	30.3	15.5	0.27	12.5	16 367	13 767	< 0.2	1.12	< 0.2	240.0
95% UCL	20.1	13.5	34.6	17.6	0.33	14.2	18 454	15 615		1.40		290.6

In 2002, two van Veen grab samples were collected from the placement areas and tested for polycyclic aromatic hydrocarbons (PAH) and TOC levels. All PAH concentrations were below detection in both samples.

5.2 Sources and History of Possible Anthropogenic Contamination

The entrance channel is used solely for the passage of ships (i.e. no loading/ unloading of ships occurs in the channel) to and from the port berths which are located approximately 2 km upstream from the mouth of the Norman River. As such, there are no direct sources of potential contamination in the entrance channel. Any anthropogenic contaminants found in entrance channel sediments would originate from upstream sources in the catchment such as the port or surrounding catchment. The major activities at the port, with respect to potential contaminant input, are the NCR lead and zinc concentrate export operations and refuelling of commercial and recreational vessels.

Previous marine sediment testing has been undertaken at the port area within the Norman River and has indicated that no significant increase in heavy metals concentrations has occurred since the commencement of concentrate exports. Historical testing within the entrance channel has also shown that all potential contaminants are below relevant screening level guidelines.

Investigation of various concentrate spills and routine water and sediment sampling has been conducted by NCR to fulfil State licence and general environmental duty requirements. Localised areas of contamination have been identified adjacent to loading facilities and reported to the State environment department (now DES), however further detailed investigation by NCR and its appointed consultant did not identify any significant issues that contribute anthropogenic contaminants to the entrance channel sediments.

5.3 Water Quality

5.3.1 Background Values

The primary water quality impacts associated with dredging is an increase in turbidity levels and or mobilisation of contaminants. Predominantly, attention is drawn to turbidity and suspended solids concentrations during dredging activity and any subsequent impacts to nearby environmental assets or receptors susceptible to deposition or light attenuation. Duration and concentration of the exposure are key determining factors in the actual impact. Generation of turbid or sediment laden water surrounding dredge operations is largely due to excavation of the sediments and/or dredge hopper overflow. At the Port of Karumba, due to the close proximity of the inner channel to Alligator Bank, the impact of potentially elevated turbidity levels on seagrass meadows and marine biota (i.e. prawns) has been recognised in previous investigations and approvals for dredging, which have required monitoring of water quality, including in the area of the meadows during dredge campaigns. Typically, this monitoring has compared turbidity levels during dredging to a reference site or trigger level that has been calculated using a best estimate of background levels.

Initial assessment of water quality parameters during the baseline survey (Dennison *et al* 1996) recorded turbidity values between 17 and 72 NTU (median 38.5 NTU and 80th Percentile =42.8 NTU) under tidal conditions of between 0.4 and 1.25m over Alligator Bank during wind conditions of between 5-7 knots SE and 10-15 knots NW to NE.

PCQ completed an investigation of “background or ambient” turbidity during 2004 and 2005 at five locations at Alligator Bank to define a suitable trigger value for future monitoring. Locations of sampling are shown in **Figure 5-2**.

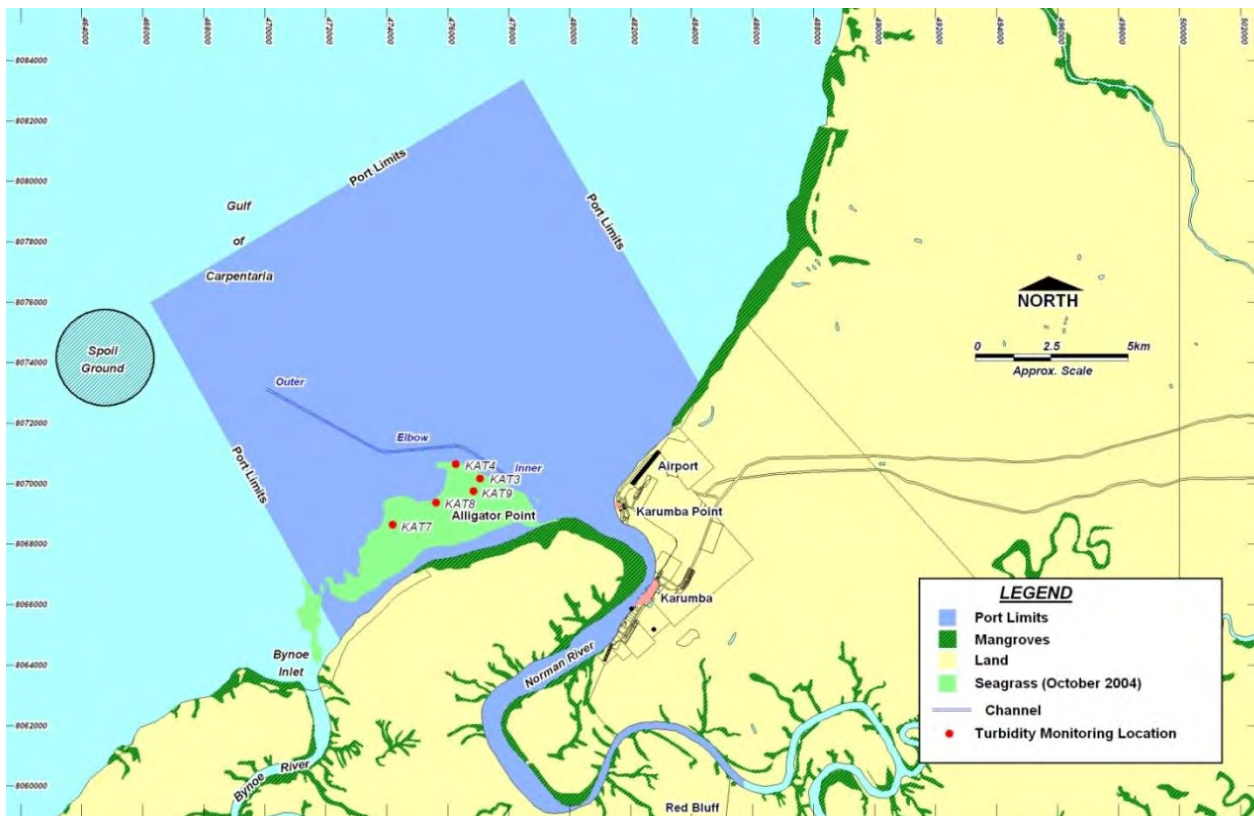


Figure 5-2 Turbidity monitoring locations (2005)

Ambient turbidity data collected by PCQ in past monitoring were assessed by consultants Hydrobiology in 2004, and combined to derive an estimate of natural average turbidity of 42.7 NTU. This was then calculated to form a trigger level of observed ambient turbidity plus 25 % to derive a value of 53.3 NTU. This value was then used as a trigger for an action based program where Approval conditions did not permit the trigger level to be exceeded by more than 25% for more than nine out of any ten day dredging period. Individual records above the trigger were recorded, but the overall project trigger was not exceeded.

In preparation for the 2006 campaign, another assessment of ambient turbidity was made using new data collected in 2005. The data demonstrated a high level of variability, with values between 1.0 and 196.7 NTU, with monthly averages ranging between 3.0 NTU in August and 78.5 NTU in October. Two key conclusions were drawn;

- Turbidity levels were broadly comparable across the five locations, with no apparent spatial trends.
- Levels measured at 3.0 m depth appear to be higher than those at 1.0 m at some locations, however, due to the small sample size of 3.0 m observations ($n = 7$), it is difficult to identify a conclusive trend.

Results from the 2004 and 2005 datasets were combined and assessed to derive a value based on the 80th percentile of the combined dataset which was determined to be 62 NTU. This value was used as the action based trigger for the 2006, 2008 and 2010 campaigns.

There has been no recent ambient turbidity testing, however it is not expected to be significantly different to previous testing as there have been no significant changes to the catchment or coastal processes in the surrounding environment.

Therefore, investigations to determine a local reference turbidity value have concluded a value of either 53 or 62 NTU to which a comparison of values observed during dredging events has been made. Based on the assessment of potential impacts to seagrass (refer **Section 6.4.1**) and the

adaption by local species to habitats of naturally high turbidity and sedimentation, a trigger value of 60 NTU is considered a conservative value.

5.3.2 During Dredging

2002 Dredging Campaign

An extensive water quality monitoring program, which involved the deployment of three real time turbidity buoys at the channel-side boundary of the seagrass meadow, aerial surveillance of the spatial extent and movement of turbidity plumes generated by the dredge and the collection of spot turbidity measurements in and around the identified dredge plumes was undertaken. This study, undertaken by WBM (2002), demonstrated that there is a high level of natural variation in the background turbidity levels and that the relative impact of dredging on turbidity levels overlaying the seagrass meadows was comparatively low. Whereas turbidity levels within plumes immediately adjacent to the dredge were usually greater than 100 NTU, these levels were typically reduced to around 30 to 40 NTU by the time that the plumes had migrated to the seagrass meadows, which was well within the identified background levels for the area (typically within 0 to 100 NTU). Furthermore, the monitoring demonstrated compliance with all approval conditions. Aerial surveillance was also undertaken in 2002. This monitoring demonstrated that the potential for turbid plumes generated by dredging to impact on the Alligator Bank seagrass meadows was only relevant during the flood tide, when currents would transport them in a predominantly south to southwest direction. During the ebb tide, plumes typically migrated in a northern direction.

2004 Dredging Campaign

Following the information gathered during the 2002 monitoring program, the TACC agreed with PCQ to a reduced monitoring program in 2004, which involved only a limited amount of aerial surveillance and the implementation of a shorter program of daily turbidity monitoring. Using data collected in the lead up to the 2004 works PCQ calculated a best estimate (average) of background turbidity, which was then used to calculate a trigger level (best estimate plus 25 % = 53.3 NTU) in accordance with PCQ's approvals for dredging. Turbidity monitoring of the locations illustrated in **Figure 5-2** was then generally undertaken on a daily basis for the first four weeks of dredging, with the daily median turbidity value then compared to the trigger level. This monitoring demonstrated that the daily median varied between 1.9 and 35.6 NTU, and hence no instances of non-compliance with PCQ's approval conditions were identified.

Aerial surveillance was undertaken at the commencement of dredging to visually assess the impacts of dredging on both the ebb and flood tides. This monitoring demonstrated that plumes generated by the dredge heads were not visible over the seagrass meadows and that, furthermore, they were not even discernible from background conditions within the immediate vicinity of the dredge. Instead, the only elevated turbidity levels associated with dredging were identified as a result of 'prop wash', which occurred due to the shallow depths and the dredge's minimal under keel clearance. Such an effect is regularly experienced in Karumba during the transit of the channel by other large vessels and is unlikely to cause any ongoing harm to the adjacent seagrass meadows.

2006 Dredging Campaign

Monitoring was completed on 6 days during the 3 week campaign, with one daily median value exceeding "background" condition. Overall, the monitoring did not exceed the trigger of "four out of five days".

2008 Dredging Campaign

A six day program was implemented during the 2008 dredging campaign to determine turbidity levels at five proposed sites at Alligator Bank, for comparison to two reference sites located on the northern side of the channel (**Figure 5-3**), well outside the zone of predicted dredging induced impact. Sampling was conducted on the incoming tide phase. Median daily values ranged between 2 and 11 NTU. No results exceeded the 62 NTU trigger, and consequently did not exceed the four out of five day trigger (**Figure 5-4**).

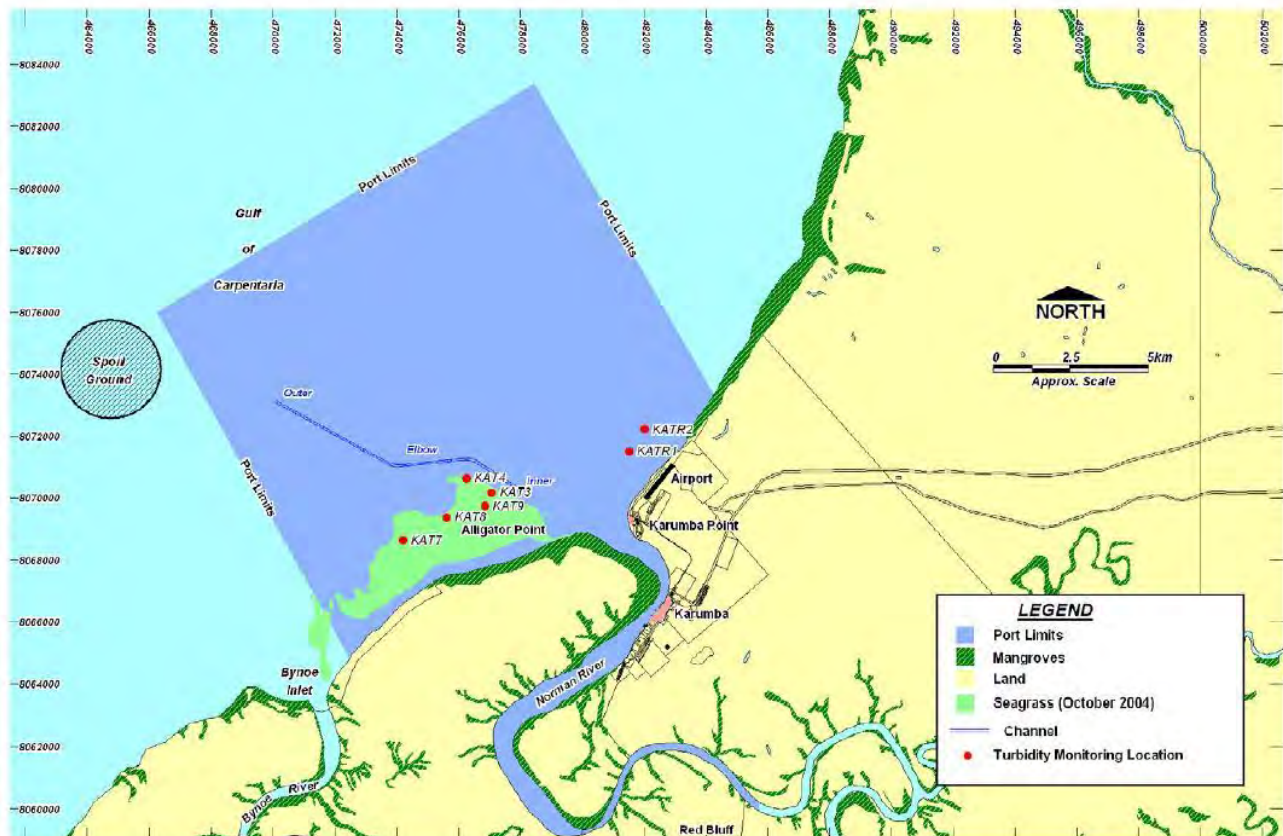


Figure 1 Monitoring locations

Figure 5-3 Turbidity Monitoring Locations (2008)

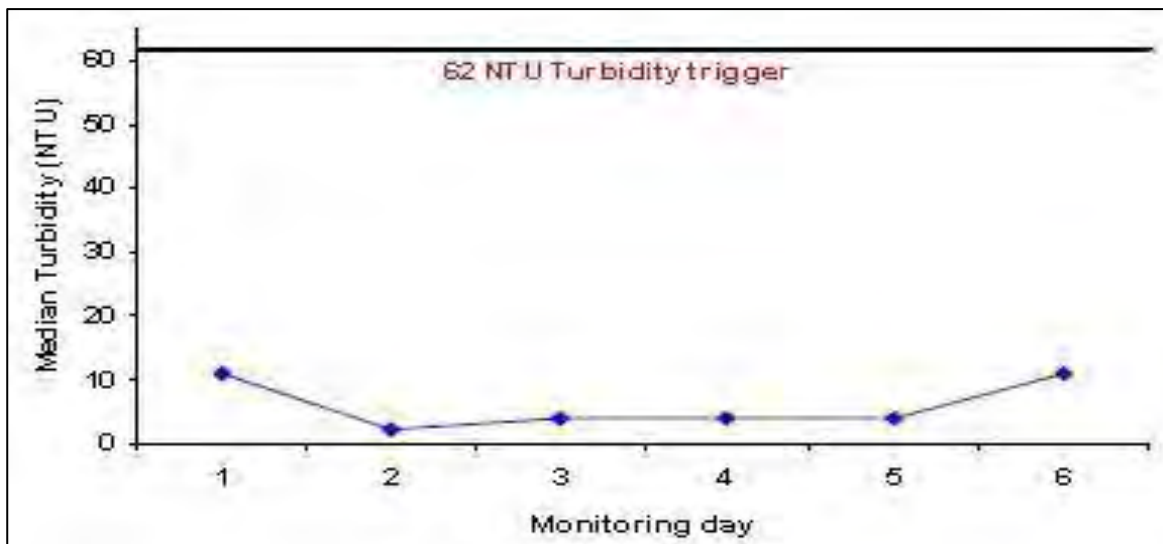


Figure 5-4 Results of 2008 Turbidity Monitoring

2009 Bed Levelling works

A reactive, trigger based monitoring program was developed as a component of the EMP for the 2009 bed levelling works. This monitoring was a targeted program based on determining what were the highest risk periods for plume impact to areas of environmental significance and proposed to monitor turbidity at those five sites used in the 2008 works, prior to and during the works, dependant on the location of dredging relative to areas of environmental significance, the duration of dredging and predicted sea state/tide pattern. Due to the very short period of actual bed levelling works only three time periods were consistent with those of highest risk. However due to low water levels over Alligator Bank, and no observed plume emanating from the works in the direction of the sampling sites, no sampling was conducted.

2010 Dredging Campaign

Requirements of the State approval for Environmentally Relevant Activity (ERA16) Extractive and Screening Activity, including dredging, required that turbidity be monitored at two locations on edge of Alligator Bank seagrass meadows and a background site on a daily basis during flood tides when the dredge was operating on a flood tide adjacent to Alligator Bank. A reactive monitoring trigger of background plus 25% or 62 NTU, whichever is greater, for a duration of not more than 72 hours. This trigger was not exceeded; with monitoring results well below these trigger levels (**Figure 5-5**).



Summary

5.4 Benthic Fauna

Samples of benthic fauna were undertaken at the existing placement sites and along two transect lines extending from the placement site in 2020 (Ports and Coastal Environmental Pty Ltd, 2020), to identify whether there were any significant differences between fauna within and immediately adjacent. The sampling locations are shown in **Figure 5-6**.



Figure 5-6 Benthic Fauna Sampling Locations 2020

Polychaeta (*Spionidae*), crustacea (*Aspeusidae*), and echinodermata (*Ophiuroidea*) were the three numerically dominant taxa over the study area. The survey found that neither abundance or diversity significantly varied between the placement site and the transects beyond its boundary. There was found to be a higher species richness and reduced evenness (species dominance) along the north west transect than the placement site.

There was a lack of difference in species, dominant taxa or abundance between areas, with *Ophiuroidea* and *spoinidae* as the dominant taxa at all sites. There was not found to be a robust gradient of macrobenthic invertebrate abundance or species richness extending outward from placement area along the two transects surveyed. This was thought to be because either the deposition of material did not extent beyond the placement area or that the assemblage had recovered from any disturbance that had occurred. It is thought the former is more likely, given that the physical characteristics of the placement site and the transects was not substantively different. While some minor variability has been identified, the overall results are consistent with no substantive impact occurring from the migration of materials extending beyond the placement site itself.

5.5 Introduced Marine Pest Species

A baseline survey within the Port for introduced marine pests was commissioned in August 2000, and was undertaken in consistent with the sampling protocols developed by the CSIRO Centre for Research on Introduced Marine Pests. The survey, which was undertaken by Neil *et al.* (2001), surveyed marine habitats for the presence and/or prevalence of introduced marine species and to determine the biodiversity of the native marine assemblages present. Efforts during the survey were primarily focussed on the habitats within the vicinity of the berths in the Norman River; however, some samples were also collected from the entrance channel to ensure comprehensive coverage of all available marine habitats.

During the survey, a total of 435 taxa were recorded within the Port, of which none were species designated as pests by the Australian Ballast Water Management Advisory Committee. Furthermore, whilst five species collected at the Port were classified as cryptogenic (i.e. their origin was uncertain and not demonstratively native or introduced), none of the taxa were considered to be exerting a detrimental effect on local marine assemblages within the area, and each were in relatively low abundance.

In addition to the 2000 survey, PCQ installed artificial settling plate devices in the Port following the detection of the black-stripe mussel at the Port of Darwin in 1999/2000. PCQ and subsequently Ports North, continued to use these plates at the main wharf area for a period through to around 2012 and was ceased when Karumba Port Supervisor role ended at the port. To date, no suspect pest species have been identified, or reported by other operators or users of the port including fishing fleet who undertake periodic hull maintenance. Agencies including DAWE and DAF have periodically engaged some surveillance activity including with Traditional Owners within the southern gulf region, and similar no reports of detected marine pests have come to hand past five year period for the Karumba area.

Regardless of the previous identification of cryptogenic species within the port, the overall risk of translocation from the channel to the placement area through the action of dredging is considered very low and comparable to potential risk of natural translocation mechanisms given the short distance between the two locations. The risk of translocation aboard the dredge is addressed by the actions within the TSHD EMP, including regular slipping, in water checks at other ports or in transit, as well as hopper and ballast exchange so as to reduce risk.

6. RISK ASSESSMENT

This section contains a risk assessment of maintenance dredging activities. It also contains a screening level self-assessment of potential impacts from maintenance dredging and placement on matters of national environmental significance (MNES) under the *Environment Protection and Biodiversity Act 1999* (EPBC Act).

6.1 Risk Assessment Framework

The risk assessment framework is based on Ports North's corporate Risk Management Framework (2018), with assessments informed by contemporary environmental impact assessment processes, and monitoring. The risk management framework utilises a consequence/likelihood matrix to ascribe an inherent risk level to different risks. Maintenance dredging risks broadly relate to the following activities:

- Maintenance dredging of the channel and swing basins by dredging plant (trailing suction hopper dredge [TSHD *Brisbane*] or a bed leveller
- Placement of maintenance dredging material at the existing Dredge Material Placement Area at sea.

In the context of these activity categories, the key risk areas for consideration can be categorised as environmental (and associated regulatory matters), operational, technical, economic, social and cultural. **Table 6-1** and **Table 6-2** present the consequence and likelihood descriptors relevant to these areas.

Table 6-1 Consequence Descriptors for Maintenance Dredging Risks

Level	Environmental & regulatory descriptors	Operational, technical & economic descriptors	Social & cultural descriptors
Minor	<ul style="list-style-type: none"> No or minimal impact on the environment. No reporting required according to legislation. 	<ul style="list-style-type: none"> Isolated disruption to commercial operations, measured in hours, with negligible economic impact 	<ul style="list-style-type: none"> Isolated community disruption up to 1 day with negligible economic impact. No or minimal impact on cultural heritage features.
Medium	<ul style="list-style-type: none"> Site-level impact that is easily containable. Environmental impact report to authorities as required. 	<ul style="list-style-type: none"> Isolated disruption to commercial operations up to 1 day with limited adverse economic impact 	<ul style="list-style-type: none"> Isolated community disruption up to 3 days with limited adverse economic impact. Disturbance or uncovering of cultural heritage features but with no direct impact.
Major	<ul style="list-style-type: none"> Temporary damage to habitat or environment. May incur cautionary or infringement notice from authorities. 	<ul style="list-style-type: none"> Disruption to commercial operations up to 3 days, including from loss of infrastructure capacity, with adverse economic impact 	<ul style="list-style-type: none"> Widespread community disruption up to 7 days with adverse economic impact. Temporary damage or relocation of cultural heritage features, including culturally significant species.
Critical	<ul style="list-style-type: none"> Permanent impact on environment Serious or repeated breach of legislation of licence conditions. Prosecution by authorities. 	<ul style="list-style-type: none"> Extended (>3 days) disruption to commercial operations, with significant adverse economic impact Material damage to infrastructure or reduction in safety rating 	<ul style="list-style-type: none"> Widespread and extended (>7 days) community disruption with significant adverse economic impact. Permanent loss of cultural heritage features, including culturally significant species.

Table 6-2 Likelihood Descriptors for Maintenance Dredging Risks

Descriptor	Probability	Description
Almost certain	>90% chance of impact occurring	The impact is likely to occur within the next year
Likely	50-90% chance of impact occurring	The impact is likely to occur within the next 1-2 years
Unlikely	10-50% chance of impact occurring	The event is likely to occur within the next 2-10 years
Rare	<10% chance of impact occurring	The event is likely to occur less than once every 10 years

Table 6-3 Matrix for Ascribing Levels to Maintenance Dredging risks

		Consequence			
		Minor	Medium	Major	Critical
Likelihood	Almost Certain	Moderate (5)	High (9)	Extreme (13)	Extreme (16)
	Likely	Low (3)	Moderate (7)	High (11)	Extreme (15)
	Unlikely	Low (2)	Moderate (6)	High (10)	Extreme (14)
	Rare	Low (1)	Low (4)	Moderate (8)	Extreme (12)

6.2 Risk Assessment Findings

Table 6-4 presents the risk assessment of impacts from maintenance dredging and placement based on the risk categories areas discussed above. The risks and impacts can be defined as either short-term (acute) or long-term (chronic). Short-term effects (generally measured in hours to days) may include, for example, physical removal of benthic habitat, smothering and burial of benthic organisms at the DMPA, temporary impacts to water quality and receiving organisms and injury to significant megafauna. Long-term effects (measured in months to years) relate to changes in habitat conditions, such as change in ecosystem character of benthic habitats or significant sediment mobilisation (resuspension) affecting habitats outside the placement area.

The residual risk level indicated in the far-right column of **Table 6-4** assumes the adoption of mitigation and monitoring measures currently utilised or proposed to be used at the Port of Karumba and common-practices relevant to modern dredging and placement campaigns. The risk assessment has concluded that all residual risk levels are considered 'low'.

Risk treatment measures, environmental management requirements, and monitoring and corrective actions are summarised in **Chapter 7** of this LTMMMP to ensure identified risks are effectively managed and reduced as far as practicable.

Table 6-4 Port of Karumba Maintenance Dredging and Placement – Risk Assessment Summary

Identified risk issue	Risk receptor	Potential impact	Details	Likelihood/ consequence	Initial risk level	Prospective risk treatment measures	Residual risk level
Environmental							
Turbidity generated during dredging and placement at DMPA	Seagrass, prawn nursery areas	Acute impacts from high concentration, low duration turbidity OR Chronic impact from low-to-moderate concentration, high duration turbidity	Whilst turbid plumes are generated by dredging and dredge placement, water quality monitoring undertaken during previous campaigns has not identified turbidity above acceptable limits being experienced at seagrass beds. Annual monitoring of these seagrass beds has not identified any adverse impacts to this sensitive receptor as a result of maintenance dredging. Dredging is undertaken outside of the prawn breeding season, which limits impacts.	Unlikely / Medium	Moderate (6)	TSHD dredging will use measures to control water quality impacts associated with dredging (e.g. use of 'green valve', overflow management in accordance with tidal conditions), if observed plumes are excessive. Annual monitoring of seagrass response will continue and be used to inform adaptation of dredging and placement program as necessary. See Chapters 3.5.2 and 7.7.3	Low
Long-term resuspension from DMPA site	Seagrass	Acute impacts from high concentration, low duration turbidity OR Chronic impact from low-to-moderate concentration, high duration turbidity	Seagrass meadows are not in close proximity to the DMPA.	Rare / Medium	Low (4)	Annual monitoring of seagrass response will continue and be used to inform adaptation of annual dredging and placement program as necessary	Low
Underwater noise during dredging and placement	Marine megafauna, particularly nesting turtles, dugongs and dolphins.	Acute hearing damage to fauna OR Behavioural impacts and masking of communication	Dredging and vessel operations produce underwater noise that may impact on marine fauna that occur near the dredging and placement works. It is likely that dredging in the channel will cause behavioural changes and movement away from the noise source within 100-200m of dredging. This impact is temporary however and	Likely / Minor	Low (3)	Megafauna exclusion zones will be use during dredging. Where megafauna enter exclusion zones, works will be mitigated to reduce noise until fauna have moved away. See Chapter 6.6 and EMP for TSHD <i>Brisbane</i> attached in Appendix 8 .	Low

Identified risk issue	Risk receptor	Potential impact	Details	Likelihood/ consequence	Initial risk level	Prospective risk treatment measures	Residual risk level
			will occur outside of the regular turtle nesting season. These localised impacts are generally considered to be of minor consequence, especially in the context of existing commercial and recreational vessel activity in the channel.				
Dredge vessel strike	Marine megafauna	Mortality or injury of megafauna	Dredge vessels are typically slow-moving, allowing sufficient time for marine megafauna to move out of the way. However, the vessels also have more powerful propellers and lower draft, meaning that there is greater chance of injury when a strike occurs. Dugongs and turtles are known to inhabit the area, and therefore could be impacted if within the vicinity of dredge vessel operations. Based on historical records, however, the incidence of strike is very low, with no recorded strike events in past 10 years.	Rare / Medium	Low (4)	Megafauna exclusion zones will be used during dredging. Where megafauna enter exclusion zones, vessel movements will be mitigated to reduce risk of strike until fauna have moved away. See Chapter 6.6 and EMPs for TSHD <i>Brisbane</i> (Appendix 8)	Low
Entrainment of turtles in dredge drag head	Marine turtles	Mortality or injury of turtles	Turtles are the most likely marine megafauna group to be entrained in a dredge head as turtles may utilise shipping channels as resting or shelter areas. However, the incidence of turtle entrainment across Queensland is low. The TSHD <i>Brisbane</i> adopts management practices and operational procedures specifically designed to minimise risks of entrainment. There has been no reported entrainment in Karumba for the past 10 years.	Rare / Medium	Low (4)	Turtle excluder devices will be installed on TSHD drag head. See EMP for TSHD <i>Brisbane</i> .	Low
Entrainment of other marine	Fish, eels and sea snakes	Mortality or injury of marine fauna	Other smaller marine fauna may become entrained in a dredge head.	Likely / Minor	Low (3)	No additional risk measures proposed	Low

Identified risk issue	Risk receptor	Potential impact	Details	Likelihood/ consequence	Initial risk level	Prospective risk treatment measures	Residual risk level
fauna in dredge drag head			There is little information on the likely incidence.				
Introduction of marine pests via dredge vessels	Local and regional marine ecosystems	Introduction of pest species to Port of Karumba area	<p>The TSHD <i>Brisbane</i> primarily dredges ports along the Queensland coast as well as occasionally dredging other ports and channels in Australia. The risk of marine pest spread, therefore, relates to pests being spread by a range of vessels entering from overseas to Australian ports, rather than from the dredge arriving from overseas ports. The primary vector for pests being spread is within ballast water and hull fouling.</p> <p>Under the EMP for the TSHD <i>Brisbane</i>, ballast water exchange occurs at sea prior to entering into any new port. It is unlikely, therefore, that the TSHD <i>Brisbane</i> will introduce new marine pests to the Port of Karumba as part of maintenance dredging.</p> <p>Periodically the TSHD <i>Brisbane</i> undergoes slipping for maintenance, which may occur overseas, and there are specific re-entry requirements from Commonwealth and State Biosecurity authorities, as well as measures outlined in the relevant next ports dredging EMP for operation of the TSHD <i>Brisbane</i>.</p> <p>See EMP: TSHD <i>Brisbane</i> (PBPL, 2016).</p>	Rare / Medium	Low (4)	Periodic monitoring of pests in Port of Karumba will be undertaken to identify whether introduction of marine pests have occurred. Refer to Section 5.5 and 7.7.2 for further detail.	Low
Smothering of benthic habitat and fauna at DMPA	Marine benthic habitat communities	Acute impacts from direct placement on benthic habitat and fauna	<p>No seagrass or other sensitive habitats are present in the DMPA area.</p> <p>The recent benthic fauna assessment (Ports and Coastal Environmental Pty Ltd, 2020) did not identify any</p>	Likely / Minor	Low (3)	Periodic surveys (every five years) of the DMPA site will be undertaken to ensure that impacts to benthic habitat does not exceed expected impacts for marine ecology.	Low

Identified risk issue	Risk receptor	Potential impact	Details	Likelihood/ consequence	Initial risk level	Prospective risk treatment measures	Residual risk level
			significant impact to benthic fauna outside the DMPA area and no identifiable difference in abundance or species. This indicates that benthic fauna recovers quickly from placement activity.			See Chapter 5.4 and 7.7.1 .	
Disturbance of contaminated material or acid sulfate soils	Local marine ecosystems	Acute or chronic impacts from contaminants and heavy metals released during dredging and placement	<p>Maintenance dredging will target only material that has settled within the past 12-24 months, none of which is expected to have potential acid sulphate soils (PASS). Even where PASS is present, dredging and placement of this material will not lead to oxidisation and generation of actual acid sulfate soils (AASS) as the material will be retained in a saturated state and placed at seas.</p> <p>Testing of material for contaminants under the National Assessment Guidelines for Dredging (DEWHA, 2009) has been undertaken since 2004 and has consistently confirmed that material is suitable for unconfined placement at sea. It is not anticipated that there will be an increase in land uses that may contribute contaminants to the marine environment from strategic port land or other Karumba land uses over the life of the LTMMP.</p>	Rare / Medium	Low (4)	Periodic assessments of sediment quality in dredging areas will be undertaken in accordance with the National Assessment Guidelines for Dredging i.e. every 5 years	Low
Spill of hydrocarbons or other chemicals	Local marine ecosystems	Acute or chronic impacts from contaminants released during dredging operations	Spills of hydrocarbons or other chemicals can cause a range of lethal and sub-lethal effects in marine flora and fauna, depending on the nature of the spill (e.g. quantity, substance, location). This risk is the same as the risk of spills associated with any vessel movements within the Port of	Rare / Medium	Low (4)	All dredge vessels will be equipped with appropriate equipment and procedures for spill response, in accordance with prevailing Port of Karumba protocols.	Low

Identified risk issue	Risk receptor	Potential impact	Details	Likelihood/ consequence	Initial risk level	Prospective risk treatment measures	Residual risk level
			Karumba, noting that vessel traffic within the port is relatively low, therefore the risk of strike likely reduced. The actual increased risk associated with dredging activities is negligible comparative to the volume of vessel traffic already in the area.			See the EMP for TSHD <i>Brisbane</i> . The Port also has a spill response plan in place for all vessels utilising the port.	
<i>Operational, technical and economic</i>							
Dredging or placement activity impedes commercial or recreational traffic	Commercial and recreational fleet Local and regional community	Temporary disruptions (hours)	Dredging within the channel can cause the displacement of vessels attempting to transit to and from the port. However, at no point would the dredge vessel cause a complete closure of the channel nor a delay exceeding a portion of an hour. Dredging works would be coordinated in consultation with the Regional Harbour Master/Vessel Traffic Services to ensure delays were minimised as far as practicable. Ports North will issue advice for distribution to key businesses in Karumba, including fishing and tackle stores, caravan parks, and also boat ramps to alert them to forthcoming dredging campaign	Likely / Minor	Low (3)	Dredging works will be coordinated in accordance with Regional Harbour Master/Vessel Traffic Service.	Low
<i>Social and cultural</i>							
Community disturbance by dredge (light, noise, fumes)	Local community	Loss of amenity	Dredging can cause disturbance to the community through the noise and associated with dredging activities as well as lighting required for any dredging occurring at night. Dredging occurs in the outer channel area,	Unlikely / Minor	Low (2)	Dredging vessels will be managed to minimise noise, lighting, and odour emissions in commercial and recreational areas.	Low

Identified risk issue	Risk receptor	Potential impact	Details	Likelihood/ consequence	Initial risk level	Prospective risk treatment measures	Residual risk level
			commencing at least 4 km from the nearest sensitive receptor (i.e. residential property or business). There have been no community complaints received during previous maintenance dredging campaigns.			See EMP for TSHD <i>Brisbane Ports North</i> complaint handling procedure.	
Cultural heritage features (indigenous and non-indigenous impacted by dredging)	Local Traditional Owners Local community	Disturbance of cultural artefacts Disturbance of culturally important marine species	Maintenance dredging only removes material that has accumulated in the channels and berths and not deeper sediments. The likelihood of cultural heritage features being impacted by maintenance dredging is extremely low.	Rare / Medium	Low (4)	If any cultural heritage features are identified (as indicated primarily by dredging surveys and monitoring of efficiency), dredging will adapt to this to prevent further destruction and allow for relocation. Traditional owners will be notified and consulted regarding maintenance works through the TACC.	Low

6.3 Water Quality

Impacts to water quality from dredging and disposal activities relate to increased turbidity and suspended solids concentrations and mobilisation of nutrients. While water quality can be impacted during dredging processes, water is a vector of the disturbance to the 'true' receptors, including, adjacent benthic communities, nekton (fishes) and megafauna such as turtles, dolphins and dugong. The alterations to water quality only are described below, with impacts to sensitive receptors discussed in other sections.

6.3.1 Turbidity and Suspended Solids Impacts at the Dredge Site

Increases in turbidity and suspended solids will occur within the zone of operation of the dredging plant. In the case of areas of sandy material, these water column effects will be short lived as the heavy fractions settle quickly and plume generation and migration is minimal. In areas of fine silty clays however, the impacts to the water column are more pronounced and longer lived due to the fine particle size and slow rate of deposition. Areas of fine silty clays present the highest potential for generation of turbid plumes and if current, tide and wind conditions are suitable, may lead to secondary impacts to areas of environmental significance. Potential acid generation due to disturbance of potential acid sulphate soil is possible, however due to the buffering capacity of seawater and the minimal exposure of dredge material to air, impacts from potential acid generation is highly unlikely.

Dredgers such as trailing suction hopper dredgers, which operates in the channel, generate most turbidity when operating in overflow mode as the hopper approaches its maximum capacity. The extent of impact from overflow mode can be reduced by using more modern trailing suction hopper dredgers, such as the *Brisbane*, which have subsurface discharges and moveable internal weirs to manage discharge turbidity and overflow duration. It should be noted that any turbidity generated in the entrance channel by overflow dredging would be limited to about 15 minutes during an approximate three hour dredge cycle, so the turbidity plumes are limited both spatially and temporally.

6.3.2 Turbidity and Suspended Solids Impacts at the Placement Area

Water quality impacts at the placement site during the disposal phase of the operation follow those described above. The duration of impact is short lived as material falls to the sea floor. However, dispersion rates vary depending on current conditions at the time of release from the hopper. Extensive sampling and aerial surveillance during previous dredging campaigns has shown that turbid plumes are generated within the water column and can persist for several hours where fine silts are disposed and low current conditions prevail. In conclusion, maintenance dredging of the outer channel (which has the greatest potential to generate turbid plumes over seagrass habitat) typically lasts for only short periods within the campaign as the dredge enters overflow operation at the end of the dredging cycle. Plume generation at the placement site extends up to about one kilometre over muddy substrate in worse case conditions.

MOBILISATION OF TOXICANTS

Prior to the disposal of dredge material, sediment sampling and analysis defines the overall suitability of the material for unconfined ocean disposal. Sediment quality has been discussed in **Section 5.1**. Sediments have been assessed according to an approved SAP and remain within the adopted screening criteria detailed within the NAGD over all testing events. Given these findings, dredge materials are considered suitable for unconfined ocean disposal and mobilisation of

toxicants during disposal is considered to be of low probability and hence low risk to the marine environment.

NUTRIENTS

Nutrient concentrations from marine sediments are a potential water quality concern, where nutrients can be released to the water column during dredging and disposal. The similarity between offshore sediment chemical and physical parameters and proposed material suggests that deposited sediments are unlikely to drive a significant variation in nutrient release to that already occurring within the background sediments. Natural forces driving algal blooms, such as periods of warm calm weather following a turbulent period would have a far wider impact than that of dredging and disposal. Given the low frequency and duration of dredging disturbance, problematic impacts associated with potential nutrient release are unlikely to manifest within the marine environment (i.e. algal blooms, seagrass health and epiphytic algal growth). Such effects would be associated with sustained nutrient elevations and not driven by episodic dredging campaigns.

Whilst the potential of nutrient release during dredging and disposal is perceivable, the existing background concentrations, and short duration of maintenance dredging activity lowers the overall likelihood and consequence of problematic nutrient elevations.

6.4 Benthic Flora and Fauna

6.4.1 Benthic Flora – Seagrass

The only benthic flora in the vicinity of dredging and disposal activities is seagrass meadows adjacent to the inner sections of the channel close to Alligator Banks and Karumba Point. A substantial body of knowledge regarding the distribution and health of seagrass at Port of Karumba has been developed since dredging commenced. Annual monitoring has established an understanding of annual trends in key seagrass communities as well as observed fluctuations in both distribution and health indicators for seagrass. No impacts attributable to operation of the Port have been identified. Rather, the key drivers of observed variation in distribution, cover and biomass, are reported to be largely driven by physical climatic factors such as wind, wave, cyclones, and flood. Although the processes of dredging and resulting increased turbidity, reduced light, mobilisation of nutrients/toxicants and increased deposition have the capacity to impact seagrasses, evidence from the study area outlines a significant resilience to such affects, resulting in a reduced risk from dredging and port operations.

LOW LIGHT AVAILABILITY

Dennison *et al.* (1997) investigated baseline availability of light to *Halodule pinifolia* and *H. ovalis* across Alligator Bank and determined that those species, dominant in the Karumba area, as being well adapted to low light intensity and high turbidity. These communities receive the highest quantities of light during periods of daytime low spring tides when shallow clear pools of low suspended solids waters cover the meadows. A highly variable intertidal light climate is present at Karumba, due to the naturally very turbid, high suspended solids waters adjacent to the coast, coupled with the variable tidal and wind regimes. Dredge induced plumes would have little impact on seagrass when background turbidity is so high that the seagrass is not receiving sufficient light for photosynthesis. Dennison *et al* 1997 described the seagrass found at Alligator Bank as being well adapted to low light intensity and high turbidity. These communities receive approximately 5.2 hours of saturated photosynthesis light per day. Manipulative experimentation using shading and measurements of chlorophyll a and b content were conducted by Dennison *et al* (1997) and determined that health indicators of *Halodule pinifolia* remained constant through 80 days of reduced light, and 40 days at 0% light. However, *Halodule ovalis* biomass declined after 80 days at 20% light, and 40 days at 0% light.

Studies by Longstaff & Dennison (1999) summarised that pulsed turbidity events caused by factors such as flooding rivers have the potential to seriously impact seagrass communities by depriving the plants of all available light. They investigated effects of light deprivation on the survival, morphology and physiology of the tropical seagrasses *Halodule pinifolia* and *Halophila ovalis* growing at Karumba where pulsed flood events are common. That study determined that for seagrass species found at Karumba, *H. ovalis* displayed little tolerance to light deprivation, with plant death occurring after 38 days in the dark. *H. pinifolia* showed a high degree of tolerance to light deprivation with no biomass loss before day 38 days and complete die-off predicted after 100 days. Shoot density, biomass and canopy height all declined after 38 days. They concluded that only long duration (>38 days) pulsed turbidity events would have a detrimental impact on *H. pinifolia* growing in the Gulf of Carpentaria.

These figures indicate that local seagrass species are well adapted to periodic high turbidity periods and are likely to exhibit a very high photosynthetic efficiency, and ability to recover from periodic high turbidity conditions.

SPATIAL AND TEMPORAL EFFECTS

The minor temporal and spatial scale of maintenance dredging operations results in a very small potential for impact to seagrass communities. Channel dredging operations (works closest to the seagrass habitats) are undertaken over a relatively short period (typically a number of days) by the trailing suction hopper dredger. In addition, the temporal effect of the dredge is further reduced, as a TSHD, which operates in overflow mode for only a small proportion of the dredging cycle (approximately 15 minutes out of three hour cycle), further reduces the actual impacting period substantially.

Many naturally occurring events (wind, wave and cyclone) exceed both the duration and magnitude of turbidity and sediment generating processes such as that experienced during maintenance dredging. Similarly, the fluctuation of ambient turbidity during the change of tide and shift between neap and spring conditions drives a flux of increased turbidity over seagrass beds (particularly those adjacent to the channel) on a daily to weekly basis.

While significant capital dredge programs or sustained land based reclamation programs have the capacity to generate significant quantities of suspended and fine sediment deposits, over extended periods, the present maintenance program is not considered to be of sufficient spatial extent or duration to result in long term irreversible negative impacts to adjacent meadows. This conclusion has been supported by the findings of the Department of Agriculture and Fisheries (DAF and formerly Fisheries Queensland (DAFF)) long-term seagrass monitoring program (Unsworth *et al.*, 2008, and McKenna & Rasheed 2011, Carter *et al.*, 2012, JCU, 2021).

In summary, the frequent and naturally occurring disturbance to seagrass beds within the study area precludes any sustained impact associated with maintenance dredging and day-to-day port operations. Any deposited sediments reaching seagrass beds would be rapidly remobilised and exported from the area during the passage of the tide and prevailing wind and wave conditions. In combination with the limited spatial and temporal scale of dredge derived impacts, impact to seagrass during maintenance dredging is considered a very low risk. Impacts attributable to dredging such as increased turbidity, reduced light penetration and increased deposition, are vastly exceeded by natural seasonal physical processes experienced within the study area.

6.4.2 Benthic Fauna

DREDGE AREA

The entrance channel is an important migratory route for fish and crustacean species that move between the estuary, Norman River and the offshore areas during their lifecycles. As such the benthic communities represent an important food source to these organisms. Significant migrations

of prawn larvae through the channel area during the wet season (November to March) were identified by CSIRO as a key consideration in scheduling of dredging during the EIA process in 1996. As a result, conditions of previous dredging and sea disposal permits have included a “Dredging Window” to proactively ensure potential impacts to prawn stocks is minimised.

The maintenance dredging area of the entrance channel is primarily open muddy substrates, with limited areas of open sandy/gravelly substrate. These habitats contain only benthic infauna and would be subject to disturbance or removal on an annual basis when dredging was undertaken. The recovery process between dredging events is anticipated to be rapid for the more common, opportunistic invertebrate species. While some recovery of the benthic community can occur following dredging, it may be subject to removal again in subsequent campaigns. It should also be noted, however, that maintenance dredging targets only those areas that are considered high spots, so there will be patchy areas of sediment removal only and recovery of infauna communities in the dredged area can be seeded by adjacent, undisturbed areas.

The area of substrate removal is minor in relation to the extent of similar substrates within the broader areas, so impacts to benthic communities would be relatively minor. Any flow-on impacts to fish and mobile crustaceans from periodic dredging are expected to be negligible since volumes of material to be extracted will be similar to previous years.

6.5 Smothering and Burial of Benthic Organisms

DREDGE AREA

The maintenance dredging area of the channel contains primarily open muddy substrates, with areas of open sandy/gravelly substrate and absence of hard bedrock substrates. These habitats contain only benthic infauna and would be subject to smothering disturbance or removal periodically when dredging was undertaken. The recovery process between dredging events is anticipated to be rapid for the more common, opportunistic invertebrate species. While some recovery of the benthic community may occur following dredging, it can be subject to removal again in subsequent years. It should be noted, however, that dredging within channels targets only those areas that are considered high spots, so there will be patchy areas of sediment deposition only and recovery of infauna communities in the dredged area can be seeded by adjacent, undisturbed areas.

The area of disturbance within the entrance channel is minor in relation to the extent of similar substrates within the remainder of the Karumba area, so impacts to benthic communities would be relatively minor. Any flow-on impacts to fish and mobile crustaceans from dredging are expected to be negligible since volumes of material to be extracted will be similar to previous years.

PLACEMENT SITE

As described in **Section 5.4**, recent benthic fauna habitat has demonstrated no significant difference between the placement area and surrounding benthic environment. This indicates that benthic fauna disturbed by placement activity recover relatively quickly following placement activity.

6.6 Direct Impacts to Marine Turtles and Cetaceans during Dredging

Several marine turtles and cetacean species (refer **Section 3.6**) are known to occur in the vicinity of the dredging and disposal locations, however no key habitat or nesting areas have been identified within proximity to dredging. To date, dredging projects in the Port of Karumba have not resulted in any verified impacts on turtles, dugongs or cetaceans whilst actively engaged in dredging or disposal operations.

Potential impacts to these fauna have been managed in recent years through several conditions attached to the Sea Dumping Permit and operational EMPs, including:

For cetaceans:

- Lookout for cetaceans within a 300m monitoring zone before dredging or placement begins; and
- Not commencing dredging or placement if cetaceans have been seen within monitoring zone until such time as they mobilise away from the area.

For marine turtles:

- Requiring any dredge used in connection with the placement activities to be fitted with a turtle exclusion device; and
- Undertaking routine maintenance dredging outside October to February (inclusive), which is the nesting period of turtle species.

Use of a dredge with a design specification such as the TSHD "*Brisbane*", which undertakes dredging under contract to Ports North, whereby it is equipped with a turtle exclusion device on each trailing suction arm. Compliance with these conditions has avoided injury or mortality to marine turtles and cetaceans over the previous Sea Dumping Permit period. Risks from routine maintenance dredging operations to these megafauna are low, based on experience under the previous permit.

Similar mitigation and monitoring conditions regarding turtle and cetacean protection measures will again be undertaken within this LTMMP.

Undertaking emergency dredging inside the October to February turtle nesting period could result in increased risk to turtles due to their likely increased presence in the inshore areas. Ports North would be required to obtain approval from DAWE to undertake such works and would require increased management to mitigate risks particularly of direct impact to turtles. It should be recognised though that the likelihood of being able to undertake dredging works between October and February is limited since this remains within the monsoon season and availability of dredgers and staff being able to access the area can be limited.

6.7 Potential Translocation of Marine Pests

The absence of any past detection of marine pests by Ports North or biosecurity agencies indicates that there is a limited risk associated the relocation of dredge sediments to the offshore disposal ground from the channel.

Any TSHD dredger contracted to undertake dredging works will be required to comply with best quarantine practices, including DAWE and Bio-Security Queensland requirements in relation to ballast water and marine pest management, hull protection systems management prior to and during dredging campaigns.

6.8 Cultural Heritage

From the consideration of description of the existing environment, **Chapter 3.4**, there are no known areas of cultural significance identified within the dredge area, placement area or surrounding areas. The areas to be impacted by routine maintenance dredging works will have similar impact to previous dredging campaigns. Volumes for each campaign will be similar to that for historic maintenance dredging and the likelihood of uncovering items of cultural heritage significance is considered low.

6.9 Cultural Values

Modern and indigenous cultural values of the Karumba area are generally understood to be confined to seasonal use of some areas for hunting, fishing and gathering zones. Contemporary indigenous use of the entrance channel is considered minimal.

There have been no specific issues of cultural or indigenous cultural heritage raised via TACC, which includes traditional owner representatives.

6.10 Fisheries and Aquaculture

Commercial, Aboriginal subsistence and recreational fishing is a significant aspect of the present environment at Port of Karumba. Commercial and recreational effort for estuarine fisheries resources is significant. These fisheries resources are influenced by the strong seasonal trends in rainfall, temperature, and subsequent outflow of the vast gulf catchment river systems. Many of the fisheries resources have life cycles triggered by the wet and dry seasons. These resources also experience increased recreational and commercial fishing pressures following improved access at the end of the wet season.

As described in **Section 3.7**, during the EIA process for development of the channel, knowledge provided by CSIRO (**Appendix 7**) on patterns of prawn migration led to Sea Dumping Permit conditions which include a period where dredging was permitted, to minimise potential impacts to the peak time in prawn movement. Hence a “dredging window” was established, which restricts dredging activity to the period between 1 May and 30 September. Potential impact risks to fisheries from dredging, such as direct physical uptake and disturbance to early life stages of fisheries resources, was assessed as high, and hence controls on timing of works through a dredge window has been implemented and shall continue under this LTMMP. Conversely, actions of the TSHD and any ancillary bed levelling works creates a mosaic of disturbed and undisturbed areas of seafloor, with resultant variable patterns of primary colonising species and subsequent food sources to fisheries resources, thereby limiting to some extent, the overall impact of the operation on fisheries resources.

Potential impacts from routine maintenance dredging that could affect fisheries resources include disturbance to food resources through either acute or chronic alteration to seagrass meadows and disturbance to food source, or ambient interactions through physical presence of dredge and operations. It is assessed that although potential impact hazards are present, likelihood and consequence of those impacts is low under the proposed short term, annual or biennial frequency dredging campaigns within the defined “dredge window” of 1 May and 30 September.

6.11 Matters of National Environmental Significance

Under the EPBC Act, an action requires referral to the administering Department of Agriculture, Water, and Environment (DAWE) where it has the potential to cause a significant impact on MNES. Section 3.2 outlines MNES that exist within the study area.

Significant Impact Guidelines have been published under the EPBC Act to provide guidance on assessing whether a significant impact is likely (DoE, 2014; DEWHA, 2013). This is also supported by specific EPBC Act Policy Statements and referral guidelines related to certain matters.

The waters of southern Gulf of Carpentaria provide potential habitat for a number of fauna species of conservation importance as described below. This section reviews the likely presence of marine species of conservation significance in Karumba region and species that could be impacted by dredging or material disposal. **Table 6-5** provides criteria-specific assessments relevant to MNES.

These results indicate maintenance dredging and placement will not have a significant impact on any EPBC-listed matter. This finding is consistent with assessment of impact significance undertaken at other Queensland ports that undertake maintenance dredging and placement activities and is commensurate with the temporary, short duration and relatively minor impact of maintenance dredging.

Table 6-5 Assessment Against Significant Impact Criteria for Listed Threatened and Migratory Species

Significant Impact Criteria	Significant Impacts (Yes/ No)	Response to Criteria
Critically endangered and endangered species		
<ul style="list-style-type: none"> • Loggerhead turtle (<i>Caretta caretta</i>) • Olive ridley turtle (<i>Lepidochelys olivacea</i>) • Red Knot (<i>Calidris canutus</i>) • Curlew sandpiper (<i>Calidris ferruginea</i>) 		<ul style="list-style-type: none"> • Lesser sand plover (<i>Charadrius mongolus</i>) • Eastern curlew (<i>Numenius madagascariensis</i>) • Leatherback turtle (<i>Oermochelys coriacea</i>) • Speartooth shark (<i>glyhis glyphis</i>)
Lead to a long-term decrease in the size of a population	No	<p>Dredging will not occur on tidal mudflats where migratory birds may be occasional visitors, but the area is not known as an important feeding or roosting area. The area is not identified as critical habitat for turtle species, although they are regular visitors to the area. Various measures including spotters, avoiding dredging in turtle nesting periods and the use of turtle exclusion devices are in place to minimise any impacts. To date, there are no records of any turtle strikes during maintenance dredging</p> <p>Blue Whales and sharks may occasionally visit the area, but again, it is not known to support any critical components of their life cycle.</p>
Reduce the area of occupancy of the species	No	No net loss to area of occupancy of any species, although some species may temporarily avoid areas around the dredge as a result of underwater noise.
Fragment an existing population into two or more populations	No	No fragmentation to any species occurrence.
Adversely affect habitat critical to the survival of the species	No	Works occur outside of breeding times for turtle species.
Disrupt the breeding cycle of a population	No	No impact to breeding areas for turtles or on mangroves
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	No	Turtle species would utilise nearby seagrass beds for foraging purposes, however these are not significantly impacted by maintenance dredging.
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat	No	Risk of introduction of new marine species from TSHD <i>Brisbane</i> is considered very low.
Introduce disease that may cause the species to decline	No	Risk of introduction of new disease from TSHD <i>Brisbane</i> is considered very low, especially comparative to existing volume of shipping traffic.
Interfere with the recovery of the species	No	See above
Vulnerable species		
<ul style="list-style-type: none"> • Green turtle (<i>Chelonia mydas</i>) 		<ul style="list-style-type: none"> • Bar-tailed godwit (baueri) (<i>Limosa lapponica baueri</i>)

Significant Impact Criteria	Significant Impacts (Yes/ No)	Response to Criteria
<ul style="list-style-type: none"> Hawksbill turtle (<i>Eretmochelys imbricata</i>) Flatback turtle (<i>Natator depressus</i>) Green Sawfish (<i>Pristis zijsron</i>) Whale Shark (<i>Rhincodon typus</i>) 		<ul style="list-style-type: none"> White shark (<i>Carcharodon carcharias</i>) Dwarf fish (<i>pristis olovata</i>) Freshwater sawfish (<i>Pristis Pristis</i>)
Lead to a long-term decrease in the size of an important population of a species	No	<p>The risk of direct injury to marine turtles, fish or shark species is low based on historical occurrence, use of spotters and use of turtle excluder devices. . There is negligible impact to seagrass and therefore no consequent impact on turtle or other marine fauna feeding.</p> <p>The area is not known as critical habitat for any of the above species.</p>
Reduce the area of occupancy of an important population	No	No net loss to area of occupancy of any species
Fragment an existing important population into two or more populations	No	No fragmentation to any species occurrence.
Adversely affect habitat critical to the survival of a species	No	Not identified as critical habitat
Disrupt the breeding cycle of an important population	No	No breeding/nesting areas for any species known to occur within the study area
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	No	Vulnerable species would forage in seagrass meadows at the mouth of the Normal river, however these are not significantly impacted by dredging activity.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	No	Risk of introduction of new marine species from TSHD <i>Brisbane</i> is considered very low, especially comparative to existing volume of shipping traffic.
Introduce disease that may cause the species to decline	No	Risk of introduction of new disease from TSHD <i>Brisbane</i> is considered very low, especially comparative to existing volume of shipping traffic.
Interfere substantially with the recovery of the species	No	See above
Migratory species		
<ul style="list-style-type: none"> Black-tailed Godwit Bar-tailed Godwit Great Frigatebird, Greater Frigatebird Whimbrel Broad-billed Sandpiper Blue Whale Little Curlew, Little Whimbrel 		<ul style="list-style-type: none"> Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish Fork-tailed Swift Australian Snubfin Dolphin Common Noddy Hawksbill Turtle Green Turtle Olive Ridley Turtle, Pacific Ridley Turtle

Significant Impact Criteria	Significant Impacts (Yes/ No)	Response to Criteria
<ul style="list-style-type: none"> Common Greenshank, Greenshank Marsh Sandpiper, Little Greenshank White Shark, Great White Shark Osprey Common Sandpiper Dugong Streaked Shearwater Lesser Frigatebird, Least Frigatebird Salt-water Crocodile, Estuarine Crocodile Terek Sandpiper Flatback Turtle Reef Manta Ray, Coastal Manta Ray Grey-tailed Tattler Pectoral Sandpiper Bryde's Whale Red-necked Stint Whale Shark Eastern Curlew, Far Eastern Curlew 		<ul style="list-style-type: none"> Loggerhead Turtle Leatherback Turtle, Leathery Turtle, Luth Australian Humpback Dolphin Dwarf Sawfish, Queensland Sawfish Green Sawfish, Dindagubba, Narrowsnout Sawfish Giant Manta Ray Narrow Sawfish, Knifetooth Sawfish Sharp-tailed Sandpiper Sanderling Lesser Sand Plover, Mongolian Plover Killer Whale, Orca Ruddy Turnstone Grey Plover Great Knot Pacific Golden Plover Red Knot, Knot Curlew Sandpiper
Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species	No	No important habitats (i.e. seagrass or mudflats/sandflats) will be materially impacted by turbidity or suspended sediments.
Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species	No	Risk of introduction of new marine species from TSHD <i>Brisbane</i> is considered very low, especially comparative to existing volume of shipping traffic.
Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species	No	The total number of individuals per species that could be impacted is low and do not represent an ecologically significant proportion of the relevant population for any species.

6.12 Socio-Economic Impacts

As outlined above, consideration of impacts of dredging on the social and economic aspects should include both positive and negative impacts to both aspects. There are clear economic benefits from the presence of a dredged channel and resultant social benefits to the community of Karumba and surrounding gulf region. There is however, periodic negative impacts to the social aspects due to visual amenity and physical presence of dredging fleet, however these are small in temporal scale, and given the low number of possible sensitive receptors in the region is assessed as a low probability, but moderate consequence.

Mitigation Actions listed in above identify that an adequately managed campaign, where the community is informed of the dredging activity will minimise this impact. Economic impacts were a significant consideration in the EIA for the establishment of the location of the channel and placement area and included consideration of the following:

- The characteristics of the dredged material and the material at the placement area site;
- Proximity to areas of environmental significance;
- Minimising impacts on marine habitats and fauna, including seagrasses and benthic infauna;
- Logistic and economic considerations, including optimisation of dredge cycle times; and
- Safety considerations in the operation of dredging equipment at the placement area site.

Assessment of suitability of the placement area location during the EIS (Dames & Moore, 1996) was based on the following positive factors, which are considered to remain valid for the term of this LTMMMP;

- The distance between the placement area and shore which prevents impacts to areas of environmental significance from turbid plumes;
- The absence of seagrasses in areas similar to the placement area due to light attenuation constraint of Gulf waters;
- The absence of evidence of impacts from material that is resuspended and relocated following placement;
- The previous disturbance history of the site;
- Its location being outside any shipping navigation channels; and
- Lack of other uses of the placement area (existing or potential).

Although there are possible negative impacts identified in previous sections on some environmental and social aspects, the net impact of a well-designed, and managed dredging campaign with appropriate mitigation measures on a socio-economic front is considered positive.

7. Management Strategies and Actions

Ports North has a corporate commitment as set out in the Environment Policy to ensure operations are completed in a manner that minimises risk and impact to the surrounding environment. An Environment Management System is in place including mechanisms for continual improvement in management of dredging activities. Ports North has measures in place to minimise contaminant input sources and managing potential impacts from dredging and dredge material disposal as far as practicable. Key management strategies and actions to minimise the impact from dredging and disposal operations are introduced below.

7.1 Environmental Management Plans (EMPs)

The Port of Brisbane Pty Ltd, as operator of the TSHD *Brisbane*, maintains its own Environmental Management Plan for dredging activity. For each individual campaign at the Port of Karumba, a project specific EMP is prepared, in accordance with the template provided in **Appendix 8**. Any bed-levelling is undertaken in accordance with **Appendix 9**. These documents are considered as sub-ordinate documents to the LTMMMP and outline the very specific operational control mechanisms to complement and achieve the high-level strategic dredging and disposal management and actions set out in this LTMMMP.

The applicable EMP template will be used as the basis for development of the campaign specific EMP by the appointed dredging contractor.

At a minimum, the EMPs for individual campaigns will include management plans for the following aspects:

- Waste management;
- Noise;
- Turbidity control;
- Protected marine fauna;
- Cultural heritage;
- Ballast water management;
- Vessel washdown; and
- Bunkering of fuel.

Within each of these elements, the EMP clearly defines:

- Impacts;
- Objectives;
- Management actions and mitigation measures;
- Performance indicators;
- Monitoring;
- Reporting;
- Corrective action;
- Term; and
- Responsibility.

Prior to the commencement of each campaign, Ports North environmental staff will review the EMP provided as a contract deliverable to ensure that all Sea Dumping Permit, and other approval conditions are addressed. Ports North staff will conduct audits as per the schedule cited in the EMP to ensure that the dredge operators are familiar with the EMP procedures and that the EMP is implemented and addresses the LTMMP, Sea Dumping Permit and other approval condition requirements.

7.2 Vessel Specifications

It is forecast that a trailing suction hopper dredger (TSHD) such as the vessel “*Brisbane*” will continue to be contracted to undertake the work at Port of Karumba for all future maintenance dredging campaigns. However, in the event that the contract is finished, or another dredging contractor is appointed, DAWE and TACC shall be duly advised and any necessary actions triggered within the LTMMP proposed management actions or monitoring programs will be enacted. Similarly, details of ancillary dredge vessels, plant or equipment, including drag barring or bed levelling vessels shall be advised to DAWE in the event there is a change.

Mitigation of potential turbidity and suspended solids impacts from dredging and material disposal by the trailing suction hopper dredge operations is achieved through the requirement for modern vessel specifications. These specifications are considered the minimum standard for trailing suction hopper dredges that will be selected to undertake dredging works in the channel and includes:

- Low wash hull-design;
- Below keel discharge;
- Central weir discharge system;

- Electronic positioning systems;
- Well maintained seals on the material placement doors or valves to minimise any leakage whilst in transit;
- Ability to distribute material uniformly over the placement area, which will be confirmed by GPS reference plots for each placement event; and
- Turtle exclusion devices fitted to suction heads.

Technical specifications for associated dredging plant such as bed levelling barges include well maintained plant and ancillary equipment, a method of accurately achieving dredging location (e.g. GPS) and an effective mooring system.

7.3 Dredging Window

Routine maintenance dredging has, and will continue to be scheduled to occur after the conclusion of the wet season at approximately the end of April each year, when possible inflows of sediments have concluded. Routine maintenance dredging will be scheduled between 1 May and 30 September each year. This period is also consistent with the “dredging window” to protect marine resources from possible effects of dredging.

As identified in **Section 4.4.1**, extreme weather events may result in flooding or storm surges depositing sediments in the channel to the extent that it requires emergency dredging to re-establish navigable depths. These events are typically associated with cyclones. As such, Ports North has no control over the extent or timing of deposition and little control over when emergency dredging may be required.

Although the exact timing of cyclonic events is uncertain, they are most likely to occur during or immediately following the summer or early autumn wet season when monsoonal activity is greatest. This timing however coincides with turtle nesting season (October to February inclusive) and prawn migration in the area (October to January), when routine maintenance dredging is not permitted.

In the event that dredging is required outside of the existing dredge window, Ports North will submit a request to vary the Sea Dumping Permit to DAWE. Supporting information for the variation request would include the following minimum information;

- Advice from the TACC specifically from stakeholders with expertise in prawn and turtle ecology;
- evidence to verify that sediment contamination status has not changed since last SAP;
- and any additional supporting information as stated in other sections of this LTMMMP,

If the need for dredging outside the window period is identified and dredger availability and operational conditions are suitable for dredging operations, Ports North will initiate management actions to mitigate additional potential impacts on the matters for which the “window” was established (nesting marine turtles and migration of prawns from the Norman River), inclusive of the following;

1. Review the anticipated vessel use and depth requirements until opening of the approved dredging window period and avoid possible impacts;
2. Liaise with the Regional Harbour Master to identify an interim declared depth to be established to enable safe vessel navigation, again to avoid possible impacts;
3. If dredging is required, identify options to minimise the volume of dredging through consideration of hydrographic information to take advantage of deeper areas if consistent with navigational safety.
4. Where possible, attempt to minimise dredging and sea disposal activities by using a bed-leveller.
5. More expansive dredging is anticipated to require the services of a TSHD, and where available, any TSHD should meet the minimum specifications identified in **Section 7.2**. If such

a vessel is not available then Ports North will liaise with DAWE to assess environment risks and agree on additional management requirements for vessel aspects that do not meet specifications identified in **Section 7.2**

6. If dredging is required to establish the interim declared depth, undertake discussions with key regulatory and advisory agencies to identify specific additional management and monitoring actions in addition to those for routine maintenance dredging.
7. Additional meetings of the TACC would be sought to inform the representatives of the need for dredging and seek their comment regarding management and monitoring actions being proposed and discussed with key regulatory and advisory agencies.
8. The TACC, as defined in the NAGD has the role “to facilitate prompt resolution of a particular issue”, and hence have the role of making a recommendation to DAWE for the ultimate authorisation of emergency dredging operations.
9. Consider additional management measures that reflect the specific requirements at that stage of their respective critical life cycle stages, inclusive of timing of works in respect of moon phase, tide, weather or location within the channel and critical documented habitat locations advised by the TACC stakeholders.
10. Additional monitoring programs (e.g. wildlife spotters, or water quality monitoring) would be implemented to measure the effectiveness of such management actions, and an increased frequency and content of reporting provided on such to the TACC and DAWE.

Ports North proposes to provide DAWE with a range of proposed mitigation and management measures when the need for an approval for emergency dredging is identified and is outside the approved window. Such measures will be commensurate with;

- the volume of material required to be dredged;
- location of that material within the channel;
- forecast impact to economic operation of the port and shipping movements; and
- timing of the work in relation to start or finish of the window and applicable impacts to particular species of management importance.

Such management measures would address the predicted impacts of the work based on the aspects and impacts identified in **Section 6**, and subsequent management measures noted in this **Section 7**, and would form the basis on which negotiation of conditions of an emergency campaign would be commenced.

7.4 Marine Pests

There have been no verified detections of marine pests, or potential pest species at the Port of Karumba. Despite this, all necessary bio-security measures will continue to be adopted for not only dredging and disposal operations, but also for general port operations. These will be undertaken in conjunction with the State and National departments with responsibility for marine pest management via the *National System for the Prevention and Management of Marine Pest Incursions the Australian Marine Pest Monitoring Manual* and accompanying *Australian Marine Pest Monitoring Guidelines*.

Any TSHD dredger contracted to undertake dredging works will be required to comply with best quarantine practices, including AQIS and Bio-Security Queensland requirements in relation to ballast water and marine pest management prior to and during dredging campaigns. Strategies for minimising the risk of translocation of marine pests from other locations to Karumba shall be addressed via the dredging campaign specific EMP to be developed and implemented by the contractor. This EMP will follow the guidance outlined in *the National Biofouling Management Guidance for Non-trading Vessels* (Commonwealth of Australia, 2009).

Management approach would follow the biofouling risk assessment framework outlined within the *National Biofouling Guidance for Commercial Vessels* (Commonwealth of Australia, 2009). This document also outlines steps for minimising the risk of marine pest risks aboard dredge vessels, and other non- trading vessels. Introduced marine pest management measures discussed include

post-service inspection and cleansing at prior area of operation, en-route ballast exchange, pre-arrival inspections and cleaning of internal systems and anchor lockers as well as ensuring the marine growth prevention system is well maintained.

Ports North will include a specific clause within each dredge contract to include requirement for vessel to be inspected prior to arrival, subject to Bio-Security QLD protocols, inspected again on arrival if required and the operator to demonstrate proof of freedom. It should also be noted that interaction with DAWE via the TACC for management and advice on any specific marine pest incursion issue is to be required.

Management of any detection of possible marine pest species within the port, maintenance dredge area or placement area will follow the implementation protocols developed under the National System for the Prevention and Management of Marine Pest Incursions. Within the term of this LTMMMP it is envisaged that monitoring and evaluation of the Port of Karumba will occur under role out of state and national bio-security initiatives in respect to marine pests. For the Port of Karumba, these initiatives are to be facilitated by Ports North to ensure risks from marine pests to the marine environment are minimised and any potential for translocation of marine pests through dredging and disposal is also avoided.

Should additional risks be identified, management actions and monitoring arrangements will be implemented as advised by the various jurisdictions, either via the TACC or through direct engagement.

7.5 Use of the Existing Placement Area

The continued use of the current placement area mitigates impacts from smothering through preventing the need to dispose of material in an area that has not been disturbed previously or is closer to areas of environmental significance. Past monitoring has identified that the placement area is functioning well and that any impacts adjacent to the placement area are minor and limited to benthic infauna in open muddy substrates of relatively minor environmental significance.

It is recognised that another placement area will ultimately need to be used when the current placement area has reached capacity but initial assessments by Ports North indicate the present site has sufficient capacity this is unlikely to be required for at least 10 years and is beyond the ten-year term of this Plan. Re-assessment of placement area capacity is proposed for the last quarter of the term of this LTMMMP.

7.6 Uniform Material Deposition

Impacts to the placement area and adjacent areas will be minimised through spreading of the dredge material in such a manner as to uniformly spread it over the placement area and minimise sediment mobilisation and turbidity plume extent beyond the placement area boundary. This is achieved through deposition patterns that vary with the prevailing current direction and understanding of the placement area bathymetry.

7.7 Scheduled Monitoring

Ports North proposes to undertake monitoring of the marine environment for:

- Those elements that have the potential for significant impact to the marine environment if the condition of sediments is not well known prior to dredging. Such elements would include sediment quality and introduced marine pest assessments; or
- Particular sensitive habitats that can be impacted through the dredging or disposal activities such as seagrass beds in the vicinity of the outer channel or benthic assemblages within and adjacent to the placement area.

Proposed monitoring schedule activities are outlined below and will be altered as a result of the continual improvement mechanisms and following resolution of a direction based on technical advice from the TACC.

7.7.1 Benthic Infauna Surveys

Monitoring of benthic assemblages is proposed approximately every five-years (i.e. 2025 and 2030). The site is a known zone of impact, for which prior assessment has been made and a permitted impact conducted for prior campaigns. Therefore, the aim of survey at the ocean disposal site is not to be primarily targeted at determining the rate or scale of recovery during continued and on-going use and impacts of material, but rather to determine the more relevant question of 'is that impact remaining within the permitted zone'. Benthic infauna assessment at the placement area will be undertaken utilising a radial axis sampling method to determine gradient of impacts at and adjacent to the placement area. This will be achieved through use of multivariate statistical analyses design to identify differences between placement area and adjacent areas for particle size and benthic infauna assemblages.

The rationale of the sampling design seeks to answer two questions:

- What is the impact at the placement area, in comparison to non-placement areas?
- How does the impact diminish with distance from the placement area?

This is achieved by taking replicate samples for infauna and one sample for particle size at five sites within the placement area and five sites on axes extending from the boundary of the placement area in line with prevailing currents. Infauna samples are sorted, identified and counted, presented using a range of descriptive statistics and subjected to a range of univariate and multivariate statistical analyses.

The benthic infauna monitoring report will be available within three months after completion of each survey. The document will be forwarded to DAWE and the TACC representatives. Monitoring results will be discussed at the subsequent TACC meeting.

In the event that impacts from material disposal outside the permitted placement area site are identified and concern is raised by either DAWE or via the TACC in regard to recovery of the surrounding areas, consultation with the TACC will be initiated to identify appropriate management responses and any required corrective actions to meet commitments at **Section 7**.

The latest survey (2020) did not identify any dredging impacts outside of the placement area boundary.

7.7.2 Introduced Marine Pests

It was identified in **Section 6.7**, that probability of translocation of marine pests due to dredging was low, and the potential for natural colonisation by dispersal across the short distance to placement area by natural mechanism was possible, therefore the need to monitor material to be dredged is considered minimal.

On that basis, it is proposed to undertake monitoring for potential marine pest species in accordance with National and State protocols if and when detection is made, prior to the next campaign after detection is made, or in conjunction with proposed infauna surveys as per frequency outlined at **Table 7-1**.

7.7.3 Seagrass Survey

It has been identified in **Sections 3.5.2** and **6.4.1** that, routine maintenance dredging and day-to-day port operations are not driving the observed variations in seagrass characteristics. Impacts to

water quality from the dredging and disposal activities are not likely to be of a temporal or spatial scale large enough relative to background variability to have any measurable or ecologically meaningful impact to seagrass. Dredging activities with the potential for plume generation are managed to minimise potential for impacts: dredging operations in overflow mode occur for very short periods per dredge cycle; and deposition at the placement areas occurs below keel level and at a location relatively distant from inshore seagrass habitat.

The high natural variability seagrass cover and extent is primarily in response to climatic factors, such as water temperature, daily exposure, water depth, rainfall and catchment runoff, which are beyond the control of port operators and confound identification of a causal link between port operations and seagrass changes.

Overall, seagrass beds are not a good indicator for detecting short term direct or indirect environmental impacts from dredging or disposal, but offer a long term indicator of general catchment health. The existing monitoring program established by the now DAF (formerly QPI&F) in 1994 was designed to measure overall trends in catchment condition, rather than specifically attempt to measure influences of dredging, disposal or other port activities.

On the basis of the low impact to seagrass habitats from dredging and disposal or port operations identified above, and through the previous and proposed water quality monitoring programs summarised at **Section 5.3.2**, monitoring of potential impacts from dredging on seagrass beds, through use of seagrass monitoring as an acute impact indicator, is not proposed.

However, Ports North will continue to undertake annual seagrass meadow health monitoring where seagrass is used as an indicator of general environmental health of the catchment, and as a long term monitoring tool as a component of this LTMMMP.

In the event that deleterious impacts of dredging activity on seagrass resources are identified, verified and reported to Ports North, either through the TACC forum or otherwise, additional mitigation actions and management strategies shall be implemented if required within the duration of this LTMMMP. Management actions include alteration to scheduling, duration, location, intensity of dredging and disposal activity, with these being undertaken in concert with matched monitoring programs.

7.7.4 Water Quality Monitoring

DREDGE EVENT MONITORING

As outlined in **Section 5.3.1**, previous work has been completed on determining a representative “background trigger” and reactive monitoring program for monitoring plume turbidity at Karumba.

When triggered, by an event listed at **Section 7.7.7** turbidity monitoring will be implemented for each dredging event; Water quality sampling will use a reactive management turbidity trigger of background plus 25% or 62 NTU whichever is greater, for a duration of no more than 72 hours, for period of flood tides when dredge is working adjacent to Alligator Bank or another sensitive site if required. Monitoring will be undertaken in close proximity to the seagrass meadows, in order to protect these values from excessive turbidity and loss of light for prolonged periods.

Dredge event water quality monitoring is not proposed for routine campaigns where impacts can be managed with normal range of mitigation options. However as set out in **Section 7.7.7** and **Table 7-2**, dredge event water quality monitoring is proposed when the following criteria are met;

- If dredging is required outside the normal “dredge window” and is approved;
- Scale of works changes significantly to >690,000 in-situ m³ (i.e. greater than 50% increase over average maintenance dredging volume); or;
- Increased intensity of campaign is proposed (i.e. more than one dredge in operation, or full time overflow dredging); or
- Strong northerly weather pattern predicted for duration of works; or;

- Results of seagrass monitoring identify dredge generated turbidity or sedimentation as a quantified cause of seagrass declines; or
- Tide and wind conditions and duration of campaign is predicted to retain turbid plume over seagrass meadows for >20 days.

It has not been necessary to conduct formal water quality monitoring during the life of the previous ten-year sea dumping permit, as the criteria above have not occurred.

Implementation of Water Quality Monitoring Program (**Appendix 10**) is set out in the Monitoring Flowchart based on the decision points that are triggered. This may include higher frequency of sampling if the campaign is scheduled for higher risk scenarios or, at a reduced frequency in lower risk periods.

The data from any such campaign or event will then be assessed for compliance against the program targets (**Appendix 10**). Where exceedances occur, management measures to reduce turbidity will be implemented as documented in the EMP (refer **Appendix 8** and **Appendix 9**).

Management measures are listed **Sections 7.1 to 7.6** and within the respective campaign specific EMP's. In cases where water quality monitoring identifies that monitoring trigger has been exceeded, corrective actions including those listed in the following ascending hierarchy of a tiered approach may be applied;

Tier 1 vessel turbidity management

- Determine source of highest concentration of turbid water discharge and identify any alternate management measures (i.e. general vessel manoeuvring, or disturbance from suction heads on seafloor, versus discharge from the hopper);
- Increase the frequency of non-overflow dredging;
- Alter controls on the hopper discharge weir system to minimise plume generation

Tier 2 dredging intensity

- Reduce hours of operation to avoid periods of forecast tide or sea state where water quality trigger may be exceeded;
- Alternate dredging with another section of channel and continue works; or.

Tier 3 campaign program

- Minimise or halt hopper discharge till dredge is in transit and away from sensitive areas where trigger has been exceeded;
- Cease dredge operations in area where exceedance of trigger occurs,
- Re-evaluate monitoring trigger and monitoring program methodology.

These corrective actions will be progressively implemented by the appointed dredging vessel operator under direction of the Dredging Supervisor and Ports North immediately the exceedance is identified as per Monitoring Flowchart and will be commensurate with the scope of the exceedance of the water quality trigger, extent of the remaining campaign, and forecast conditions.

In the event of repeated non-compliance against trigger levels following implementation of management actions, and corrective actions, consideration will be made for inclusion of emerging water quality monitoring methods, such as more intensive monitoring activities to better characterise the ambient turbidity environment and verify the suitability of the trigger value. This could include deployment of data loggers to continuously collect information on light levels and water quality parameters reaching sensitive habitats such as seagrass throughout the year. This option will be considered for implementation following a trial of such technology, verification of those results through technical review by an experienced aquatic ecologist and subsequent approval for implementation by the TACC. Such a change to the water quality monitoring program will provide critical information leading up to dredging events and enable quantification of resilience of key habitats, determine reasons for changes in such habitats, differentiate between dredge induced

impacts and natural events and subsequently may provide an additional information source for consideration by the TACC.

7.7.5 Sediment Sampling and Analysis

It is proposed to undertake two surveys during the life of the LTMMP, during 2025 and 2030. Under the NAGD, **Section 4.2.1**, testing of sediments to be dredged is not required within 5 years providing the contamination status has not changed significantly.

If altered operations create a potential contaminant source within the port during the permit period, then an additional sediment survey will be undertaken, if required, to identify whether contamination of sediments is occurring. The timing for any additional survey and the scope of analyses will be reviewed by Ports North in consultation with the TACC.

Should any significant operational or environmental incidents or changes occur after implementation of the approved SAP, or the results of that SAP indicate changes to contaminant levels within proposed dredge sediment, the list of target contaminants of concern in the subsequent SAP is to be developed and submitted based on assessment of those findings. An updated SAP will be provided to DAWE in the year prior to the next 5 yearly sediment survey for approval.

The results of the sediment surveys will be provided to DAWE and the TACC representatives for comment and discussion at the subsequent TACC meeting.

7.7.6 Summary of Monitoring Schedule

A tabulated summary of the monitoring program is provided in **Table 7-1**.

Each of the proposed ecological health monitoring programs and the knowledge gained from these is to be used to inform management of dredging and disposal and to ensure that the level of resilience of marine flora and fauna with potential to be affected by action of dredging and disposal is established prior to dredging campaigns through open technical dialogue between Ports North, Port of Karumba TACC and DAWE. Monitoring programs established by Ports North have to date established an understanding of the seasonal fluctuations in key marine habitats, including seagrass and levels of resilience that may contribute to an increased probability of vulnerability to effects of dredging or material placement.

The scope of such ecological health monitoring and the mode of delivery could change over the term of the LTMMP as future advice is provided by the TACC, regulatory requirements change, knowledge on the impacts of dredging and disposal develops, and as result of preceding monitoring inform the continual improvement process. Therefore, this schedule is a proposed outline of the key items to be implemented over the term of the LTMMP and be subject to periodic review, alteration with subsequent consultation with the TACC and approval by DAWE.

Table 7-1 Summary of LTMMMP Monitoring Schedule

Objective	Activity	Monitoring Item	Details	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	Comments
			Scheduled Dredging												
Disposal of dredge material will not result in chemical contaminant impacts to the marine environment	Disposal	Sediment quality assessment	Compare contaminant levels at 95%UCL of the mean to NAGD screening levels or local derived screening level.	✓	*	*	✓	*	*	*	*	✓	*	*	✓ Compare primary contaminants list each five years. *Amend the 2025 and 2030 SAP sampling if contamination events occur prior to that sampling, or if the 2025 or 2030 SAP results dictate a change to the Contaminants of Concern is required.
Dredging activities will not lead to decline in Seagrass meadows adjacent to channel attributable to impacts of dredging	Dredging	Seagrass Monitoring Program	Appraise outcomes of the annual pre wet season surveys under the Long Term Seagrass Monitoring Program	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
No significant accumulation of primary contaminant substances at the placement area	Disposal	Sediment quality assessment	Compare contaminant levels against NAGD screening levels and historic levels	✓			✓					✓			✓ Compare primary contaminants list each five years.
Translocation of marine pests via dredging to the placement area will not occur.	Dredging	Marine pest monitoring program	Cooperate with agencies implementing the National System for the Prevention and Management of Marine Pest Incursions	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	As required, contribute to design and review of any risk based programs by State or Commonwealth Agencies.
There will be no deleterious impact on marine benthic infauna communities adjacent to the placement area resulting from sediment mobilisation	Disposal	Benthic infauna; Particle size distribution	Compare sites within and adjacent to placement area and identify gradient of impacts radiating from placement area				✓					✓			Undertake at same time in year for temporal consistency.
Turbidity plume during dredging of channel does not extend to Alligator Bank or other areas of environmental significance at levels above “Trigger” value	Dredging and Bed Levelling	Water Quality Monitoring Plan	Implement the Plan (Appendix 10) and any reactive management triggers that arise when trigger event at Section 7.7.7 occurs	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	When triggered, implement Water Quality Monitoring Plan at Appendix 10 for each campaign and periodically review applicable “Trigger” value.
Disposal Site will have sufficient capacity for future dredging requirements	Disposal	Analysis of capacity	Implement modelling or validation process to verify placement area has capacity for future disposal that it is not of depth where extreme wave depth may induce mobilisation, or depth may inhibit shipping movement.										✓		Compile hydrographic modelling and spoil ground capacity report to support future LTMMMP version

7.7.7 Triggers for Changes to Monitoring Schedule

It is possible that variations to the Monitoring Schedule set out in **Table 7-1** may occur throughout the life of the LTMMP, and therefore the following summary **Table 7-2** outlines some of these potential changes and actions to be taken should they arise. These specific management actions will be implemented via the works specific EMP for the respective campaigns to meet acceptance by the TACC and DAWE.

Table 7-2 Monitoring Triggers

Trigger	Yes	No
Scientific advice on ecological receptors is provided to the TACC, and a corrective action to the existing monitoring arrangements is agreed by the TACC and Ports North.	Implement requested changes to monitoring arrangements.	Continue monitoring schedule as per Table 10-1
Scale of works changes significantly to >690,000 in-situ m ³ (i.e. greater than 50% increase over average maintenance dredging volume).	Enact Water Quality Monitoring Plan.	Dredge as usual
Increased intensity of campaign is proposed (i.e. more than one dredge in operation, or full time overflow dredging).	Follow Water Quality Monitoring Plan.	Dredge as usual
Strong northerly weather pattern predicted for duration of works.	Consider constraints on timing of work to lower tides to minimise plume dispersion to Alligator Bank – and or implement reactive Water Quality Monitoring Plan.	Dredge as usual
Timing of works is required outside normal window.	Seek advice from TACC, DAWE, and CSIRO on up to date status of prawn stocks/season and turtle nesting.	Dredge as usual
Method of dredging is significantly different to dredging campaigns using the TSHD “Brisbane” (i.e. such as full time overflow operation, use of a cutter suction or grab dredge etc.)	Assess vessel specifications and determine likelihood of changes to potential impacts. Implement additional plume verification monitoring.	Dredge as usual
Incident event causes potential contamination to proposed dredge area after completion of scheduled 2025 and 2030 SAP.	Modify list of contaminants of concern, conduct an interim SAP process for potentially affected area prior to the next campaign, then update the subsequent scheduled 5 year SAP.	Implement latest approved SAP
Scheduled surveys of seagrass meadows adjacent to the dredging area identify dredge generated turbidity or	Implement management actions (change to duration of campaigns, duration in sectors, time relative to tide or wind state.	Dredge as usual

Trigger	Yes	No
sedimentation as a quantified cause of seagrass declines.		
<p>Verified detection of Marine Pest (National Action List species) within proposed dredge material with potential to colonise disposal site.</p> <p>(i.e. Biosecurity Queensland or DAWE detect and positively identify a listed pest species in an area with high potential to effect the dredge area)</p>	Implement risk based assessment to design and implement pre-dredge monitoring of proposed material under guidance from State Bio-Security and National arrangements.	Dredge as usual, no additional monitoring

7.8 Oil Spill Response

Ports North is responsible for first strike response to all oil spills within Karumba Port Limits and would respond in accordance with the protocols established in its Oil Response Plan. The Oil Response Plan responds to oil spills from ships and other sources within the Port of Karumba.

The first response team of the Port of Karumba are all trained to “Level 1 – Oil Spill Responder” and are under the management of the Regional Harbourmaster. Port of Karumba retains the necessary equipment to enable a first-strike response. The equipment is audited quarterly and maintained by staff at the Port of Karumba.

In addition to this first strike oil response capability at the Port of Karumba, any contracted dredge vessel would be required to have, and implement as necessary, a Shipboard Oil Pollution Emergency Plan, which outlines the role, responsibilities and actions to be followed should an uncontrolled release of oils/fuels occur.

7.9 Reporting of Incidents and Contingency Arrangements

The reporting of incidents and contingency arrangements is an element included within Ports North’s Environmental Management System, and is also a requirement of its existing approvals.

All Ports North staff and any contractors involved, have the responsibility to report any significant incidents and emergencies:

- Reporting of incident events during dredging and disposal will be required within the timeframes set out in the Sea Dumping Permit;
- The Queensland Government also have specific reporting and incident notification procedures as per the *Environmental Protection Act 1994*, in the case of Material or Serious Environmental Harm, which are applicable in the case of a major incident. In the first instance, reporting should be to the operational works supervisor, but generally, the Chief Executive Officer will have the overall responsibility to initiate corrective action for environmental incidents;
- All incidents should be reported to the Project Superintendent, as specified by Ports North;
- In the case of an environmental emergency, after first notifying the Chief Executive Officer, the operational works supervisor is to contact Ports North’s Environment Manager, who would help co-ordinate and manage a response;
- Depending on the nature and magnitude of the incident, the Chief Executive Officer may be required to notify approval agencies as appropriate. It is the Environment Managers’ responsibility to ensure that contact numbers are at hand prior to the commencement of the project; Refer to the campaign specific contact details as set out on the applicable copy of **Table 2-2**;
- Significant environmental incidents will be logged in writing, with all relevant details recorded, after corrective action has been completed. The environmental events register will be made available for inspection by agencies, the Operational Works Supervisor and Chief Executive Officer at all times.

Ports North will report the following information to agencies, if at any time during the course of dredging or disposal activities any unanticipated environmental risk is identified:

- Nature of incident and type of risk associated with the incident, including (where possible) volume, nature and chemical composition of substances released;
- Measures taken to mitigate the risk;

- The success of the measures undertaken; and
- Proposed future monitoring.

Specific arrangements for Incidents and Contingencies are outlined in the EMP developed for each campaign. These also reflect the “Karumba Emergency Response Plan” which is a controlled document under the supervision of Ports North Security and Emergency Manager. This document contains contingency arrangements for:

- Scope of area to which the plan applies – port limits;
- Cyclone contingency procedure;
- Risk assessment of possible emergencies; and
- Contacts list for implementation of the Plan.

7.10 Continuous Improvement

An effective and compliant LTMMMP can only be maintained through a process consistent with standard Environmental Management Systems, namely the cycle of continual improvement. Ports North is committed to ensuring that management of operations, including dredging activities at each of its Ports meets the general environmental duty and environmental policy.

Monitoring to date suggests that impacts from dredging and disposal operations at the Port of Karumba are being well managed and impacts to the marine environment are not significant. Opportunities for improvement appear to be limited given the environmental management and monitoring practices currently in place, and the limited activity within the port.

Dredging will be undertaken under a project specific EMP to ensure that all permit requirements are captured and adhered to. Placement of dredge material is through sub-surface release, which minimises dredge plume generation.

A range of monitoring is undertaken to ensure that any impacts to the dredging and disposal locations and their adjacent areas are minimised.

To facilitate discussion of opportunities for continuous improvement, an agenda item will be included to TACC meetings, whereby any stakeholder can raise an improvement for consideration.

Changes to the implementation of the LTMMMP, EMPs and subsequent monitoring programs will be implemented where impact hypothesis have been tested and determined to be acceptable and to ensure economic and resource efficiency is maintained. Any proposed changes will be incorporated into the LTMMMP which will be resubmitted to DAWE for approval.

Implementation of the LTMMMP is a component of the overall Environmental Management System for activities conducted by Ports North across the regional ports. Specifically, the EMS is implemented to manage the day to day permit and licence compliance, as well as the campaign specific EMP. The EMS implemented by Ports North is consistent with the Australian Standard AS/NZ:140001 which is based on the objective of continual improvement in management and environmental outcomes.

This LTMMMP outlines a management and monitoring structure that, over the life of the Plan and Sea Dumping Permit will enable a documented mechanism to ensure that the actions of dredging, disposal and monitoring continues to improve the management of contaminants, pollution and mitigates residual environmental impacts over the life of the LTMMMP.

It is acknowledged that this is a living document that is to be updated to meet changes to legislative requirements, informed by emerging scientific and ecological knowledge, and improvements to best practice management of dredging and disposal. Updates identified to continually improve the document will be managed via document version control, an issues log

recorded against the minutes of the TACC meeting, and most recent version of document maintained on Ports North's website.

Once approved by DAWE, the LTMMP and Permit will be uploaded to Ports North's external website (www.portsnorth.com.au) within the recommended LTMMP guideline timeframe, i.e. 2 weeks. Subsequent revisions will be uploaded and notification advice provided to TACC on availability of documents to facilitate access.

7.11 Record Keeping, Reporting and Auditing Requirements

Consistent with previous Sea Dumping Permit Conditions, Ports North proposes to:

- a) Keep records comprising either weekly plotting sheets or a certified extract of the ship's log which detail:
 - The times and dates of when each placement run is commenced and finished;
 - The position of the vessel at the beginning and end of each dredging run;
 - The position (by GPS) of the vessel at the beginning and end of each placement run with the inclusion of the path of each disposal run;
 - The volume of dredge material (in cubic metres) placed; and
 - Records of observations for marine fauna and outcomes of those observations.

These records will to be retained for audit purposes for the duration of the permit.

- b) Undertake bathymetric surveys of the Disposal Site as follows:
 - One prior to the commencement of any placement activities; and
 - One at completion of all placement activities authorized under the permit.
- c) Ports North will provide a digital copy of the final bathymetric survey to the RAN Hydrographer.
- d) Ports North will provide a report on the bathymetry to DAWE within the specified period of the final bathymetric survey being undertaken. The report must include a chart showing the change in sea floor bathymetry as a result of placement and include written commentary on the volumes of placement material that appear to have been retained within the placement area.
- e) To facilitate annual reporting to the International Maritime Organisation, Ports North will report to DAWE by 31 January each year the following:
 - Permit start date;
 - Permit expiry date;
 - Approved placement site;
 - Nature of material;
 - Permit quantity;
 - Quantity placed per calendar year; and
 - placement method used.

The responsible parties for each of these reporting requirements will be the Environment Manager.

Ports North has a requirement set out in the dredging contract for Karumba dredging that requires the Superintendent to compile a "Close Out Report" or equivalent, at conclusion of each annual campaign which includes commentary on volume, incidents and effectiveness of the campaign and any operational issues identified. This item is a useful reference point for each campaign and is useful audit evidence, and assists in compiling the annual IMO Return Form, required under the Sea Dumping Permit.

Compliance monitoring is one component of the Environmental Management System (EMS) as part of Ports North business management strategy. Include within the EMS are procedures for monitoring implementation of permits, licences, and management plans, auditing and subsequent

reporting, as well as a corrective actions process. The Sea Dumping Permit and LTMMMP for Karumba are to be subject to this system of periodic internal audits and are to be facilitated by the Environment Manager. Consideration is to be made to periodic external third party auditing of the implementation of Permit, LTMMMP and EMP requirements at a future campaign to measure the performance of Ports North management system for dredging and disposal.

In the event that advice provided by the TACC to Ports North include feedback on the most recent outcomes of seagrass surveys or other ecological monitoring prior to the planned campaign, indicate a lowered resilience to potential impacts of dredging, then higher levels of dredge mitigation strategies or monitoring will be implemented, such as:

- Detailed assessment of turbidity during dredging;
- Additional ecological assessments such as seagrass surveys prior to dredging to provide up to date assurance they are in robust or otherwise condition; and
- Potential changes to dredge operation to ensure impacts such as turbidity are reduced in their effect on sensitive receptors such as seagrass, through control on tidal (ebb vs flood), wind (onshore vs offshore), method (overflow vs non overflow).

Requirement for these additional measures are to be managed through the technical advice role of the TACC process.

Once approved by DAWE, any changes to the LTMMMP and Permit will be uploaded within the recommended LTMMMP guideline timeframe, i.e. 30 days. Subsequent revisions will be uploaded in a timely manner and advice provided to TACC of such document availability to facilitate access to the document.

7.1 Compliance Monitoring

Ports North will periodically conduct an audit of management systems to ensure compliance with Permit conditions, and implementation of the LTMMMP at least once per annum during December. These audits will be consistent with the Ports North Environmental Management System and any corrective actions dealt with under that system.

Any significant incidents would be reported and responded to as identified in **Section 7.9**. Significant incidents would include impacts to protected marine fauna and incidents potentially resulting in environmental harm. Corrective measures that Ports North is able to follow includes for example, alteration to contract conditions, implementation of additional monitoring and reporting requirements, issue of specific work instructions or directions etc. at a level sufficient to achieve the desired management response and subsequent environmental outcome.

7.2 LT MMP Deliverables and Performance Indicators

Table 7-3 identifies those items from preceding sections where commitments, initiatives, and actions have been specified and these indicators will form the basis of audit criteria to indicate the success or otherwise of the management measures which is essential in verifying the effectiveness of this LT MMP.

Table 7-3 Performance Indicators - Commitments, Initiatives and Actions

Indicators		Frequency	Format/Record
(a)	TACC of relevant stakeholders is established and meets regularly	Annual for the Permit and LT MMP term	Established committee and formal meeting minutes
(b)	TACC meeting	Annual	Meeting or teleconference, and formal meeting minutes
(c)	TACC provides scientifically valid advice and consultation	Update from each stakeholder group per meeting, or if specifically requested at any point by Ports North or DAWE	Meeting contribution, or advice document
(d)	Latest version of LT MMP agreed between Ports North and the TACC, and once approved by DAWE is available via Ports North's website within two weeks of approval and any subsequent approvals for future versions.	For the Permit and LT MMP term	Website link
(e)	Environmental Management Plan for the TSHD are in place for dredging campaigns	Per dredge campaign	EMP document and evidence of EMP implementation audits
(f)	Environmental Management Plans are in place for bed levelling campaigns	Per campaign	EMP document and evidence of EMP implementation audits
(g)	Placement Records up to date and available	Per campaign-as per Permit Condition	Log records – hydrographic
(h)	Hydrographic plans for dredge area and placement site are up to date and supplied to relevant stakeholders	Post campaign-as per Permit Condition	Final hydrographic survey drawings held by Ports North survey section
(i)	Monitoring programs are implemented	To meet schedule at Table 7-1	Final reports on each Program/Initiative available to TACC, and stakeholders
(j)	Final monitoring program reports are provided via the Ports North website	Within 21 days of final report completion	Website link

Indicators		Frequency	Format/Record
(k)	Continual improvement in the implementation of contemporary best practice environmental stewardship by Ports North in management of dredging and disposal at Port of Karumba	For the Permit and LTMMMP term	Evidence of implementation of this LTMMMP
(l)	Maintain annual reporting requirements under the Sea Dumping Permit.	Annually by 31 January	IMO Report Form
(m)	Technical review of placement area capacity and future needs	After 2029	Spoil ground capacity study report
(n)	EMP Management Elements Performance Indicators are achieved as per respective campaign type	Each campaign - specific EMP applicable to or TSHD (Appendix 8) or Bed Levelling (Appendix 9) campaign	EMP Close Out Report and/or Internal verification audit reports

7.3 Review of Management Plan

This Long Term Management and Monitoring Plan will be reviewed, and updated if necessary, according to the following timetable:

- Reviewed for currency of monitoring data and monitoring design mid-term (2027);
- Where monitoring or management is proposed to be changed, any proposed modifications will be discussed with the TACC and DAWE. Any changes will be incorporated into the LTMMMP and the Plan will be resubmitted to DAWE for approval; or
- Where unanticipated environmental risks are identified and are of a nature that warrants a review of the LTMMMP.

Review shall be undertaken at a frequency of not more than five years within the proposed ten year permit period.

Outcomes of this review will inform amendments and publication of future versions of this LTMMMP as identified in **Section 7.11** throughout the life of the Sea Dumping Permit and LTMMMP.

8. ABBREVIATIONS

Abbreviations

AIMS	The Australian Institute of Marine Science
AMSA	Australian Maritime Safety Authority
BOM	Bureau of Meteorology
CPA	Cairns Port Authority
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DAF	Queensland Department of Agriculture and Fisheries (formerly DAFF)
DAWE	Department of Agriculture, Water and Environment (formerly DSEWPac)
DEEDI	Department of Employment, Economic Development and Innovation
DERM	Department of Environment and Resource Management
DES	Queensland Department of Environment and Science (formerly DEHP)
DEWHA	Department of Environment, Water, Heritage and the Arts
DMPA	Dredged material placement area
DPI&F	Queensland Department of Primary Industries and Fisheries
EIA	Environmental impact assessment
EMP	Environmental management plan
EP Act	<i>Environmental Protection Act 1994</i>
ERA	Environmentally Relevant Activity
EMS	Environmental management system
EPBC Act	Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i>
FNQPC	Far North Queensland Ports Corporation Ltd, now trading as Ports North
GM	General manager
GPS	Global positioning system
HAT	Highest astronomical tide
IAS	Impact assessment study, prepared for the Century Project
IMO	International Maritime Organization
IODG	Interim Ocean Disposal Guidelines
LAT	Lowest astronomical tide
LTMMP	Long Term Management and Monitoring Plan for Maintenance Dredging and Disposal
MNES	Matter of National Environmental Significance
MSES	Matter of State Environmental Significance
MSQ	Maritime Safety Queensland
NAGD	National Assessment Guidelines for Dredging, 2009
NCR	New Century Resources

NTU	Nephelometric Turbidity Unit
NODGDM	National Ocean Disposal Guidelines for Dredged Material 2002
PN	Ports North (Far North Queensland Ports Corporation Ltd)
PAH	Polycyclic aromatic hydrocarbon
PCQ	Ports Corporation of Queensland Limited
PSD	Particle size distribution
QPI&F	Queensland Primary Industry and Fisheries
RHM	Regional Harbour Master
SAP	Sampling and Analysis Plan
SPL	Strategic Port Land
TACC	Technical Advisory and Consultative Committee
TBT	Tributyltin
TSHD	Trailing suction hopper dredger
UCL	Upper confidence level

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10. APPENDICES

APPENDIX 1	EPBC ACT PROTECTED MATTERS SEARCH RESULTS
APPENDIX 2	SEA DUMPING PERMIT
APPENDIX 3	TIDAL WORKS DEVELOPMENT PERMIT
APPENDIX 4	ENVIRONMENTAL AUTHORITY FOR ERA16
APPENDIX 5	SECTION 86 APPROVAL FOR OPERATIONAL WORKS
APPENDIX 6	SEAGRASS MONITORING 2021
APPENDIX 7	CSIRO ADVICE STATEMENT 2010
APPENDIX 8	ENVIRONMENTAL MANAGEMENT PLAN – DREDGING CAMPAIGN – TSHD
APPENDIX 9	ENVIRONMENTAL MANAGEMENT PLAN – BED LEVELLING CAMPAIGN
APPENDIX 10	WATER QUALITY MONITORING PLAN

Appendix 1 EPBC Act Protected Matters Search Results



EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Please see the caveat for interpretation of information provided here.

Report created: 12-Jan-2022

[Summary](#)

[Details](#)

[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

[Acknowledgements](#)

Summary

Matters of National Environment Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the [Administrative Guidelines on Significance](#).

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance (Ramsar	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	1
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	20
Listed Migratory Species:	49

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at <http://www.environment.gov.au/heritage>

A [permit](#) may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Lands:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	81
Whales and Other Cetaceans:	10
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None
Habitat Critical to the Survival of Marine Turtles:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have

State and Territory Reserves:	None
Regional Forest Agreements:	None
Nationally Important Wetlands:	None
EPBC Act Referrals:	None
Key Ecological Features (Marine):	1
Biologically Important Areas:	2
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

Commonwealth Marine Area

[Resource Information]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside a Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area.

Feature Name

EEZ and Territorial Sea

Listed Threatened Species

[Resource Information]

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.
Number is the current name ID.

Scientific Name	Threatened Category	Presence Text
BIRD		
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Species or species habitat known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Species or species habitat known to occur within area
Limosa lapponica baueri Nunivak Bar-tailed Godwit, Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
MAMMAL		

Scientific Name	Threatened Category	Presence Text
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat may occur within area
REPTILE		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat likely to occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Species or species habitat likely to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
SHARK		
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Glyphis glyphis Speartooth Shark [82453]	Critically Endangered	Species or species habitat may occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Pristis pristis Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat known to occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Breeding likely to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Sphyrna lewini Scalloped Hammerhead [85267]	Conservation Dependent	Species or species habitat likely to occur within area

Listed Migratory Species	[Resource Information]	
Scientific Name	Threatened Category	Presence Text
Migratory Marine Birds		
Anous stolidus Common Noddy [825]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat may occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat known to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat may occur within area
Migratory Marine Species		
Anoxypristis cuspidata Narrow Sawfish, Knifetooth Sawfish [68448]		Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat may occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Crocodylus porosus Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area
Dugong dugon Dugong [28]		Species or species habitat likely to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat likely to occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Species or species habitat likely to occur within area
Mobula alfredi as Manta alfredi Reef Manta Ray, Coastal Manta Ray [90033]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Mobula birostris as Manta birostris Giant Manta Ray [90034]		Species or species habitat may occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Orcaella heinsohni Australian Snubfin Dolphin [81322]		Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area
Pristis pristis Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat known to occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Breeding likely to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Sousa sahalensis as Sousa chinensis Australian Humpback Dolphin [87942]		Species or species habitat known to occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Arenaria interpres Ruddy Turnstone [872]		Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris alba Sanderling [875]		Species or species habitat likely to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Calidris ruficollis Red-necked Stint [860]		Species or species habitat known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Species or species habitat known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Species or species habitat known to occur within area
Limicola falcinellus Broad-billed Sandpiper [842]		Species or species habitat likely to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Species or species habitat known to occur within area
Numenius phaeopus Whimbrel [849]		Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Species or species habitat known to occur within area
Pluvialis squatarola Grey Plover [865]		Species or species habitat known to occur within area
Tringa brevipes Grey-tailed Tattler [851]		Species or species habitat known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Species or species habitat known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Species or species habitat known to occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species		[Resource Information]
Scientific Name	Threatened Category	Presence Text
Bird		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Anous stolidus Common Noddy [825]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area
Arenaria interpres Ruddy Turnstone [872]		Species or species habitat known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris alba Sanderling [875]		Species or species habitat likely to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area overfly marine area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area overfly marine area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area

Scientific Name	Threatened Category	Presence Text
Calidris ruficollis Red-necked Stint [860]		Species or species habitat known to occur within area overfly marine area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Species or species habitat known to occur within area overfly marine area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat may occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Species or species habitat known to occur within area
Charadrius ruficapillus Red-capped Plover [881]		Species or species habitat known to occur within area overfly marine area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat known to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat may occur within area
Himantopus himantopus Pied Stilt, Black-winged Stilt [870]		Species or species habitat known to occur within area overfly marine area
Limicola falcinellus Broad-billed Sandpiper [842]		Species or species habitat likely to occur within area overfly marine area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Limosa limosa Black-tailed Godwit [845]		Species or species habitat known to occur within area overfly marine area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Species or species habitat known to occur within area overfly marine area
Numenius phaeopus Whimbrel [849]		Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Species or species habitat known to occur within area
Pluvialis squatarola Grey Plover [865]		Species or species habitat known to occur within area overfly marine area
Recurvirostra novaehollandiae Red-necked Avocet [871]		Species or species habitat known to occur within area overfly marine area
Stiltia isabella Australian Pratincole [818]		Species or species habitat known to occur within area overfly marine area
Tringa brevipes as Heteroscelus brevipes Grey-tailed Tattler [851]		Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area overfly marine area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Species or species habitat known to occur within area overfly marine area
Xenus cinereus Terek Sandpiper [59300]		Species or species habitat known to occur within area overfly marine area
Fish		
Campichthys tricarinatus Three-keel Pipefish [66192]		Species or species habitat may occur within area
Choeroichthys brachysoma Pacific Short-bodied Pipefish, Short-bodied Pipefish [66194]		Species or species habitat may occur within area
Choeroichthys suillus Pig-snouted Pipefish [66198]		Species or species habitat may occur within area
Corythoichthys amplexus Fijian Banded Pipefish, Brown-banded Pipefish [66199]		Species or species habitat may occur within area
Corythoichthys flavofasciatus Reticulate Pipefish, Yellow-banded Pipefish, Network Pipefish [66200]		Species or species habitat may occur within area
Doryrhamphus excisus Bluestripe Pipefish, Indian Blue-stripe Pipefish, Pacific Blue-stripe Pipefish [66211]		Species or species habitat may occur within area
Doryrhamphus janssi Cleaner Pipefish, Janss' Pipefish [66212]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Festucalex cinctus Girdled Pipefish [66214]		Species or species habitat may occur within area
Halicampus brocki Brock's Pipefish [66219]		Species or species habitat may occur within area
Halicampus grayi Mud Pipefish, Gray's Pipefish [66221]		Species or species habitat may occur within area
Halicampus spinirostris Spiny-snout Pipefish [66225]		Species or species habitat may occur within area
Haliichthys taeniophorus Ribbioned Pipehorse, Ribbioned Seadragon [66226]		Species or species habitat may occur within area
Hippichthys cyanospilos Blue-speckled Pipefish, Blue-spotted Pipefish [66228]		Species or species habitat may occur within area
Hippichthys penicillus Beady Pipefish, Steep-nosed Pipefish [66231]		Species or species habitat may occur within area
Hippocampus hystrix Spiny Seahorse, Thorny Seahorse [66236]		Species or species habitat may occur within area
Hippocampus kuda Spotted Seahorse, Yellow Seahorse [66237]		Species or species habitat may occur within area
Hippocampus planifrons Flat-face Seahorse [66238]		Species or species habitat may occur within area
Hippocampus spinosissimus Hedgehog Seahorse [66239]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Hippocampus trimaculatus Three-spot Seahorse, Low-crowned Seahorse, Flat-faced Seahorse [66720]		Species or species habitat may occur within area
Solegnathus hardwickii Pallid Pipehorse, Hardwick's Pipehorse [66272]		Species or species habitat may occur within area
Trachyrhamphus bicoarctatus Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within area
Trachyrhamphus longirostris Straightstick Pipefish, Long-nosed Pipefish, Straight Stick Pipefish [66281]		Species or species habitat may occur within area
Mammal		
Dugong dugon Dugong [28]		Species or species habitat likely to occur within area
Reptile		
Acalyptophis peronii Horned Seasnake [1114]		Species or species habitat may occur within area
Aipysurus duboisii Dubois' Seasnake [1116]		Species or species habitat may occur within area
Aipysurus eydouxii Spine-tailed Seasnake [1117]		Species or species habitat may occur within area
Aipysurus laevis Olive Seasnake [1120]		Species or species habitat may occur within area
Astrotia stokesii Stokes' Seasnake [1122]		Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Chitulia inornata as Hydrophis inornatus Plain Seasnake [87379]		Species or species habitat may occur within area
Chitulia ornata as Hydrophis ornatus Spotted Seasnake, Ornate Reef Seasnake [87377]		Species or species habitat may occur within area
Crocodylus porosus Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area
Disteira kingii Spectacled Seasnake [1123]		Species or species habitat may occur within area
Disteira major Olive-headed Seasnake [1124]		Species or species habitat may occur within area
Enhydrina schistosa Beaked Seasnake [1126]		Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat likely to occur within area
Hydrelaps darwiniensis Black-ringed Seasnake [1100]		Species or species habitat may occur within area
Hydrophis atriceps Black-headed Seasnake [1101]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Hydrophis caerulescens Dwarf Seasnake [1103]		Species or species habitat may occur within area
Hydrophis elegans Elegant Seasnake [1104]		Species or species habitat may occur within area
Hydrophis macdowelli as Hydrophis mcdowelli Small-headed Seasnake [75601]		Species or species habitat may occur within area
Lapemis curtus as Lapemis hardwickii Spine-bellied Seasnake [83554]		Species or species habitat may occur within area
Leioselasma pacifica as Hydrophis pacificus Large-headed Seasnake, Pacific Seasnake [87378]		Species or species habitat may occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Species or species habitat likely to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Parahydrophis mertoni Northern Mangrove Seasnake [1090]		Species or species habitat may occur within area
Pelamis platurus Yellow-bellied Seasnake [1091]		Species or species habitat may occur within area

Whales and Other Cetaceans		[Resource Information]
Current Scientific Name	Status	Type of Presence
Mammal		
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area

Current Scientific Name	Status	Type of Presence
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat may occur within area
Delphinus delphis Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Orcaella heinsohni as Orcaella brevirostris Australian Snubfin Dolphin [81322]		Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Sousa sahalensis as Sousa chinensis Australian Humpback Dolphin [87942]		Species or species habitat known to occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area

Extra Information

Key Ecological Features

[\[Resource Information \]](#)

Key Ecological Features are the parts of the marine ecosystem that are considered to be important for the biodiversity or ecosystem functioning and integrity of the Commonwealth Marine Area.

Name	Region
Gulf of Carpentaria coastal zone	North

Biologically Important Areas		
Scientific Name	Behaviour	Presence
Marine Turtles		
Chelonia mydas		
Green Turtle [1765]	Foraging	Likely to occur
Seabirds		
Fregata ariel		
Lesser Frigatebird [1012]	Breeding	Known to occur

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data are available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance

3 DATA SOURCES

Threatened ecological communities

For threatened ecological communities where the distribution is well known, maps are generated based on information contained in recovery plans, State vegetation maps and remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species

Threatened, migratory and marine species distributions have been discerned through a variety of methods. Where distributions are well known and if time permits, distributions are inferred from either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc.) together with point locations and described habitat; or modelled (MAXENT or BIOCLIM habitat modelling) using

Where little information is available for a species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc.).

In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More detailed distribution mapping methods are used to update these distributions

4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded
- seals which have only been mapped for breeding sites near the Australian continent

The breeding sites may be important for the protection of the Commonwealth Marine environment.

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

- [-Office of Environment and Heritage, New South Wales](#)
- [-Department of Environment and Primary Industries, Victoria](#)
- [-Department of Primary Industries, Parks, Water and Environment, Tasmania](#)
- [-Department of Environment, Water and Natural Resources, South Australia](#)
- [-Department of Land and Resource Management, Northern Territory](#)
- [-Department of Environmental and Heritage Protection, Queensland](#)
- [-Department of Parks and Wildlife, Western Australia](#)
- [-Environment and Planning Directorate, ACT](#)
- [-Birdlife Australia](#)
- [-Australian Bird and Bat Banding Scheme](#)
- [-Australian National Wildlife Collection](#)
- [-Natural history museums of Australia](#)
- [-Museum Victoria](#)
- [-Australian Museum](#)
- [-South Australian Museum](#)
- [-Queensland Museum](#)
- [-Online Zoological Collections of Australian Museums](#)
- [-Queensland Herbarium](#)
- [-National Herbarium of NSW](#)
- [-Royal Botanic Gardens and National Herbarium of Victoria](#)
- [-Tasmanian Herbarium](#)
- [-State Herbarium of South Australia](#)
- [-Northern Territory Herbarium](#)
- [-Western Australian Herbarium](#)
- [-Australian National Herbarium, Canberra](#)
- [-University of New England](#)
- [-Ocean Biogeographic Information System](#)
- [-Australian Government, Department of Defence](#)
- [Forestry Corporation, NSW](#)
- [-Geoscience Australia](#)
- [-CSIRO](#)
- [-Australian Tropical Herbarium, Cairns](#)
- [-eBird Australia](#)
- [-Australian Government – Australian Antarctic Data Centre](#)
- [-Museum and Art Gallery of the Northern Territory](#)
- [-Australian Government National Environmental Science Program](#)
- [-Australian Institute of Marine Science](#)
- [-Reef Life Survey Australia](#)
- [-American Museum of Natural History](#)
- [-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania](#)
- [-Tasmanian Museum and Art Gallery, Hobart, Tasmania](#)
- [-Other groups and individuals](#)

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the [Contact Us](#) page.

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Appendix 2 Sea Dumping Permit



ENVIRONMENT PROTECTION (SEA DUMPING) ACT 1981

SEA DUMPING PERMIT No.: SD2022-4019

for

Ports North

(ABN: 38 657 722 043)

I, KAITLYN BRADEY, a delegate of the Minister for the Environment, acting under Sections 19 and 21 of the *Environment Protection (Sea Dumping) Act 1981*, hereby grant a sea dumping permit to Ports North, Corner Grafton & Hartley Street, Cairns, QLD, 4870 (ABN: 38 657 722 043), to load for the purposes of dumping, and to dump up to 2,487,300 cubic metres *in-situ* of dredged material, derived from maintenance dredging of the entrance channel and amended navigational corridor (Appendix 3 and Appendix 4); and up to 62,700 cubic metres *in-situ* of dredged material, derived from capital dredging of the amended navigational corridor (Appendix 4), within the Port of Karumba, QLD, commencing on the date of signature of this permit and extending until 2 June 2032, subject to conditions which are specified in Appendices 1 and 2, and maps and tables presented in Appendices 3 and 4.

DATE.....2ndday of.....June.....2022

.....
KAITLYN BRADEY
Delegate of the Minister

This permit comprises [twelve] (12) pages, including Appendices 1, 2, 3 and 4

CONDITIONS FOR DUMPING AT SEA OF MAINTENANCE AND CAPITAL DREDGED MATERIAL DERIVED FROM PORT OF KARUMBA

Definitions

In this permit:

Act	means the <i>Environment Protection (Sea Dumping) Act 1981</i> .				
Application	means the Application for a permit under the Act submitted by Ports North and received by the Department on 16 February 2022 with further information received on 4 April 2022.				
Capital Dredging	means all capital dredging of material, where: <ul style="list-style-type: none"> (i) the dredging is intended to enlarge or deepen existing channel or port areas or to create new ones for navigable depth of the port to the current gazetted depth of the channel, or less; and (ii) the dredged material is to be dumped at sea. 				
Department	means the Australian Government Department responsible for administering the Act .				
Disposal Site	means the disposal area (site code: AU0028) bound by the following co-ordinates (GDA94), defined by a circle of 1,600 metre (m) radius, centred on: <table border="1" style="margin: 10px auto; width: 80%;"> <tr> <th>Latitude</th><th>Longitude</th></tr> <tr> <td>-17°25'4.94" S</td><td>140°40'5.72" E</td></tr> </table>	Latitude	Longitude	-17°25'4.94" S	140°40'5.72" E
Latitude	Longitude				
-17°25'4.94" S	140°40'5.72" E				
Dumping activities	means all activities associated with the dumping permitted under this permit, including: <ul style="list-style-type: none"> (i) the loading for the purpose of dumping of dredged material; and (ii) the dumping of the material at the prescribed disposal site, 				
Emergency dredging	is defined as contingency maintenance dredging of material deposited as a result of one or more weather event or storm surges associated with cyclones, where: <ul style="list-style-type: none"> (i) the dredging is intended to re-establish navigable depth of the port to the approved design depth of the channel and ancillary areas, or less; and (ii) the dredged material is to be dumped at sea. 				
Environmental incident	means any event which has the potential to, or does impact, on the environment.				

Environmental risk	means any risk, which has the potential to impact on the environment.
EPBC Act	Means the <i>Environment Protection and Biodiversity Conservation Act 1999</i> .
GPS	means Global Positioning System.
Maintenance Dredging	means all maintenance dredging of material, where: <ol style="list-style-type: none"> (i) the dredging is intended to re-establish navigable depth of the port to the current gazetted depth of the channel, or less and (ii) the dredged material is to be dumped at sea.
Marine Species Minister	means all cetaceans, pinnipeds, dugongs, sharks and marine turtles listed under the EPBC Act .
	means the Australian Government Minister administering the Act and includes a delegate of the Minister.
Monitoring and Management Plan	means the Port of Karumba Entrance Channel Long Term Monitoring and Management Plan dated 14 February 2022, or as subsequently revised in accordance with conditions 9-13.
Monitoring zone	means the area within a 300-metre radius of the vessel .
Ports North	means Ports North, Corner Grafton & Hartley Street, Cairns QLD, 4870
Vessel	means any vessel or vessels used for or in connection with dumping activities .

Conditions

1. Except so far as the contrary intention appears, terms used in the conditions of this permit have the same meaning as such terms in the **Act**.
2. **Ports North** must ensure that no more than 2,550,000 cubic metres (*in-situ*) of material derived from **maintenance** and **capital dredging** within the Port of Karumba, QLD, as specified in the **Application**, is loaded and dumped at the disposal site, which includes:
 - a) no more than 2,237,300 cubic metres (*in-situ*) of material derived from **maintenance dredging** of the entrance channel and amended navigational corridor as described at Appendix 3 and Appendix 4.
 - b) no more than 250,000 cubic metres (*in-situ*) of material derived from **emergency dredging** (contingency maintenance) of the entrance channel and amended navigational corridor as described at Appendix 3 and Appendix 4.
 - c) no more than 62,700 cubic metres (*in-situ*) of material, derived from **capital dredging** of the amended navigational corridor as described at Appendix 4.
3. **Ports North** must ensure that dredging and dumping activities only take place between 1 May and 30 September each year, to avoid the prawn migration period, and turtle movements.
4. If dredging is required outside of the period between 1 May and 30 September, **Ports North** must submit a request to the **department** to vary this permit.

5. **Ports North** must ensure that **dumping activities** of material derived from **maintenance, capital and emergency dredging** are in accordance with procedures detailed in a **Monitoring and Management Plan** in accordance with Condition 9.

Disposal Site

6. **Ports North** must only dump within the **disposal site**.
7. **Ports North** must ensure that each load of dredged material is dumped so that the dumped material is evenly distributed over the whole **disposal site**.
8. **Ports North** must establish by **GPS** that, prior to dumping, the **vessel** is within the **disposal site**.

Monitoring and Management Plan

9. The **Ports North** must implement the approved **Monitoring and Management Plan**.
10. The **Ports North** may submit for the **Minister's** approval a revised version of the **Monitoring and Management Plan** specified under Condition 9. If the **Minister** approves such a revised **Monitoring and Management Plan**, the revised **Monitoring and Management Plan** must be implemented in place of the original **Monitoring and Management Plan** specified at Condition 9.
11. If the **Minister** believes that it is necessary or desirable for the better protection of the environment to do so, the **Minister** may request the **Ports North** to make specified revisions to the **Monitoring and Management Plan** approved under Condition 9 and submit the revised **Monitoring and Management Plan** for the **Minister's** approval. If the **Minister** approves a revised **Monitoring and Management Plan** pursuant to this condition, **Ports North** must implement that **Monitoring and Management Plan** instead of the original **Monitoring and Management Plan**.
12. **Ports North** may revise the **Monitoring and Management Plan** specified under Condition 9 without submitting it for re-approval, if the taking of the action in accordance with the revised **Monitoring and Management Plan** would not be likely to have a new or increased impact on the environment or reduce the public accessibility of information. If **Ports North** makes this choice they must:
 - a) notify the **Department** in writing that the **Monitoring and Management Plan** has been revised and provide the **Department** with an electronic copy of the revised plan, including a covering letter outlining the changes and the reasons that **Ports North** considers that taking the action in accordance with the revised plan or procedure would not be likely to have a new or increased impact on the environment;
 - b) implement the revised **Monitoring and Management Plan** within five (5) calendar days of the revised **Monitoring and Management Plan** being submitted to the **Department**; and
 - c) for the life of this permit, maintain a record of the reasons **Ports North** considers that taking the action in accordance with the revised **Monitoring and Management Plan** would not be likely to have a new or increased impact on the environment or reduce the public accessibility of information.
13. The **Monitoring and Management Plan** must be made available for the life of the permit (electronically) on **Ports North** website within 30 days of the **Monitoring and Management Plan** being approved by the **Minister**.

Mitigation Measures for Protection of Marine Species

14. Prior to the commencement of the **dumping activities**, **Ports North** must ensure that a check is undertaken, using binoculars from a high observation platform, for **marine species** within the **monitoring zone**.
15. If any **marine species** are sighted in the **monitoring zone**, **Ports North** must not commence or continue **dumping activities** until either 20 minutes after the last **marine species** is observed in the **monitoring zone**, or the **vessel** has moved to another area of the **disposal site** where it can maintain a minimum distance of 300 metres (m) between the **vessel** and any **marine species**.

Environmental Risk and Incidents

16. If, at any time during the course of the **dumping activities**, an **environmental incident** occurs or an **environmental risk** is identified, all reasonable measures must be taken immediately by **Ports North** to minimise or mitigate the risk or the impact. **Ports North** must provide a report on the **environmental incident** or **environmental risk** to the **Department** within 72 hours and include:
 - details of the incident or risk,
 - the measures taken,
 - the success of those measures in addressing the incident or risk and
 - any additional measures proposed to be taken.
17. **Ports North** must document any incidents involving the **dumping activities** that result in injury or death to any **marine species**. The date, time and nature of each incident and the species involved, if known, must be recorded, and the incident is to be reported to the **Department** within 72 hours.

Compliance of all Parties engaged in dumping activities

18. **Ports North** must ensure that all persons engaged in the **dumping activities** under this permit, including the owner(s) and person(s) in charge of the **vessel**, comply with this permit and the requirements of the **Act**. The fulfilment of these conditions remains the responsibility of **Ports North**.

Access for Observers

19. If requested by the **Department**, the **Ports North** must provide access for at least two (2) nominees of the **Department** to witness, inspect, examine and/or audit any part of the operations, including any **dumping activities** or monitoring activities, the **vessel** or any other equipment, or any documented records. **Ports North** must provide all reasonable assistance to the nominees of the **Department** for carrying out their duties.

Record-keeping and Reporting

20. **Ports North** must make and retain records comprising either weekly plotting sheets or a certified extract of the ship's log which detail, for both **maintenance and capital dredging** works:
 - a) the dates and times of when each dumping run commenced and finished;
 - b) the position (as determined by **GPS**) of the dumping **vessel** at the beginning and end of each dumping run, including the path of each dumping run;
 - c) the volume of dredged material (*in-situ* cubic metres) dumped and quantity in dry tonnes for the specified operational period and compared to the total amount permitted under the permit on a daily basis;

- d) the person(s) undertaking the **marine species** observation required in Condition 14 and any **marine species** observed within the **monitoring zone** for each run, including the date, time and approximate distance from the **vessel**, and the action taken to comply with Condition 15; and
 - e) the person(s) responsible for the operation of the vessel at any time during **dumping activities**.
21. **Ports North** must retain the records required by Conditions 16, 17 and 18 for verification and audit purposes.
 22. **Ports North** must ensure that a bathymetric survey of the **disposal site** is undertaken by a suitably qualified person:
 - a) prior to the commencement of **dumping activities** under this permit; and
 - b) within one (1) month of the completion of all **dumping activities** authorised under this permit.
 23. Within two (2) months of the final bathymetric survey being undertaken, **Ports North** must provide a digital copy of each of the bathymetric surveys to the Australian Hydrographic Office, Locked Bag 8801, Wollongong, NSW 2500 or via email at datacentre@hydro.gov.au.
 24. **Ports North** must provide a report on the bathymetry to the **Department** within two (2) months of the final bathymetric survey being undertaken. The report must include a chart showing the change in sea floor bathymetry as a result of **dumping activities** and include written commentary on the volumes of dumped material that appear to have been retained within the **disposal site**.
 25. To facilitate annual reporting to the International Maritime Organization, **Ports North** must report to the **Department** by 31 January each year, including on the day of the expiry of the permit or completion of all **dumping activities** under this permit, information at Appendix 2 to this permit, or in a format as approved by the **Department** from time to time. Note that the annual reporting format should include the reporting outcomes for both the **maintenance and capital dredging** and dumping activities.

SEA DUMPING PERMIT INTERNATIONAL REPORTING REQUIREMENTS

Please fill in this form and return it by **email** to the **department** by **31 January each year**. This information is required for Australia's international reporting obligations under the London Protocol.

Email: seadumping@awe.gov.au and epbcmonitoring@awe.gov.au, quoting the permit reference number.

Permit Holder: Ports North	
Address:	
Submitted by:	
Phone:	
Email:	Date: (dd/mm/yyyy)

Permit Details:

1) Sea Dumping Permit number: SD2022-4019

2) Permit start date: (dd/mm/yyyy) Permit end date: (dd/mm/yyyy)

3) Description of material *Please tick relevant box or boxes*

Capital Dredged Material ☐, Maintenance Dredged Material ☐, Fish Waste ☐,
 Vessels ☐, Platforms or other man-made structures ☐, Sewage Sludge ☐, CO₂ ☐,
 Organic Material of Natural Origin ☐, Bulky Waste ☐, Inert-Inorganic Geological Material ☐

4) Total permit quantity (cubic metres/number): _____

Annual Report:

5) Specify the calendar year this report applies to: _____ (*Reporting period*)

6) Quantity dumped in the specified calendar year. Where multiple sites are used, please specify volume per site.

Geodetic Datum:

Site Code	Latitude (North/South degrees, minutes)	Longitude (East/West degrees, minutes)	Number/ Volume/ Type <i>For dredged material, please provide 'in-situ cubic metres' AND 'dry weight tonnes'</i>

Site Code	Latitude (North/South degrees, minutes)	Longitude (East/West degrees, minutes)	Number/ Volume/ Type <i>For dredged material, please provide 'in-situ cubic metres' AND 'dry weight tonnes'</i>

For dredged material, please briefly describe any conversion rates used for calculating disposal volumes:

7) Please specify the remaining permit quantity: _____

8) Additional comments:

9) Was monitoring of the disposal sites conducted during the reporting period? Yes ☐ No ☐
If yes, please complete questions 10-13 of this form.

Monitoring of the disposal sites

If multiple sites were used, please specify the site codes in the response to questions 10-13.

10) What type(s) of field monitoring was undertaken?

Biological ☐, Geological ☐, Chemical ☐, Physical ☐, Other ☐ (explain) _____

11) When was field monitoring conducted?

Before dumping ☐, During dumping ☐, After Dumping ☐, Other ☐ (explain, provide dates)

12) Where any adverse impact(s) found beyond those that were predicted? Yes ☐, No ☐
If yes, briefly describe the impacts (e.g. physical, chemical or biological) and their spatial or temporal variation.

13) Provide a website/URL link to Field Monitoring Reports, or any additional information.

Maintenance (and Emergency/Contingency) Dredging Channel Map – Entrance Channel (Reach 1, 2 and 3)



Figure 1: Maintenance (and Emergency) Dredging Entrance Channel (Reach 1, 2 and 3)

CHANNEL LIMITS			
	CHANNEL POINT	EASTING	NORTHING
CHANNEL SETOUT ORIGIN	A	478 131.23	8070 438.79
	B	478 114.72	8070 413.74
	C	478 098.23	8070 388.68
	D	476 838.65	8071 217.86
	E	476 685.98	8071 390.21
	F	476 629.57	8071 330.82
INTERSECT OF CHANNEL CENTRELINE	G	476 550.01	8071 443.80
	H	476 426.91	8071 381.03
	I	476 407.58	8071 460.16
	J	476 189.24	8071 378.75
INTERSECT OF CHANNEL CENTRELINE	K	474 234.86	8071 219.7
PROPOSED NAVIGATION CORRIDOR AREA	L	474 112.38	8071 177.77
	M	474 105.96	8071 252.80
	N	474 078.85	8071 174.52
INTERSECT OF CHANNEL CENTRELINE	O	473 987.49	8071 195.8
	P	473 901.50	8071 295.26
	Q	473 865.74	8071 228.98
	R	473 685.96	8071 397.18
	S	473 372.39	8071 170.49
	T	473 311.70	8071 604.53
	U	473 109.55	8071 248.44
	V	472 578.35	8072 010.79
	W	472 549.62	8071 956.14
	X	469 550.48	8073 688.35
	Y	469 521.41	8073 635.86

Table 1: Mapping coordinates for Maintenance Dredging channel (Reach 1, 2 and 3).

Note: Channel Points (not highlighted) in **Table 1**. Associated mapping coordinates (Eastings and Northings) are represented in **Figure 2** diagrammatically.



Figure 2: Maintenance Dredging channel (green highlight) – view Reaches 1, 2 and 3 (except for the purple shaded (amended navigational corridor) maintenance and capital dredging area).

Note: Channel Points in **Table 1** and associated mapping coordinates (Eastings and Northings) are represented above diagrammatically.

Maintenance and Capital Dredging Corridor Map – Amended navigational corridor



Figure 3: Aerial photograph – Maintenance and Capital Dredging corridor (dark pink shading).

CHANNEL LIMITS			
	CHANNEL POINT	EASTING	NORTHING
CHANNEL SETOUT ORIGIN	A	478 131.23	8070 438.79
	B	478 114.72	8070 413.74
	C	478 098.23	8070 388.68
	D	476 838.65	8071 217.86
	E	476 685.98	8071 390.21
	F	476 629.57	8071 330.82
INTERSECT OF CHANNEL CENTRELINE	G	476 550.01	8071 443.80
	H	476 426.91	8071 381.03
	I	476 407.58	8071 460.16
	J	476 189.24	8071 378.75
INTERSECT OF CHANNEL CENTRELINE	K	474 234.86	8071 219.7
	L	474 112.38	8071 177.77
PROPOSED NAVIGATION CORRIDOR AREA	M	474 105.96	8071 252.80
	N	474 078.85	8071 174.52
INTERSECT OF CHANNEL CENTRELINE	O	473 987.49	8071 195.8
	P	473 901.50	8071 295.26
	Q	473 865.74	8071 228.98
	R	473 685.96	8071 397.18
	S	473 372.39	8071 170.49
	T	473 311.70	8071 604.53
	U	473 109.55	8071 248.44
	V	472 578.35	8072 010.79
	W	472 549.62	8071 956.14
	X	469 550.48	8073 688.35
	Y	469 521.41	8073 635.86

Table 2: Mapping coordinates for Maintenance and Capital Dredging corridor (amended navigational corridor)

Note: Channel Points highlighted in **Table 2**. Associated mapping coordinates (Eastings and Northings) are represented in **Figure 4** diagrammatically.

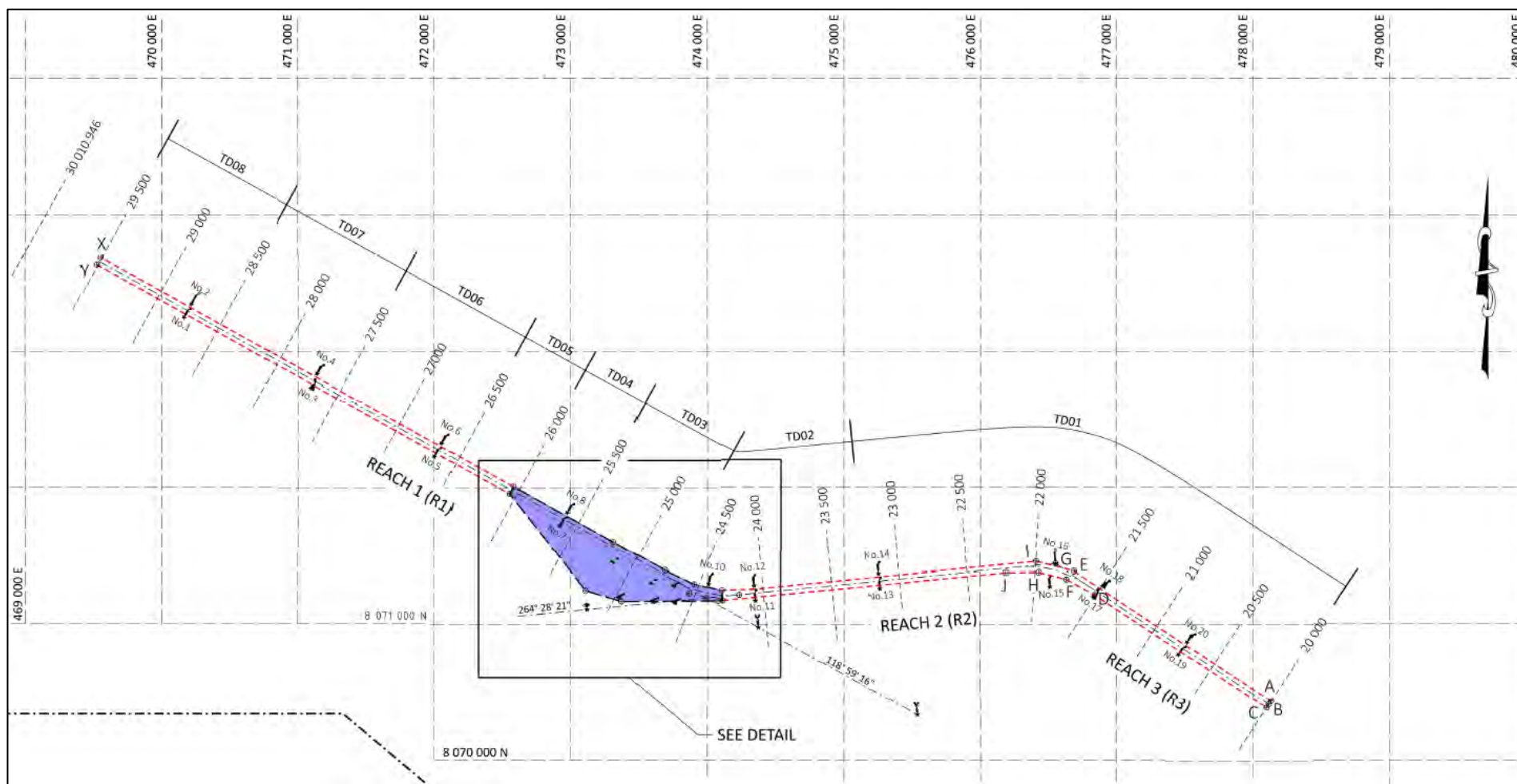


Figure 4: Maintenance and Capital Dredging area (amended navigational corridor) as represented by purple shading.

Note: Highlighted Channel Points in **Table 2** and associated mapping coordinates (Eastings and Northings) are represented above diagrammatically.

Appendix 3 Tidal Works Development Permit



SARA reference: 2202-27298 SDA

11 May 2022

Ports North
level 5 348 Edward St
BRISBANE QLD 4000
lisa.mckinnon@bmtglobal.com

Attention: Ms Lisa McKinnon

Dear Lisa,

SARA Decision notice— Port of Karumba

(Assessment Manager decision notice given under section 63 of the *Planning Act 2016*)

The development application described below was confirmed as properly made by the State Assessment and Referral Agency (the department) on 2 March 2022.

Decision

Outcome:	Approved, subject to conditions
Date of decision:	11 May 2022
Conditions:	The approval is subject to the conditions in Attachment 1 .
Advice:	Advice to the applicant is in Attachment 2 .
Reasons:	The reasons for decisions are in Attachment 3 .
Currency period:	This development approval will lapse if development is not started within the currency periods stated in section 85 of the <i>Planning Act 2016</i> .

Development Details

Description:	Development permit	Material change of use for Environmentally Relevant Activity – 16 Dredging Operational works for Tidal Works
SARA role:	Assessment manager	
SARA trigger:	<ul style="list-style-type: none"> Schedule 8, Table 4, Item 1 (Planning Regulation 2017) – Environmentally relevant activities Schedule 8, Table 4, Item 3 (I) (Planning Regulation 2017) – Operational work that is tidal works not on strategic port land or work carried out completely or partly within a coastal management district Schedule 10, Part 17, Division 3, Subdivision 2, Table 1 (Planning 	

	Regulation 2017) – Tidal works or work in a coastal management district
SARA reference:	2202-27298 SDA
Street address:	Adjacent to Lot 9 on NM143
Real property description:	Adjacent to Lot 9 on NM143
Local government area:	Carpentaria Shire Council
Applicant name:	Ports North
Applicant contact details:	Level 5 348 Edward St Brisbane QLD 4000 lisa.mckinnon@bmtglobal.com

Additional details

Native title considerations:	Complete
Further development permits:	No further development permits are required to be obtained before the development can be carried out.
Level of assessment:	Code assessable
Properly made submissions:	Not applicable
Environmental authority:	<p>This development application was also taken to be an application for an environmental authority under section 115 of the <i>Environmental Protection Act 1994</i>. Below are the details of the decision:</p> <ul style="list-style-type: none"> • Approved • Reference: P-EA-100242989 • Effective date: 28 April 2022 • Prescribed environmentally relevant activity (ERA): ERA 16 (1)(c) - dredging more than 100,000t but not more than 1,000,000t per year. <p>A copy of the permit will be provided to the applicant separately. However, if you are seeking further information on the environmental authority, the Department of Environment and Science's website includes a register. This can be found at: www.des.qld.gov.au</p>

Dispute resolution

Representations:	The rights of applicants to make representations about this decision notice during the applicant's appeal period is set out in Chapter 3, Part 5 of the <i>Planning Act 2016</i> . Copies of the relevant provisions are in Attachment 4 .
Appeal:	The rights of applicants to appeal to a tribunal or the Planning and Environment Court against decisions about a development application are set out in Chapter 6, Part 1 of the Planning Act. Copies of the relevant appeal provisions are in Attachment 5 .

For further information please contact Rebecca Carpenter, Principal Planner, on 07 3452 7477 or via email DAAT@dsdilgp.qld.gov.au who will be pleased to assist.

Yours sincerely

A handwritten signature in dark ink, appearing to be 'Steve Conner', written over a light blue horizontal line.

Steve Conner
Executive Director

enc **Attachment 1** – Assessment manager conditions
 Attachment 2 – Advice to the applicant
 Attachment 3 – Reasons for the decision
 Attachment 4 – Negotiated decision provisions
 Attachment 5 – Appeal provisions
 Attachment 6 – Approved plans and specifications
 Attachment 7 – Referral agency response
 Attachment 8 – Signed environmental authority

cc Carpentaria Shire Council, council@carpentaria.qld.gov.au
 Ports North, enquiries@portsnoth.com.au

Attachment 1—Assessment manager conditions

(Given under section 63(2)(e)(ii) of the *Planning Act 2016*)

(Copies of the plans and specifications referenced below are found at **Attachment 6**)

No.	Conditions of development approval	Condition timing
Operational works (Tidal works)		
The chief executive administering the <i>Planning Act 2016</i> nominates the Director-General of Department of Environment and Science to be the enforcement authority for the development to which this development approval relates for the administration and enforcement of any matter relating to the following condition(s):		
1.	The construction of the dredge channel must be undertaken generally in accordance with the following plan: <ol style="list-style-type: none"> Proposed Navigation Corridor and Nominal Dredge Profile Detail, prepared by Ports North, drawing number KA-026-001, as amended in red by SARA on 11/05/2022. 	For the duration of the works
2.	<ol style="list-style-type: none"> In the event that the works cause disturbance or oxidisation of acid sulfate soil, the affected soil must be treated and thereafter managed (until the affected soil has been neutralised or contained) in accordance with the current <i>Queensland Acid Sulfate Soil Technical Manual: Soil management guidelines</i>, prepared by the Department of Science, Information Technology, Innovation and the Arts, 2014. Submit certification from an appropriately qualified person on acid sulfate soil, confirming that the affected soil has been neutralised or contained in accordance with (a) above to be provided to palm@des.qld.gov.au or mailed to: Department of Environment and Science Permit and Licence Management Implementation and Support Unit GPO Box 2454 Brisbane Qld 4001 <p><i>Note: Appropriately qualified person means a person or persons who has professional qualifications, training, skills and experience relevant to soil chemistry or acid sulfate soil management and can give authoritative assessment, advice and analysis in relation to acid sulfate soil management using the relevant protocols, standards, methods or literature.</i></p>	<ol style="list-style-type: none"> Upon disturbance or oxidisation until the affected soil has been neutralised or contained At the time the soils have been neutralised or contained.
3.	<ol style="list-style-type: none"> Prepare a hydrographic survey to (conducted to a minimum Class B survey) the dredge area and the immediate adjacent area affected by the dredging by a registered survey. Submit the hydrographic survey to palm@des.qld.gov.au or mailed to: Department of Environment and Science Permit and License Management Implementation and Support Unit GPO Box 2454 Brisbane Qld 4001. 	Within two months of completion of the works
The chief executive administering the <i>Planning Act 2016</i> nominates the Director-General of Department of Transport and Main Roads to be the enforcement authority for the development to which this development approval relates for the administration and enforcement of any matter relating to the following condition(s):		
4.	<ol style="list-style-type: none"> Provide written notice to the Regional Harbour Master (Cairns), 	(a)

No.	Conditions of development approval	Condition timing
	<p>email rhmcairns@msq.qld.gov.au when the development authorised under this approval is scheduled to commence.</p> <p>b) Provide written notice to the Regional Harbour Master (Cairns), email rhmcairns@msq.qld.gov.au when the development authorised under this approval has been completed.</p> <p>Each notice must state SARA reference 2202-27298 SDA, the location and name of registered place and the condition number under which the notice is being given.</p>	<p>At least 20 business days prior to the commencement of works</p> <p>(b) Within 20 business days of the completion of works</p>
Material change of use		
<p>The chief executive administering the <i>Planning Act 2016</i> nominates the Director-General of Department of Environment and Science to be the enforcement authority for the development to which this development approval relates for the administration and enforcement of any matter relating to the following condition(s):</p>		
5.	<p>The dredging must be undertaken generally in accordance with the following plans:</p> <p>i. Proposed Navigation Corridor and Nominal Dredge Profile Detail prepared by Ports North, drawing number KA-026-001, as amended in red by SARA on 11/05/2022.</p>	For the duration of the works

Attachment 2—Advice to the applicant

General advice	
1.	Terms and phrases used in this document are defined in the <i>Planning Act 2016</i> its regulation or the State Development Assessment Provisions (SDAP) v3.0. If a word remains undefined it has its ordinary meaning.

Attachment 3—Reasons for the decision

(Given under section 63(5) of the *Planning Act 2016*)

The reasons for the department's decision are:

- The proposal complies with State code 7: *Maritime safety* of the State Development Assessment Provisions (SDAP) due to all vessels, structures, plant and equipment associated with the project will be lit/marketed in accordance with the required standards such that they do not cause a risk to navigation safety.
- The tidal works achieves compliance with the applicable performance outcomes of State code 8 of the SDAP:
 - o will not adversely impact coastal processes
 - o the tidal works maintains coastal processes, enhances public use of, and access to and along state coastal land.
- The dredging achieves compliance with applicable performance outcomes of State code 22 of the SDAP:
 - o the dredging is located and designed to avoid and mitigate environmental harm on environmental values of the natural environment
 - o adequately mitigates impacts associated with the environmentally relevant activity.

Material used in the assessment of the application:

- The development application material and submitted plans
- *Planning Act 2016*
- Planning Regulation 2017
- The *State Development Assessment Provisions* (version 3.0), as published by the department
- The Development Assessment Rules
- SARA DA Mapping system

Attachment 4—Negotiated decision provisions

Attachment 5—Appeal provisions

Attachment 6—Approved plans and specifications

(given under section 43 (b) of the Planning Regulation 2017)

Attachment 7— Referral agency response – Ports North

Attachment 8 — Signed Environmental Authority

(given under section 43 (b) of the Planning Regulation 2017)

Appendix 4 Environmental Authority for ERA16

Permit

Environmental Protection Act 1994

Environmental authority P-EA-100241989

This environmental authority is issued by the administering authority under Chapter 5 of the Environmental Protection Act 1994.

Environmental authority number: P-EA-100241989

Environmental authority takes effect on the date that your related development approval takes effect. This is the take effect date.

The anniversary date of this environmental authority is the same day each year as the take effect date. The payment of the annual fee will be due each year on this day.

Environmental authority holder(s)

Name(s)	Registered address
Far North Queensland Ports Corporation Ltd - Trading as Ports North	Cnr Grafton & Hartley St (1b Lake St) Cairns QLD 4870

Environmentally relevant activity and location details

Environmentally relevant activity/activities	Location(s)
ERA 16 (1)(c) - dredging more than 100,000t but not more than 1,000,000t per year	Unallocated State Land at the Mouth of the Norman River, adjacent to Lot 9 on NM143

Additional information for applicants

Environmentally relevant activities

The description of any environmentally relevant activity (ERA) for which an environmental authority (EA) is issued is a restatement of the ERA as defined by legislation at the time the EA is issued. Where there is any inconsistency between that description of an ERA and the conditions stated by an EA as to the scale, intensity or manner of carrying out an ERA, the conditions prevail to the extent of the inconsistency.

An EA authorises the carrying out of an ERA and does not authorise any environmental harm unless a condition stated by the EA specifically authorises environmental harm.

A person carrying out an ERA must also be a registered suitable operator under the *Environmental Protection Act 1994* (EP Act).

Contaminated land

It is a requirement of the EP Act that an owner or occupier of contaminated land give written notice to the administering authority if they become aware of the following:

- the happening of an event involving a hazardous contaminant on the contaminated land (notice must be given within 24 hours); or
- a change in the condition of the contaminated land (notice must be given within 24 hours); or

- a notifiable activity (as defined in Schedule 3) having been carried out, or is being carried out, on the contaminated land (notice must be given within 20 business days);

that is causing, or is reasonably likely to cause, serious or material environmental harm.

For further information, including the form for giving written notice, refer to the Queensland Government website www.qld.gov.au, using the search term 'duty to notify'.

Take effect

Please note that, in accordance with section 200 of the EP Act, an EA has effect:

- a) if the authority is for a prescribed ERA and it states that it takes effect on the day nominated by the holder of the authority in a written notice given to the administering authority-on the nominated day; or
- b) if the authority states a day or an event for it to take effect-on the stated day or when the stated event happens; or
- c) otherwise-on the day the authority is issued.

However, if the EA is authorising an activity that requires an additional authorisation (a relevant tenure for a resource activity, a development permit under the *Planning Act 2016* or an SDA Approval under the *State Development and Public Works Organisation Act 1971*), this EA will not take effect until the additional authorisation has taken effect.

If this EA takes effect when the additional authorisation takes effect, you must provide the administering authority written notice within 5 business days of receiving notification of the related additional authorisation taking effect.

If you have incorrectly claimed that an additional authorisation is not required, carrying out the ERA without the additional authorisation is not legal and could result in your prosecution for providing false or misleading information or operating without a valid environmental authority.

Amanda Gray
Department of Environment and Science
Delegate of the administering authority
Environmental Protection Act 1994

Enquiries:
Coastal and Marine Assessment
Department of Environment and Science

Phone: 1300 130 372
Email: palm@des.qld.gov.au

Date issued: 28/04/2022

Amanda Gray

Obligations under the *Environmental Protection Act 1994*

In addition to the requirements found in the conditions of this environmental authority, the holder must also meet their obligations under the EP Act, and the regulations made under the EP Act. For example, the holder must comply with the following provisions of the Act:

- general environmental duty (section 319)
- duty to notify environmental harm (section 320-320G)
- offence of causing serious or material environmental harm (sections 437-439)
- offence of causing environmental nuisance (section 440)
- offence of depositing prescribed water contaminants in waters and related matters (section 440ZG)
- offence to place contaminant where environmental harm or nuisance may be caused (section 443)

Environmental authority P-EA-100241989

Conditions of environmental authority

Location: Unallocated State Land at the Mouth of the Norman River, adjacent to Lot 9 on NM143

Activity: ERA 16 (1)(c) - dredging more than 100,000t but not more than 1,000,000t per year.

The environmentally relevant activitie(s) conducted at the location(s) as described above must be conducted in accordance with the following site-specific conditions of the approval.

Agency interest: General	
Condition number	Condition
G1	The quantity of material removed under this permit must not exceed 750,000 tonnes per year.
G2	The activity under this environmental authority must be conducted within the bounds and specifications of the following approved plans: <ul style="list-style-type: none"> Proposed Navigation Corridor and Nominal Dredge Profile Detail prepared by Ports North dated 11/04/2022, drawing number KA-026-001, revision O.
G3	Dredge material is authorised for placement within the dredge material placement area , as per: <ul style="list-style-type: none"> Proposed Navigation Corridor and Nominal Dredge Profile Detail prepared by Ports North dated 11/04/2022, drawing number KA-026-001, revision O.
G4	The port authority of the port area to which this permit attaches must maintain direction of any operator carrying out an activity authorised by this permit.
G5	The operator must ensure that environmental harm is not caused by this ERA except where specifically permitted by a condition of this environmental authority.
G6	The operator must: <ol style="list-style-type: none"> install all measures, plant and equipment necessary to ensure compliance with the conditions of this environmental authority; maintain and calibrate such measures, plant and equipment in an efficient condition and keep records of the maintenance; and operate such measures, plant and equipment in an efficient manner.

Environmental authority P-EA-100241989

G7	<p>The operator must implement an integrated environmental management system (IEMS) from <i>(the commencement of this ERA or specified date)</i>. The IEMS must identify all causes of environmental harm, including but not limited to the actual and potential release of any contaminants, the nature of the environmental harm and the actions that will be taken to prevent environmental harm being caused. The IEMS must be made available to the administering authority when requested. The IEMS must achieve the following outcomes:</p> <ul style="list-style-type: none"> a) Material intended to be dredged under this permit is tested and analysed in accordance with the latest version of the National Assessment Guidelines for Dredging 2009. b) Significant and sensitive receptors (including for example wetland and ecosystem features) in the port area are identified and mapped. c) Environmental aspects and potential impacts are identified. d) Control measures that minimise the potential for environmental harm are in place. e) Contingency plans and emergency procedures are in place. f) Organisational structures, accountability and responsibility is recorded. g) Arrangements for effective communication are documented and undertaken. h) All contaminant releases are monitored. i) Staff are trained and aware of the requirements of this permit. j) Appropriate records are kept. k) Reviews of environmental performance and continual improvement are undertaken periodically.
G8	The IEMS must not be implemented or amended in a way that contravenes any condition of this environmental authority.
G9	<p>The operator must implement a monitoring plan that complies with the latest version of the Administering Authority's Water Quality Sampling Manual from the commencement of this ERA. The monitoring plan must achieve the following outcomes:</p> <ul style="list-style-type: none"> a) Long-term ecological impacts associated with dredging operations are monitored. b) Compliance with the conditions of this environmental authority is monitored. c) Operations are adjusted in response to monitoring results to ensure compliance with environmental authority conditions.
G10	<p>The monitoring plan must include (but not be limited to) the following:</p> <ul style="list-style-type: none"> a) a description of the dredge equipment to be used, including the discharge points for turbid waters; b) a plan for the lawful disposal of the dredged material; c) a list of environmental values located within and adjacent to the dredge operation; d) the methods for collection and analysis of the samples (including specific areas to be monitored, when monitoring is to be undertaken and duration of monitoring); and e) the methods of analysing the data and responding to the results.
G11	The operator must maintain a record of sites where dredging is carried out (specifying the boundaries of the dredged area by GPS coordinates) and the volume of material removed from each site (to the nearest tonne) and submit these records to the port authority.
G12	The port authority must maintain a record of all documents or information provided under condition G11 and all monitoring results required by this permit.
G13	All records required by this permit must be kept for five years and be made available to the administering authority upon request.

Environmental authority P-EA-100241989

G14	The port authority must record the following details for all complaints received and provide to the administering authority upon request: <ul style="list-style-type: none"> a) Time, date, name and contact details of the complainant. b) Reasons for the complaint. c) Details of investigations undertaken by the port authority. d) Conclusions formed. e) Actions taken to resolve the complaint.
G15	Any breach of a condition of this environmental authority must be reported to the administering authority as soon as practicable within 24 hours of becoming aware of the breach. Records must be kept including full details of the breach and any subsequent actions taken.
G16	Chemicals and fuels in containers of greater than 15 litres must be stored within a secondary containment system
G17	Any containment area specified in condition G16 must be certified by appropriately qualified person(s) (e.g. registered professional engineer of Queensland) and maintained to that condition.
Agency interest: Water	
Condition number	Condition
WT1	Contaminants must not be directly or indirectly released to waters other than wastewater released from the discharge point during the loading and unloading of dredge spoil.
WT2	In carrying out the ERA, the release of contaminants (including any release caused by extraction of material from the bed of waters) must: <ul style="list-style-type: none"> a) only occur within the permitted areas specified in condition G2; b) not have any properties which are capable of causing environmental harm; c) not produce any slick or other visible evidence of oil or grease, nor contain visible floating oil, grease, scum, litter or other objectionable matter; and d) be carried out taking all practical measures necessary to minimise the concentration of suspended solids released during the loading and pump-out of the vessel.

Environmental authority P-EA-100241989

WT3	<p>Any dredging must be conducted using equipment that is in survey and registered and, in relation to environmental performance, is equal to or better than the following equipment:</p> <p>a) Trailing Suction Hopper Dredge that is equipped, as a minimum, with:</p> <ul style="list-style-type: none">i. below keel discharge of tail waters via an anti-turbidity control valve;ii. on-board systems for determining solids to water ratio or density of dredged material;iii. electronic positioning and depth control system for defining the location and depth of dredging activities; andiv. dredge heads and depth control capable of, and where appropriate, fitted with fauna exclusion devices (e.g. turtle deflectors). <p>b) Cutter Suction Dredge that is equipped, as a minimum, with:</p> <ul style="list-style-type: none">i. electronic positioning and depth control system for defining the location and depth of dredging activities;ii. continuous delivery connection (e.g. floating or submerged pipeline) to an approved placement site;iii. a system or process to ensure the delivery system integrity is maintained at all times; andiv. systems for determining solids to water ratio or density of dredged material during operations. <p>c) Grab Dredge that is equipped, as a minimum, with:</p> <ul style="list-style-type: none">i. electronic positioning system for defining the location and depth of dredging activities.																			
WT4	<p>Dredging must not start until provision has been made to lawfully place or dispose of the dredge material. Evidence of applicable approvals must be made available to the administering authority when requested.</p>																			
WT5	<p>Material dredged under this permit must not be placed at sea except at a place authorised under an authority, licence or other permit issued by either or both the Commonwealth or Queensland governments to receive the dredged material.</p>																			
WT6	<p>Monitoring must be undertaken and records kept of receiving water quality potentially impacted by the dredging operations for the quality characteristics and not less frequently than specified in Table 1 – Receiving water release limits. All determinations must be made in accordance with methods prescribed in the latest edition of the Department of Environment and Science’s Water Quality Sampling Manual.</p> <p>Table 1 – Receiving water release limits</p> <table><tr><th rowspan="2">Quality characteristics</th><th rowspan="2">Monitoring point</th><th rowspan="2">Units</th><th colspan="2">Release limit</th><th rowspan="2">Monitoring frequency</th></tr><tr><th>Minimum</th><th>Maximum</th></tr><tr><td rowspan="2">Turbidity</td><td>W1¹,W2²</td><td>NTU</td><td>-</td><td>Either: background plus 25% or 62NTU, whichever is the greater value, for a duration of at no more than 72 hours</td><td>Daily during the *flood tide, when the dredge is operating in the section of the channel adjacent to the Alligator Bank seagrass meadows</td></tr><tr><td>W3³ (background)</td><td>NTU</td><td>-</td><td>-</td><td>*monitoring must still be undertaken daily for those days when no flood tide occurs.</td></tr></table> <p>W1- The edge of the seagrass beds at Alligator Point W2- The edge of the seagrass beds at Alligator Point, no closer than 100m from W1, W3- Background: at least 100m up-current of the dredging operations, at a site experiencing similar wind, wave and tidal conditions as W1 and W2. Sampling must be undertaken within 1 hour of sampling from W1 and W2.</p>	Quality characteristics	Monitoring point	Units	Release limit		Monitoring frequency	Minimum	Maximum	Turbidity	W1 ¹ ,W2 ²	NTU	-	Either: background plus 25% or 62NTU, whichever is the greater value, for a duration of at no more than 72 hours	Daily during the *flood tide, when the dredge is operating in the section of the channel adjacent to the Alligator Bank seagrass meadows	W3 ³ (background)	NTU	-	-	*monitoring must still be undertaken daily for those days when no flood tide occurs.
Quality characteristics	Monitoring point				Units	Release limit		Monitoring frequency												
		Minimum	Maximum																	
Turbidity	W1 ¹ ,W2 ²	NTU	-	Either: background plus 25% or 62NTU, whichever is the greater value, for a duration of at no more than 72 hours	Daily during the *flood tide, when the dredge is operating in the section of the channel adjacent to the Alligator Bank seagrass meadows															
	W3 ³ (background)	NTU	-	-	*monitoring must still be undertaken daily for those days when no flood tide occurs.															
WT7	<p>If the receiving water release limit in Table 1 is exceeded at either W1 or W2, dredging operations must be amended to achieve compliance with the limit.</p>																			

Environmental authority P-EA-100241989

WT8	Monitoring results must be made available to the administering authority upon request.
WT9	Monitoring must be done by an appropriately qualified person in accordance with methods set out in the latest version of the administering authority's water quality sampling manual.
Agency interest: Land	
Condition number	Condition
L1	Treatment and management of acid sulfate soils must comply with the guidance provided in the current edition of the <i>Queensland Acid Sulfate Soil Technical Manual</i> .
Agency interest: Noise	
Condition number	Condition
N1	Noise generated by the activity must not cause environmental nuisance to any sensitive place or commercial place .
Agency interest: Waste	
Condition number	Condition
W1	All waste generated in carrying out the activity must be reused, recycled or removed to a facility that can lawfully accept the waste.
Agency interest: Air	
Condition number	Condition
A1	The release of airborne contaminants from the activity must not cause environmental nuisance .

Definitions

Key terms and/or phrases used in this document are defined in this section and **bolded** throughout this document. Applicants should note that where a term is not defined, the definition in the *Environmental Protection Act 1994*, its regulations or environmental protection policies must be used. If a word remains undefined it has its ordinary meaning.

Activity means the environmentally relevant activities, whether resource activities or prescribed activities, to which the environmental authority relates.

Administering authority means the Department of Environment and Science or its successor or predecessors.

Appropriately qualified person(s) means a person or persons who has professional qualifications, training, skills or experience relevant to the nominated subject matter and can give authoritative assessment, advice and analysis to performance relative to the subject matter using the relevant protocols, standards, methods or literature.

Commercial place means a place used as a workplace, an office or for business or commercial purposes and includes a place within the curtilage of such a place reasonably used by persons at that place.

Dredged material means mud, sand, coral, shingle, gravel, clay, earth and other material removed by dredging. Dredged material includes dredge spoil and extracted quarry material.

Dredge Material Placement Area means the area denoted for placement on the following plan Proposed Navigation Corridor General Arrangement & Details prepared by Ports North dated 31/01/2022, drawing number KA-025-001, revision O.

Dredging includes extraction of mud, sand, coral, ballast, shingle, gravel, clay, earth and other material from the bed of Queensland tidal and non-tidal **waters**. **Dredging** does not include the banks of a waterway.

Environmental harm as defined in Chapter 1 of the *Environmental Protection Act 1994*

Environmental Nuisance as defined in Chapter 1 of the *Environmental Protection Act 1994*.

Measures has the broadest interpretation and includes plant, equipment, physical objects, bunding, containment systems, monitoring, procedures, actions, directions and competency.

Records include breach notifications, written procedures, analysis results, monitoring reports and monitoring programs required under a condition of this authority.

Release of a contaminant into the environment means to:

- deposit, discharge, emit or disturb the contaminant
- cause or allow the contaminant to be deposited, discharged, emitted or disturbed
- fail to prevent the contaminant from being deposited, discharged emitted or disturbed
- allow the contaminant to escape
- fail to prevent the contaminant from escaping.

Sensitive place includes the following and includes a place within the curtilage of such a place reasonably used by persons at that place:

1. a dwelling, residential allotment, mobile home or caravan park, residential marina or other residential premises; or
2. a motel, hotel or hostel; or
3. a kindergarten, school, university or other educational institution; or

4. a medical centre or hospital; or
5. a protected area under the Nature Conservation Act 1992, the Marine Parks Act 2004 or a World Heritage Area; or
6. a public park or garden; or
7. for noise, a place defined as a sensitive receptor for the purposes of the Environmental Protection (Noise) Policy 2019.

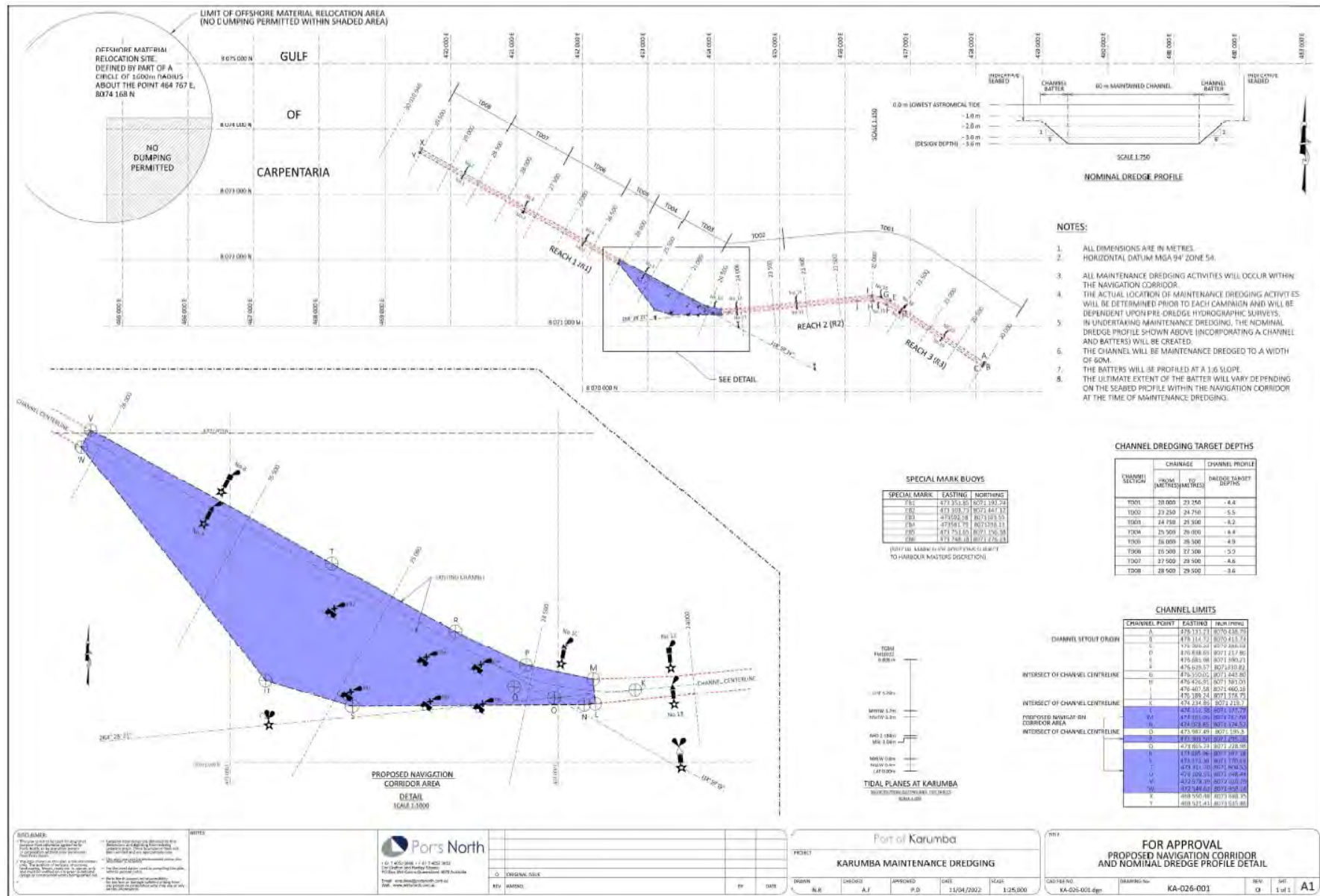
Waters includes river, stream, lake, lagoon, pond, swamp, wetland, unconfined surface water, unconfined water, natural or artificial watercourse, bed and bank of any waters, dams, non-tidal or tidal waters (including the sea), stormwater channel, stormwater drain, roadside gutter, stormwater run-off, and groundwater and any part thereof.

Attachments

- **Proposed Navigation Corridor and Nominal Dredge Profile Detail** prepared by **Ports North** dated **11/04/2022**, drawing number **KA-026-001**, revision **O**.

END OF PERMIT

Proposed Navigation Corridor and Nominal Dredge Profile Detail prepared by **Ports North** dated **11/04/2022**, drawing number **KA-026-001**, revision **O**.



Appendix 5 Section 86 Approval for Operational Works



22 JUN 1996

Queensland Department of Environment and Heritage

Northern Regional Centre • Pallarenda • Queensland

PO Box 5391 • Townsville Mail Centre Qld 4810 • Telephone (077) 22 5211 • Facsimile (077) 22 5222

Enquiries to Mr J. Day
Telephone (077) 225211
Your reference
Our reference N25001 , (807408)

24th June 1996

Chief Executive Officer
Ports Corporation of Queensland
GPO Box 409
BRISBANE QLD 4001

Dear Sir

RE: CHANNEL DREDGING AND MATERIAL RELOCATION AT KARUMBA

I am directed to inform you that in pursuance of the provisions of section 86 of the Harbours Act 1955, sanction has been given to the plans deposited for:-

- The construction of a dredged channel; and
- material rehandling and relocation

in the areas at Karumba shown on the sanctioned plans and subject to the following conditions:-

Note for the purposes of this approval, the following definitions apply:

'Constructing authority' means Ports Corporation of Queensland or the principal contractor for the works.

'DAG' means Karumba Dredging Advisory Group

'Department' means Queensland Department of Environment

'environmental harm' is as defined in the Environment Protection Act 1994

'nominated representative' means an officer of the Queensland Department of Environment, or a person appointed by the Regional Director as his representative.

'person' shall include a corporation or a company (words importing the singular number or plural number shall include the plural number and singular number respectively). Any reference herein to a State Officer or body of persons shall be referred to as a reference to any other officer or body for the time being exercising the powers or performing the functions of the first mentioned officer or body.

'proponent' means Ports Corporation of Queensland

'Regional Director' means the Regional Director (Northern) of the Department of Environment or his nominated representative

'Regional Harbour Master' means the relevant Regional Harbour Master, Department of Transport who is responsible for that particular area or his nominated representative.

'TACC' means the Technical Advisory and Consultative Committee set up as required by the Environmental Protection Agency, Department of Environment, Sport and Territories.

'works' means the carrying out of any dredging, material relocation, excavation, reclamation, installation and maintenance activities.

CONDITIONS

1. Advice prior to Works

The constructing authority must inform the Regional Harbour Master and the Regional Director of the following, at least 14 days prior to commencement of the works:-

- a) The proposed date of the commencement of the works or site establishment.
- b) The proposed timetable associated with the works.
- c) The name and address of the dredging contractors undertaking the works.
- d) The name and telephone number of the proponent's Superintendent who is contactable at all times when works are in progress; plus a contact for the dredging contractor(s).

2. Notices

The constructing authority must issue notices, advice or any other form of notification required by the Regional Harbour Master to ensure the safe and coordinated operation of the Port.

3. Advice re completion of works

The constructing authority must inform the Regional Harbour Master of the completion of the works within 14 days of practical completion.

4. Marine Plant & Equipment requirements

All marine plant and equipment used by the constructing authority must:-

- a) Carry the requisite signals as specified by the *Queensland Marine (Prevention of Collisions) Regulation 1992* and approved by the Regional Harbour Master. All floating plant must meet Department of Transport (Maritime Division) survey and crewing requirements.

b) Be fitted with effective silencing devices by the constructing authority to keep noise to a minimum.

c) Be maintained by the constructing authority to minimise discharge of noxious fumes and pollutants.

5. **Removal of obstructions**

If any snags or obstructions are encountered during the carrying out of the works, the constructing authority must at its cost and expense remove and dispose of them as directed by the Regional Harbour Master.

6. **Navigation requirements**

All floating plant and moorings for such plant shall be kept clear of navigation channels when moored, and the moorings shall be marked and lit in accordance with the requirements of the Regional Harbour Master.

7. **Warning signs**

The constructing authority must supply, install and maintain, at its own cost, any navigation lights, buoys, marks and any warning signs which the Regional Harbour Master considers necessary. All lights, marks, buoys and signs must be in accordance with the requirements of the Department of Transport (Maritime Division).

8. **Sea relocation**

a) The proponent must ensure that the dredging of material is confined within the boundaries of the works shown on the sanctioned plans and that all material is disposed of in sanctioned sea dumping areas or in authorised reclamation areas.

b) The proponent must ensure that any material dumped in the offshore dump site does not exceed bathymetric levels advised in writing by the Regional Harbour Master.

9 **No material outside sanctioned areas**

Any material which is deposited outside the alignment of the works shown on the sanctioned plans or any debris which falls or is deposited on tidal lands or into tidal waters during the construction of the works shall be removed by the constructing authority at its cost and expense prior to the practical completion of the works, to the satisfaction of the Regional Harbour Master and the Regional Director.

10. **Comply with instructions**

The constructing authority must comply with all instructions issued by the Regional Harbour Master and the works must be curtailed or cancelled if the Regional Harbour Master formally requests such action.

11. **Status Reports during dredging**

The constructing authority and Ports Corporation of Queensland must provide the Regional Harbour Master and the Regional Director information as to the status of and the program for the works during the dredging operation in a form and at a frequency approved by the Regional Harbour Master and the Regional Director.

12. **Reports on completion of dredging stages**

The proponent must, within 1 month of the date of completion of any dredging works of a period greater than two (2) weeks, submit to the Regional Director:-

- a) A letter from a Registered Professional Engineer of Queensland certifying that the works have been completed in accordance with the sanctioned plan and conditions of this approval;
- b) A copy of plots of pre and post dredge surveys of the areas dredged and the material relocation areas; and
- c) The calculated volumes of material excavated and placed at each material relocation area.

13. **Restoration of banks or structures**

If, as a result of removal of material, or any other cause attributable to the constructing authority, any bank or structure is displaced, the constructing authority at its cost and expense shall restore the bank or structure to its former condition and take such other action as is necessary to ensure the stability of the bank or structure to the satisfaction of the Regional Harbour Master and the Regional Director.

14. **Shipping Operations**

Port and shipping operations from Karumba Port will continue throughout the duration of these works. Port operations and shipping movements are not to be disrupted, impeded or inconvenienced by the works in any way.

15. **Public safety**

The constructing authority must at its own cost, ensure that all appropriate and necessary safeguards, in and around the works are undertaken and maintained at all times, to ensure the safety of the public and users of the area.

16. **Approval for dredging and relocation only**

The granting of this sanction pursuant to Section 86 of the *Harbours Act* 1955 is for the construction of dredging and relocation works only and does not include any revetment walls, bunding or structures associated with the works.

17. **Approved period for dredging**

All dredging operations shall be confined to the period between the 1st day of May and the 30th day of September inclusive unless otherwise determined in accordance with Condition 26.

18. **Approval to be available**

The proponent must ensure that this approval or a certified copy of the approval is available, on all vessels used for works relevant to this approval, for inspection on demand by the Regional Harbour Master or the Regional Director.

19. **Awareness of Approval**

The proponent must ensure that all persons involved with any works conducted in conjunction with this approval have been advised of, and acknowledge, the conditions applying to this approval. This condition extends to all employees, contractors and sub-

contractors of the Proponent who are acting on behalf of, or at the direction of, the Proponent for the purposes specified in this approval.

20. **Indemnity**

The proponent shall within 20 working days of the date that this approval is granted, provide a letter to the Department of Environment which:

- a) indemnifies the Department against:
 - (i) liability to any person or persons whatsoever in respect of or in relation to any death, bodily injury, damage to property, financial loss or infringement or breach or impairment or diminution of rights or amenities arising out of the works or any other activities carried out within the marine and estuarine environment whether sanctioned by this approval or any other permits or approvals other than a liability by virtue of the negligence of the Department or the Chief Executive of the Department;
 - (ii) any and all loss or damage, costs, charges or expenses incurred by the Department to rehabilitate the marine and estuarine environment if the proponent fails to do so; and
 - (iii) any and all loss or damage arising out of, or costs, charges or expenses incurred by the proponent for, or in relation to, any natural action which threatens the structural integrity or viability of the works; and

if the proponent fails to indemnify the Department or fails to carry out any such rehabilitation (in each case as required by the provisions of this condition) then the Department may seek to recover the amount of any loss, damage costs or expenses thereof from the proponent in a court of law; and

- b) effects and maintains unlimited public risk insurance covering liability to any person or persons whatsoever in respect of death, bodily injury, property damage and financial loss for and in respect of the occupation and use of the works and the area of the marine and estuarine environment subject to this approval.

21. **Accord with other permits**

The proponent must ensure that all works are undertaken in accordance with the provisions and conditions of:

- a) any relevant permit(s) issued under the *Environment Protection (Sea Dumping) Act* 1981. The constructing authority must forward a copy of any such permit(s) to the Regional Director, at least 7 days prior to the commencement of works.
- b) any relevant International Conventions; and
- c) the laws in force in the State of Queensland.

22. **Onshore material relocation**

- a) The proponent must ensure that appropriate sediment control measures are taken to ensure any discharge or tailwater from any onshore relocation areas contains turbidities no greater than those naturally experienced in the receiving waters at that time of the year.

b) Prior to onshore relocation of dredge material, written notification to the Department is required to determine appropriate methods of onshore treatment and management.

23. **No debris or litter**

The proponent must ensure that:

a) Any debris, litter, rubbish, or material resulting from works which falls or is deposited on tidal lands or into tidal, marine or estuarine waters during the dredging operations must be removed by the Proponent at its cost and expense to the satisfaction of the relevant Regional Harbour Master and the Regional Director.

b) all plant, equipment and associated materials used in the works must be removed from the marine environment and appropriately disposed of upon completion of the works.

24. **Further works**

The proponent shall not implement any modifications to the sanctioned works without approval in writing from the Regional Director.

25. **Trigger levels**

The proponent and the constructing authority shall protect all seagrass beds within the Port limits or any seagrass beds occurring within a radius of 3 nautical miles from any approved sea dump site from impacts due to light attenuation and sedimentation originating from dredge and dump plumes. Agreed monitoring programs are to be implemented for:

- a) measurement of ambient turbidities over the seagrass beds;
- b) measurement of duration and turbidity of invasive plumes;
- c) use of regular aerial monitoring with photography as detailed in the monitoring program

Initially and until modified by the TACC following review of the monitoring data, trigger levels will be based upon the following:

Turbidity at any point within the seagrass meadows being 25% above ambient background levels (*ambient = best estimate for the relevant area adjacent to the seagrass beds*). A management response, such as those set out in Condition 26, will be triggered if these levels are exceeded for 90% of any 10 day period (eg 9 out of 10 days).

The selection of the location of the ambient measurements will be subjective and based on aerial flights and visual determination of areas outside plumes. Ambient data cannot be chosen from a site where a plume has been observed/ measured /suspected.

These trigger levels which have been arbitrarily set, may be modified by the TACC during dredging after consideration of the monitoring results. They are likely to be superseded in subsequent years following consideration of the data generated during the trial period as described in Condition 32 (a). If any trigger levels approved by the TACC are exceeded, then the Regional Director may direct the proponent to cease or modify the works as described in Condition 26.

26. **Cease or modify works**

If:

a) any works, including material relocation, by the proponent are deemed by the Regional Director to cause environmental harm to the sea grass beds defined in Condition 25 due to

any cause whatsoever (including Acts of God, negligence or deliberate or accidental act of any person not party to this approval); or

b) the works are deemed by the Regional Director to cause environmental harm within the marine environment; or

c) the approvals are revoked or surrendered or are rendered invalid through any cause whatsoever,

then the proponent must cease or modify the works, or such parts of the works within such reasonable time as the Regional Director directs.

27. **Advice re environmental harm**

The proponent must supervise all activities associated with the dredging and material relocation operations and must advise the Regional Director of any environmental harm resulting from these works or if works are likely to cause environmental harm as set out in Condition 30.

28. **Rehabilitation if deemed appropriate**

In order to repair any environmental harm (whether direct or indirect, cumulative or immediate) arising out of the works, the proponent must rehabilitate the affected area as directed from time to time and to a standard set by the Regional Director. The Regional Director must not direct rehabilitation exceeding the conditions existing at the time of commencement of activities in connection with this approval.

29. **Costs of rehabilitation or mitigation**

All cost associated with rehabilitation as set out in Condition 28 or the mitigation of environmental harm in relation to works shall be borne by the proponent.

30. **Environmental harm**

If at any time environmental harm occurs, including any environmental harm to living organisms or damage to the marine or estuarine environments as a result of dredging operations, or is likely to occur, the proponent must immediately take appropriate measures to mitigate or eliminate such environmental harm, which may include the cessation of current operations and the imposition of restrictions on the method and location of future operations.

The proponent must, as soon as practicable, make a report to the nominated representative detailing the nature and extent of the environmental harm, the measures adopted or proposed to be adopted for the elimination or mitigation of this risk. This report shall also be forwarded as soon as practicable to the Regional Director and to the TACC. The proponent must also undertake any additional monitoring required by the Regional Director to assess the level of environmental harm and the effectiveness of the measures to mitigate the environmental harm.

31. **Written agreements on monitoring, Environmental Site Supervisor, etc**

The proponent must, prior to the commencement of any dredging operations:-

a) Enter into a written agreement with the Regional Director for the employment and funding (appropriate salary, living expenses and operating costs) of a Conservation Officer (Level P03) to be employed within the Northern Region of the Department of Environment.

The period of employment for the trial dredging as set out in Condition 32 (a) shall cover the dredging from 3 weeks before the start of the dredging operations to 2 weeks following completion. The continuing employment for subsequent dredging stages will be as agreed by the TACC.

- b) Enter into a written agreement with the Regional Director in respect of the requirements and funding for a comprehensive monitoring program as set out in Condition 32 (b);
- c) Enter into a written agreement with the Regional Director in respect of the procedure to be used to convey a direction from the Regional Director to either modify or cease dredging operations in accordance with Condition 26 hereof; and
- d) Enter into a written agreement with the Regional Director in respect of the spacing of the soundings on the plots of the surveys referred to in Condition 12.

32. Trial dredging period

- a) The works conducted within the first eight weeks of the approved program (or the total 1996 dredging program, whichever is the longer period) will be regarded as a trial and monitored and managed in accordance with Conditions 25, 31 and 32(b).
- b) The proponent must implement and fund a monitoring program approved by the TACC prior to commencement of works for the dredging and material relocation operations. The program must include monitoring of the impact of the works on water quality including turbidity in the vicinity of the dredging and material relocation areas and in nearshore waters adjacent to and over the seagrass beds and any environmental harm to living organisms.
- c) Any subsequent works sanctioned by this approval other than those described in Condition 32 (a), must be conducted according to guidelines written by the Department and approved by the TACC and must not commence until such approval from the TACC is given. These guidelines and approvals will be comprised of an acceptable Environmental Management and Monitoring Program and be based on the results of the trial described in Condition 32 (a).

33. Provision of data

The proponent must make all data collected during approved monitoring programs available to the Regional Director, other officers of the Queensland Government and the Commonwealth Environment Protection Agency free of charge for use without restriction if so requested.

34. Monitoring reports and Verification of models

The proponent must produce reports on the monitoring program:

- a) within 2 months of completion of the dredging described in Condition 32 (a), including verification of the model(s) used in the EIA;
- b) within 2 months of the completion of capital dredging;
- c) within 2 months of the completion of each stage of maintenance dredging; and
- d) in a format agreed by the TACC.

The proponent must forward 2 copies of the above reports to the Regional Director and a copy to each member of the TACC.

35. **Assistance to Departmental officers**

The proponent must provide the Regional Director and the Regional Harbour Master with access to any activities and vessels associated with the works, including monitoring, and must give all reasonable assistance to the Regional Director and the Regional Harbour Master during the conduct of the dredging, relocation or monitoring.

Copies of the sanctioned plans are returned herewith.

I wish to point out that the sanction or conditions do not constitute a ruling on structural safety and you must make your own arrangements to ensure adequacy of design and work.

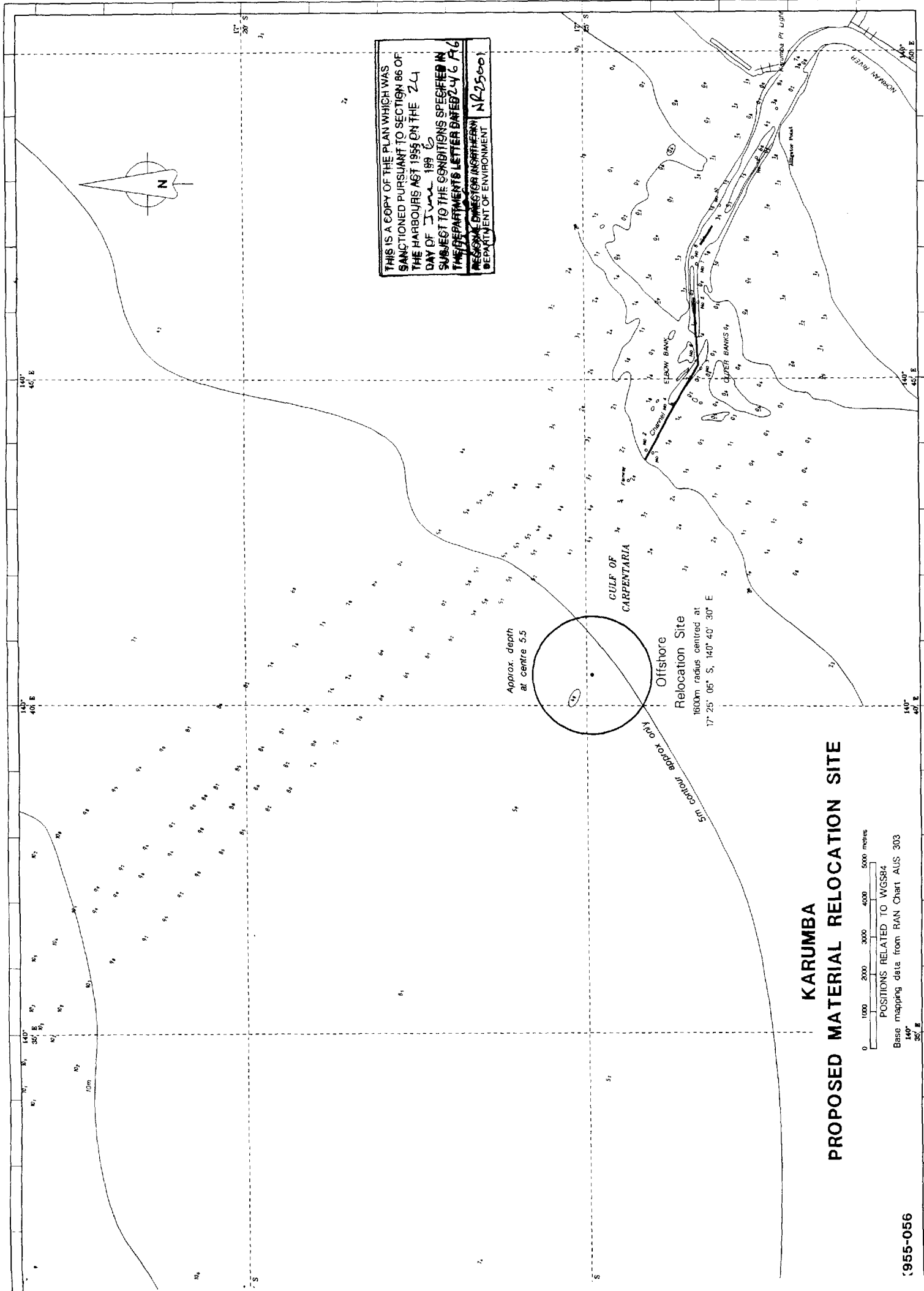
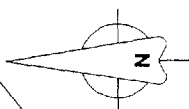
The granting of this sanction pursuant to the *Harbours Act* does not remove the need to obtain any further approvals for this work which may be required pursuant to other legislation, both State and Commonwealth. Applicants are advised to check with all relevant statutory authorities for such approvals as may be required.

Your attention is drawn to the provisions of the *Native Title Act* 1993 (Commonwealth) in so far as it may affect your right to construct these works on the subject land.

Yours faithfully


for G W Mercer
REGIONAL DIRECTOR
NORTHERN

THIS IS A COPY OF THE PLAN WHICH WAS
 SANCTIONED PURSUANT TO SECTION 86 OF
 THE HARBOURS ACT 1955 ON THE 24
 DAY OF June 1996
 SUBJECT TO THE CONDITIONS SPECIFIED IN
 THE DEPARTMENT'S LETTER DATED 24/6/96
 REGIONAL DIRECTOR (NORTHERN)
 DEPARTMENT OF ENVIRONMENT NR25001



Approx. depth
 at centre 5.5

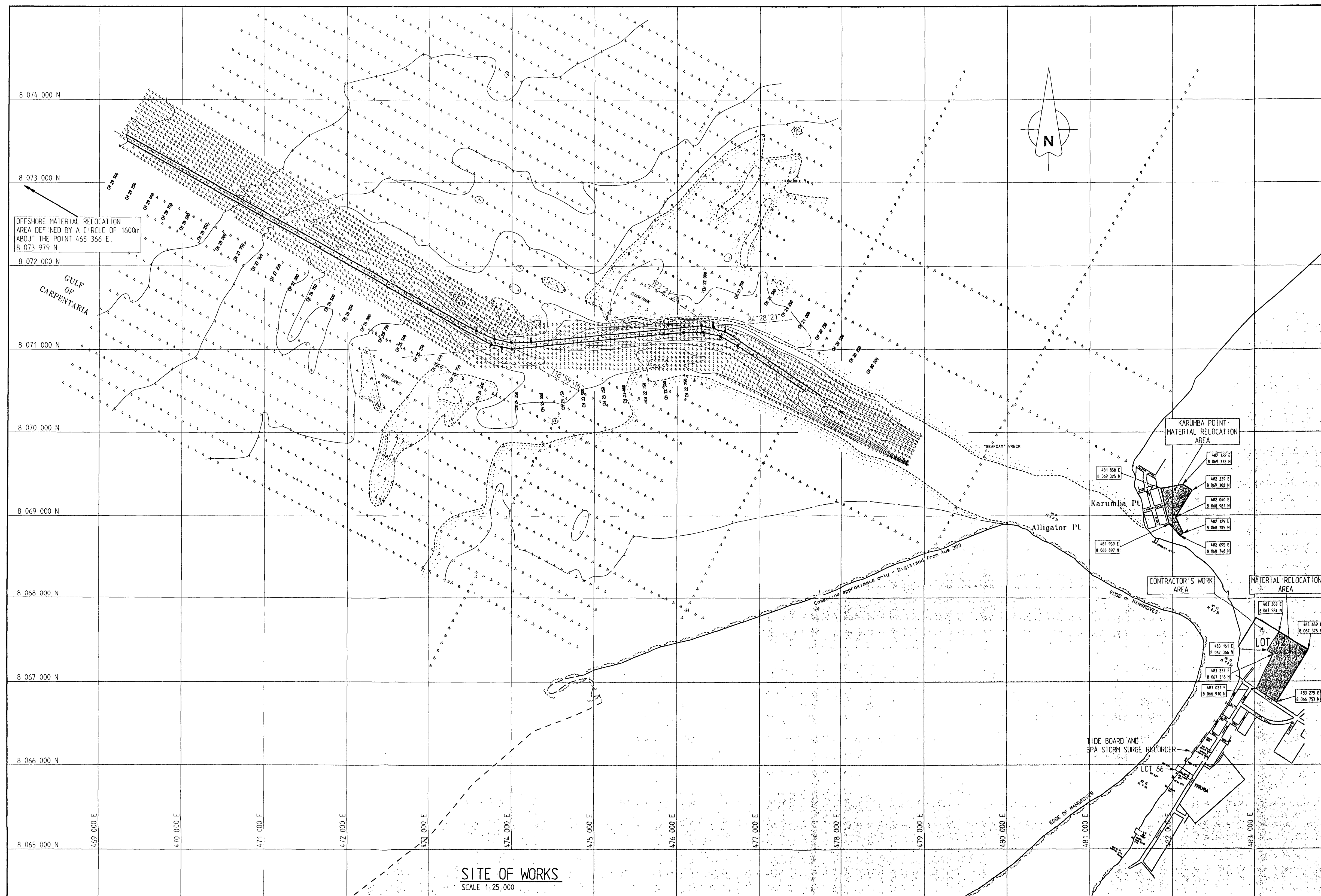
GULF OF
 CARPENTARIA

Offshore

Relocation Site
 1600m radius centred at
 17° 25' 05" S, 140° 40' 30" E

KARUMBA PROPOSED MATERIAL RELOCATION SITE

0 1000 2000 3000 4000 5000 metres
 POSITIONS RELATED TO WGS84
 Base mapping data from RAN Chart AUS 303
 140° 35' E



LOCALITY PLAN

TABULATION OF SURVEY MARKS AND CHANNEL

AMG COORDINATES AMG84 ZONE 54

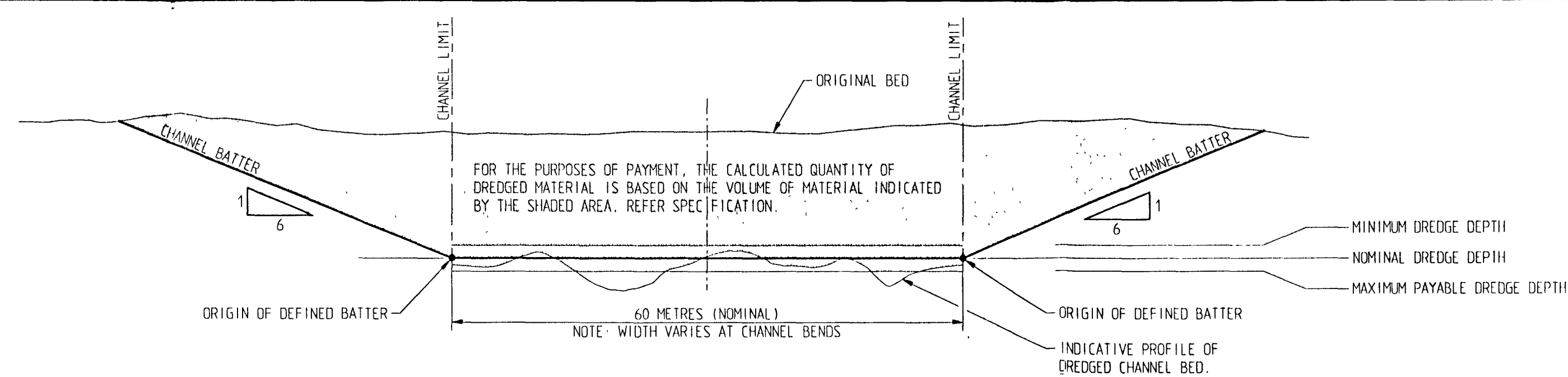
	MARK	EASTING	NORTHING
PM 96677 D/H BRASS PLAQUE IN CONC.		481 552.15	0 069 496.07
STN B. D/H IN CONC WALL		480 770.89	0 068 710.60
STN C IRON PIN		482 729.44	0 066 839.80
STN D SCREW IN JETTY		481 783.72	0 068 685.57
RN D/H IN KERB		482 759.71	0 066 845.75
AIRPORT WINDSOCK		481 896.2	0 070 046.8
TOP ATRIAL MICROWAVE TOWER		482 695.3	0 066 445.2
KARUMBA POINT LIGHT		481 755.55	0 068 111.80
LIGHTHOUSE LIGHT		482 758.0	0 065 180.0
CENTRE WATER TOWER		482 760.7	0 065 175.3
A - INTERSECT. c CHANNEL & 470 000 E		478 000.00	0 070 238.9
B - INTERSECTION CHANNEL c's		476 435.2	0 071 269.0
C - INTERSECTION CHANNEL c's		473 872.7	0 071 021.1
D - CORNER OF CHANNEL		476 571.2	0 071 215.4
E - CORNER OF CHANNEL		476 292.8	0 071 285.4
F - CORNER OF CHANNEL		476 723.9	0 071 043.1
G - CORNER OF CHANNEL		476 574.0	0 071 155.1
H - CORNER OF CHANNEL		476 312.1	0 071 206.3
I - CORNER OF CHANNEL		476 074.5	0 071 204.0
J - CORNER OF CHANNEL		474 229.5	0 071 085.7
K - CORNER OF CHANNEL		473 991.2	0 071 078.0
M - CORNER OF CHANNEL		473 786.7	0 071 120.5
N - CORNER OF CHANNEL		473 571.2	0 071 222.4
O - CORNER OF CHANNEL		473 997.6	0 071 003.0
P - CORNER OF CHANNEL		473 751.0	0 071 054.2

NOTES:

- 1 ALL DIMENSIONS ARE IN METRES.
- 2 ALL LEVELS AND SOUNDINGS ARE IN METRES, AND ARE REDUCED TO L.A.T.
VERTICAL DATUM FOR LEVELS ESTABLISHED FROM PM 10222 RL 6.808 LAT.
HORIZONTAL DATUM IS AGO (AM854) ZONE 54
ORIGIN PM 96677 EASTING 481 552, 15 NORTHING 8 069 496.07
3. SURVEY INFORMATION ON THIS DRAWING WAS DERIVED FROM QUEENSLAND DEPARTMENT
OF TRANSPORT ORG. Nos. K955-052 AND K955-055.

TABULATION OF CHANNEL GEOMETRIES

CHANNEL SECTION	CHAINAGE		CHANNEL DREDGE DEPTHS		
	FROM (METRES)	TO (METRES)	NOMINAL DEPTH (METRES BELOW L.A.T.)	MINIMUM DEPTH (METRES BELOW L.A.T.)	MAXIMUM PAYABLE DEPTH (METRES BELOW L.A.T.)
A	20 000	22 500	-3.80	-3.70	-3.90
B	22 500	24 500	-6.00	-5.90	-6.10
C	24 500	25 000	-4.05	-3.95	-4.15
D	25 000	25 500	-4.05	-3.95	-4.15
E	25 500	26 000	-4.30	-4.20	-4.40
F	26 000	26 500	-4.60	-4.50	-4.70
G	26 500	27 500	-5.45	-5.35	-5.55
H	27 500	28 000	-4.00	-3.90	-4.10
I	28 000	28 750	-3.90	-3.80	-4.00
J	28 750	29 500	-3.40	-3.40	-3.40



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SANCTIONED PURSUANT TO SECTION 86 OF
THE HARBOURS ACT 1955 ON THE 24
DAY OF June 1996
SUBJECT TO THE CONDITIONS SPECIFIED IN
THE DEPARTMENTS LETTER DATED 24/6/96

REG. NO. 1255001

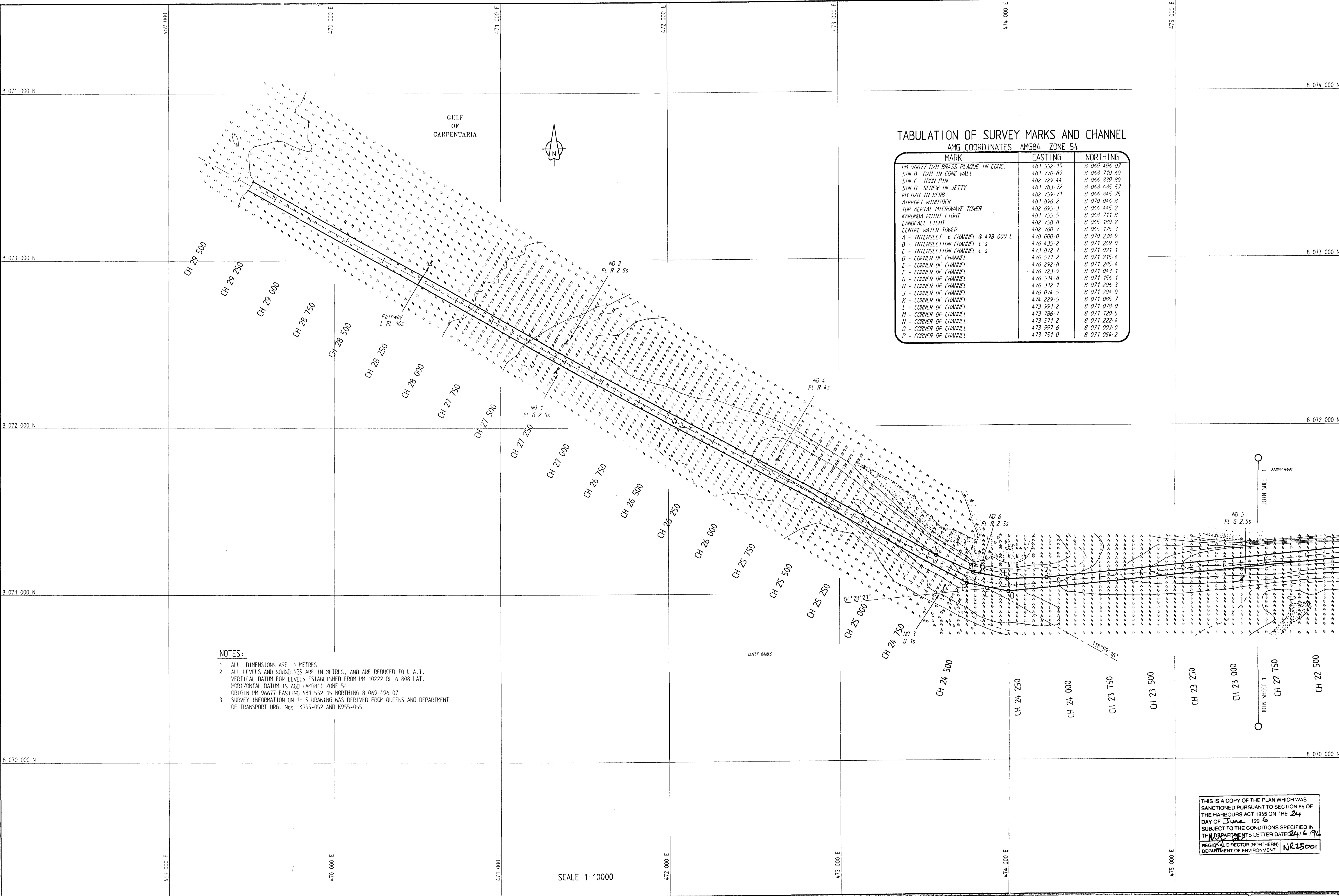
REGIONAL DIRECTOR (NORTHERN)
DEPARTMENT OF ENVIRONMENT

NR255001

TYPICAL CHANNEL CROSS SECTION

NTS

[illegible]



TABULATION OF SURVEY MARKS AND CHANNEL

MARK	EASTING	NORTHING
PM 96677 D/H BRASS PLAQUE IN CONC.	481 552.15	8 069 496.07
STN B. D/H IN CONC WALL	481 770.89	8 068 710.60
STN C. IRON PIN	482 729.44	8 066 839.80
STN D. SCREW IN JETTY	481 783.72	8 068 685.57
RM D/H IN KERB	482 759.71	8 066 845.75
AIRPORT WINDSOCK	481 896.2	8 070 046.8
TOP AERIAL MICROWAVE TOWER	482 695.3	8 066 445.2
KARUMBA POINT LIGHT	481 755.5	8 068 711.8
LANDFALL LIGHT	482 758.8	8 065 180.2
CENTRE WATER TOWER	482 760.7	8 065 175.3
A - INTERSECT. x CHANNEL 8 478 000 E	478 000.0	8 070 238.9
B - INTERSECTION CHANNEL c's	476 435.2	8 071 269.0
C - INTERSECTION CHANNEL c's	473 872.7	8 071 021.1
D - CORNER OF CHANNEL	476 571.2	8 071 215.4
E - CORNER OF CHANNEL	476 292.8	8 071 285.4
F - CORNER OF CHANNEL	476 723.9	8 071 043.1
G - CORNER OF CHANNEL	476 514.8	8 071 156.1
H - CORNER OF CHANNEL	476 312.1	8 071 206.3
J - CORNER OF CHANNEL	476 074.5	8 071 204.0
K - CORNER OF CHANNEL	474 229.5	8 071 085.7
L - CORNER OF CHANNEL	473 991.2	8 071 078.0
M - CORNER OF CHANNEL	473 786.7	8 071 120.5
N - CORNER OF CHANNEL	473 571.2	8 071 222.4
O - CORNER OF CHANNEL	473 997.6	8 071 003.0
P - CORNER OF CHANNEL	473 751.0	8 071 054.2

NOTES:

- 1 ALL DIMENSIONS ARE IN METRES
- 2 ALL LEVELS AND SOUNDINGS ARE IN METRES, AND ARE REDUCED TO L.A.T.
VERTICAL DATUM FOR LEVELS ESTABLISHED FROM PM 10222 RL 6 808 LAT.
HORIZONTAL DATUM IS AGD (AMGB4) ZONE 54
ORIGIN PM 96677 EASTING 481 552.15 NORTHING 8 069 496.07
- 3 SURVEY INFORMATION ON THIS DRAWING WAS DERIVED FROM QUEENSLAND DEPARTMENT OF TRANSPORT DRG. Nos. K955-052 AND K955-055

SCALE 1:10000

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REGIONAL DIRECTOR (NORTHERN)
DEPARTMENT OF ENVIRONMENT N225001

KA-1-3-1A	SITE PLAN AND ARRANGEMENT	Amend	Description	Date	Approved	Contract No	410-21-279-1-A	File No	Ratio Scales (Before Reduction)	11 0 10 20 30 40 50 60	12 0 20 40 60 80 100	12.5 0 50 100 150	150 0 100 200 300	1.5	JAS-ANZ QUALITY SYSTEM CERTIFIED TO AS 3901/ISO 9001 REG. NO. 088	D.K.C. Drafting Design Ckd Manager Marine	Examined Snr Co-ord (Tech & Admin) Approved Date 12.4.96	QUEENSLAND TRANSPORT Queensland Department of Transport Transport Technology Division Marine Business Centre	Ports Corporation Queensland	KARUMBA DEVELOPMENT DREDGING DREDGING DETAILS SHEET 2 OF 2	© The State of Queensland, Queensland Transport, 1996. KA-1-3-3 Drawing Number
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Appendix 6 Seagrass Monitoring 2021



PORT OF KARUMBA LONG-TERM ANNUAL SEAGRASS MONITORING 2021

Scott A, McKenna S and Rasheed M

Report No. 21/70

January 2022

PORT OF KARUMBA LONG-TERM ANNUAL SEAGRASS MONITORING 2021

A Report for Ports North

Report No. 21/70

January 2022

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Acknowledgments:

This project was funded by Ports North. We wish to thank TropWATER staff for their assistance in the field and laboratory.

KEY FINDINGS

Seagrass Condition 2021



1. In 2021 there were improvements in all seagrass condition indicators in the Karumba monitoring meadow. Seagrass condition was very good for the first time since 2017.
2. Seagrass condition at the Alligator Bank long term monitoring meadow improved in 2021, continuing the trajectory of recovery from the poorest condition in more than two decades recorded in 2019 following local floods.
3. Above average numbers of *Halodule uninervis* seeds and *Halophila ovalis* fruits were found in the meadow.
4. The seagrass meadow on Elbow Bank was also surveyed in 2021 and area remained high, however biomass was the lowest recorded.
5. The seagrass in Karumba is an important foraging ground for dugong with their feeding trails recorded in both seagrass meadows, particularly concentrated on Alligator Bank.
6. In 2021 environmental conditions were favourable, enabling significant recovery of the Alligator Bank seagrass meadow. The meadow has now fully recovered from the flood related declines recorded in 2019, with area, biomass and seed banks at high levels likely conferring good levels of resilience for the seagrass meadow in 2022.

IN BRIEF

Seagrasses have been monitored annually in the Port of Karumba since 1994. Each year, the monitoring meadow between the Norman and Bynoe Rivers at Alligator Bank (Figure 1) is assessed for changes in biomass (density), distribution (area), species composition, and reproductive capacity (seed bank, fruits and flowers). Changes to area, biomass and species composition are assessed using a seagrass condition index (see 2.3 and Appendix 1 of this report for further details).

In 2021 seagrasses in the broader port limits were also surveyed as part of expanded surveys conducted every 3 years in the monitoring program. This included intertidal areas on Elbow Bank (Figure 1).

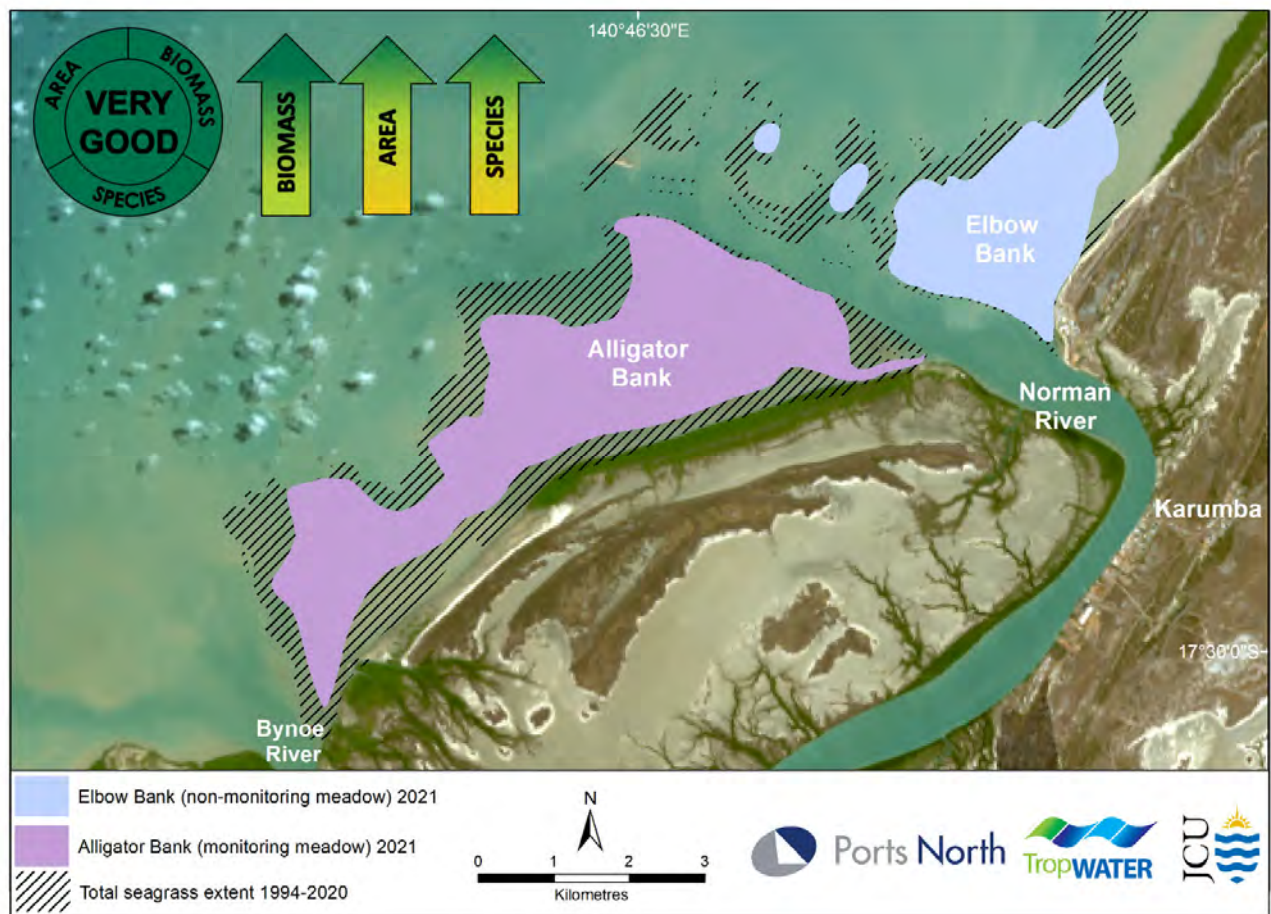


Figure 1. Seagrass condition at Alligator Bank, Karumba, 2021. Non-monitoring meadow at Elbow Bank also shown.

Seagrass in the Alligator Bank monitoring meadow at Karumba had fully recovered in 2021 from flood related declines and was in very good condition. This improvement continues the trajectory of recovery from 2019 after severe weather caused major losses, and the meadow was in the poorest condition recorded in more than two decades. Seagrass biomass, area and species composition all improved in 2021. From 2020 to 2021, the largest improvement was seen in area, with the south western end of the meadow returning for the first time since 2018. Additionally there was a substantial increase of the more stable species *Halodule uninervis* in 2021, displacing the colonising species *Halophila ovalis* that had driven much of the early recovery.

Accompanying the return of seagrass area, biomass and species was the return of above average numbers of *Halodule uninervis* seeds in the below ground seed bank, as well as *Halophila ovalis* fruits in the meadow.

Dugong feeding was recorded in both meadows at Karumba and was concentrated in the Alligator Bank monitoring meadow.

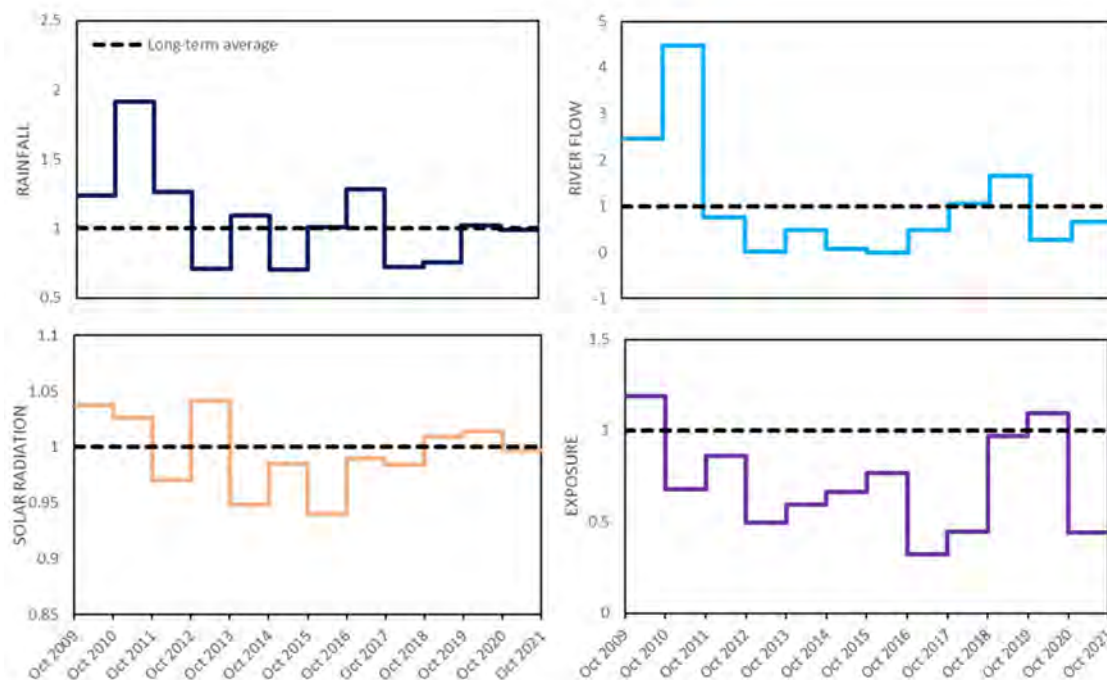


Figure 2. Change in climate variables as a proportion of the long-term average in Karumba. See Section 3.5 for detailed climate data.

The favourable environmental conditions in 2021 have facilitated meadow recovery, with all of the climate variables measured close to or below the long-term average in 2021 (Figure 2). The recovery of the meadow and the below ground seed bank in 2021, means Karumba seagrasses have a high level of resilience leading into 2022 and an ability to recover via the seed bank if faced with large scale climate or anthropogenic impacts.

Karumba seagrass monitoring is part of a broader seagrass program that examines the condition of seagrasses in the majority of Queensland commercial ports and areas of high anthropogenic activity, and is a component of TropWATER's broader seagrass assessment and research program. Overall seagrass condition was good at Weipa in 2021, which is the closest location to Karumba. For full details of the Queensland ports seagrass monitoring program, see <https://www.tropwater.com/project/management-of-ports-and-coastal-facilities/>

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1 INTRODUCTION

Seagrasses provide a range of critically important and economically valuable ecosystem services including coastal protection, support of fisheries production, nutrient cycling and particle trapping (Costanza et al. 2014; Hemminga & Duarte 2000; Costanza et al. 1997). Seagrass meadows show measurable responses to changes in water quality, making them ideal candidates for monitoring the long-term health of marine environments (Orth et al. 2006; Abal & Dennison 1996; Dennison et al. 1993).

1.1 Queensland Ports Seagrass Monitoring Program

A long-term seagrass monitoring and assessment program has been established in the majority of Queensland's commercial ports. The program was developed by James Cook University's Centre for Tropical Water & Aquatic Ecosystem Research (TropWATER) in partnership with the various Queensland port authorities. While each location is funded separately, a common methodology and rationale is used, providing a network of seagrass monitoring locations throughout Queensland (Figure 3).

A strategic long-term assessment and monitoring program for seagrasses provides port managers and regulators with the key information to ensure that seagrasses and ports can co-exist. These results are useful for planning and implementing port development and maintenance programs to ensure minimal impact on seagrasses. The program also provides an ongoing assessment of many of the most threatened seagrass communities in Queensland.

The data collected as part of this program has resulted in significant advances in the science and knowledge of tropical seagrass ecology. This data has been instrumental in developing tools, indicators and thresholds for the protection and management of seagrasses. The program also provides an understanding of the drivers of tropical seagrass change. It provides local information for individual ports as well as feeding into regional assessments of the status of seagrasses.

For more information on the program and reports from the other monitoring locations see <https://www.tropwater.com/project/management-of-ports-and-coastal-facilities/>



Figure 3. Location of Queensland port seagrass assessment sites.

1.2 Karumba Seagrass Monitoring Program

The Karumba port entrance and the Norman River channel are naturally shallow and require periodic maintenance dredging to allow the passage of vessels. Dredging has the potential to cause a high level of environmental risk to marine habitats such as seagrass meadows (Erftemeijer and Lewis 2006) unless management strategies are adopted to minimise potential risks. Ports North is responsible for dredging in the port and for managing and monitoring Karumba's port environment. Seagrass meadows are the key marine habitat that occur within the Port of Karumba that can be affected by port activities.

Seagrasses form a key ecological habitat in the Karumba region and Ports North have funded a long-term seagrass monitoring program since 1994. The initial six year (1994-2000) seagrass monitoring program was commissioned as part of a wider range of environmental studies to assess and monitor the impacts of dredging and other port developments (Rasheed et al. 2001). Following this, a long-term seagrass monitoring program for the Port of Karumba was developed.

Results from the monitoring program are used by Ports North to assess the health of the ports' marine environment and help identify possible effects of port operations and developments on seagrasses. The program also provides an assessment of the resilience of seagrass meadows to withstand a range of potential influences, e.g. land runoff and dredging impacts, and provides a simple assessment of condition to confirm that port activities are not impacting the seagrass. The program also satisfies environmental monitoring requirements as part of the port's long-term dredge management plan, and is used by management agencies to assess the status and condition of seagrass resources in the region.

This report presents results from the September 2021 monitoring and port limit wide survey. The objectives of the survey were:

1. Map seagrass distribution in the Alligator Bank monitoring meadow between the Norman and Bynoe River;
2. Determine seagrass species composition and biomass within the monitoring meadow;
3. Measure the reproductive capacity of the monitoring meadow;
4. Conduct an expanded survey to include intertidal seagrass on Elbow bank to provide updated information on seagrass distribution and density in the wider port area;
5. Assess seagrass condition in the Alligator Bank monitoring meadow by comparing results with previous monitoring surveys, and compare results with other seagrass monitoring programs throughout Queensland.

2 METHODS

2.1 Sampling Approach

The 2021 survey was designed to provide updated information on seagrass habitats within the Port of Karumba, including seagrass distribution, density and species composition. The sampling method used followed those established for the Karumba long-term seagrass monitoring program as well as other seagrass programs established in Queensland Ports including Weipa, Cairns, Mourilyan Harbour, Townsville, Gladstone, Mackay, Thursday Island and Abbot Point.

For more details see: <https://www.tropwater.com/project/management-of-ports-and-coastal-facilities/>

2.2 Sampling Methods

The Karumba seagrass survey was conducted on 14-15th September 2021. The survey area covered the intertidal area of Alligator Bank and Elbow Bank. Detailed monitoring program methods are available in previous reports (Rasheed et al. 1996; Rasheed et al. 2001; McKenna and Rasheed 2011).

Seagrass meadow boundaries were mapped from a helicopter survey conducted during the spring low tide when intertidal banks were exposed. Waypoints were recorded around the edge of the meadow using a global positioning system (GPS) and digitised into a Geographic Information System (GIS).

Seagrass metrics were recorded at survey sites scattered haphazardly within the mapped meadow. The number of sites was based on a power analysis that considered within-meadow variability (Unsworth et al. 2009). Site characteristics including seagrass species composition and above-ground biomass, epiphyte cover, algae and other benthic cover, and dugong feeding activity were recorded at each site.

Seagrass above-ground biomass was measured using a visual estimate of biomass technique (as described by Kirkman 1978 and Mellors 1991). This method has been used in surveys throughout Queensland (e.g. Rasheed et al. 2008; Rasheed and Unsworth 2011; Rasheed et al. 2014; McKenna et al. 2015; York et al. 2015). The method involves an observer ranking above-ground seagrass biomass within three randomly placed 0.25m² quadrats at each site. Observer measurements are calibrated against biomass values from quadrats harvested

and dried to determine mean above-ground biomass in grams dry weight per square metre (g DW m⁻²) at each site. The percent contribution of each seagrass species to total biomass within each quadrat also was recorded.

Sampling of the seagrass seed bank (seeds stored in the sediments) and other seagrass reproductive structures (fruit and flowers) was conducted at 17 sites within the monitoring meadow. A Van Veen sediment grab (0.01885m²) was used to collect samples at sites haphazardly scattered throughout the meadow. Seagrass and sediment/seed samples were sorted by passing the sample through a 1 mm sieve. Any seagrass reproductive structures in the 1 mm fraction were identified and counted. The 1 mm mesh size was small enough to retain seeds/pericarps of *H. uninervis* and fruits and flowers of *H. uninervis* and *H. ovalis*. Seeds of *H. ovalis* were not measured because their small size allows them to pass through the sieve mesh and requires a microscope to locate them.

2.3 Habitat Mapping and Geographic Information System

All survey data was entered into a GIS for presentation of seagrass spatial data. Satellite imagery of the Karumba region plus information recorded during the monitoring survey was used to map seagrass meadows. Three seagrass GIS layers were created in ArcMap® 10.8:

2.3.1 Site layer

The site (point) layer contains data collected at each site, including:

- Site number
- Temporal details – Survey date and time.
- Spatial details – Latitude and longitude.
- Habitat information – Sediment type; seagrass information including presence/absence, above-ground biomass (total and for each species) and biomass standard error (SE); site benthic cover (percent cover of algae, seagrass, benthic macro-invertebrates, open substrate); dugong feeding trail presence/absence.
- Sampling method and any relevant comments.

2.3.2 Biomass interpolation

The interpolation (raster) layer describes spatial variation in seagrass biomass across each meadow and was created using an inverse distance weighted interpolation of seagrass site data within the mapped meadow.

2.3.3 Meadow layer

The meadow (polygon) layer provides summary information for all sites within each meadow, including:

- Meadow ID number – A unique number assigned to each meadow to allow comparisons among surveys.
- Temporal details – Survey date.
- Habitat information – Mean meadow biomass \pm standard error (SE), meadow area (hectares) \pm reliability estimate (R), number of sites within the meadow, seagrass species present, meadow density and community type (Tables 1, 2), meadow landscape category (Figure 4).
- Sampling method and any relevant comments.

Meadow boundaries were constructed using GPS marked meadow boundaries, seagrass presence/absence site data, field notes, and aerial photographs taken during helicopter surveys. Meadow area was determined using the calculate geometry function in ArcMap®. The meadow boundary was assigned a mapping precision estimate (in metres) based on mapping methodology used for that meadow. Mapping precision was estimated to be ± 5 m due to the error associated with GPS fixes. The mapping precision estimate was used to

calculate a buffer around each meadow representing error; the area of this buffer is expressed as a meadow reliability estimate (R) in hectares.

Table 1. Seagrass meadow community type nomenclature in the Port of Karumba.

Community type	Species composition
Species A	Species A is 90-100% of composition
Species A with Species B	Species A is 60-90% of composition
Species A with Species B/Species C	Species A is 50% of composition
Species A/Species B	Species A is 40-60% of composition

Table 2. Seagrass meadow density categories based on mean above-ground biomass ranges for each species in the Port of Karumba.

Density	Mean above-ground biomass (g DW m ⁻²)	
	<i>Halodule uninervis</i> (narrow)	<i>Halophila ovalis</i>
Light	< 1	< 1
Moderate	1 - 4	1 - 5
Dense	> 4	> 5

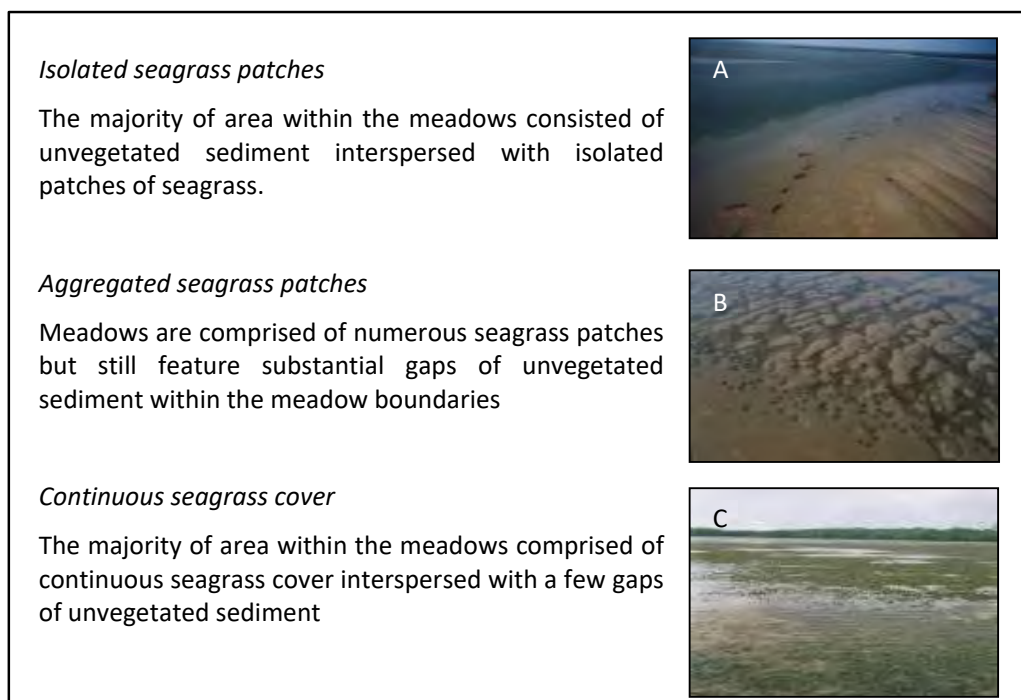


Figure 4. Seagrass meadow landscape categories: (A) isolated seagrass patches, (B) aggregated seagrass patches, (C) continuous seagrass cover.

2.4 Seagrass Meadow Condition Index

A condition index was developed for seagrass monitoring meadows in Karumba based on changes in mean above-ground biomass, total meadow area, and species composition relative to a baseline. Seagrass condition for each indicator in each meadow was scored from 0 to 1 and assigned one of five grades: A (very good), B (good), C (satisfactory), D (poor) and E (very poor). Overall meadow condition is the lowest indicator score where this is driven by biomass or area. Where species composition is the lowest score, it contributes 50% of the overall meadow score, and the next lowest indicator (area or biomass) contributes the remaining 50%. The flow chart in Figure 5 summarises the methods used to calculate seagrass condition. See Appendix 1 and 2 for full details of score calculation.

2.5 Environmental data

Environmental data were collated for the 12 months preceding each survey:

- Tidal data was provided by Maritime Safety Queensland (MSQ) (© The State of Queensland (Department of Transport and Main Roads) 2019, Tidal Data) for Karumba (www.msq.qld.gov.au). Predicted data were used for five days in August and three days in September 2020 where the tidal gauge was not working.
- Data for rainfall (mm), air temperature (°C), and global solar exposure (MegaJoules, MJ m⁻²) were obtained for the nearest weather station from the Australian Bureau of Meteorology (BOM) (Normanton Airport, Station #029063; <http://www.bom.gov.au/climate/data/>).
- Norman River flow data (megalitres; ML) was obtained from the Queensland Government (Glenore Weir, Station #916001B; <https://water-monitoring.information.qld.gov.au/>).

2.6 Seagrass Reproduction Analysis

Halodule uninervis seeds and pericarps in the sediment were compared among years (2003-2021) using a negative binomial regression model in R (version 3.6.2) using the MASS package (Venables and Ripley 2002). Data exploration protocols prior to all analyses followed Zuur et al. (2010) and included checks for zero inflation and overdispersion. Statistical significance of year in each model was tested using a likelihood ratio test. Statistical analyses could not be performed on *H. uninervis* and *H. ovalis* fruit and flower counts due to the large number of zeros in the data; this data is presented graphically instead.

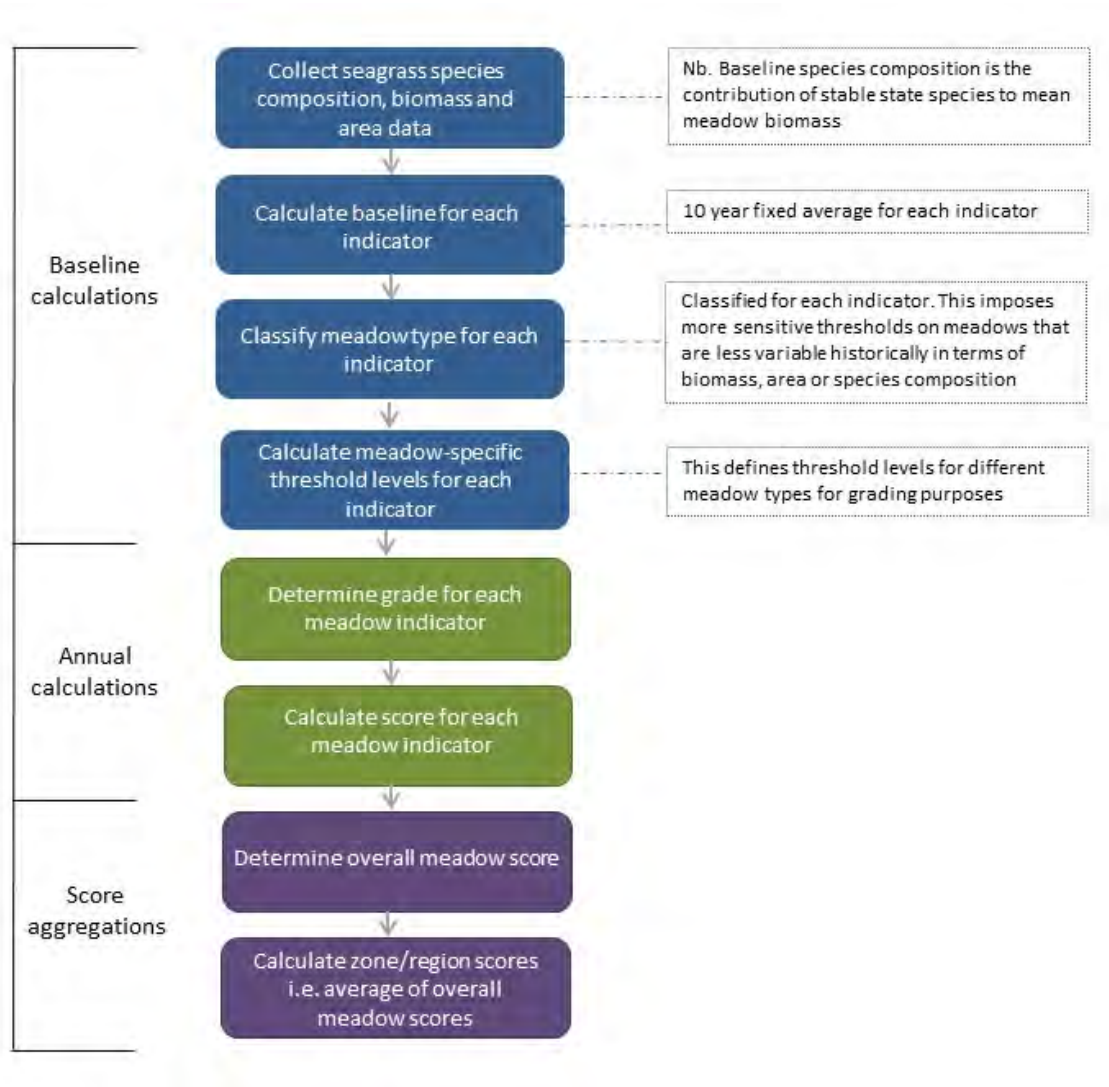


Figure 5. Process used to determine Karumba seagrass monitoring meadow condition grades and scores each year.

3 RESULTS

3.1 Seagrass Species

Seagrass was present at 102 of the 103 sites surveyed in the Alligator bank monitoring meadow in 2021 and at 36 of 41 sites surveyed on Elbow Bank. Two seagrass species were present in Karumba: *Halodule uninervis* (narrow leaf form) was the dominant species recorded and accounted for approximately 94% of above-ground seagrass biomass in the Alligator Bank Monitoring meadow, while *Halophila ovalis* accounted for the remaining 6%, (Figures 6 and 7). The Elbow Bank meadow was also dominated by *H. uninervis*, with this species accounting for approximately 69% of above-ground biomass, and *H. ovalis* accounting for 31%.

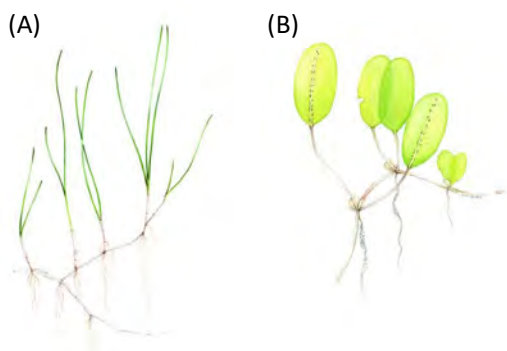


Figure 6. Seagrass species found in Karumba: (A) *Halodule uninervis*, Family Cymodoceaceae (narrow leaf form); (B) *Halophila ovalis*, Family Hydrocharitaceae.

3.2 Seagrass Condition in the Alligator Bank Monitoring Meadow

Seagrass in the Alligator Bank monitoring meadow was in a very good condition in 2021 (Table 3, Figure 7). The Alligator Bank meadow has recovered from the losses in biomass and area documented in the 2019 survey. Above-ground biomass increased from 3.8 ± 0.3 g DW m⁻² in 2020 to 6.8 ± 0.7 g DW m⁻² in 2021 and condition improved from good to very good (Table 3, Figure 7). Meadow area increased from 933 ± 9 ha in 2020 to 1324 ± 13 ha in 2021 and improved from satisfactory to very good condition (Table 3, Figures 7 and 8). Seagrass species composition has recovered from the lowest ever recorded score in 2020, to a very good score, with the meadow dominated by the more stable species *H. uninervis* in 2021.

Table 3. Grades and scores for seagrass indicators (biomass, area and species composition) for Karumba.

Meadow	Biomass	Area	Species Composition	Overall Meadow Condition
Alligator Bank	0.93	1	0.93	0.93

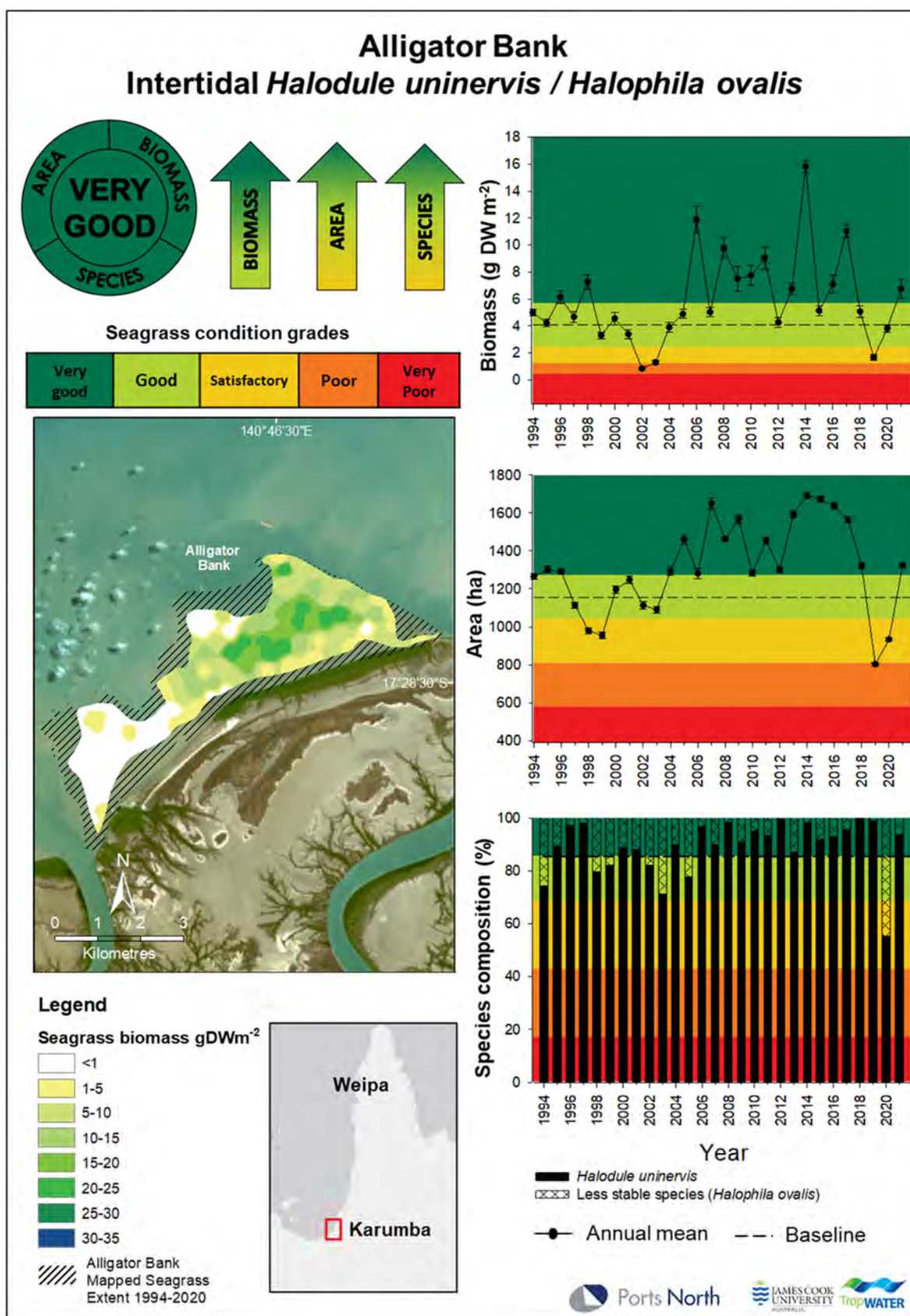


Figure 7. Changes in biomass, area and species composition for the Karumba seagrass monitoring meadow from 1994 to 2021 (biomass error bars = SE; area error bars = “R” reliability estimate).

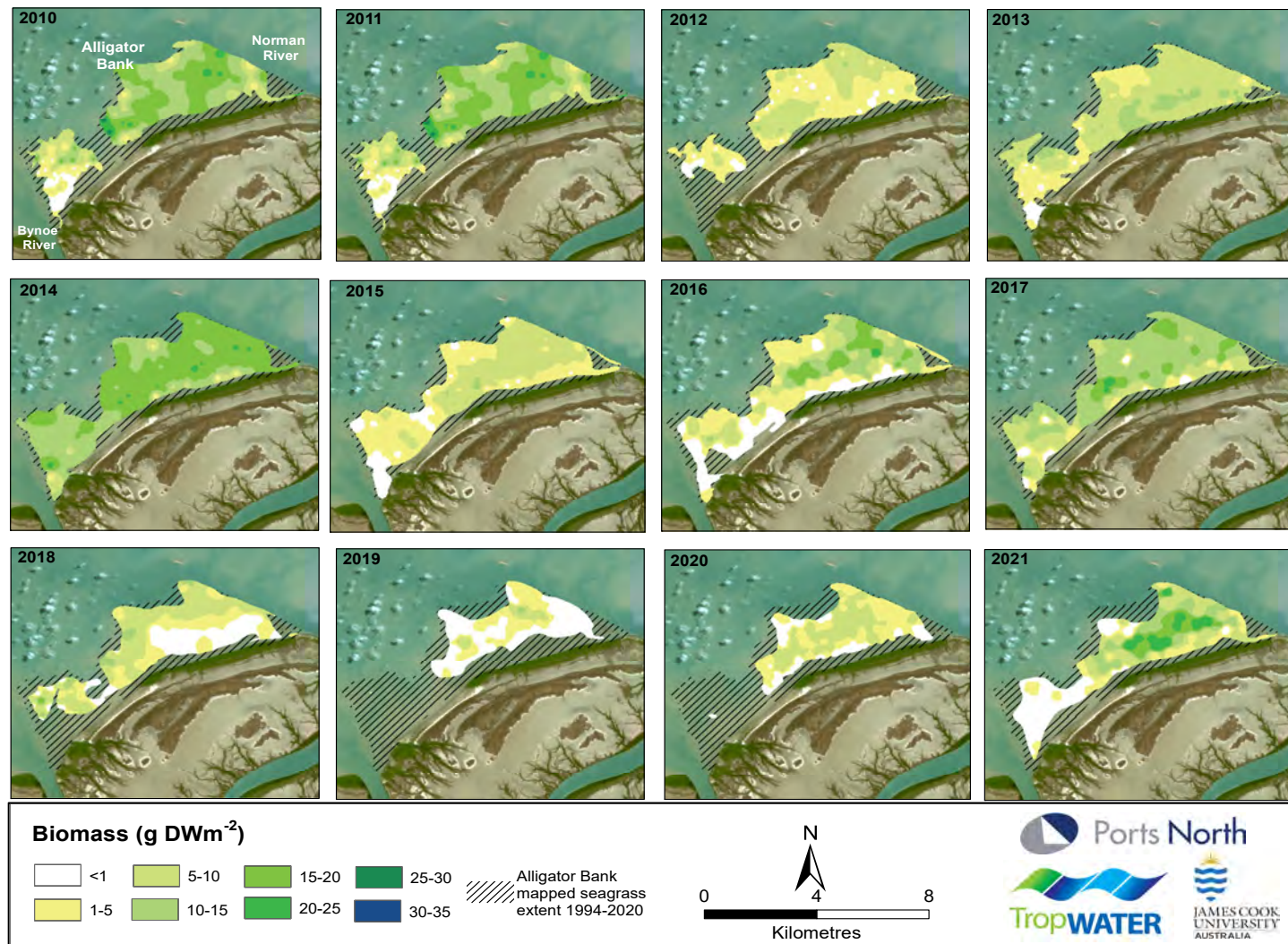


Figure 8. Biomass and area change in the Alligator Bank monitoring meadow, 2010 to 2021.

3.3 Seagrass in the broader Port of Karumba

In 2021 seagrasses in the broader Karumba port limits (beyond the Alligator Bank monitoring meadow) were surveyed. As in previous broader surveys; October 1994, October 1997, September 2015 and November 2018 (see Rasheed et al. 2001a, Sozou et al. 2016, Van de Wetering et al. 2018), large areas of intertidal seagrass were found (Figure 9).

A total of 41 habitat characterisation sites were assessed within the mapped boundary of the Elbow Bank seagrass meadow in 2021. Similar to previous surveys, *Halodule uninervis* and *Halophila ovalis* were the two species present and formed a large area of seagrass in several meadows across the bank, although in 2021 these meadows were less fragmented than in previous years.

Seagrass biomass on Elbow Bank in 2021 was 0.98 ± 0.37 g DW m⁻², which was lower than previously recorded values (Table 4). The area of seagrass on Elbow Bank in 2021 was the second highest recorded (Table 4).

Dugong feeding trails were recorded at 5% of sites on Elbow Bank (Figure 13) which is lower than the 36.4% recorded in 2018 and 33% recorded in 2015.

Table 4. Table of Area (ha) and Mean Biomass (g DW m⁻²) of Elbow Bank seagrass monitoring surveys 1994, 1997, 2015, 2018 & 2021.

Area (ha)				
1994	1997	2015	2018	2021
152	422	571	543	567
Mean Biomass \pm SE (g dw m ⁻²)				
3.36 ± 0.30	6.99 ± 0.46	2.36 ± 0.41	1.32 ± 0.19	0.98 ± 0.37

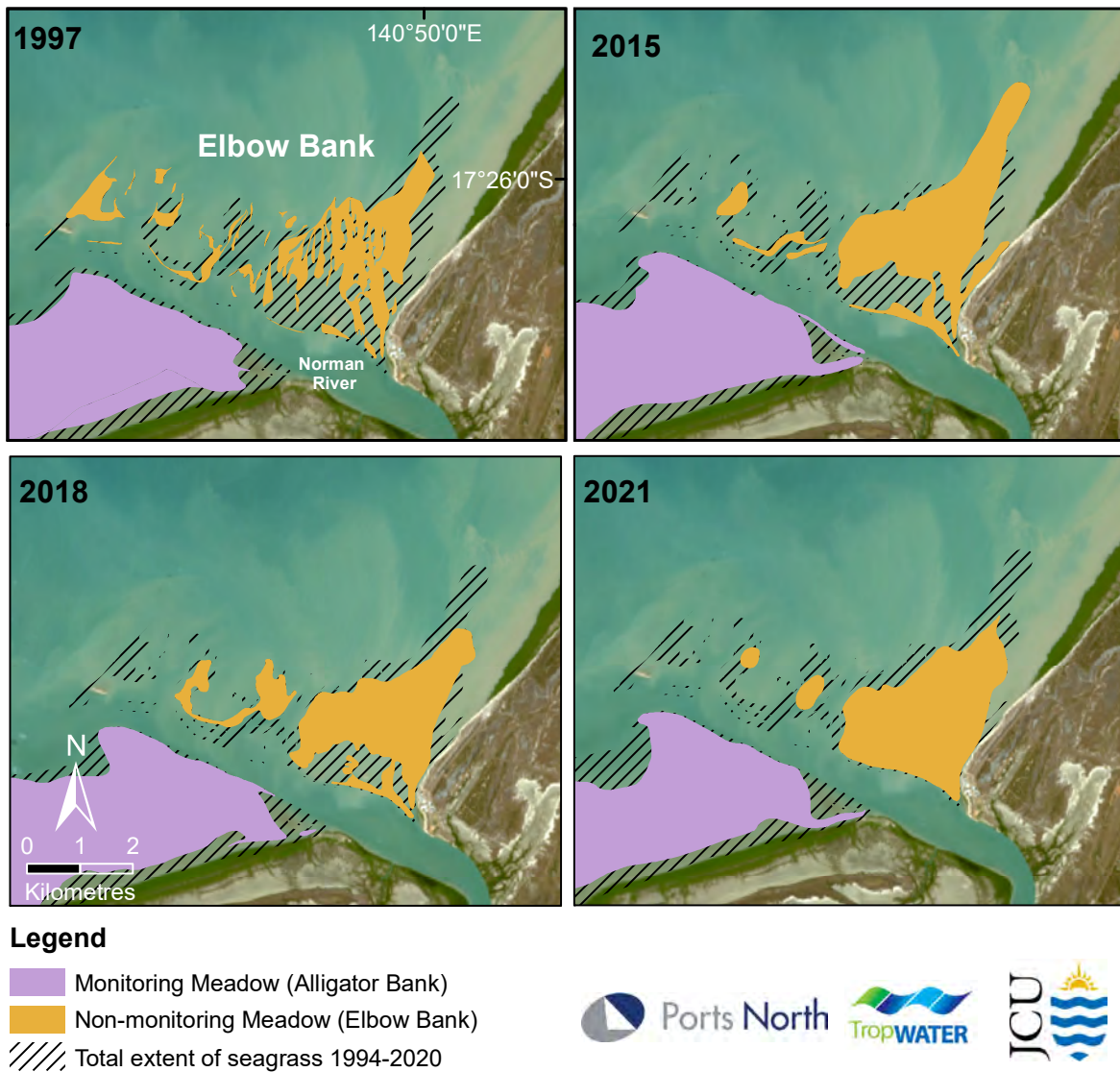


Figure 9. Comparative map of seagrass distribution on Elbow Bank for years 1997, 2015, 2018 and 2021.

3.4 Comparison with Previous Monitoring Surveys

Overall seagrass condition improved to very good in 2021 for the first time since 2017, continuing the trajectory of recovery from poor in 2019 and to satisfactory in 2020 (Table 3, Figure 7). This change in score was driven by improvements in seagrass biomass, area and species composition in the monitoring meadow. Above-ground biomass increased in 2021 and improved from good to very good. Area increased substantially in 2021 and improved from satisfactory to very good. Species composition increased from satisfactory to very good condition in 2021, reversing the condition declines seen in 2020.

Average meadow above-ground biomass increased by 3 g DW m⁻² from 2020 to 2021 (Figure 7). This trend continues the steady recovery in above-ground biomass also seen in 2020, from the low levels in 2019. Above-ground biomass condition in 2021 has returned to very good for the first time since 2017 (Figure 7). There is now a larger area of high biomass seagrass within the monitoring meadow, and multiple sites where biomass of over 20 g DW m⁻² was recorded (Figures 7 and 8).

Seagrass meadow area also improved substantially in 2021, with an over 70% increase compared to 2020. This increase resulted in an improvement in condition from satisfactory to very good, similar to above-ground biomass, the last time area at Karumba was very good was in 2017 (Figure 7). The meadow has once again expanded at the south-western end so that the overall footprint is similar to the historical area here, this is the first time the south western end of the meadow has been present since 2018 (Figure 8).

Seagrass species composition also improved to very good in 2021, from the lowest recorded score in 2020. The meadow was once again dominated by the more stable species *H. uninervis*, in 2021 this species made up 94% of biomass in the meadow (Figure 7). The proportion of *H. uninervis* in the meadow has doubled since the 2020 survey and the values are now more similar to those recorded in previous years.

3.5 Seagrass Reproductive Capacity

Halodule uninervis seeds and pericarps (outer casings of seeds) were found throughout the monitoring meadow in 2021 (Figure 10), with a mean density of 84 seeds m⁻² and 3 pericarps m⁻² across the meadow. As the 2019 survey used a different sampling method, these results cannot be directly compared, however other survey years used a Van Veen grab and can be compared to 2021. *Halodule uninervis* seed density varied significantly among years at the .05 level (Chi square=88, df=17, p=<0.001) when compared against the NULL model, post hoc analysis showed that in 2021 the number of seeds was significantly higher than in 2004 (p=<0.05), but did not differ from any other year (Figure 11A). *Halodule uninervis* pericarp density varied significantly among years at the .05 level (Chi square=152, df=17, p=<0.001) when compared against the NULL model, post hoc analysis showed that pericarp densities in 2021 were significantly lower than all other years apart from 2004-2007 (p=<0.05) (Figure 11A). Similar to previous years, there were no *H. uninervis* fruits or flowers found in the Alligator Bank meadow in 2021 (Figure 11B). There were an above average number of *H. ovalis* fruits in the meadow in 2021, and *H. ovalis* flowers were found here at one site for the first time since 2015 (Figures 10 and 11C).

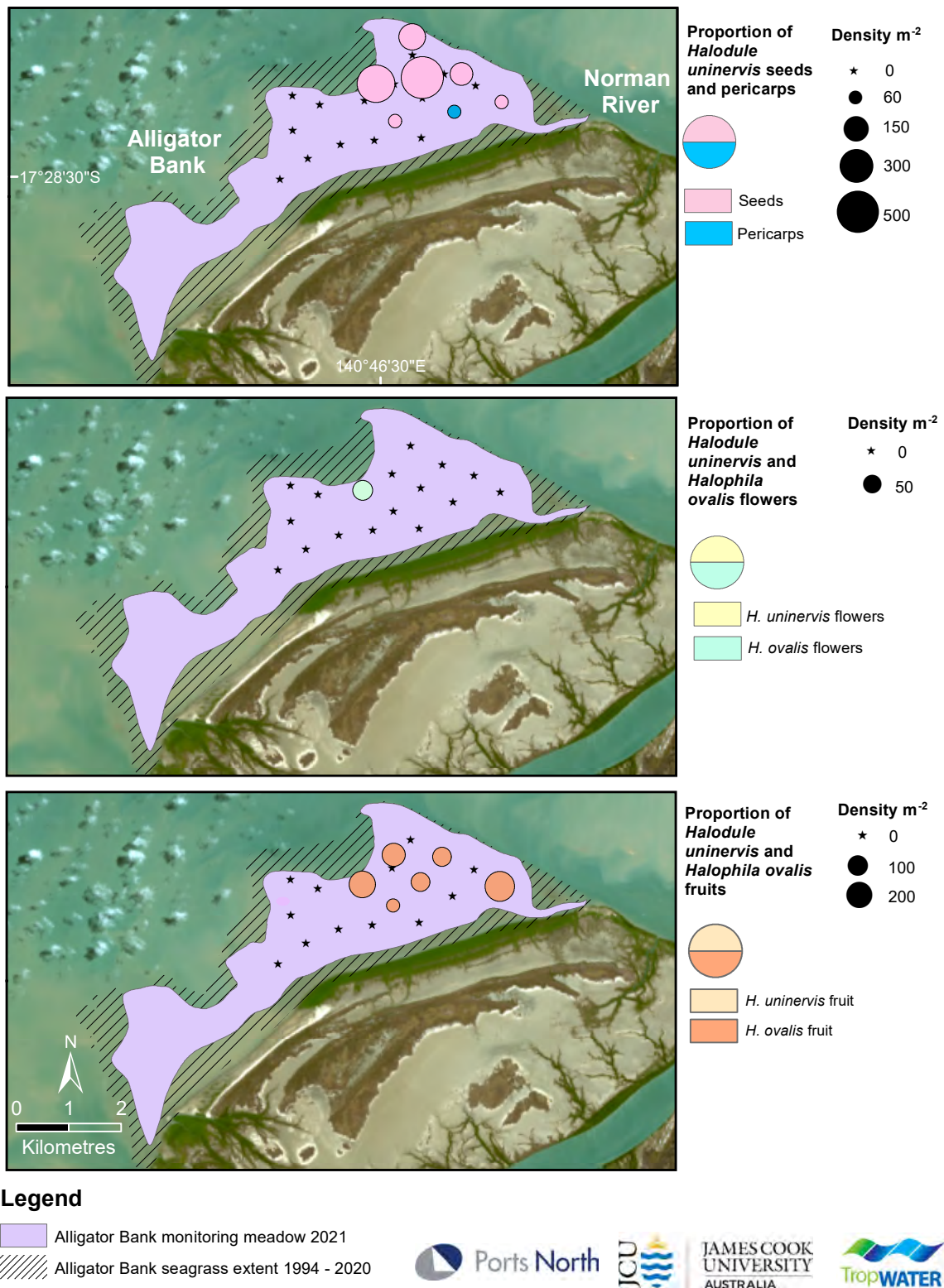


Figure 10. Density of *H. uninervis* seeds and pericarps, and *H. uninervis* and *H. ovalis* flowers and fruits in 2021.

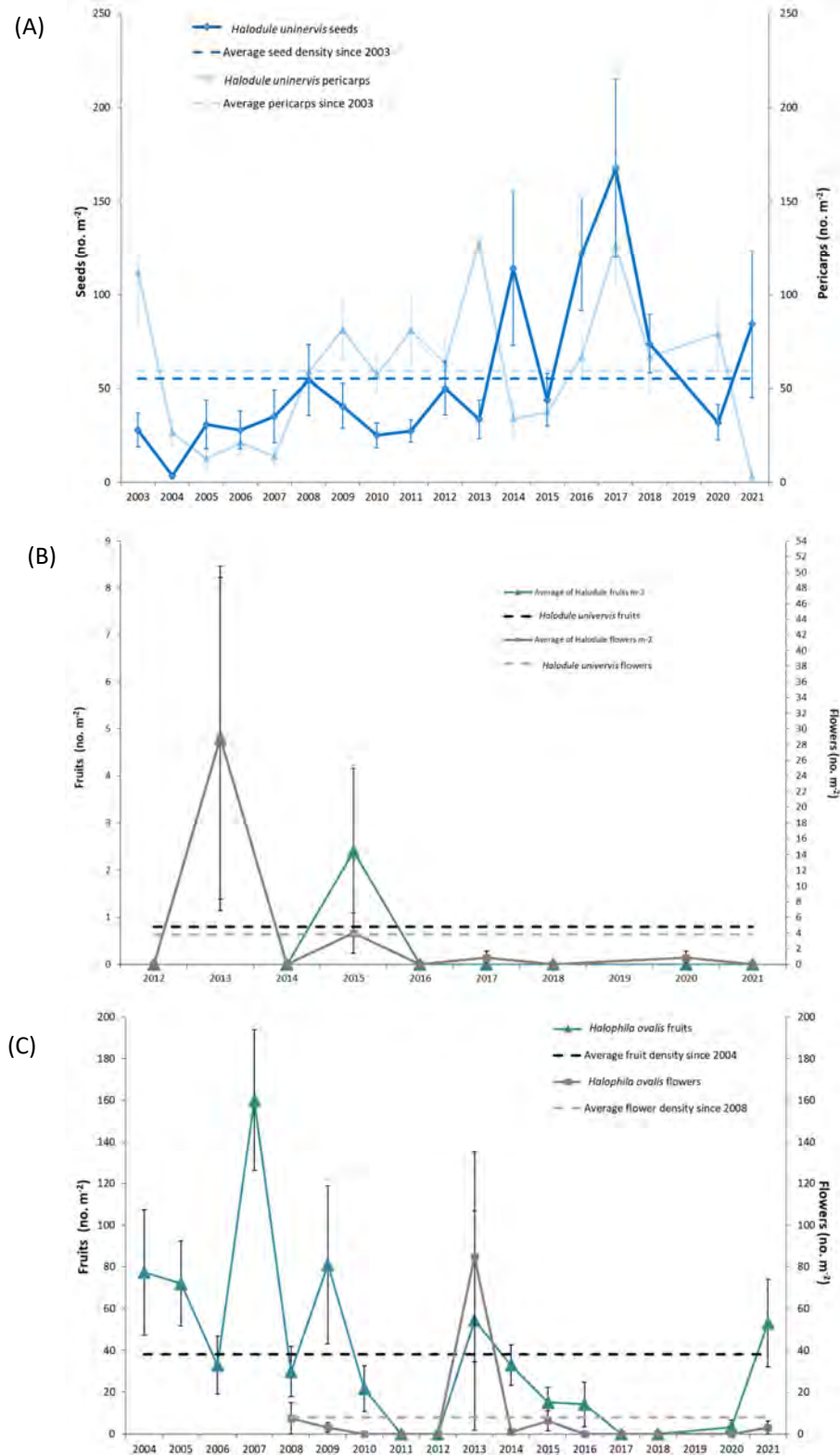


Figure 11. Mean density (± SE) of (A) *Halodule uninervis* seeds and pericarp pieces, (B) *H. uninervis* fruits and flowers, and (C) *Halophila ovalis* fruits sampled within the monitoring meadow. Data from 2019 have been excluded due to a different sampling method used.

3.6 Dugong Feeding Activity

Dugong feeding trails have been observed within seagrass meadows over the history of the Karumba monitoring program. Dugong feeding trails were observed at 29% of sites within the Alligator Bank monitoring meadow in 2021, compared to 52% in 2020, 9% in 2019 and 29% in 2018. Although this percentage is lower than previous years, the meadow area has been expanding over time. Feeding trails were particularly abundant on Alligator Bank (Figures 12 and 13).

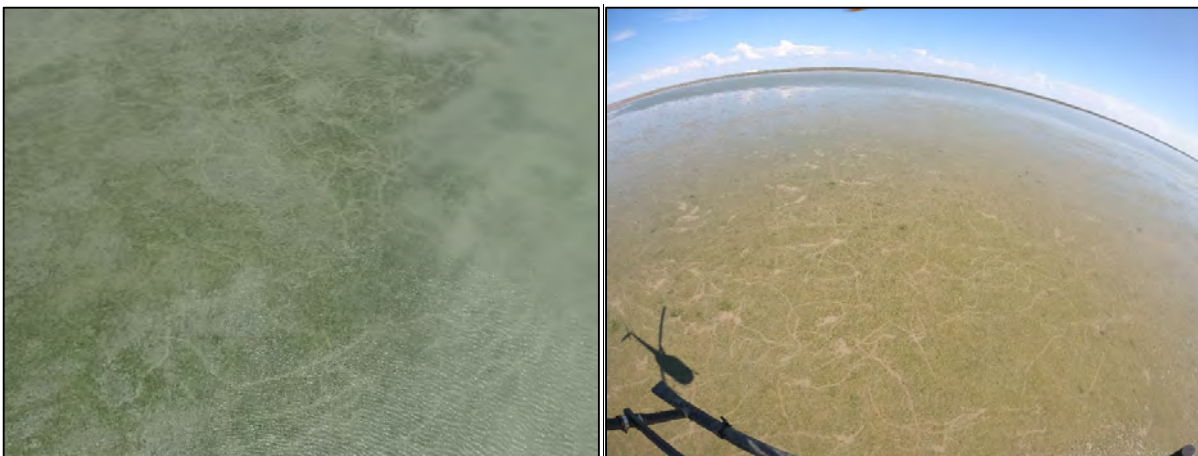


Figure 12. Dugong feeding trails in the Elbow Bank (left) and Alligator Bank (right) seagrass meadow in 2021.

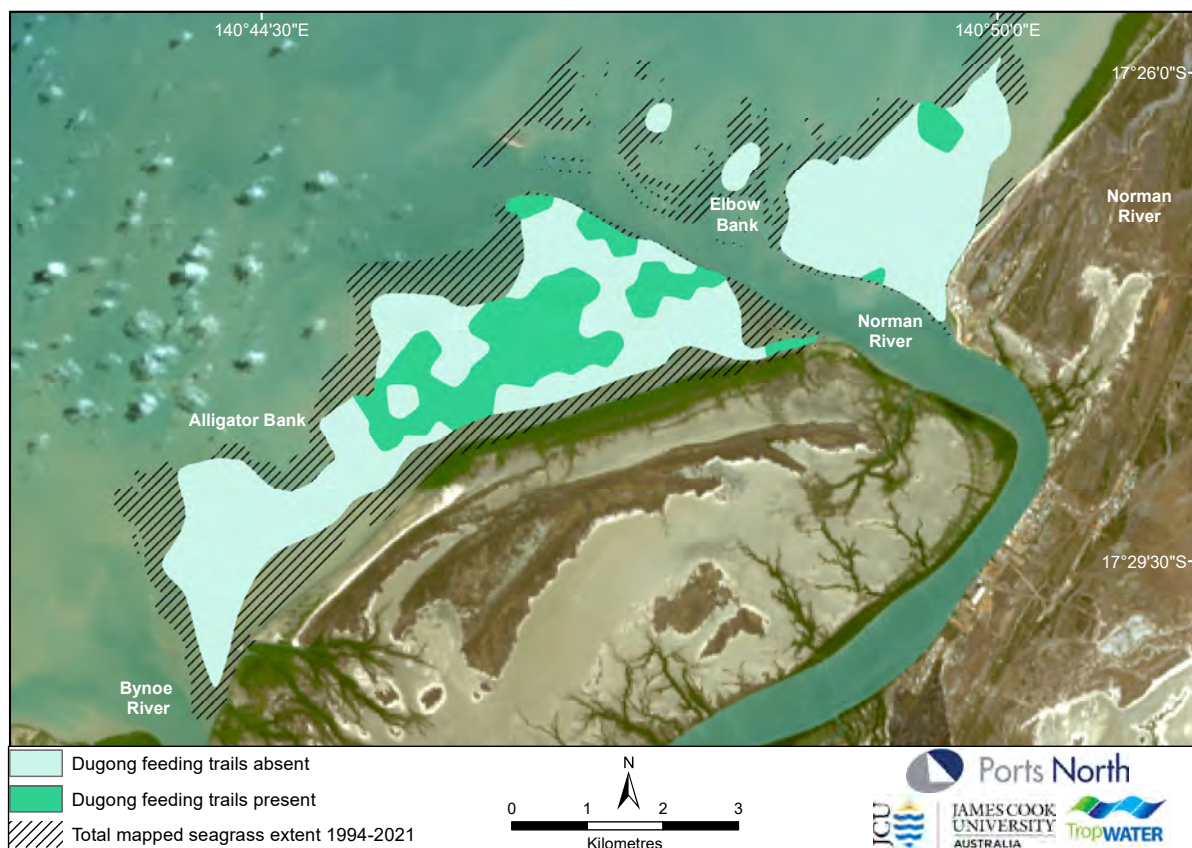


Figure 13. Location of dugong feeding trails within the Alligator Bank and Elbow Bank meadows in October 2021.

3.7 Karumba Environmental Conditions

3.7.1 Rainfall

Total annual rainfall for the Normanton area in the twelve months prior to the September 2021 survey was 785 mm. This was just below the average annual rainfall for the area (Figure 14), however, almost three quarters of this total (558 mm) occurred in January and February 2021 (Figure 15). During the survey month there was 6.2mm of rain, and only 4.2 mm fell in the three months leading up to the survey, all in August 2021 (Figure 15).

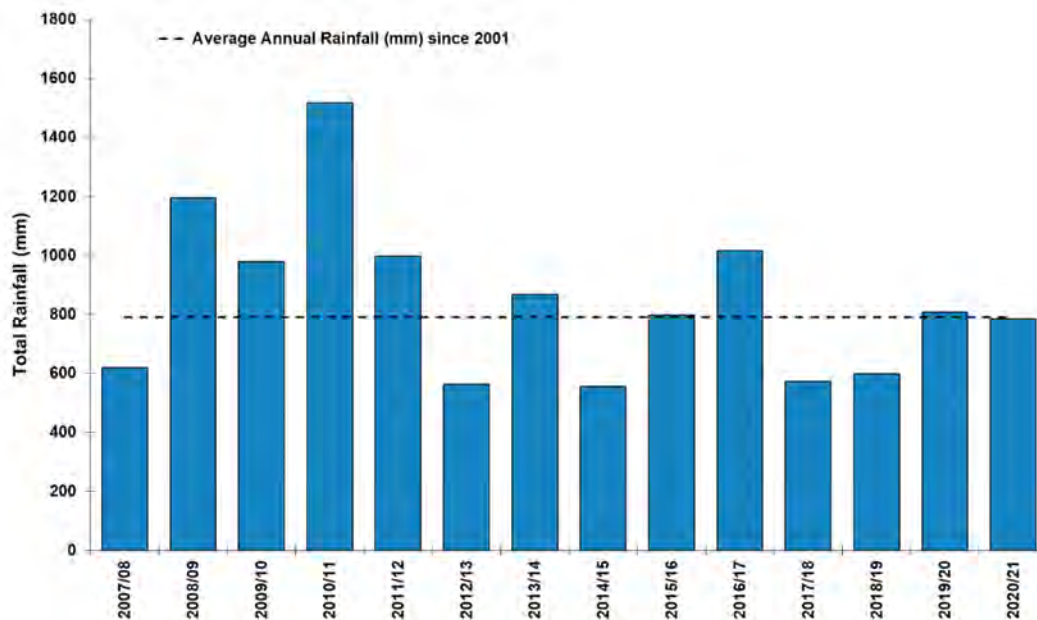


Figure 14. Total annual rainfall (mm) recorded at Normanton Airport, 2007/08 – 2020/21, in each 12 months prior to seagrass survey.

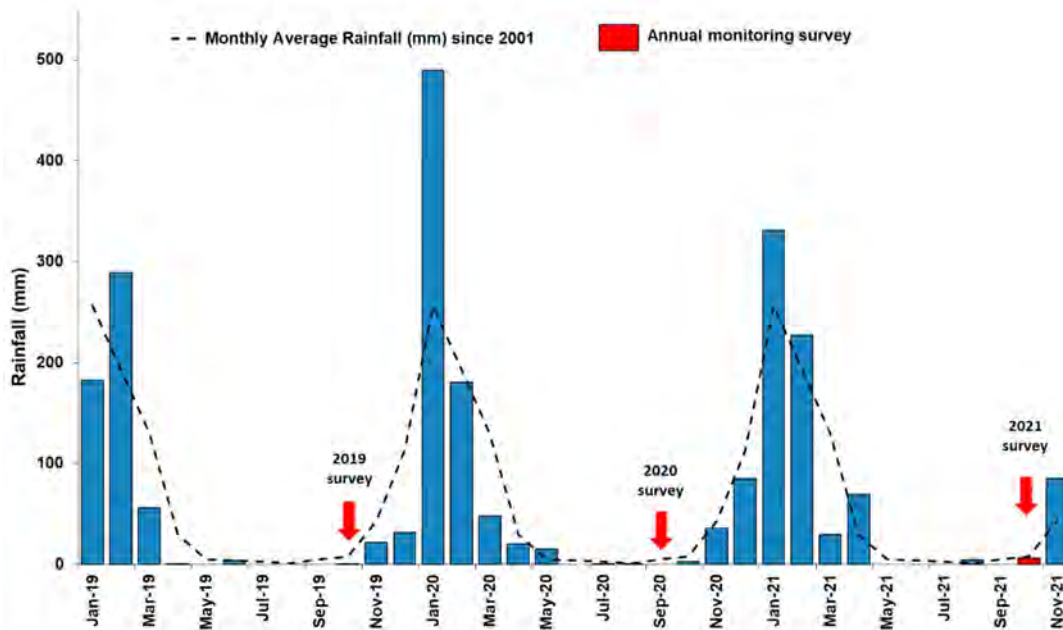


Figure 15. Total monthly rainfall (mm) recorded at Normanton Airport, January 2019 - November 2021.

3.7.2 River flow

Total annual river flow 12 months prior to the seagrass survey was 1181 GL, the majority of this flow (880GL) occurred in January 2021 (Figures 16 and 17). The total annual river flow was higher than 2019/20, but remained below the average (Figure 16).

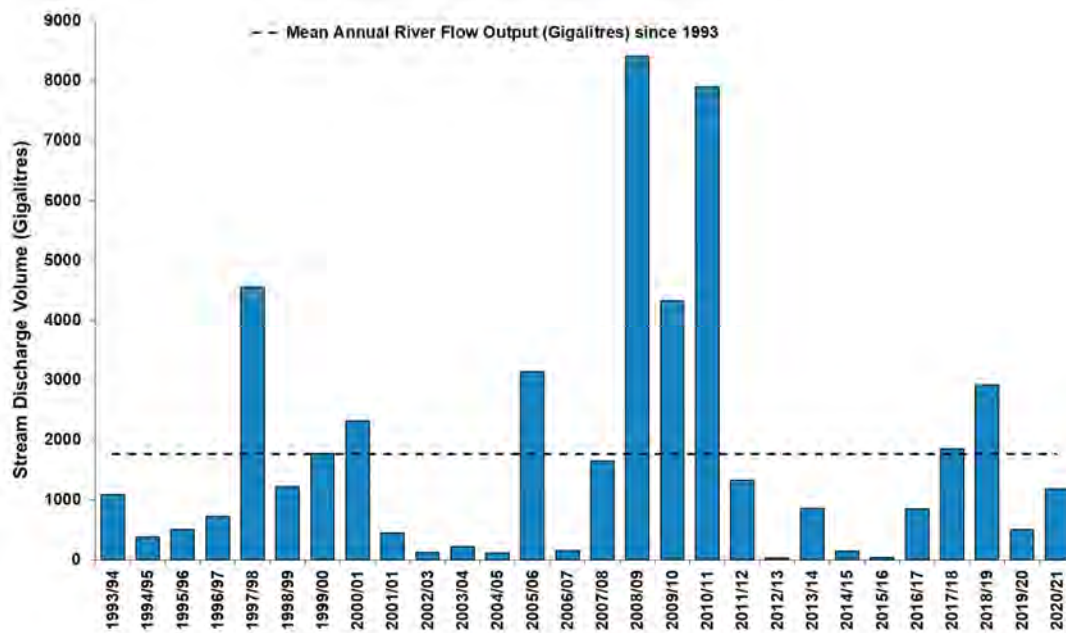


Figure 16. Total Norman River flow (measured as stream discharge volume in Gigalitres, GL) recorded at Glenore Weir, 1993/94 – 2020/21 twelve month year (2020/21) is twelve months prior to survey.

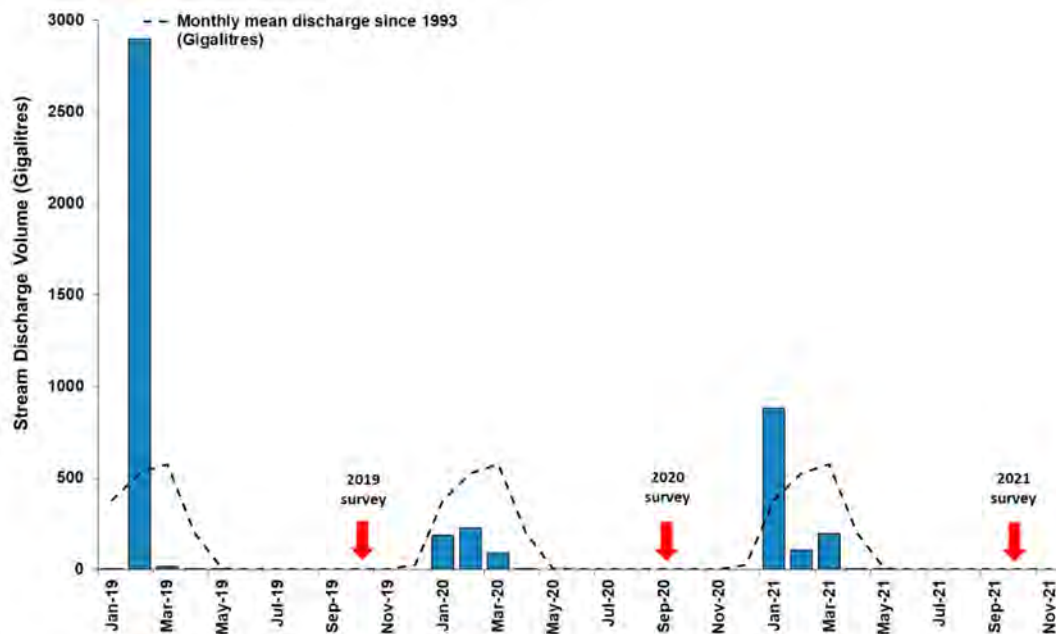


Figure 17. Total Norman River flow (measured as stream discharge volume in Gigalitres) recorded at Glenore Weir, January 2019 - November 2021.

3.7.3 Air Temperature

Air temperature was above-average in the region in 2020/21, with a mean annual daily maximum air temperature of 34.1°C (Figure 18). Monthly average maximum daily temperatures were close to the average for the year prior the survey, but above average in October 2021 (Figure 19).

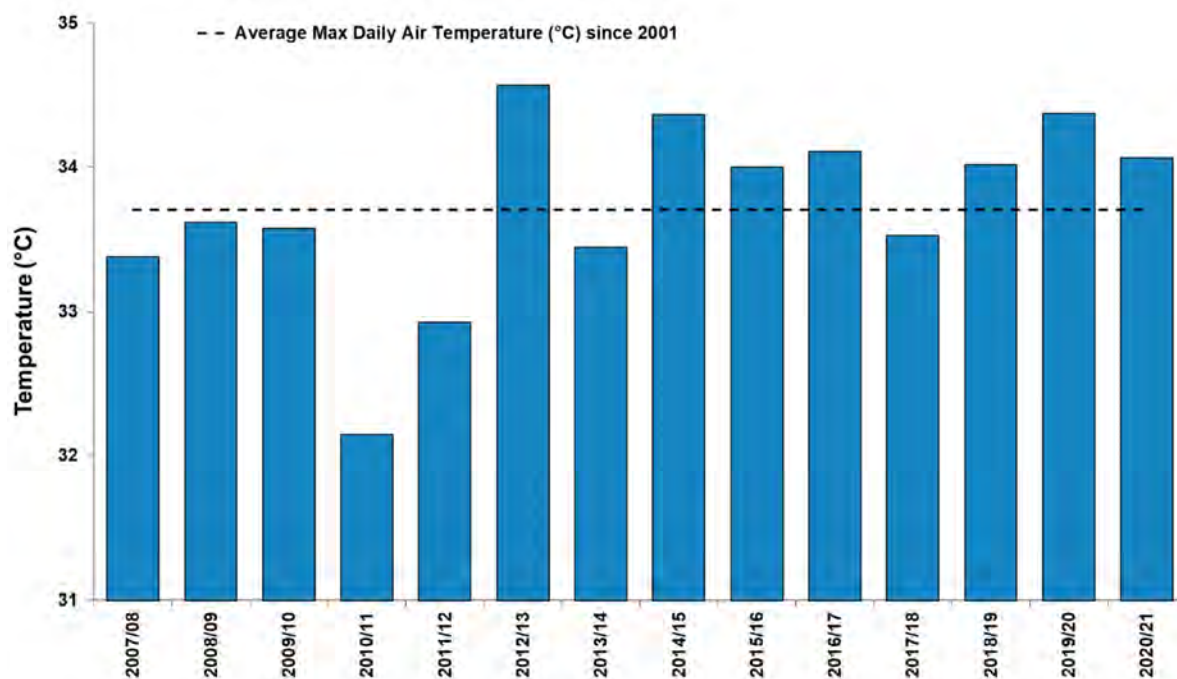


Figure 18. Mean maximum daily air temperature (°C) recorded at Normanton Airport, 2007/08 - 2020/21. Twelve month year (2020/21) is twelve months prior to survey.

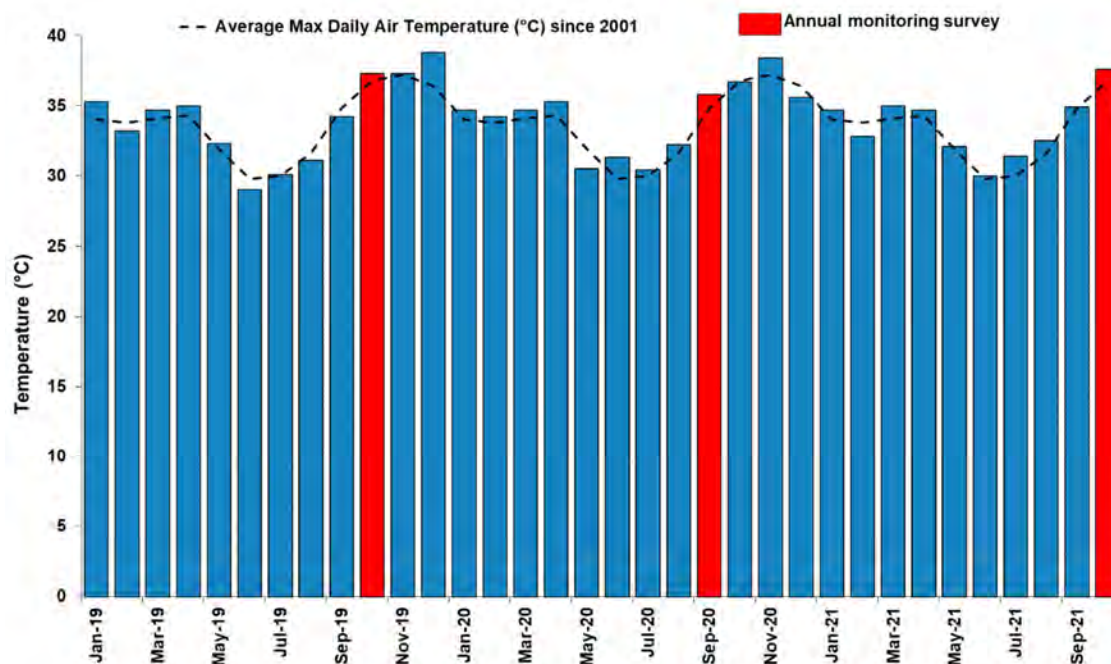


Figure 19. Monthly mean maximum daily air temperature (°C) recorded at Normanton Airport, January 2019 – October 2021.

3.7.4 Daily Global Solar Exposure

Daily global solar exposure is a measure of the total amount of solar energy falling on a horizontal surface in one day. Values are generally highest in clear sun conditions during spring/summer and lowest during winter. Global solar exposure in the Normanton area was slightly below-average in 2020/21 at 22.1 MJ m⁻² (MegaJoules m⁻²) (Figure 20), with solar exposure well above average in November 2020 and March 2021 (Figure 21).

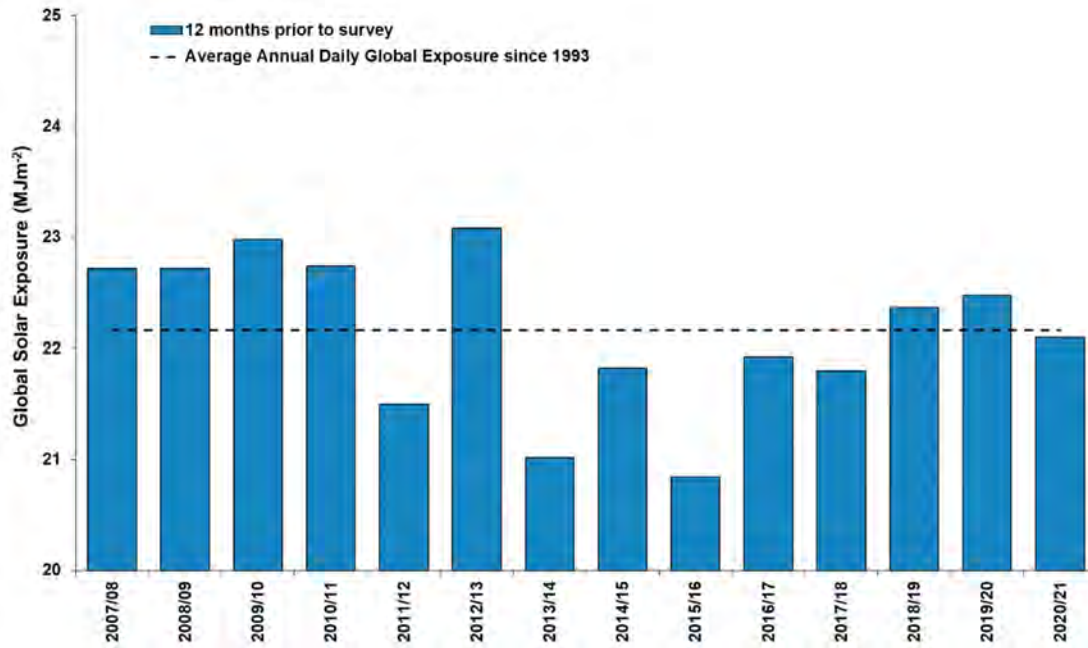


Figure 20. Mean daily global exposure (MegaJoules m⁻²) recorded at Normanton Airport, 2007/08 – 2020/21. Twelve month year (2020/21) is twelve months prior to survey.

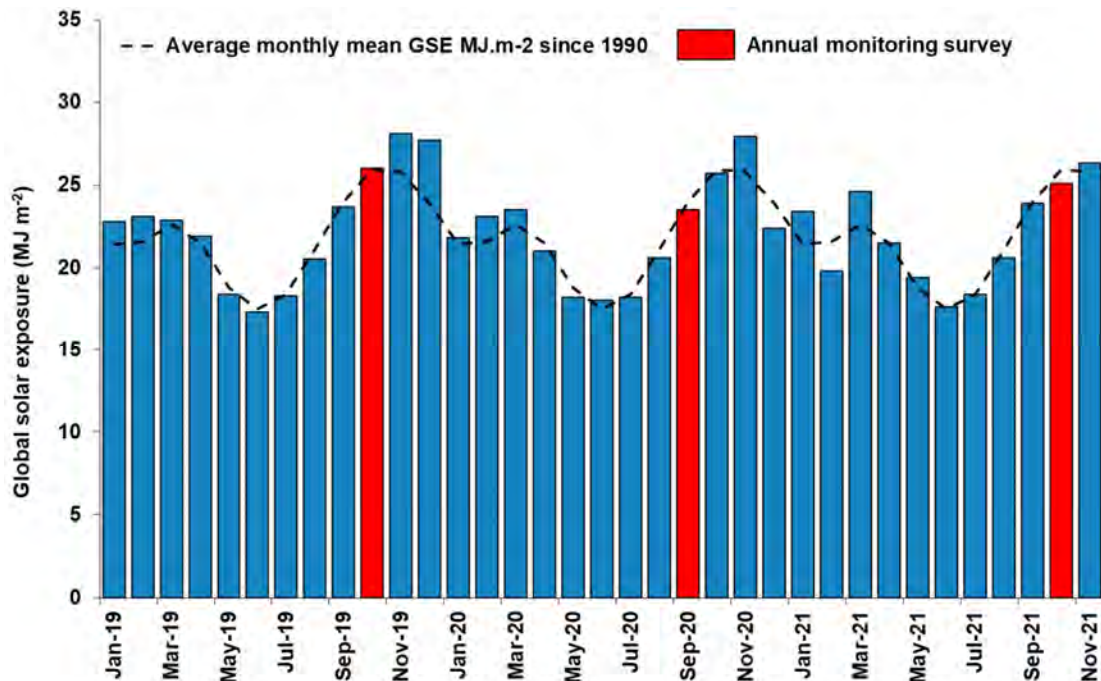


Figure 21. Mean daily global solar exposure (MegaJoules m⁻²) recorded at Normanton Airport, January 2019– November 2021.

3.7.5 Tidal Exposure of Seagrass Meadows

Annual daytime exposure to air for intertidal seagrass was well below-average in 2021 (Figure 22). Intertidal banks were exposed for a total of 81 hours in the 12 months prior to the survey (Figure 22). Monthly daytime exposure to air was also below-average in the year prior to the survey, with the exception of April 2021 (Figure 23).

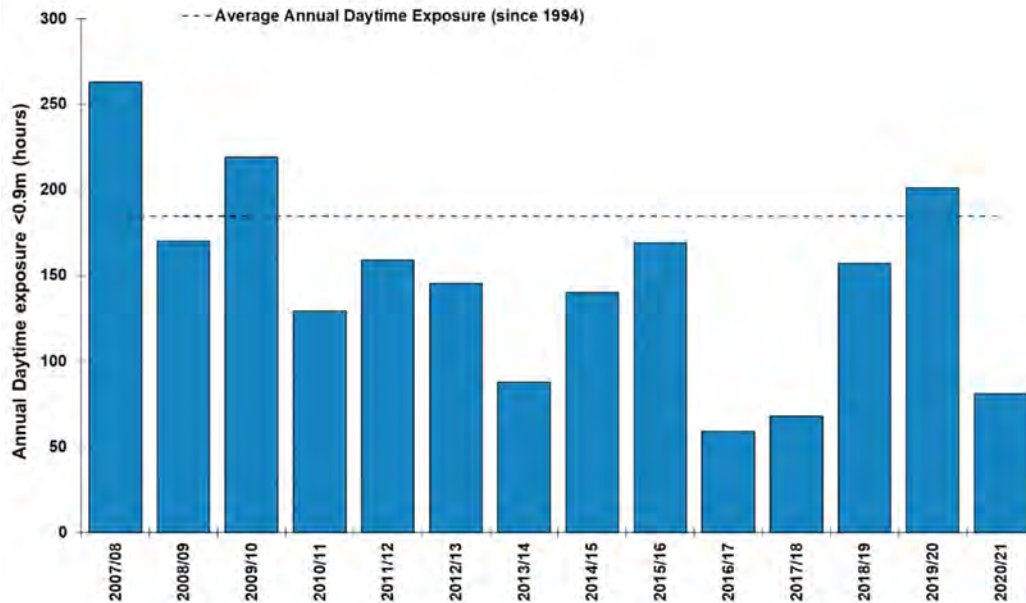


Figure 22. Total hours daytime exposure (annual) of intertidal seagrass in Karumba; 2007/08 – 2020/21. Twelve month year is twelve months prior to survey. *Assumes intertidal banks become exposed at a tide height <0.9m above Lowest Astronomical Tide.

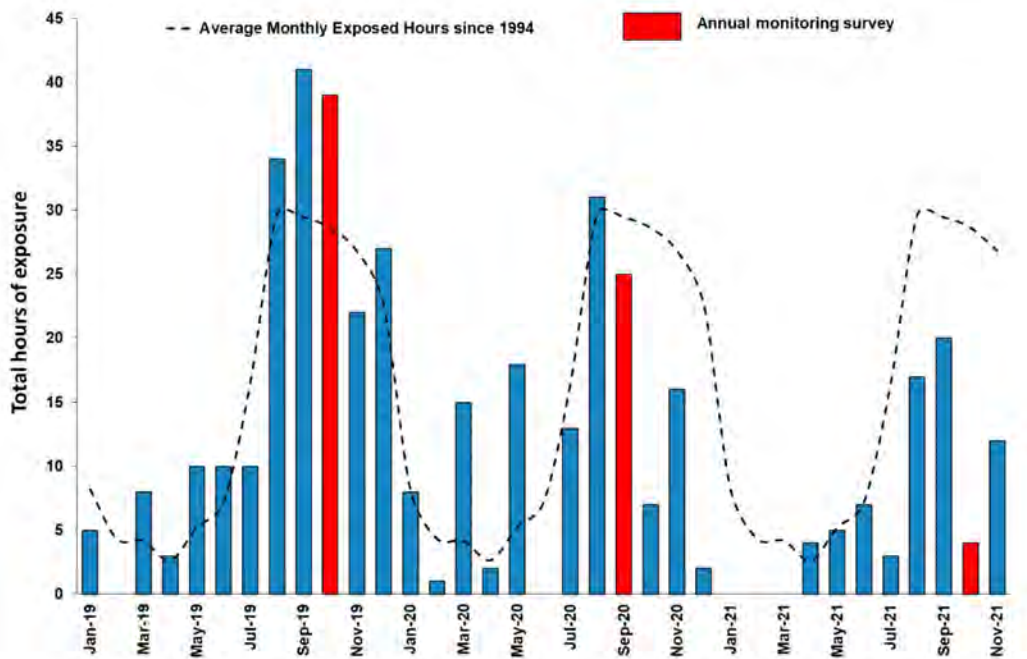


Figure 23. Total hours of daytime exposure (monthly), January 2019 to November 2021. *Assumes intertidal banks become exposed at a tide height <0.9m above Lowest Astronomical Tide.

4 DISCUSSION

In 2021 the Alligator Bank seagrass meadow had fully recovered from the flood related declines recorded in 2019. All seagrass indicators improved to give an overall score of very good, with dramatic improvements in both meadow area and species composition. Environmental conditions were favourable for seagrass growth, allowing significant recovery that was characterised by a high percentage of the usually dominant and more stable species *Halodule uninervis* returning to the meadow. The seed bank (seeds stored in the below ground sediments) was also replenished in 2021 following reductions in seed numbers in 2020, leading to increased meadow resilience.

The improvement in seagrass condition in Karumba comes after severe weather caused seagrass declines resulting in the poorest condition recorded in over a decade in 2019. Flooding of the Norman River in 2018/19 caused large-scale declines of seagrass biomass and area in Karumba. These flooding and flow events created a persistent turbid plume that reduced light levels and resulted in seagrass loss (Shepherd et al. 2020, Van De Wetering et al. 2019). In 2020, more favourable conditions allowed the meadow to begin to recover achieving a satisfactory condition. In 2021 conditions were once again favourable allowing recovery of the Alligator Bank seagrass meadow.

Environmental conditions were favourable for seagrass growth in 2021. River flow, temperature and long-term tidal exposure cycles have been identified in past research as strongly influencing changes in seagrass biomass and distribution in Karumba (Rasheed and Unsworth 2011) and in 2021 these were all at levels considered to be favourable for seagrass growth. The only extreme weather was on 4th January 2021 when Tropical Cyclone Imogen crossed the coast just north of Karumba, with 263 mm of rain falling in one day causing flooding and high river flow rates for much of January. This resulted in above average rainfall and river flow for January 2021, however this event was less severe than previous years, and did not cause sustained flooding or a persistent turbid plume, so it does not appear to have had a long-term impact on seagrass recovery.

Recovery of the seagrass meadow at Karumba has taken two years with largely favourable environmental conditions. This meadow has previously recovered from smaller scale losses by the year following the disturbance (McKenna and Rasheed 2013, Taylor et al. 2014), however the cumulative and severe flooding of 2018 and 2019 caused a sudden and dramatic decline in seagrass condition at a scale not previously recorded. Maintenance of the very good condition of the seagrass meadow will depend on favourable conditions remaining, but the recovery means that the meadow is likely to be more resilient in the face of any short-term weather events. The Alligator Bank meadow was in a good or very good condition from 2004 to 2017, maintaining this score even in high rainfall years, showing it can be resilient in years of higher rainfall and river flow if area and biomass are high as they are in 2021.

In 2021 there was a dramatic improvement in the species composition score in Karumba, with a shift towards the more stable species *H. uninervis*, which made up 94% of seagrass biomass. This is an improvement from 2020, where the colonising species *H. ovalis* made up 45% of seagrass biomass in the meadow, this was the highest proportion in the 27-year history of sampling at Karumba. In tropical Queensland and elsewhere *Halophila* species are often the first to return following disturbance events, where they persist at higher densities until the recovery of larger slower growing species occurs (Rasheed 2004). The meadow at Karumba has now shifted away from this colonising species and is dominated by the more stable species *H. uninervis*, this is an important feature of a healthy and resilient seagrass meadow (Unsworth et al. 2015).

In 2021 seagrasses in the broader port limits of Karumba were also surveyed, including the meadow on Elbow Bank. This area was last surveyed in 2018 prior to the most serious flooding and flow events which caused declines in the Alligator Bank meadow. It is likely this meadow was also impacted by flooding in 2018, and particularly 2019, and may still be recovering. Although meadow area was the second highest recorded at Elbow Bank in 2021, seagrass biomass was the lowest recorded and there was a high percentage of colonising *H. ovalis* present in the meadow. The Elbow Bank meadow appears to be recovering at a slower rate than the meadow on Alligator Bank, this may be due to its smaller size and often more fragmented nature. Fragmented meadows may be less resilient and can take longer to recover from disturbance (Unsworth et al. 2015), however favourable environmental conditions should allow increases in biomass of *H. uninervis* in this meadow similar to those seen on the Alligator Bank meadow.

Seed densities in the Karumba Alligator Bank monitoring meadow increased in 2021 and were above average, whereas numbers of pericarps were very low. This was a shift from 2020 where there were high numbers of pericarps but low numbers of seeds. This shift suggests that in 2020 seeds in the seed bank were germinating to help drive recovery, whereas in 2021 the seed bank was replenished and fewer seeds were germinating. A similar pattern in seed numbers was observed in Cairns Harbour following seagrass declines caused by climatic conditions, and the seagrass meadows there also recovered over time and a viable seed bank returned (Reason et al. 2020).

Seagrasses provide a wide range of important ecosystem services and the recovery of meadow area and biomass in Karumba will likely increase the delivery of a range of services (Nordlund et al. 2016, Scott et al. 2018). For example, Karumba seagrasses are an important nursery ground for prawns and fish (Rasheed et al. 1996) and feeding ground for megaherbivores such as dugong. Seagrass biomass, area and a stable species mix are all important for the delivery of these ecosystem services.

The seagrass at Karumba is the only substantial area of seagrass for dugong feeding between Mornington Island and the Archer River in the southern Gulf of Carpentaria (Rasheed et al. 1996). Although dugong feeding activity was observed at fewer sites in 2021 than in 2020, the meadow area was much larger in 2021, and also included some lower biomass areas at the south western end. The higher biomass area of the Alligator Bank meadow remains an important feeding area for dugongs. Megaherbivore feeding activity can maintain the meadow in a lower biomass state, but could also have positive impacts for the meadow such as increasing seagrass productivity and spreading seeds (Scott et al. 2018, Tol et al. 2017).

In 2021 seagrass condition in the Karumba seagrass meadow had recovered with an improvement in all seagrass metrics, and replenishment of the seed bank. These improvements are very encouraging and have resulted in a meadow score of very good. Favourable environmental conditions should allow seagrass to be maintained in very good condition. The high biomass, area and healthy seed bank recorded in 2021 also means that the meadow is likely to have good levels of resilience, and a capacity to recover from future weather related or anthropogenic impacts during 2022.

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6 APPENDICES

Appendix 1. Seagrass Score Calculation

A1.1 Baseline Calculations

Baseline conditions for seagrass biomass, meadow area and species composition were established from annual means calculated over the first 10 years of monitoring (1994-2003) following the methods of Carter et al. (2015) and Bryant et al. (2014). The 1994-2003 period incorporates a range of conditions present in the Port of Karumba, including El Niño and La Niña periods, and multiple extreme rainfall and river flow events (Sozou et al. 2016).

Baseline conditions for species composition were determined based on the annual percent contribution of each species to mean meadow biomass of the baseline years. The meadow was classified as either single species dominated (one species comprising $\geq 80\%$ of baseline species), or mixed species (all species comprise $< 80\%$ of baseline species composition). Where a meadow baseline contained an approximately equal split in two dominant species (i.e. both species accounted for 40–60% of the baseline), the baseline was set according to the percent composition of the more persistent/stable species of the two (see Section A1.4 Grade and Score Calculations and Figure A1.1).

A1.2 Meadow Classification

A meadow classification system was developed for the three condition indicators (biomass, area, species composition) in recognition that for some seagrass meadows these measures are historically stable, while in other meadows they are relatively variable. The coefficient of variation (CV) for each baseline for each meadow was used to determine historical variability. Meadow biomass and species composition were classified as either stable or variable (Table A1.1). Meadow area was classified as either highly stable, stable, variable, or highly variable (Table A1.1). The CV was calculated by dividing the standard deviation of the baseline years by the baseline for each condition indicator.



Table A1.1 Coefficient of variation (CV; %) thresholds used to classify historical stability or variability of meadow biomass, area and species composition.

Indicator	Class			
	Highly stable	Stable	Variable	Highly variable
Biomass	-	$< 40\%$	$\geq 40\%$	-
Area	$< 10\%$	$\geq 10, < 40\%$	$\geq 40, < 80\%$	$\geq 80\%$
Species composition	-	$< 40\%$	$\geq 40\%$	-

A1.3 Threshold Definition

Seagrass condition for each indicator was assigned one of five grades (very good (A), good (B), satisfactory (C), poor (D), very poor (E)). Threshold levels for each grade were set relative to the baseline and based on meadow class. This approach accounted for historical variability within the monitoring meadows and expert knowledge of the different meadow types and assemblages in the region (Table A1.2).

Table A1.2. Threshold levels for grading seagrass indicators for various meadow classes relative to the baseline. Upwards/ downwards arrows are included where a change in condition has occurred in any of the three condition indicators (biomass, area, species composition) from the previous year.

Seagrass condition indicators/ Meadow class		Seagrass grade				
		A Very good	B Good	C Satisfactory	D Poor	E Very Poor
Biomass	Stable	>20% above	20% above - 20% below	20-50% below	50-80% below	>80% below
	Variable	>40% above	40% above - 40% below	40-70% below	70-90% below	>90% below
Area	Highly stable	>5% above	5% above - 10% below	10-20% below	20-40% below	>40% below
	Stable	>10% above	10% above - 10% below	10-30% below	30-50% below	>50% below
	Variable	>20% above	20% above - 20% below	20-50% below	50-80% below	>80% below
	Highly variable	> 40% above	40% above - 40% below	40-70% below	70-90% below	>90% below
Species composition	Stable and variable; Single species dominated	>0% above	0-20% below	20-50% below	50-80% below	>80% below
	Stable; Mixed species	>20% above	20% above - 20% below	20-50% below	50-80% below	>80% below
	Variable; Mixed species	>20% above	20% above- 40% below	40-70% below	70-90% below	>90% below
		<div> <div>Increase above threshold from previous year</div> <div>  </div> <div>Decrease below threshold from previous year</div> <div>  </div> </div>				

A1.4 Grade and Score Calculations

A score system (0–1) and score range was applied to each grade to allow numerical comparisons of seagrass condition (see Carter et al. 2015 for a detailed description, and Table A1.3).

Score calculations for each meadow's condition required calculating the biomass, area and species composition for that year (see Baseline Calculations section), allocating a grade for each indicator by comparing the current year's values against meadow-specific thresholds for each grade, then scaling biomass, area and species composition values against the prescribed score range for that grade.

Scaling was required because the score range in each grade was not equal (Table A1.3). Within each meadow, the upper limit for the very good grade (score = 1) for species composition was set as 100% (as a species could never account for >100% of species composition). For biomass and area, the upper limit was set as the maximum mean plus standard error (SE; i.e. the top of the error bar) value for a given year, compared among years during the baseline period.

An example of calculating a meadow score for biomass in satisfactory condition is provided in Appendix 2.

Table A1.3. Score range and grading colours used in the Karumba seagrass report card.

Grade	Description	Score Range	
		Lower bound	Upper bound
A	Very good	≥ 0.85	1.00
B	Good	≥ 0.65	< 0.85
C	Satisfactory	≥ 0.50	< 0.65
D	Poor	≥ 0.25	< 0.50
E	Very poor	0.00	< 0.25

Where species composition was determined to be anything less than “perfect” condition (i.e. a score < 1), a decision tree was used to determine whether equivalent and/or more persistent species were driving this grade/score (Figure A1.1). If this was the case then the species composition score and grade for that year was recalculated including those species. Concern regarding any decline in the stable state species should be reserved for those meadows where the directional change from the stable state species is of concern (Figure A1.1). This would occur when the stable state species is replaced by species considered to be earlier colonisers.

Such a shift indicates a decline in meadow stability (e.g. a shift from *H. uninervis* to *H. ovalis*). An alternate scenario can occur where the stable state species is replaced by what is considered an equivalent species (e.g. shifts between *C. rotundata* and *C. serrulata*), or replaced by a species indicative of an improvement in meadow stability (e.g. a shift from *H. decipiens* to *H. uninervis* or any other species).

The directional change assessment was based largely on dominant traits of colonising, opportunistic and persistent seagrass genera described by Kilminster et al. (2015). Adjustments to the Kilminster model included: (1) positioning *S. isoetifolium* further towards the colonising species end of the list, as successional studies following disturbance demonstrate this is an early coloniser in Queensland seagrass meadows (Rasheed 2004); and (2) separating and ordering the *Halophila* genera by species. Shifts between *Halophila* species are ecologically relevant; for example, a shift from *H. ovalis* to *H. decipiens* may indicate declines in water quality and available light for seagrass growth as *H. decipiens* has a lower light requirement (Collier et al. 2016) (Figure A1.1).

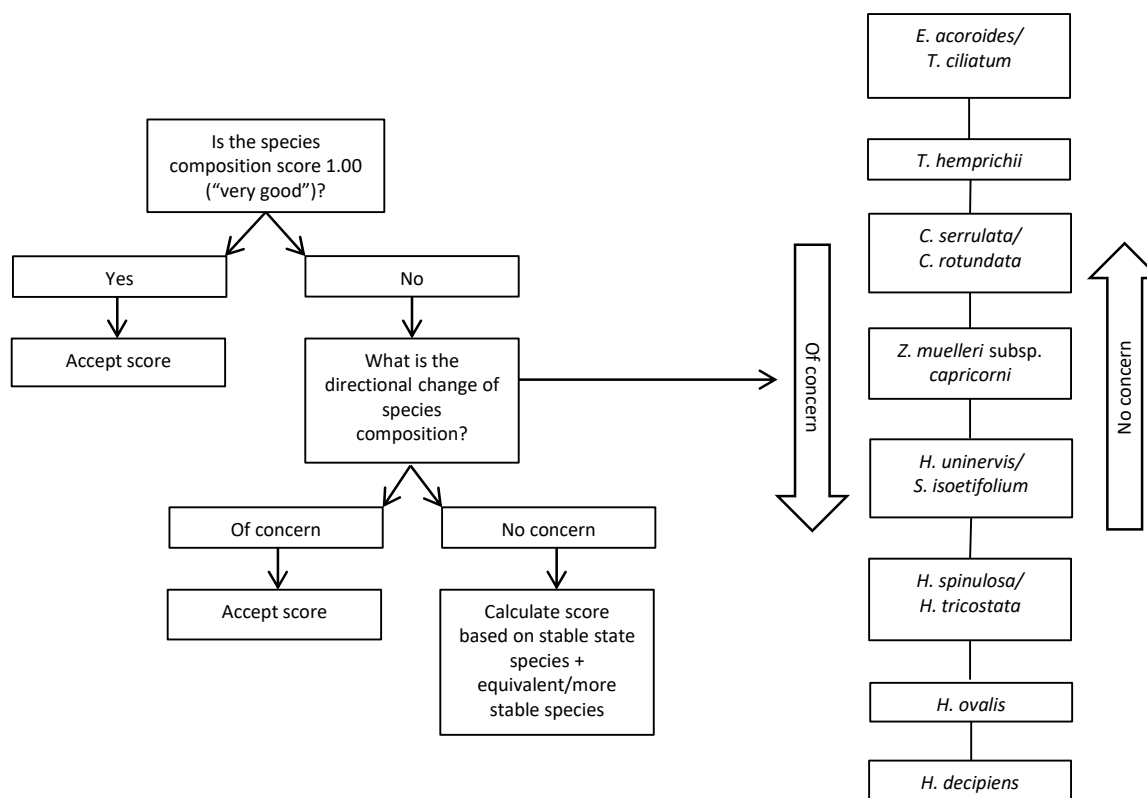


Figure A1.1. (a) Decision tree and (b) directional change assessment for grading and scoring species composition for Karumba seagrass.

A1.5 Score Aggregation

Each overall meadow grade/score was defined as the lowest grade/score of the three condition indicators within that meadow. The lowest score, rather than the mean of the three indicator scores, was applied in recognition that a poor grade for any one of the three described a seagrass meadow in poor condition. Maintenance of each of these three fundamental characteristics of a seagrass meadow is required to describe a healthy meadow. This method allowed the most conservative estimate of meadow condition to be made (Bryant et al. 2014). In cases where species composition was the lowest score, an average of both the species composition score and the next lowest score is used to determine the overall meadow score. This is to prevent a case where a meadow may have a spatial footprint and seagrass biomass but a score of zero due to changes in species composition.

Appendix 2. Biomass score calculation example

1. Determine the grade for the 2015 (current) biomass value (i.e. good).
2. Calculate the difference in biomass (B_{diff}) between the 2015 biomass value (B_{2015}) and the biomass value of the lower threshold boundary for the “good” grade (B_{good}):

$$B_{diff} = B_{2015} - B_{good}$$

Where B_{good} or any other threshold boundary will differ for each condition indicator depending on the baseline value, meadow class (stable, variable, highly variable [area only]), and whether the meadow is dominated by a single species or mixed species (species composition calculations only).

3. Calculate the range for biomass values (B_{range}) in that grade:

$$B_{range} = B_{very\ good} - B_{good}$$

Where B_{good} is the upper threshold boundary for the good grade.

Note: For species composition, the upper limit for the very good grade is set as 100%. For area and biomass, the upper limit for the very good grade is set as the mean plus the standard error (i.e. the top of the error bar) for the maximum recorded mean annual value for that indicator and meadow.

4. Calculate the proportion of the good grade (B_{prop}) that B_{2015} takes up:

$$B_{prop} = \frac{B_{diff}}{B_{range}}$$

5. Determine the biomass score for 2015 ($Score_{2015}$) by scaling B_{prop} against the score range (SR) for the good grade (SR_{good}), i.e. 0.20 units (see Table 6):

$$Score_{2015} = LB_{good} + (B_{prop} \times SR_{good})$$

Where LB_{good} is the defined lower bound (LB) score threshold for the good grade, i.e. 0.65 units.

Appendix 7 CSIRO Advice Statement 2010

Appendix 8

Port of Karumba LT MMP

Environmental Management Plan for a Trailing Suction Hopper Dredge (TSHD) Dredging Campaign

Template for Inclusion in
Long Term Management and Monitoring Plan (LT MMP)

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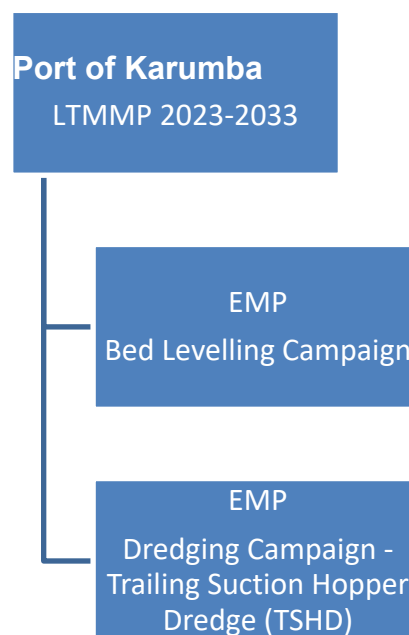
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1 Scope

As a sub-ordinate document to the approved Long Term Management and Monitoring Plan (LTMMP), this Environmental Management Plan (EMP) shall form the template to which appointed contractors shall follow, or in the scenario where the dredging contractor has their own EMP, be the approved benchmark to which Ports North will determine if it meets and exceeds the following management arrangements.

Conditions of the dredging contract will include a requirement for the Contractor to follow the approved EMP, the LTMMP and any corresponding Approval conditions (including Sea Dumping Permit and State approvals)

Figure 1. Document Map - Linkages between LTMMP and EMP's



2 Introduction

Ports North engages the services of a dredging contractor for dredging and drag barring works to periodically maintain the entrance channel at Port of Karumba.

This Environmental Management Plan (EMP) forms the operational control document for a typical Trailing Suction Hopper Dredge (TSHD) while undertaking the dredging works and is intended to ensure all site specific environmental issues that are the responsibility of the dredging contractor engaged by Ports North, under the contract arrangements, are adequately addressed. Approval conditions have also been considered as part of the development of this EMP. The EMP forms part of the Karumba LTMMP which is a component of the Ports North's Environmental Management System to ensure the environmental management practices for dredging are conducted in an environmentally sound manner.

In developing the EMP, consideration has been given to the environmental Aspects and Impacts to ensure all impacting processes are addressed through clearly defined management actions, mitigation measures, and performance indicators.

This EMP is developed for a typical modern TSHD such as the vessel “*Brisbane*” that is owned and operated by Port of Brisbane Pty Ltd which has conducted most recent maintenance dredging campaigns at the Port of Karumba, and is engaged under a long term contract for dredging services to the northern Queensland Ports for maintenance dredging. This vessel was designed to meet the need for dredging in some of the shallow coastal Port’s including Karumba, Weipa and Cairns and includes several design specifications which ensure a high level of environmental and dredging performance.

A typical maintenance dredging campaign at the Port of Karumba is of an approximate duration of 4-6 weeks.

3 Description of Dredging Plant

3.1 TSHD

A typical Trailer Suction Hopper Dredge (*TSHD*) can operate 24 hours per day to ensure a continuity of activity and maximise efficiency of the campaign.

Requirement for dredging activity is determined by comparison of required or design depths of a site with pre-dredging hydrographic survey. Specialised vessels independent of the dredge undertake all survey work.

The hydrographic survey information is digitally uploaded to the *TSHD* on-board computer system allowing the dredge master to display the depth information for a site with dredge target areas clearly highlighted.

The vessel can operate in either automatic, where onboard computers control vessel dredge systems, or manual mode for dredging operations. Further, the onboard computers will assist the positioning of the vessel by displaying a differentially corrected GPS position of the vessel track against intended dredge areas. Dredge Pipe Operator and Dredge Manager are present on the bridge during all operations regardless of dredging mode, and all vessel movements are directed by the Dredge Manager.

The vessel extracts material by lowering two suction heads (one on either side of the vessel) to the seafloor whilst steaming slowly ahead. Large pumps onboard then draw water through the heads entraining sediments from the seafloor in a similar fashion to a household vacuum cleaner, depositing a mixture of water and sediments into the vessel’s central hopper.

The dredge heads are not fitted with any mechanical agitation equipment and rely solely on the suction head provided by the onboard pumps. Whilst the vessel has the ability to pump high-pressure water to the dredge head to agitate sediments, this is generally not required unless operating in compacted sands.

The concentration of sediments delivered to the hopper is dependant on a number of factors, such as sediment type and dredging conditions, but is generally in the order of 10-30% solids. That is, 70-90% of the material pumped to the hopper is water and must be discharged to achieve effective loading.

A best practice *TSHD* will include a central column weir to control water discharge. This weir may consist of rings stacked vertically. The position of the rings and hence the depth to which water in the hopper must be before overflowing to discharge, is controlled automatically by the

draft of the vessel. This controls the residence time of the water in the hopper, providing maximum time for suspended material to settle and reducing discharge suspended sediment concentration and turbidity.

Discharge from the weir is through the bottom of the vessels hull below the keel on the centreline. As such, discharge of waters during dredging is 4-6m below the water's surface, depositing sediments near the bed and further reducing settlement time and dispersion of turbidity plume.

The effective capacity of the hopper is dependant upon the type of material being dredged. While the volume of the hopper is 2900m³, effective capacities range from 2100 m³ for sands, to 2900 m³ for fine silts.

This variation in effective hopper capacity is due to both the maximum load carrying capacity of the vessel and the differences in settling time for the material dredged. Material with a high silt content (<0.075mm) takes a relatively long time to settle from suspension in the water. As the hopper residence time is reduced, insufficient material settles in the hopper per cubic metre dredged to make the works economically viable.

Hopper residence time is the time taken for water pumped to the hopper to flow out the discharge weir. As the hopper fills with sediment, the residence time, and hence the potential for settling of suspended sediment decreases. A compensation point is reached as the load curve (a plot of sediment load verses total dredging time) asymptotes. That is, the amount of material retained in the hopper per unit of dredging time decreases.

Once the hopper has reached optimum capacity for the type of material being dredged, the vessel steams to the relocation site. The material may be bottom dumped (as is generally undertaken for placement at sea) by opening large valves in the floor of the hopper to allow the material to fall out through the hull.

Alternately, the material can be pumped out via a bow discharge pipe (generally used for on-shore placement). A floating pipeline is connected to the bow coupling and material within the hopper agitated with high-pressure water jets to achieve the correct consistency for pumping. Material is then delivered via the pipeline to detention basins on-shore.

3.2 Bed Levelling - Sweep Bar

The process of bed levelling is typically used in conjunction with and after the final transit of the *TSHD* in a given sector of the dredge area to achieve a smooth final channel bottom profile.

The Sweep Bar (or commonly known as a bed leveller) is a specialised vessel used to provide a uniform minimum water depth within navigation channels and berths.

The sweep bar will be suspended from a tug. In similar function to a blade on a common earth moving plant such as a grader/bulldozer, the sweep bar has a small blade on the underside. This is designed to gather material into the internal confines of the sweep bar, transporting it as the bar is moved along. As the equipment travels over hollows in the bed, material falls from the bar and fills these. Conversely, small hillocks and rises in the bed are levelled out to provide a uniform minimum water depth.

A sweep bar may also be used in isolation, as a specific campaign if only a small section of seafloor requires removal. Activity such as this is addressed in the separate EMP for a typical Bed Levelling Campaign.

4 Environmental Legislation and Approvals

In addition to the applicable legislation that covers the broader actions of dredging and disposal as set out in the LTMMMP Section 2, the environmental legislation relevant to the particular aspects of dredging operations by a Trailing Suction Hopper Dredge is discussed, but is not limited to the legislation listed below;

4.1 Applicable State Legislation

Environmental Protection Act 1994

The objective of the *Environmental Protection Act 1994* is 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 consistent with "ecologically sustainable development".

The protection of Queensland's environment is to be achieved by an integrated management program that is consistent with ecologically sustainable development.

The program is cyclical and involves the following phases –

- Establishing the state of the environment and defining environmental objectives;
- Developing effective environmental strategies;
- Implementing environmental strategies and integrating them into efficient resource management; and
- Ensuring accountability of environmental strategies.

Until amendment of the *EP Act* in 2008, dredging works undertaken within Port Limits by a Port Authority were exempt from requiring an Environmentally Relevant Activity (ERA) approval.

The 2008 amendments to the Act and subordinate legislation now specify that dredging (extractive and screening activities) requires an ERA 16 as follows:

"Extractive and screening activities (the relevant activity) consists of any of the following-

- a) dredging of a total of 1000t or more of material from the bed of naturally occurring surface waters, in a year;*
- b) extracting, other than by dredging, material from a wild river area;*
- c) extracting, other than by dredging, a total of 5000t or more of material, in a year, from an area other than a wild river area;*
- d) screening 5000t or more of material in a year.*

Ports North has a general responsibility under the Act to ensure that no environmental harm (serious or material) or environmental nuisance occurs as a result of its activities. This EMP has been prepared to encompass the components of the works to be undertaken by the Contractor, to the extent to which it has control, and will be enacted by the Contractors staff as the working document.

Coastal Protection and Management Act 1995/ Harbours Act

The objective of the *Coastal Protection and Management Act 1995* (CPM Act) is “to -

- (a) *provide for the protection, conservation, rehabilitation and management of the coast, including its resources and biological diversity; and*
- (b) *have regard to the goal, core objectives and guiding principles of the National Strategy for Ecologically Sustainable Development in the use of the coastal zone; and*
- (c) *provide, in conjunction with other legislation, a coordinated and integrated management and administrative framework for the ecologically sustainable development of the coastal zone; and*
- (d) *encourage the enhancement of knowledge of coastal resources and the effect of human activities on the coastal zone.”*

The *CPM Act* requires that a person obtains a tidal works approval for work in, on or above land under tidal water, or land that will or may be under tidal water because of development on or near the land. A tidal works approval essentially approves the engineering design and location of structures (e.g. channels, swing basins, wharves etc). Prior to the CPMA tidal works approvals were referred to as approvals under *Section 86* of the *Harbours Act* (1955). These approvals were issued into perpetuity.

4.2 Applicable Commonwealth Legislation

Environment Protection (Sea Dumping) Act 1981

The *Environment Protection (Sea Dumping) Act 1981* is commonwealth legislation providing for the protection of the environment by regulating dumping into the sea, incineration at sea and artificial reef placements, and for related purposes. These requirements are set out further in the Environmental Legislation section of the LTMMP.

4.3 Approvals Summary

Copies of applicable, valid approvals are to be provided prior to each campaign and included in Appendix 2 of this EMP to enable access by dredge crew and a copy will be onboard the dredge at all times.

The dredging contractor will be required to ensure that its dredging operations comply with those conditions of the above approvals for which it is responsible, in accordance with the dredging contractual arrangements. Ports North, as the proponent, is responsible for supplying all relevant information regarding the environmental approvals and associated conditions, including the LTMMP to the contractor.

5 Roles and Responsibilities

The approvals applicable to maintenance dredging campaigns include a range of conditions which must be complied with and some of these conditions relate to operational activities while others relate to broader management issues, environmental monitoring and reporting. Contract negotiations between dredging contractor and Ports North will clarify responsibility for compliance with the various conditions. The following table provides an outline of the roles and responsibilities of the staff involved in the Karumba dredging project. This also provides an outline of the chain of command and links between parties involved in the project.

Table 5.1: Roles and Responsibilities of Key Employees Associated with the Karumba Maintenance Dredging Campaigns

*** This table is to form the template for the contacts list, and be updated with the campaign specific details once Contractor is appointed, and names and phone numbers of all positions filled out. It is acknowledged that organisation structures, specific staff names and phone numbers will change from time to time.

Position	Name and Contact Numbers	Responsibility	Reporting to
Staff Onboard THSD			
Vessel Master		Responsible for all aspects of vessel shipboard management Maintaining watch and record of marine fauna during dredging and disposal operations	Manager Dredging Operations
Chief Engineer		Responsible for operation and maintenance of onboard machinery	Vessel Master
Crew		Implementation of specific EMP components i.e. spill response, waste, general duty,	
Contractors Staff On-Shore			
Site Manager		Management of day to day operations of project	Manager Dredging Operations
Manager Dredging Operations		Management of overall operations of dredger.	Senior Management
Environmental Coordinator		Responsible for undertaking monitoring of EMP implementation	Senior Management
Senior Management		Responsible for overall management of the Contractors dredging activities	CEO/General Manager
Ports North			
Ports North Port Operations 24hr Contact	Ph; (07)4051 2558 Mobile: 0419 657 350 Fax; (07) 4031 2551 Email: enquiries@portsnorth.com.au		
Chief Executive Officer		Legal and contract compliance	Ports North Board
GM- Corporate Services		Community – complaints and engagement	CEO
GM - Planning and Infrastructure		Dredge contract Defining dredge requirement, areas and volume	CEO
Port Supervisor		Contact for local port information and coordination of emergency situations	GM-P&I
Surveyor and Survey Assistant/Draftsperson		Conduct of hydrographic surveys (channel and spoil ground). Determination of areas to be dredged.	
Project Superintendent (may be appointed by Ports North)		Contract supervision, monitoring	GM-P&I
Environment Manager		EMP implementation Contact for coordination and management of environmental incidents (i.e. fauna injuries, hazardous spills) Auditing and inspection of Sea Dumping Permit, LTMMP and Supervision of monitoring	GM-P&I
MSQ Contacts			
Maritime Safety Queensland	1300 551 899		
Manager Remote Area Services Karumba		Contact for Marine Pollution, hazardous spills and shipping safety issues	

6 Environmental Management Plan

The purpose of the Environmental Management Plan (EMP) is to:

- Identify the potential aspects and impacts (including hazards) associated with undertaking the dredging and material relocation works;
- Identify the appropriate mitigation measures for each potential environmental hazard; and
- Indicate the corrective actions to be undertaken if an undesirable impact or unforeseen level of impact occurs.

It should be noted that the *TSHD* is being operated by a contractor for Ports North to undertake the dredging works. Ultimate responsibility for the project lies with Ports North and this EMP provides a description of only those components of the operational control component of the LTMMP within the control of Ports North as per contract arrangements. Other compliance monitoring and reporting issues are to be addressed by Ports North.

The sections below provide an outline of the structure and details of the component management plans.

6.1 Structure

Each of the following EMP elements address the environmental aspects and subsequent potential impacts as outlined in the following structure of Table 6.1

Table 6.1: Management Plan Structure and Components

Item	Content
Aspect	The Aspect that requires management.
Impact	The predicted impact on the environment in the absence of sound environmental protection and management measures.
Objective	What is intended to be achieved?
Management Actions and Mitigation Measures	Tasks that will be undertaken to implement ensure Objective is met. Includes possible measures that may be implemented where suitable.
Performance Indicators	Qualitative or quantitative measurement to gauge objective.
Monitoring	Details of measurement of performance indicators.
Reporting	Nature, timing and responsibility for reporting results.
Corrective Action	Action to be taken if monitoring indicates objective is not being met.
Term	Active term of management plan.
Responsibility	Delegation/nomination of responsibilities for overseeing management plan operation.

6.2 Aspects and Management Plans

The following environmental aspects are the elements of a typical campaign that have been identified as issues requiring specific management to avoid unacceptable environmental impacts, and subsequent management plan components have been developed accordingly.

All permit condition compliance monitoring is to be conducted by Ports North or appointed auditor in conjunction with the following measures.

Waste - The general categories of waste have been defined as follows:

- General Garbage (refuse generated from crew);
- Co-mingled recycled waste including paper, plastics, metals and glass;
- Paper and cardboard waste;

- Sewage Waste (including both black and grey waters); and
- Oily water, oil wastes and other hazardous or regulated wastes such as greases, paints and chemicals.

(Due to the isolated location recycling facilities waste may not be available to receive the recycling waste at which stage all waste will go to general waste).

Noise – The generation of noise during vessel operation and potential impacts on sensitive receptors forms the basis of this management plan. Issues of workplace noise are to be controlled and managed under existing occupational health and safety protocols within the respective vessel safety management system.

Turbidity – Whilst this management plan aims to limit the generation of plumes as much as practical, the principal management response will be to ensure that dredging operations are only undertaken within approved areas. Where required, water quality monitoring of the dredging works will be undertaken by Ports North in accordance with the monitoring component of the LTMMP and any additional management actions required to address approval conditions.

Protected Marine Fauna – This management plan addresses the potential for the *TSHD* to directly impact on protected marine fauna, during dredging (e.g. capture of marine turtles in dredge head), transit (collision) or material relocation operations. Overarching issues of secondary impacts such as habitat disturbance are beyond the scope of this document and would have been addressed in impact assessments associated with the original capital works approvals, or site-specific considerations by regulatory authorities when issuing necessary licenses/permits.

It should be noted that Sea Dumping Permits issued for dredging projects may include a requirement for a “Dredging Window” to avoid impacts to certain species. The proposed dredging period is to be compliant with this condition, or an approved variation granted by the Determining Authority.

Cultural Heritage – This management plan is generally in the scope of maintaining a watch on dredge material for unanticipated items of cultural significance. Management plans for items of identified cultural significance which have the potential to be directly impacted by the dredging operations will be developed by the contractor as part of the license/permits works.

Ballast Water – The *TSHD* is likely to have relatively small ballast water tanks which are only discharged in special circumstances (e.g. light draft required for shallow water (<3m) work). With Queensland and New South Wales there are no specific ballast water management requirements for ballast water taken up within Australia’s territorial sea and domestic ports. While there are no current requirements, an earlier guideline titled, Australian Coastal Voyage Ballast Water Management Guidelines, was produced and provided recommendations in relation to domestic ballast water management. The *TSHD* ballast water management plan is based on those earlier guidelines with the highest level of treatment being adopted as standard, to completely minimise translocation risks. To further minimise the risk of translocation of exotic organisms whenever possible fresh water is to be used to fill the ballast tanks.

Vessel Washdown – This management plan is applicable to areas where wash waters may flow directly overboard, such as the deck and dredge head.

Bunkering of Fuel – Refuelling the *TSHD* is to occur by vessel-to-shore connection. There is the potential for fuel spill/leaks to enter the waterways however; this risk is controlled by operating procedures and use of licensed contractors to perform the fuel transfer.

6.2.1 Waste Management

6.2.2 General and recycling waste

The *TSHD* is to be fitted with sufficient general waste bins, and co-mingled recycling bins for the collection of on-board wastes. These are to be fitted with secured lids to prevent material being blown overboard during either

storage or handling. An approved contractor is to collect the bins as required, when the vessel is alongside port reception facilities during reprovisioning/crew-change operations.

Element	Waste Management – General Refuse and Recycling
Impact	
Objective/Target	To ensure that general refuse produced on-board the <i>TSHD</i> is collected, retained and transferred to appropriate facility without unintentional loss.
Management Actions and Mitigation Measures	<p>During at-sea operations:</p> <ul style="list-style-type: none"> • Supply of appropriate collection bins in areas such as galley, crew quarters and mess. • Transfer of bins as required to large bins on-deck. • All on-deck bins secured in position to prevent movement whilst at sea. • Material placed in bin to be as compacted as possible to reduce space requirements. • Where facilities exist to recycle material, appropriate separation of refuse. • Bin lids to be chained down to prevent wind blown material loss at all times. • All collection points to be emptied to on-deck bin when near capacity. • Visual check to ensure that on-deck bins have sufficient capacity to retain general waste until next scheduled on-shore transfer. <p>During transfer:</p> <ul style="list-style-type: none"> • Licensed collector to be used to collect general refuse for transfer to approved facility. • Bin lids to be chained in position during transfer to prevent material loss.
Performance Indicators	No loss of general refuse over-board during collection, storage or transfer.
Monitoring	Regular visual assessment of collection points. Visual inspection of on-deck bins.
Reporting	Reporting of material loss over-board to Vessel Master.
Corrective Action	If practicable, retrieve material that was lost overboard. Review procedure causing material loss and rectify immediately.
Term	During all operations.
Responsibility	Vessel Master.

6.2.3 Sewage Treatment

The *TSHD* is to be fitted with a sewage treatment system, which treats all onboard blackwater and greywater. The system should enable compliance with International Maritime Organisation (IMO) criteria and meet the requirements of the Queensland *Transport Operations (Marine Pollution) Regulation (2008)*. Any waste water not able to be treated to sufficient quality for overboard discharge, should be held onboard till such time as onshore discharge to a licensed waste contractor is possible.

Element	Waste Management – Sewerage Treatment
Impact	Harm to receiving water quality due to discharge of contaminants, including nutrients, faecal coliforms and prescribed water contaminants.
Objective/Target	To ensure sewage generated on-board is appropriately treated and releases are managed.
Management Actions and Mitigation Measures	<p>During at-sea operations:</p> <ul style="list-style-type: none"> All sewage effluent (including grey waters and black water) generated onboard shall be directed to the onboard treatment system. Treated effluent shall be diverted to onboard holding tanks, or disposed to ocean if treatment is compliant for intended discharge area. Effluent from the treatment system and holding tank is to be discharged in appropriate locations to ensure compliance with relevant legislation (see Appendix 1 - Untreated sewage discharge- which includes a plan showing restricted locations for discharge of untreated sewerage for Karumba). Sludge tank to be pumped out as required by Chief Engineer after testing. Pump-out of sludge tank to be managed as for untreated sewage discharges and, by way of appropriately licensed contractors where required. <p>Service records:</p> <ul style="list-style-type: none"> The sewage treatment system is to be managed and maintained as described in the applicable sewage treatment manual, operational procedures manual and records maintained in sewage log book. Details of the independent testing entity (name, address) and the date and results of each routine assessment of the treatment system are to be described in the sewage log book. <p>System Improvements:</p> <ul style="list-style-type: none"> Improvements to the sewerage treatment system, aimed at improving effluent discharge quality shall be trialled and monitored
Performance Indicators	<p>No sewage discharge within an area that prohibits the discharge of untreated sewerage.</p> <p>Ongoing improvement in the quality of effluent discharge from the sewerage treatment system.</p>
Monitoring	<p>Vessel Master to monitor vessel location during sewerage discharge events to ensure vessel is not within an area that the discharge of untreated sewage is prohibited.</p> <p>Routine testing and analysis of sewage discharge quality by accredited laboratory.</p>
Reporting	<p>Reporting of sewerage discharge location in Sewage Log Book.</p> <p>Reporting of monitoring results against legislative requirements to Environmental staff.</p>
Corrective Action	<p>Review procedure resulting in sewerage discharge in prohibited location and rectify immediately.</p> <p>Review sewage storage system inputs and operation. Modify procedures, to improve discharge quality</p>
Term	During all operations.
Responsibility	<p>Management and operation of on-board system is by the Vessel's Chief Engineer.</p> <p>Ensuring sewerage discharge is not within a prohibited location is by the Vessel's Master. Sampling results review and corrective action is by Environmental staff in conjunction with Chief Engineer.</p>

6.2.4 Hazardous Waste

Hazardous waste includes waste oils, oily water, oil sludge, chemicals and paints. Oily water is often contained within the bilge water holding tank and is to be discharged onshore by a licensed contractor.

Element	Waste Management – Hazardous Waste
Impact	Environmental harm from improper disposal, handling or loss of hazardous substances.
Objective/Target	To ensure hazardous waste generated on-board is appropriately managed. Respective product Material Safety Data Sheet (MSDS) requirements are met
Management Actions and Mitigation Measures	<p>During at-sea operations:</p> <ul style="list-style-type: none"> Oils may be recycled through the engine until the waste oil forms a sludge which is transferred to a holding tank for onshore pump-out by a licensed contractor. Any minor amounts of hazardous waste materials are to be contained and stored in bunded areas until discharge onshore. All hazardous waste to be stored in appropriate manner and clearly marked in accordance with legislative requirements. <p>During Transfer:</p> <ul style="list-style-type: none"> Hazardous waste to be collected by licensed contractor only, for disposal at approved facility. All procedures to minimise spills during transfer of hazardous waste to contractor shall be followed. Spill response equipment shall be easily identifiable and conveniently located.
Performance Indicators	No inappropriate storage or disposal of hazardous wastes.
Monitoring	Reporting by all crew of any observations of inappropriate storage or handling of hazardous wastes.
Reporting	Exception reports directly to Vessel Master.
Corrective Action	Vessel Master to review procedure breakdown and correct if required. This may include staff training.
Term	During all operations.
Responsibility	Management and operation of on-board system is by the Vessel Master, with input from Environmental staff as required.

6.3 Noise

A modern *TSHD* should be fitted with well maintained noise reduction devices to limit the noise generated during works as much as possible. Further, the nature of the works is such that the potential for disruptive noise to sensitive places (e.g. residential areas) is limited by distance.

Element	Noise Management																															
Impact	Noise impacts to sensitive receptors for example residential areas, resulting in complaint about vessel operations.																															
Objective/Target	To ensure noise generated by operation of the <i>TSHD</i> does not unduly impact adjacent areas.																															
Management Actions and Mitigation Measures	<div><ul style="list-style-type: none">All noise reduction equipment to be maintained as per manufactures' specifications.Where the vessel is operating in an especially noise sensitive environment (e.g. close proximity to residential areas), crew are to be informed to minimise noise where possible.All noise from activities must not exceed the acoustic quality objectives specified in the <i>Environmental Protection Noise Policy</i>. Noise levels for selected receptors identified in the <i>Environmental Protection Noise Policy</i> are in the table below:</div> <table><tr><th rowspan="2">Sensitive receptor</th><th rowspan="2">Time of Day</th><th colspan="3">Noise Level (measured at receptors) dB(A)</th></tr><tr><th>L_{Aeq,adj,1hr} (Equivalent continuous sound pressure level)</th><th>L_{A10,adj,1hr} (Noise level exceed 10% of time)</th><th>L_{A1,adj,1hr} (Noise level exceed 1% of time)</th></tr><tr><td>Dwelling (outdoors)</td><td>Daytime and evening</td><td>50</td><td>55</td><td>65</td></tr><tr><td rowspan="2">Dwelling (indoors)</td><td>Daytime and evening</td><td>35</td><td>40</td><td>45</td></tr><tr><td>Night time</td><td>30</td><td>35</td><td>40</td></tr><tr><td>Commercial and retail activity (indoors)</td><td>When the activity is open for business</td><td>45</td><td></td><td></td></tr></table>					Sensitive receptor	Time of Day	Noise Level (measured at receptors) dB(A)			L _{Aeq,adj,1hr} (Equivalent continuous sound pressure level)	L _{A10,adj,1hr} (Noise level exceed 10% of time)	L _{A1,adj,1hr} (Noise level exceed 1% of time)	Dwelling (outdoors)	Daytime and evening	50	55	65	Dwelling (indoors)	Daytime and evening	35	40	45	Night time	30	35	40	Commercial and retail activity (indoors)	When the activity is open for business	45		
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Commercial and retail activity (indoors)	When the activity is open for business	45																														
Performance Indicators	No noise based complaints regarding the operation of the vessel.																															
Monitoring	All complaints recorded in appropriate system and forwarded to Vessel Master and Environment staff. If necessary noise shall be monitored to determine the level of impact.																															
Reporting	Annual review of all complaints received and follow-up action undertaken.																															
Corrective Action	Vessel Master to investigate source of complaint. If this relates to inappropriate work practices, inform crew of necessary changes and ensure these are undertaken. If complaints relates to plant, investigate effectiveness of noise reduction equipment and review/replace as required.																															
Term	During all operations.																															
Responsibility	Management and operation of on-board systems is by the Vessel Master, with input from Environment staff as required.																															

6.4 Turbidity Control

The Dredging Contractor and Ports North will ensure that the dredging operation minimises turbidity production to reduce impacts to adjacent marine resources, such as seagrasses. The *TSHD* should be fitted with a range of best practice design features (e.g. central column weir and below keel discharge) to minimise turbidity production.

Turbidity monitoring of the dredging works will be undertaken by Ports North in accordance with LTMMMP monitoring plan requirements which has been prepared to address approval requirements. Should the monitoring identify that turbidity production from the dredging works is exceeding approval limits the Vessel Master will be urgently advised and dredging activities will be modified to ensure compliance with these limits.

Element	Turbidity Management
Impact	Potential impacts through deposition, light attenuation or decline to water quality due to anthropogenic elevation of suspended sediment within water column which may impact on marine species, including flora. Impacts to scenic amenity may also occur, giving rise to community complaint or concern.
Objective/Target	To ensure turbid plumes generated by the operation of the <i>TSHD</i> are minimised and comply with approval limits.
Management Actions and Mitigation Measures	<ul style="list-style-type: none"> • Within the practicalities of the vessel, minimise the generation of plumes by control of a discharge weir system. • Ensure dredging and material relocation is undertaken within the approved areas only by reference to electronic navigation aids and visual marks as required. • Observe all site-specific requirements, which may influence dredging times or the use of overflow dredging (eg tides, wind direction and velocity etc.). • As required under the approval conditions, Ports North is to implement a water quality and turbidity monitoring program if required.
Performance Indicators	No dredging or placement of material outside approved areas. Turbidity levels as a result of dredging works to be maintained within the limits stipulated within relevant approvals
Monitoring	Review of vessel dredging and placement tracks against approved area boundaries. Ports North to monitor turbidity levels in accordance with approval requirements.
Reporting	Reporting of any release of dredged material outside the nominated spoil ground to Vessel Master, Environment staff and Ports North Project Superintendent. Reporting by Ports North of any exceedence of permitted turbidity limits from monitoring activities to Vessel Master.
Corrective Action	Vessel Master to investigate the reason any release of dredged material outside the nominated spoil ground and take appropriate action. Ports North to determine if corrective action to reduce turbidity production is required. Vessel Master to develop and implement appropriate corrective action in consultation with Manager Dredging Operations (Corrective actions may include such as, reduction in load size, no overflow dredging etc).
Term	During all operations.
Responsibility	Management and operation of on-board systems is by the Vessel Master, with input from Manager Dredging Operations and Environment staff as required. Ports North is responsible for determining if turbidity levels at the dredge site are exceeding approval limits and determining if corrective action is required.

6.5 Protected Marine Fauna

The following procedure outlines the management to be put in place to minimise the risk of harming large marine fauna including turtles, dugongs and cetaceans during dredging operations. In the event of an incident, contacts are to be followed as outlined in this document.

Element	Protected Marine Fauna
Objective/Target	To ensure the minimisation of the capture of, or harm to, protected marine fauna during dredging and material relocation process.
Actions	<ul style="list-style-type: none"> Follow the procedures for the protection of marine fauna to meet the conditions outlined in the Sea Dumping Permit. Specifically: <ul style="list-style-type: none"> Prior to the commencement of each dredging and dumping run, Dredge Vessel Master to check, using binoculars from a high observation platform, for cetaceans, dugongs and turtles within the vicinity of vessel operation (i.e. adjacent to the dredging/dumping run about to be commenced). Dredging and dumping activities may only be commenced if no individuals of large marine fauna have been observed in the area adjacent to the dredge, and where there is a low likelihood of a collision occurring. Where any of the large marine fauna are sighted within the area adjacent to the dredge, dredging/dumping activities are to be halted until the last individual has been observed to leave the vicinity of the dredge. Vessel Master to maintain watch for marine fauna in high risk areas and take necessary action where risk of a collision may exist. Dredging and material placement only in approved areas. Turtle excluders will be fitted where possible during all operations where turtles may reasonably be encountered. Dredge suction to be started only when dredge heads are in contact with seafloor at start of dredge run, and then stopped once dredge heads are lifted from seafloor. Load to be inspected on an opportunistic basis for marine fauna remains.
Performance Indicators	<p>No dredging or placement of material outside approved areas.</p> <p>No capture of, or harm to, protected marine fauna.</p>
Monitoring	<p>Review of vessel dredging and placement tracks against approved area boundaries.</p> <p>Load to be inspected on an opportunistic basis for marine fauna remains.</p> <p>Visual monitoring of area adjacent to dredging operations, in accordance with Sea Dumping Permit conditions.</p>
Reporting	<p>Reporting of exceptions to Vessel Master Environmental staff (including time, nature of incident, species involved).</p> <p>This reporting requirement is irrespective of whether the fauna is dead or alive.</p> <p>Ports North to be urgently advised by Vessel Master, of any incidents to allow them to notify the Determining Authority of the incident, within timeframe specified in accordance with conditions of the Sea Dumping Permit.</p>
Corrective Action	Vessel Master to investigate reason for exception and take appropriate action.
Term	During all operations.
Responsibility	Management and operation of on-board systems is by the Vessel Master, with input from Environment staff as required.

6.6 Cultural Heritage

Cultural heritage refers to both European and Indigenous heritage issues.

Element	Cultural Heritage
Objective/Target	To ensure dredging operations do not disturb/destroy items of European or non-European cultural significance.
Actions	<ul style="list-style-type: none"> • Ensure dredging and material relocation is undertaken within the approved areas only by reference to electronic navigation aids and visual marks as required. • Undertake opportunistic visual inspection of dredge load and dredge heads, reporting any items of suspected cultural significance. If items are found, retain and report to relevant authorities through Vessel Master and Environment staff.
Performance Indicators	No disturbance of items of cultural significance.
Monitoring	Opportunistic inspection of the dredged material for evidence of items of cultural heritage. Monitoring of dredge movement through use of electronic aids to ensure it is within designated area.
Reporting	Reporting of exceptions to Vessel Master and Environment staff.
Corrective Action	Vessel Master to investigate reason for exception and take appropriate action.
Term	During all operations.
Responsibility	Management and operation of on-board systems is by the Vessel Master, with input from Environment staff as required.

6.7 Bunkering of Fuel

The *TSHD* is regularly re-fuelled by the use of a licensed contractor, typically on crew change.

Element	Bunkering of Fuel
Impact	Potential environmental harm from fuel product spills if approved operating procedures are not enacted
Objective/Target	To ensure bunkering of fuel to the <i>TSHD</i> is appropriately transferred and spillage is prevented.
Management Actions and Mitigation Measures	During land transfer: <ul style="list-style-type: none"> • Licensed contractor is used to transfer fuels and levels shall be monitored. • Standard work procedures and bunkering operations are to be followed, including those in place by the fuel supply contractor.
Performance Indicators	No spills or leaks during fuel transfer.
Monitoring	Visual inspections of fuel-dispensing equipment during fuel transfer.
Reporting	Reporting of unanticipated spill/leak to Vessel Master in the first instance, then Manager Dredging Operations and Environment staff.
Corrective Action	In the event of a major spill, call Emergency Spill Response team for corrective action. Vessel Master to investigate source and cause of spill or inappropriate work practices. Change to operating procedures and inform crew.
Term	During all operations.
Responsibility	Management and operation of bunkering of fuel is by the Vessel Master.

6.8 Ballast Water and Hull Fouling Management

Given all dredging will occur within Port limits there is a low risk associated with the ballast water. However, if the *TSHD* is going to leave following a dredging job within Port limits or returning from a dredging job outside Port limits, the following shall be followed.

Element	Ballast Water – Hull Fouling Management
Impact	Translocation of marine flora and fauna species from another port to the site of vessel operations may have a long term deleterious impact to natural resident marine flora and fauna. This is especially the case for known marine pest species.
Objective/Target	To ensure that the risk of translocation of organisms in ballast water by the <i>TSHD</i> is minimised.
Management Actions and Mitigation Measures	<p>Implement best practice vessel maintenance and management</p> <p>Conduct actions required under ANZECC Hull Maintenance Guidelines, AQIS and Bio-Security Queensland invasive species protocols.</p> <p>Implement National Biofouling Management Guidance for Non-trading Vessels (Commonwealth of Australia, 2009).</p> <p>Finalising operations at Port:</p> <ul style="list-style-type: none"> • Before leaving Port of origin, undertake a thorough hopper wash within the material location area only. • If discharge pipes have been utilised during operations, undertake a thorough flush of these systems. • Inspect hopper and dredge gear (esp. heads) to ensure that no material which may transport organisms (such as sediments, organic material or waters) is retained. <p>During transit between areas of operation:</p> <ul style="list-style-type: none"> • Any ballast tanks holding seawaters will be exchanged with a minimum 150% of design volume with seawaters at a location as distant from the coastline or other shallow (<100m) areas as possible, but not less than 5nm. • Ballast tanks filled with freshwaters will be retained without treatment. • Waters held within the hopper during transit will be treated as for other ballast waters. <p>During operations at dredge area:</p> <ul style="list-style-type: none"> • Release of ballast waters will be minimised at all times; • A record will be kept of volumes, location and times of ballasting and deballasting operations. <p>Leaving Port of Operations</p> <ul style="list-style-type: none"> • When leaving the Port of Operations the vessel, hoppers and pipe work is to be adequately inspected and cleansed to ensure potential for translocation of pest species to next port of call. Follow specific vessel operation procedures.
Performance Indicators	<p>Contract requirements for vessel inspection, proof of freedom and prior port of operation clearance is complete prior to vessel arrival and commencement of dredging.</p> <p>No release of high risk ballast water during operations.</p>
Monitoring	<p>Remain informed of risk profile assessment work by Bio-security agencies for respective Australian ports.</p> <p>Vessel Log of ports of call and operation</p> <p>Review of vessel log of ballast/de-ballasting operations.</p>
Reporting	Vessel Master to maintain record of operations and review for non-conformances.
Corrective Action	Review procedure causing release and rectify immediately.
Term	During all operations.
Responsibility	Vessel Master.

6.9 Vessel Wash Down

This management plan relates to the washing of the dredge head or the deck of the *TSHD* where an accumulation of dredge spoil may have occurred.

Element	Vessel Wash down
Impact	Potential harm from cleaning agents may occur if improper agents are used in vessel cleansing. Wash down of hopper, pipe work or dredge heads in areas outside the approved work area or spoil ground may lead to additional turbidity impacts, or deposition of spoil outside approved disposal site.
Objective/Target	To minimise the release of potential contaminants to enter the environment.
Management Actions and Mitigation Measures	<ul style="list-style-type: none">• Prior to washing, preference shall be given to sweeping the deck and/or equipment.• If washing is required, biodegradable degreaser shall only be used where necessary and will be applied sparingly.• Only 'quick-break' degreasers shall be used and any discharges shall be minimised.• Wash down of the deck and or dredge head shall only occur within the designated dredge area.• Degreasers only to be used if sweeping or watering the deck/equipment is not appropriate.
Performance Indicators	No inappropriate use of degreasers or wash down in undesignated areas.
Monitoring	Reporting by crew of any observations of contamination to the waterway whilst washing the deck/equipment.
Reporting	Exception reports directly to vessel Master.
Corrective Action	Vessel Master to review procedure breakdown and correct if required. This may include staff training.
Term	During all operations.
Responsibility	Management and operation of on-board system is by the Vessel Master, with input from Environment staff as required.

6.10 Environmental Complaints

Any complaints received by Dredge Vessel crew relating to the operation of the *TSHD* will be recorded as part of standard operating procedures. Complaints will be recorded on the appropriate form and forwarded to the Vessel Master. The Master is to then initiate actions to resolve/investigate the complaint as required, with assistance from Ports North staff as necessary. A copy of all complaints will be forwarded to the respective Ports North staff via the Site Supervisor.

Issues which are not directly related to the operation of the *TSHD*, but are related to the Karumba dredging project will be forwarded to the Site Supervisor and Ports North. Whilst feedback on the resolution of the issue will be sought for recording to Ports North's Management Systems, the management of the issue will be the responsibility of the Project Superintendent and Ports North protocols.

6.11 Dredging Activity

The crew of the *TSHD* are to keep a record of dredging activity, which meets Ports North reporting requirements under the Sea Dumping Permit. Such information will include the times and dates of each dumping run, begin and end points of dredge runs, material type, volume, location of material relocation and other pertinent observations as part of the standard vessel operating procedures. This data will be forwarded to Ports North at the completion of works.

Regular review and checking of dredge location relative to approved area, review of dredge volume to date relative to permitted campaign volume and verification of disposal point or track records will be completed by the Contactor to ensure compliance with applicable permits.

7 Emergency Procedures

The TSHD is to maintain a *Shipboard Emergency Plan*, which outlines the role, responsibilities and actions to be followed during an emergency, including uncontrolled release of oils/fuels.

Further, all crew are to be trained and accredited in accordance with the Australian Maritime Safety Authority (AMSA) requirements for Australian Coastal voyages.

It is recommended that the TSHD vessel maintains an accredited to AS4801 Safety Management System. As part of this system, all onboard procedures are to be available to all crew in a written format in the Operational Procedures Manual and a vessel log is to be maintained by the Vessel Master.

Emergency Contact Details

Reporting to	Contact Numbers
AMSA Marine Incident Reporting	
Via Mobile Phone)	1800 641 792
Via Satellite	00612 6230 6811
Harbour Master (Cairns)	
Office	07 4052 7470 (24 Hours)
Mobile	0418 774 028
Port Control (via Cairns)	
Office	07 4052 7470 (24 Hours)
Mobile	0418 774 028
Medical Facilities	
Karumba Health Centre Normanton Road Karumba.	07 4745 9137
Normanton Hospital Brown St Normanton	07 4745 1144

8 Reporting

A final close out report summarising the outcomes of the EMP implementation is to be developed by the Contractor, noting any reportable items in the respective sections above, outcome of the campaign, and any observations that may be of interest to the TACC and DAWE.

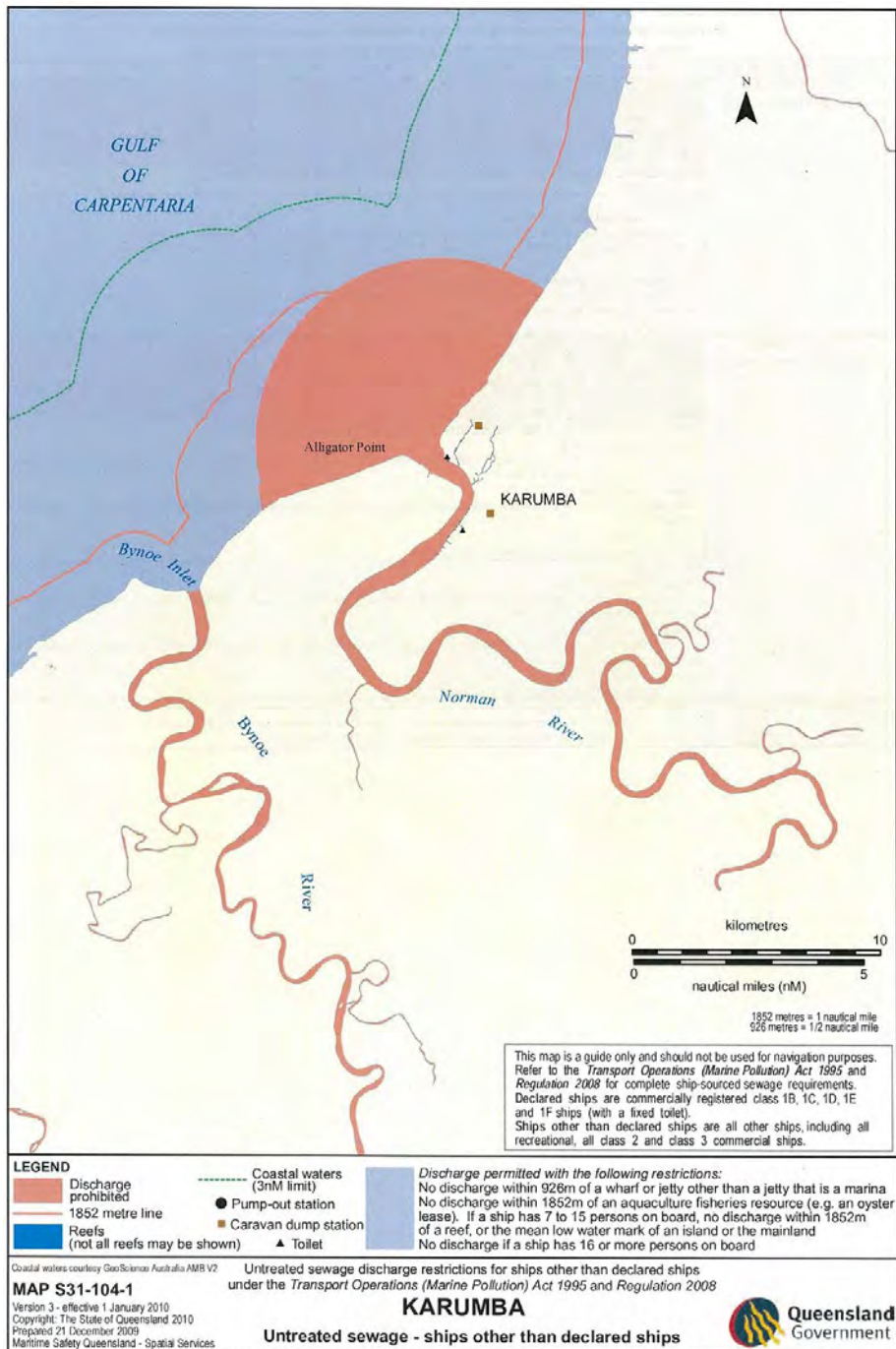
Such close out report will be provide to and reviewed by Ports North.

9 Appendices

9.1 Appendix 1 Sewage Discharge Areas

Untreated Sewage Discharge Karumba

The discharge of untreated sewage, is required to comply with s47 of *Transport Operations (Marine Pollution) Act 1995 (TOMPA)*, Schedule 4 of *Transport Operations (Marine Pollution) Regulation 2008 (TOMPR)* as prescribed below.



9.2 *Appendix 2 Approvals*

Permits and Licences for Project

- valid copies of applicable environmental approvals to be attached as at time of contract resolution and commencement of EMP implementation

Appendix 8 Environmental Management Plan – Dredging Campaign – TSHD

Appendix 8

Port of Karumba LT MMP

Environmental Management Plan for a Trailing Suction Hopper Dredge (TSHD) Dredging Campaign

Template for Inclusion in
Long Term Management and Monitoring Plan (LT MMP)

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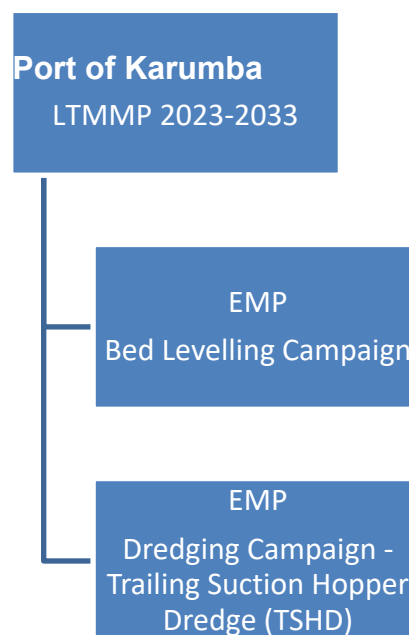
Document Control		Drafted	Released
Version 0	Original by Port of Brisbane Pty Ltd for Far North Queensland Ports Corporation Ltd	July 2010	August 2010
Version 1	Updated for Ports North for LTMMMP	February 2012	March 2012
Version 2	Updated as Appendices for LTMMMP Ver 6 lodged with DSEWPac in March 2012	April 2012	June 2012
Version 3	Updated for Final LTMMMP	January 2013	February 2013
Version 4	Updated for LTMMMP 2023-2033	February 2022	February 2022

1 Scope

As a sub-ordinate document to the approved Long Term Management and Monitoring Plan (LTMMP), this Environmental Management Plan (EMP) shall form the template to which appointed contractors shall follow, or in the scenario where the dredging contractor has their own EMP, be the approved benchmark to which Ports North will determine if it meets and exceeds the following management arrangements.

Conditions of the dredging contract will include a requirement for the Contractor to follow the approved EMP, the LTMMP and any corresponding Approval conditions (including Sea Dumping Permit and State approvals)

Figure 1. Document Map - Linkages between LTMMP and EMP's



2 Introduction

Ports North engages the services of a dredging contractor for dredging and drag barring works to periodically maintain the entrance channel at Port of Karumba.

This Environmental Management Plan (EMP) forms the operational control document for a typical Trailing Suction Hopper Dredge (TSHD) while undertaking the dredging works and is intended to ensure all site specific environmental issues that are the responsibility of the dredging contractor engaged by Ports North, under the contract arrangements, are adequately addressed. Approval conditions have also been considered as part of the development of this EMP. The EMP forms part of the Karumba LTMP which is a component of the Ports North's Environmental Management System to ensure the environmental management practices for dredging are conducted in an environmentally sound manner.

In developing the EMP, consideration has been given to the environmental Aspects and Impacts to ensure all impacting processes are addressed through clearly defined management actions, mitigation measures, and performance indicators.

This EMP is developed for a typical modern TSHD such as the vessel “*Brisbane*” that is owned and operated by Port of Brisbane Pty Ltd which has conducted most recent maintenance dredging campaigns at the Port of Karumba, and is engaged under a long term contract for dredging services to the northern Queensland Ports for maintenance dredging. This vessel was designed to meet the need for dredging in some of the shallow coastal Port’s including Karumba, Weipa and Cairns and includes several design specifications which ensure a high level of environmental and dredging performance.

A typical maintenance dredging campaign at the Port of Karumba is of an approximate duration of 4-6 weeks.

3 Description of Dredging Plant

3.1 TSHD

A typical Trailer Suction Hopper Dredge (*TSHD*) can operate 24 hours per day to ensure a continuity of activity and maximise efficiency of the campaign.

Requirement for dredging activity is determined by comparison of required or design depths of a site with pre-dredging hydrographic survey. Specialised vessels independent of the dredge undertake all survey work.

The hydrographic survey information is digitally uploaded to the *TSHD* on-board computer system allowing the dredge master to display the depth information for a site with dredge target areas clearly highlighted.

The vessel can operate in either automatic, where onboard computers control vessel dredge systems, or manual mode for dredging operations. Further, the onboard computers will assist the positioning of the vessel by displaying a differentially corrected GPS position of the vessel track against intended dredge areas. Dredge Pipe Operator and Dredge Manager are present on the bridge during all operations regardless of dredging mode, and all vessel movements are directed by the Dredge Manager.

The vessel extracts material by lowering two suction heads (one on either side of the vessel) to the seafloor whilst steaming slowly ahead. Large pumps onboard then draw water through the heads entraining sediments from the seafloor in a similar fashion to a household vacuum cleaner, depositing a mixture of water and sediments into the vessel’s central hopper.

The dredge heads are not fitted with any mechanical agitation equipment and rely solely on the suction head provided by the onboard pumps. Whilst the vessel has the ability to pump high-pressure water to the dredge head to agitate sediments, this is generally not required unless operating in compacted sands.

The concentration of sediments delivered to the hopper is dependant on a number of factors, such as sediment type and dredging conditions, but is generally in the order of 10-30% solids. That is, 70-90% of the material pumped to the hopper is water and must be discharged to achieve effective loading.

A best practice *TSHD* will include a central column weir to control water discharge. This weir may consist of rings stacked vertically. The position of the rings and hence the depth to which water in the hopper must be before overflowing to discharge, is controlled automatically by the

draft of the vessel. This controls the residence time of the water in the hopper, providing maximum time for suspended material to settle and reducing discharge suspended sediment concentration and turbidity.

Discharge from the weir is through the bottom of the vessels hull below the keel on the centreline. As such, discharge of waters during dredging is 4-6m below the water's surface, depositing sediments near the bed and further reducing settlement time and dispersion of turbidity plume.

The effective capacity of the hopper is dependant upon the type of material being dredged. While the volume of the hopper is 2900m³, effective capacities range from 2100 m³ for sands, to 2900 m³ for fine silts.

This variation in effective hopper capacity is due to both the maximum load carrying capacity of the vessel and the differences in settling time for the material dredged. Material with a high silt content (<0.075mm) takes a relatively long time to settle from suspension in the water. As the hopper residence time is reduced, insufficient material settles in the hopper per cubic metre dredged to make the works economically viable.

Hopper residence time is the time taken for water pumped to the hopper to flow out the discharge weir. As the hopper fills with sediment, the residence time, and hence the potential for settling of suspended sediment decreases. A compensation point is reached as the load curve (a plot of sediment load verses total dredging time) asymptotes. That is, the amount of material retained in the hopper per unit of dredging time decreases.

Once the hopper has reached optimum capacity for the type of material being dredged, the vessel steams to the relocation site. The material may be bottom dumped (as is generally undertaken for placement at sea) by opening large valves in the floor of the hopper to allow the material to fall out through the hull.

Alternately, the material can be pumped out via a bow discharge pipe (generally used for on-shore placement). A floating pipeline is connected to the bow coupling and material within the hopper agitated with high-pressure water jets to achieve the correct consistency for pumping. Material is then delivered via the pipeline to detention basins on-shore.

3.2 Bed Levelling - Sweep Bar

The process of bed levelling is typically used in conjunction with and after the final transit of the *TSHD* in a given sector of the dredge area to achieve a smooth final channel bottom profile.

The Sweep Bar (or commonly known as a bed leveller) is a specialised vessel used to provide a uniform minimum water depth within navigation channels and berths.

The sweep bar will be suspended from a tug. In similar function to a blade on a common earth moving plant such as a grader/bulldozer, the sweep bar has a small blade on the underside. This is designed to gather material into the internal confines of the sweep bar, transporting it as the bar is moved along. As the equipment travels over hollows in the bed, material falls from the bar and fills these. Conversely, small hillocks and rises in the bed are levelled out to provide a uniform minimum water depth.

A sweep bar may also be used in isolation, as a specific campaign if only a small section of seafloor requires removal. Activity such as this is addressed in the separate EMP for a typical Bed Levelling Campaign.

4 Environmental Legislation and Approvals

In addition to the applicable legislation that covers the broader actions of dredging and disposal as set out in the LTMMMP Section 2, the environmental legislation relevant to the particular aspects of dredging operations by a Trailing Suction Hopper Dredge is discussed, but is not limited to the legislation listed below;

4.1 Applicable State Legislation

Environmental Protection Act 1994

The objective of the *Environmental Protection Act 1994* is 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 consistent with "ecologically sustainable development".

The protection of Queensland's environment is to be achieved by an integrated management program that is consistent with ecologically sustainable development.

The program is cyclical and involves the following phases –

- Establishing the state of the environment and defining environmental objectives;
- Developing effective environmental strategies;
- Implementing environmental strategies and integrating them into efficient resource management; and
- Ensuring accountability of environmental strategies.

Until amendment of the *EP Act* in 2008, dredging works undertaken within Port Limits by a Port Authority were exempt from requiring an Environmentally Relevant Activity (ERA) approval.

The 2008 amendments to the Act and subordinate legislation now specify that dredging (extractive and screening activities) requires an ERA 16 as follows:

"Extractive and screening activities (the relevant activity) consists of any of the following-

- a) dredging of a total of 1000t or more of material from the bed of naturally occurring surface waters, in a year;*
- b) extracting, other than by dredging, material from a wild river area;*
- c) extracting, other than by dredging, a total of 5000t or more of material, in a year, from an area other than a wild river area;*
- d) screening 5000t or more of material in a year.*

Ports North has a general responsibility under the Act to ensure that no environmental harm (serious or material) or environmental nuisance occurs as a result of its activities. This EMP has been prepared to encompass the components of the works to be undertaken by the Contractor, to the extent to which it has control, and will be enacted by the Contractors staff as the working document.

Coastal Protection and Management Act 1995/ Harbours Act

The objective of the *Coastal Protection and Management Act 1995* (CPM Act) is “to -

- (a) *provide for the protection, conservation, rehabilitation and management of the coast, including its resources and biological diversity; and*
- (b) *have regard to the goal, core objectives and guiding principles of the National Strategy for Ecologically Sustainable Development in the use of the coastal zone; and*
- (c) *provide, in conjunction with other legislation, a coordinated and integrated management and administrative framework for the ecologically sustainable development of the coastal zone; and*
- (d) *encourage the enhancement of knowledge of coastal resources and the effect of human activities on the coastal zone.”*

The *CPM Act* requires that a person obtains a tidal works approval for work in, on or above land under tidal water, or land that will or may be under tidal water because of development on or near the land. A tidal works approval essentially approves the engineering design and location of structures (e.g. channels, swing basins, wharves etc). Prior to the CPMA tidal works approvals were referred to as approvals under *Section 86* of the *Harbours Act* (1955). These approvals were issued into perpetuity.

4.2 Applicable Commonwealth Legislation

Environment Protection (Sea Dumping) Act 1981

The *Environment Protection (Sea Dumping) Act 1981* is commonwealth legislation providing for the protection of the environment by regulating dumping into the sea, incineration at sea and artificial reef placements, and for related purposes. These requirements are set out further in the Environmental Legislation section of the LTMMP.

4.3 Approvals Summary

Copies of applicable, valid approvals are to be provided prior to each campaign and included in Appendix 2 of this EMP to enable access by dredge crew and a copy will be onboard the dredge at all times.

The dredging contractor will be required to ensure that its dredging operations comply with those conditions of the above approvals for which it is responsible, in accordance with the dredging contractual arrangements. Ports North, as the proponent, is responsible for supplying all relevant information regarding the environmental approvals and associated conditions, including the LTMMP to the contractor.

5 Roles and Responsibilities

The approvals applicable to maintenance dredging campaigns include a range of conditions which must be complied with and some of these conditions relate to operational activities while others relate to broader management issues, environmental monitoring and reporting. Contract negotiations between dredging contractor and Ports North will clarify responsibility for compliance with the various conditions. The following table provides an outline of the roles and responsibilities of the staff involved in the Karumba dredging project. This also provides an outline of the chain of command and links between parties involved in the project.

Table 5.1: Roles and Responsibilities of Key Employees Associated with the Karumba Maintenance Dredging Campaigns

*** This table is to form the template for the contacts list, and be updated with the campaign specific details once Contractor is appointed, and names and phone numbers of all positions filled out. It is acknowledged that organisation structures, specific staff names and phone numbers will change from time to time.

Position	Name and Contact Numbers	Responsibility	Reporting to
Staff Onboard THSD			
Vessel Master		Responsible for all aspects of vessel shipboard management Maintaining watch and record of marine fauna during dredging and disposal operations	Manager Dredging Operations
Chief Engineer		Responsible for operation and maintenance of onboard machinery	Vessel Master
Crew		Implementation of specific EMP components i.e. spill response, waste, general duty,	
Contractors Staff On-Shore			
Site Manager		Management of day to day operations of project	Manager Dredging Operations
Manager Dredging Operations		Management of overall operations of dredger.	Senior Management
Environmental Coordinator		Responsible for undertaking monitoring of EMP implementation	Senior Management
Senior Management		Responsible for overall management of the Contractors dredging activities	CEO/General Manager
Ports North			
Ports North Port Operations 24hr Contact	Ph; (07)4051 2558 Mobile: 0419 657 350 Fax; (07) 4031 2551 Email: enquiries@portsnorth.com.au		
Chief Executive Officer		Legal and contract compliance	Ports North Board
GM- Corporate Services		Community – complaints and engagement	CEO
GM - Planning and Infrastructure		Dredge contract Defining dredge requirement, areas and volume	CEO
Port Supervisor		Contact for local port information and coordination of emergency situations	GM-P&I
Surveyor and Survey Assistant/Draftsperson		Conduct of hydrographic surveys (channel and spoil ground). Determination of areas to be dredged.	
Project Superintendent (may be appointed by Ports North)		Contract supervision, monitoring	GM-P&I
Environment Manager		EMP implementation Contact for coordination and management of environmental incidents (i.e. fauna injuries, hazardous spills) Auditing and inspection of Sea Dumping Permit, LTMMP and Supervision of monitoring	GM-P&I
MSQ Contacts			
Maritime Safety Queensland	1300 551 899		
Manager Remote Area Services Karumba		Contact for Marine Pollution, hazardous spills and shipping safety issues	

6 Environmental Management Plan

The purpose of the Environmental Management Plan (EMP) is to:

- Identify the potential aspects and impacts (including hazards) associated with undertaking the dredging and material relocation works;
- Identify the appropriate mitigation measures for each potential environmental hazard; and
- Indicate the corrective actions to be undertaken if an undesirable impact or unforeseen level of impact occurs.

It should be noted that the *TSHD* is being operated by a contractor for Ports North to undertake the dredging works. Ultimate responsibility for the project lies with Ports North and this EMP provides a description of only those components of the operational control component of the LTMMP within the control of Ports North as per contract arrangements. Other compliance monitoring and reporting issues are to be addressed by Ports North.

The sections below provide an outline of the structure and details of the component management plans.

6.1 Structure

Each of the following EMP elements address the environmental aspects and subsequent potential impacts as outlined in the following structure of Table 6.1

Table 6.1: Management Plan Structure and Components

Item	Content
Aspect	The Aspect that requires management.
Impact	The predicted impact on the environment in the absence of sound environmental protection and management measures.
Objective	What is intended to be achieved?
Management Actions and Mitigation Measures	Tasks that will be undertaken to implement ensure Objective is met. Includes possible measures that may be implemented where suitable.
Performance Indicators	Qualitative or quantitative measurement to gauge objective.
Monitoring	Details of measurement of performance indicators.
Reporting	Nature, timing and responsibility for reporting results.
Corrective Action	Action to be taken if monitoring indicates objective is not being met.
Term	Active term of management plan.
Responsibility	Delegation/nomination of responsibilities for overseeing management plan operation.

6.2 Aspects and Management Plans

The following environmental aspects are the elements of a typical campaign that have been identified as issues requiring specific management to avoid unacceptable environmental impacts, and subsequent management plan components have been developed accordingly.

All permit condition compliance monitoring is to be conducted by Ports North or appointed auditor in conjunction with the following measures.

Waste - The general categories of waste have been defined as follows:

- General Garbage (refuse generated from crew);
- Co-mingled recycled waste including paper, plastics, metals and glass;
- Paper and cardboard waste;

- Sewage Waste (including both black and grey waters); and
- Oily water, oil wastes and other hazardous or regulated wastes such as greases, paints and chemicals.

(Due to the isolated location recycling facilities waste may not be available to receive the recycling waste at which stage all waste will go to general waste).

Noise – The generation of noise during vessel operation and potential impacts on sensitive receptors forms the basis of this management plan. Issues of workplace noise are to be controlled and managed under existing occupational health and safety protocols within the respective vessel safety management system.

Turbidity – Whilst this management plan aims to limit the generation of plumes as much as practical, the principal management response will be to ensure that dredging operations are only undertaken within approved areas. Where required, water quality monitoring of the dredging works will be undertaken by Ports North in accordance with the monitoring component of the LTMMP and any additional management actions required to address approval conditions.

Protected Marine Fauna – This management plan addresses the potential for the *TSHD* to directly impact on protected marine fauna, during dredging (e.g. capture of marine turtles in dredge head), transit (collision) or material relocation operations. Overarching issues of secondary impacts such as habitat disturbance are beyond the scope of this document and would have been addressed in impact assessments associated with the original capital works approvals, or site-specific considerations by regulatory authorities when issuing necessary licenses/permits.

It should be noted that Sea Dumping Permits issued for dredging projects may include a requirement for a “Dredging Window” to avoid impacts to certain species. The proposed dredging period is to be compliant with this condition, or an approved variation granted by the Determining Authority.

Cultural Heritage – This management plan is generally in the scope of maintaining a watch on dredge material for unanticipated items of cultural significance. Management plans for items of identified cultural significance which have the potential to be directly impacted by the dredging operations will be developed by the contractor as part of the license/permits works.

Ballast Water – The *TSHD* is likely to have relatively small ballast water tanks which are only discharged in special circumstances (e.g. light draft required for shallow water (<3m) work). With Queensland and New South Wales there are no specific ballast water management requirements for ballast water taken up within Australia’s territorial sea and domestic ports. While there are no current requirements, an earlier guideline titled, Australian Coastal Voyage Ballast Water Management Guidelines, was produced and provided recommendations in relation to domestic ballast water management. The *TSHD* ballast water management plan is based on those earlier guidelines with the highest level of treatment being adopted as standard, to completely minimise translocation risks. To further minimise the risk of translocation of exotic organisms whenever possible fresh water is to be used to fill the ballast tanks.

Vessel Washdown – This management plan is applicable to areas where wash waters may flow directly overboard, such as the deck and dredge head.

Bunkering of Fuel – Refuelling the *TSHD* is to occur by vessel-to-shore connection. There is the potential for fuel spill/leaks to enter the waterways however; this risk is controlled by operating procedures and use of licensed contractors to perform the fuel transfer.

6.2.1 Waste Management

6.2.2 General and recycling waste

The *TSHD* is to be fitted with sufficient general waste bins, and co-mingled recycling bins for the collection of on-board wastes. These are to be fitted with secured lids to prevent material being blown overboard during either

storage or handling. An approved contractor is to collect the bins as required, when the vessel is alongside port reception facilities during reprovisioning/crew-change operations.

Element	Waste Management – General Refuse and Recycling
Impact	
Objective/Target	To ensure that general refuse produced on-board the <i>TSHD</i> is collected, retained and transferred to appropriate facility without unintentional loss.
Management Actions and Mitigation Measures	<p>During at-sea operations:</p> <ul style="list-style-type: none"> • Supply of appropriate collection bins in areas such as galley, crew quarters and mess. • Transfer of bins as required to large bins on-deck. • All on-deck bins secured in position to prevent movement whilst at sea. • Material placed in bin to be as compacted as possible to reduce space requirements. • Where facilities exist to recycle material, appropriate separation of refuse. • Bin lids to be chained down to prevent wind blown material loss at all times. • All collection points to be emptied to on-deck bin when near capacity. • Visual check to ensure that on-deck bins have sufficient capacity to retain general waste until next scheduled on-shore transfer. <p>During transfer:</p> <ul style="list-style-type: none"> • Licensed collector to be used to collect general refuse for transfer to approved facility. • Bin lids to be chained in position during transfer to prevent material loss.
Performance Indicators	No loss of general refuse over-board during collection, storage or transfer.
Monitoring	Regular visual assessment of collection points. Visual inspection of on-deck bins.
Reporting	Reporting of material loss over-board to Vessel Master.
Corrective Action	If practicable, retrieve material that was lost overboard. Review procedure causing material loss and rectify immediately.
Term	During all operations.
Responsibility	Vessel Master.

6.2.3 Sewage Treatment

The *TSHD* is to be fitted with a sewage treatment system, which treats all onboard blackwater and greywater. The system should enable compliance with International Maritime Organisation (IMO) criteria and meet the requirements of the Queensland *Transport Operations (Marine Pollution) Regulation (2008)*. Any waste water not able to be treated to sufficient quality for overboard discharge, should be held onboard till such time as onshore discharge to a licensed waste contractor is possible.

Element	Waste Management – Sewerage Treatment
Impact	Harm to receiving water quality due to discharge of contaminants, including nutrients, faecal coliforms and prescribed water contaminants.
Objective/Target	To ensure sewage generated on-board is appropriately treated and releases are managed.
Management Actions and Mitigation Measures	<p>During at-sea operations:</p> <ul style="list-style-type: none"> All sewage effluent (including grey waters and black water) generated onboard shall be directed to the onboard treatment system. Treated effluent shall be diverted to onboard holding tanks, or disposed to ocean if treatment is compliant for intended discharge area. Effluent from the treatment system and holding tank is to be discharged in appropriate locations to ensure compliance with relevant legislation (see Appendix 1 - Untreated sewage discharge- which includes a plan showing restricted locations for discharge of untreated sewerage for Karumba). Sludge tank to be pumped out as required by Chief Engineer after testing. Pump-out of sludge tank to be managed as for untreated sewage discharges and, by way of appropriately licensed contractors where required. <p>Service records:</p> <ul style="list-style-type: none"> The sewage treatment system is to be managed and maintained as described in the applicable sewage treatment manual, operational procedures manual and records maintained in sewage log book. Details of the independent testing entity (name, address) and the date and results of each routine assessment of the treatment system are to be described in the sewage log book. <p>System Improvements:</p> <ul style="list-style-type: none"> Improvements to the sewerage treatment system, aimed at improving effluent discharge quality shall be trialled and monitored
Performance Indicators	<p>No sewage discharge within an area that prohibits the discharge of untreated sewerage.</p> <p>Ongoing improvement in the quality of effluent discharge from the sewerage treatment system.</p>
Monitoring	<p>Vessel Master to monitor vessel location during sewerage discharge events to ensure vessel is not within an area that the discharge of untreated sewage is prohibited.</p> <p>Routine testing and analysis of sewage discharge quality by accredited laboratory.</p>
Reporting	<p>Reporting of sewerage discharge location in Sewage Log Book.</p> <p>Reporting of monitoring results against legislative requirements to Environmental staff.</p>
Corrective Action	<p>Review procedure resulting in sewerage discharge in prohibited location and rectify immediately.</p> <p>Review sewage storage system inputs and operation. Modify procedures, to improve discharge quality</p>
Term	During all operations.
Responsibility	<p>Management and operation of on-board system is by the Vessel's Chief Engineer.</p> <p>Ensuring sewerage discharge is not within a prohibited location is by the Vessel's Master. Sampling results review and corrective action is by Environmental staff in conjunction with Chief Engineer.</p>

6.2.4 Hazardous Waste

Hazardous waste includes waste oils, oily water, oil sludge, chemicals and paints. Oily water is often contained within the bilge water holding tank and is to be discharged onshore by a licensed contractor.

Element	Waste Management – Hazardous Waste
Impact	Environmental harm from improper disposal, handling or loss of hazardous substances.
Objective/Target	To ensure hazardous waste generated on-board is appropriately managed. Respective product Material Safety Data Sheet (MSDS) requirements are met
Management Actions and Mitigation Measures	<p>During at-sea operations:</p> <ul style="list-style-type: none"> Oils may be recycled through the engine until the waste oil forms a sludge which is transferred to a holding tank for onshore pump-out by a licensed contractor. Any minor amounts of hazardous waste materials are to be contained and stored in bunded areas until discharge onshore. All hazardous waste to be stored in appropriate manner and clearly marked in accordance with legislative requirements. <p>During Transfer:</p> <ul style="list-style-type: none"> Hazardous waste to be collected by licensed contractor only, for disposal at approved facility. All procedures to minimise spills during transfer of hazardous waste to contractor shall be followed. Spill response equipment shall be easily identifiable and conveniently located.
Performance Indicators	No inappropriate storage or disposal of hazardous wastes.
Monitoring	Reporting by all crew of any observations of inappropriate storage or handling of hazardous wastes.
Reporting	Exception reports directly to Vessel Master.
Corrective Action	Vessel Master to review procedure breakdown and correct if required. This may include staff training.
Term	During all operations.
Responsibility	Management and operation of on-board system is by the Vessel Master, with input from Environmental staff as required.

6.3 Noise

A modern *TSHD* should be fitted with well maintained noise reduction devices to limit the noise generated during works as much as possible. Further, the nature of the works is such that the potential for disruptive noise to sensitive places (e.g. residential areas) is limited by distance.

Element	Noise Management				
Impact	Noise impacts to sensitive receptors for example residential areas, resulting in complaint about vessel operations.				
Objective/Target	To ensure noise generated by operation of the <i>TSHD</i> does not unduly impact adjacent areas.				
Management Actions and Mitigation Measures	<ul style="list-style-type: none">All noise reduction equipment to be maintained as per manufactures' specifications.Where the vessel is operating in an especially noise sensitive environment (e.g. close proximity to residential areas), crew are to be informed to minimise noise where possible.All noise from activities must not exceed the acoustic quality objectives specified in the <i>Environmental Protection Noise Policy</i>. Noise levels for selected receptors identified in the <i>Environmental Protection Noise Policy</i> are in the table below:				
	Sensitive receptor	Time of Day	Noise Level (measured at receptors) dB(A)		
			L _{Aeq,adj,1hr} (Equivalent continuous sound pressure level)	L _{A10,adj,1hr} (Noise level exceed 10% of time)	L _{A1,adj,1hr} (Noise level exceed 1% of time)
	Dwelling (outdoors)	Daytime and evening	50	55	65
	Dwelling (indoors)	Daytime and evening	35	40	45
		Night time	30	35	40
	Commercial and retail activity (indoors)	When the activity is open for business	45		
Performance Indicators	No noise based complaints regarding the operation of the vessel.				
Monitoring	All complaints recorded in appropriate system and forwarded to Vessel Master and Environment staff. If necessary noise shall be monitored to determine the level of impact.				
Reporting	Annual review of all complaints received and follow-up action undertaken.				
Corrective Action	Vessel Master to investigate source of complaint. If this relates to inappropriate work practices, inform crew of necessary changes and ensure these are undertaken. If complaints relates to plant, investigate effectiveness of noise reduction equipment and review/replace as required.				
Term	During all operations.				
Responsibility	Management and operation of on-board systems is by the Vessel Master, with input from Environment staff as required.				

6.4 Turbidity Control

The Dredging Contractor and Ports North will ensure that the dredging operation minimises turbidity production to reduce impacts to adjacent marine resources, such as seagrasses. The *TSHD* should be fitted with a range of best practice design features (e.g. central column weir and below keel discharge) to minimise turbidity production.

Turbidity monitoring of the dredging works will be undertaken by Ports North in accordance with LTMMMP monitoring plan requirements which has been prepared to address approval requirements. Should the monitoring identify that turbidity production from the dredging works is exceeding approval limits the Vessel Master will be urgently advised and dredging activities will be modified to ensure compliance with these limits.

Element	Turbidity Management
Impact	Potential impacts through deposition, light attenuation or decline to water quality due to anthropogenic elevation of suspended sediment within water column which may impact on marine species, including flora. Impacts to scenic amenity may also occur, giving rise to community complaint or concern.
Objective/Target	To ensure turbid plumes generated by the operation of the <i>TSHD</i> are minimised and comply with approval limits.
Management Actions and Mitigation Measures	<ul style="list-style-type: none"> • Within the practicalities of the vessel, minimise the generation of plumes by control of a discharge weir system. • Ensure dredging and material relocation is undertaken within the approved areas only by reference to electronic navigation aids and visual marks as required. • Observe all site-specific requirements, which may influence dredging times or the use of overflow dredging (eg tides, wind direction and velocity etc.). • As required under the approval conditions, Ports North is to implement a water quality and turbidity monitoring program if required.
Performance Indicators	No dredging or placement of material outside approved areas. Turbidity levels as a result of dredging works to be maintained within the limits stipulated within relevant approvals
Monitoring	Review of vessel dredging and placement tracks against approved area boundaries. Ports North to monitor turbidity levels in accordance with approval requirements.
Reporting	Reporting of any release of dredged material outside the nominated spoil ground to Vessel Master, Environment staff and Ports North Project Superintendent. Reporting by Ports North of any exceedence of permitted turbidity limits from monitoring activities to Vessel Master.
Corrective Action	Vessel Master to investigate the reason any release of dredged material outside the nominated spoil ground and take appropriate action. Ports North to determine if corrective action to reduce turbidity production is required. Vessel Master to develop and implement appropriate corrective action in consultation with Manager Dredging Operations (Corrective actions may include such as, reduction in load size, no overflow dredging etc).
Term	During all operations.
Responsibility	Management and operation of on-board systems is by the Vessel Master, with input from Manager Dredging Operations and Environment staff as required. Ports North is responsible for determining if turbidity levels at the dredge site are exceeding approval limits and determining if corrective action is required.

6.5 Protected Marine Fauna

The following procedure outlines the management to be put in place to minimise the risk of harming large marine fauna including turtles, dugongs and cetaceans during dredging operations. In the event of an incident, contacts are to be followed as outlined in this document.

Element	Protected Marine Fauna
Objective/Target	To ensure the minimisation of the capture of, or harm to, protected marine fauna during dredging and material relocation process.
Actions	<ul style="list-style-type: none"> Follow the procedures for the protection of marine fauna to meet the conditions outlined in the Sea Dumping Permit. Specifically: <ul style="list-style-type: none"> Prior to the commencement of each dredging and dumping run, Dredge Vessel Master to check, using binoculars from a high observation platform, for cetaceans, dugongs and turtles within the vicinity of vessel operation (i.e. adjacent to the dredging/dumping run about to be commenced). Dredging and dumping activities may only be commenced if no individuals of large marine fauna have been observed in the area adjacent to the dredge, and where there is a low likelihood of a collision occurring. Where any of the large marine fauna are sighted within the area adjacent to the dredge, dredging/dumping activities are to be halted until the last individual has been observed to leave the vicinity of the dredge. Vessel Master to maintain watch for marine fauna in high risk areas and take necessary action where risk of a collision may exist. Dredging and material placement only in approved areas. Turtle excluders will be fitted where possible during all operations where turtles may reasonably be encountered. Dredge suction to be started only when dredge heads are in contact with seafloor at start of dredge run, and then stopped once dredge heads are lifted from seafloor. Load to be inspected on an opportunistic basis for marine fauna remains.
Performance Indicators	<p>No dredging or placement of material outside approved areas.</p> <p>No capture of, or harm to, protected marine fauna.</p>
Monitoring	<p>Review of vessel dredging and placement tracks against approved area boundaries.</p> <p>Load to be inspected on an opportunistic basis for marine fauna remains.</p> <p>Visual monitoring of area adjacent to dredging operations, in accordance with Sea Dumping Permit conditions.</p>
Reporting	<p>Reporting of exceptions to Vessel Master Environmental staff (including time, nature of incident, species involved).</p> <p>This reporting requirement is irrespective of whether the fauna is dead or alive.</p> <p>Ports North to be urgently advised by Vessel Master, of any incidents to allow them to notify the Determining Authority of the incident, within timeframe specified in accordance with conditions of the Sea Dumping Permit.</p>
Corrective Action	Vessel Master to investigate reason for exception and take appropriate action.
Term	During all operations.
Responsibility	Management and operation of on-board systems is by the Vessel Master, with input from Environment staff as required.

6.6 Cultural Heritage

Cultural heritage refers to both European and Indigenous heritage issues.

Element	Cultural Heritage
Objective/Target	To ensure dredging operations do not disturb/destroy items of European or non-European cultural significance.
Actions	<ul style="list-style-type: none"> • Ensure dredging and material relocation is undertaken within the approved areas only by reference to electronic navigation aids and visual marks as required. • Undertake opportunistic visual inspection of dredge load and dredge heads, reporting any items of suspected cultural significance. If items are found, retain and report to relevant authorities through Vessel Master and Environment staff.
Performance Indicators	No disturbance of items of cultural significance.
Monitoring	Opportunistic inspection of the dredged material for evidence of items of cultural heritage. Monitoring of dredge movement through use of electronic aids to ensure it is within designated area.
Reporting	Reporting of exceptions to Vessel Master and Environment staff.
Corrective Action	Vessel Master to investigate reason for exception and take appropriate action.
Term	During all operations.
Responsibility	Management and operation of on-board systems is by the Vessel Master, with input from Environment staff as required.

6.7 Bunkering of Fuel

The *TSHD* is regularly re-fuelled by the use of a licensed contractor, typically on crew change.

Element	Bunkering of Fuel
Impact	Potential environmental harm from fuel product spills if approved operating procedures are not enacted
Objective/Target	To ensure bunkering of fuel to the <i>TSHD</i> is appropriately transferred and spillage is prevented.
Management Actions and Mitigation Measures	During land transfer: <ul style="list-style-type: none"> • Licensed contractor is used to transfer fuels and levels shall be monitored. • Standard work procedures and bunkering operations are to be followed, including those in place by the fuel supply contractor.
Performance Indicators	No spills or leaks during fuel transfer.
Monitoring	Visual inspections of fuel-dispensing equipment during fuel transfer.
Reporting	Reporting of unanticipated spill/leak to Vessel Master in the first instance, then Manager Dredging Operations and Environment staff.
Corrective Action	In the event of a major spill, call Emergency Spill Response team for corrective action. Vessel Master to investigate source and cause of spill or inappropriate work practices. Change to operating procedures and inform crew.
Term	During all operations.
Responsibility	Management and operation of bunkering of fuel is by the Vessel Master.

6.8 Ballast Water and Hull Fouling Management

Given all dredging will occur within Port limits there is a low risk associated with the ballast water. However, if the *TSHD* is going to leave following a dredging job within Port limits or returning from a dredging job outside Port limits, the following shall be followed.

Element	Ballast Water – Hull Fouling Management
Impact	Translocation of marine flora and fauna species from another port to the site of vessel operations may have a long term deleterious impact to natural resident marine flora and fauna. This is especially the case for known marine pest species.
Objective/Target	To ensure that the risk of translocation of organisms in ballast water by the <i>TSHD</i> is minimised.
Management Actions and Mitigation Measures	<p>Implement best practice vessel maintenance and management</p> <p>Conduct actions required under ANZECC Hull Maintenance Guidelines, AQIS and Bio-Security Queensland invasive species protocols.</p> <p>Implement National Biofouling Management Guidance for Non-trading Vessels (Commonwealth of Australia, 2009).</p> <p>Finalising operations at Port:</p> <ul style="list-style-type: none"> • Before leaving Port of origin, undertake a thorough hopper wash within the material location area only. • If discharge pipes have been utilised during operations, undertake a thorough flush of these systems. • Inspect hopper and dredge gear (esp. heads) to ensure that no material which may transport organisms (such as sediments, organic material or waters) is retained. <p>During transit between areas of operation:</p> <ul style="list-style-type: none"> • Any ballast tanks holding seawaters will be exchanged with a minimum 150% of design volume with seawaters at a location as distant from the coastline or other shallow (<100m) areas as possible, but not less than 5nm. • Ballast tanks filled with freshwaters will be retained without treatment. • Waters held within the hopper during transit will be treated as for other ballast waters. <p>During operations at dredge area:</p> <ul style="list-style-type: none"> • Release of ballast waters will be minimised at all times; • A record will be kept of volumes, location and times of ballasting and deballasting operations. <p>Leaving Port of Operations</p> <ul style="list-style-type: none"> • When leaving the Port of Operations the vessel, hoppers and pipe work is to be adequately inspected and cleansed to ensure potential for translocation of pest species to next port of call. Follow specific vessel operation procedures.
Performance Indicators	<p>Contract requirements for vessel inspection, proof of freedom and prior port of operation clearance is complete prior to vessel arrival and commencement of dredging.</p> <p>No release of high risk ballast water during operations.</p>
Monitoring	<p>Remain informed of risk profile assessment work by Bio-security agencies for respective Australian ports.</p> <p>Vessel Log of ports of call and operation</p> <p>Review of vessel log of ballast/de-ballasting operations.</p>
Reporting	Vessel Master to maintain record of operations and review for non-conformances.
Corrective Action	Review procedure causing release and rectify immediately.
Term	During all operations.
Responsibility	Vessel Master.

6.9 Vessel Wash Down

This management plan relates to the washing of the dredge head or the deck of the *TSHD* where an accumulation of dredge spoil may have occurred.

Element	Vessel Wash down
Impact	Potential harm from cleaning agents may occur if improper agents are used in vessel cleansing. Wash down of hopper, pipe work or dredge heads in areas outside the approved work area or spoil ground may lead to additional turbidity impacts, or deposition of spoil outside approved disposal site.
Objective/Target	To minimise the release of potential contaminants to enter the environment.
Management Actions and Mitigation Measures	<ul style="list-style-type: none">• Prior to washing, preference shall be given to sweeping the deck and/or equipment.• If washing is required, biodegradable degreaser shall only be used where necessary and will be applied sparingly.• Only 'quick-break' degreasers shall be used and any discharges shall be minimised.• Wash down of the deck and or dredge head shall only occur within the designated dredge area.• Degreasers only to be used if sweeping or watering the deck/equipment is not appropriate.
Performance Indicators	No inappropriate use of degreasers or wash down in undesignated areas.
Monitoring	Reporting by crew of any observations of contamination to the waterway whilst washing the deck/equipment.
Reporting	Exception reports directly to vessel Master.
Corrective Action	Vessel Master to review procedure breakdown and correct if required. This may include staff training.
Term	During all operations.
Responsibility	Management and operation of on-board system is by the Vessel Master, with input from Environment staff as required.

6.10 Environmental Complaints

Any complaints received by Dredge Vessel crew relating to the operation of the *TSHD* will be recorded as part of standard operating procedures. Complaints will be recorded on the appropriate form and forwarded to the Vessel Master. The Master is to then initiate actions to resolve/investigate the complaint as required, with assistance from Ports North staff as necessary. A copy of all complaints will be forwarded to the respective Ports North staff via the Site Supervisor.

Issues which are not directly related to the operation of the *TSHD*, but are related to the Karumba dredging project will be forwarded to the Site Supervisor and Ports North. Whilst feedback on the resolution of the issue will be sought for recording to Ports North's Management Systems, the management of the issue will be the responsibility of the Project Superintendent and Ports North protocols.

6.11 Dredging Activity

The crew of the *TSHD* are to keep a record of dredging activity, which meets Ports North reporting requirements under the Sea Dumping Permit. Such information will include the times and dates of each dumping run, begin and end points of dredge runs, material type, volume, location of material relocation and other pertinent observations as part of the standard vessel operating procedures. This data will be forwarded to Ports North at the completion of works.

Regular review and checking of dredge location relative to approved area, review of dredge volume to date relative to permitted campaign volume and verification of disposal point or track records will be completed by the Contactor to ensure compliance with applicable permits.

7 Emergency Procedures

The TSHD is to maintain a *Shipboard Emergency Plan*, which outlines the role, responsibilities and actions to be followed during an emergency, including uncontrolled release of oils/fuels.

Further, all crew are to be trained and accredited in accordance with the Australian Maritime Safety Authority (AMSA) requirements for Australian Coastal voyages.

It is recommended that the TSHD vessel maintains an accredited to AS4801 Safety Management System. As part of this system, all onboard procedures are to be available to all crew in a written format in the Operational Procedures Manual and a vessel log is to be maintained by the Vessel Master.

Emergency Contact Details

Reporting to	Contact Numbers
AMSA Marine Incident Reporting	
Via Mobile Phone)	1800 641 792
Via Satellite	00612 6230 6811
Harbour Master (Cairns)	
Office	07 4052 7470 (24 Hours)
Mobile	0418 774 028
Port Control (via Cairns)	
Office	07 4052 7470 (24 Hours)
Mobile	0418 774 028
Medical Facilities	
Karumba Health Centre Normanton Road Karumba.	07 4745 9137
Normanton Hospital Brown St Normanton	07 4745 1144

8 Reporting

A final close out report summarising the outcomes of the EMP implementation is to be developed by the Contractor, noting any reportable items in the respective sections above, outcome of the campaign, and any observations that may be of interest to the TACC and DAWE.

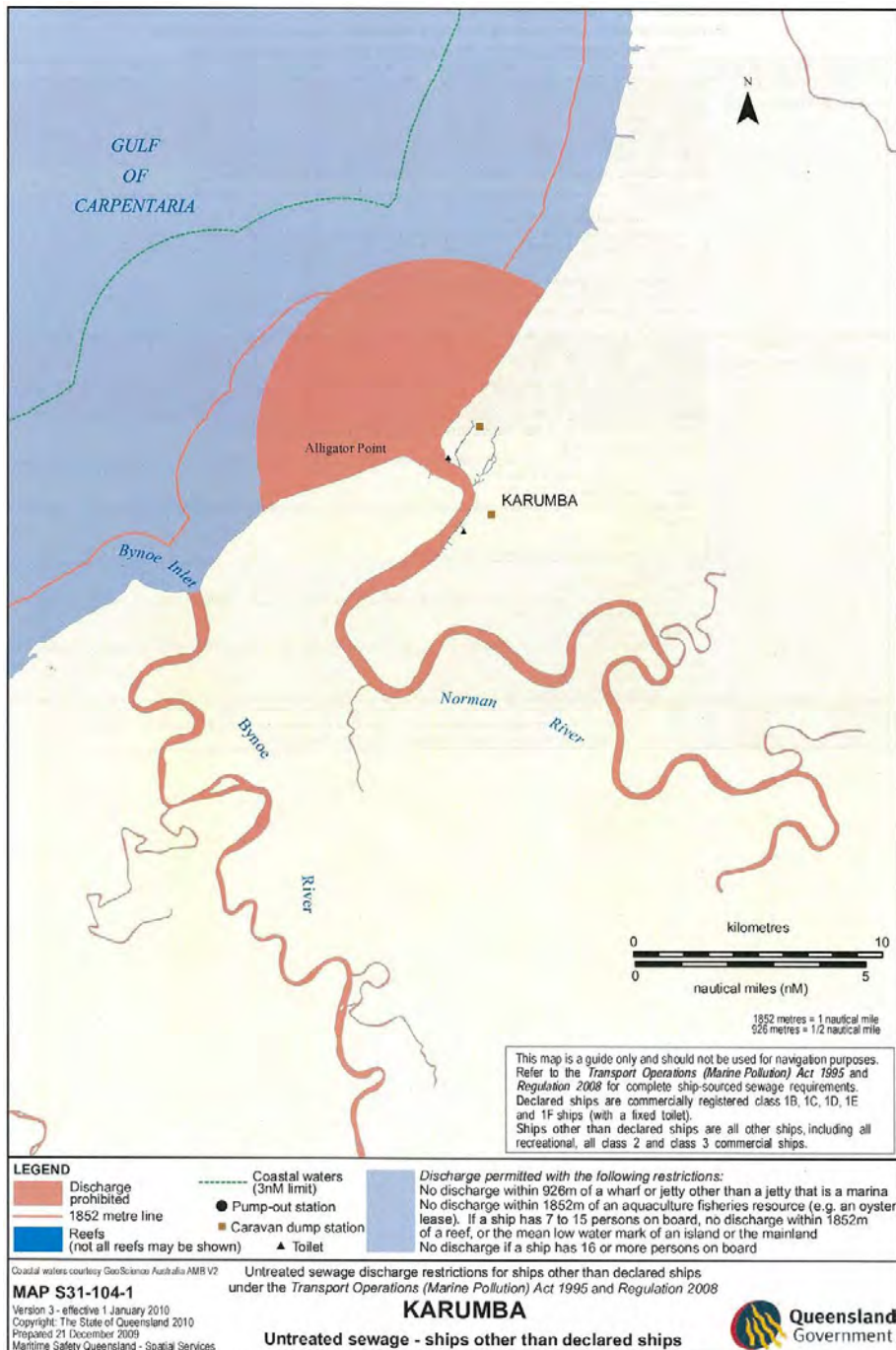
Such close out report will be provide to and reviewed by Ports North.

9 Appendices

9.1 Appendix 1 Sewage Discharge Areas

Untreated Sewage Discharge Karumba

The discharge of untreated sewage, is required to comply with s47 of *Transport Operations (Marine Pollution) Act 1995 (TOMPA)*, Schedule 4 of *Transport Operations (Marine Pollution) Regulation 2008 (TOMPR)* as prescribed below.



9.2 *Appendix 2 Approvals*

Permits and Licences for Project

- valid copies of applicable environmental approvals to be attached as at time of contract resolution and commencement of EMP implementation

Appendix 9 Environmental Management Plan – Bed Levelling Campaign

Appendix 9

Port of Karumba LTMMP

Channel Bed Levelling

ENVIRONMENTAL MANAGEMENT PLAN

Template for Inclusion in
Long Term Management and Monitoring Plan (LTMMP)

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Document Control		Drafted	Released
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Version 1	Updated for LTMMMP to form template	January 2011	March 2012
Version 2	Updated as Appendices for LTMMMP and change to Agency names	April 2012	June 2012
Version 3	Updated for Final LTMMMP	January 2013	February 2013
Version 4	Updated for LTMMMP 2023-2033	February 2022	February 2022

I Scope

This document forms an Appendix to the Karumba Long Term Management and Monitoring Plan (LTMMP) and is to be considered a template for use by an appointed bed levelling vessel contractor as engaged by Ports North for the conduct of bed levelling campaigns at Port of Karumba. The Contractor may already have an existing document for their own operations, and in such case those management plan specifications shall prevail to the extent where this document, as approved by the DAVE will have superiority.

2 Introduction

Environmental management measures have been developed for the proposed bed levelling works to ensure environmental safeguards are in place to minimise impact on the natural environment. All personnel involved in the project are required to demonstrate a general environmental duty of care throughout the project. This Environmental Management Plan (EMP) identifies potential impacts and the management strategies to be implemented during the bed levelling works.

Far North Queensland Ports Corporation Limited (FNQPC), trading as Ports North, has an Environmental Management Framework, and associated Policy, which provides a framework for continually improving operations and practices (refer Appendix A).

Ports North staff and contractors involved in this project are required to protect the environment under requirements of applicable legislation, including the *Queensland Environmental Protection Act 1994*. The appointed Contractor is required to comply with the requirements of Ports North's Environment Policy and all management measures specified below.

Bed levelling works are an interim low environmental risk maintenance activity aimed at producing navigable depth at least cost and in a timely manner to allow continued operation of shipping channel and the port.

3 Description of Proposed Activities

The objective of this work is to conduct bed levelling or drag baring works, to relocate accumulated sediments from the shallow section of the channel, to adjacent deeper sections and allow sufficient draft until the regular maintenance dredging campaign.

Previous bed levelling activities have typically been completed during a two week campaign.

4 Legislative Requirements

Approvals under applicable sections of Commonwealth and State environmental legislation are maintained by Ports North for areas in which dredging, bed levelling or disposal may occur. Such approvals may be ongoing development approvals for the subject area or require an annual renewal. Brief description of key legislative requirements is provided as follows;

Environmental Protection Act 1994

Under the *Queensland Environmental Protection Act 1994* (EP Act), an environmental duty of care is required at all stages of the project by all staff (*Section 316* of the EP Act). The basic principles of the EP Act should be understood by all project staff.

No approvals or thresholds are triggered for the conduct of bed levelling works under the *Environmental Protection Regulation 2019*, and hence there are no Environmentally Relevant Activities (ERA's) involved in the proposed activity.

Fisheries Act 1994

Approvals under the *Fisheries Act 1994* are required where direct impacts to marine flora or fauna defined under the Act are likely to occur. No such approvals are required for either the maintenance dredging campaigns, or bed levelling work as prior surveys by the former Department of Agriculture and Fisheries (DAF) have determined the spatial extent of seagrass meadows as being outside the channel and works area. Across the southern Gulf of Carpentaria, light limitation due to natural turbidity precludes colonisation of marine flora such as seagrass from such depths as those that are found within the maintained channel.

Coastal Protection and Management Act 1998

An approval under the former *Section 86* of the *Harbours Act 1955* is in place for works on defined areas of the sea bed within the port limits inclusive of dredging, disposal and bed levelling.

Nature Conservation Act 1992

Under the *Nature Conservation Act 1992*, individuals and organisations have an obligation to prevent any potential injury or harm to flora and fauna. All environmental safeguards must be implemented, particularly during periods of likely movement of turtles, dugong or other large marine fauna.

5 Responsibilities and Contacts

A contacts list based on the example below is to be generated for the project once Contract arrangement is finalised to ensure chain of communication is clearly documented.

Contact details for the following positions will be recorded;

Position	Name and Contact Number	Role
Superintendent		Contractor liaison
Ports North Environment Manager		EMP implementation Incident recording and reporting Supervise applicable monitoring
Contractor		Conduct of drag bar works
Ports North Port Supervisor		Customer and stakeholder liaison Supervision
Ports North General Manager Planning and Infrastructure		Contract management Customer and stakeholder liaison Supervision of contractors
Ports North General Manager Corporate Services		Community engagement and complaints

6 Implementation

The Contractor will be responsible for the implementation of this EMP for the duration of the project including;

- monitoring the environmental management of day-to-day dredge vessel operations;
- ensure that all personnel working onsite are aware of their environmental responsibilities and the importance of the EMP.
- regular inspection of the adequacy of all environmental controls, including health and safety requirements.

7 Induction

All personnel working onsite must attend an induction or 'tool box' by the Principal Contractor prior to commencing works. The induction will cover relevant provisions from this EMP, including:

- Performing work duties with minimal impact on the existing environment
- General environmental duty of care
- Incident recognition and reporting – including marine fauna

Superintendent will maintain a record (Diary, Register or File) of the completed inductions.

8 Auditing

An environmental audit may be conducted by Ports North to determine implementation status of this EMP at any time during the project. The Contractor must keep a copy of this document together with any relevant environmental licence, permit or approvals onsite at all times.

The Port Supervisor may also inspect the works at any time to ensure all project commitments by the Contractor are implemented.

9 General Environmental, Safety or Community Impacts

To minimise impacts on social and environmental aspects of the project, the following management measures shall be adopted:

- All site personnel will be advised of their responsibilities for reporting any potential or actual environmental harm in accordance with the *Environmental Protection Act 1994*.
- The Superintendent for the project is to be notified of any safety or environmental incidents (including complaints) that occur immediately.
- An Incident Form will be completed and remedial actions will be monitored.
- Cultural heritage duty of care – observation and reporting duties.
- The Contractor is required to record all details of any community complaint received and to notify Superintendent including details of the action taken to rectify the situation.
- The Contractor will comply with all employer and employee obligations under the *Work Health and Safety Act 2011* and shall prepare a Safety Management Plan to cover site activities.
- Port Supervisor will consult with relevant stakeholders prior to commencement of works.
- Notice to mariners will be implemented by Maritime Safety Queensland, alerting recreational and commercial fishers and other port traffic to the location and extent of works.
- Superintendent will maintain a diary record of any complaints received and actioned.

10 Environmental Management Elements

This section provides principles, controls and management strategies for the different aspects of the project, which must be adhered to at all times by all persons involved in the project to reduce the potential impacts identified.

10.1 Aspects and Impacts

Under conditions of general operations, with all management actions, mitigation measures in place, the following qualitative risk profile is considered to prevail.

Standard Environmental Aspects	Potential Impacts	Consequence	Likelihood	Risk
Noise	Impacts to sensitive receptors and subsequent complaints	L	L	L
Odour/ Air Emission	Impacts to sensitive receptors and subsequent complaints	L	L	L
Water Quality	Influence on quality of receiving waters from works, aesthetics, and subsequent impacts to flora and fauna	H	H	H
Contaminated Sediments	Mobilisation of contaminants in to water column and subsequent water quality impacts	M	L	L
Marine Fauna	Damage to large marine fauna, marine animal strikes	H	M	H
Cultural Heritage	Damage to artefacts or sites	L	L	L
Natural Disaster	Surge, wind, flooding	L	H	H
Waste (Solid & Liquid)	Pollutant release, complaints	M	L	M
Community Engagement	Impacts to sensitive receptors and subsequent complaints	M	L	M

Detail on these Aspects and Impacts, along with detail of typical environmental management plan content is explored in the following sections in the context of a typical bed levelling operation;

10.1.1 Water Quality including Turbidity

After consideration of possible spoil contaminants has been assessed and material considered suitable for dredging and disposal, the primary consideration then relates to sedimentation and turbidity. Secondary water quality effects such as changes to dissolved oxygen, sulphides, pH and conductivity are typically of very minor risk. The Contractor and Ports North will ensure that bed levelling operations minimises turbidity production to reduce impacts to adjacent marine resources, such as seagrasses wherever practical through use of best practice equipment, mitigation measures and effective management of the campaign. Monitoring component for water quality impacts of dredging and bed levelling works will be implemented in accordance with LTMMMP monitoring plan which has been prepared to address approval requirements.

Aspect	Water Quality - Turbidity
Impact	<p>The primary environmental impacts associated with bed levelling is the re-suspension of sediment into the water column and the creation of suspended particle plumes which may affect adjacent areas (e.g flora) by sedimentation or reduction of light penetration through the water. Natural turbidity levels in the coastal zone of the Gulf of Carpentaria typically observed at Port of Karumba can be very high, dependant on wind, tidal and catchment runoff conditions.</p> <p>Therefore short term works are expected to be well within natural tolerances. Previous extensive monitoring completed since 1996 and subsequent maintenance dredging indicates natural turbidity values to 300NTU at Alligator Bank under low water levels and strong onshore northerly wind conditions.</p> <p>Sediments and turbidity from the works are most likely to move toward sensitive areas in period of north-west to north-east winds and incoming spring tides.</p>
Objective/Target	To ensure turbid plumes generated by the operation of bed levelling equipment is minimised and comply with approval conditions.
Management Actions and Mitigation Measures	<ul style="list-style-type: none"> • Within the practicalities of the vessel, minimise the generation of plumes by control of vessel operations. • Ensure dredging and material relocation is undertaken within the approved areas only by reference to electronic navigation aids and visual marks as required. • Observe all site-specific requirements, which may influence work times (e.g. tides, wind direction and velocity etc.). • As required under the approval conditions, Ports North is to implement a water quality and turbidity monitoring program if required by LTMMMP or Permit.
Performance Indicators	<p>No dredging or placement of material outside approved areas.</p> <p>Turbidity levels as a result of dredging works to be to be maintained within the limits stipulated within relevant approvals</p>
Monitoring	<p>Review of vessel dredging and placement tracks against approved area boundaries.</p> <p>Ports North to monitor turbidity levels in accordance with approval requirements and LTMMMP initiatives.</p>
Reporting	<p>Reporting of any bed levelling activity outside the nominated works area by Vessel Master to Environment staff and Ports North Project Superintendent.</p> <p>Reporting by Ports North of any cases where results exceed permitted turbidity limits from monitoring activities to Vessel Master.</p>
Corrective Action	<p>Ports North to investigate actions of Vessel Master to determine reason for any activity outside the nominated work area and take appropriate action.</p> <p>Should the monitoring identify that turbidity production from the bed levelling works is exceeding approval limits the Vessel Master will be urgently advised and dredging activities will be modified (duration, location, intensity) to ensure compliance with these limits.</p> <p>Ports North to determine if corrective action to reduce turbidity production is required. Vessel Master to develop and implement appropriate corrective action in consultation with Superintendent.</p>
Term	During all operations.
Responsibility	<p>Management and operation of on-board systems is by the Vessel Master</p> <p>Ports North is responsible for determining if turbidity levels at the work site are exceeding approval limits and determining if corrective action is required.</p>

10.1.2 Contaminated Sediments

Previous sediment analysis plan (SAP) implementation at the Port of Karumba has occurred in 2002, 2006, 2009, 2015, and 2020. This has shown material within the entrance channel to be generally clean and consist predominantly of natural concentrations of base metals, an absence of herbicides or pesticides and low concentrations of antifouling paint residue tri-butyl tin. Material from Port of Karumba has been assessed previously as suitable for placement at sea and is considered uncontaminated.

Consequently no specific water quality monitoring for contaminants is proposed for routine bed levelling operations.

Aspect	Contaminated Sediments
Impact	Movement of contaminated sediment during bed levelling has potential to mobilise elements into the water which may have acute or chronic effects to flora and fauna, or may then disperse to surrounding areas. An understanding of the contaminant status of the sediment to be dredged is required and is typically assessed when determining disposal options for dredging prior to capital or maintenance dredging campaigns in accordance with the <i>National Assessment Guidelines for Dredged Material (NAGD) 2009</i> .
Objective/Target	To ensure mobilised sediments generated by the operation of bed levelling equipment does not result in water quality impacts to surrounding flora, fauna and is minimised to comply with approval conditions.
Management Actions and Mitigation Measures	Ensure conduct of Sediment Analysis Plan process as per NAGD (2009) and that potential water quality impacts are assessed for proposed spoil. Within the practicalities of the vessel, minimise the generation of plumes by control of vessel operations. Ensure dredging and material relocation is undertaken within the approved areas only by reference to electronic navigation aids and visual marks as required. As required under the approval conditions, Ports North is to implement a water quality and turbidity monitoring program if required by LTMMMP or Permit.
Performance Indicators	An approved Sediment Analysis Plan is implemented and Report is approved by the DAWE for the proposed work area.
Monitoring	Ensure SAP process is implemented as set out in LTMMMP, and in the event that contaminants are detected at a level above which water column effects may occur proceed through Phase III and IV to determine requirement for any specific contaminant monitoring requirement.
Reporting	Reporting of verifiable reports of contaminant issues that have been confirmed as caused by bed levelling activity. Reporting by Ports North of any cases where results exceed permitted limits from monitoring activities to DAWE.
Corrective Action	Ports North to Implement SAP and any required specific contaminant monitoring if required.
Term	During all operations.
Responsibility	Ports North is responsible for ensuring SAP is implemented and any required actions in respect of contaminant monitoring are addressed.

10.1.3 Waste Management

The bed levelling vessel and supporting vessels are to be fitted with sufficient waste bins for the collection of on-board wastes until such time as appropriate on shore refuse disposal can be enacted.

Aspect	Waste Management
Impact	Un-controlled release of waste from work sites as litter may impact the nearby environment and also present a visual impact. Inappropriate disposal of waste that does not follow the waste management hierarchy of reduce, reuse, recycle dispose impacts on resource availability and future sustainability of materials supply.
Objective/Target	To ensure that general refuse produced on-board the vessels is collected, retained and transferred to appropriate facility without unintentional loss.
Management Actions and Mitigation Measures	<p>During at-sea operations:</p> <ul style="list-style-type: none"> • Supply of appropriate collection bins in areas such as galley, crew quarters and mess. • Transfer of waste as required to on-deck bins. • All on-deck bins secured in position to prevent movement whilst at sea. • Material placed in bin to be as compacted as possible to reduce space requirements. • Where facilities exist to recycle material, appropriate separation of refuse. • These are to be fitted with secured lids to prevent material being blown overboard during either storage or handling. • Bin lids to be chained down to prevent windblown material loss at all times. • All collection points to be emptied to on-deck bin when near capacity. • Visual check to ensure that on-deck bins have sufficient capacity to retain general waste until next scheduled on-shore transfer. <p>During transfer:</p> <ul style="list-style-type: none"> • An approved contractor is to collect the bins as required when the vessel is alongside port reception facilities. • Licensed collector to be used to collect general refuse for transfer to approved facility. • Bin lids to be chained in position during transfer to prevent material loss. <p>General</p> <p>Potential wastes generated from the project are likely to be minimal and consist of minor volumes of waste generated by the crew onboard the bed levelling vessel.</p> <ul style="list-style-type: none"> • Minimise waste generation. Adopt the waste minimisation practices of - reduce, reuse and recycle. • Ensure there is no contamination of surrounding environments in compliance with the General Environmental Duty of the <i>Environmental Protection Act 1994</i>. • Waste removal should go to an approved landfill facility unless other conditions apply. <p>Complete Daily EMP Checklist – refer Appendix D</p>
Performance Indicators	No loss of general refuse over-board during vessel operations, collection, storage or transfer.
Monitoring	Regular visual assessment of collection points and on-deck bins.
Reporting	Reporting of material loss over-board to Vessel Master. Complete Incident Form –Appendix B
Corrective Action	If practicable, retrieve material that was lost overboard. Review procedure causing material loss and rectify immediately.
Term	During all operations.
Responsibility	Crew and then Vessel Master.

10.1.4 Noise

Vessels and equipment utilised in a typical bed levelling campaign should be fitted with well maintained noise reduction devices to limit the noise generated during works as much as possible. Further, the nature of the works and remote rural port locations is such that the potential for disruptive noise to sensitive places (e.g. residential areas) is limited by distance.

Aspect	Noise Management
Impact	Noise generated from vessels plant or equipment during development or maintenance works has potential to disturb the amenity of surrounding areas, including noise sensitive areas such as residential areas. Infrequent or high volume noise is typically a cause for complaint, especially outside normal working hours. Ambient noise levels within the Port of Karumba are expected to be generally at a low background level with some influence of transiting vessel traffic from Port facilities. Minimal impact is normally expected on nearby sensitive receptors.
Objective/Target	To ensure noise generated by operation of the Bed Leveller does not unduly impact adjacent areas.
Mitigation Measures and Management Actions	<ul style="list-style-type: none"> All noise reduction equipment to be maintained as per manufactures' specifications. Where the vessel is operating in an especially noise sensitive environment (e.g. close proximity to residential areas), crew are to be informed to minimise noise where possible. All noise from activities must not exceed the acoustic quality objectives specified in the <i>Environmental Protection Noise Policy 2019</i>. Noise levels for selected receptors identified in the <i>Environmental Protection Noise Policy</i>. <p>Noise generated by vessels involved in the bed levelling works is not likely to be significant, nor is it likely to be located near noise sensitive areas.</p> <p>Prior approval is required from Ports North if works are expected to occur outside these hours:</p> <ul style="list-style-type: none"> 6:00am – 6:00pm (Monday – Sunday). All equipment is to be maintained and operated in accordance with the Australian standard AS 2436:1981 "Guide to noise control on construction, maintenance and demolition sites". Vehicles and equipment will be turned off when not in use. All noise complaints shall be recorded and reported to the Superintendent as soon as practical. <p>Complete Daily EMP Checklist – refer Appendix D</p>
Performance Indicators	No noise based complaints regarding the operation of the vessel.
Monitoring	All complaints recorded in appropriate system and forwarded to Vessel Master and Environment staff. If necessary noise shall be monitored to determine the level of impact.
Reporting	Annual review of all complaints received and follow-up action undertaken. Complete Incident Form –Appendix B
Corrective Action	Vessel Master to investigate source of complaint. If this relates to inappropriate work practices, inform crew of necessary changes and ensure these are undertaken. If complaints relates to plant, investigate effectiveness of noise reduction equipment and review/replace as required. Should additional complaints be received following implementation of the above measures, then additional Mitigation Measures will be developed as required.
Term	During all operations.
Responsibility	Management and operation of on-board systems is by the Vessel Master, with input from Environment staff as required.

10.1.5 Hull Fouling Management

Maintenance of effective hull protection systems and minimisation of fouling through routine slipping and cleaning is required to ensure a low risk from translocation of potential marine pest species to or from the Port of Karumba. This is especially the case where a foreign vessel is brought into the country to complete the contract. Low ballast water volume requirement for bed levelling vessels and hence lower risk mean hull fouling is a more probable issue. The following approach is to be implemented.

Element	Ballast Water – Hull Fouling Management
Impact	Translocation of marine flora and fauna species from another port to the site of vessel operations may have a long term deleterious impact to natural resident marine flora and fauna. This is especially the case for known marine pest species.
Objective/Target	To ensure that the risk of translocation of organisms in ballast water and hull fouling is minimised.
Management Actions and Mitigation Measures	<p>Implement best practice vessel maintenance and management Conduct actions required under ANZECC Hull Maintenance Guidelines, AQIS and Bio-Security Queensland invasive species protocols. Implement <i>National Biofouling Management Guidance for Non-trading Vessels (Commonwealth of Australia, 2009)</i>.</p> <p>Finalising operations at Port:</p> <ul style="list-style-type: none"> • Before leaving Port of origin, undertake a thorough wash within the work area only. • undertake a thorough flush of pipe work systems. • Inspect drag bar, chains, ropes etc to ensure that no material which may transport organisms (such as sediments, organic material or waters) is retained. <p>During transit between areas of operation:</p> <ul style="list-style-type: none"> • Any ballast tanks holding seawaters will be exchanged with a minimum 150% of design volume with seawaters at a location as distant from the coastline. • Ballast tanks filled with freshwaters will be retained without treatment. <p>During operations at dredge area:</p> <ul style="list-style-type: none"> • Release of ballast waters will be minimised at all times; • A record will be kept of volumes, location and times of ballasting and deballasting operations. <p>Leaving Port of Operations</p> <ul style="list-style-type: none"> • When leaving the Port of Operations the vessel, hull, and pipe work is to be adequately inspected and cleansed to ensure potential for translocation of pest species to next port of call. Follow specific vessel operation procedures.
Performance Indicators	<p>Contract requirements for vessel inspection, proof of freedom and prior port of operation clearance is complete prior to vessel arrival and commencement of dredging.</p> <p>No release of high risk ballast water during operations.</p>
Monitoring	<p>Remain informed of risk profile assessment work by Bio-security agencies for respective Australian ports.</p> <p>Vessel Log of ports of call and operation</p> <p>Review of vessel log of ballast/de-ballasting operations.</p>
Reporting	Vessel Master to maintain record of operations and review for non-conformances.
Corrective Action	Review procedure causing release and rectify immediately.
Term	During all operations.
Responsibility	Vessel Master.

10.1.6 Air Emissions

The generation of emissions with potential to impact on air quality during vessel operation and potential impacts on sensitive receptors forms the basis of this section. Issues of workplace air quality are to be controlled and managed under existing occupational health and safety protocols within the respective vessel safety management system.

Aspect	Air Quality - Emissions
Impact	Vessel operation has the potential to generate visible and invisible exhaust emissions which may have potential to cause nuisance impacts to nearby sensitive receptors. Emissions generated from vessels plant or equipment during development or maintenance works has potential to disturb the amenity of surrounding areas, including sensitive areas such as residential areas. Ambient air quality within the Port of Karumba are expected to be generally in excellent natural condition with minimal influence of transiting vessel traffic from Port facilities, and industrial land use. Minimal impact is normally expected on nearby sensitive receptors.
Objective/Target	To ensure air quality emissions generated by operation of the bed levelling vessel plant and equipment does not unduly impact adjacent areas.
Mitigation Measures and Management Actions	<ul style="list-style-type: none"> • All equipment to be maintained as per manufactures' specifications. • All emissions from activities must not exceed the applicable air quality objectives specified in the <i>Environmental Protection (Air) Policy 2019</i>. • Air quality emissions generated by vessels involved in the bed levelling works is not likely to be significant, nor is it likely to be located near noise sensitive areas. • All equipment is to be maintained and operated in accordance with the applicable Australian Standards. • Vessels and equipment will be turned off when not in use. • All air quality complaints shall be recorded and reported to the Superintendent as soon as practical. <p>Complete Daily EMP Checklist – refer Appendix E</p>
Performance Indicators	No air quality based complaints regarding the operation of the vessel.
Monitoring	All complaints recorded in appropriate system and forwarded to Vessel Master and Environment staff. If necessary air quality may be monitored to determine the level of impact.
Reporting	Annual review of all complaints received and follow-up action undertaken. Complete Incident Form –Appendix B
Corrective Action	<p>Vessel Master to investigate source of complaint. If this relates to inappropriate work practices, inform crew of necessary changes and ensure these are undertaken. If complaints relates to plant, investigate effectiveness of emission reduction equipment and review/replace as required.</p> <p>Contractor to visually monitor emission levels through observation on a daily basis</p> <p>Should additional complaints be received following implementation of the above measures, then additional Mitigation Measures will be developed as required.</p>
Term	During all operations.
Responsibility	Management and operation of on-board systems is by the Vessel Master, with input from Environment staff as required.

10.1.7 Marine Fauna

Operation of vessels, including bed levelling plant and equipment in coastal environments has a risk of harming large marine fauna including turtles, dugongs and cetaceans; however this risk is typically very low due to the mobile nature of most species and slow movement of bed levelling equipment.

Aspect	Marine Fauna
Impact	Local flora and fauna may be disturbed as a result of the bed levelling works due to – <ul style="list-style-type: none"> • Presence of vessel in proximity to exposed intertidal mud flats which may disturb birdlife, • Increased sedimentation which may impact nearby seagrass, • Direct contact impacts of vessel with marine fauna such as crocodiles, dugong and turtles.
Objective/Target	Minimise capture of, or harm to, protected marine fauna during bed levelling operations and vessel operations.
Management Actions and Mitigation Measures	Follow the procedures for the protection of marine fauna to meet the conditions outlined in the Sea Dumping Permit. Specifically: <ul style="list-style-type: none"> • Prior to the commencement of each bed levelling run, Vessel Master to check, from a high observation platform, for cetaceans, dugongs and turtles within the vicinity of vessel operation (i.e. adjacent to the vessel about to be commenced). • Bed levelling activities may only be commenced if no individuals of large marine fauna have been observed in the area adjacent to the vessel, and where there is a low likelihood of a collision occurring. • Where any of the large marine fauna are sighted within the area adjacent to the bed levelling vessel, activities are to be halted until the last individual has been observed to leave the vicinity of the vessel. Vessel Master to maintain watch for marine fauna in high risk areas and take necessary action where risk of a collision may exist. Bed levelling works only in approved areas. Avoid and prevent injury to all wildlife during the project. Complete Daily EMP Checklist – refer Appendix D
Performance Indicators	No bed levelling outside approved areas. No capture of, or harm to, protected marine fauna.
Monitoring	Review of vessel tracks against approved area boundaries. Review of bed levelling vessel log book for events where fauna was encountered. Visual monitoring of area adjacent to operations, in accordance with Sea Dumping Permit conditions.
Reporting	Reporting of exceptions to Vessel Master and Environmental staff (including time, nature of incident, species involved). This reporting requirement is irrespective of whether the fauna is dead or alive. Ports North to be urgently advised by Vessel Master, of any incidents to allow them to notify the DAWE of the incident, within timeframe specified in accordance with conditions of the Sea Dumping Permit. Complete Incident Form –Appendix B
Corrective Action	Vessel Master to investigate exception, and take appropriate action. In the event of a sick or injured animal, the Contractor shall notify the Superintendent or Port Supervisor who will follow up with Environment staff and or QPWS-DES.
Term	During all operations.
Responsibility	Management and operation of on-board systems is by the Vessel Master, with input from Environment staff as required.

10.1.8 Community Engagement

Management of interactions between bed levelling vessels and community members, delays to vessel movement and general misunderstanding of the process of bed levelling may lead to complaint by members of the public. The following section outlines the framework for this important aspect of the works;

Aspect	Community Engagement
Impact	Extreme weather or natural disaster events including tropical cyclones, storm surge, tsunamis, flooding, and abnormal weather patterns may impact dredging or bed levelling work.
Objective/Target	To ensure dredging operations are completed without undue community complaint. Community is well informed of the occurrence of the works and informed of the environmental management measures in place.
Management Actions and Mitigation Measures	Ensure notice is provided via signage at boat ramps and if applicable MSQ "Notice to Mariners". Schedule of forth coming works is to be advised well in advance of works through the Karumba Technical Advisory Consultative Committee (TACC) for dissemination to respective stakeholder groups,
Performance Indicators	No complaints in regard to impact of works on the community.
Monitoring	Check signage, notices Port Supervisor to monitor community interactions and discussions and advise General Manager Projects and Planning or General Manager Corporate Services of any emerging issues.
Reporting	Reporting of complaints by Port Supervisor, Vessel Master and Environment staff.
Corrective Action	Ports North to investigate reason for exception and take appropriate action.
Term	During all operations.
Responsibility	Ports North Operations staff and Ports North dredge contract supervisor.

10.1.9 Natural Disaster

Events involving significant weather or geographic events may periodically give rise to situations where additional management actions may be required to prepare and protect of works, plant or equipment to minimise risk of subsequent environmental harm.

Aspect	Natural Disaster
Impact	Extreme weather or natural disaster events including tropical cyclones, storm surge, tsunami, flooding, and abnormal weather patterns may impact dredging or bed levelling work.
Objective/Target	To ensure dredging operations are prepared and a clear plan of action is in place for natural disaster events to minimise risk of release of contaminants, physical impacts from dredge vessels. Nil damage to plant or equipment or surrounding environmental assets.
Management Actions and Mitigation Measures	Ensure respective Port Contingency and Emergency Plans are in place. MSQ cyclone contingency plan is enacted Dredging contractors' staff are to be aware of Contingency Plan requirements and topic is addressed during induction process Complete Daily EMP Checklist – refer Appendix D
Performance Indicators	Nil damage to plant or equipment or surrounding environmental assets due to dredge plant equipment or discharges from said equipment during a natural disaster event.
Monitoring	Check induction records Ensure port supervisor has copies of contingency plans available to advise dredging contractor
Reporting	Reporting of exceptions by Vessel Master and Environment staff. Complete Incident Form –Appendix B
Corrective Action	Ports North to investigate reason for exception and take appropriate action.
Term	During all operations.
Responsibility	Port operations staff and Ports North dredge contract supervisor.

10.1.10 Cultural Heritage

Cultural heritage refers to both European and Indigenous heritage issues.

Aspect	Cultural Heritage
Impact	The project area has been previously disturbed whereby the likelihood of uncovering a cultural heritage item is minimal. However, there is still potential to uncover an item of cultural significance, however potential for observation of such items on the seafloor or hopper or drag head is considered minimal.
Objective/Target	To ensure dredging operations do not disturb/destroy items of European or non-European cultural significance.
Management Actions and Mitigation Measures	<ul style="list-style-type: none"> • Ensure cultural heritage investigation has been adequately addressed in initial project assessment process and that likelihood of disturbance is thereby low. • Ensure dredging and material relocation is undertaken within the approved areas only by reference to electronic navigation aids and visual marks as required. • Undertake opportunistic visual inspection of dredge load and dredge heads, reporting any items of suspected cultural significance. If items are found, retain and report to relevant authorities through Vessel Master and Environment staff. • Implement requirements in regard to the Queensland Aboriginal and Torres Strait Islander Duty of Care guidelines all times during the project, in accordance with the obligations of the <i>Aboriginal and Torres Strait Island Act 2005</i>. • All onsite personnel are responsible for reporting any potential cultural heritage items or objects, particularly during earthworks • If a cultural heritage item is found (excluding human skeleton remains, which are to be reported to the police), works in the immediate area of the find shall cease and CPL will be advised. The Traditional Owners and DES shall be contacted. • Complete Daily EMP Checklist – refer Appendix D
Performance Indicators	No disturbance of items of cultural significance.
Monitoring	Opportunistic inspection of the dredged material for evidence of items of cultural heritage. Monitoring of dredge movement through use of electronic aids to ensure it is within designated area.
Reporting	Reporting of exceptions to Vessel Master and Environment staff. Complete Incident Form –Appendix B
Corrective Action	Vessel Master to investigate reason for exception and take appropriate action.
Term	During all operations.
Responsibility	Management and operation of on-board systems is by the Vessel Master, with input from Environment staff as required.

Insert Contractors Environment Policy, or default to Ports North Policy

PORTS NORTH ENVIRONMENTAL INCIDENT REPORT FORM



This form is to be completed for any environmental accident or incident.
Please note: this form is to be filled in after the event at the time of the incident please call either;

- Port Supervisor
- Operations Office Cairns – (07) 40512558 or 0419 657 350
- Environment Manager – (07) 40523820 or 0439 723 008

Once completed, please forward to
Environment Manager, Ports North, PO Box 594, Cairns Q, 4870. Ph: 4052 3820, Fax: 4052 3853

Event Details

Please Circle

Incident (release or harm to environment occurred)		Near Miss (no release to environment or harm)	
When:	_____	Date _ _ / _ _ / _ _	Time _____ am/pm
Reported BY:	_____	Date _ _ / _ _ / _ _	Time _____ am/pm
Reported TO:	_____	Date _ _ / _ _ / _ _	Time _____ am/pm
Location details: _____			

Description

Describe clearly the circumstances leading to the accident/incident, and the accident/incident itself. As far as possible verify the facts recorded, and identify witnesses.

Type	If Spill – Approx Quantity
Cause/Circumstance	
Drawing?	
Name	Position
Organisation	Telephone
Signature	Date

Prevention: *To be completed by Manager/Supervisor*

Method of Cleanup;

Equipment Used

Method and Location of Waste Disposal

Existing Measures in Place to prevent or Minimise this type of event;

Follow Up:

Measures to be implemented to prevent this occurring again?

Name

Signature

Position

Date

Organisation

Close Out: *To be completed by Environment section*

Recorded in Register?

Follow Up Letter Sent to Company

Feedback provided to Reporter?


Appendix C

Site Plan of Works Area

Insert for respective campaign - Hydro survey and work instruction showing dredge area blocks, and copy of Permit drawings

Appendix D

Daily EMP Check Sheet



PORTS NORTH
DREDGING ENVIRONMENTAL MANAGEMENT PLAN - IMPLEMENTATION CHECKLIST

Job: _____

Start Date: _____ Week Number ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10

Complete the following section prior to commencing works	Tick or circle
1) Are the Environment Manager or Officers contact numbers available to all staff?	Yes / No
2) Are staff induction records up to date?	Yes / No
3) Is the QPWS Marine Animal Hotline number easily available to all staff? Ph:1300 130 372	Yes / No
4) Are copies of the Incident Report Form accessible?	Yes / No
5) Does the Works Supervisor hold all relevant emergency contacts and understand the correct reporting procedures for major environmental incidents?	Yes / No
6) Is the Complaint Register available?	Yes / No
7) Copies of the EMP are available to all staff?	Yes / No
Complete the following section during the works (daily inspection)	Day
	1 2 3 4 5 6
1) Are all waste containment structures functioning correctly?	
2) Are all waste bins of suitable capacity to contain all wastes (food wastes, etc.)?	
3) Has equipment been checked to ensure it is in good working condition and not leaking oils, lubricants or fuel?	
4) Are emergency spill kits available to staff at all times?	
5) Are the Spill Response procedures available and up to date, and all staff adequately trained?	
6) Records of vessel maintenance are accurate and up to date?	
7) All complaints have been recorded and details forwarded where required?	
8) Have all trackable wastes been stored and disposed of appropriately?	
9) Register of all MSDS documents is up to date for all chemicals on board?	
10) All records of marine wildlife that could possibly have been impacted by the works have been reported to the contract supervisor and QPWS?	
11) Record of working hours is complete – and within the permitted timeframe?	
12) All operating plant have been inspected for excess noise?	
13) Are there any incidents requiring reporting today?	
Add brief Incident details here:	
Complete this section upon conclusion of works	
1) Have all appropriate authorities been notified that works have been completed (MSQ, GBRMPA, other Agencies)?	
2) Have the Incident and Complaint Registers been forwarded to Environment Manager?	

Works Supervisor: _____ Date: ____/____/____

Notes:

Dredging EMP - Supervisors Orientation

Appendix 10 Water Quality Monitoring Plan

Appendix 10

Water Quality Monitoring Plan Dredging and Bed Levelling Campaign

Port of Karumba

Entrance Channel Maintenance Dredging

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Document Control		Drafted	Released
Version 0	Original by Far North Queensland Ports Corporation Ltd for 2009 Bed Levelling campaign	August 2009	September 2009
Version 1	Revised for 2010 campaign	March 2010	May 2010
Version 2	Updated for inclusion in LTMMMP–for Dredging and Bed Levelling campaigns	February 2011	February 2011
Version 3	Updated as Appendices for LTMMMP Ver 6 lodged with DSEWPac in March 2012. Agency references updated	April 2012	June 2012
Version 4	Updated for LTMMMP Ver 7 lodged with DSEWPac in August 2012. Agency references updated	August 2012	August 2012
Version 5	Updated for LTMMMP Ver 8. Monitoring Flowchart updated.	August 2012	September 2012
Version 6	Updated for LTMMMP Ver 9. Flowchart updated.	December 2012	December 2012
Version 7	Updated for Final LTMMMP	January 2013	February 2013
Version 8	Updated for LTMMMP 2023-2033	February 2022	February 2022

I Introduction

Environmental management measures have been developed for the proposed dredging or bed-levelling campaigns to ensure environmental safeguards are in place to minimise impact on the natural environment. All personnel involved in the project are required to demonstrate a general environmental duty of care throughout the project. The LTMMP and campaign specific details of the Environmental Management Plan (EMP) are to be implemented by the appointed contractor. This Water Quality Monitoring Plan is to be implemented to address the monitoring requirements of LTMMP and builds on the program implemented in earlier campaigns (including 2010 and 2014) to address the conditions of the ERA16 approval granted by the DES in (**Appendix E**).

Ports North (PN) has an Environmental Management Framework, and associated Policy, which provides a framework for continually improving operations and practices.

Staff and contractors involved in this project are required to protect the environment under the relevant environmental legislation and general environmental duty. The appointed contractor is required to comply with the requirements of Ports North's Environment Policy and all management measures specified below.

Prolonged flooding in the Norman and Bynoe River catchments may result in extensive periods of freshwater discharge, high turbidity and sediment deposition in the adjacent coastal zone, including impacts to marine flora and fauna. Significant declines in seagrass condition are often predicted as a consequence of the prolonged effects of the flood events, however advice and prior findings from seagrass surveys may show an initial early dry season decline but return to an advanced state of recovery in biomass or distribution by the start of the next wet season. Additional short duration and intensity flood events or successive large annual events may make seagrass reserves more susceptible to potential impacts of dredging, however this level of resilience has not been researched or documented. Monitoring of dredge generated turbidity, assessed as the primary water quality impact to marine flora at this Port, is considered a precautionary approach, and is included as a precautionary measure for the ongoing maintenance dredging of the Port of Karumba.

Due to natural accumulation of sediments, parts of the channel may shallow to less than 3.6m design depth of the channel.

The objective of this work is to monitoring the primary water quality parameters in conjunction with maintenance dredging by the trailer suction hopper dredge vessel and or associated post dredging bed levelling or drag baring works, to remove and relocate accumulated sediments from shallow sections of the channel with all spoil relocated to the spoil ground.

2 Location

The proposed sampling area is the entrance channel to the Port of Karumba, located on the south eastern coast of the Gulf of Carpentaria. The project is located with the Port Limits. Refer **Appendix C** for site location.

The entrance channel is used by various vessels including the barge *Wunma* for transfer of mineral concentrates, commercial fishing fleet, Sea Swift shipping company barges, and numerous recreational fishing boats. Commercial shipping to the port delivers supplies and services to the Karumba community and services the extensive prawn trawl fishing fleet that is based from Karumba.

3 Legislative Requirements

Environmental Protection Act 1994

Under the *Environmental Protection Act 1994* (EP Act), environmental duty of care is required at all stages of the project by all staff (Section 316 of the EP Act). The basic principles of the EP Act should be understood by all project staff.

Under the *Environmental Protection Regulation 2019*, the action of maintenance dredging is classified as Environmentally Relevant Activity (ERA) 16 Extractive and Screening Activity 1(c) dredging 100,000 to < 1 million t/yr. Approvals issued by the Department of Environment and Science (DES) (see **Appendix E**) are held by Ports North and copy issued to the appointed dredging contractor.

Fisheries Act 1994

Approvals under the *Fisheries Act 1994* are required where direct impacts to marine flora or fauna defined under the Act are likely to occur. No such approvals are required for maintenance dredging campaigns as prior surveys have determined the spatial extent of seagrass meadows as being outside the channel and works area. Extent of the primary fisheries habitat, namely the extensive seagrass meadows is shown in **Appendix A**.

Coastal Protection and Management Act 1998

An approval under the former Section 86 of the *Harbours Act 1955* is in place for works on defined areas of the sea bed within the port limits inclusive of dredging, disposal and bed levelling. Permit N25001 issued 1996, amended September 1996, defines the initial approved structure of the channel and spoil ground. Additional alignment changes, including those to develop a navigational corridor are addressed under a Development Permit for Operational Works- Tidal Works, with copy outlined in **Appendix B**.

Nature Conservation Act 1992

Under the *Nature Conservation Act 1992*, individuals and organisations have an obligation to prevent any potential injury or harm to flora and fauna. All environmental safeguards must be implemented, particularly during periods of likely movement of turtles, dugong or other large marine fauna.

Environment Protection (Sea Dumping) Act 1981

The *Sea Dumping Act* enables Australia to implement obligations under the “London Protocol” for sea disposal activity. The act applies to all vessels in Australian waters for the regulation of waste disposal to sea, inclusive of dredge spoil. An approval by the Department of Agriculture, Water and the Environment (DAWE), is to be issued as a Sea Dumping Permit.

Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act)

This Act regulates those activities which may have a significant impact on matters of national environment significance (NES) and establishes an integrated regime for biodiversity conservation and the assessment and management of important protected areas. Matters of national significance include; World Heritage properties, RAMSAR wetlands, listed migratory species and ecological communities, listed migratory species, commonwealth marine areas, national heritage places, nuclear actions and actions on commonwealth land or involving commonwealth agencies. Dredging and disposal activity at Port of Karumba has potential to influence listed and migratory species, including turtles, dugong crocodiles, and wader birds. Assessment of these interactions on matters of NES is made by DAWE in consideration of approvals for dredging and sea dumping.

4 Impact to Sensitive Areas

The dominant sensitive environmental areas adjacent to the proposed works are the seagrass meadows, and intertidal mudflats. Foreshore intertidal mudflats and surrounding coastal wetlands are host to numerous species of resident and migratory wading birds, many with international conservation significance.

Seagrass meadows at the Port of Karumba are shown in **Appendix A**. Meadows adjacent to the channel are mostly low biomass meadows of *Halodule uninervis* and *Halophila ovalis* found growing over Alligator Bank between the Norman River, and south to the Bynoe River. For example, monitoring during November 2011 indicated a core meadow of 1454 Ha with surrounding aggregated fringing patches. Density was the third highest on record and above the 18 year average.

Dugong activity is generally a regular feature and evident at sites within the meadow area.

The works area has previously been dredged and bed levelled, and extensive monitoring of potential impacts from those works has been implemented in previous works campaigns, including significantly larger programs. Impacts identified from those larger works campaigns have been assessed as minimal, potential impacts of dredge generated turbidity to adjacent sensitive marine areas are considered to be low.

It is noted that the framework outlined in this Plan, including methodology for sampling may be applied, where agreed with DAWE and TACC for other sensitive areas of interest other than Alligator Bank.

5 Responsibilities, Implementation and Auditing

Ports North will be responsible for conduct of this Water Quality Monitoring Plan, or through the use of a suitably qualified environmental consultant.

The Contractor will be responsible for the implementation of the EMP for operation of the dredging vessel and ancillary vessels for the duration of the project (refer LTMMP Appendix 13-10 or 13-11 for detail).

The Contractor and Supervisor are required to ensure that all personnel working onsite are aware of their environmental responsibilities and the importance of the project EMP and implementation of this Monitoring Plan.

Ports North staff may conduct an environmental audit in accordance with the project EMP and to ensure the implementation of this Monitoring Plan at any time during the project. The Port Supervisor may also inspect the works at any time to ensure all project commitments are been implemented.

6 Monitoring Elements

This section identifies the components of the water quality monitoring plan for the project and must be followed to ensure compliance with LTMMP and the Permit requirements.

6.1 Water Quality including Turbidity

Impact

The primary environmental impacts associated with dredging is the re-suspension of sediment into the water column and the creation of suspended particle plumes which may affect adjacent areas (e.g flora) by settlement and accumulation of particles [Sedimentation] or reduction of light penetration through the water [Turbidity]. Natural turbidity levels in the coastal zone of the Gulf of Carpentaria typically observed at Port of Karumba can be very high, dependant on wind, tidal and catchment runoff conditions. Therefore dredging works are expected to be generally within natural tolerances, but episodic peaks in concentration may occur. Previous extensive monitoring completed as part of the 1996 capital dredging and subsequent maintenance dredging, including the campaign during 2008 indicated natural turbidity range of up to 300NTU at Alligator Bank under low water levels and strong onshore northerly wind conditions.

Management

Although minimal impacts from contaminated sediments on water column or turbidity on the seabed at sensitive areas (discussed below) are expected, Sediments from the works are most likely to move toward sensitive areas in period of north-west to north-east winds and incoming spring tides. Specific water quality monitoring conditions have been included in previous approvals, such as the ERA16 approval for the 2010 campaign.

The Monitoring Program flowchart is outlined in **Appendix B**.

6.2 Contaminated Sediments

Impact

The movement of contaminated sediment during dredging has potential to mobilise elements into the water which may have acute or chronic effects to flora and fauna, or may then disperse to surrounding areas. An understanding of the contaminant status of the sediment to be dredged is required and is typically assessed when determining disposal options for dredging prior to capital or maintenance dredging campaigns in accordance with the *National Assessment Guidelines for Dredged Material (NAGD) 2009*.

Management

Sediment analysis plan implementation at the Port of Karumba was completed in 2009, 2015 and 2020 and showed that material within the entrance channel to be generally clean and consist predominantly of natural concentrations of base metals, an absence of herbicides or pesticides and low concentrations of antifouling paint residue tri-butyl tin. Material from the Port of Karumba has been assessed previously as suitable for placement at sea and is considered un-contaminated. The 2020 SAP Report was approved by DAWE and informs a component of the Sea Dumping Permit application.

Consequently no specific water quality monitoring for contaminants is proposed.

6.3 General Water Quality Parameters

Collection of data on parameters inclusive of temperature, pH, salinity, dissolved oxygen may be included as comparative indices to assist in identification in any trends observed in the target turbidity parameter, such as freshwater/saltwater stratification as well as contribute to the general port environmental database.

7 Monitoring Matrix

The above evaluation of potential aspects and impacts of the work and subsequent management options give rise to the following monitoring elements to be implemented under normal conditions, and in the absence of a “contaminating” event/incident;

Impact	Specifics	Required Yes / No ?	Justification
Water Quality	Dissolved Metals	No	Nil sediment contaminant concerns
	Tri-Butyl Tin	No	Nil sediment contaminant concerns
	Herbicides and Pesticides	No	Nil sediment contaminant concerns
	PAH/BTEX/TPH	No	Nil sediment contaminant concerns
	Turbidity	Yes	-Define lateral extent of plume relative to seagrass meadows. -useful data to inform management of future bed levelling/dredging works.

	Ph,T ⁰ C, Cond, %DO	Yes	Useful ambient data able to be collected at same time as turbidity
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8 Methods

All personnel implementing this monitoring plan must be familiar with intent of the LTMMP and respective campaign specific EMP (refer Appendix of LTMMP Appendix 13-10 and 13-11), the requirements of this plan, and State *Water Quality Monitoring and Sampling Manual* (2009) for the correct methods of sampling to be implemented.

The Management Framework Flowchart (**Appendix B**) for implementing the Water Quality Monitoring Plan is set out below. Observation of tidal predictions for Port of Karumba for proposed dredging period is to be conducted to identify periods with highest likelihood of moving turbid plumes across Alligator Bank (larger incoming spring tides). Highest likelihood periods however are contingent on flood/incoming spring tides, where if suitable wind/sea state condition prevail, and water level is high enough to inundate the flats, may present a condition suitable for dispersion of turbid plumes to the Alligator Bank seagrass meadows.

A reactive approach to monitoring and subsequent mitigation measures through management of dredge vessel operations is to be employed for this Plan, and a trigger value of 62ntu (or other such approved value) for a period of greater than 72 hours (or other such approved period) at specified points has been assigned.

In-situ point sampling will be conducted from a small vessel at locations identified in **Appendix C**. Exact location of sampling for site W3 may vary depending on direction of dredge plume migration and conditions, and a nominal outer and inner site have been identified that should have “background or reference” qualities,

Sample Site Locations

Site ID	Location	Type
KA-W1	Edge of seagrass meadow- near rear channel lead	Potential Impact
KA-W2	Edge of seagrass meadow- near channel	Potential Impact
KA-W3_inner	Mid Channel – between Karumba and Alligator Points	Reference
KA-W3_outer	Sand flats adjacent to outer channel	Reference – alternate site if W3_inner is affected by dredge turbidity, or wind/tide/current direction dictates need for Reference site in this area

An Horiba U-10 multi-parameter probe water quality meter or equivalent will be used. Observation and recording of turbidity and water quality parameters;

- Turbidity (NTU)
- pH
- Salinity (%)
- Temperature (°C)
- Dissolved Oxygen (mg/l)

will be recorded at Surface (0 to 0.5m) then at Bottom (0.5m above seafloor).

Average of the two values will be used for calculation and comparison to the “Trigger”

Data will be gathered by suitably trained field staff using calibrated instruments, with data recorded to a field sheet shown at **Appendix D**.

If suitable tide and weather conditions prevail, aim for two sampling events per day, at approximately Start, Middle and toward End of proposed campaign to verify success of the management and mitigation measures conducted during the dredging or bed levelling operation.

9 Results and Reporting

Outcomes of the monitoring will be consolidated and comparison of results at W1 and W2 assessed against the background ambient conditions at reference site W3 and turbidity “Trigger” value of 62NTU (or other such approved value). This process will follow the process and management triggers outlined in **Appendix B**, and subsequent reporting requirements within the respective campaign EMP.

Results will also trigger the respective management and corrective actions where an exceedence occurs.

An assessment will be conducted at conclusion of each sampling event, and any requirements for Management Actions triggered as per the campaign specific EMP.

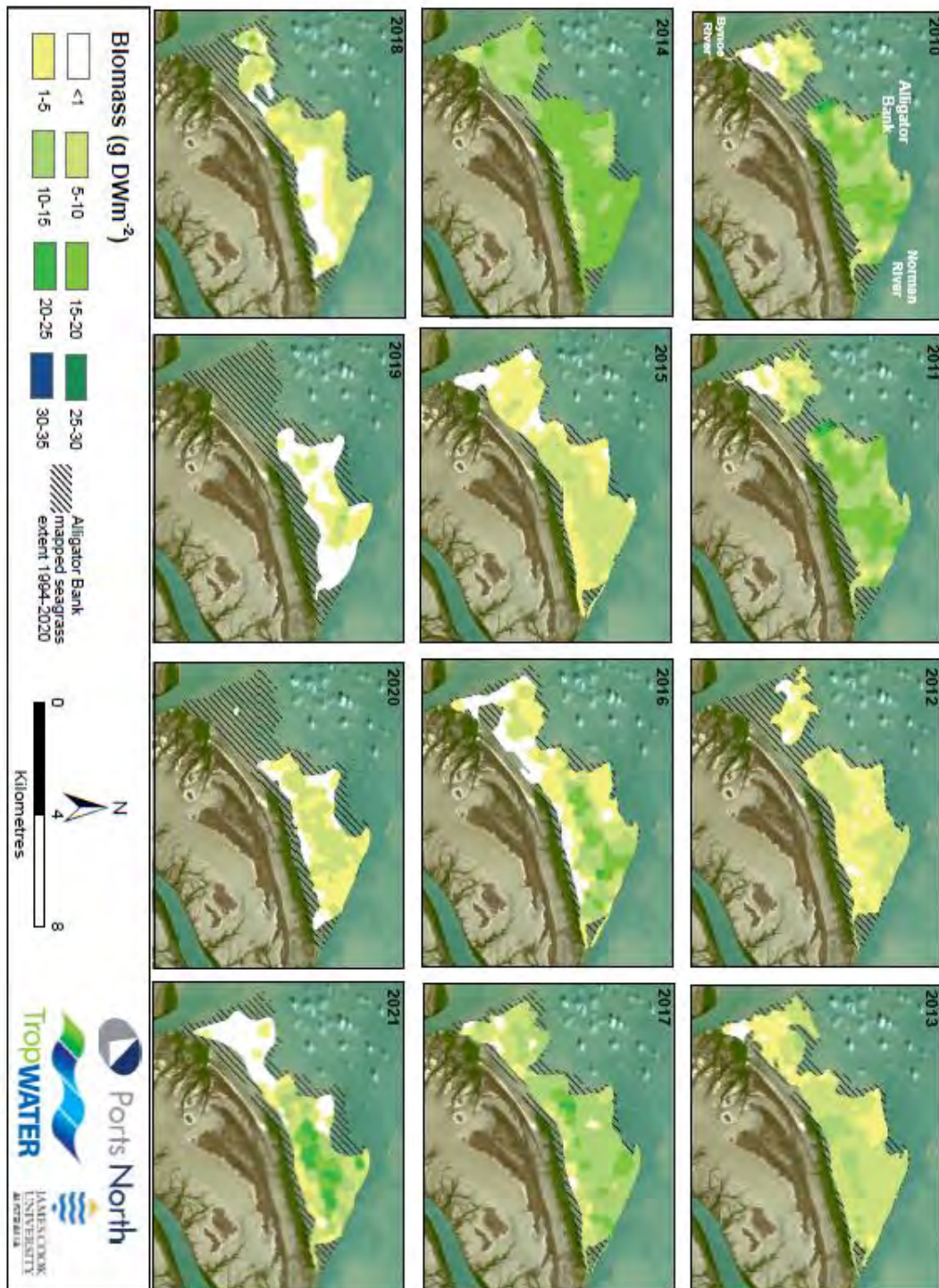
Overall findings of the Plan implementation will be concluded in the Project Close-Out Report to inform stakeholders and future decisions on environmental management options for dredging works at Port of Karumba.

Information gathered in each round of monitoring will contribute to the environmental monitoring database for the Port of Karumba maintained by Ports North.

Appendix A

Example Seagrass Distribution

Karumba long-term annual seagrass monitoring 2021 – TropWATER 21/70



Biomass and area change in the Alligator Bank monitoring meadow, 2010 to 2021.

Appendix B

Monitoring Process and Flowchart

Karumba Water Quality Monitoring Plan - Process Diagram

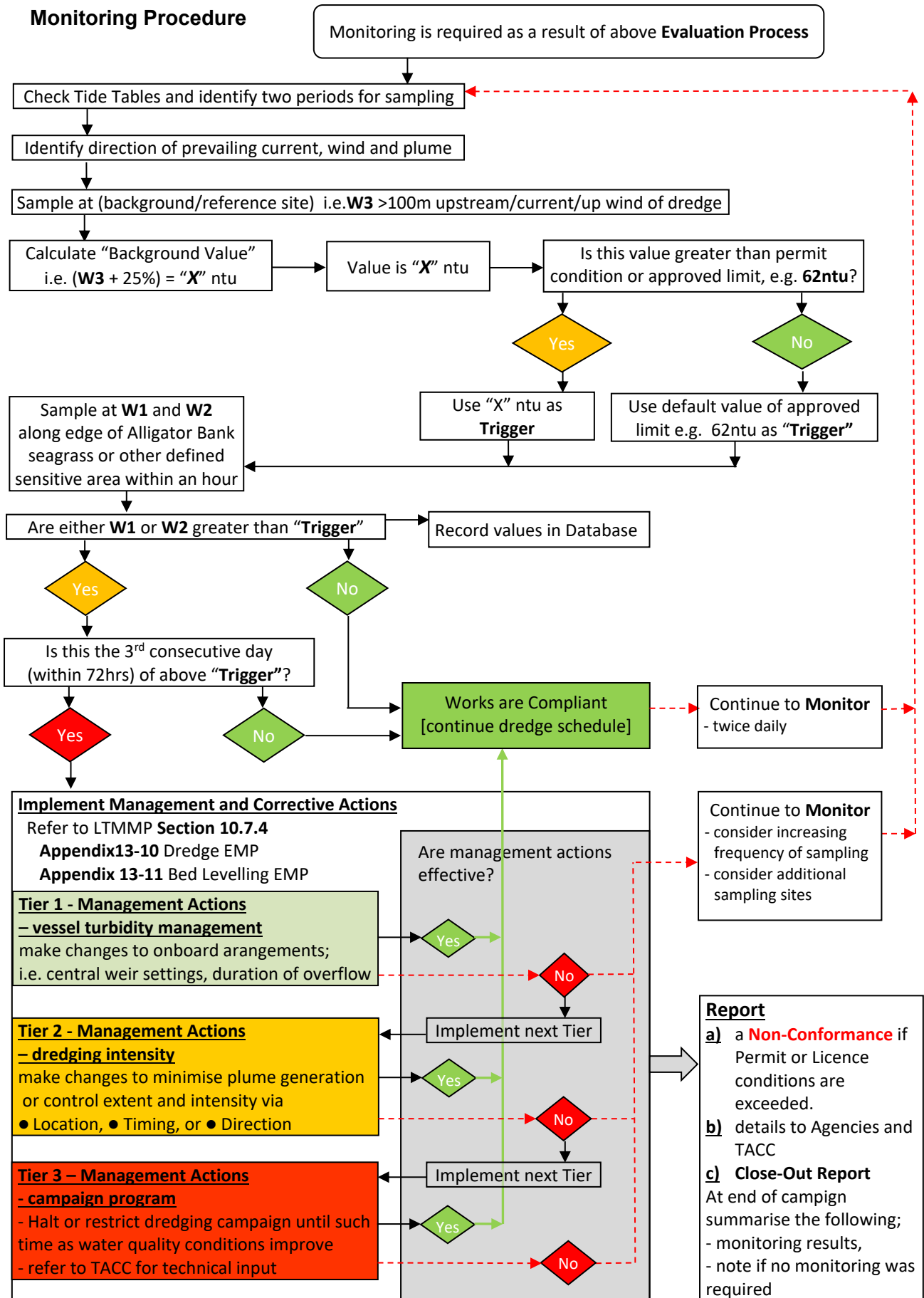
Ports North Environment staff, in conjunction with the dredge/bed levelling project manager will determine the need for water quality monitoring firstly by assessing if the following conditions in Evaluation Process and Monitoring Procedure below are met;

Evaluation Process

Criteria A	Yes	No
Timing		
Is the campaign scheduled and approved outside the period 1 May to 30 September?	<input type="checkbox"/>	<input type="checkbox"/>
Method, Scale and Intensity		
Has scale of works changes significantly to >690,000m ³ (i.e. greater than 50% increase over average dredging volume)?	<input type="checkbox"/>	<input type="checkbox"/>
Is an increased intensity of campaign proposed (i.e. more than one dredge in operation, or full time overflow)?	<input type="checkbox"/>	<input type="checkbox"/>
Is a dredge other than the TSHD <i>Brisbane</i> proposed? (i.e. use of a cutter suction or grab dredge etc.)	<input type="checkbox"/>	<input type="checkbox"/>
Is a dredge without turbidity management features proposed? (i.e. no central weir control, under keel discharge, or overflow control)	<input type="checkbox"/>	<input type="checkbox"/>
Management or Monitoring Survey Outcomes		
Has scientific advice on ecological receptors provided to the TACC, and a corrective action to the existing monitoring arrangements been agreed by the TACC and Ports North?	<input type="checkbox"/>	<input type="checkbox"/>
Have water quality or turbidity issues been identified as a concern for seagrass health as a result of most recent survey?	<input type="checkbox"/>	<input type="checkbox"/>
Location		
Are works in channel beside Alligator Bank (i.e. between Karumba Point and Beacon 9 or 10) ?	<input type="checkbox"/>	<input type="checkbox"/>
Are works proposed adjacent to a recently identified sensitive area?	<input type="checkbox"/>	<input type="checkbox"/>
If there is a "Yes" positive response to any of Criteria "A", proceed to Criteria "B".		If all are "NO", no monitoring is required
Criteria B		
Weather and Tide		
Are strong on-shore wind conditions forecast? [i.e. >15kn N to W]	<input type="checkbox"/>	<input type="checkbox"/>
Will the tide height allow a potential plume to reach seagrass meadows (i.e. Alligator Bank)? [i.e Karumba Tide >1m]	<input type="checkbox"/>	<input type="checkbox"/>
If one Criteria A is "Yes" and both of Criteria B are "Yes" then initiate monitoring as per "Monitoring Procedure" overleaf/below		If both are "No", NO MONITORING Make Note in Close Out Report

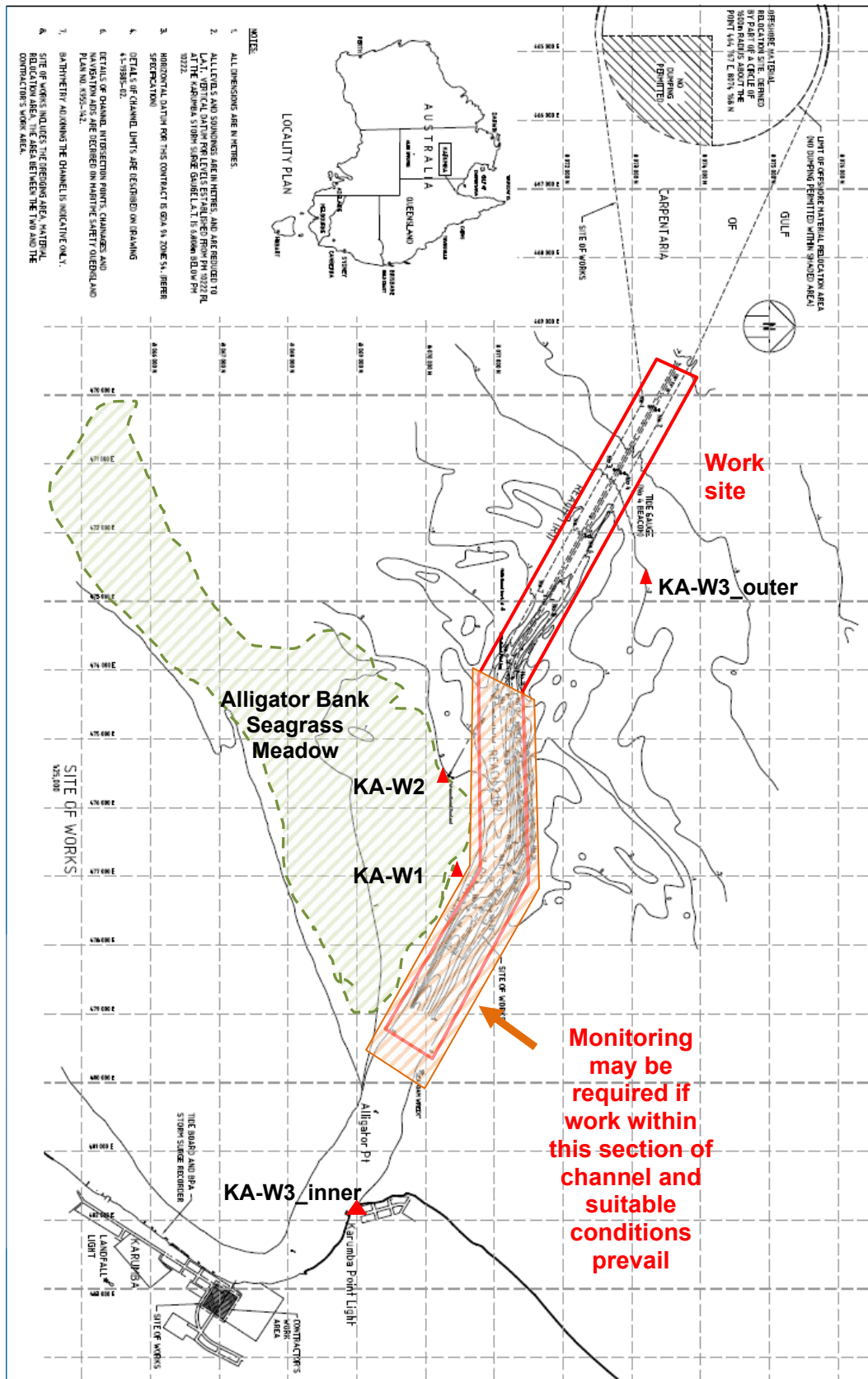
If Monitoring is Triggered by above Evaluation Process , implement Monitoring Procedure, below, if suitable tide and weather conditions prevail, aiming for two sampling events per day, at approximately Start, Middle and toward End of proposed campaign to verify success of the management and mitigation measures conducted during the dredging or bed levelling operation.

Monitoring Procedure



Appendix C

Sampling Site Plan



Appendix D**Water Quality Monitoring Field Data Sheet****Rainfall to 9am****Rainfall to 3pm****Cloud Cover (/6^{ths})****Wind Speed (knots)****Wind Direction****Tide Times and Heights:**

Date	Time	Site	Strata	Depth (approx m's)	Turbidity (NTU)	Dissolved Oxygen (mg/l)	Salinity (%)	pH	Temperature (0 ^c)
		KA-W1-a	Surface						
		KA-W1-b	Depth						
		KA-W2-a	Surface						
		KA-W2-b	Depth						
		KA-W3-a	Surface						
		KA-W3-b	Depth						

Comments

Field Staff

Signed by Field Data Recorder

Data Input Date

Signed by Data Input Staff

Appendix E Example of conditions - ERA16 Permit

Development Permit CONDITIONS (refer Appendix B of EMP for up to date conditions)

Conditions for ERA 16 Extractive or screening activities Threshold 1(c) – Dredging material >100,000 – 1 million t/yr

Interest: General

Limitations of permit

G1 This development permit attaches to the part of the port area defined by the map in Attachment 1

G2 This development permit authorises ERA 16 (dredging) that is for maintenance work on lawful work as specified by the diagrams in Attachment 2.

G3 The port authority of the port area to which this permit attaches must maintain direction of any operator carrying out an activity authorised by this permit.

Prevent environmental harm

G4 The operator must ensure that environmental harm is not caused by this ERA except where specifically permitted by a condition of this development permit.

Maintenance of measures, plant and equipment

G5 The operator must:

- (a) install all measures, plant and equipment necessary to ensure compliance with the conditions of this development permit
- (b) maintain and calibrate such measures, plant and equipment in an efficient condition and keep records of the maintenance
- (c) operate such measures, plant and equipment in an efficient manner.

Integrated environmental management system (IEMS)

G6 The operator must implement an integrated environmental management system (IEMS) from *(the commencement of this ERA or specified date)*. The IEMS must identify all causes of environmental harm, including but not limited to the actual and potential release of any contaminants, the nature of the environmental harm and the actions that will be taken to prevent environmental harm being caused. The IEMS must be made available to the Administering Authority when requested.

The IEMS must achieve the following outcomes:

- (a) material intended to be dredged under this permit is tested and analysed in accordance with the latest version of the National Assessment Guidelines for Dredging 2009
- (b) significant and sensitive receptors (including for example wetland and ecosystem features) in the port area are identified and mapped
- (c) environmental aspects and potential impacts are identified
- (d) control measures that minimise the potential for environmental harm are in place
- (e) contingency plans and emergency procedures are in place
- (f) organisational structures, accountability and responsibility is recorded
- (g) arrangements for effective communication are documented and undertaken
- (h) all contaminant releases are monitored
- (i) staff are trained and aware of the requirements of this permit
- (j) appropriate records are kept
- (k) reviews of environmental performance and continual improvement are undertaken periodically.

G7 The IEMS must not be implemented or amended in a way that contravenes any condition of this development permit.

Monitoring Plan

G8 The operator must implement a monitoring plan that complies with the latest version of the Administering Authority's Water Quality Sampling Manual from the commencement of this ERA.

The monitoring plan must achieve the following outcomes:

- (a) long-term ecological impacts associated with dredging operations are monitored
- (b) compliance with the conditions of this development permit is monitored
- (c) operations are adjusted in response to monitoring results to ensure compliance with development permit conditions.

G9 The monitoring plan must include (but not be limited to) the following:

- (a) a description of the dredge equipment to be used, including the discharge points for turbid waters
- (b) a plan for the lawful disposal of the dredged material
- (c) a list of environmental values located within and adjacent to the dredge operation
- (d) the methods for collection and analysis of the samples (including specific areas to be monitored, when monitoring is to be undertaken and duration of monitoring)
- (e) the methods of analysing the data and responding to the results.

Records

G10 The operator must maintain a record of sites where dredging is carried out (specifying the boundaries of the dredged area by GPS coordinates) and the volume of material removed from each site (to the nearest tonne), and submit these records to the port authority.

G11 The port authority must maintain a record of all documents or information provided under condition G13 and all monitoring results required by this permit.

G12 All records required by this permit must be kept for five years and be made available to the administering authority upon request.

Complaint response

G13 The port authority must record the following details for all complaints received and provide to the administering authority upon request:

- time, date, name and contact details of the complainant
- reasons for the complaint
- details of investigations undertaken by the port authority
- conclusions formed
- actions taken to resolve the complaint.

Notification

G14 Any incident of environmental harm (including a reasonable suspicion that environmental harm has or is likely to have occurred) outside the lawful work as specified in condition G2 must be reported as soon as practicable to the relevant DERM regional office.

Interest: Air Nuisance

A1 The release of airborne contaminants from the activity must not cause environmental nuisance.

Interest: Noise Nuisance

N1 Noise from the activity must not cause environmental nuisance.

Interest: Water

Release of contaminants

W1 Contaminants must not be directly or indirectly released to waters other than wastewater released from the discharge point during the loading and unloading of dredge spoil.

W2 In carrying out the ERA, the release of contaminants (including any release caused by extraction of material from the bed of waters) must:

- only occur within the permitted areas specified in condition G2
- not have any properties which are capable of causing environmental harm
- not produce any slick or other visible evidence of oil or grease, nor contain visible floating oil, grease, scum, litter or other objectionable matter
- be carried out taking all practical measures necessary to minimise the concentration of suspended solids released during the loading and pump-out of the vessel.

Equipment

W3 Any dredging must be conducted using equipment that is in survey and registered and, in relation to environmental performance, is equal to or better than the following equipment:

- Trailing Suction Hopper Dredge that is equipped, as a minimum, with:
 - below keel discharge of tail waters via an anti-turbidity control valve
 - on-board systems for determining solids to water ratio or density of dredged material
 - electronic positioning and depth control system for defining the location and depth of dredging activities
 - dredge heads and depth control capable of, and where appropriate, fitted with fauna exclusion devices (e.g. turtle deflectors).
- Cutter Suction Dredge that is equipped, as a minimum, with:
 - electronic positioning and depth control system for defining the location and depth of dredging activities
 - continuous delivery connection (e.g. floating or submerged pipeline) to an approved placement site
 - a system or process to ensure the delivery system integrity is maintained at all times
 - systems for determining solids to water ratio or density of dredged material during operations.
- Grab Dredge that is equipped, as a minimum, with:
 - electronic positioning system for defining the location and depth of dredging activities.

Placement of dredge material

W4 Dredging must not start until provision has been made to lawfully place or dispose of the dredge material. Evidence of applicable approvals must be made available to the administering authority when requested.

Placement of dredge material at sea

W5 Material dredged under this permit must not be placed at sea except at a place authorised under an authority, licence or other permit issued by either or both the Commonwealth or Queensland governments to receive the dredged material.

Monitoring for 2010 dredging program

W6 Monitoring must be undertaken and records kept of receiving water quality potentially impacted by the dredging operations for the quality characteristics and not less frequently than specified in Table 1 – Receiving water release limits. All determinations must be made in accordance with methods prescribed in the latest edition of the Department of Environment and Resource Management's Water Quality Sampling Manual.

Table 1 – Receiving water release limits

Quality characteristics	Monitoring point	Units	Release limit		Monitoring frequency
			Minimum	Maximum	
Turbidity	W1 ¹ , W2 ²	NTU	-	Either: background plus 25% or 62NTU, whichever is the greater value, for a duration of at no more than 72 hours	Daily during the *flood tide, when the dredge is operating in the section of the channel adjacent to the Alligator Bank seagrass meadows
	W3 ³ (background)	NTU	-	-	*monitoring must still be undertaken daily for those days when no flood tide occurs.

¹ W1- The edge of the seagrass beds at Alligator Point

² W2- The edge of the seagrass beds at Alligator Point, no closer than 100m from W1

³ W3- Background: at least 100m up-current of the dredging operations, at a site experiencing similar wind, wave and tidal conditions as W1 and W2. Sampling must be undertaken within 1 hour of sampling from W1 and W2.

W7 If the receiving water release limit in Table 1 is exceeded at either W1 or W2, dredging operations must be amended to achieve compliance with the limit.

W8 Monitoring results must be made available to the administering authority upon request.

W9 Monitoring must be done by a competent person in accordance with methods set out in the latest version of the administering authority's water quality sampling manual.

Appendix F Tide Predictions and Priority Sampling Periods

Insert campaign specific details from Tide Tables or Tides website with works and priority sampling periods marked up

Example:

