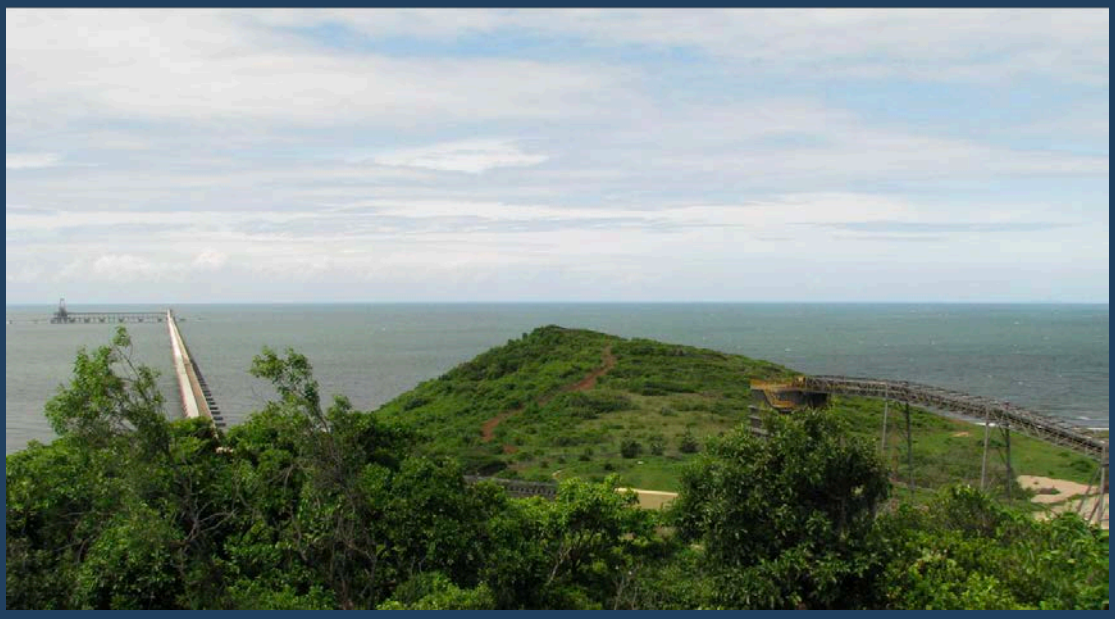
North Queensland Bulk Ports Corporation



Port of Abbot Point

Long-term Maintenance Dredging Management Plan

2018 – 2043

December 2018

ADAPTIVE STRATEGIES

DOCUMENT TRACKING

PREPARED BY:	Tom Kaveney and Lee Archinal (Adaptive Strategies)
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1. Introduction

The Port of Abbot Point (the port) is a coal export port managed by the North Queensland Bulk Ports Corporation Pty Ltd (NQBP).

Located 25 km north of Bowen, the port is of significant strategic value as there are very few locations along Queensland's eastern seaboard where deep water (>15 m) is so close inshore (Figure 1). It is the most northerly coal port and is well situated relative to the Queensland coalfields in the Bowen and Galilee basins.

The existing port has been operational since 1984. The surrounding area was made a State Development Area (SDA) in 2008. As a vital node in Queensland's trade supply chain, the Port of Abbot Point forms one of the state's major gateways to international energy markets.

The port was planned and designed in the early 1980s to support the export of coal from the Collinsville and Newlands mines. The port was approved by the Queensland Government to develop as a deepwater port facility in 1981. Operations commenced in 1984 and by 2010, the Port was exporting up to 15 million tonnes per annum. In 2011, an upgrade to the existing coal terminal increased the export capacity of the port to 50 million tonnes per annum.

Currently the port comprises a single terminal with rail in-loading facilities, coal handling and stockpiling areas and a single 2.8 kilometre offshore trestle jetty and conveyor connecting to two offshore berths and two shiploaders.

NQBP are responsible for maintaining the navigational depths at the Port of Abbot Point as required under the *Transport Infrastructure Act 1994*. Since the Port was commissioned in 1984 the sediment management activities undertaken have involved bed levelling to remove high spots in the approaches to the berths and a single small volume (less than 20,000 m^3) maintenance dredging program in berth 1 which was undertaken simultaneously with the capital dredging of berth 2 in 2008. It is also worth noting that the Material Offload Facility (MOF) was dredged in 2017 so that it could be reinstated for a number of purposes

1.1. Purpose and Objectives

The purpose of this Long-term Maintenance Dredging Management Plan (LMDMP) is to document the strategy for managing natural sediment accumulation at the Port of Abbot Point, in a way that ensures the safe and efficient operation of the Port and the ongoing protection of local environmental values and the Outstanding Universal Value (OUV) of the GBRWHA.

The objectives of the LMDMP are to:

1. Provide a framework for maintenance dredging of the Port over the next 25 years.
2. Establish a robust, transparent long-term planning approach to managing port sediment.
3. Outline operational, planning, consultation and monitoring arrangements.
4. Maintain local environmental values, including the Outstanding Universal Value of the GBRWHA.
5. Apply continual improvement practices in the management of sediment and dredging actions.

1.2. Changes to the LMDMP

This plan is intended to demonstrate commitment to the long-term management of maintenance dredging and placement activities for the Port of Abbot Point, from 2018 to 2043.

This LMDMP will be reviewed and updated every 5 years or when one of the following occurs:

a) when permit conditions have been changed or amended or new permits issued
b) when monitoring results report substantially different impacts than were predicted, or
c) if an incident occurs that poses a significant risk to effective future management.

The current approved LMDMP will be maintained on the North Queensland Bulk Ports (NQBP) website – www.nqbp.com.au.

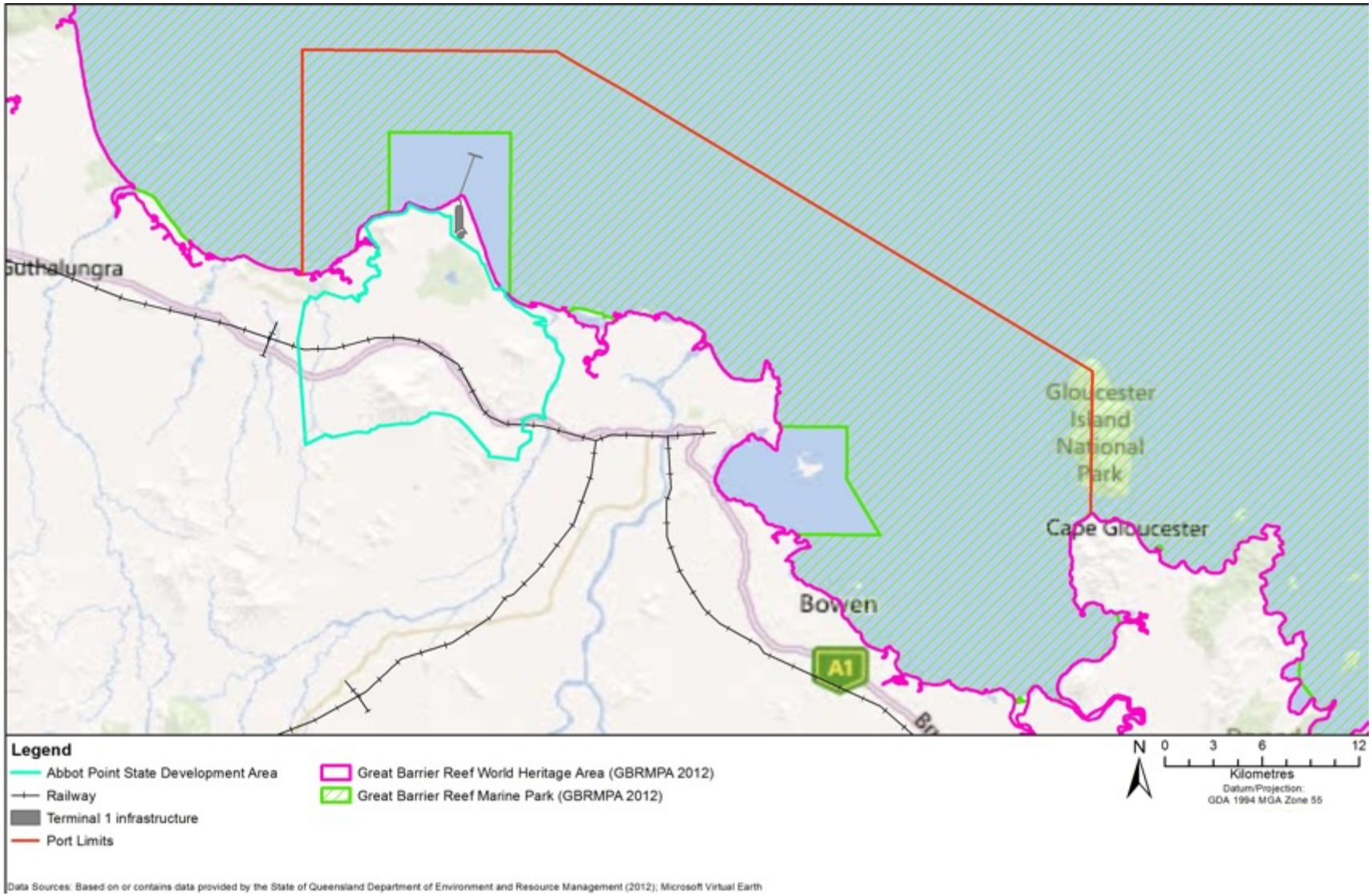

Figure 1: Port of Abbot Point

1.3. POLICY CONTENT

The plan will also ensure that dredging activities align with the principles, elements and objectives described in:

- Reef 2050 Long term Sustainability Plan (CoA 2015)
- Environmental Code of Practice for Dredging and Dredged Material Management (Ports Australia 2016)
- GBRWHA Maintenance Dredging Strategy (SOQ 2016)
- National Assessment Guidelines for Dredging (NAGD) (CoA 2009).

Reef 2050 Long Term Sustainability Plan

The Reef 2050 Plan was released by the Australian and Queensland governments in March 2015 and is the overarching framework for protecting and managing the Reef until 2050. The Plan is a world-first document that outlines concrete management measures for the next 35 years to ensure the Outstanding Universal Value of the Reef is preserved now and for generations to come.

The Plan sets clear actions, targets, objectives and outcomes to drive and guide the short, medium and long-term management of the Reef. The Plan firmly responds to the pressures facing the Reef and will address cumulative impacts and increase the Reef's resilience to longer term threats such as climate change.

In relation to ports, the Reef 2050 Plan notes that:

> "As an island nation, Australia relies heavily on its maritime links. In 2012-13, ports in and adjacent to the World Heritage Area accounted for 20 per cent of the total throughput of all Australian ports combined, with a value of $40 billion.
>
> Ports have been operated along the Great Barrier Reef coast since well before its world heritage listing and are included within its boundaries. The footprint of port areas is small, covering less than 0.1 per cent of the World Heritage Area. The importance of ensuring port activities are ecologically sustainable, particularly dredge projects and the placement of dredge material, is recognised by all levels of government and by the ports industry.
>
> Ports on the Great Barrier Reef coast are major hubs for the export of Australian products including coal, minerals, sugar and other agricultural products, and liquefied natural gas. The ports of Gladstone (18 berths), Townsville (9 berths), Hay Point (7 berths) and Abbot Point (2 berths) are tiny compared to the megaports of China, Singapore, Europe and the United States which each have 75 to 250 shipping berths and will remain tiny by comparison after current expansion plans are completed.
>
> The Outlook Report 2014 found the direct and flow-on effects of port activities, including dredging and the placement of dredge material, generally occur in areas that are already under pressure from an accumulation of impacts. While port activities have a significant localised effect, these activities pose a relatively lower threat to the health of the broader World Heritage Area compared to, for example, the broadscale impacts from land-based run-off."

The Reef 2050 Plan includes a number of port related actions that make clear the need for port authorities to understand the sedimentation characteristics of their ports, avoid and reduce impacts where possible, and establish sustainable long-term management arrangements.

Ports Australia Dredging Code of Practice

The Ports Australia *Dredging Code of Practice for Dredging and Dredged Material Management* sets out a number of environmental principles that Australian ports meet when undertaking dredging and placement of dredged material. The principles have been defined on the basis of ecologically sustainable development principles.

Queensland Maintenance Dredging Strategy

Queensland's *Maintenance Dredging Strategy for Great Barrier Reef World Heritage Area Ports* (SOQ 2016) provides a framework for sustainable, leading practice management of maintenance dredging at ports in the Great Barrier Reef World Heritage *(*GBRWHA). The framework builds on the current regulatory requirements to ensure the ongoing protection of the Reef's values and the continued operating efficiency of ports within the

GBRWHA. The Strategy sets up a framework for maintenance dredging management and requires ports within the GBRWHA to develop and implement long-term maintenance dredging management plans.

Figure 2: Framework for Long-term maintenance dredging management (SOQ 2016)

The development and implementation of this Plan is in line with applicable principles contained in the Maintenance Dredging Strategy, specifically:

- Developing the knowledge base, using the best science available
- Avoiding or minimising the need for maintenance dredging
- Application of the principles of ecologically sustainable development
- Maintaining and enhancing environmental values, including the OUV of the Great Barrier Reef World Heritage Area
- Going further than avoiding and mitigating impacts, to look for opportunities to deliver environmental protection, restoration or enhancement outcomes (working with nature principles)
- Application of comparative analysis to determine the most suitable solutions
- Application of adaptive management and continuous improvement processes
- Reporting evaluated performance and providing access to data and information from monitoring
- Favouring transparency, consultation with key stakeholders and values-based assessment.

This LMDMP fulfils the expectations of the Queensland's *Maintenance Dredging Strategy for Great Barrier Reef World Heritage Area Ports*, as outlined in Figure 3. The LMDMP comprises the main planning and management tool, while the supporting Maintenance Dredging EMP and Monitoring Program are provided in separate documents.

- The Maintenance Dredging EMP is developed in conjunction with the dredge operator, it is specific an individual dredging program and contains the operational controls for the dredge.
- The Monitoring Program is developed by NQBP and outlines the ambient, impact and adaptive monitoring overseen by the Port Authority.

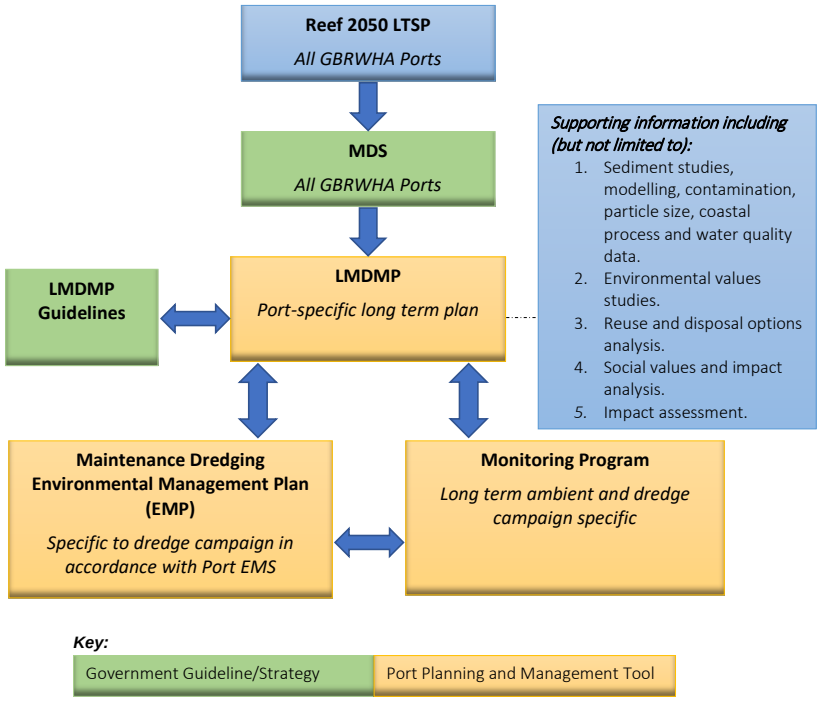

Figure 3: Planning and implementation mechanisms for maintenance dredging of ports Queensland wide (CoA 2009)

National Assessment Guidelines for Dredging (NAGD)

The NAGD established a scientific assessment framework to determine if dredge material is suitable for ocean placement in line with the *Environment Protection (Sea Dumping) Act 1981* and the *1996 Protocol to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 1972* (the London Protocol). The Guidelines include an assessment framework (Figure 4) that is applied to ensure the impacts of dredged material loading and placement are adequately assessed.

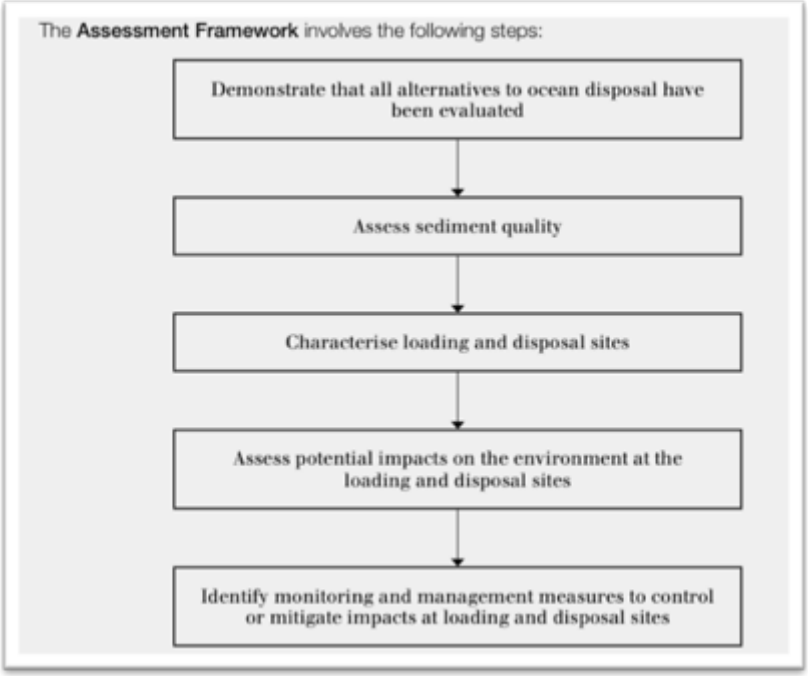

Figure 4: National assessment framework for dredge material disposal (CoA 2009)

1.4. GOVERNANCE

LEGISLATION AND APPROVALS

Maintenance and capital dredging programs are subject to a number of Commonwealth and Queensland government laws and policies. This section describes the key environmental, cultural and planning legislation and policies that apply to dredging and dredge material placement projects undertaken at the Port of Abbot Point. Specifics on which of these particular legislation and approvals processes apply to a proposed dredging project will need to be undertaken in the initial planning stage of any proposed dredging program, taking into account the specifics of each proposed dredging program.

COMMONWEALTH LEGISLATION AND POLICY

A number of key pieces of Commonwealth environmental and cultural protection legislation may apply to dredging projects undertaken within Australia:

- *Environment Protection (Sea Dumping) Act 1981*
- *Environment Protection and Biodiversity Conservation Act 1999*
- *Great Barrier Reef Marine Park Act 1975.*

Environment Protection (Sea Dumping) Act 1981

Dumping of waste and other material from any vessel, aircraft or platform in Australian waters is prohibited under the *Environment Protection (Sea Dumping) Act 1981*, unless a permit has been issued. Permits are most commonly issued for dredging operations and the creation of artificial reefs. The Act fulfils Australia's international obligations under the London Protocol (to prevent marine pollution by controlling dumping of wastes and other matter). The Act is administered by the Department of Environment and Energy (DEE); or by the Great Barrier Reef Marine Park Authority (GBRMPA) for activities inside the Great Barrier Reef Marine Park.

Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is the Australian Government's central environmental legislation. The EPBC Act provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities, wetlands and heritage places which are defined in the EPBC Act as matters of national environmental significance (MNES).

The EPBC Act is triggered when a development proposal has the potential to have a significant impact on MNES. Approval under this Act is not required is significant impact to MNES will not result.

Great Barrier Reef Marine Park Act 1975

The *Great Barrier Reef Marine Park Act 1975* is the primary Act relating to the Great Barrier Reef Marine Park. It establishes the Great Barrier Reef Marine Park and the Great Barrier Reef Marine Park Authority (GBRMPA), a Commonwealth authority responsible for the management of the Marine Park. The Act provides a framework for planning and management of the Marine Park, including through zoning plans, plans of management and a system of permissions. Dredging or placement of material inside the Marine Park requires a permit issued by GBRMPA.

STATE LEGISLATION AND POLICY

The Queensland Government also regulates maintenance dredging under a series of State laws. The legislation that applies is determined by the location of the dredging activity and the type and scale of dredging being undertaken.

The primary legislation that may apply includes:

- *Queensland Marine Parks Act 2004*
- *Sustainable Ports Development Act 2015*
- *Fisheries Act 1994*
- *Planning Act 2016*

Queensland Marine Parks Act 2004

The Great Barrier Reef Coast Marine Park (GBR Coast MP) is a state marine park that runs the full length of the GBR from just north of Baffle Creek (north of Bundaberg) to Cape York. It provides protection for Queensland tidal lands and tidal waters.

The Marine Parks Act 2004 supports the creation of a comprehensive and balanced zoning system within the GBR Coast MP, providing protection of the Great Barrier Reef's unique biodiversity, while continuing to provide opportunities for the use of and access to the marine park.

Sustainable Ports Development Act 2015

The *Sustainable Ports Development Act 2015* (Qld) (SPD Act) restricts new port development in and adjoining the GBRWHA to within current port limits and outside Commonwealth and state marine parks. It also prohibits major capital dredging for the development of new or expansion of existing port facilities in the GBRWHA outside the priority ports of Gladstone, Abbot Point, Townsville and Hay Point/Mackay, and prohibits the sea-based placement of port-related capital dredge material within the GBRWHA.

In addition, the SPD Act mandates master planning for priority ports and their surrounding land and marine areas.

Fisheries Act 1994

The main purpose of the *Fisheries Act 1994* (Qld) is to provide for the use, conservation and enhancement of the community's fisheries resources and fish habitats. This is undertaken in a manner that seeks to apply and balance the principles of ecological sustainable development.

Marine plants are a key component of fish habitat. Dredging activity impacts marine plants through a range of actions including the direct physical impact of the process, through the mobilisation of sediments and through smothering at spoil placement sites. Approval is often required to ensure the goals of ecologically sustainable development are met.

Planning Act 2016

The *Planning Act 2016* (Qld) aims to establish an efficient, effective, transparent, integrated, coordinated, and accountable system of land use planning, development assessment and related matters that facilitates the achievement of ecological sustainability. Includes regulation of activities in tidal areas.

APPROVALS

A number of State and Federal approvals necessary for ongoing maintenance dredging and placement at the Port of Abbot Point. Currently, there are no immediate needs to undertake maintenance dredging at the Port. Permits and other approvals to undertake maintenance dredging will be sought once an identified need to dredge is determined.

NOTIFICATION AND OBLIGATIONS SCHEDULE

Prior to maintenance dredging commencing NQBP will develop a 'notifications and obligations schedule' that clearly outlines relevant reporting requirements and obligations arising from all current permits. The schedule will separately show notification requirements and condition obligations for the periods:

1. Pre-maintenance dredging commencing.
2. During active maintenance dredging and placement.
3. Post-maintenance dredging reporting and closeout.

The most current notifications and obligations schedule will be provided to the Technical Advisory Consultative Committee (TACC).

1.5. RESPONSIBILITIES

NQBP is a government owned corporation that reports to two Government Shareholding Ministers (Minister for Main Roads, Road Safety and Ports; and the Treasurer). The shareholding ministers are represented by a Board of Directors who oversee the governance and direction of the organisation.

NQBP as the Port Authority for the Port of Abbot Point are responsible for all maintenance dredging activities.

The existing terminal (T1) is currently owned and operated by Adani Abbot Point Terminal (AAPT). In 2017-18 the port exported approximately 28.0 million tonnes.

A *Maintenance Dredging Steering Committee* oversees the day to day planning and operations of maintenance dredging at the Port of Abbot Point. The committee is responsible for:

- financial review and approval
- dredging contract review and approval
- approval of the LMDMP, Monitoring Program and environmental management plans
- review and approval of external affairs and media correspondence.

The committee is chaired and attended by key executives of NQBP and includes senior representatives from the port terminal.

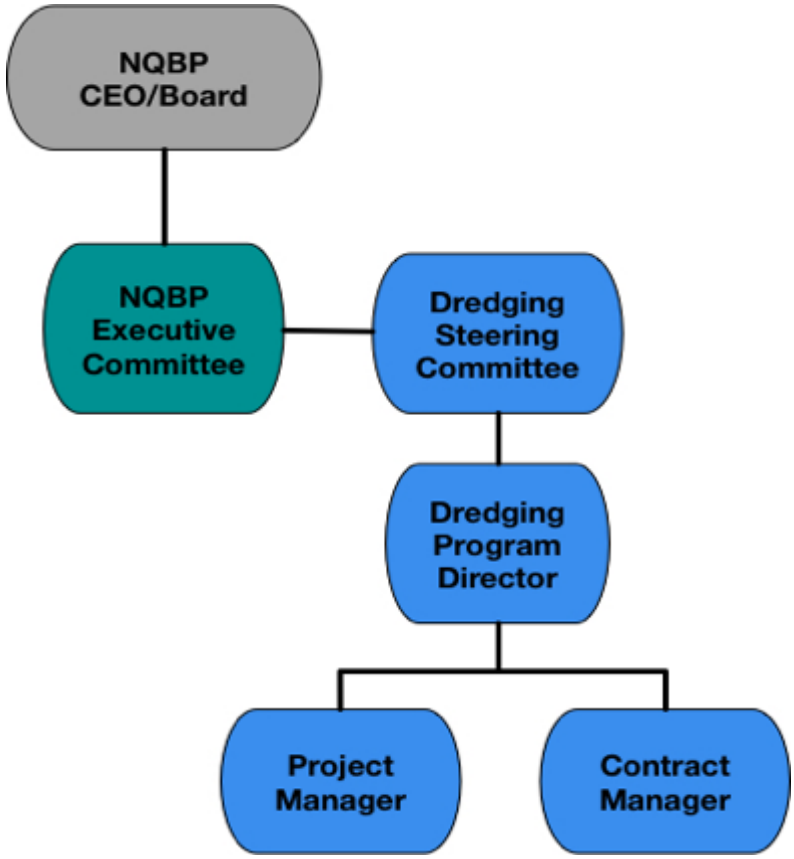

Figure 5: Structure of Maintenance Dredging Steering Committee

2. Port Locality, Setting and Shipping

The Port of Abbot point is the most northerly Queensland coal exporting port, exporting 28.0 million tonnes per annum.

All of the vessels calling at the Port are bulk carriers, which are a highly efficient form of transport globally and are able to move large volumes of product effectively around the world. Bulk carriers vary in size, however, the four main industry standards of bulk carriers are:

- Handy: up to 40,000 dry weight tonnes (DWT).
- Handymax: up to around 50,000 DWT, and around 150 m to 200 m in length.
- Panamax: up to around 90,000 DWT, and averaging around 230 m in length, but limited in beam to 32 m to permit passage through current Panama Canal locks.
- Capesize: upwards of 90,000 DWT, but typically around 100 000 DWT to 250,000 DWT, with a length of around 280 m or more and wider in the beam than a Panamax ship.

To accommodate bulk carriers of this size the navigational areas within the Port have been deepened to enable the safe departure of loaded vessels.

Figure 6 provides a cross-sectional representation of the various depths related to dredging and safe vessel movements.

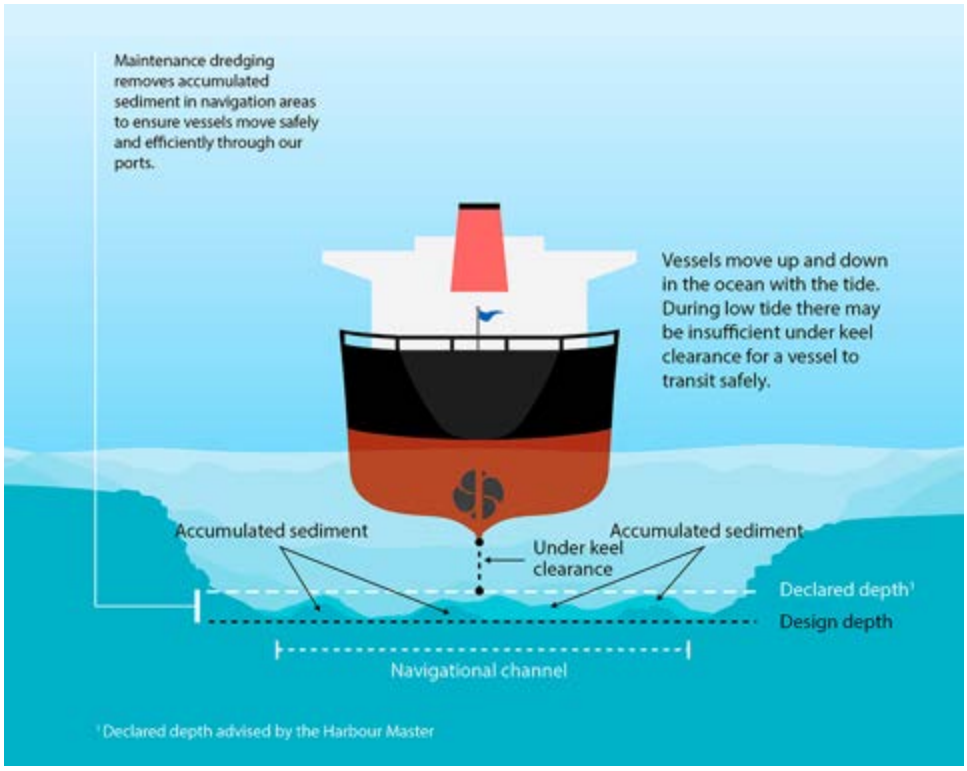

Figure 6: Shipping channel terms and depths

2.1. Channels and Apron

The Port of Abbot Point has infrastructure for the export of coal, currently the only commodity to be exported from the Port. All facilities have been developed to support the transfer of the coal onto ships from trains that enter the port area.

At Abbot Point, offshore infrastructure currently consists of two offshore ship loaders located at the end of a 2.7 km long trestle jetty, which is serviced by a conveyor.

The Port consists of two berths, an approach apron to the berths and a multipurpose Material Offloading Facility (MOF). The berths are located 2.7 km offshore, which allows the berths and approaches to be located in naturally deep water (between -16 to -18 m LAT). The MOF is located adjacent to the shoreline on the eastern side of the Abbot Point headland in naturally shallow water. Further details of these areas are provided below:

- Berth 1: area = 31,500 m^2, design depth = -19.0 m LAT;
- Berth 2: area = 33,800 m^2, design depth = -19.5 m LAT;
- Approaches: area = 2,000,000 m^2 (estimated as due to the naturally deep water in the area a definitive boundary for the approaches is not available), design depth = -17.2 m LAT;
- MOF berth: area = 1,200 m^2, design depth = -3 m LAT; and
- MOF approaches: area = 4,700 m^2, design depth = -2 m LAT.

Located in the town of Bowen are the Bowen Wharves. This facility is primarily utilised for the mooring and refuelling of the two tugs that service the coal terminal and occasionally for the mooring of other vessels that visit the port.

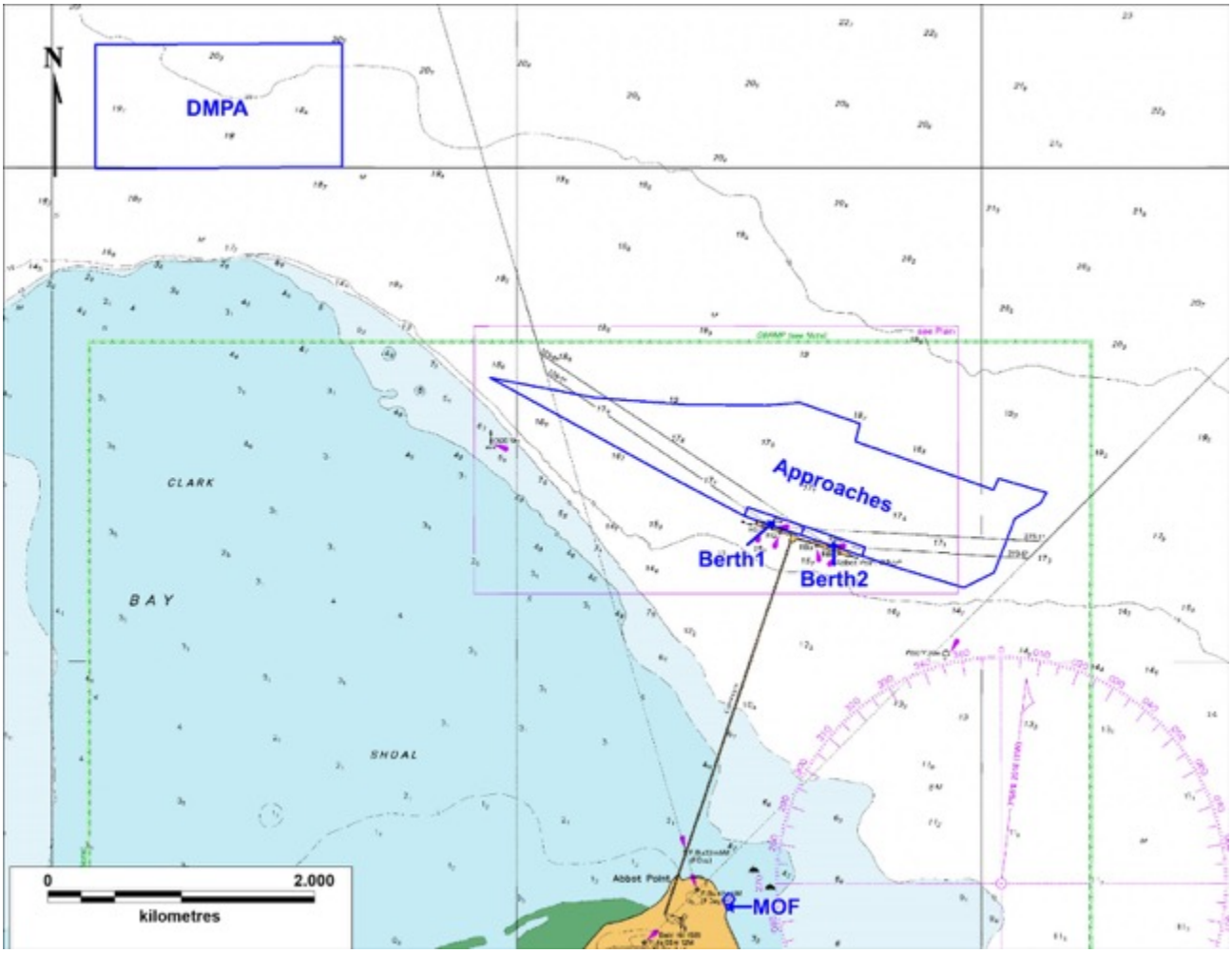

Figure 6: Navigational infrastructure at the Port of Abbot Point

3. Port Environmental Values

In managing sediment and dredging activities at the Port of Abbot Point it is essential to understand the environmental, social and cultural values of the Port and the surrounding area. The commercial activities were discussed previously in Section 3.

The focus is on values that are considered important or notable at a national, regional or local level. The aim is to provide a useful level of detail and relevance to management planning. Values are described for the broader area incorporating the port limits and adjacent environs. More detailed information regarding these values can be found in the *Port of Abbot Point Environmental Values Report* (Adaptive Strategies 2018).

The current state of the terrestrial and marine environment at Abbot Point reflects:

- pre-european Indigenous occupation and use
- its past use for agricultural purposes
- development and operation as an industrial port since 1984
- its proximity to ecologically important areas.

As such, the environment of Abbot Point is comprised of both developed and undeveloped areas. The undeveloped areas broadly include the following:

- Great Barrier Reef World Heritage Area and Marine Park
- marine foraging areas for turtles, dugongs and inshore dolphins
- low density nesting beaches for green and flatback turtles
- the Caley Valley Wetland, which is important habitat for a number of bird species
- a variety of vegetation types in different conditions including:
- the endangered Semi-evergreen vine thicket (SEVT) ecological community
- woodland, riparian, mangrove and coastal areas.

WHAT IS AN 'IMPORTANT VALUE'?

- For the purposes of this review, *important environmental* values are those that are:
- Matters of national environmental significance protected under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).
- Matters of state environmental significance protected under Queensland environmental protection and management laws.
- Habitats or ecosystems that are considered 'important' or 'critical to the survival' of listed species or communities.
- Values that contribute significantly to the Outstanding Universal Value of the GBRWHA.

Important *social and cultural* values are those that are:

- Included in national or state registers.
- Identified by traditional owners or community members.
- Values that contribute to the appreciation culture and heritage in the region.
- Features that provide a connection to the landscape, history or previous or current use of the area.

There are also extensive cleared areas currently or previously used for farming as well as some cleared, but undeveloped areas, that are used to support existing industrial uses, such as equipment laydown.

The Port of Abbot Point is an existing coal port and is of significant strategic value as there are very few locations along Queensland's eastern seaboard where deep water (>15 m) is so close inshore. It is the most northerly coal port and is well situated relative to the Queensland coalfields in the Bowen and Galilee basins.

At the same time the port is located within the Great Barrier Reef World Heritage Area and contains numerous environmental, cultural and social values. Accordingly, the area requires careful and sustainable planning and management.

The existing Port has been operational since 1984. The surrounding area was made a State Development Area (SDA) in 2008. The Port has been identified under the *Sustainable Ports Development Act 2015* as a priority port requiring a master plan. As a vital node in Queensland's trade supply chain, the Port of Abbot Point forms one of the state's major gateways to international energy markets.

The region also continues to support areas of international, national and state environmental significance. Historic land use practices have resulted in fragmented remnants of native vegetation throughout the landscape and along riparian corridors. These natural features provide important habitat corridors for a variety of native flora and fauna. The marine environment adjacent to the Port and coastline also contributes to the diversity of values in the region and importantly the Outstanding Universal Value (OUV) of the GBRWHA.

3.1. OUV OF THE GBR WORLD HERITAGE AREA

The Port of Abbot Point is within the GBRWHA (listed as a World Heritage Area in 1981). The GBRWHA is listed based on it meeting four World Heritage criteria for OUV:

- Natural beauty and natural phenomena
- Major stages of the Earth's evolutionary history
- Ecological and biological processes
- Habitats for conservation of biodiversity.

The evaluation of key attributes expressed within the Port of Abbot Point has determined that there are several attributes with either minor, or major presence in the study area or adjacent areas (Adaptive Strategies 2018). These attributes can be summarised as follows:

- There is a significant presence of seabirds within the Caley Valley Wetlands, with important populations of four migratory shorebirds species (Latham's Snipe; Red-necked Stint; Australian painted snipe and Sharp-tailed sandpiper) occurring within the Abbot Point study area.
- There is minor presence of a range of attributes relating to marine species including:
    - low level green turtle breeding
    - reef fish species
    - low numbers of migrating Humpback whales
    - low numbers of dugong
    - inshore dolphin species, including the indo-pacific humpback and snubfin dolphins.
- There is also minor presence of a number of ecosystem related attributes within and adjacent to the Abbot Point study area including:
    - areas of mangrove forests
    - vegetated mountains
    - areas of inshore seagrass habitat
    - potential habitat areas for two threatened plant species.

The minor presence of these attributes relates to all of the four natural heritage criteria.

The findings indicate that the Outstanding Universal Value of the GBRWHA is expressed within the Abbot Point study area through the presence of important populations of shorebirds and minor occurrences of marine species and terrestrial and marine ecosystems.

3.2. ABBOT POINT ENVIRONMENTAL FEATURES

The key environmental values present in the area of the Port are summarised in Table 1.

Table 1: Regional environmental features

FEATURE	DESCRIPTION
World Heritage	The area lies adjacent to, and within the Great Barrier Reef World Heritage Area. Of the important key environmental features present within the region, two are considered to contribute significantly to the OUV of the GBRWHA. • The presence of important populations of migratory birds and shorebirds within the Abbot Point study area is important as they significantly contribute to the expression of World Heritage OUV attributes at Abbot Point • Connectivity between the wetland and the World Heritage Area is important as it contributes to the integrity of ecological processes within the adjacent GBRWHA.
Remnant Vegetation	The Abbot Point region supports a wide range of remnant vegetation types in varying condition and patch size. Vegetation types mapped within the area include mangroves, dunal vegetation, vine forest, swamps and wetlands, open eucalypt forest and tussock grassland (Adaptive Strategies 2018). The presence of 29 listed vegetation communities within the Abbot Point study area is important as: • 11 of the communities are listed as Endangered or are Of concern under the NC Act • the communities provide a diversity of habitat types which support a diversity of fauna and flora including threatened species • they provide connectivity between terrestrial areas to large coastal wetland and riparian areas.
Threatened Ecosystems	One threatened ecological community occurs within the Port area. The presence of approximately 107.6 ha of Semi-evergreen vine thicket (SEVT) within the Abbot Point area is important as: • SEVT is listed as endangered under the EPBC Act and Of Concern under the NC Act • this area of SEVT represents 11% of the 984 ha occurring within the Abbot Point region (Bowen to Cape Upstart National Park) • it provides habitat for a diversity of fauna and flora in the area • it provides a vegetation buffer between existing development at Abbot Point and low density turtle nesting sites found along Abbot Point Beach, Dingo Beach and the shoreline north of Mt Luce • the patches present represent areas of SEVT in generally good condition.
Threatened Terrestrial Fauna	The presence of potential habitat for five threatened fauna species may be important as it may contain new records in the Abbot Point region for the following species: • two listed terrestrial birds (black-throated finch, red goshawk) • coastal sheathtail bat • northern quoll • yakka skink. Until further field surveys of potential habitat areas are undertaken it cannot be determined whether the Abbot Point study area supports important populations of these threatened species.
Shorebirds	Internationally recognised migratory shorebird sites occur within the Caley Valley Wetland. The presence of migratory birds within the Abbot Point study area is important as: • the area supports a high diversity of migratory bird species (16 species) • there are ecologically significant populations of Little tern and Great Egret present.

Threatened Terrestrial Flora	The presence of potential habitat for two threatened flora species within the Abbot Point study area is important as it may contain new records of *Croton magneticus* and *Ozothamnus eriocephalus* for the region. Until further field surveys of potential habitat areas are undertaken it cannot be determined whether the Abbot Point study area supports important populations of these two threatened flora species.
Mangroves	The areas along the coast and fringing the Caley Valley Wetland support areas of mangrove community. These areas contain a diversity of mangrove species that is found throughout the region.
Caley Valley Wetland	The presence of the Caley Valley Wetlands within the Abbot Point area is important as it provides a diversity of wetland habitat areas that vary seasonally and temporarily (Figure 8). The Wetlands contain the following six habitat zones: • coastal water zone (marine habitat types); • western estuarine zone (estuarine vegetation, tidal flats and creeks); • hypersaline saltpan zone (natural saltpan and degraded wetland habitat); • wetland basin zone (shallow lagoon with fringing saltmarsh vegetation); • saltwater creek zone (permanent freshwaters and riparian vegetation including some mangroves); and • terrestrial zone (ephemeral streams and terrestrial ecosystems). These wetland habitat areas within and surrounding the Caley Valley Wetland provides habitat for a diversity of migratory shorebirds. The Wetland is particularly important in supporting ecologically significant populations of the following migratory species: • Latham's snipe • Sharp-tailed sandpiper • Red-necked stint.
Water courses	Surface and groundwater quality and flows within the Abbot Point area are important for the maintenance of the health of Caley Valley Wetland and inshore marine water quality conditions (through runoff). Watercourses within the Abbot Point area provide flows into the Caley Valley Wetlands and include: • Saltwater Creek (permanent) • Mt Stewart, Six Mile, Goodbye, Maria, Tabletop, Branch and Splitters Creeks (ephemeral). Watercourse condition is important in maintaining the health of the Caley Valley Wetland and aquatic habitat provided by Saltwater Creek.

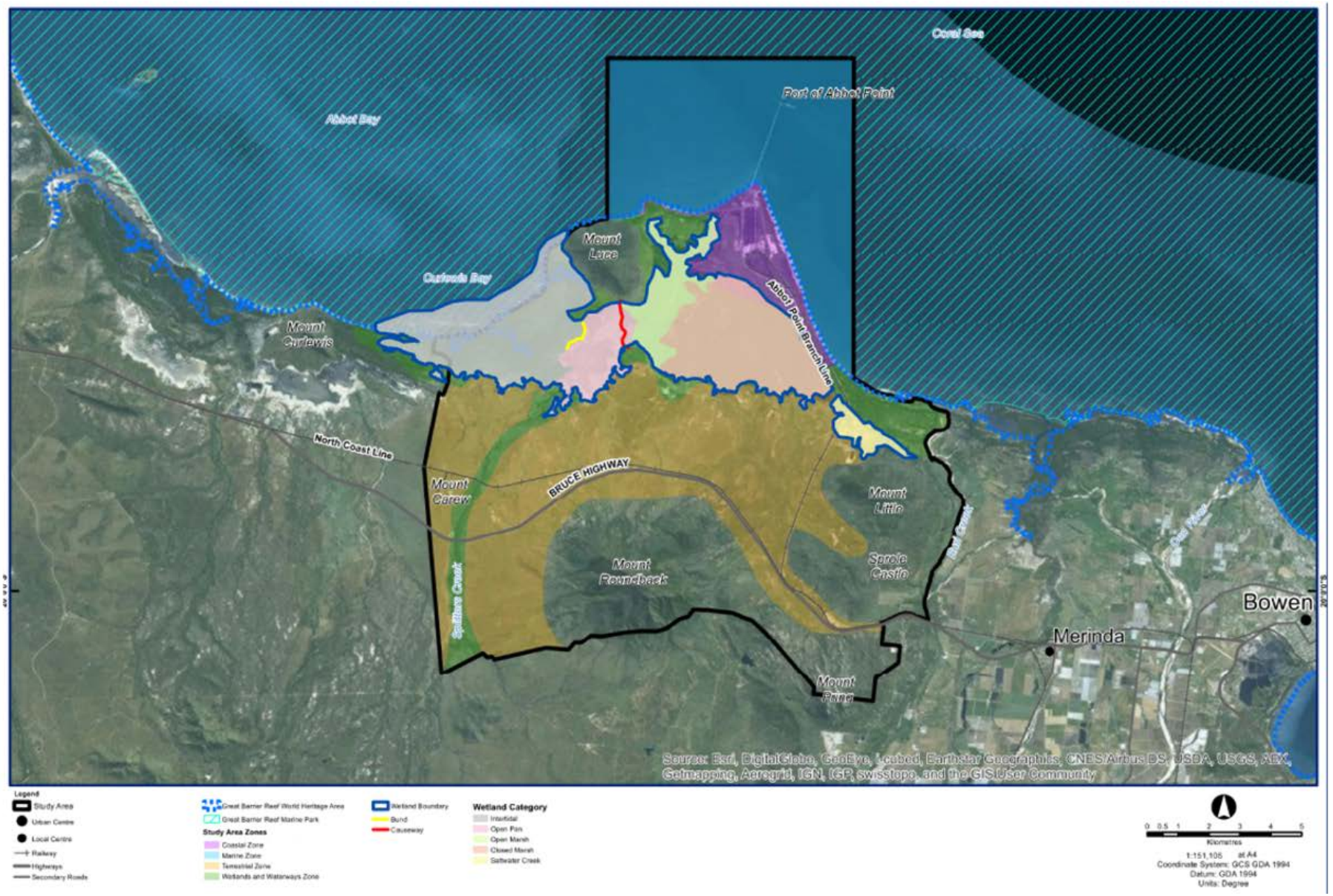

Figure 7: Habitat Zones at Abbot Point

3.3. MARINE VALUES

The key marine values present in the vicinity of the Port are summarised in Table 2.

Table 2: Marine values

FEATURE	DESCRIPTION
Threatened and migratory marine fauna	There is a known presence of a number of threatened and migratory marine fauna within the Abbot Point area: • six threatened marine turtle species (including low density nesting for green and flatback turtles) • five migratory species (Humpback whale (also threatened), Indo-Pacific Humpback dolphin; Australian snubfin dolphin, dugong, giant manta ray). Until further field surveys of the populations of Indo-Pacific humpback and Australian snubfin dolphins are undertaken it cannot be determined whether the Abbot Point study area supports important populations of these two species.
Seagrass and macroalgae	Seagrass in the region is naturally variable in distribution and species composition due to a number of seasonal factors. Deepwater seagrasses are particularly transient, and usually only occur between July and November. Deepwater seagrass meadows have been recorded offshore of Abbot Point (Figure 9).The presence of seagrass beds within the offshore waters of the Abbot Point area is important as: • they provide good quality foraging habitat for threatened marine turtle species and migratory dugong • they provide nursery habitat for many species of fish, crustaceans and marine invertebrates • they may also be important foraging habitat for snubfin dolphins as sightings are often associated with seagrass beds. The presence of macroalgae communities is important for providing foraging habitat for threatened marine turtles.
Coral and other marine fauna	Fringing coral reefs at Camp Island, Holbourne Island and Nares Rock (offshore of Abbot Point) provide habitats for a number of marine species.
Marine water quality	Marine water quality contributes to the condition of marine habitats within the offshore area of Abbot Point and consequently influences the abundance and diversity of marine fauna and flora the area supports.

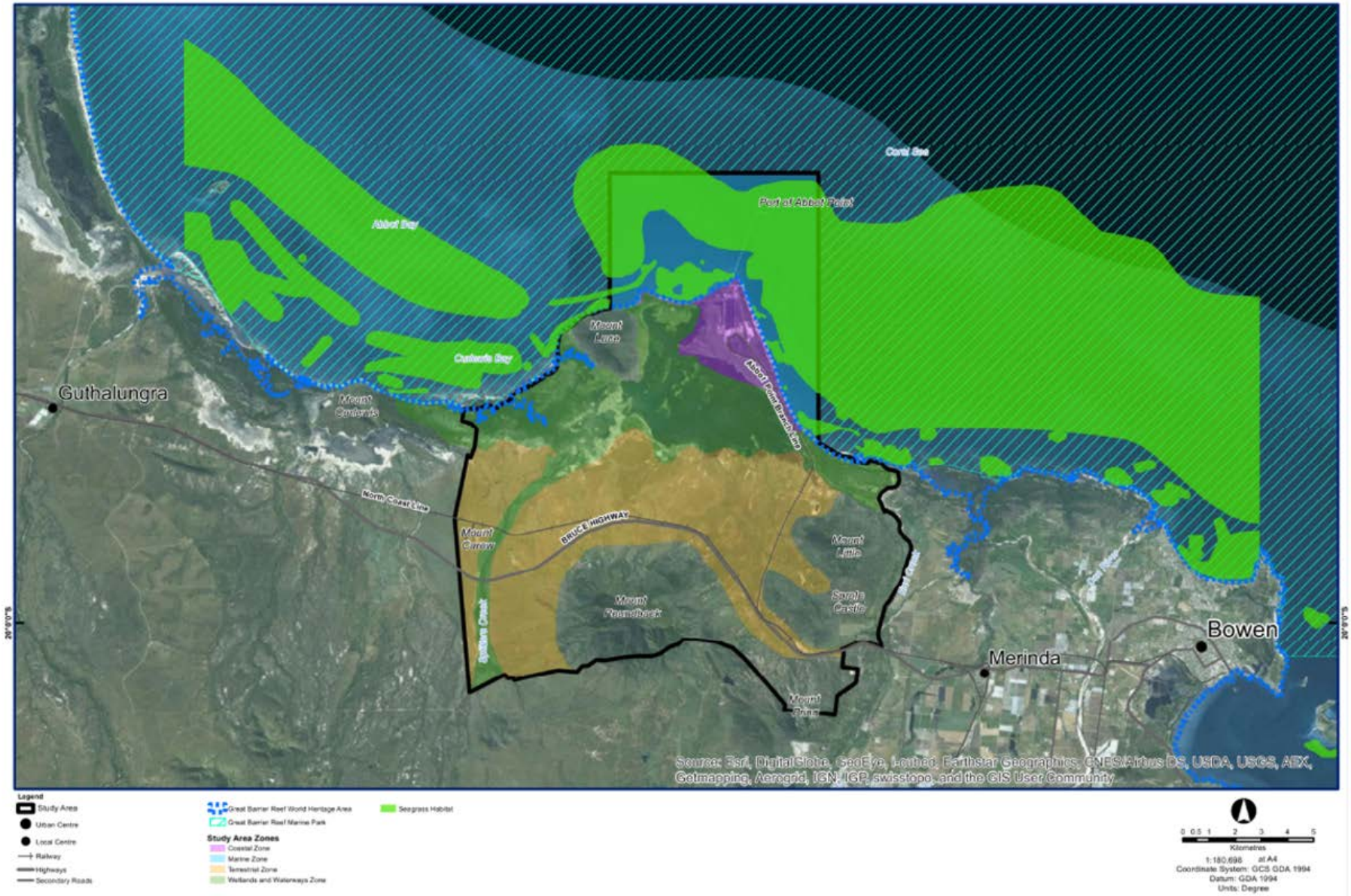

Figure 8: Seagrass mapping in vicinity of Port of Abbot Point

3.4. SOCIAL VALUES

Table 3: Regional social features

FEATURE	DESCRIPTION
Population & demography	The Whitsunday LGA had an estimated resident population of 34 784 as at 30 June 2017 and has had an average annual growth rate of 0.8 per cent over five years. The closest residential area to the Port of Abbot Point, Bowen, has a current estimated resident population of 9269 with a negative population growth of -0.3 per cent over five years. In June 2016 in Bowen, 18.7 per cent of residents were aged under 15 years, 63.0 per cent between 15 and 65 years and 18.2 per cent 65 years and over. The population of Bowen is relatively older than that of Queensland more generally. Bowen has a greater proportion of both males and females aged between 25-29 however. The median age in the area was 40.2 years. In 2016, 9.3 per cent of people in the area identified as Aboriginal or Torres Strait Islander, much higher than that of the Whitsunday region at 4.8 per cent and Queensland as a whole at 4.0 per cent. Of residents in the area, 14.7 per cent were born overseas – in comparison to the Whitsunday region at 15.4 per cent and 21.6 per cent for Queensland.
Family composition	There were 2201 families in Bowen at the time of the 2016 Census and 36.3 per cent were families with children. The percentage of one-parent families was, at 16.4 per cent, higher than the Whitsunday region at 14.6 per cent but very similar to Queensland as whole at 16.5 per cent.
Income & disadvantage	Median family income in Bowen is lower than the Mackay region in general. There were 264 low-income families (12.0 per cent of families in comparison to 10.7 per cent in the Whitsunday region and 9.4 per cent in Queensland overall). The Index of Relative Socio-Economic Disadvantage value for the area indicates that it is relatively disadvantaged with most people in the two most disadvantaged quintiles and none in the two least disadvantaged percentiles in comparison to the Whitsunday region as a whole (19.3 per cent in the two least disadvantaged percentiles). According to Social Services data, higher proportions of people are receiving allowances such as the age pension, family tax benefit and Newstart in Bowen, than in the Whitsunday region and Queensland more generally.
Workforce participation & employment	The labour force of the region at end June quarter 2018 was 20 848 and for Bowen, 5075. The most recent (June quarter 2018) estimated unemployment rate for Bowen was 5.5 per cent, higher than the Whitsunday LGA's unemployment rate of 3.4 per cent. The major industries of employment for residents of Bowen are Agriculture, Forestry and Fishing (16.8 per cent) and Health care and Social assistance (10.4 per cent). These proportions are higher than those of the Whitsunday region (9.3 and 7.1 per cent respectively), and are also higher proportions working in these industries than for Queensland as a whole. Other important areas of employment for residents of Bowen include Retail Trade (9.1 per cent), Transport, Postal and Warehousing (9.0 per cent) and Accommodation and Food Services (7.3 per cent).

Housing cost & supply	In Bowen 82.2 per cent of private dwellings were separate houses. Only 6.3 per cent of dwellings are apartments. A higher proportion of occupied private dwellings in the area were fully owned in 2016 (30.5 per cent) than in Queensland generally. 41.3 per cent were rented compared to 36.4 per cent for the Whitsunday region. Median mortgage repayments per month in Bowen (at $1,723) are slightly lower than the Whitsunday region and Queensland ($1,733 per month). Median rent is slightly lower in Bowen than in the greater Whitsunday area.
Education & training	There are eight early childhood education and care services in Bowen including three long day care services. Bowen has three state government schools (two primary, one high school) and a Catholic primary school. There is also a small primary school at Merinda, 10kms north of Bowen. There are 943 primary school students enrolled in Bowen schools and 603 high school students in 2015. There are 77 students enrolled at Merinda. TAFE Queensland North has a campus in Bowen. The nearest university campuses are at Townsville or Mackay. In 2016, Bowen recorded 42.5 per cent of people with a highest level of schooling of year 11 or 12 (or equivalent). This is lower than for Queensland (58.9 per cent) as a whole. Of people aged 15 years and over, 53.1 per cent had a non-school qualification, in comparison to 59.1 per cent in Queensland. Where people specified the field of their non-school qualification, 19.8 per cent had a qualification in Engineering and Related Technologies and 10.5 per cent in Management and Commerce.
Community infrastructure	Bowen is the focus for retailing, business and administrative/ community services in the region. Bowen has a post office, branches of most major banks and a major retail shopping centre including a Woolworths and IGA supermarket. Bowen has a successful co-operative society serving the local area. Girudala Community Co-Operative Society Ltd is a not-for-profit community organisation established in 1974. It promotes and supports education, housing, health and employment. The co-operative has built up a large housing stock over the past 30 years and is now one of the largest co-operatives in North Queensland. Bowen receives health services through the Mackay Health and Hospital Service. Bowen Hospital is a 27-bed facility providing 24 hour emergency, inpatient/outpatient ward, home help, x-ray and ultrasound, pharmacy, mental health and oral health services and palliative care.
Recreational activities	Sporting clubs include sailing, soccer, golf, swimming, rugby league and rugby union, and tennis. There are a range of community clubs including Lions, RSL and Rotary and a number of churches (Anglican, Catholic, Bowen Baptist and Bowen Christian Family Outreach). There are seven beaches, including the award-winning Horseshoe Bay, and activities available include snorkelling, fishing, sailing, boating, water skiing and swimming. Muller's Lagoon, the Whitsunday Islands and Flagstaff Hill are also important recreational areas for Bowen. There are limited cultural facilities in Bowen. Major Bowen events during the year are the Family Fishing Classic in September and the Bowen Cultural and Seafood Festival in October.

3.5. CULTURAL HERITAGE VALUES

DEFINITION OF CULTURAL HERITAGE

Cultural heritage encompasses the customs, practices, places, objects, artistic expressions and values developed by a community and passed on to later generations. Such heritage is generally a visible and tangible representation of value systems, beliefs, traditions and lifestyles but may also have intangible aspects. Cultural heritage may be preserved in the built environment (including archaeological remains), the natural environment (for example, cultural landscapes or coasts and shorelines) and artefacts (objects, pictures, etc.). Cultural heritage management involves the identification of cultural heritage, an assessment of its significance, and the development and implementation of management procedures.

Table 4: Cultural heritage features

FEATURE	DESCRIPTION
Traditional owners	The Juru People are the registered native title owners of the Abbot Point area. They have non-exclusive native title rights and interests over about 176 000 square hectares of land and waters between Bowen and Ayr, including 10kms out to sea, and covering the area of Abbot Point. The Juru People also have exclusive native title rights over approximately 6053 hectares and non-exclusive native title rights over approximately 1516 hectares of land and water extending from Bowen to north of Home Hill and east into the Coral Sea
Indigenous cultural heritage	From both an archaeological and Aboriginal cultural heritage point of view, the coastline at Abbot Point is confirmed as an area with very high cultural heritage values, containing a complex of significant cultural sites and materials. It continues to have a high level of traditional, cultural and spiritual values to the Juru People. As the site is highly culturally significant, the Juru People have requested that all reasonable efforts should be made to avoid and protect particular areas within the Abbot Point area. It should be noted that it is the express wish of the Juru People that the specific locations of culturally significant sites not be made public or published.
Culture and landscape	It is important to note that Indigenous people see the natural environment and the cultural landscape as integral parts of the Aboriginal heritage concept. Indigenous cultural values are viewed as being inextricably linked to the natural attributes of the landscape. The cultural significance of an area is not just due to the presence of tangible sites or objects; it is rooted in the 'connection to country' of its people (Bird 2009). The Traditional owners will have a strong interest in any development or activities proposed that are likely to impact on areas of significance, or the linkage and connection of those features in the landscape.
Cultural heritage management	A Port of Abbot Point and Abbot Point State Development Area indigenous land use agreement (ILUA)(QI2011/063 10 May 2012) is in place with the Juru People and is administered through Juru Enterprise Limited. Cultural sites in the Port of Abbot Point area are currently managed by North Queensland Bulk Ports in consultation with the Juru People under existing ILUA and the Port of Abbot Point Environmental Management Plan. Cultural heritage management is consulted on and agreed for specific plans for activities at the port. Under such plans Juru Enterprise Limited is able to identify and manage any impacts on Aboriginal cultural heritage values in both onshore and offshore areas.
Other cultural heritage	Development or dredging activities in the port of Abbot Point area are unlikely to impact on other identified cultural heritage sites in Bowen. There are a number of shipwrecks near Bowen that are considered of importance to the town and its history but none are within 15 kms of the port. None are within a historic shipwreck protected zone.

4. Consultation

4.1. Technical Advisory and Consultative Committee

Under the NAGD (CoA 2009), development of a Technical Advisory and Consultative Committee (TACC) is necessary to assist in the consultation process required for a Sea Dumping Permit application. The NAGD states that:

> *"The TACC is intended to assist ports and other proponents and Determining Authority to access local knowledge and reconcile various stakeholder interests."*

The TACC is intended to:

- provide continuity of direction and effort in protecting the local environment
- support communication between stakeholders
- assist in the establishment of longer term management arrangements, including reviewing the development and implementation of management plans and monitoring programs
- review dredging and dumping activities in accordance forecast plans and programs
- make recommendations to the port authority and regulators as necessary or appropriate.

Once a clear need to undertake maintenance dredging is identified, NQBP will establish a TACC for the Port of Abbot Point, which will include representatives from Commonwealth, Queensland and local governments, port users and community interest groups. Invitation to join the TACC will be issued to the organisations listed in Table 5 as well as any other relevant organisations identified at the time

Table 5: TACC Membership

Organisation	Member Category
North Queensland Bulk Ports	Port Authority
Adani Abbot Point Terminal	Terminal Operator
Great Barrier Reef Marine Park Authority	Commonwealth Government
Department of Environment and Energy	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
Whitsunday Regional Council	Local Government
North Queensland Land Council Representative	Traditional Owners
Reef Catchments Limited	Natural Resource Management Group
James Cook University	Technical
Queensland Seafood Industry Association	Industry
Whitsunday Charter Boat Industry Association	Industry
Whitsunday Boating Operators Association	Industry
Explore Whitsundays	Industry
Australian Marine Conservation Society	Community
Mackay Conservation Group	Community
Whitsunday Local Marine Advisory Committee	Community

5. Sediment Assessment

5.1. PORT SEDIMENT CHARACTERISTICS

Port navigational areas, including shipping channels, aprons and berth pockets, are areas that have been deepened to allow the safe navigation, movement, loading and transit of ships trading at the Port. In these deeper areas of the Port, currents, wave energy and tidal regimes are responsible for mobilising and transporting sediments. This can be different to what is occurring in the adjacent natural seabed areas. The different depths and water movement can cause significant changes in the patterns of sediment scouring and accumulation.

The natural seabed depth at the Port of Abbot Point ranges from around 15 m below lowest astronomical tide, (LAT). The apron area is constructed to a designed navigational depth of 17.2 below LAT, whereas the design depth of the berth areas being 19.0 and 19.5 m below LAT.

Accretion of seabed sediments results in ‘high spots’ or ‘high areas’ within the navigational areas, above which safe navigational depths are enforced by the Regional Harbour Master. The result is often reduced ‘declared’ depths, the effects of which may significantly affect the efficiency of the Port.

To identify the opportunities to identify if there is an ongoing need for maintenance dredging, and to answer key questions a number of studies were needed that focused on:

- Defining the nature and sources of marine sediments that accumulate in the navigational areas of the Port.
- Describing the forces that drive sediment dynamics at the local, regional and wider Great Barrier Reef lagoon scale.

NATURE OF THE SEDIMENT

Sediment accretion within the berths and apron is minimal under normal conditions. Currently depths are close to design in most areas.

Based on laboratory analysis the nature of the sediment in the navigational infrastructure at the Port was found to be sandy/silt material (Advisian, 2018). Figure 10 shows the particle size distribution for previous sediment testing.

The minimal accumulation in the berths at the time of Plan preparation (December 2018) means that certainty about the type and volume of sediment that may need to be dredged in future cannot be provided. It is most likely that any maintenance dredging will be the result of storm or cyclonic action and the type of sediment involved may vary. The eventual type and mixture of the sediments is an important consideration when examining the ability to avoid, reduce, reuse or dispose of sediment.

Future testing of any accumulated sediment will be necessary.

The sediment at the material offloading facility (MOF) currently has a higher sand and gravel content (Figure 11), most likely a result of sand moving along the beach south to north and settling in the protected area inside the breakwall.

Laboratory testing has consistently shown that the sediment is suitable for ocean placement with very low levels of contamination and bioavailability as per the NAGD (CoA 2009).

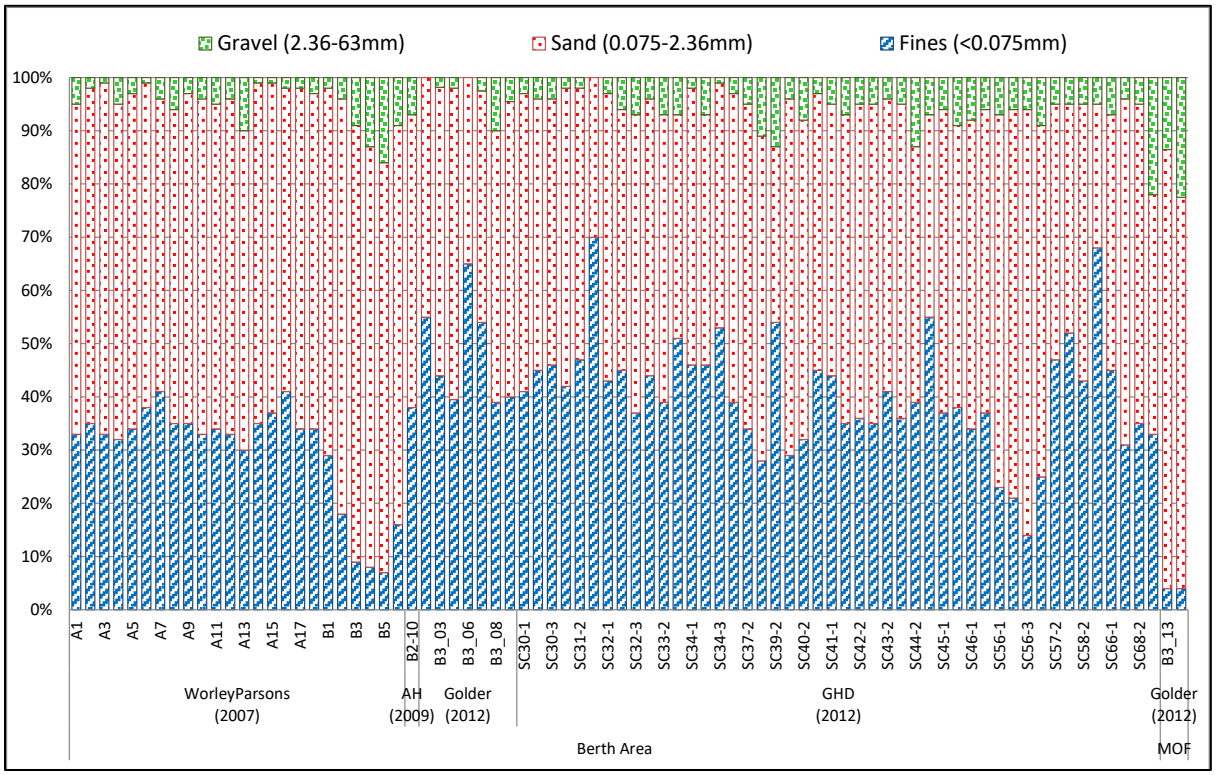

Figure 9: Particle size distribution results for berth and apron areas

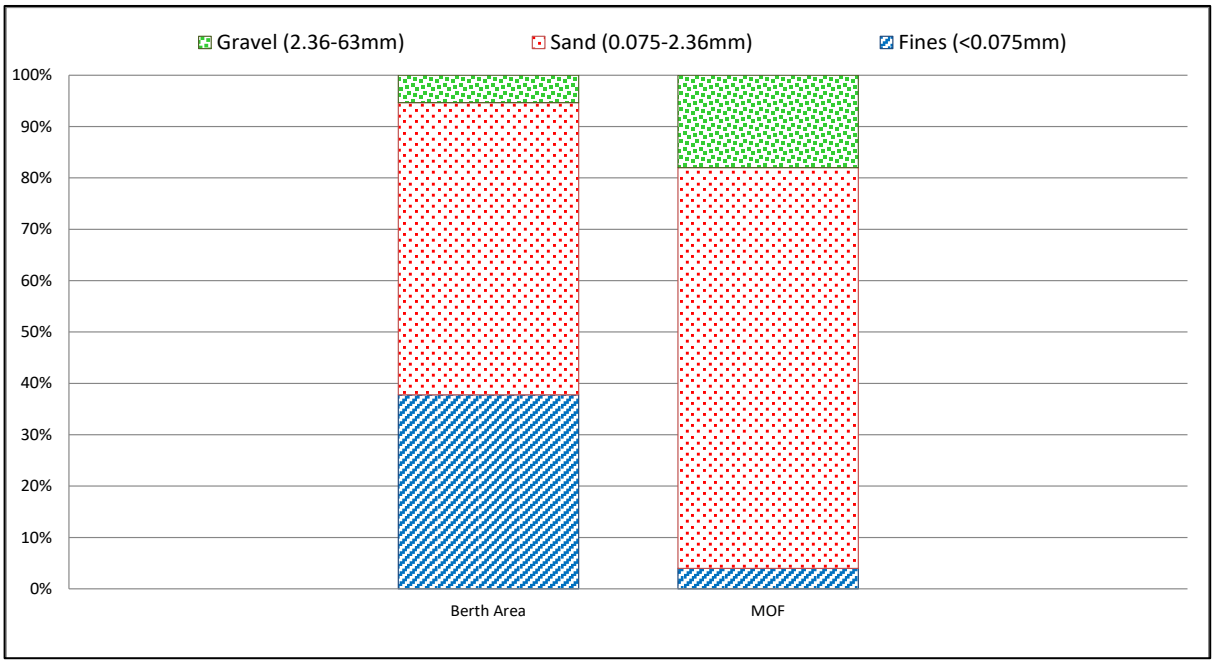

Figure 10: Comparison of participle size distribution between berths and MOF

SEDIMENT BUDGET

An in-depth examination of the sediment transport and dynamics in the central Great Barrier Reef (Gibbs *et al.,* 2016) identified and clarified the major sediment types and distributions in the region. This study has enabled the development of an integrated conceptual model of the sediment transport mechanisms and provides estimates of sediment transport rates and fluxes.

The sediment budget calculations indicate that sediment is generally moving northwards within four defined sediment transportation processes:

- ***Littoral drift*** - littoral transport along the surf zone is one of the major sediment transport pathways on exposed coastlines. The offshore reefs of the GBR act as efficient dissipaters of ocean swells and hence the energy contained in the wave environment by the time it reaches the coast is substantially reduced by comparison to coastal areas south of Fraser Island.
- **Fluvial** (river) or 'new' sources of fluvial sand inputs, while important, are of a tiny magnitude in comparison to the existing available seabed sources of coarse sediments available for littoral transport.
- ***Nearshore turbidity pathway*** - re-suspension which is not driven by breaking waves but rather the transient orbital flows beneath waves, along with tidal flows, act on the seafloor to create a bed shear stress large enough to mobilise fine sediments. Once mobilised, waves, wind and tidal movements transport the finer particles northwards along the coastline.
- ***Inner-shelf bed load transport*** - Larger waves (~ 1 m) and stronger tidal currents (> 0.25 m/s) are able to re-suspend larger sand particles. As in the turbidity pathway, once the bed shear stress is sufficient to mobilise sand particles, a near bottom current flow is required to generate the transport of material. The wind generated water movements established during prolonged wind events, the same winds that generated the waves, are able to mobilise the sands and transport these northwards.

The model indicates that the volume of sediment deposition (storage) is relatively small compared to the overall volume of sediment moving within the system. In areas where there is high tidal activity or where fluvial currents are strong and dynamic, much higher gravel content is found in the sediment than in other areas where sand, carbonates, or muds are more prevalent.

As a result, the system is considered balanced, meaning almost the same volumes of sediments that are entering a location are leaving.

When investigating the contribution of catchment derived sediments, the model proposes that reducing fluvial sources of sediment through in-catchment sediment control measures will result in very little reduction in sediment accumulation.

5.2. MAINTENANCE DREDGING AND PLACEMENT REQUIREMENTS

Since 1984 only limited sediment management activities have been required at the Port of Abbot Point to maintain the design depths. This is due to the naturally deep water around the berths and apron areas and is also thought to be due to relatively low sediment transport rates in the area (Port and Coastal Solutions 2018). Details of the historic sediment management activities are as follows:

- 2008 capital and maintenance dredging: capital dredging of 201,315 m^3 was undertaken to create berth 2 and the approach directly adjacent to it (Port and Coastal Solutions 2018).
- As part of the 2008 dredging program, maintenance dredging of the existing berth was also undertaken with the volume removed estimated to be less than 20,000 m^3. The sediment which was removed during the program was relocated to an offshore DMPA located approximately 5 km to the west-north-west of the Port.
- 2014 bed levelling: bed levelling was undertaken to remove high spots in the approaches which were above the design depth. The areas were to the north of the two berths and to the east of berth 2.
- 2015 bed levelling: bed levelling was undertaken to remove high spots in the approaches which were close to and above the design depth. The areas were to the north of the two berths, to the west of berth 1 and to the east of berth 2.
- 2016 bed levelling: bed levelling was undertaken to remove high spots in the approaches which were above the design depth. The areas were to the west of berth 1 and to the east of berth 2.
- 2017 MOF dredging: dredging was undertaken to reinstate the design depths in the MOF. Approximately 9,000 m^3 of sediment was removed and re-used to nourish the nearby beach.

To better understand exactly where sediment accumulates and in what quantities within the Port's navigational areas, an examination was undertaken of the historic siltation in the apron and berths (Port and Coastal Solutions 2018). The work was designed to:

1. Provide quantitative changes in bathymetry overtime.
2. Analyse the cause and reasons behind any changes.

Coastal processes were defined using a wide range of hydrodynamic, meteorological and sedimentation data. Some of the key findings around coastal processes are detailed in Table 6.

Table 6: Coastal processes and site conditions at the Port of Abbot Point

Process	Description
Tides	• The Port is located in an area of the Queensland coast that experiences high tidal ranges, with semi-diurnal tides and a peak tidal range of 7.14 m (MSQ, 2015).
Wind Climate	• Local wind climate is governed by the east to south east trade winds, with lighter land breezes from the south-west sector during the winter months and lighter north-easterly afternoon sea breezes common during summer afternoons.
Wave Climate	• The Port is largely protected from large swell waves as a result of the GBR and islands. • Large open fetch to the south east and predominant south easterly trade winds dominate the local wave direction.
Current Regime	• Water currents are predominantly driven by tidal action. • Predominant south easterly trade winds act to reinforce the net northerly tidal current.
Cyclones	• Recent notable cyclones include TC Ului (March 2010), TC Dylan (January 2014) and TC Debbie (March 2017).
Water Quality	• Concentrations of suspended sediment in waters adjacent to the Port are predominantly driven by bed sediments being suspended through current and wave action.
Deposition	• Abbot Point is not an accretional environment, with very little deposition under typically conditions.

Port and Coastal Solutions (2018) has conducted an extensive bathymetric analysis of historical hydrographic survey data of the Port of Abbot Point and sediment movements to better understand sedimentation rates and bathymetric changes in the navigational areas of the port. The following summarises the findings of this analysis.

Bathymetric Analysis: Analysis of historic bathymetric data has shown that very little net sedimentation has historically occurred in the berths and approaches of the Port of Abbot Point. Based on the results no ongoing sediment management is expected to be required within the berths while some sediment management of localised areas of sedimentation will be required in the approaches.

The Abbot Point Material Offload Facility (MOF) has been found to be subject to net sedimentation in the 12 months following maintenance dredging. As such, ongoing sediment management will be required in the MOF to maintain the design depths and ensure the MOF remains operational.

Tropical Cyclones have been found to influence the bed levels at the Port of Abbot Point, with erosion of approximately 0.1 m (175,000 m^3) in the approaches during TC Debbie (followed by 95,000m^3 accretion following this event). However, there is a risk that future TCs could result in net sedimentation at the Port rather than net erosion. Based on this, there is the possibility that emergency maintenance dredging/sediment management activities at the Port of Abbot Point could be required in the future following a TC.

There were limited bathymetric surveys of the Abbot Point dredge material placement area (DMPA) available for analysis (three in total). Based on the available surveys it was found that the area was stable and over the long term the Abbot Point DMPA can be considered to be predominantly retentive. It is important to note that the sediment placed at the DMPA over the period considered was predominantly from capital dredging as opposed to maintenance dredging.

Sediment Transport Understanding: There are two key processes which result in the resuspension and transport of sediment in the Abbot Point region. The first process involves existing fine-grained sediment on the sea bed being resuspended by wave action and transported by currents (tidal and wind-generated). The second process involves existing sandy sediment in the nearshore region being transported in a net north-westerly direction, as a result of wave action close to the shore. The first process influences the sediment transport at the berth, approaches and DMPA, while the second process influences the sediment transport at the MOF. A conceptual model of the sediment budget and influencing factors is shown at Figure 12.

The region is subject to relatively low rates of sediment transport, with annual resuspension estimated to be four times lower than at the Ports of Mackay and Hay Point. The naturally deep water within the berths and approaches of the Port of Abbot Point increases the potential for low sedimentation rates within these areas.

Sedimentation Rates: The average sedimentation rates within the Port of Abbot Point were estimated based on the available bathymetric survey data. The average annual sedimentation in the berths was estimated to be 1,000 m^3 and given the existing available volume below design depths of 75,000 m^3 (refer Figure 13) the ongoing sedimentation in the berths is not expected to influence the design depths. The annual average sedimentation over the approaches area has been 1,000 m^3, with some of this sedimentation (hundreds of cubic metres per year) resulting in localised small areas being at or above the design depth.

There is only sedimentation data available for the MOF over the year after the maintenance dredging reinstated the facility (refer Figures 14 and 15). Based on this an annual sedimentation of approximately 3,000 m^3 is estimated.

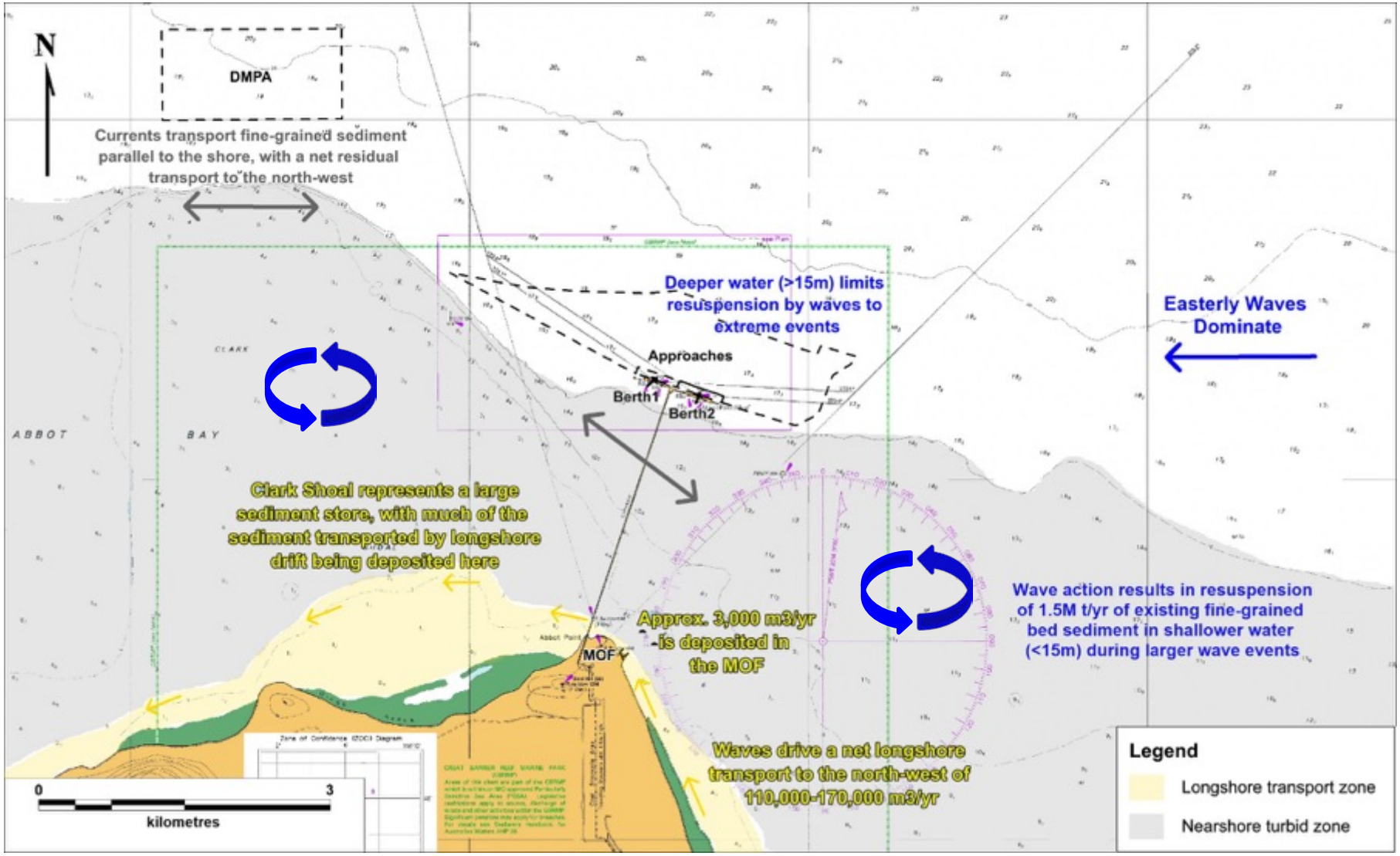

Figure 11: Conceptual sediment budget for the Port of Abbot Point (Port and Coastal Solutions 2018)

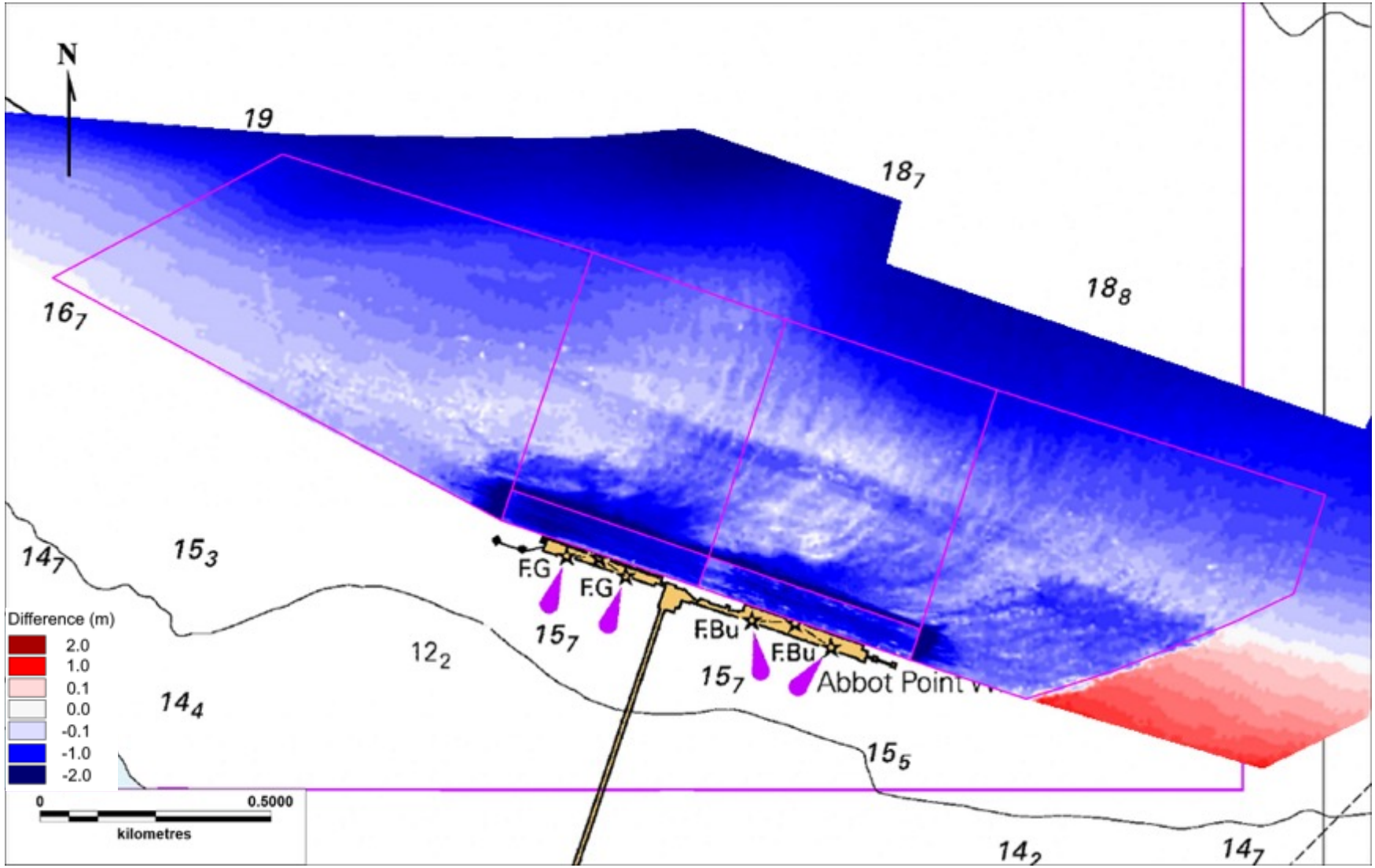

Figure 12: Depths above (red) and below (blue) design depth at the berths and approaches August 2018 (Port and Coastal Solutions 2018)

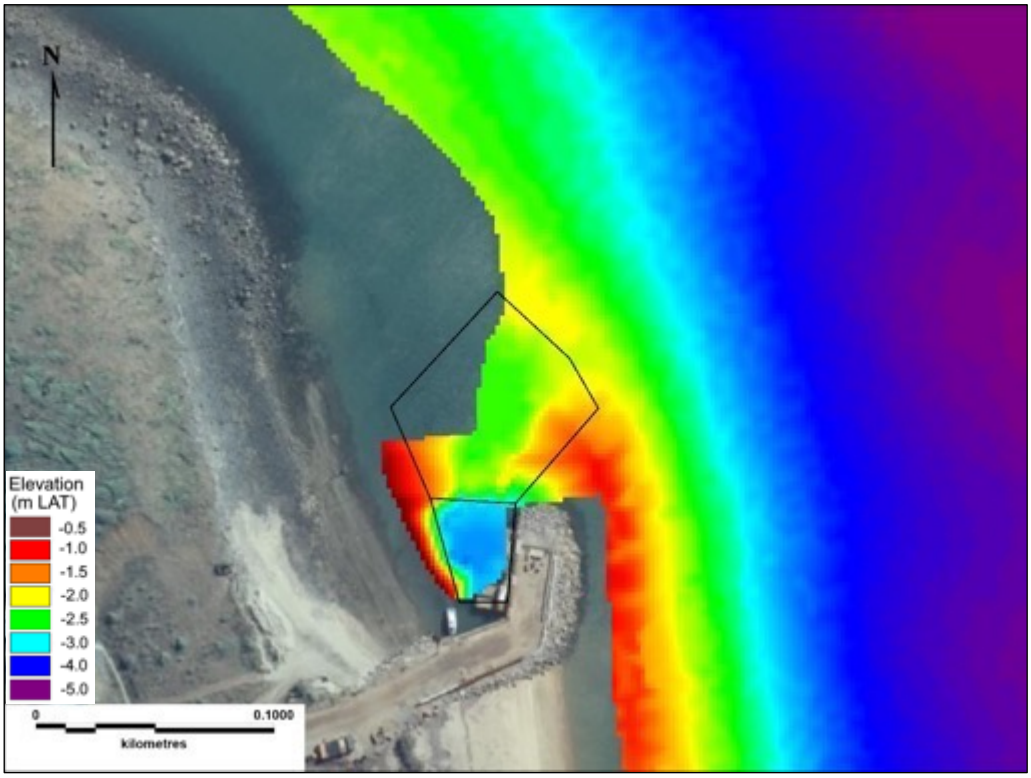

Figure 13: Abbot Point MOF bathymetry July 2017 (post dredging) (Port and Coastal Solutions 2018)

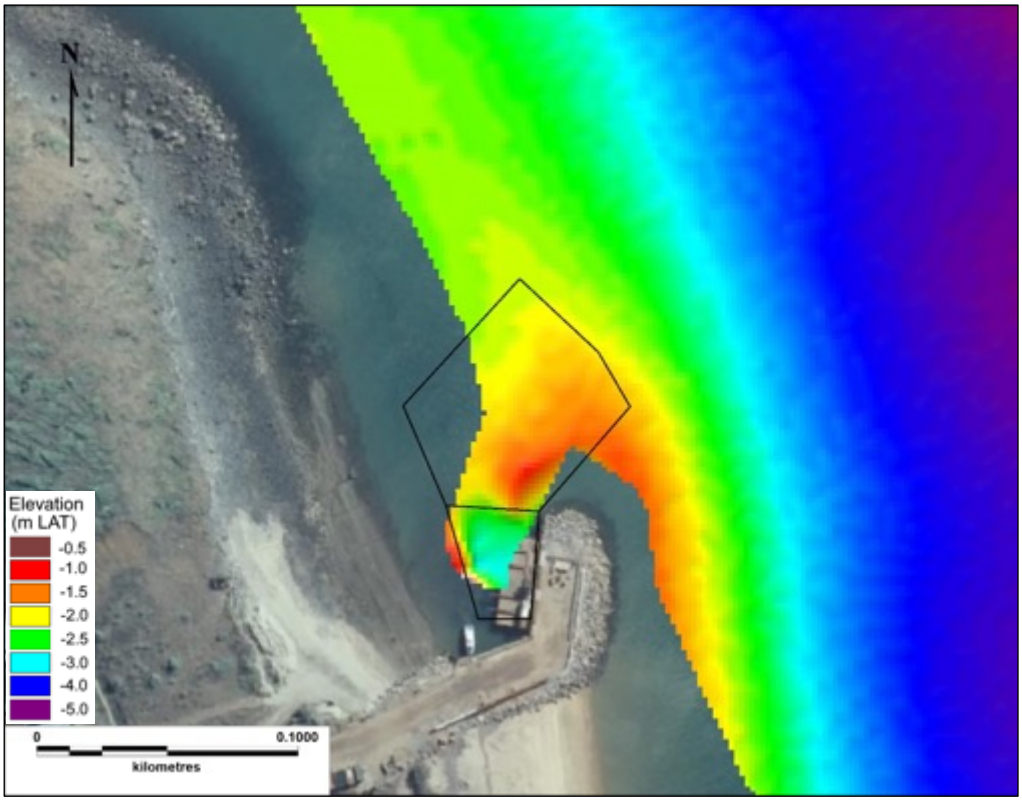

Figure 14: Abbot Point MOF bathymetry August 2018 (1 year post dredge)(Port and Coastal Solutions 2018)

5.3. Avoid or Reduce Sedimentation

The following two sediment management approaches have historically been used and are expected to continue to be adopted at the Port of Abbot Point:

- **Dredging**: a single maintenance dredging program (estimated to be approximately 17,000 m^3 based on analysis of bathymetric data) has been undertaken at the approaches and berths of the Port of Abbot Point since it was commissioned in 1984. In addition, maintenance dredging of approximately 9,000 m^3 was undertaken at the Abbot Point MOF in 2017 to reinstate the MOF berth and approach apron.
- **Bed levelling**: since the maintenance and capital dredging in 2008 there have been three bed levelling programs undertaken (2014, 2015 and 2016). Since 2016 bed levelling has not been required, but this was mainly due to TC Debbie reducing the bed level of the approaches by approximately 0.1 m. The historic bed levelling has targeted areas of the approaches to the berths which have been at or above the design depth of -17.2 m LAT.

A range of other potential solutions to avoid or reduce the natural sedimentation or the requirement for maintenance dredging at the Port of Abbot Point were considered (Port and Coastal Solutions 2018). Based on a comparative analysis, bed levelling was found to be a feasible solution to manage the sedimentation in the approaches of the Port of Abbot Point instead of maintenance dredging. No realistic options to avoid or reduce sedimentation at the MOF were identified.

5.1. Future Dredging Requirements

Based on the bathymetric analysis it is possible to estimate the future sedimentation within the Port of Abbot Point and therefore estimate the future sediment management requirements. The bathymetric analysis predicted that regular sediment management in the order of approximately 3,000 m^3/yr is likely to be required to ensure the Abbot Point MOF remains operable. In addition, gradual shallowing of a number of areas of the approaches to the berths is expected to continue which could be in the order of hundreds of cubic metres a year.

The predicted sediment management activities required to maintain the design depths at the Port of Abbot Point are as follows:

- **Maintenance Dredging**: 3,000 m^3 removed every year from the Abbot Point MOF
- **Bed levelling**: an estimated five days of bed levelling required every 2 years to remove high spots from the approaches to the berths to ensure depths remain below the design depth.

However, it is important to note that there is the possibility that an extreme event (such as a cyclone) could result in high sedimentation at the Port of Abbot Point and so there is the possibility that emergency maintenance dredging could be required.

MOF

As outlined above, 3,000 m^3/yr has been taken as an indication of an average annual sedimentation rate in the berth and approach of the MOF. Based on this it is estimated that approximately 30,000 m^3 of sediment will require managing for the MOF to remain operational over the next 10 years.

Due to the clean sandy nature of the material accumulating in the MOF (deposited from long-shore coastal drift), previous dredging actions in this area have used the dredged material for beach replenishment along Abbot Point beach to the south of the MOF.

5.2. FUTURE ASSESSMENT OF SEDIMENT ACCUMULATION AND DREDGING NEEDS

Should sediment accumulation increase at the Port of Abbot Point in the future, overtime or from a cyclone event, maintenance dredging may be necessary. Prior to undertaking any significant maintenance dredging activities, it will be necessary to examine options for the reuse and placement of any dredged material.

In line with the Maintenance Dredging Strategy for Great Barrier Reef World Heritage Area Ports (SoQ 2016) a comparative analysis of options should be undertaken. NQBP has pioneered a sustainable sediment management assessment method that should be applied. Such an approach has already been applied at the Ports of Hay Point and Mackay (refer text box below).

SSM METHOD

An SSM assessment is designed to determine what is the best short and long-term approach to managing sediments within the Port. This includes investigation and consideration of:

- the source and nature of the particular sediment at the Port
- the requirements for management of the sediment in the short and longer term
- whether sediment can be managed without dredging while maintaining port operations and meeting legal requirements
- the feasible alternatives for use or placement of material if dredging is required
- the best package of measures to provide for long-term (e.g. 25-year) sustainable management of marine sediments at the Port.
- The assessment involves consultation with stakeholders including Commonwealth, State and Local Government; port operators; conservation groups; the local community including indigenous people, fishing groups and community bodies; researchers; and tourism operators.

The assessment provides valuable context for long-term management at the port, including understanding the economic effects of sedimentation and development a long-term sediment management strategy. The key steps in the assessment are outlined in Figure 16.

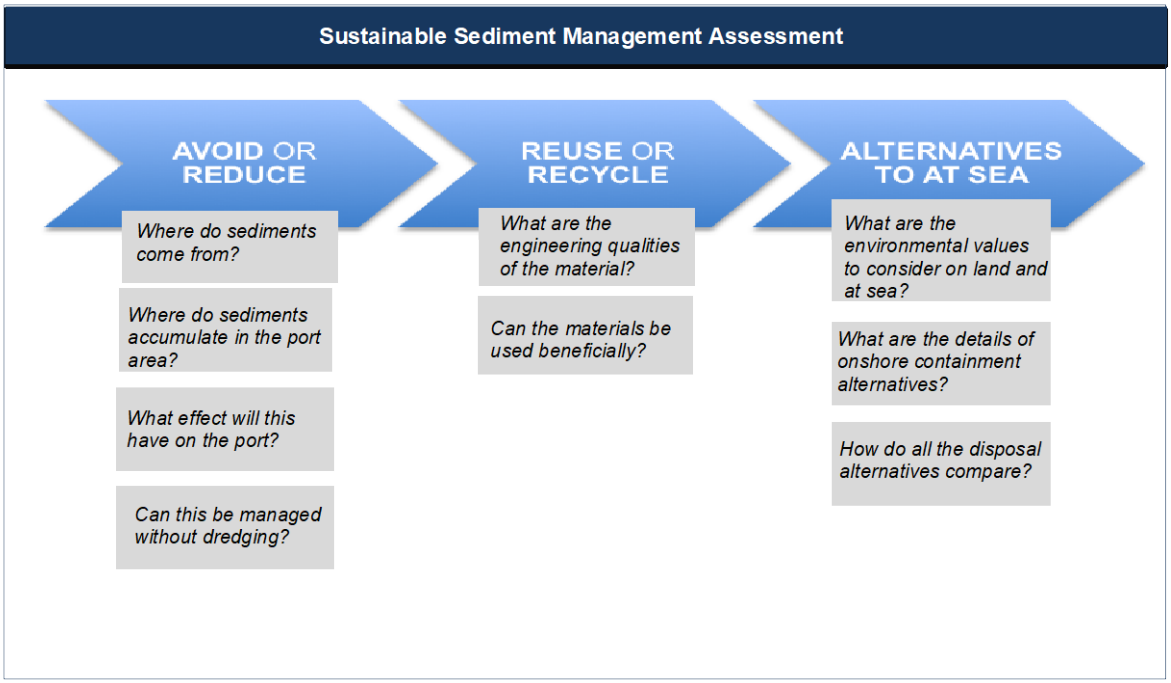

Figure 15: Key steps in the SSM assessment method

Comparative Analysis

A central component of an SSM assessment is a structured decision-making process that focuses on what is important to all stakeholders, not just the port authority and port customers. Contained within this structured process is a detailed comparative analysis of the various alternatives that are available to manage sediment to determine the best long-term strategy.

The decision-making process is a complex task dealing with social, economic and environmental factors. The principles of Structured Decision Making (Gregory *et al*, 2012) are used to provide a robust method for the analysis. The process involved the following five steps:

SUSTAINABLE SEDIMENT MANAGEMENT

From 2015 to 2017, NQBP undertook an extensive research project to investigate the most sustainable way to manage accumulated sediment in and around the Port of Hay Point.

The project: the ***Port of Hay Point Sustainable Sediment Management Assessment for Navigational Maintenance*** **(SSM),** was to understand how the day to day operations at the Port of Hay Point are affected by marine sedimentation and to determine, if necessary, the best way to manage operations and sediments. The main objectives of the assessment were:

- assess the feasibility of avoiding or reducing the need for maintenance dredging at the Port
- comprehensively investigate opportunities to beneficially reuse accumulated sediment
- consider alternatives to at-sea placement, based on environmental values and other constraints
- compare the range of alternatives in a way that considers (at a minimum) risks to the environment, health and safety, social and economic values and the exclusion of future uses
- consider the 'immediate' (1-3 years) and 'long-term' (25 years) suitability of alternatives.

This innovative sediment management approach has been widely acknowledged and a similar framework is now applied in the Department of Transport and Main Road's Maintenance Dredging Strategy for Great Barrier Reef World Heritage Area Ports. This is applicable to all ports operating in the GBRWHA.

The SSM project investigated where specifically the sediment at the Port of Hay Point comes from, what impact it has on Port operations, whether accumulation can be eliminated or reduced, and what alternatives are available to reuse or dispose of any sediment that might need to be dredged.

For further details and data associated with the comparative analysis please refer to the Port of Hay Point Sustainable Sediment Management Assessment for Navigational Maintenance Report (Adaptive Strategies 2017) and supporting technical reports.

All reports are available at https://nqbp.com.au/sustainability/research-and-reports/sustainable-sediment-management-research.

6. Risk Assessment Framework

Depending on the scale and frequency, dredging and dredge material placement activities have the potential to adversely impact on sensitive environmental receptors, social or cultural values associated with the Port.

Impacts can occur over a short or long term and can be direct or indirect. Dredging related impacts can result from:

- the direct removal of benthic habitat in the vicinity of the dredged area
- smothering of benthic organisms in offshore dredge placement locations
- changes to marine water quality from increased turbidity and sedimentation
- mobilisation of contaminants released from dredged sediments
- collisions and disturbance from vessel movements
- increased noise and lighting from dredge vessel operations.

Prior to any future major maintenance dredging activity a risk assessment of potential impacts to environmental, social or cultural values should be undertaken. The assessment will help to determine the level of potential harm that environmental, social or cultural values are at from the proposed dredging program. The assessment will assist in refining where management measures to avoid, reduce or mitigate impacts are needed. Identified measures can then be incorporated into a Maintenance Dredging EMP. This process is outlined in Figure 17.

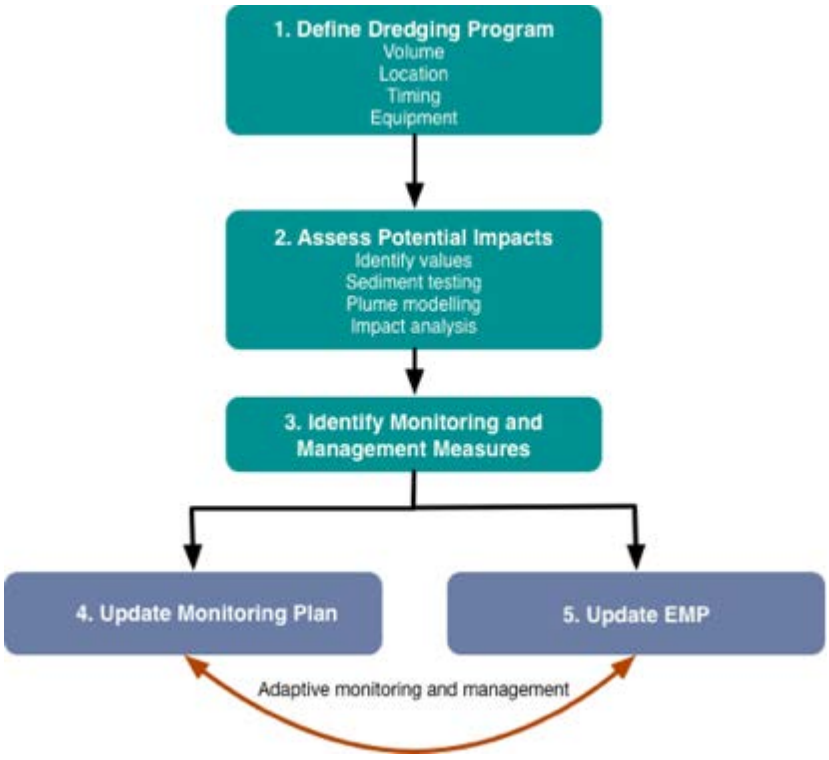

Figure 16: Process for identification of potential impacts and management measures

Information needed to inform the risk assessment should include:

- up to date environmental values information, including data from baseline surveys of coral, seagrass and water quality
- dredging program design including: dredge type, volumes, locations, duration, seasonal timing
- sediment characteristics: particle sizes, contamination results
- sediment plume modelling
- an environmental impact assessment, including an EPBC act self-assessment against significant impact criteria.

7. Treatment of Key Risks

NQBP is committed to minimising and managing potential impacts from dredging and dredge material relocation as far as practicable.

Based on the results of a risk assessment, targeted and ambient monitoring and established best practice; a set of key management strategies and actions to minimise the impact from dredging and dredge material relocation operations can be identified and incorporated into any future Maintenance Dredging EMP.

These measures should, if necessary, be supplemented and enhanced with the ongoing real time inputs from an adaptive monitoring program.

7.1. Environmental Management Plan

An EMP provides the operational practices required for dredging activities to meet environmental standards. The EMP forms the operational control document to ensure all site specific environmental issues are adequately addressed. The EMP will cover all aspects of major dredging operations specific to Abbot Point and will contain:

1. Location and description of the activities
2. Timing of the dredging operations
3. Measures to meet permit conditions
4. Standard management measures relating to:
   - Waste management
   - Ballast water management
   - Bunkering of fuel
   - Vessel washdown
5. Adaptive management measures relating to:
   - Water quality
   - Marine fauna
   - Climate conditions
6. Operation and incident reporting
7. Emergency procedures and contacts

7.2. Adaptive Management Measures

Adaptive management provides for continuous monitoring, evaluation and adjustment of management response measures based on real-time monitoring and environmental conditions (Figure 18).

Based on an understanding of acceptable environmental conditions and thresholds for impact a series of response levels (triggers) can be established and then monitored to ensure that conditions that may produce environmental harm are avoided or ceased before impacts occur.

Figure 17: Adaptive management cycle (CEDA, 2015)

8. Environmental Management Framework

The following framework is designed to provide a repeatable structure for planning and executing any future maintenance dredging activities at the Port of Abbot Point.

The framework provides NQBP and its stakeholders with a clear and structured process for identifying, planning and implementing maintenance dredging. This process provides certainty for NQBP staff, TACC members and regulators around how NQBP will plan and manage dredging activities. The framework will also be key to supporting long-term permit applications.

The framework is illustrated in Figure 19. It is comprised of a staged planning and design process. Three key elements feed into the framework including consultation, monitoring and supporting studies. The framework provides NQBP with:

1. A technically informed process for the identification of Port maintenance dredging and dredge material management needs.
2. A process for identification, risk assessment and management of potential impacts to environmental values from proposed activities.
3. Adaptive management and operational controls to avoid and minimise potential impacts during dredging activities.
4. Ongoing monitoring and management of Port needs and values.

Most importantly, the framework provides a process that will be undertaken in collaboration with key Port stakeholders. Stakeholder consultation will occur throughout the application of the framework including during any dredging program design, execution and ongoing monitoring and management.

The framework draws on and incorporates aspects of processes outlined in relevant key policy documents. These include the:

- The National Assessment Guidelines for Dredging (NAGD) assessment framework for ocean disposal (CoA 2009).
- Queensland Maintenance Dredging Strategy for Great Barrier Reef World Heritage Area Ports (SOQ 2016)
- Long Term Monitoring and Management Plan Requirements for 10 year Permits to Dump Dredge Material at Sea (CoA 2012).

Details of each of the steps in the framework are described in the following sections including:

- Identification of Port navigation needs, risks and sediment management approaches
- Dredging program design
- Dredging execution and control
- Monitoring and management

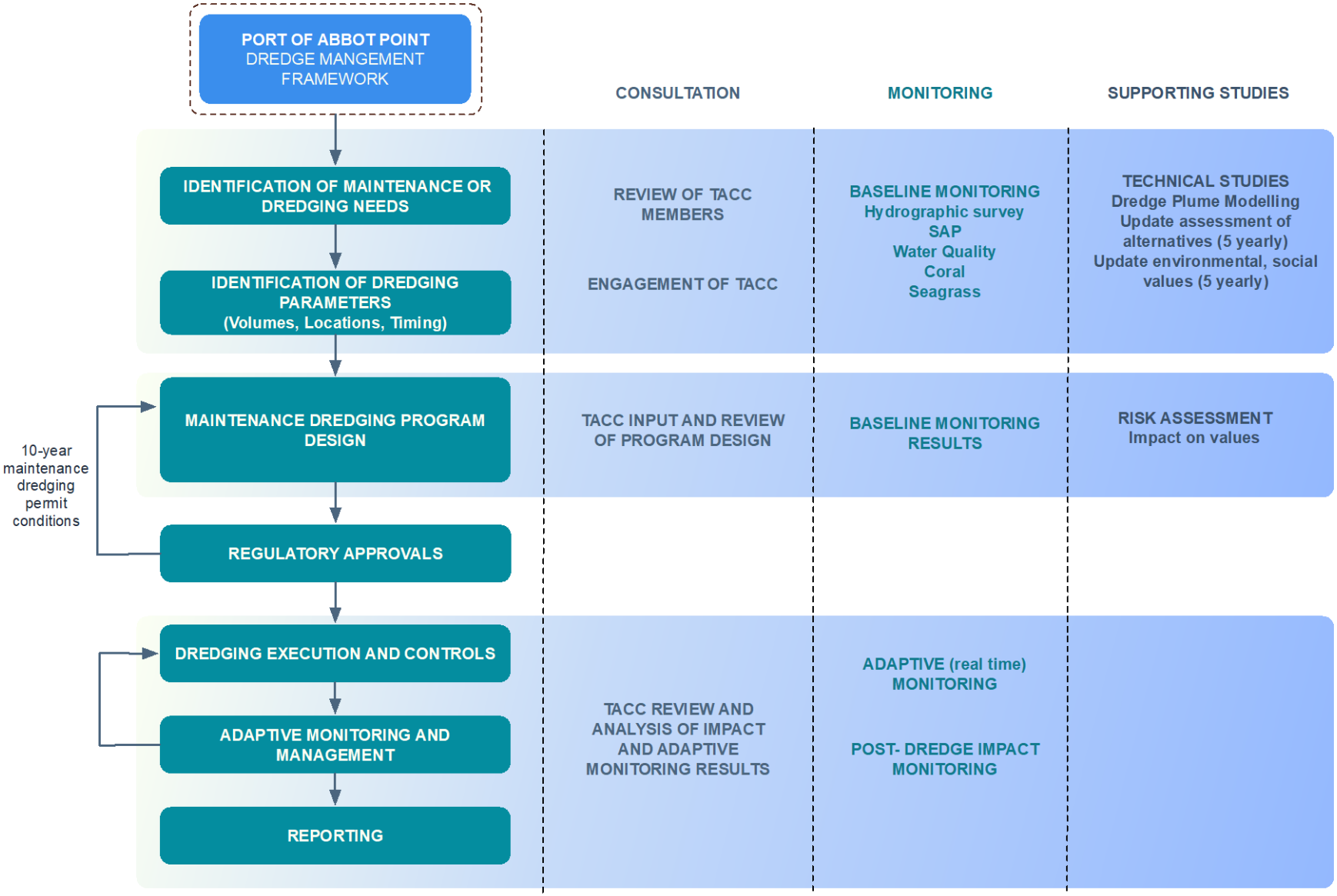

Figure 18: Dredge Management Framework

8.1. Identification of Maintenance Dredging Needs

Identification of navigational risks in the offshore environment of a Port is one of the first steps of the framework process and is key to identifying whether maintenance dredging is likely to be required. Regular baseline monitoring (bathymetric surveys) of the offshore infrastructure of the Port including berths, swing basins and channels, is required. This monitoring will map sediment distribution within key offshore operational areas of each Port. Data from the monitoring will also be able to identify changes in sediment dynamics over time.

Where sediment accumulation may create a potential or future navigational hindrance, a risk assessment should then be undertaken. The aim of the assessment is to determine the level of risk posed to the ongoing safe operation of the Port. The level of risk can then be used to trigger the timing of the further phases of the dredge management framework.

Broad categories of risk are outlined in Table 7. An aim of the framework is to maintain all Port areas in the low or medium risk rating at all times.

Table 7: Navigational risk categories

Risk	Description	Response
Extreme	Port vessel access and safety is compromised. Declared depths are above Port operational requirements. The full loading of vessels is constrained by berth depths. Loaded vessels cannot depart Port or can only depart on high tide.	Sediment management measures are required immediately. Expedite framework planning and actions.
High	Safety and/or access to the Port could be compromised at any time in the near future or access is already significantly tidally constrained. Loaded vessels can only depart on high tide.	Sediment management measures are required immediately. Expedite framework planning and actions.
Medium	Port depths and sedimentation trends indicate that access and/or safety could be compromised within the next 12-18 months (especially in the case of cyclonic activity)	Commence planning for appropriate sediment management action(s).
Low	Sedimentation rates are low, indications are that Port access will not be compromised or affected within the next 2 years (depending on cyclonic influences).	Continue to monitor.

8.2. Identification of Dredging Parameters

Should an immediate or future navigational risk at the Port be identified, it is necessary to determine the appropriate response in terms of the type of sediment management activity required.

Baseline monitoring data will be required to inform this phase. Up to date information regarding sediment volumes, quality and contamination may be needed. The specific data required includes:

1. Sediment Sampling and Analysis Plan (SAP) results. The process for undertaking sampling and analysis of sediments is described the NAGD (CoA 2009).
2. Bathymetric survey data.

SEDIMENT MANAGEMENT OPTIONS

Depending on the scale of sedimentation and level of navigational risk posed a range of management options could be applied. These need not necessarily be stand-alone actions and could be deployed sequentially to reduce and then remove the risk. Measures include:

A. **Bed levelling:** using a drag bar, high spots of sediment accumulation can be removed and reduced by shifting them into lower lying depressions in channels and berths. This can help to maintain a suitable

declared depth. Rarely is this a long-term solution but it can be used to alleviate immediate risks or to prolong the period between major dredging activities.

B. **Propeller wash agitation** from operating vessels within the Port area may be of some assistance in reducing the accumulation of sediment in certain areas. This may be partially effective in berth areas and in the shallower channel areas. Minor variation of the vessel path along the channel may assist in widening the area free of accumulated sediment.

C. **Hopper dredging:** often considered the more traditional dredging method, use of a trailing suction hopper dredge (vessel) where sediment is collected in the hopper of the vessel and placed at a designated location. This method is necessary for removing larger volumes and areas. Figure 20 provides a cross section of a typical hopper dredge.

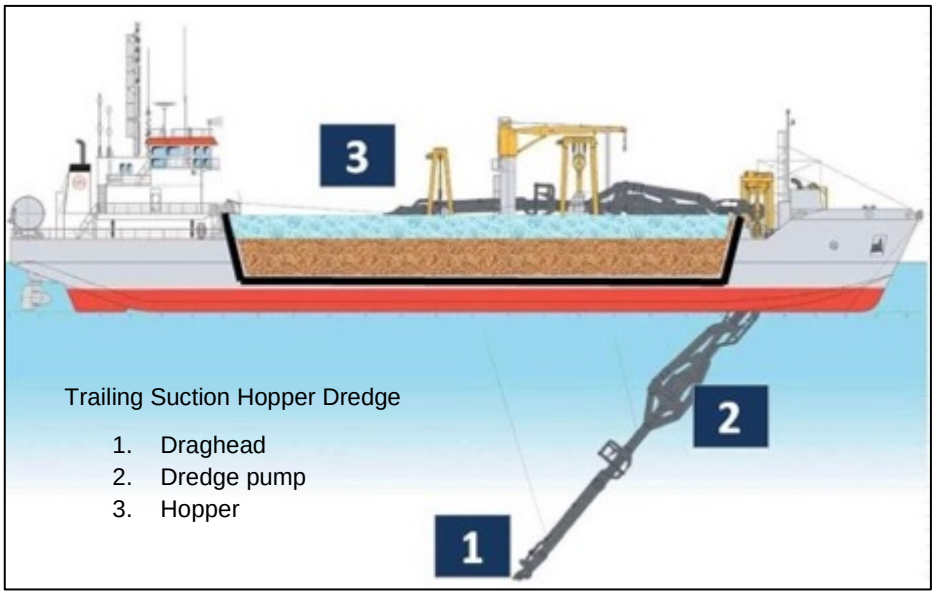

Figure 19: Cross section of a Trailing Suction Hopper Dredge (Source: Ports Australia 2016)

8.3. Dredging Program Design

Should it be determined that hopper dredging is required then the next stages from the sediment management framework is the design of the dredging program and obtaining of relevant approvals.

Where the need for maintenance dredging and dredge material placement has been identified, planning for all aspects of the program needs to be undertaken. This includes:

- timing and duration of the dredge program
- location of dredging areas and volumes
- equipment needs and standard procedures (TSHD Brisbane or other suitable dredge)
- identification and assessment of potential impacts to values at dredging and placement sites
- mitigation and management measures (including adaptive management) to address potential impacts to values
- operational controls
- monitoring requirements.

All three input elements of the framework, including consultation, monitoring and supporting studies, will aid in the design of individual dredging programs. Additionally, standard dredging procedures and guidelines will need to be incorporated into the design.

TYPE OF DREDGE

Depending on the ongoing viability and availability the *TSHD Brisbane* will be used for any dredging required over at least the next 10-years.

Subsequent to this or if the *TSHD Brisbane* is not available a similar and suitable trailer suction hopper dredge would be commissioned and used.

A brief description of the *TSHD Brisbane* operations is provided below.

Material to be dredged is 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. The capacity of the hopper is dependent on the sediment type – with volumes (including both sediment and water) approximating 2,800m^3 for fine silts and 1,700 m^3 for sands (of a maximum hopper capacity of 2,900m^3). Each extraction run takes approximately 1 hour to complete. 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 ratio of material delivered to the central hopper of the *TSHD Brisbane* 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 material capacity, these 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. Overflow occurs only toward the very end of the dredging run as the hopper nears capacity (typically the last ten minutes of a one hour dredging run).

Once the dredge has filled its hopper, the vessel will then relocate the material to the designated dredge material relocation ground. Dredged material is discharged below keel level to minimise turbidity generation. Each dredged 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 time taken to place material over the dredge material relocation ground is typically about 15 minutes.

Mitigation of potential turbidity and suspended solids impacts from dredging and dredge material relocation is partly achieved through the use of suitable and specifically designed modern vessels. The following are considered the minimum standard of specification for TSHDs that will be selected to undertake maintenance dredging works in the Port of Abbot Point:

- The dredger will operate under a Maintenance Dredging EMP. The EMP will be revised by NQBP in conjunction with the dredging contractor, and implemented for each maintenance dredging program. The permit conditions, dredge dumping procedures, any associated adaptive monitoring arrangements and corrective actions are incorporated into the EMP. Implementation of the EMP is audited by NQBP environmental staff.
- During the dredging works, electronic logs of each dredge material relocation event will be maintained.
- TSHDs undertaking dredging works at the Port of Abbot Point will include the following specifications:
    - Central weir discharge system
    - Below keel discharge point
    - Low wash hull design
    - Electronic positioning system (GPS)
    - Turtle exclusion devices on intake heads.

Introduced marine pests

Introduced marine species are species translocated to regions outside their natural range, typically by the passage of vessels nationally and internationally. Where these species present a threat to human health or environmental and economic values, they are termed a 'pest'. Outbreaks of marine pests are an obvious possible risk at Ports trading with international clients. Translocation of marine pests may occur via:

- Ballast water - used to control the trim and draft of a vessel;
- Fouling - encrusting organisms via fouling of vessels (*e.g.* hulls, propellers, intake grates etc.).

Any dredger contracted to undertake dredging works will be required to comply with marine pest protocols, including National and Queensland bio-Security requirements in relation to ballast water and marine pest management, this includes the National System for the Prevention and Management of Marine Pest Incursions, in particular the National Biofouling Management Guidance for Non-Trading Vessels.

The TSHD Brisbane operates in Australian water only and complies with National standards.

TACC CONSULTATION

Consultation with the TACC should occur during the design phase of larger dredging activities, particularly those involving a hopper dredge, sea or land placement. The TACC should be consulted on:

- Proposed program specifics such as the location of dredging and placement sites and the timing and duration of dredging and associated activities
- Results of the risk assessment of potential impacts to values and proposed mitigation and management controls
- Scope of program monitoring and reporting requirements.
- Further details on TACC membership and role is provided in Section 5.

9. Monitoring Framework

Should major maintenance dredging be needed NQBP will oversee the implementation of a monitoring program, with each component being undertaken by appropriately qualified marine scientists.

Overall, the monitoring program is made up of a combination of regular ambient monitoring (long-term monitoring) and individual dredging event related monitoring (impact and real time monitoring). The environmental monitoring plan aims to:

- assess the long-term ambient environmental health of the Port and nearby sensitive receptors
- detect any impacts from maintenance dredging, both immediately after dredging programs and over time
- respond to real time environmental conditions during maintenance dredging to prevent serious environmental harm
- collect data that will be used to drive continual improvement.

These aims will be met through the implementation of a three-tiered approach to monitoring (Figure 21). The three-tiers will include ambient, impact and adaptive monitoring. Results from each tier of the monitoring program will be used to inform the relevant stages of the dredging management framework.

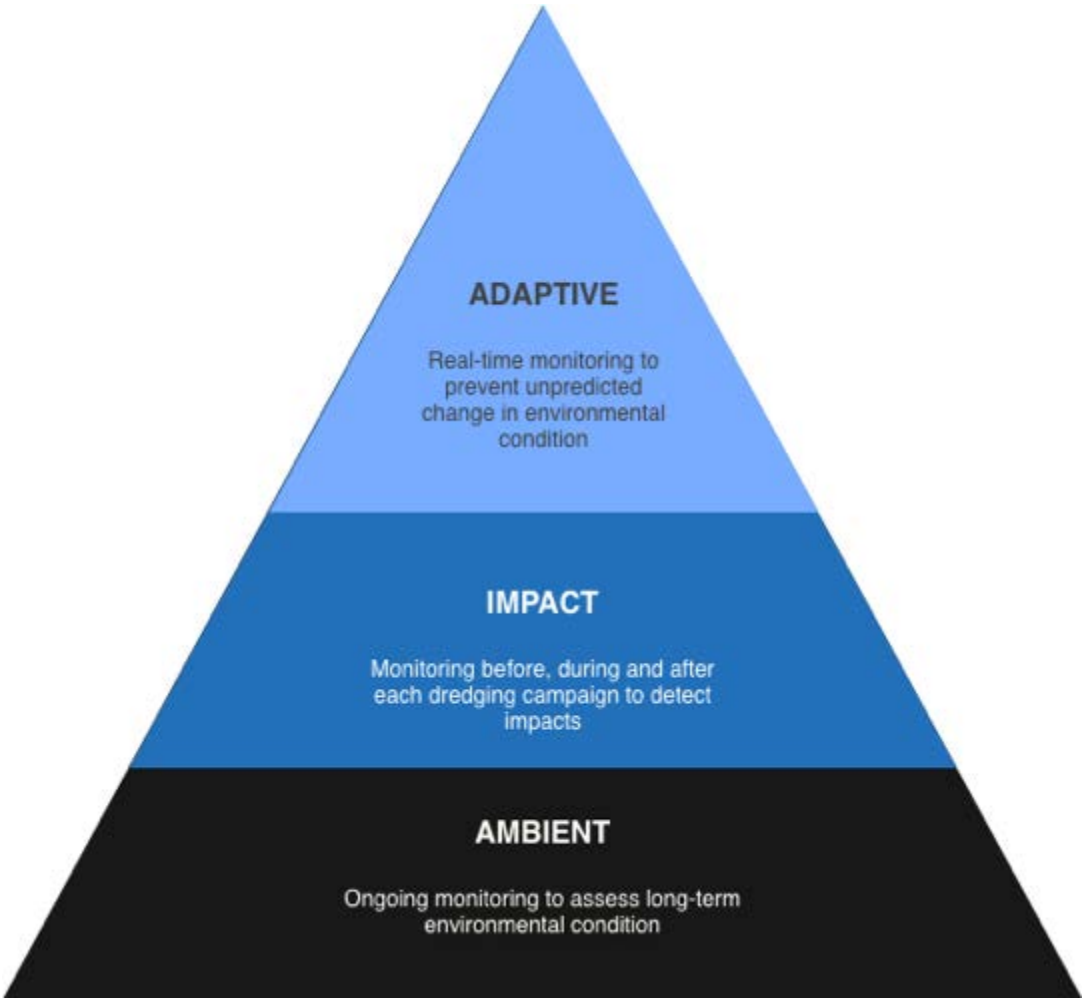

Figure 20: Tiered approach to monitoring

AMBIENT

The aim of this monitoring is to provide a long-term environmental health assessment of the Port and nearby sensitive receptors. The ambient monitoring program focuses on water quality, coral, seagrass and invasive marine pests.

IMPACT

Impact monitoring will be implemented for each maintenance dredging program, with the aim of detecting any adverse impacts due to dredging. If the results of the impact monitoring detect changes in the condition of sensitive receptors, the data can be used in conjunction with data from baseline and adaptive monitoring programs to understand likely cause of impact (i.e. was it dredging).

The impact monitoring program focuses on water quality and coral, as the two receptors most likely to be adversely impacted by dredging. The ephemeral nature of seagrass means that as a sensitive receptor is less suited to short term impact assessment monitoring and detection of dredging related changes. A long term seagrass data set is being established which may enable future analysis and correlation of seagrass health with other factors.

ADAPTIVE

Adaptive monitoring and management will be implemented for each maintenance dredging program. The program is focused on real time collection and analysis of data to detect potential environmental harm and undertake corrective actions where necessary. This is a key step in impact avoidance and management.

Monitoring of water quality, weather conditions and certain marine fauna will be undertaken. Responses to monitoring results will be required if trigger values occur. The nature of the response will be scaled according to the environmental risk. Triggers and the required adaptive management actions are provided in the dredge program management section (Section 9).

Monitoring review and updates

The monitoring program will be reviewed after each dredging program and updated prior to any future dredging.

The review will examine the;

- Effectiveness of monitoring methods
- Response times and outcomes of adaptive monitoring actions
- Monitoring results and data
- Environmental changes and any incidents causing harm

The review will be undertaken in consultation with the TACC and their feedback incorporated into any future program revisions.

10. Performance Review

The *Environmental Code of Practice for Dredging And Dredging Material Relocation* (Ports Australia 2016) identifies that 'transparent and open information sharing is important to improve knowledge and to understand community values, client needs and government expectations. Communication and reporting is an important component of this, to demonstrate performance and provide for community accountability'.

In fulfilment of this principle, reporting under this Plan will involve:

- regular updates to the TACC on any planned or conducted dredging activities
- publication (on the NQPB website) of an annual report detailing:
  - dredging activity in the past 12 months
  - results of any environmental monitoring associated with dredging actions
  - indications of any possible upcoming dredging activities.

For any operations covered by a Commonwealth Sea Dumping Permit, an annual report meeting the International Maritime Organisation's reporting requirements will be submitted to the Australian Government each year. The report will summarise the dredging and placement monitoring activates undertaken during the year, including:

- permit number
- permit start and expiry dates
- locations and type of material dredged
- volume dredged at each location
- placement locations used
- placement method used.

RECORD KEEPING

During dredging activities, NQBP (or their contractors) will keep records which detail:

- the times and dates of when each material placement run is commenced and finished
- the position (by GPS) of the vessel at the beginning and end of each dumping run with the inclusion of the path of each dredge material relocation run
- the volume of dredge material (in cubic metres) dumped for the specific operational period. These records will be retained for audit purposes
- detail of any spill of oil, fuel or other potential contaminant, details of remedial action and monitoring instigated as result.
- details of any marine mega fauna observations during dredging activities
- time and duration of any alterations to the program, including stop work actions, as a result of any environmental mitigation measure.

Post any dredging, NQBP will

- undertake a bathymetric survey of the dredged area and dredge material placement site
- within one month of the completion of the bathymetric survey provide a digital copy of the final survey results to the RAN Hydrographer, copied to relevant regulatory agencies.

INCIDENTS AND CONTINGENCY ARRANGEMENTS

All NQBP staff, and any contractors involved, have the responsibility to report any significant incidents and emergencies.

- In the first instance, reporting should be to the operational works supervisor, but generally, the Environment Manager will have the responsibility to initiate corrective action for environmental incidents.
- All incidents should be reported to the Manager responsible for the Project, as specified by NQBP.
- In the case of an environmental emergency, after first notifying the Environment Manager, the operational works supervisor may make contact with NQBP's nominated consultants, who would help co-ordinate and manage a response. Depending on the nature and magnitude of the incident, the Environment Manager may be required to notify government regulators.

Significant environmental incidents should be logged in writing, with all relevant details recorded, after corrective action has been completed.

Should an environmental incident occur during the course of dredging or placement of material, NQBP will take measures to mitigate the risk or impact. NQBP would report the following information to DES/GBRMPA, within 24 hours of confirmation of an incident:

- 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
- proposed future measures (if required) and monitoring.

AUDITING AND IMPROVEMENTS

NQBP will undertake an internal audit during and after the completion of each dredging program, as per the 'Notifications and Obligations Schedule'. Audit findings will be provided to the TACC and will be used to inform improvements and revisions to the Maintenance Dredging EMP and Marine Environment Monitoring Program.

11. Supporting Information

Adaptive Strategies Pty Ltd (2017) Port of Hay Point Sustainable Sediment Management Assessment for Navigational Maintenance. Prepared for NQBP.

Adaptive Strategies (2018) Port of Abbot Point Environmental Values Assessment. Report prepared for NQBP.

Advisian (2018) Marine Sediment Properties Report, Port of Abbot Point. Report prepared for NQBP.

CEDA. (2015). Integrating Adaptive Environmental Management into Dredging Projects. Position Paper.

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Ports Australia (2016) Environmental code of practice for dredging and dredged material management. August 2016. Available at http://www.portsaustralia.com.au/assets/Publications/Ports-Australia-Dredging-Code-of-Practice.pdf

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