

Maintenance dredging at the Port of Mackay

▶ Information package





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Executive summary

NQBP periodically removes natural built-up sediment from the Port of Mackay to maintain navigational depths and for operational efficiency of the Port, specifically within the enclosed breakwaters of Mackay Harbour.

Natural sediment transport at the Port of Mackay occurs as a result of wind and wave energy resuspending marine sediments in the coastal areas. Tidal energy results in a net import of sediment within the Mackay Harbour. The low current speed within the harbour means that it retains much of this sediment and acts as a sediment sink. This process results in sediments accumulating in some navigational areas, which affects the navigational depths and the efficiency of the Port.

Sustainable Sediment Management Assessment

A range of options were assessed to determine whether maintenance dredging could be avoided, reduced or whether the sediment removed during the maintenance dredging could be recycled or reused. This work is brought together through NQBP's Sustainable Sediment Management Assessment for Navigational Maintenance. This study found that sediment resuspension in the Mackay region is largely driven by wave

action and tidal currents with suspended sediment imported during flood tides. The amount of suspended sediment is also influenced by weather events such as cyclones. The low current speed within the harbour means that it retains much of this suspended sediment which then settles and accumulates within navigational areas. Sediment accumulation due to catchment run-off was found to have minimal influence on sedimentation within the harbour.

A key finding of the assessment was that maintenance dredging was considered to provide the most cost effective and lowest greenhouse gas (GHG) emissions solution to sediment build up, with low environmental and operational effects and high effectiveness.

Bed levelling is a modern technique used in many ports and harbours. It involves towing equipment behind a vessel to level high spots and ridges on the seabed. The Port of Mackay also has a siltation trench built into the seafloor infrastructure to trap sediment and provide a sink for material moved by bed levelling. Based on the assessment, it was found that bed levelling in conjunction with continued use of the siltation trench could effectively reduce the frequency of the maintenance dredging required within the harbour, but would not eliminate this need.

Figure of study approach



The assessment also included an investigation of options to recycle or reuse the dredged material to avoid disposal. However, the assessment found that due to the nature and volumes of the material that would be removed by maintenance dredging, there would be limited beneficial reuse opportunities.

NQBP's structured decision-making approach included participation from a range of stakeholders who were brought together to understand what is of value to them and what key metrics are used to inform our decision-making, including environment, cultural heritage, port economics and operations, health and safety and social.

Preferred sediment management option

Placement of marine material on land was found to be a less favourable option than placement at sea. Placement at the existing Dredged Material Placement Area (DMPA) was identified as the preferred long-term sediment management option.

Environmental risk assessment and management plans

Underpinning the preferred sediment management option is an environmental risk assessment and best practice maintenance dredging management plans. NQBP will also continue to implement industry leading monitoring and management programs.



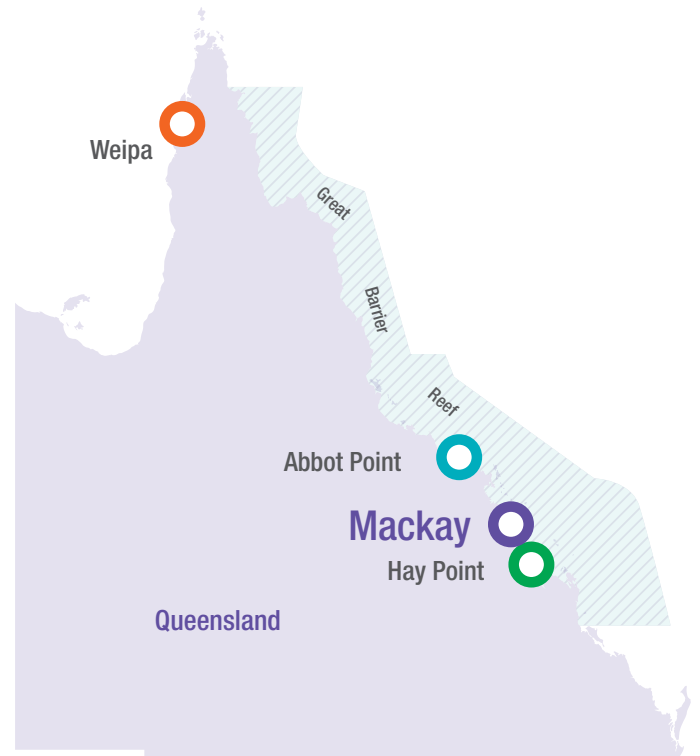
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About the Port of Mackay

NQBP manages the Port of Mackay, on the central east coast of Queensland. Established in 1939, the Port operates 24 hours a day, seven days a week and extends over 800 hectares of land and water under the direct control of NQBP.

The Mackay region is one of the largest sugar producing area in Australia, and the Port hosts one of the world's largest bulk sugar terminals. The region also supports the nearby Bowen Basin and Galilee Basin coalfields, which produce most of Queensland's coal. The dominant trades through the Port are sugar, fuel and breakbulk cargo.

The Port of Mackay is enclosed by breakwaters (also referred to as the Mackay Harbour), has four main berthing areas and a slipway. The neighbouring Mackay Marina (owned privately) features a residential and tourist precinct, major marina amenities, over 450 marina berths and lift out shipyard.



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What is maintenance dredging?

When you look out at a port, you'll see the ships, ocean, the wharves and maybe some loading and offloading machinery. What you won't see is the infrastructure beneath the surface. This includes a shipping channel or approaches, swing basins to manoeuvre, and berthing pockets for secure loading and unloading. All of these are man-made depressions in the seabed that allow a ship to navigate and manoeuvre into port.

Over time, natural forces like tides, wind, waves, storms and cyclones cause sediment to constantly shift (sediment transport) and resuspend throughout the water column (resuspension) before settling, often within port's approaches, swing basins and berth pockets.

This natural build-up of sediment starts to reduce the depth of the navigational areas, which have a design depth and a declared depth.

- Design depth is the original construction depth that port engineers consider ideal for operating safely and efficiently at both high tide and low tide.

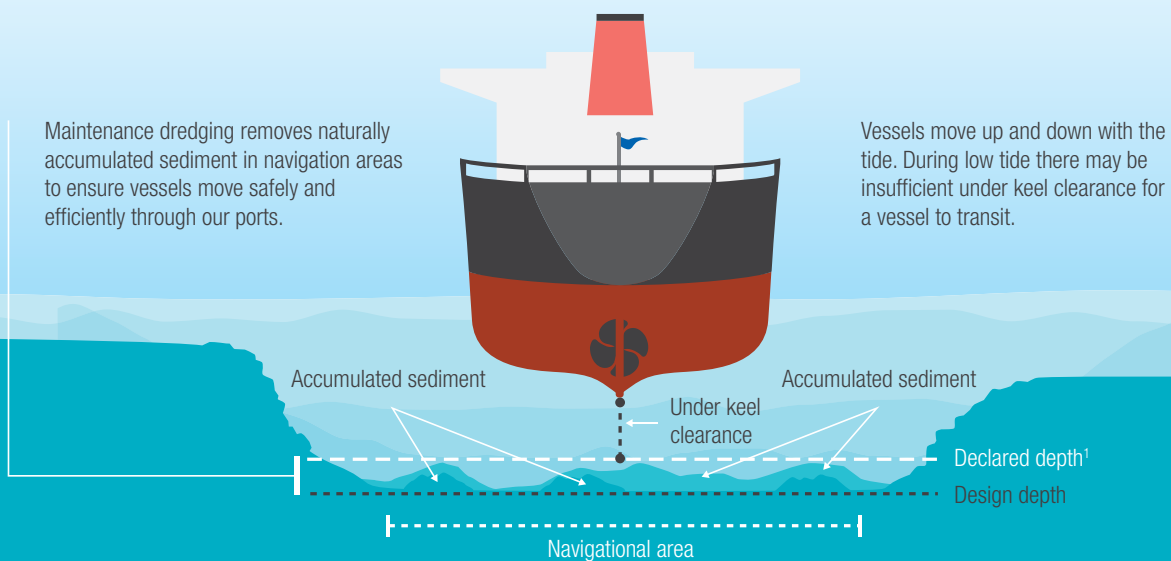
- Declared depth is designated by the Regional Harbour Master, acknowledging this sediment build-up and safe vessel clearance.

If maintenance dredging does not take place, the approaches, basins and pockets get shallower, as illustrated below.

As the distance between ship and seabed (known as under keel clearance) reduces, the Port's day-to-day activities become more difficult. The depth necessary for safe loading, manoeuvring and transit of ships is impacted. This can cause shipping delays that have significant flow-on effects for businesses and the broader economy.

Capital versus maintenance dredging

Maintenance dredging is the removal and placement of accumulated material from existing ship navigational areas to an approved placement area. Capital dredging involves the removal of previously undisturbed areas of seabed to expand or create new shipping channels, berths or swing basins.



¹Declared depth advised by the Harbour Master

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How is maintenance dredging performed at the Port of Mackay?

For the Port of Mackay, NQBP typically uses what is called a Trailing Suction Hopper Dredger (TSHD) to undertake maintenance dredging.

It is mainly used for dredging loose and soft material such as sand, gravel, silt or clay. The diagram below illustrates this more clearly. In the first step, one or two suction tubes, equipped with a drag head, are lowered on the seabed and the drag head is trailed over the bottom. A pump system sucks up a mixture of sands, silts or clay and water, and discharges it in the 'hopper' or hold of the vessel. Once fully loaded, the vessel sails to the designated placement site. The material is then deposited at the approved location through bottom doors or valves, as shown in the second step.

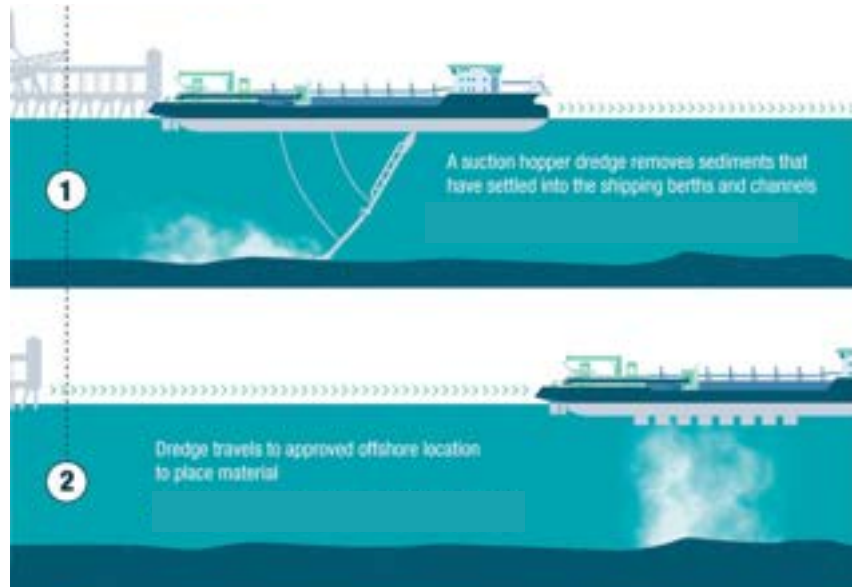


Figure: 1. Trailing Suction Hopper Dredger undertaking maintenance dredging
2. Trailing Suction Hopper Dredger placing material

International, national and state regulation

Activities to manage marine sediment in ports are highly regulated and, in particular, any dredging and dredged material placement is subject to detailed regulatory approval processes under international conventions, and under national and state legislation. Australia is a signatory to the London Protocol, an international convention that aims to "protect and preserve the marine environment". The placement of dredged material at sea may be allowed where in accordance with the London Protocol and the National Assessment Guidelines for Dredging (NAGD).

The NAGD sets out the framework for the environmental impact assessment and permitting of at-sea placement of dredged material. Prior to any decision to dredge and place material, a comprehensive assessment is required. A strict NAGD criteria determines whether dredge material will be

suitable for at-sea placement or whether it must be placed onshore. NQBP must have in place State and Commonwealth permits to conduct any maintenance dredging and at-sea placement within the Port of Mackay.

NQBP currently has 10-year Sea Dumping Permits in place for maintenance dredging at two NQBP ports – Weipa and Hay Point with the Mackay permit recently expiring in January 2022.

An additional Summary Report outlines the process NQBP undertakes to seek a new 10-year permit under the *Environment Protection (Sea Dumping) Act 1981* for the continued placement of the dredged material at the existing Dredged Material Placement Area.

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Why is maintenance dredging needed at the Port of Mackay?

To maintain navigational depths and operational efficiency at the Port of Mackay, NQBP undertakes periodic maintenance dredging, removing and relocating built-up sediment.

Extreme weather events such as tropical cyclones can result in significant increases in sedimentation. This can lead to increased maintenance dredging requirements as a result of these events. At the Port of Mackay, the breakwaters help to reduce very large sediment influxes, but NQBP studies have shown that there is currently no feasible alternative to traditional maintenance dredging.

Economic impacts

If maintenance dredging did not occur at the Port of Mackay, there would be several potential economic impacts. There would be increases in vessel delays, the diversion of trade to other ports, additional supply chain costs and a loss of economic output for the region.

NQBP commissioned an independent economic review by Synergies Economic Consulting as part of our Sustainable Sediment Management assessment. This review found

that without maintenance dredging, the Port of Mackay could become totally constrained within 10 years. Resulting economic costs are estimated to be \$224.0 million in Net Present Value (NPV) terms over a 20-year analysis period. Community cost increases would largely be attributable to road costs, as well as increased heavy vehicle environmental impacts and road maintenance. The annual regional economic impacts from loss of production of port related commodities totalled \$100.1 million in regional output, \$24.4 million in gross regional product, and 119 jobs.



You can download the full economic review and all other supporting studies on the NQBP website



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What maintenance dredging will take place

Maintenance dredging has occurred periodically at the Port of Mackay since its establishment in 1939.

NQBP is applying for a new 10-year Sea Dumping Permit to facilitate the continued placement of dredge material at the currently approved Dredge Material Placement Area (DMPA). The current permit expired on 25 January 2022.

Historic records of dredging and material relocation show approximately 40,000 m³ annually. In 2004, maintenance dredging using a larger trailing suction hopper dredge (TSHD) reduced the frequency to approximately every 3-5 years.

In the late 1990s a sediment trench was constructed for the sole purpose of trapping sediment in a non-navigable area of the Port. The trench has been very effective and in recent years has significantly contributed to a lesser frequency of maintenance dredging (no maintenance dredging occurred between 2013 and 2020).

Dredge planning has been based on a need to accommodate the anticipated volumes, outlined in the table below.

In brief, the full 10-year volume may be in the order of 575,000 m³

Number of years	Anticipated volume	Total (including +15% overdredge allowance)
8 years in 10-year period	40,000 m ³ (typical year) totalling 320,000 m ³	368,000 m ³
2 years in 10-year period	90,000 m ³ (cyclonic year) totalling 180,000 m ³	207,000 m ³
TOTAL: 10 years	500,000 m³	575,000 m³

How long will the maintenance dredging take?

NQBP would expect maintenance dredging to occur approximately every 3-5 years (approximately 10 to 15 days duration respectively). In 2021, following 7 years of no maintenance dredging, dredging occurred over 12 days, included 120 dredge cycles and resulted in 123,870 m³ of accumulated sediment removed.

Methodology

Maintenance dredging requires specially designed vessels. These vessels are crewed by highly experienced people, with equipment and technology designed to protect the environment. NQBP prefers to use a Trailing Suction Hopper Dredger (TSHD) for its maintenance dredging programs. The TSHD that NQBP has used in the past has features such as under keel discharge, green-valve technology and turtle deflectors to reduce the risk of harm to marine life. The maintenance dredging process involves using a vessel which acts like an underwater vacuum cleaner. This mainly removes loose sand, clay and silt. This process is described in section 4.

Placement area

The existing dredged material placement area (DMPA) for the Port of Mackay is located approximately 2km North-East of Slade Islet (or 3km North-East of the Mackay Harbour) and has been used by the Port since the 1960s.

The DMPA is considered to be partially retentive over the short-term, although over the long term the DMPA is considered stable during typical conditions and is subjected to erosion during cyclone events. As such the DMPA is not considered to have a defined holding capacity or threshold.



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What are the environmental receptors and risks?

Based on years of studies and peer-reviewed research, NQBP reports and experts have concluded that the risk to environmental receptors from maintenance dredging at the Port of Mackay will be predominantly low with some temporary, short-term impact to benthic habitat possible.

We note that our independent environmental risk assessment assigned a 'Medium' risk rating to the risk of introduced marine pests; however, this was accompanied by a likelihood level of 'Unlikely' when considered in the context of maintenance dredging activities.

Any dredge vessel undertaking works at the Port of Mackay is required to comply with Australian Quarantine and Inspection Service and Bio-Security Queensland requirements in relation to ship ballast water and marine pest management. This includes the National System for the Prevention and Management of Marine Pest Incursions.

Environmental receptors

The environmental values around the Port of Mackay are reflective of an inshore environment of the Central Coast of Queensland. The inshore marine environments are naturally turbid, with prevailing wind being the main driver of conditions. Habitats in the area include benthic infauna communities, fringing rocky reef around inshore islands and coastal habitats including mangroves, however none of these habitats are found within the Port itself or within the dredge material placement area.

There are a number of protected fauna species that are known to occur in the waters off the Port including marine turtles, migratory whales, dolphins, dugong, migratory shorebirds and water mouse. The Port and surrounding areas also have values for tourism, recreation, fisheries and heritage. Of these, of most significance is that the Port is located within the Great Barrier Reef World Heritage Area (GBRWHA).

The Mackay region makes some contribution to the Outstanding Universal Value (OUV) of the GBRWHA under the majority of the Property's listing criteria. In all cases, this contribution is incremental, in that the area supports a subset

of the features and processes identified in the listing. However, none of the area's contributions to OUV are significant at the scale of the World Heritage Property.

Risk conclusions

The potential risks and impacts of maintenance dredging are well known. All potential impacts were assessed against known environmental values and data to determine the risks posed by maintenance dredging at the Port of Mackay. The key findings of this risk assessment are:

- Resuspension of sediments from maintenance dredging is comparable to natural suspended sediment concentrations. Importantly, analysis against intensity and duration thresholds indicated that dredging would not result in impacts to sensitive environmental values under any dredging scenario, including modelled volumes as high as 1,000,000 m³ in a single campaign.
- Water quality monitoring results and numerical modelling of sediment transport demonstrates that natural day-to-day suspended sediment levels are much higher than those generated by maintenance dredging.
- Risks to sensitive communities are likely to be low for seagrass and medium for benthic communities, which may be temporarily impacted at the Dredge Material Placement Area due to smothering. However, studies have indicated the communities recover and restabilise.
- Other sensitive communities, such as coral and mangroves, lie outside of area predicted to be impacted by turbidity and sedimentation and the risks from maintenance dredging are negligible.
- Protected species are also unlikely to be significantly impacted by maintenance dredging. The Port of Mackay does not support important populations for marine species and disturbance to habitats (including critical habitat for one marine turtle) will be low.
- Other port users may experience short-term disruptions to their activities, but these disruptions will not be significant.

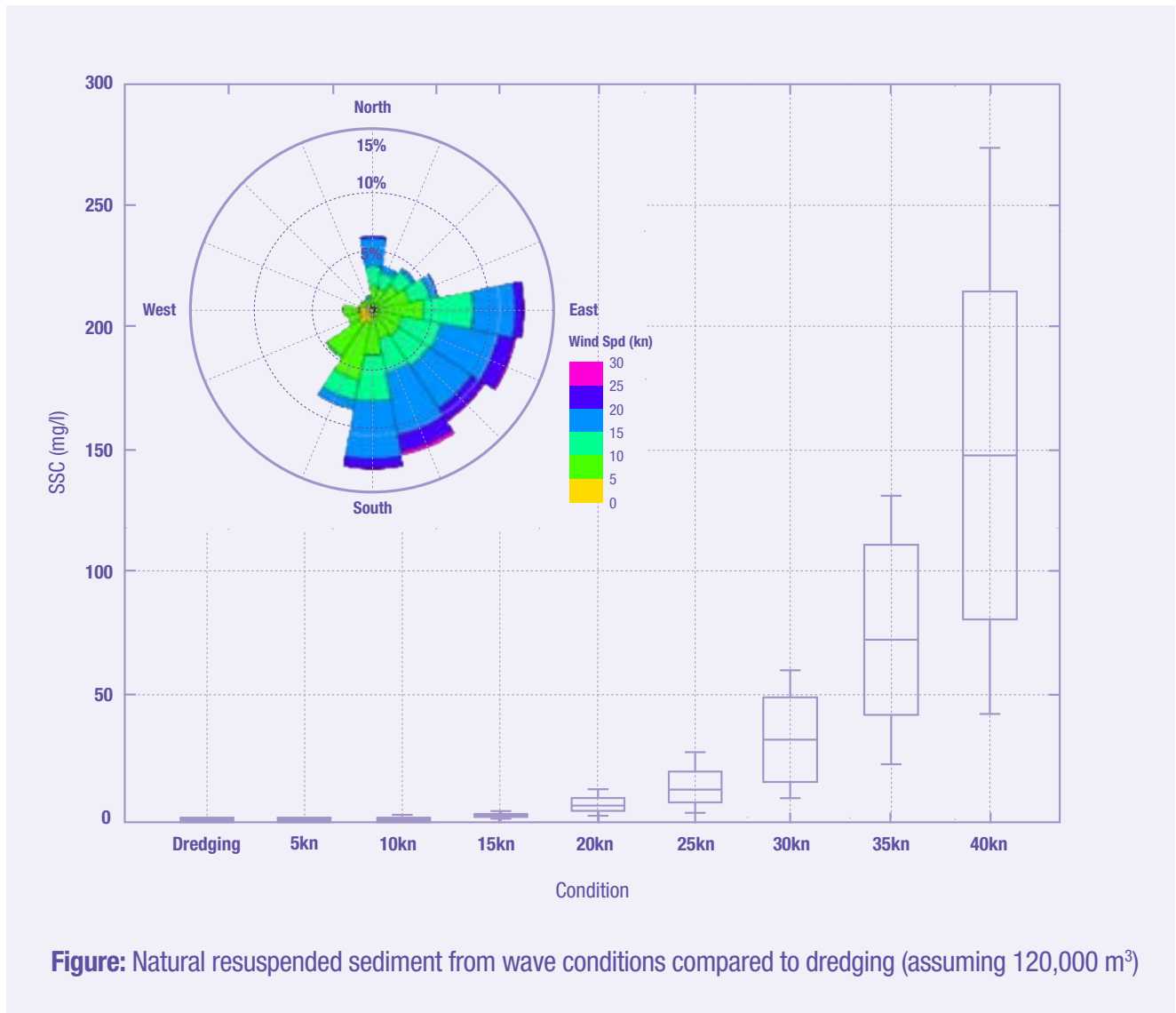
Environmental risk assessment summary table

Risk activity (cause)	Potential environmental receptors	Potential impact	Consequence	Likelihood	Risk rating
Smothering from dredge material placement	Benthic macroinvertebrate communities	Temporary disturbance of benthic habitat and associated communities	Minor Temporary, short term negative impact	Likely	Medium
Dredging and placement generated sediment plume	Coral reef, seagrass and mangrove communities	Changes to water quality leading to mortality or changes in the diversity or cover of coral, seagrass or mangroves	Negligible Impacts is within the natural variation and tolerance of the system	Rare	Low
Dredging and placement generated sediment plume	Coral reef, seagrass and mangrove communities	Sediment deposition resulting in loss of coral, seagrass or mangroves	Negligible Impacts is within the natural variation and tolerance of the system	Rare	Low
Release of contaminants and nutrients	Marine Biota	Potential for lethal and sub-lethal effects on biota	Negligible Material is suitable for unconfined ocean disposal	Rare	Low
Dredging suction	Foraging marine turtles	Potential for marine fauna to be caught	Negligible No impact at the population or sub-population level	Unlikely	Low
Noise	Inshore dolphins, dugong, marine turtles	Potential for alienation of habitat	Negligible No impact at the population or sub-population level	Rare	Low
Lighting	Foraging inshore dolphins, dugong and marine turtles	Alienation of habitat, potential mortality	Negligible No impact at the population or sub-population level	Rare	Low
Introduction of marine pests	Marine Biota	Potential competition with native species and changes to the ecosystem	High Significant impact on the environment in the Port and potentially in the greater region	Unlikely	Medium
Dredge program	Marine users	Disruption of activities	Negligible Impact is confined to a small area or interest group that is not vulnerable	Possible	Low

Environmental receptors and risks - modelling

The extensive bathymetric modelling undertaken by NQBP shows that ongoing maintenance dredging and placement volumes at the Port of Mackay are dependent on natural coastal conditions with wave energy the main driver of resuspended sediments. Tropical cyclones or tropical lows have significant impacts during the wet season. Numerical modelling of dredging and placement demonstrates that any increase in suspended sediments associated with maintenance dredging and placement still remains below the natural suspended sediment range in the coastal area around Mackay.

The natural suspended sediment concentration (SSC) is generally much higher than that resulting from maintenance dredging and was predicted to remain within natural conditions for the sensitive receptors for all dredge scenarios considered.



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How will environmental risks be managed?

Marine monitoring program

NQBP has overseen a comprehensive ongoing ambient marine monitoring program since 2014. The program is currently undertaken by James Cook University marine scientists. The program helps NQBP understand the natural marine environment (monitoring of seagrass, water quality and inshore rocky fringing reefs) and collects data to drive continual improvement. Annual reports from the program can be reviewed on the NQBP website (research and reports).

Maintenance dredging monitoring program

The environmental maintenance dredging monitoring plan aims to:

- Detect any impacts from maintenance dredging.
- Respond to environmental conditions during maintenance dredging programs to manage unpredicted changes to water quality.

These aims will be met through the implementation of a three-tiered approach, as detailed in the Port of Mackay Marine Environmental Monitoring Plan (see below). Results from each tier of the monitoring program will be used to inform how NQBP manages maintenance dredging.

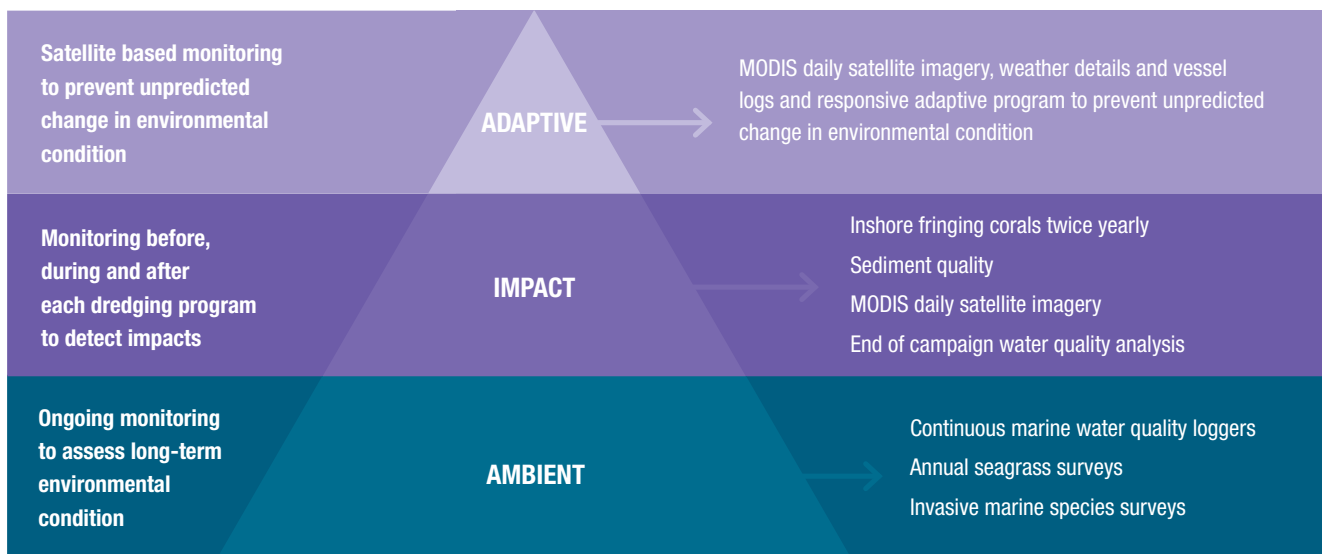
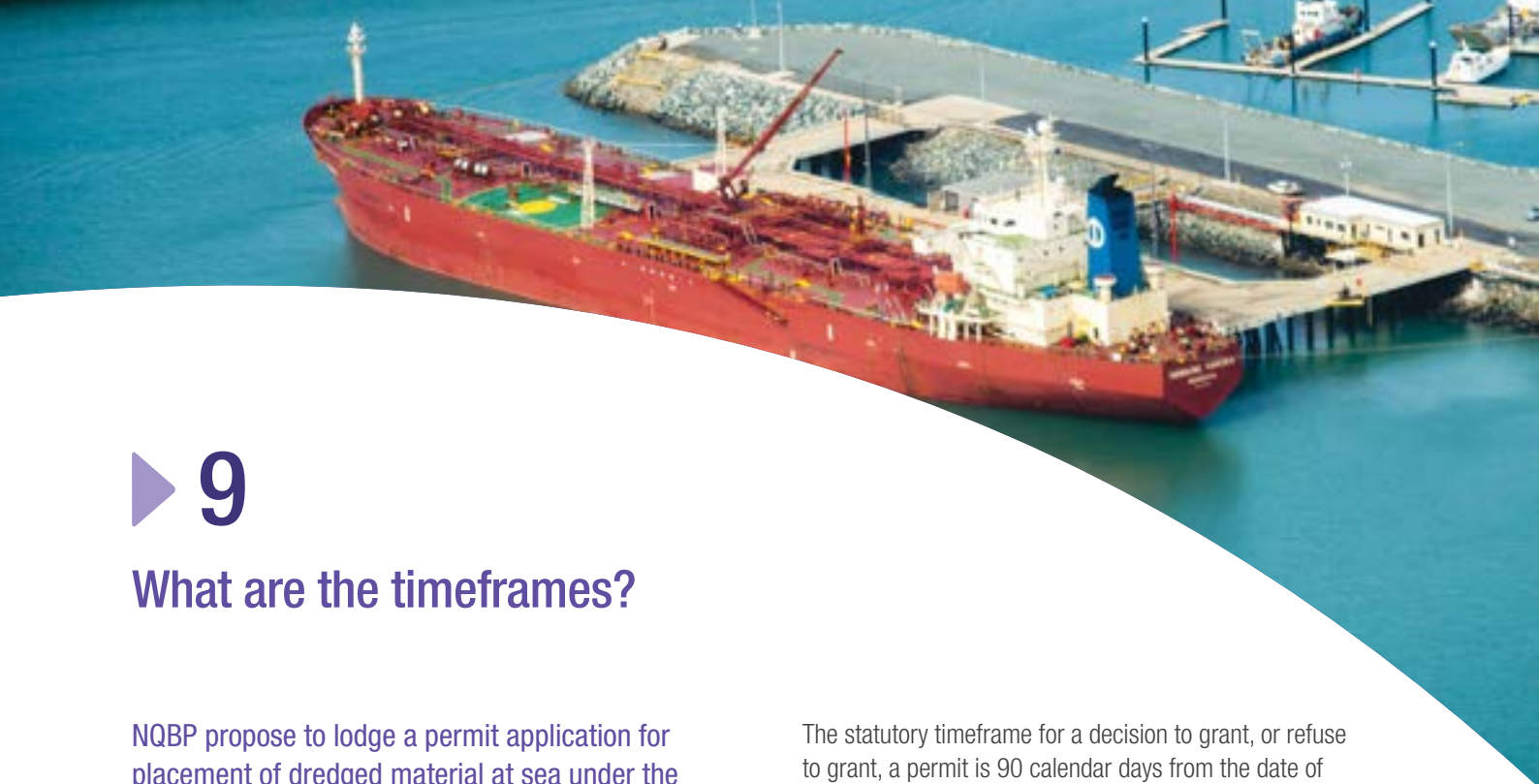


Figure: Three-tiered approach to marine environmental monitoring



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What are the timeframes?

NQBP propose to lodge a permit application for placement of dredged material at sea under the *Environment Protection (Sea Dumping) Act 1981* with the Commonwealth Department of Agriculture, Water and the Environment (DAWE) in mid-2022.

The statutory timeframe for a decision to grant, or refuse to grant, a permit is 90 calendar days from the date of application. There are no known immediate needs for maintenance dredging at the Port of Mackay, but planning has commenced for a possible 2024 program, pending weather conditions and sedimentation rates at the Port over the next few years.

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Will the works impact access by other port users?

Direct physical impact with other port users from collision with the maintenance dredge vessel is unlikely as the vessel will be moving at a slow pace. During maintenance dredging operations, the dredge will be displaying the lights and day shapes as required by orders and regulations for preventing collisions at sea.

There will be restricted safety zones around the maintenance dredge equipment. However, this will be minimal and will be designed to ensure the safety of the boating and fishing public.

Maintenance dredging only occurs periodically at the Port of Mackay so port users and mariners will be provided with plenty of notification and information regarding any future maintenance dredging operations.

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Who has been engaged and consulted?

NQBP is engaging with stakeholders throughout the application process and the Commonwealth Department of Agriculture, Water and the Environment during the assessment period. NQBP's long-term maintenance dredging management plan is being developed in consultation with a Technical Advisory and Consultative Committee (TACC).

The TACC consists of representatives from:

- North Queensland Bulk Ports (port authority)
- Department of Agriculture, Water and the Environment (Commonwealth Government)
- Department of Environment and Science (Queensland Government)
- Department of Agriculture and Fisheries (Queensland Government)
- Department of Transport and Main Roads (Queensland Government)
- Maritime Safety Queensland (Queensland Government)
- Biosecurity Queensland (Queensland Government)
- Mackay Regional Council (Local Government)
- Yuwi Aboriginal Corporation (Traditional Owners)
- Reef Catchments Limited (Natural Resource Management Group)
- James Cook University (Technical)
- Queensland Seafood Industry Association (Industry)
- Tug Services Provider (Industry)
- Whitsunday Charter Boat Industry Association (Industry)
- Mackay Tourism Limited (Industry)
- Conservation Volunteers Australia (Conservation)
- Australia Marine Conservation Society (Conservation)
- Mackay Conservation Group (Conservation)
- Mackay Recreational Fishers Alliance Inc. (Community)
- Port of Mackay Community Reference Group representative (Community).

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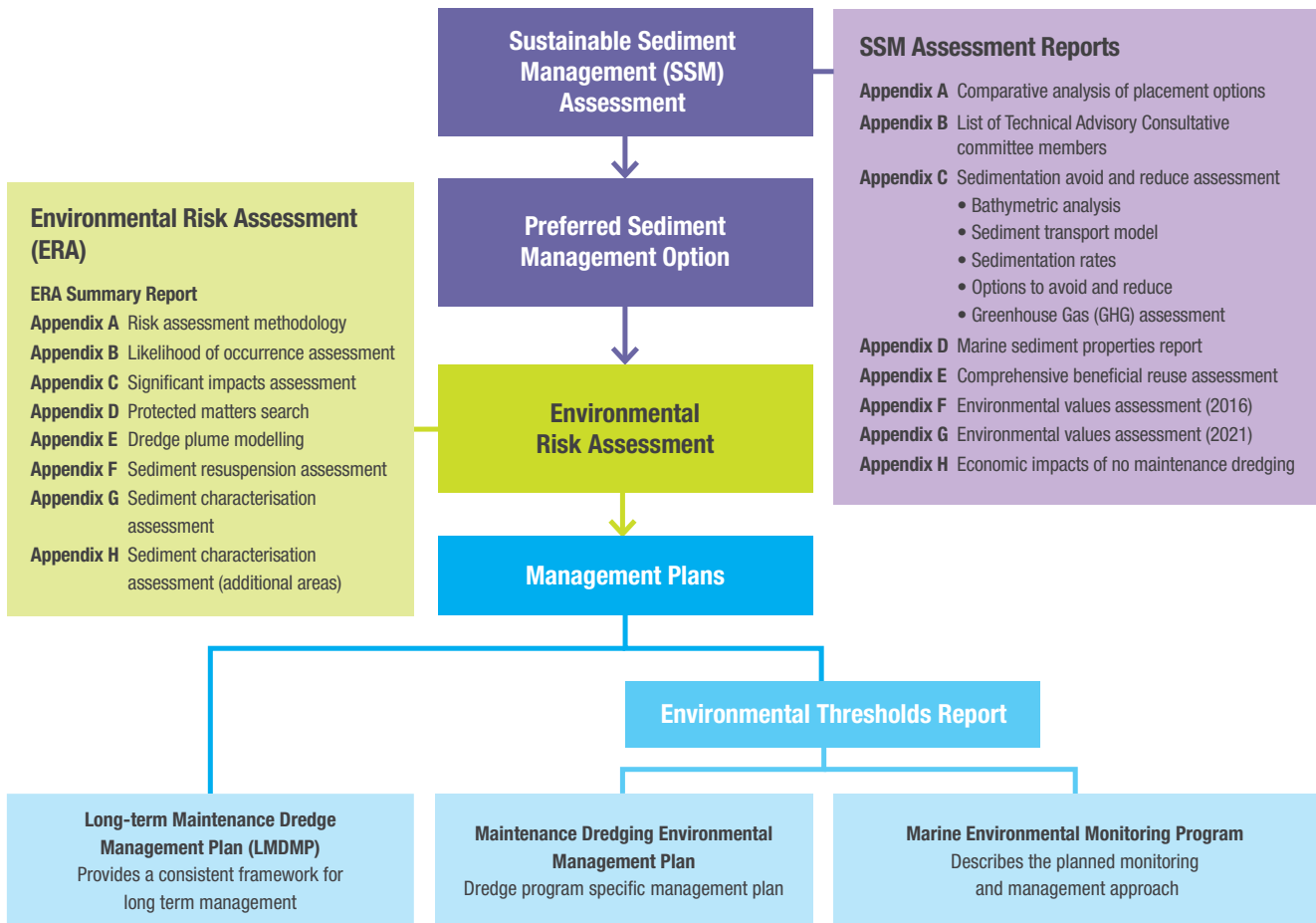
Where do I go for more information?

Industry-leading research, as well as technical studies, have informed NQBP's approach to the proposed maintenance dredging. The approach has been designed to minimise impacts to the environment. NQBP have spent years undertaking detailed studies and engaging with a range of stakeholders to understand the source of natural sediment accumulation and appropriate removal and placement options at the Port of Mackay.

NQBP's long-term maintenance dredging management plan is being developed in consultation with a Technical Advisory Consultative Committee consisting of representatives from the Commonwealth, state and local government, port users, traditional owners, environmental/conservation and community interest groups.

NQBP's Port of Mackay Sustainable Sediment Management (SSM) Assessment reports were peer reviewed by Dr Paul Erftemeijer and are considered best practice. The SSM weighed up possible options for sediment management and determined that placement of maintenance dredge material at the existing placement area was consistently ranked as the highest performing long-term approach.

NQBP's assessment reports have found the risks to environmental receptors are predominantly low with some temporary, short-term impacts to benthic habitat possible and marine pest management required. For more detailed information on any aspect of this assessment please view the below reports on [NQBP's website](#).





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