Australian Government
Great Barrier Reef Marine Park Authority

MINUTE

To: Director EAM
cc:

File No:
Date: 31 January 2014

From: Bruce Elliot
Branch: Biodiversity Conservation and Sustainable Use

SUBJECT: Delegates Notes - Abbot Point Capital Dredging Project Assessment - Sea Dumping Act Decision

After considering this assessment, I have formed the view that the most appropriate option is to grant a permit for the proposed DMRA site with conditions.

Disposal at the DMRA is part of a larger controlled action that has been approved by the Environment Minister under the EPBC Act. As part of his approval, the Minister has assessed that the proposed DMRA site is acceptable with conditions.

The only disposal site about which there is sufficient information to make a permit decision at this time is the proposed DMRA site. Until the investigation area is fully assessed, it cannot be assumed that other appropriate alternatives exist. Such an assessment is required as part of the Ministers EPBC Act approval, but will not be completed prior to a decision being required under the Sea Dumping Act. In the interim, the proposed DRMA site must be assessed on its merits (rather than rejected on the assumption that yet to be identified alternatives exist).

In his advice pursuant to s163(1)(a) of the EPBC Act, the Minister has advised that NQBP has addressed all the requirements for loading and disposal of sediments at sea and recommended that a permit should be granted under section 19 of the Sea Dumping Act.

There are options for monitoring, managing and mitigating the potential impacts of the proposed conduct to acceptable levels. These include measures to mitigate the risk of impacts to coral communities, the Catalina wreck and fish habitat.

A longer term monitoring program is required in the EPBC Act conditions and can be required to include monitoring that will identify any immediate and longer term impacts on water quality at Whitsunday tourism sites.

When considering the Sea Dumping Act decision, I have also taken into account the assessments relating to the GBRMP Act and EPBC Act decisions.

Through the supplementary PER, NQBP has demonstrated that is has reasonably investigated alternatives other than disposal offshore.

Residual impacts will be offset by longer term improvements to water quality as per the conditions detailed in the Minister's EPBC Act approval.

BE/01/2014

The conditions relating to the EPBC Act approval include a requirement for the proponent to submit to the Minister for approval a Disposal Site Analysis Plan (DSAP). The DSAP must include identification of alternative disposal sites for further analysis. Dredging and disposal cannot commence until the DSAP has been completed and approved by the Minister.

Bruce Elliot
General Manager
31/01/14

Australian Government
Great Barrier Reef Marine Park Authority

GREAT BARRIER REEF MARINE PARK AUTHORITY

General Manager (Decision)

File No: 17/2248
Branch: BCSU
Comms section consulted: No

ABBOT POINT CAPITAL DREDGING PROJECT - SEA DUMPING DECISION

Timing:
A decision under the *Environment Protection (Sea Dumping) Act 1981* (Sea Dumping Act) is required on or before 31 January 2014 to coincide with your decision under the *Great Barrier Reef Marine Park Act 1975* (Marine Park Act) (as you prefer).

Purpose: To brief you on your options as the delegate for making a decision under the Sea Dumping Act for the Port of Abbot Point Capital Dredging Project.

Background: The background of the application under the Sea Dumping Act is attached as Attachment A (the sea dumping assessment). The sea dumping assessment is consistent with the revised specific guidelines for assessment of dredged material, under Annex 2 of the London Protocol. The draft sea dumping permit is attached as Attachment B and still requires comments from Legal Services.

The Authority received the application under the Sea Dumping Act on 14 February 2013 from North Queensland Bulk Ports Corporation Limited for offshore disposal in the Great Barrier Reef Marine Park of three million cubic metres of dredge material associated with capital dredging at the Port of Abbot Point.

Following the decision of Hon Greg Hunt MP under the *Environment Protection and Biodiversity Conservation 1999 Act* made on the 10 December 2013, the Authority had 30 days to make a decision under the Sea Dumping Act. The 30 day statutory timeframe has been exceeded.

On 17 December, the Authority sent a letter to Brad Fish of North Queensland Bulk Ports Corporation regarding the sea dumping application (refer to Attachment C). The letter states the current application under the Sea Dumping Act is a valid application and is limited to the site proposed in the Public Environment Report (PER).

On 20 December, Brad Fish replied to the Authority's letter dated 17 December 2013, requesting to meet to further discuss the sea dumping application (refer to Attachment D). Brad Fish also sent a letter on 13 January 2014 confirming that North Queensland Bulk Ports Corporation is supportive of GBRMPA continuing to process the current sea dumping application for the PER site (refer to Attachment E).

On 23 January 2014, the Authority received a letter from the Hon Greg Hunt MP Minister for the Environment regarding the decision on approval of the Abbot Point Capital Dredging Project under the Sea Dumping Act (refer to Attachment F). The letter states "I wish to advise you under section 163(1)(a) of the EPBC Act, that North Queensland Bulk Ports Corporation has addressed all of the requirements for the loading and disposal of sediment at sea and therefore recommend that a permit should be granted under section 19 of the

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Sea Dumping Act". Recommended conditions for the permission under the Sea Dumping Act were provided as an attachment to the letter.

There are two options available as the delegate of the Sea Dumping Act in making this decision:

1. Grant a Sea Dumping permit to load for the purposes of dumping, and to dump up to 3,000,000 cubic metres of seabed material, being a maximum of 1,300,000 cubic metres per annum, derived from capital dredging at the Port of Abbot Point.
   OR
2. Refuse to grant a Sea Dumping permit for this activity.

For further details of the options refer to Attachment A. It is important to note, under the Sea Dumping Act a permit may only be granted:

- for controlled material that is within Annex 1 to the London Protocol; and
- in accordance with Annex 2 of the London Protocol.

Due to the 31 January 2014 deadline for the decision under the *Great Barrier Reef Marine Park Act 1975* (Marine Park Act), and due to the preference to make a decision on the sea dumping application at the same time, considerable time constraints have been experienced in providing a comprehensive sea dumping assessment. The Abbot Point Capital Dredging Project assessment under the Marine Park Act was provided to you on Monday 20 January 2014.

Consultation: The Authority's Legal Services are being consulted in relation to drafting the conditions of the sea dumping permit.

Recommendation/s:

1. That you consider the information in this brief and the assessment report in making your decision under the *Environment Protection (Sea Dumping) Act 1981*	1. (Noted) / Please discuss

Adam Smith
EAM
24/1/2014

Secondary Contact
Rean Gilbert
ext 813

0404 068 075

General Manager
BCSU
31/1/2014

Attachments

A	Sea Dumping Assessment
B	Draft Sea Dumping Permit (requires Legal Services' comments)
C	Letter from Authority to NQBP sent on 17 December 2013
D	Letter from NQBP to Authority received on 20 December 2013
E	Letter from NQBP to Authority received on 13 January 2014
F	Letter from Hon Greg Hunt MP approval of Sea Dumping permission and recommended conditions

SEA DUMPING ACT

PERMIT ASSESSMENT

Permit Assessment for Sea Dumping

SUMMARY APPLICATION DETAILS

Applicant name:	North Queensland Bulk Ports Corporation Limited.
Application Date (Received):	14 February 2013.
Assessment Type:	*Environment Protection (Sea Dumping) Act 1981*
Dumping Type:	Loading for the purpose of dumping and dumping of capital dredge material at sea.
Proposed Use:	Loading and Disposal of up to 3,000,000m^3 of capital dredge material derived from dredging at the Port of Abbot Point over a period of approximately 5 - 6 years, with no more than 1,300,00m^3 in any one year.
Period of Permit:	Application seeks permission for the period 2013 to 2020.
Zones and Locations:	Within a Proposed Dredge Material Relocation Area (DMRA), 24 km north east of Abbot Point in water depths of -39 metres to -44 metres LAT[1]. The Proposed DMRA is located within a General Use Zone of the Marine Park. The proposed dredging area is located outside the Marine Park within the Great Barrier Reef World Heritage Area.

SUMMARY ASSESSMENT DETAILS

Fees:	The required Sea Dumping Application fee of $23,600 has been paid.
Sea Dumping Assessment:	The *Environment Protection (Sea Dumping) Act 1981* outlines the matters the GBRMPA, as the responsible agency, must have regard to in considering applications for permissions. Under the *Environment Protection (Sea Dumping) Act 1981* a permit may only be granted: o for controlled material that is within Annex 1 to the Protocol; and o in accordance with Annex 2 of the Protocol.

[1] GHD. 2012 Abbot Point, Terminal 0, Terminal 2 and Terminal 3 Capital Dredging Public Environment Report (EPBC 2011/6213/GBRMPA G34897.1) pg 2-29.

OPTIONS AVAILABLE TO THE DELEGATE

1. Grant a Sea Dumping permit to load for the purposes of dumping, and to dump up to 3,000,000 cubic metres of seabed material, being a maximum of 1,300,000 cubic metres per annum, derived from capital dredging at the Port of Abbot Point.

2. Refuse to grant a Sea Dumping permit for this activity.

The London Protocol, Annex 2, Clause 15 states that each assessment should conclude with a statement supporting a decision to issue or refuse a permit for dumping. The assessment can conclude that the application for sea dumping is consistent with some matters of the London Protocol and not consistent with others.

A permit for dumping in this case could be refused on the grounds of:
~ There is a lack of adequate information to determine the likely effects of the proposed disposal option (Annex 2, Paragraph 14)
~ Article 3 of the London Protocol states that "Contracting Parties shall apply a precautionary approach to environmental protection from dumping of wastes or other matter whereby appropriate preventative measures are taken when there is reason to believe that wastes or other matter introduced into the marine environment are likely to cause harm even when there is no conclusive evidence to prove a causal relation between inputs and their effects".
~One alternative that was considered (moving the DMRA) is not seen to be disproportionate in costs and is likely to provide for a better environmental, social and heritage outcome.
~Pursuant to Annex 2 (Paragraph 14) a comparative assessment needs to consider the economics and exclusion of future uses. The comparative assessment did not consider the future uses of other users of the area; it only considered the future use of the area for the port proponent.

A permit for dumping in this case could be granted on the grounds that:
~ The alternatives considered, the trestles and land based disposal could be seen to be disproportionate in costs (Annex 2, Paragraph 6).
~ A letter from the Hon Greg Hunt MP (Minister for the Environment) on the 23 January 2014 states that "the assessment of the dredging project under the EPBC Act addressed the assessment framework outlined in part four of the National Assessment Guidelines for Dredging (2009). That included the evaluation of alternatives, sampling and analysis of sediments, assessment of potential impacts on the environment, and the monitoring and management of impacts. The sediment to be dredged was found not to be contaminated and to be suitable for sea disposal. I wish to advise you under section 163(1)(a) of the EPBC Act, that North Queensland Bulk Ports Corporation has addressed all of the requirements for the loading and disposal of sediments at sea and therefore recommend that a permit should be granted under section 19 of the Sea Dumping Act."

ASSESSMENT OFFICER

Rean Gilbert **Date:** 24/01/2014
Rean Gilbert, Manager, Ports and Shipping
(This assessment was conducted by a team of assessment officers including Nicholas Baker, Kevin Edison and Rean Gilbert)

DIRECTOR

The technical assessment conducted by Rean Gilbert and the Ports and Shipping team is consistent with the *Environment Protection (Sea Dumping) Act 1981*, Annex 2 of the London Protocol, the Revised Specific Guidelines for Assessment of Dredged Material and the Australian Government *National Assessment Guidelines for Dredging* (2009). The assessment officer and team have provided a comprehensive assessment report which relies primarily on the information provided by the proponent. There are some gaps in information provided by the proponent which makes it challenging to assess some criteria: for example item 12 of the London Protocol suggests "Assessment of potential effects should lead to a concise statement of the expected consequences of the sea or land disposal options, i.e. the "Impact Hypothesis"" and item 14 "An analysis of each disposal option should be considered in the light of a comparative assessment of the following concerns: human health risks, environmental costs, hazards (including accidents), economics and exclusion of future uses"

Based on the information and time available, the assessment team has provided two options for the delegate (refusal or approval).

Adam Smith Date: 24/1/14

Dr Adam Smith, Director (Environmental Assessment and Management)

DELEGATE

See notes in attached minute

Decision to grant a permit with conditions

Date: 31/01/2014

Bruce Elliot, General Manager (Biodiversity Conservation and Sustainable Use)

SUMMARY

The proposed activity involves the loading of 3,000,000 cubic metres of dredge material derived from capital dredging at the Port of Abbot Point over a period of approximately 5 - 6 years, with no more than 1,300,00m^3 in any one year.
The proposed DMRA (Table 1) is approximately 400 ha (~2km by 2km) in size and located 24 km north east of Abbot Point in water depths of -39 metres to -44 metres LAT[2].

Table 1: Coordinates of proposed Dredge Material Relocation Area

Location Point	Latitude	Longitude
A	19°47'31.1"S	148°17'48.2"E
B	19°47'30.6"S	148°18'57.7"E
C	19°48'35.5"S	148°18'58.2"E
D	19°48'35.7"S	148°17'48.6"E

EXECUTIVE SUMMARY

The Great Barrier Reef Marine Park (Marine Park) is a multi-use protected area that stretches 2300km along the Queensland Coast and covers 344,000km^2. It is the largest coral reef ecosystem in the world and supports an outstanding array of plants and animals. The Marine Park supports a variety of uses, particularly tourism, fishing, recreation and shipping. It is an integral part of the lifestyles and livelihood of communities along the Great Barrier Reef Coast.

The Port of Abbot Point (the Port) is an existing operational coal port located within port limits approximately 25 kilometres North West of Bowen on the central Queensland Coast. North Queensland Bulk Ports Corporation Limited (NQBP), as operators of the Port, have made application under the *Environment Protection (Sea Dumping) Act* 1981for a sea dumping permit, specifically the disposal of up to 3,000,000m^3 of capital dredge material to the Marine Park over a period of approximately 5 - 6 years.

Disposal of dredge material is a result of capital dredging works associated with a proposed expansion of the Port of Abbot Point. A proposed 400 hectare Dredge Material Relocation Area (DMRA) is located approximately 25 km east/north east of the Port.

During the application process, the proponent has undertaken a Multi Criteria Analysis (MCA) and the Great Barrier Reef Marine Park Authority (GBRMPA) has participated in both the MCA and several options workshops with the proponent to discuss alternatives to sea dumping.

Section 19 of the Sea Duping Act states that a permit for dumping or loading for dumping, may only be grated for controlled material that is within Annex 1 of the Protocol and may only be grated in accordance with Annex 2 to the Protocol.

Dredge material is listed as a controlled material in Annex 1. Annex 2, describes the considerations for assessing a sea dumping permit. The overarching considerations are that dredged sediment is a resources that should be used for beneficial purposes, management options should be guided by the comparison of both dumping and alternatives, and management actions for dredged material should ensure as far as practicable, that environmental disturbance and detriment are minimised and the

[2] GHD. 2012 Abbot Point, Terminal 0, Terminal 2 and Terminal 3 Capital Dredging Public Environment Report (EPBC 2011/6213/GBRMPA G34897.1) pg 2-29.

benefits maximised. Annex 2 also talks about the characterisation of material and contamination of waste.

The proponent has undertaken the relevant analysis of the dredge material which was determined to be uncontaminated.

Waste Prevention

The proponent has elected to pursue sea dumping as the option to deal with the waste generated from capital dredging. No reduction or waste prevention strategy has been provided. The proponent has determined that the treatment of dredge material for reuse, avoidance of dredging by building longer trestles and onshore disposal, is not economically feasible and believes that these options will have further environmental impacts.

Environment

Water quality at the Port of Abbot Point is seasonally variant but usually above relevant water quality guidelines. Water quality at the mid shelf area, where the DMRA is proposed is slightly above GBRMPA water quality guidelines for most parameters. There is no mid shelf water quality data provided in the proponents Public Environment Report (PER).

The dredge footprint is located at the end of the current port terminal and is shown in Figure 1. The DMRA is located on the mid shelf and in the Nora reef/mid shelf lagoon (NRL) bioregion (Figure 2). The proposal has the potential to impact on water quality in the surrounding area during each dredging and disposal campaign and for a period of time thereafter.

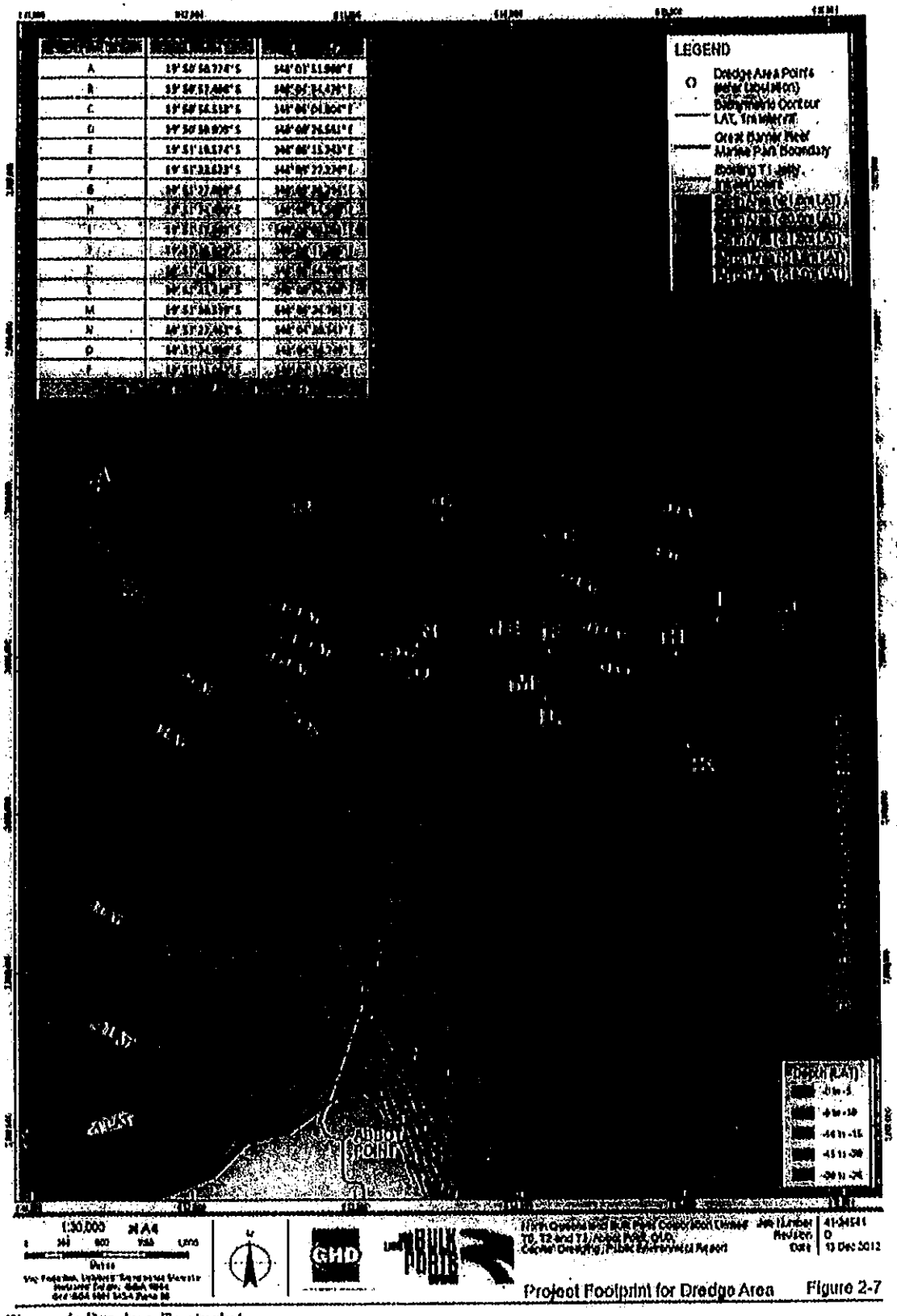

Figure 1: Dredge Footprint

Water quality is a value of the Great Barrier Reef and a decline in water quality may also have flow-on impacts on other environmental values including coral, seagrass, benthic (bottom) habitat, species of conservation concern as well as social values of fishing, tourism and general amenity.

The dredge plume modelling undertaken by the proponent has limitations and possibly underestimates the plume extent. The model predicts an approximate "worst case" area of 650 km^2 of Great Barrier Reef Marine Park to be affected by a decline in water quality from both the dredging and disposal. The temporal scale of potential impacts may be compounded by ongoing re-suspension and movement of dumped material and overflowed dredge material with the prevailing conditions and potentially impacting on water quality and sensitive receptors nearby.

A reduction in water quality can be minimised (through the use of conditions) but not avoided during dredging or disposal. Options are available to manage the flow-on impacts on sensitive receptors through the use of management arrangements (such as the use of trigger values to control water quality at sensitive receptor sites). Mitigation strategies would need to be sufficiently robust to prevent and minimise any irreversible impacts on Great Barrier Reef values.

Sensitive receptors which are close to the dredge area include seagrasses and potential seagrass habitat (immediately surrounding) and Camp Island Reef (20km west of the port). The DMRA is in close proximity to Nares Rock (5 km NE), Holbourne Island (7km NE) and a Catalina WWII wreck (4km south). Nares Rock and Holbourne Island are surrounded by coral reef communities.

The assessment report considers information contained in the original Public Environment Report (PER), the supplementary PER, public comments, published scientific literature and any other environmental, economic, social and strategic issues.

Other users of the Marine Park offshore from Abbot Point include but are not limited to commercial fishing operators, recreational fishers, tourists (for example scuba divers diving the nearby Catalina dive wreck (WWII aircraft)) and Traditional Owners.

Potential Impacts

Potential impacts are associated with the disposal of up to 3 million cubic metres over a period of approximately 5 - 6 years, with no more than 1,300,00m^3 in any one year to the proposed DMRA.

Water quality is expected to decline due to increased turbidity and suspended sediments and through subsequent re-suspension of dredge material. The worst case sediment plume predicted to occur from the both the dredging and disposal activity (from the PER) will cover a footprint of up to 650 km^2 or more. The information provided by the proponent may potentially underestimate the footprint of water quality declines and the extent of potential impacts.

Scientific information suggests that with the inclusion of large-scale currents in models the dredge spoil has the potential to move larger distances than previously modelled (i.e. further then the modelling in the PER)[3]. The assessment concludes that impacts on water quality will be difficult to mitigate, manage or offset.

Seagrass is the dominant benthic community at the Port of Abbot Point and is currently recovering from extreme weather events of the past years. No seagrass has been identified within the DMRA. Seagrass species within nearby Abbot Bay (approximately 25 km away) are of high value as they have been identified as those which are preferred by Dugong as food[4].

Potential impacts to seagrasses from dredging and disposal are partly irreversible and likely to prolong current recovery for an undetermined number of years.

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[3] SKM 2013, Improved dredge material management for the Great Barrier Reef Region, Great Barrier Reef Marine Park Authority, Townsville.

[4] Rasheed, M.A., Thomas, R. and McKenna, S.A. 2005. Port of Abbot Point seagrass, algae and benthic macro-invertebrate community survey - March 2005. DPI&F Information Series QI05044 (DPI&F, Cairns), 27 pp

There is uncertainty as to what impacts dredging and disposal will have on nearby reefs (i.e. Camp Island Reef, Holbourne Island Reef and Nares Rock Reef), the severity of the impacts or the reversibility of the impacts. Potential impacts to corals could be managed through conditions of permission with a preference for avoiding plume dispersal in the direction of the coral reef sites.

The proposed DMRA is located approximately 3 km from a WWII Catalina aircraft wreck. The proposed action may cause sedimentation issues at the wreck site which will have heritage issues and flow on effects for those that dive the wreck site. Due to the proximity of the proposed activity to the WWII heritage site implementing management and mitigating conditions may not appropriately protect the site. Any potential impacts associated with dredge material disposal on the WWII Catalina aircraft wreck should be avoided to maintain the preservation of this heritage site. The proposal in its current form poses unacceptable risks to the heritage values[5] of the Great Barrier Reef Marine Park that are not manageable other than to relocated the DMRA further away from the heritage site.

Other potential indirect impacts include a possible temporary reduction in target species or catch for fishers associated with turbidity and sedimentation at preferred fishing sites near Holbourne Island and Nares Rock, and on the areas amenity for tourism and recreational users'.

The proposed activity has the potential to impact on the social values of the Great Barrier Reef Region by creating a negative perception around the health and state of the Great Barrier Reef as a desirable destination and well-managed marine protected area, thus impacting on social values and potentially reducing GBR tourism

Potential impacts associated with social perception could be managed through media campaigns, fact sheets, communication plans in order to increase public awareness around dredge material disposal to the Marine Park.

The proponent has explored alternative options which are intended to minimise or avoid the need for dredging and disposal. These have included the use of trestles and land-based dredge disposal. These options have all been eliminated by the proponent for technical, schedule or budgetary reasons. In general, the proponent maintains that the options will be significantly more expensive than the option to dredge and dispose in the World Heritage Area and may have additional environmental impacts.

Conclusion

The environment surrounding the Port of Abbot Point is in moderate to poor condition. Seagrasses are currently recovering from extreme weather impacts and water quality is above relevant guidelines.

The proponent has investigated alternative options which are intended to minimise or avoid sea dumping. There are technically feasible alternatives which would achieve this. These alternatives would come at an extra cost to the proponent, however are likely to result in better and more manageable environmental, social, cultural and heritage impacts than sea dumping.

Potential impacts to sensitive receptors resulting from dredging and disposal may be unmanageable through conditions of permission.

[5] Heritage is all the things that make up Australia's identity - our spirit and ingenuity, our historic buildings, and our unique, living landscapes. Our heritage is a legacy from our past, a living, integral part of life today, and the stories and places we pass on to future generations. http://www.environment.gov.au/topics/heritage

Background

The proponent for this application is the Port Authority, North Queensland Bulk Ports Corporation Limited (NQBP).

NQBP submitted a referral under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) on 5 December 2011 for the proposed activity. The Great Barrier Reef Marine Park Authority (GBRMPA) provided initial advice to the Department of the Environment (then the Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) on the referral, recommending that the project be declared a controlled action, requiring assessment through an Environmental Impact Statement (EIS).

On 6 January 2012, the Department of the Environment declared the referral to be a controlled action to be assessed by Public Environment Report (PER). The application was deemed a Marine Parks application under section 37AB of the *Great Barrier Reef Marine Park Act 1975* as elements of the proposed activity were located within the Marine Park.

Guidelines were issued for the PER on 26 June 2012 with input from GBRMPA and a draft PER was provided to regulators for review on 21 September 2012.

Officers from the Great Barrier Reef Marine Park Authority (GBRMPA) and other regulatory agencies attended a multi criteria analysis workshop to determine the most suitable option to dispose of the dredged material. As a result of the multi criteria analysis workshop, NQBP selected an offshore dredge material disposal site 24 km from the dredge site, which is located within the Great Barrier Reef Marine Park (the Marine Park), the Great Barrier Reef World Heritage property, the National Heritage place and the Commonwealth marine area.

On 13 December 2012 NQBP requested a variation to the proposal on the following matters:

- Limit dredging to a maximum of 3 million cubic metres of sediment;
- Identify the dredge material disposal site approximately 24 km from the dredge site;
- Increase the dredge footprint by 10 ha (up to 185 ha), due to a change in the alignment for safety reasons; and
- Increase the dredge depth of certain berth pockets

The Department of the Environment notified GBRMPA on 21 December 2012 that a decision had been made to publish the draft PER for public comment. The draft PER was made available for public comment between 4 January 2013 and 15 February 2013. A total of 103 public submission were received (84 percent were from the Abbot Point Action Group- a community group of fishers, residents and families in Bowen who are campaigning against Abbot Point Coal Terminal expansion for community and fishing reasons) .

Some of the views expressed within the public submissions included the validity of the assessment and dredge plume modelling in the PER, and noted the potential impacts of dredging and the offshore disposal of dredge material in relation to:

- Recreational and commercial fisheries in the Bowen area
- The recently discovered Catalina World War 2 plane wreck and associated heritage and tourism values
- Water quality and biodiversity
- The local tourism industry
- The Outstanding Universal Value of the Great Barrier Reef World Heritage Area.

Following the public consultation period for the PER, GBRMPA, Department of the Environment and the proponents for the port expansion held three workshops in February 2013 and March 2013, which discussed the feasibility of alternatives to the proposed dredging and disposal project, modelling methodologies and alternate options for dredge material disposal.

On 14 February 2013 North Queensland Bulk Ports Corporation Limited (NQBP) submitted an application under the *Environment Protection (Sea Dumping) Act 1981*. The application is for the capital dredging of approximately 3 million cubic metres, and for the disposal of the dredged material at sea.

GBRMPA has been delegated powers under the Sea Dumping Act when either the loading or dumping of waste occurs within the Marine Park[6].

The Minister for the Environment granted an EPBC approval with conditions on 10 December 2013 for the proposed activity.

The Port of Abbot Point (the Port) is an operational coal port located within port limits approximately 25 kilometres North West of Bowen on the central Queensland Coast. The port commenced operations in 1984 and underwent a major expansion (which was completed in) 2011 of the existing terminal (Terminal 1(T1)) to increase the capacity to 50 million tonnes per annum from the original capacity of approximately 17 million tonnes per annum[7]. Currently the terminal is operating at approximately 34% of the 50 Mtpa capacity, similar to their 2008/2009 throughput[8].

Since the establishment of the Port, maintenance dredging at the port has only been required twice, once in 1986 (26,000 m^3) and again in 2008 (20,000 m^3)[9] along with 275,000 m^3 of capital dredging associated with the expansion of T1. The dredge material from the 2008 campaign was disposed of at the previously permitted disposal site located 7 km offshore in the Great Barrier Reef Marine Park (GBRMP)[10] under Marine Park permit (G08/25493.1).

The capital dredging includes the dredging of six new berth pockets and ship apron areas using a trailer suction hopper dredge. The area to be dredged is located approximately 3 km offshore within the port limits of the Port of Abbot Point (Figure 2).

On 27 November 2013 NQBP requested a variation to their sea dumping application on the following matters: inclusion of a larger Investigation Area for further studies to identify a site for sea dumping of dredge material.

GBRMPA received legal advice on the variation request which stated that they '...do not think that the Sea Dumping Act allows permit applications to be materially varied after they have been made'.

The application has not been varied from the original application and is assessed as the dredging and disposal to sea at the location shown in Figure 2 and bounded by coordinates in Table 2.

Table 2: Coordinates of the proposed Dredge Material Relocation Area

Location Point	Latitude	Longitude
A	19°47'31.1"S	148°17'48.2"E
B	19°47'30.6"S	148°18'57.7"E
C	19°48'35.5"S	148°18'58.2"E
D	19°48'35.7"S	148°17'48.6"E

[6] Environment Protection Sea Dumping Act 1981, Instrument of Delegation, 19 September 2013.
[7] GHD. 2012 Abbot Point, Terminal 0, Terminal 2 and Terminal 3 Capital Dredging Public Environment Report (EPBC 2011/6213/GBRMPA G34897.1). GHD Brisbane. (Chapter 1 Introduction)
[8] Abbot Point Monthly Actual Throughput, 2013. Retrieved 19 June, 2013, from North Queensland Bulk Ports Web site: http://www.nqbp.com.au/abbot-point
[9] GHD. 2012 Abbot Point, Terminal 0, Terminal 2 and Terminal 3 Capital Dredging Public Environment Report (EPBC 2011/6213/GBRMPA G34897.1). GHD Brisbane. (Chapter 1 Introduction)
[10] GHD. 2012 Abbot Point, Terminal 0, Terminal 2 and Terminal 3 Capital Dredging Public Environment Report (EPBC 2011/6213/GBRMPA G34897.1). GHD Brisbane. (Chapter 1 Introduction)

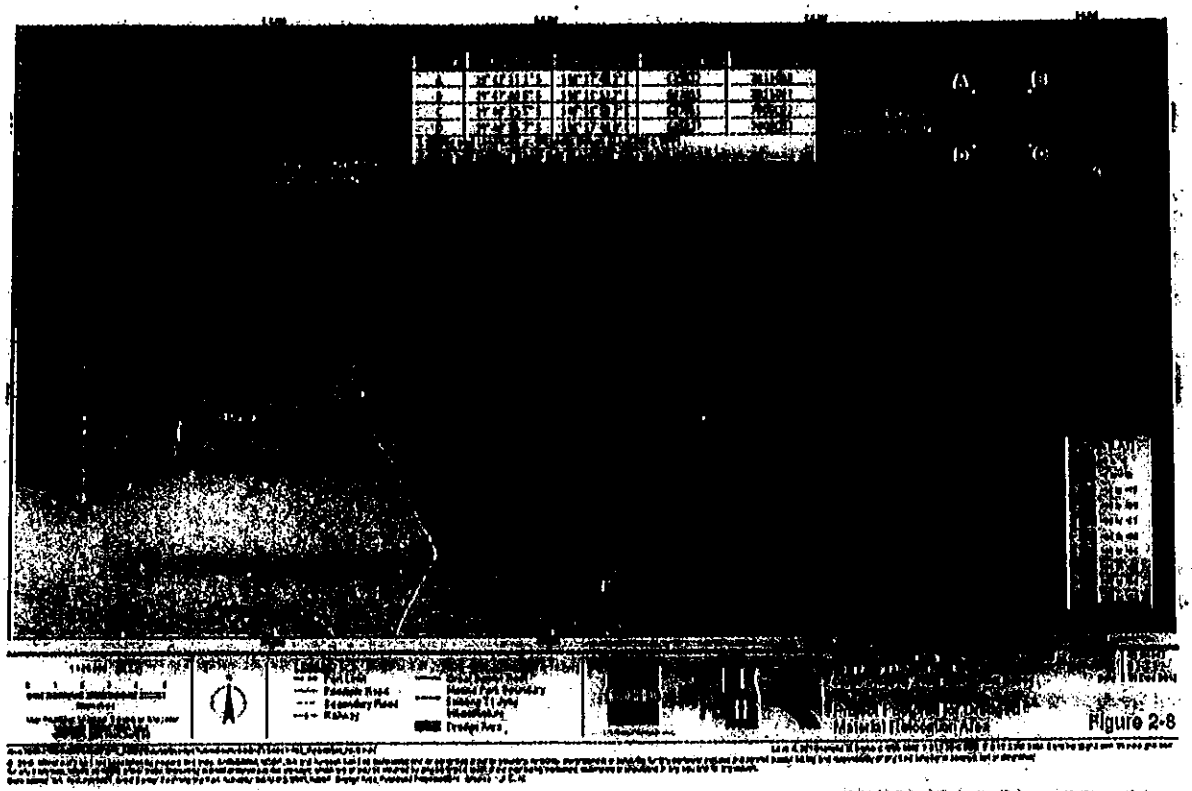

Figure 2: Location of the previously used dredge disposal site at Abbot Point and the proposed Dredge Material Relocation Area

Other Projects Associated with the capital dredging project

The capital dredging of 3 million cubic metres of dredge material at the Port of Abbot Point is to facilitate the development of three new terminals: Terminal 0, Terminal 2 and Terminal 3.

Terminal 0 relates to EPBC referral 2011/6194 which was approved with conditions on 10 December 2013. The proponent for this development is Adani.

Terminal 2 relates to EPBC referral 2011/6185, which was withdrawn by the applicant on 23 October 2013.

Terminal 3 relates to EPBC referral 2008/4468. This project was approved with conditions 4 October 2012.

Consideration of Assessment Criteria – In Accordance with Annex 2 London Protocol

Throughout this assessment, alignment has been made with Annex 2 of the London Protocol and the Revised Specific Guidelines for Assessment of Dredged Material. The assessment proceeds in order of those requirements and the numbers represent the clauses of Annex 2, not the order of the document as there are some clauses not relevant for the assessment.

GENERAL

1 The acceptance of dumping under certain circumstances shall not remove the obligations under this Annex to make further attempts to reduce the necessity for dumping.

The proponent has not proposed to minimise or reduce the necessity for dumping at sea. The proponent intends to dispose of 100% of dredged material at sea.

There is no long term strategic plan by the proponent in relation to avoiding or minimising future dredging and sea disposal at the Port of Abbot Point.

WASTE PREVENTION AUDIT

2 The initial stages in assessing alternatives to dumping should, as appropriate, include an evaluation of:
.1 types, amounts and relative hazard of wastes generated;
.2 details of the production process and the sources of wastes within that process; and
.3 feasibility of the following waste reduction/prevention techniques:
.1 product reformulation;
.2 clean production technologies;
.3 process modification;
.4 input substitution; and
.5 on-site, closed-loop recycling.

3 In general terms, if the required audit reveals that opportunities exist for waste prevention at source, an applicant is expected to formulate and implement a waste prevention strategy, in collaboration with relevant local and national agencies, which includes specific waste reduction targets and provision for further waste prevention audits to ensure that these targets are being met. Permit issuance or renewal decisions shall assure compliance with any resulting waste reduction and prevention requirements.

4 For dredged material and sewage sludge, the goal of waste management should be to identify and control the sources of contamination. This should be achieved through implementation of waste prevention strategies and requires collaboration between the relevant local and national agencies involved with the control of point and non-point sources of pollution. Until this objective is met, the problems of contaminated dredged material may be addressed by using disposal management techniques at sea or on land.

Prevention or reduction of waste is discussed in detail in the Consideration of Waste Management Options section (5 and 6) below.

Information provided by the proponent regarding preventing or reducing the need for dredging at the Port of Abbot Point, indicates there are limited opportunities.

The port is situated in relatively deep water, the option of engineering trestles and berths which extend further offshore is considered a possibility.

Clause 4 (Annex 2) states that for dredged material the goal of waste management should be to identify and control the sources of contamination. The proponent has satisfactorily demonstrated that the material proposed for disposal is clean and not contaminated.

Paragraph 2 (Annex 2- Revised specific guidelines for assessment of dredged material) specifies that a component of the waste prevention audit for dredged material should include "minimising the volumes of sediment that must be dredged by using improved engineering practices". The proponent has demonstrated that improved engineering practices may minimise or avoid any sea dumping. The cost of the improved practice was stated to be cost prohibitive.

Paragraph 2.3 (Annex 2- Revised specific guidelines for assessment of dredged material) states that "application of best engineering and operational practices to dredging operations will provide opportunities for minimizing the quantity of material that must be dredged and disposed of at sea and reducing the environmental impact of dredging activities".

CONSIDERATION OF WASTE MANAGEMENT OPTIONS

5 Applications to dump wastes or other matter shall demonstrate that appropriate consideration has been given to the following hierarchy of waste management options, which implies an order of increasing environmental impact:

.1 re-use;
.2 off-site recycling;
.3 destruction of hazardous constituents;
.4 treatment to reduce or remove the hazardous constituents; and
.5 disposal on land, into air and in water.

The material is characterised in detail in Sections 7 and 8.

The material to be dredged was sampled and analysed in accordance with the *National Assessment Guidelines for Dredging 2009* (NAGD) and found to be free of contaminants of concern and suitable chemically for unconfined ocean disposal.

The material to be dredged would require substantial treatment and stabilisation in order for it to be suitable for beneficial re-use as construction material or fill. The proponent estimates (due to the particle size distribution) that it could take up to four years to treat and stabilise the material for beneficial reuse on land[11].

The cost of stabilisation is estimated to be between $37.00 and $168.00/m^3 ($111million and $474 million)[12]. This does not include the other associated costs of de-watering, bund wall construction and water quality monitoring.

See below (section 6) a description and assessment of alternatives including land disposal.

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[11] GHD. 2012 Abbot Point, Terminal 0, Terminal 2 and Terminal 3 Capital Dredging Public Environment Report (EPBC 2011/6213/GBRMPA G34897.1). GHD Brisbane (Executive Summary, page xxi)
[12] SKM 2013, *Improved dredge material management for the Great Barrier Reef Region*, Great Barrier Reef Marine Park Authority, Townsville.

6 **A permit to dump wastes or other matter shall be refused if the permitting authority determines that appropriate opportunities exist to re-use, recycle or treat the waste without undue risks to human health or the environment or disproportionate costs. The practical availability of other means of disposal should be considered in the light of a comparative risk assessment involving both dumping and the alternatives.**

Before the submission of the draft PER, NQBP conducted a multi criteria analysis (MCA) to review the potential options to avoid or minimise the need for dredging and ocean disposal. The MCA indicated that disposal of dredge material at a deeper (than the existing disposal site) offshore disposal site was the most preferred option. The multi-criteria analysis did not consider options that avoided the need for dredging and disposal at sea (i.e. longer trestles).

Public comment received on the draft PER highlighted concerns around potential impacts to commercial fishing grounds, proximity to sensitive marine environments at Hicbourne Island and Nares Rocks including the discovery of a World War II plane wreck (the Catalina) to the south of the proposed DMRA. After the public comment period for the draft PER closed, NQBP held three workshops with the department and GBRMPA to further discuss options to reduce or eliminate dredging and sea disposal.

NQBP detailed a number of trestle options, some of which were navigationally unfeasible and orders of magnitude more expensive. Other options (reviewed by Maritime Safety Queensland) were considered navigationally safe and two of the options, were considered better (navigationally) than the proposed option[13].

In addition, NQBP provided information on several options for the onshore disposal of dredged material, noting that they considered that these would also have other environmental impacts that would require further assessment.

A selection[14] of feasible alternatives have been including in this assessment for comparison against the proposed option (

Table 3).

Table 3: Summary of trestle extension options presented for the Port of Abbot Point

Option	NQBP Proposed Option (Figure 1	Option 3 – Trestle Extension with 50% Dredging	Supplementary Option 5 – Trestle Extension with elimination of berth pocket and land disposal (Figure 2 & Figure 3 or 4)
Dredge Amount Required	3,000,000 m³	0 m³	600,000 m³
Disposal Site Location	Sea Disposal	Not required	Sea / Land Disposal
Maximum trestle length required (km)	3.9	8.9	5.2
Overall extension	0	5	1.3

[13] CDM Smith. 2013. North Queensland Bulk Port Corporation Abbot Point Terminal 0, 2 and 3 Capital Dredging PER Supplementary Report. CDM Smith Brisbane. (Draft Summary Minutes 27 March 2013 Workshop).
[14] More options were reviewed in the workshops; however this assessment has chosen to look at those options which are technically feasible and less costly than the other options.

to proponent preferred option (km)			
Approximate Cost[15]	$30,000,000	$1.35 billion	$430,000,000

[15] CDM Smith. 2013. North Queensland Bulk Port Corporation Abbot Point Terminal 0, 2 and 3 Capital Dredging PER Supplementary Report. CDM Smith Brisbane, (Table 5-3 Trestle Option Review, Page 5-27).

The proponent's preferred option for this project is the sea disposal of 3 million cubic metres of dredge material and trestles that are 3.9 km long (Figure 3).

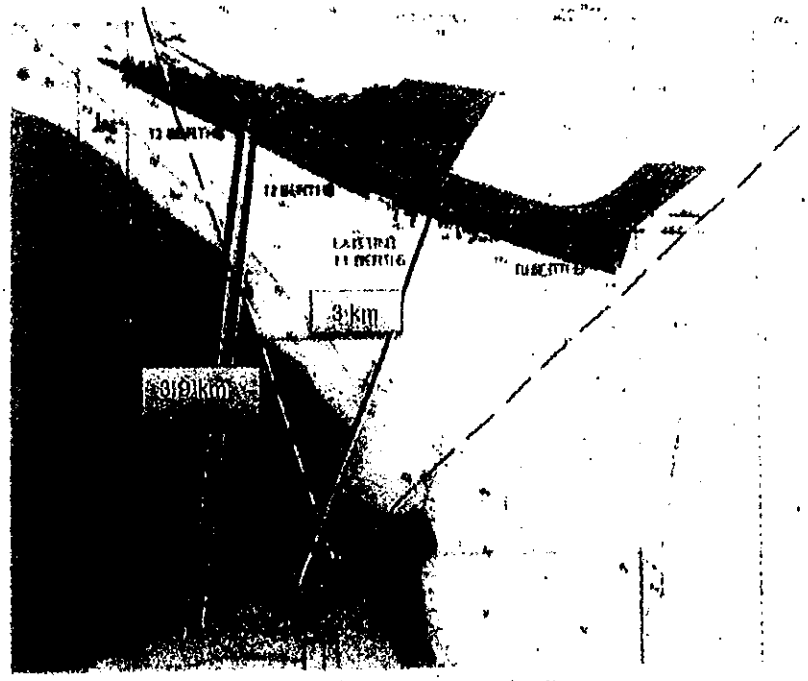

Figure 3: North Queensland Bulk Ports proposed option

Proponents Option 5

This option requires the extension of trestles 1.3 km further than the proponents proposed option. Dredging would only be required for Terminal berth pockets and a maximum volume of 500,000 cubic metres (Figure 4).

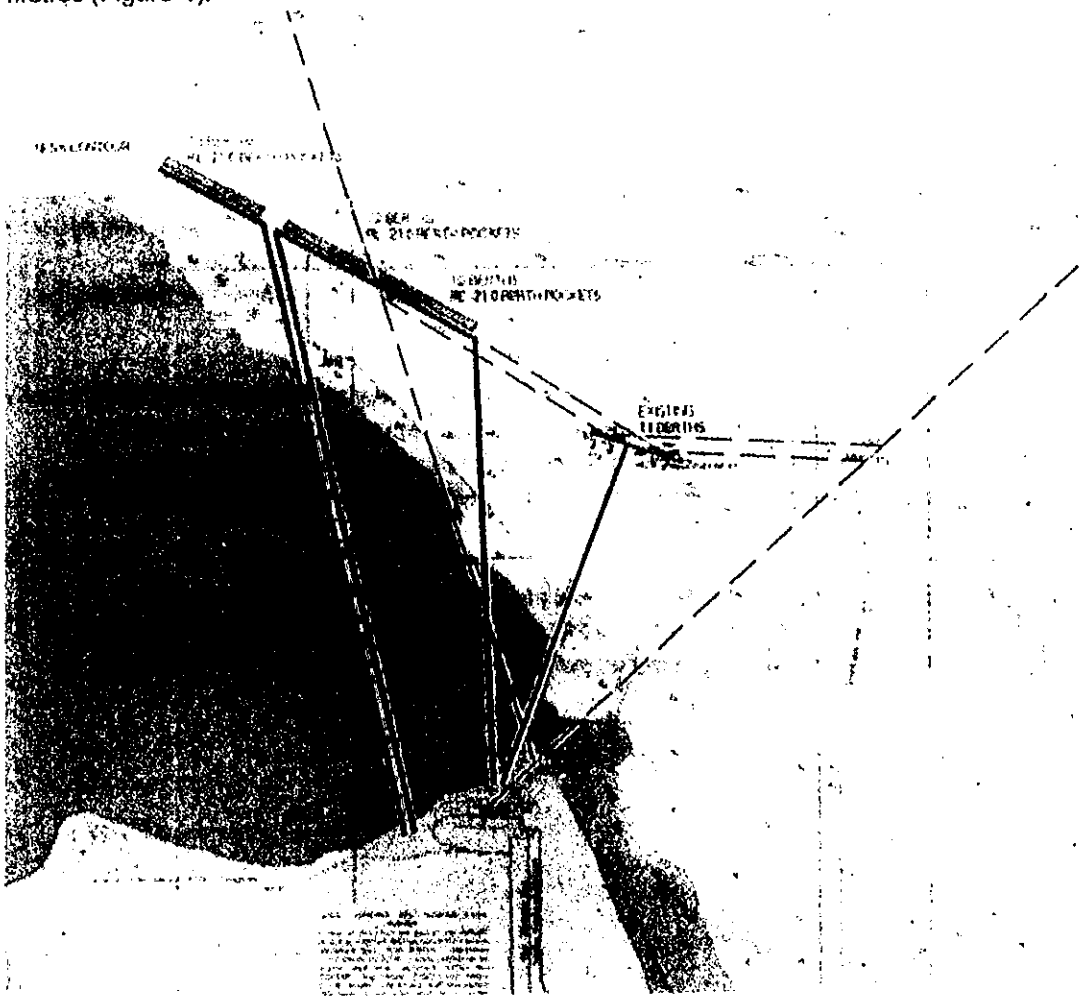

Figure 4: Proponents Option 5

The proponent estimates that option 5 would incur a delay of around 1 - 2 years and cost $430 million more than the proposed option of sea disposal of 3 million cubic metres (which is costed at $30 million)[16].

A detailed breakdown of costs has not been provided. These costs are broad estimates providing an indication of the cost differences.

The proponent has identified the constraints with option 5. They include:

- Port infrastructure located in GBRMP, until boundary could be re-aligned.
- Operational Port Limits would need to be modified so that the port could operate safely.
- Adverse public response and reputational impacts associated with locating coal loading infrastructure within the GBRMP.
- No tenure held and would be required prior to projects proceeding.
- Additional approvals required.
- Additional Native Title requirements.

[16] CDM Smith. 2013. North Queensland Bulk Port Corporation Abbot Point Terminal 0, 2 and 3 Capital Dredging PER Supplementary Report. CDM Smith Brisbane, (Table 5-3 Trestle Option Review, Page 5-27 to 5-30).

- Still requires dredging.

The length of trestles proposed under the proponents Option 5 is similar in length to existing jetties at Lucinda (5.8km long) and preliminary drawings for the proposed Dudgeon Point Coal Terminal (5 to 6 km). In both instances trestle length is a function of available water depth to allow for effective port operations.

Land Disposal Options

A series of land based disposal options were presented in the Supplementary report to the PER[17]. Beneficial reuse of the dredged material as land for development is possible if left for a period of 5 or more years[18]. Clean fill is a valuable resource and as an example, the Abbot Point terminal proponents expect to bring in up to $144 million worth of clean fill for the construction of their terminal areas[19].

Management of a land disposal site is well established practice. A process of self-grading settlement ponds resulting in the ultimate release of managed tail water is standard practice. The proposed dredge material is chemically clean and although potentially acid sulphate soil (PASS), the acid neutralising capacity is higher than the acid generating capacity[20]. Monitoring of PASS may be required and can be treated if detected.

Bunding and lining of settlement and containment ponds is practical and provides adequate management of dredge material and seawater (see Figure 7). The placement of saturated dredge material is unlikely to increase the risk of ground water salination or enter surrounding wetlands if managed properly.

[17] CDM Smith. 2013. North Queensland Bulk Port Corporation Abbot Point Terminal 0, 2 and 3 Capital Dredging PER Supplementary Report. CDM Smith Brisbane, (Section 3.2.2.2Onshore and Reclamation Options, Page 3-4).

[18] CDM Smith. 2013. North Queensland Bulk Port Corporation Abbot Point Terminal 0, 2 and 3 Capital Dredging PER Supplementary Report. CDM Smith Brisbane, (Section 5.2.1.4 Onshore and Reclamation Disposal Options).

[19] GHD. 2012 Abbot Point, Terminal 0, Terminal 2 and Terminal 3 Capital Dredging Public Environment Report (EPBC 2011/6213/GBRMPA G34897.1). GHD Brisbane (Appendix E, Dredged Material Relocation and Reuse Options Assessment, Page 42)

[20] GHD. 2012 Abbot Point, Terminal 0; Terminal 2 and Terminal 3 Capital Dredging Public Environment Report (EPBC 2011/6213/GBRMPA G34897.1). GHD Brisbane (Executive Summary. Page xxii)

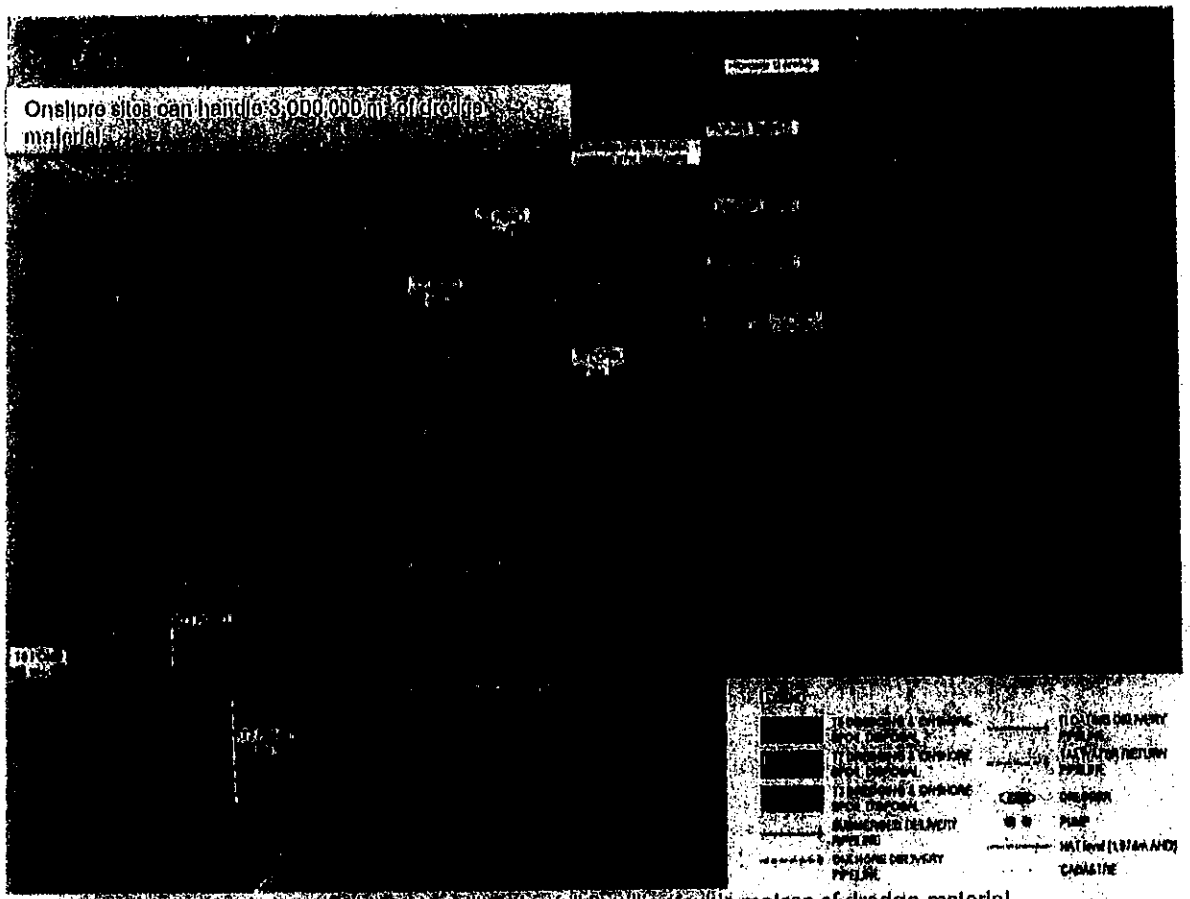

Figure 5: Land disposal site capable of handling the full 3 million cubic metres of dredge material

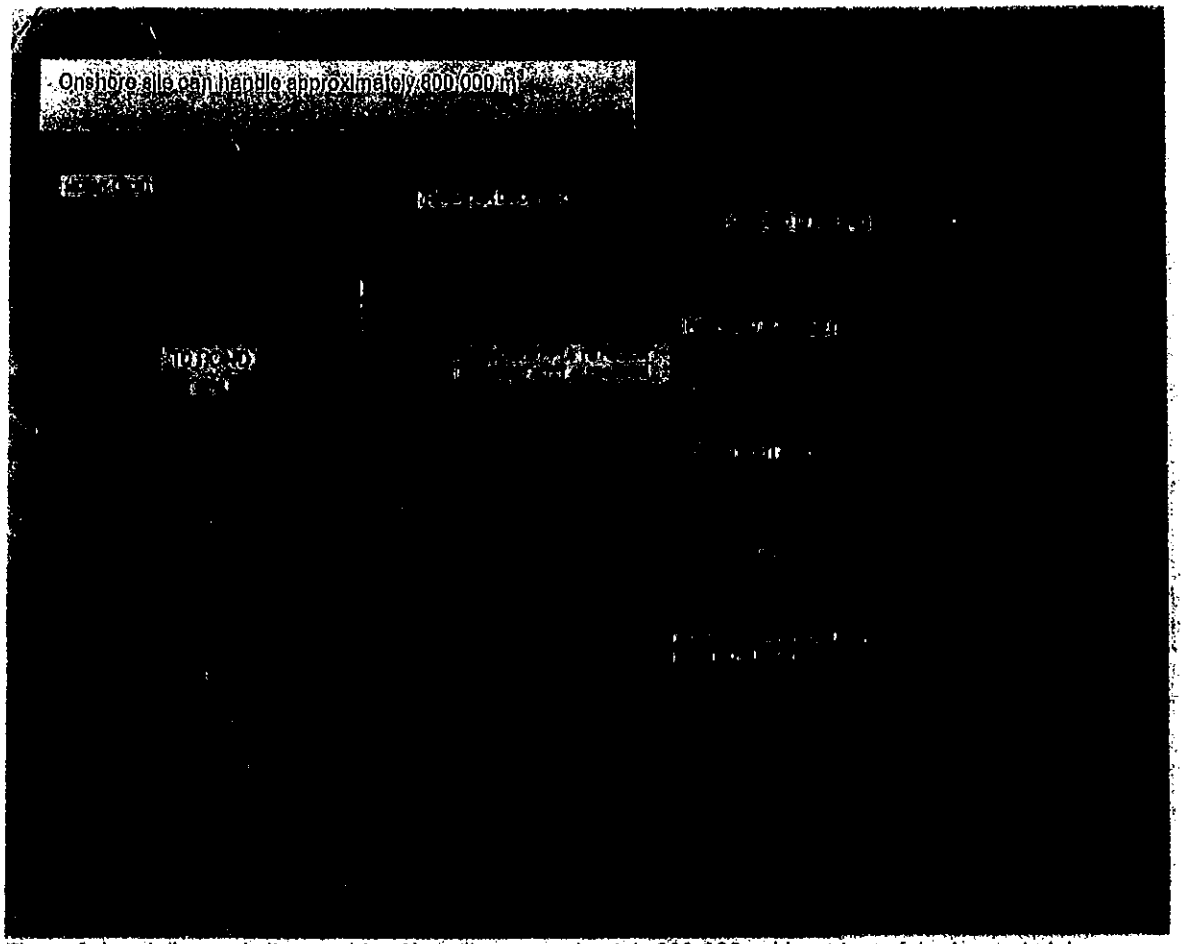

Figure 6: Land disposal site capable of handling approximately 800,000 cubic metres of dredge material


Figure 7: Wiggins Island Coal Export Terminal – Onshore dredge material relocation facility

The Supplementary report to the PER concludes that:[21]

- All trestle extension options are an order of magnitude more expensive than offshore disposal ($30 million compared to a minimum of $400 million). Accordingly these costs are considered to be disproportionate considering the low environmental impact of offshore disposal"
- Most of the onshore disposal options were technically feasible. However the proponents were of the view that there were other environmental risks and the options would cause project delays and significant extra costs.
- Offshore disposal was still considered the preferred and most feasible (from an environment and cost perspective) option by the proponents".

Consideration

- There are several alternatives to the current proposal as identified in the Supplementary PER report that potentially provide more manageable environmental impacts to the Marine Park. These are recognised as being more expensive and technically challenging.

- These options have been eliminated in the PER and Supplementary Report as being *"disproportionate considering the low environmental impact of offshore disposal"*[22].

- The proponent proposes to mitigate potential impacts at the proposed DMRA by investigating a broader area within the Marine Park for a suitable disposal site for 3 million cubic metres of dredge material that will eliminate potential impacts to Holbourne Island, Nares Rock and the wreck of the Catalina. This cannot be assessed under the current Sea Dumping Application.

Summary

- Alternatives to avoid the placement of dredge material offshore within the Marine Park exist but may be unfeasible for the proponent, economically.

- Alternatives come with increased cost and appear to have environmental benefits by avoiding significant potential impacts associated with dredge material disposal at sea.

- Land based disposal options at the Port of Abbot Point are technically feasible but have project timing and cost implications depending on volume of material being placed on land.

- Land disposal of dredge material could possibly be managed more actively than sea disposal, where the only management/mitigation measure employable to reduce ongoing re-suspension is the selection of a potentially retentive disposal site. The GBRWHA in general is a highly dispersive environment and very few areas are considered highly retentive[23].

- There is a strong focus within the PER and Supplementary PER towards monitoring and subsequent management of the proposed conduct rather than the avoidance of impacts.

- Management and monitoring of potential impacts associated with a dredge material disposal campaign is unlikely to provide enough warning for positive avoidance and adaptive management measures for sensitive areas in close proximity to the disposal site (such as the WWII Catalina heritage site).

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[21] CDM Smith. 2013. North Queensland Bulk Port Corporation Abbot Point Terminal 0, 2 and 3 Capital Dredging PER Supplementary Report. CDM Smith Brisbane, (Section 3, Page 3-4 to 3- 5).
[22] CDM Smith. 2013. North Queensland Bulk Port Corporation Abbot Point Terminal 0, 2 and 3 Capital Dredging PER Supplementary Report. CDM Smith Brisbane, (Section 3 Key Issues, Environmental Management and Enhancement for MNES, Page 3-4)
[23] SKM 2013, Improved dredge material management for the Great Barrier Reef Region, Great Barrier Reef Marine Park Authority, Townsville.

- The proponents intends to investigate a new offshore disposal site within a larger investigation Area offshore form the Port of Abbot Point, this is also a requirement of the EPBC Act approval conditions.

- The application under the Sea Dumping Act is only for the proposed DMRA.

Appropriate opportunities exist to re-use the dredge material. These opportunities may be disproportionate in cost. Although more costly than sea dumping, the alternatives may provide better environmental and social outcomes.

- *When considering the high conservation value of the Great Barrier Reef World Heritage Area, the alternative options are likely to produce a better and more manageable environmental outcome than the proposed option by: avoiding impacts by eliminating or the need to place dredge material in the Marine Park; and*
- *The use of the material as construction fill for the current terminal developments (i.e. T0, T2, T3) is considered in the proponents options assessment. Time delays and stabilisation costs are cited as the main reason for not pursuing these options. The disposal of material in a nearby area (not the current port area but within the state development area) is considered as an option (Figure 5).*
- *This material will take 5 or more years to settle, which would then be suitable for future construction purposes*

CHEMICAL, PHYSICAL AND BIOLOGICAL PROPERTIES

7 **A detailed description and characterization of the waste is an essential precondition for the consideration of alternatives and the basis for a decision as to whether a waste may be dumped. If a waste is so poorly characterized that proper assessment cannot be made of its potential impacts on human health and the environment, that waste shall not be dumped.**

8 **Characterization of the wastes and their constituents shall take into account:**
.1 origin, total amount, form and average composition;
.2 properties: physical, chemical, biochemical and biological;
.3 toxicity;
.4 persistence: physical, chemical and biological; and
.5 accumulation and biotransformation in biological materials or sediments.

The material to be dredged is well characterized in the proponents Sampling and Analysis Plan Report. A total of 69 locations within the dredge area footprint were collected and analyzed.

The PER states that the sediment proposed to be disposed is generally made up of a mixture of terrigenous sandy clay, clayey sand or silty clay[24]. Analysis of the physio-chemical properties of the sediment showed that no noteworthy contamination exists and on the basis of 95% Upper Confidence Limits (UCL) for the analysed contaminants, all passed their respective National Assessment Guidelines for Dredging 2009 (NAGD) screening levels[25].

The sediment to be dredged and disposed was found to be Potential Acid Sulphate Soil (PASS), although because the acid neutralising capacity of the sediment is greater than the acid generating potential, no impacts from ASS are expected to occur if the dredged material is disposed onshore or offshore[26].

The particle size distribution associated with the dredge material proposed for disposal within the Marine Park is shown in Table 4, It can be assumed that on average approximately 39 per cent of the dredged sediment (i.e. the silt and clay fraction) contains fine sediments. On average the material proposed to be dredged contains 54 per cent sand. Clay content generally increased with depth and from overall visual observations natural residual geological material is present at depths of 0.5 to 1m below the sea floor.[27]

[24] GHD. 2012 Abbot Point, Terminal 0, Terminal 2 and Terminal 3 Capital Dredging Public Environment Report (EPBC 2011/6213/GBRMPA G34897.1). pg 3-37
[25] GHD. 2012 Abbot Point, Terminal 0, Terminal 2 and Terminal 3 Capital Dredging Public Environment Report (EPBC 2011/6213/GBRMPA G34897.1). GHD Brisbane (Chapter 3 Environmental Values, Potential Impacts and Mitigation Summary)
[26] GHD. 2012 Abbot Point, Terminal 0, Terminal 2 and Terminal 3 Capital Dredging Public Environment Report (EPBC 2011/6213/GBRMPA G34897.1). GHD Brisbane (Chapter 3 Environmental Values, Potential Impacts and Mitigation Summary)
[27] GHD. 2012 Abbot Point, Terminal 0, Terminal 2 and Terminal 3 Capital Dredging Public Environment Report (EPBC 2011/6213/GBRMPA G34897.1). GHD Brisbane pg 3-37

Table 4: Statistical Summary of Sediment Particle Size Distribution Results

Table 3-6 Statistical Summary of Sediment Particle Size Distribution Results for Dredge Area

Particle Size		PSD (%) Dredge Area	PSD (%) using Seawater Dredge Area	PSD (%) Relocation Area
Cobbles (>6 cm)	Minimum	0	0	0
	Maximum	0	0	0
	Average	0	0	0
	Standard Deviation	0	0	0
Gravel (>2 mm)	Minimum	1	2	0
	Maximum	36	21	5
	Average	7.7	5.2	0.5
	Standard Deviation	5.4	4.2	1.4
Sand (0.06 mm - 2.00 mm)	Minimum	26	31	7
	Maximum	83	83	26
	Average	54	52	12.6
	Standard Deviation	11	10	5.4
Silt (2.00 µm - 60 µm)	Minimum	2	15	34
	Maximum	47	66	59
	Average	19	43	50.5
	Standard Deviation	8.2	9.6	6.5
Clay (<2 µm)	Minimum	7	<1	29
	Maximum	41	<1	40
	Average	20	<1	36.5
	Standard Deviation	5.4	0	2.9

DUMP-SITE SELECTION

11 **Information required to select a dump-site shall include:**

.1 physical, chemical and biological characteristics of the water-column and the seabed;
.2 location of amenities, values and other uses of the sea in the area under consideration;
.3 assessment of the constituent fluxes associated with dumping in relation to existing fluxes of substances in the marine environment; and
.4 economic and operational feasibility.

The proposed DMRA is in close proximity to known values of the Great Barrier Reef Marine Park such as Conservation Park Zones, Habitat Protection Zone and a heritage site. There is a high probability that an alternate dump site will have better environmental, social and heritage outcomes.

The PER and the Supplementary Report to the PER assesses the environmental values at Abbot Point and the proposed disposal site including a desktop assessment of relevant literature and field based studies between 2008 and 2012. Survey techniques included video transects, macroinvertebrate grabs, megafauna observation transects and benthic sled and free diver visual surveys[28]. Sample locations were in most cases limited to port limits although some benthic grabs and video transects were taken over a larger area (Figure 8 samples within port limits, Figure 9 samples over large area).

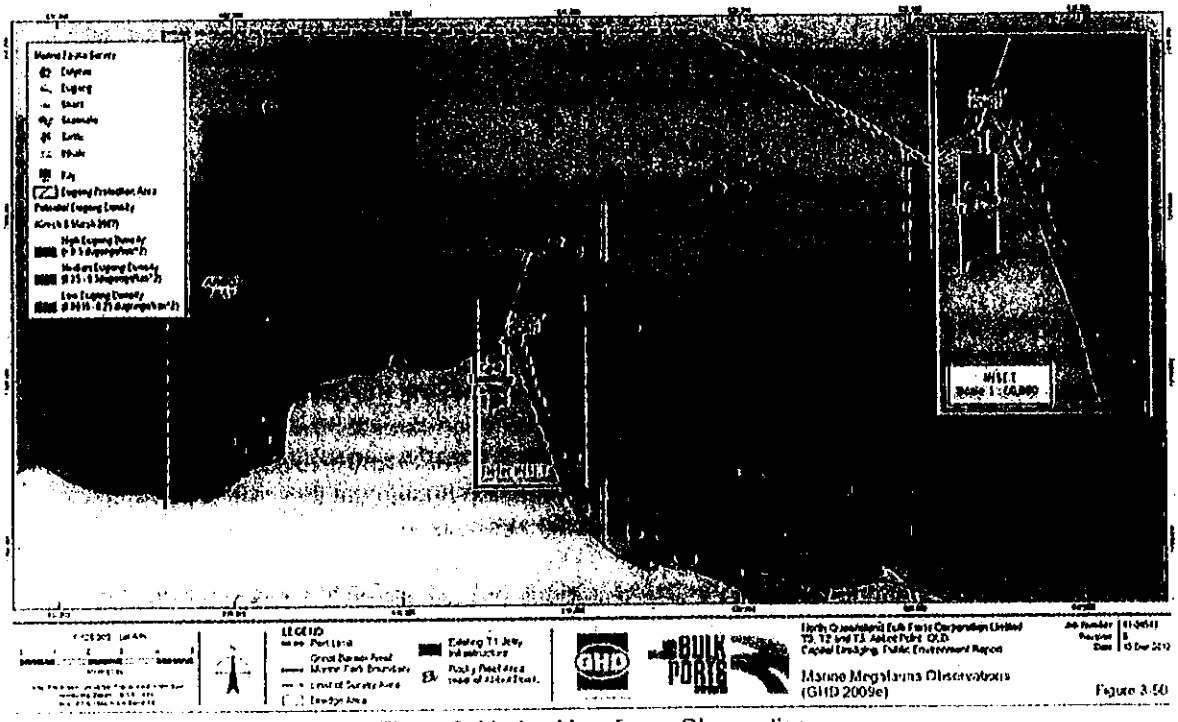

Figure 8: Marine Megafauna Observations

[28] GHD. 2012 Abbot Point, Terminal 0, Terminal 2 and Terminal 3 Capital Dredging Public Environment Report (EPBC 2011/6213/GBRMPA G34897.1). GHD Brisbane (page 3-83 to 3-91)

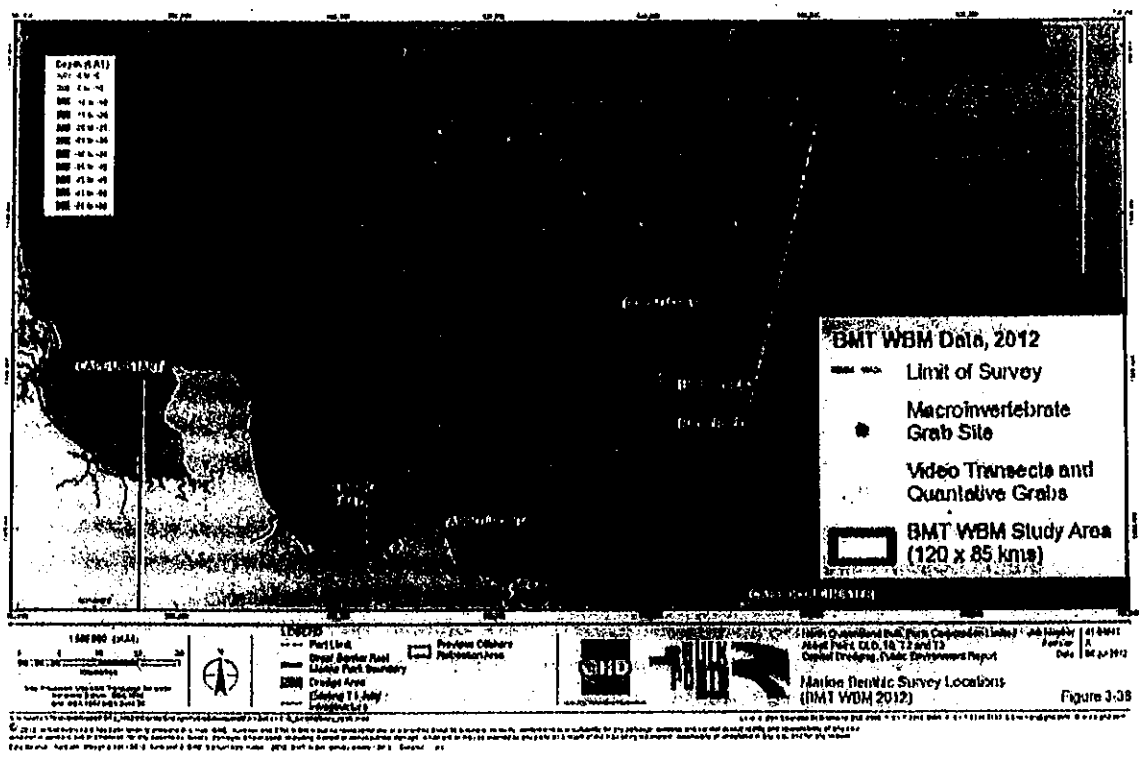

Figure 9: Benthos Survey Locations

The proponent describes the environment at and nearby the proposed DMRA as not containing natural heritage attributes at a scale or value of consequence to the World Heritage Area (WHA) as a whole[29].

The PER notes that the sediment found at the DMRA is slightly different than the dredge area and has finer sediments than the area to be dredged[30]. This may indicated that the proposed DMRA is more retentive than the dredge area.

No monitoring or investigation of water quality has been undertaken at the DMRA by the proponent (most of the water quality monitoring was focussed around the dredge site and immediate surrounds). There is some historical data available[31] for mid shelf water quality in the general area of the DMRA. This data has been used in this assessment as a high level guide to what may be expected at the DMRA. On average TSS annual means are slightly above GBRMPA water quality guidelines. Nutrient parameters are also above guidelines. Water quality is variable throughout the year with the highest turbidity and nutrient concentrations occurring during the wet season.

Users of the Marine Park in and around the DMRA include but are not limited to commercial fishing operators, recreational fishers, tourists (for example scuba divers diving the nearby Catalina dive wreck (WWII aircraft)) and Traditional Owners.

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[29] CDM Smith. 2013. North Queensland Bulk Port Corporation Abbot Point Terminal 0, 2 and 3 Capital Dredging PER Supplementary Report. CDM Smith Brisbane, (Section 3 Key Issues, Environmental Management and Enhancement for MNES)

[30] GHD. 2012 Abbot Point, Terminal 0, Terminal 2 and Terminal 3 Capital Dredging Public Environment Report (EPBC 2011/6213/GBRMPA G34897.1). GHD Brisbane (Executive Summary, page xxiii)

[31] Data derived from De'ath and Fabricius (2008) Water Quality of the Great Barrier Reef: Distributions, Effects on Reef Biota and Trigger Values for the protection of ecosystem health. Research Publication No. 89

The PER states that no marine flora was observed within the proposed DMRA and areas adjacent to and within the DMRA are made up of patches of macroinvertebrates comprised mostly of mud scallops, with occasional hermit crabs, gastropods, polychaetes and crinoids[32].

The PER also reports that no corals have been located at the DMRA[33]. The closest coral reefs to the proposed DMRA are fringing reefs at Holbourne Island and Nares Rock (5-7 km NE) and Camp Island (40km W).

Holbourne Island is a National Park with no camping allowed, and the GBRMPA has afforded the waters adjacent to the island a level of protection by designating it a Conservation Park Zone. It is considered to be the northern most island of the Whitsundays Island Group.

There is very little information available on the coral communities at Nares Rock, the location is designated as a Habitat Protection Zone. During meetings with fishers it has become apparent that both Holbourne Island and Nares Rock are important to both recreational and commercial fishers and particularly important for targeting demersal and pelagic fish.

Reef Health and Impact Surveys (RHIS) (used to inform the Reef Health Incident Response System) have been undertaken at both Holbourne Island and Camp Island Reefs. Surveys at Camp Island reef found up to 45% live coral cover in some locations in 2012, while surveys at Holbourne Island found 0% live coral cover[34]. Surveys identified large amounts of coral rubble (up to 74%) and live coral rock (up to 40%) in 2010. The lack of coral could also correlate with Cyclone Hamish which passed through the region as a Category 5 cyclone in March 2009.

A combined site inspection which included members of GBRMPA, Department of the Environment, local stakeholders and port proponent (Adani) was conducted in July 2013 to further understand the environment around the proposed conduct. Attendees conducted some informal (i.e. not structured or repeatable) reef surveys of Holbourne Island. The surveys indicated a relatively healthy coral cover with mean cover of 21% live coral cover, 17% live rock, 41% coral rubble and 21% sand.

The environment at and in proximity to the proposed DMRA contains examples of both Strong Tidal Inner Mid Shelf Reefs (RE4) and Non-reef mid shelf lagoon (NB7) bioregions. Camp Island (within nearby Abbot Bay) is the northern most example of its bioregion (RE4 Coastal Southern Reefs). Bioregions are important as they describe and distinguish the biological and physical diversity of the GBR. Bioregions also helped to inform the zoning of the Marine Park.

The RE4- Coastal Southern Reefs bioregion is characterised by moderate tidal ranges, moderate to high turbidity. Broad Sound mouth and Proserpine River influence on water quality. Varying exposure levels within the region, fairly high habitat diversity. Biologically distinct.

The Mid shelf lagoon bioregion is characterised by Muds dominate, minimal algae or seagrass. Leeward parts of Hook and Bait Reefs are geomorphologically different. Very steep, extensive benthos, gravel, low sponge diversity but only 21% of species are similar to those in southern lagoonal reefs. Mobile sand dunes influenced by strong East Australian Current.

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[32] GHD. 2012 Abbot Point, Terminal 0, Terminal 2 and Terminal 3 Capital Dredging Public Environment Report (EPBC 2011/6213/GBRMPA G34897.1). GHD Brisbane (Executive Summary, page xxiv)

[33] GHD. 2012 Abbot Point, Terminal 0, Terminal 2 and Terminal 3 Capital Dredging Public Environment Report (EPBC 2011/6213/GBRMPA G34897.1). GHD Brisbane (Chapter 3 Environmental Values, Potential Impacts and Mitigation)

[34] The lack of coral found at Holbourne Island more than likely represents the locations surveyed rather than the health of the reef, as surveys were taken on the non-reef side of the island.

Commercial fishers in the area participate in more than one fishery with the three key fisheries being East Coast Trawl Fishery, East Coast Inshore Finfish Fishery and the Coral Reef Finfish Fishery[35]. The peak period of activity for the commercial line fishery is September to November, while for the net fishery it is June through September[36]. The net fishery slightly overlaps with the dredge window permitted by the EPBC conditions (1 March to 30 June).

Nares Rock and Holbourne Island are important for both recreational and commercial fishers, and in particular the importance of the location for targeting demersal and pelagic fish[37]. Increased turbidity can affect coral reef fish[38]. Increased turbidity has been shown to impair habitat choice and foraging success[39]. Other evidence of impacts due to increased sedimentation and turbidity shows that there can be an impact to predator-prey interactions.

Consideration

- Coral cover in the broader Great Barrier Reef has declined significantly over the last 25 to 30 years and evidence suggests that fish stocks are currently under stress[40]. Inshore mega fauna such as dolphin and dugong populations are substantially smaller than 50 years ago and recent extreme weather events have exacerbated this and other risks to their population status[41].
- The majority of information characterising the existing environment in the proponent's PER is derived from studies within close proximity to the Port of Abbot Point, and within the proposed DMRA.
- Sediment characteristics at the proposed DMRA should be largely the same as the material to be dredged. In this case the material to be dredged is coarser in composition to the area where the material will be disposed. Changes to sediment composition could result in changed benthic communities at the DMRA post disposal (i.e. coarse sediments would result in colonisation by different organisms when compared to the colonisation of fine silts).
- Water quality data is lacking for the DMRA and further monitoring and data analysis is needed to accurately determine the existing state of water quality in the area. Historical data for the region indicates that the water quality is on average better than the nearby inshore areas.
- Commercial fishers in the area participate in more than one fishery with the three predominant fisheries being, East Coast Trawl Fishery, East Coast Inshore Finfish Fishery and the Coral Reef Finfish Fishery.
- Nares Rock and Holbourne Island are important for both recreational and commercial fishers, and in particular the importance of the location for targeting demersal and pelagic fish.

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[35] CDM Smith. 2013. North Queensland Bulk Port Corporation Abbot Point Terminal 0, 2 and 3 Capital Dredging PER Supplementary Report. CDM Smith Brisbane (Appendix E, Page 5-6)
[36] CDM Smith. 2013. North Queensland Bulk Port Corporation Abbot Point Terminal 0, 2 and 3 Capital Dredging PER Supplementary Report. CDM Smith Brisbane (Appendix E, Page 5-6)
[37] CDM Smith. 2013. North Queensland Bulk Port Corporation Abbot Point Terminal 0, 2 and 3 Capital Dredging PER Supplementary Report. CDM Smith Brisbane (Appendix E, Page 28)
[38] Amelia S. Wenger, Mark I. McCormick, Determining trigger values of suspended sediment for behavioral changes in a coral reef fish, Marine Pollution Bulletin, Volume 70, Issues 1–2, 15 May 2013, Pages 73-80
[39] Amelia S. Wenger, Mark I. McCormick, Determining trigger values of suspended sediment for behavioral changes in a coral reef fish, Marine Pollution Bulletin, Volume 70, Issues 1–2, 15 May 2013, Pages 73-80
[40] De'ath, G., Fabricius, K.E., Sweatman, H. and M. Puotinen. 2012. The 27–year decline of coral cover on the Great Barrier Reef and its causes. Proceedings of the National Academy of Sciences. 109(44): 17995-17999.
[41] Brodie, J., McCulloch, M., Coles, R., Mumby, P., Fernandes, L., Pandolfi, J., Hoegh-Guldberg, O., Possingham, H., Marsh, H. and Richmond, B. 2013. Declaration by concerned scientists on industrial development of the Great Barrier Reef coast.

- The WWII plane wreck (the Catalina) is approximately 3 kilometres to the south of the proposed DMRA[42].
- The commercial fishing industry and the dependent industries (i.e. seafood retailers) are the industry most likely to be impacted by the disposal of dredge material at the DMRA. The proponent acknowledges that the fishery is locally important[43].
- Additional water quality sampling and analysis is required before any commencement of the activity. Use of inshore data (as per the PER) could lead to over-estimation of water quality parameters which could mask any water quality impacts caused by the action during monitoring activities.

[42] CDM Smith. 2013. North Queensland Bulk Port Corporation Abbot Point Terminal 0, 2 and 3 Capital Dredging PER Supplementary Report. CDM Smith Brisbane. Pg 2-5

[43] CDM Smith. 2013. North Queensland Bulk Port Corporation Abbot Point Terminal 0, 2 and 3 Capital Dredging PER Supplementary Report. CDM Smith Brisbane (2-10)

ASSESSMENT OF POTENTIAL EFFECTS

12 Assessment of potential effects should lead to a concise statement of the expected consequences of the sea or land disposal options, ie, the "Impact Hypothesis". It provides a basis for deciding whether to approve or reject the proposed disposal option and for defining environmental monitoring requirements.

13 The assessment for dumping should integrate information on waste characteristics, conditions at the proposed dump-site(s), fluxes, and proposed disposal techniques and specify the potential effects on human health, living resources, amenities and other legitimate uses of the sea. It should define the nature, temporal and spatial scales and duration of expected impacts based on reasonably conservative assumptions.

14 An analysis of each disposal option should be considered in the light of a comparative assessment of the following concerns: human health risks, environmental costs, hazards (including accidents), economics and exclusion of future uses. If this assessment reveals that adequate information is not available to determine the likely effects of the proposed disposal option then this option should not be considered further. In addition, if the interpretation of the comparative assessment shows the dumping option to be less preferable, a permit for dumping should not be given.

15 Each assessment should conclude with a statement supporting a decision to issue or refuse a permit for dumping.

The Sea Dumping application provided a chapter on impact hypothesis consistent with paragraph 12 of Annex 2 of the London Protocol. The impacts were divided into potential physical impacts and biological impacts. The predicted impacts, according to the proponent's Sea Dumping application include:

- A maximum increase in bed thickness at the relocation area of less than 800mm.
- As the material to be disposed is slightly different to the area where it will be disposed the action has the potential to affect the habitat structure at the disposal site. The proponent's assessment concludes that benthic assemblages at Abbot Point are able to recover from burial impacts and that impacts would be temporary.
- Water quality is not expected to be impacted by heavy metals and metalloids.
- Sediment plumes will be generated as a result of material placement.
- Potential impacts to marine megafauna due to vessel movements and noise. The risk is considered low due to the low speed of the dredger and the relatively short duration of the dredge campaign.

According to the London Protocol and in order to assess potential effects, a comparative assessment of human health risks, environmental costs, hazards (including accidents), economics and exclusion of future uses, is to be analysed for each disposal option.

The multi-criteria analysis was conducted based on the workshop held on 27 and 28 March 2012. Ports associated stakeholders and management agency representatives attended the workshop. The multi-criteria analysis factors are ordered differently to those recommended in the London protocol in relation to the comparative assessment. There is one area in the analysis presented in the Sea Dumping application that has not been addressed and that relates to "economics and exclusion of future uses". Although the multi-criteria analysis included "capacity of future use and project expansion", it only considered this from the ports future dredging and disposal capacity not in terms of commercial fishing or tourism activities. Social "community" does include the potential impacts on community which considers commercial fishing but in the light of impacts on property, competition, use of infrastructure, impacts on community livelihood, and residential amenity.

One of the tools used in Environmental Impact Assessment to predict the extent and risk to sensitive areas and receptors from a dredging and disposal activity is the use of hydrodynamic/sediment plume modelling. The outputs of the model are entirely dependent on the quality and accuracy of the inputs. If inputs are inaccurate or incomplete, there will be considerable uncertainty associated with the outputs.

Predictive modelling used by the proponents for the PER, contains uncertainties regarding the quality and outputs of the model. Therefore the likelihood and consequences of predicted impacts are difficult to assess and there is considerable uncertainty. In particular the modelling to support the proponent's conclusion that the disposal of dredge material will not impact other GBRMPA zones is deficient and shows that the spatial extent of the impact will be larger than the model domain, but the total extent of impacts is undefined.

The proposed conduct at both the dredging location and the DMRA has the potential to impact on the environment and on the social, cultural and heritage values of the World Heritage Area.

Dredging operations can roughly be categorised into a number of different phases all of which will have their own impacts and challenges. These phases are:

1. dislodging of the *in-situ* material;
2. raising the dredge material to the surface;
3. horizontal transport; and
4. disposal or further treatment.

Under the Sea Dumping Act, loading for the purposes of dumping is to be considered. For this reason, the impacts of dredging will be considered in the context of what happens to the material once it is 'loaded'. That is, the overflow of that material and the resuspension of that material and other loading associated impacts. Any overflow of excess water causes further sediments to enter the water column thus increasing the turbidity in the area. During the third phase of dredging sediments can escape from damaged or poorly closing bottom doors of hoppers.

The exact amount of suspended sediments released during each phase of dredging is not exactly known. What is known is that when operating in overflow mode, the dredger ship will lose roughly 4%[44] of the dredged material in the turbid water released through the overflow. This material (120,000 cubic metres from overflow) will create a turbid plume that can smother benthic communities and cause declines in water quality in at least 410 km^2 surrounding the dredged area.
The sediment will then be available for resuspension and the extent of the water quality and benthic community effects will be increased over scale and time as the sediment migrates until it consolidates.

Potential impacts include:

- A decline in water quality at and around the dredging and disposal locations - including, increased total suspended solids concentration, increased sedimentation rates and release of nutrients as a result of the disposal and re-suspension of the overflowed and dumped dredge material.
- It is possible that within the period of proposed works, another La Niña event may eventuate, adding to the cumulative water quality stressors at the DMRA potentially contributing to the water quality stressors associated with dredge material disposal. El Niño and La Niña occur on average every 3 to 5 years. La Niña typically brings wetter conditions for Australia with

[44] CDM Smith. 2013. Technical Note: Comparison of Material Available for Re-suspension from Dredging and Catchment Based Sources at Abbot Point. CDM Smith, Brisbane

cooler days, warmer nights and increased tropical cyclone activity. The 2010-11 La Niña broke rainfall records, resulted in flooding and cyclones to the GBR (BOM website).

- Direct and indirect impacts on benthic habitats (including seagrasses and corals) as a result of dredging, dredge material disposal and ongoing re-suspension of dredged material is expected.
- Direct and indirect impacts on mobile marine fauna.
- Interactions with mega-fauna from the transportation of dredge material to the disposal site by the dredging and associated work vessels.
- Impacts to the social values of local communities whose livelihood and reef dependant activities such as commercial fishing may be affected from the dredging and disposal activity.
- Impacts to cultural and heritage values of the Great Barrier Reef World Heritage Values including Indigenous and non-indigenous values.

These potential impacts are discussed in detail below.

WATER QUALITY

Suspended Solids

The proponent's water quality monitoring was focussed on the dredge site and immediate surrounds. There is therefore no water quality information provided for the mid-shelf area around the DMRA. Total suspended solids concentrations are not known with any certainty for the DMRA, however historical data can be used to assume, for the purposes of this assessment, that the TSS and turbidity at the DMRA is better than that at the inshore dredge area.

Mid shelf TSS in the region ranges between 0 and 30mg/l and records a mean of 2.2mg/l which is only slightly above GBRMPA water quality guideline value of 2mg/l. Dredging will generate a dredging plume increasing TSS concentrations which are likely to impact on water quality and benthic communities in the GBRWHA.

The footprint of geographical area which may be impacted at levels between 5-10mg/l in a 95 percentile "worst case" scenario by the dredging activity has the dredging plume extending into the Great Barrier Reef Marine Park and reacting the Marine National Park Zone and Conservation Park Zone of Upstart Bay (Figure 10) some 30 km north west.

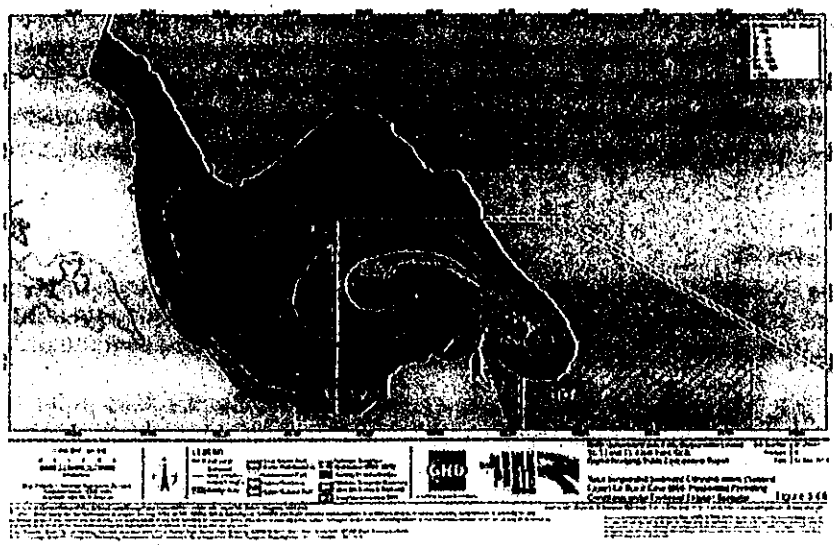

Figure 10: 95th percentile plume predicted associated with the dredging activity

The current water quality of Abbot Bay is described in the report: Abbot Point Cumulative Impact Assessment Technical Report Marine Water Quality Final (2012) GHD as follows:

"A number of parameters recorded results outside when comparing the relevant comparative statistic to the ANZECC and GBRMP/QWQ guidelines".

This includes:

- TSS means during wet and dry seasons are above the GBRMP/QWQ guideline value of 2 mg/L.
- Total Phosphorus site medians above ANZECC guidelines value of 0.015 mg/l and GBRMP/QWQ guideline values of 0.02 mg/L.
- All Total Nitrogen site medians above ANZECC guideline value of 0.1 mg/L and the GBRMP/QWQ guideline of 0.14 mg/L[45].
- Chlorophyll *a* has a concentration of 3.78 ug/L in wet season and 1.04 ug/L dry season compared to ANZECC and GBRMPA guidelines values of 1.4 and 0.45 ug/L respectively.

The guideline values of most importance to the Marine Park are the GBRMPA water quality guidelines as they are in place specifically to protect inshore coral reef ecosystems[46] (Table 5).

[45] GHD. 2012. Abbot Point Cumulative Impact Assessment Technical Report Marine Water Quality Final. GHD: Brisbane

[46] GHD. 2012. Abbot Point Cumulative Impact Assessment Technical Report Marine Water Quality Final. GHD: Brisbane

Table 5: Comparison of water quality parameters against guideline trigger values

Abbot Bay Water Quality	GBRMP Water Quality Guidelines	ANZECC Water Quality Guidelines	Wet season average at Abbot Bay[47]	Dry season average at Abbot Bay[48]
Total Suspended Solids (TSS) (mg/l)	20	N/A	10.7 - 30.2	16 - 20.3
Turbidity (NTU)	1 - 5	1-20	2.35 - 2.719	1.35 - 1.5
Total Nitrogen (µg/l)	0.14	0.1	0.335 - 0.934	0.128 - 0.998
Total Phosphorus (mg/l)	0.02	0.0016	0.004 - 0.249	0.146 - 0.8
Chlorophyll a (µg/l)	0.45 - 1.5	0.07 - 1.4	3.748	1.04

Abbot Bay's water quality is influenced by run off from the Don River Catchment which covers an area of 3695 km^2 and the Burdekin River catchment which covers an area of 130,126 km^2[49]. Approximately 92% of the Don River catchment has been cleared, predominantly for agricultural use and around 73% of the Burdekin catchment has been cleared for grazing. Nutrient export from both catchments is classified as medium to high risk to the values of the Marine Park and collectively, the catchments contribute 4293 k tonnes/yr of Total Suspended Solids (TSS) into the Marine Park, of which approximately 70% is fine sediment[50].

The PER states that turbidity in Abbot Bay is seasonally variant and in general, turbidity is lower in the dry season (May to October) and higher in the wet season (November to April)[51]. Spatially turbidity in the bay is higher in shallow more energetic environments and lower in deeper offshore sites[52,53]. TSS are generally seasonally variant and related to wind, wave and terrigenous river sediment input. TSS in Abbot Bay is elevated year round and found to be above the relevant GBRMP/QWQ guidelines[54].

In Abbot Bay, ambient levels of nutrients during both wet and dry season in the water column exceed the ANZECC and GBRMP/QWQ guideline values[55]. The PER indicates that there is a seasonal

[47] GHD. 2012. Abbot Point Cumulative Impact Assessment Technical Report Marine Water Quality Final. GHD: Brisbane
[48] GHD. 2012. Abbot Point Cumulative Impact Assessment Technical Report Marine Water Quality Final. GHD: Brisbane
[49] State of Queensland. 2013. Second Report Card 2010, Reef Water Quality Protection Plan. State of Queensland, Brisbane
[50] State of Queensland. 2013. Second Report Card 2010, Reef Water Quality Protection Plan. State of Queensland, Brisbane
[51] GHD. 2012 Abbot Point, Terminal 0, Terminal 2 and Terminal 3 Capital Dredging Public Environment Report (EPBC 2011/6213/GBRMPA G34897.1). GHD Brisbane (Chapter 3 Environmental Values, Potential Impacts and Mitigation Summary)
[52] GHD. 2012 Abbot Point, Terminal 0, Terminal 2 and Terminal 3 Capital Dredging Public Environment Report (EPBC 2011/6213/GBRMPA G34897.1). GHD Brisbane (Chapter 3 Environmental Values, Potential Impacts and Mitigation Summary)
[53] GHD. 2012. Abbot Point Cumulative Impact Assessment Technical Report Marine Water Quality Final. GHD: Brisbane
[54] GHD. 2012. Abbot Point Cumulative Impact Assessment Technical Report Marine Water Quality Final. GHD: Brisbane
[55] GHD. 2012. Abbot Point Cumulative Impact Assessment Technical Report Marine Water Quality Final. GHD: Brisbane

variability, and that the nutrient levels in the water remain above relevant guidelines all year round[56]. All Total Nitrogen site median values are above the ANZECC guideline value of 0.1 mg/L and the GBRMP/QWQ guideline of 0.14 mg/L. All but one (which is below GBRMP/QWQ but above ANZECC) median Total Phosphorus values exceed the ANZECC guideline value of 0.015 mg/L and the GBRMP/QWQ guideline of 0.02 mg/L[57].

The PER states that the sediment proposed to be disposed is generally made up of a mixture of terrigenous sandy clay, clayey sand or silty clay[58]. Analysis of the physio-chemical properties of the sediment showed that no noteworthy contamination exists and on the basis of 95% Upper Confidence Limits (UCL) for the analysed contaminants, all passed their respective National Assessment Guidelines for Dredging 2009 (NAGD) screening levels[59].

The sediment to be dredged and disposed was found to be Potential Acid Sulphate Soil (PASS), although because the acid neutralising capacity of the sediment is greater than the acid generating potential, no impacts from acid sulphate soils are expected to occur if the dredged material is disposed onshore or offshore[60].

The particle size distribution associated with the dredge material proposed for disposal within the Marine Park is shown in Table 4. Approximately 39 per cent of the dredged sediment (i.e. the silt and clay fraction less that 60 microns) contains fine sediments. On average the material proposed to be dredged contains 54 per cent sand. Clay content generally increased with depth and from overall visual observations natural residual geological material is present at depths of 0.5 to 1m below the sea floor.[61]

Predictive modelling of the increases in TSS concentrations as a result of dredging and disposal was undertaken by the proponent in order to predict potential impacts. The modelling system used was a three dimensional model and a range of hydrodynamic, wave and sediment transport modules. The resulting models interact dynamically to represent the combined effects of tide wind and waves of the transport of sediments. Model outputs are represented as both 50th (average) and 95th (worst-case) percentile plumes modelled under prevailing conditions. The model was initially run for 6 weeks between July and August 2007 for an expected 10 week proposed dredge and disposal campaign. In addition the months of September to November 2003 were simulated in an alternative wave and climate scenario[62]. The modellers chose to run the model under 2007 conditions which they acknowledge are conservatively mild conditions[63]. The proponent considers the outputs modelled during 2007 (95th percentile outputs) to represent a worst case plume scenario. However, modelling under more energetic conditions (such as 2011) could potentially generate larger plumes that move

[56] GHD. 2012 Abbot Point, Terminal 0, Terminal 2 and Terminal 3 Capital Dredging Public Environment Report (EPBC 2011/6213/GBRMPA G34897.1). GHD Brisbane (Chapter 3 Environmental Values, Potential Impacts and Mitigation Summary)
[57] GHD. 2012. Abbot Point Cumulative Impact Assessment Technical Report Marine Water Quality Final. GHD: Brisbane
[58] GHD. 2012 Abbot Point, Terminal 0, Terminal 2 and Terminal 3 Capital Dredging Public Environment Report (EPBC 2011/6213/GBRMPA G34897.1). pg 3-37
[59] GHD. 2012 Abbot Point, Terminal 0, Terminal 2 and Terminal 3 Capital Dredging Public Environment Report (EPBC 2011/6213/GBRMPA G34897.1). GHD Brisbane (Chapter 3 Environmental Values, Potential Impacts and Mitigation Summary)
[60] GHD. 2012 Abbot Point, Terminal 0, Terminal 2 and Terminal 3 Capital Dredging Public Environment Report (EPBC 2011/6213/GBRMPA G34897.1). GHD Brisbane (Chapter 3 Environmental Values, Potential Impacts and Mitigation Summary)
[61] GHD. 2012 Abbot Point, Terminal 0, Terminal 2 and Terminal 3 Capital Dredging Public Environment Report (EPBC 2011/6213/GBRMPA G34897.1). GHD Brisbane pg 3-37
[62] GHD. 2012 Abbot Point, Terminal 0, Terminal 2 and Terminal 3 Capital Dredging Public Environment Report (EPBC 2011/6213/GBRMPA G34897.1). Appendix H1, pg xvi -xvii
[63] GHD. 2012 Abbot Point, Terminal 0, Terminal 2 and Terminal 3 Capital Dredging Public Environment Report (EPBC 2011/6213/GBRMPA G34897.1). GHD Brisbane (Chapter 3 Environmental Values, Potential Impacts and Mitigation Summary)

greater distances.

Figure 11 shows the 95th percentile model outputs for total sediment concentrations as "above background" for the proposed DMRA modelled under July to August 2007[64] conditions.
The modelling indicates no visible plume at Holbourne Island. Nares Rock, which is not shown on the map, is predicted to be impacted by increased TSS (up to 25mg/l) (and therefore sediment).This may lead to stress and impacts on corals such as production of mucus and tissue necrosis, as well as algal symbionts being affected by increased light attenuation[65].

It is noteworthy that the cumulative effects of both the dredging and disposal plumes are not full assessed in the PER or supplementary PER. In an alternate weather scenario, dredging plumes may also reach Nares Rock and Holbourne Island and possibly the Catalina wreck in low concentrations[66].

Water quality around the proposed action is expected to experience increased turbidity and suspended sediments from the direct action of dredge material disposal and through subsequent re-suspension of dredge material. The worst case plume provided in the PER (Figure 11) predicts the plume to move predominantly in a NW/SE direction extending out 20 km to the NW and approximately 8 km to the SE. The information provided by the proponent may potentially underestimate the footprint of water quality declines and the extent of potential impacts due to the parameters used within the model.

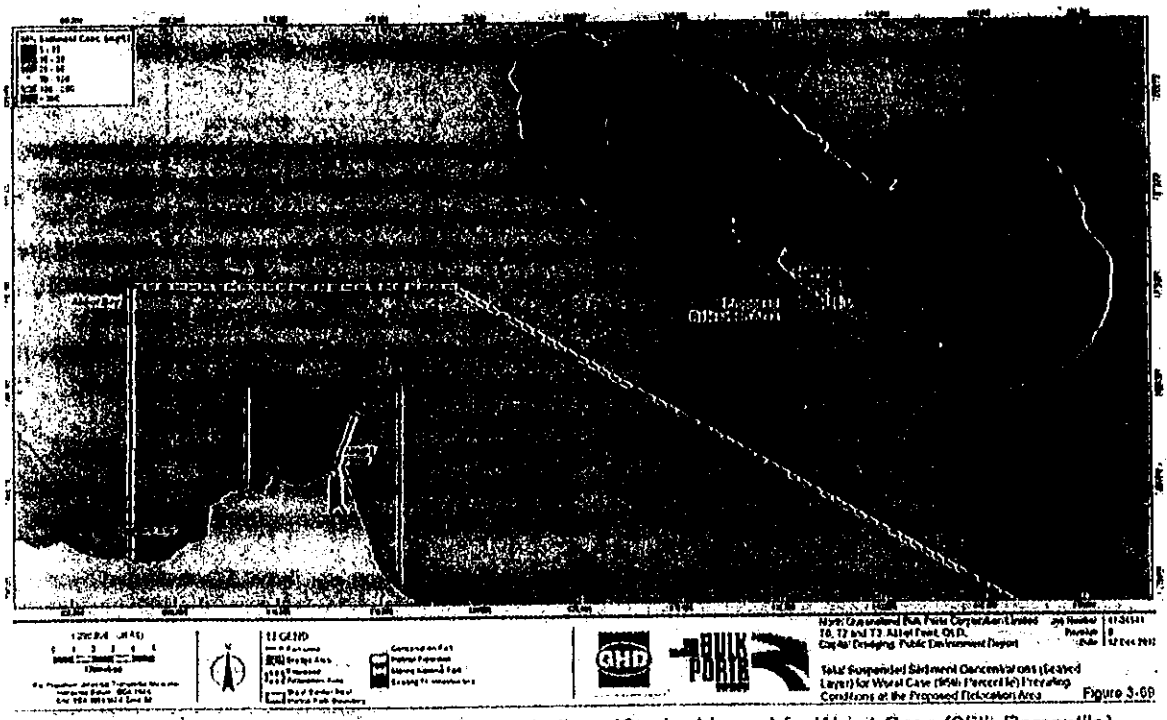

Figure 11: Total Suspended Sediment Concentrations (Seabed Layer) for Worst Case (95th Percentile) Prevailing Conditions at the Proposed Relocation Area

No comparative alternate weather scenarios (95th percentile) have been provided in the PER or supplementary PER for the proposed DMRA.

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[64] GHD. 2012 Abbot Point, Terminal 0, Terminal 2 and Terminal 3 Capital Dredging Public Environment Report (EPBC 2011/6213/GBRMPA G34897.1). GHD Brisbane pg 3-145

[65] Erftemeijer, P. L. A., Riegl, B., Hoeksema, B. W. & Todd, P. A. (2012). Environmental impacts of dredging and other sediment disturbances on corals: A review. *Marine Pollution Bulletin, 64*, 1737-1765. doi:10.1016/j.marpolbul.2012.05.008

[66] GHD. 2012 Abbot Point, Terminal 0, Terminal 2 and Terminal 3 Capital Dredging Public Environment Report (EPBC 2011/6213/GBRMPA G34897.1). GHD Brisbane Appendix H1

The proponent has considered migration of non-cohesive sediment (i.e. sand and gravel) from the proposed DMRA once it has been deposited over a 5 month period starting 15 June 2004 to 16 November 2004[67]. Figure 12, shows the depth and pattern of sedimentation as of 18 October 2004, three months after the start of the simulation [68]. No further long term outputs are presented in the PER documentation. This output assumes that the cohesive material (i.e. silts and clays) will eventually be fully exhausted (i.e. dispersed). No long-term modelling of the cohesive fraction of the sediment (roughly 39%) has been provided for the proposed DMRA .

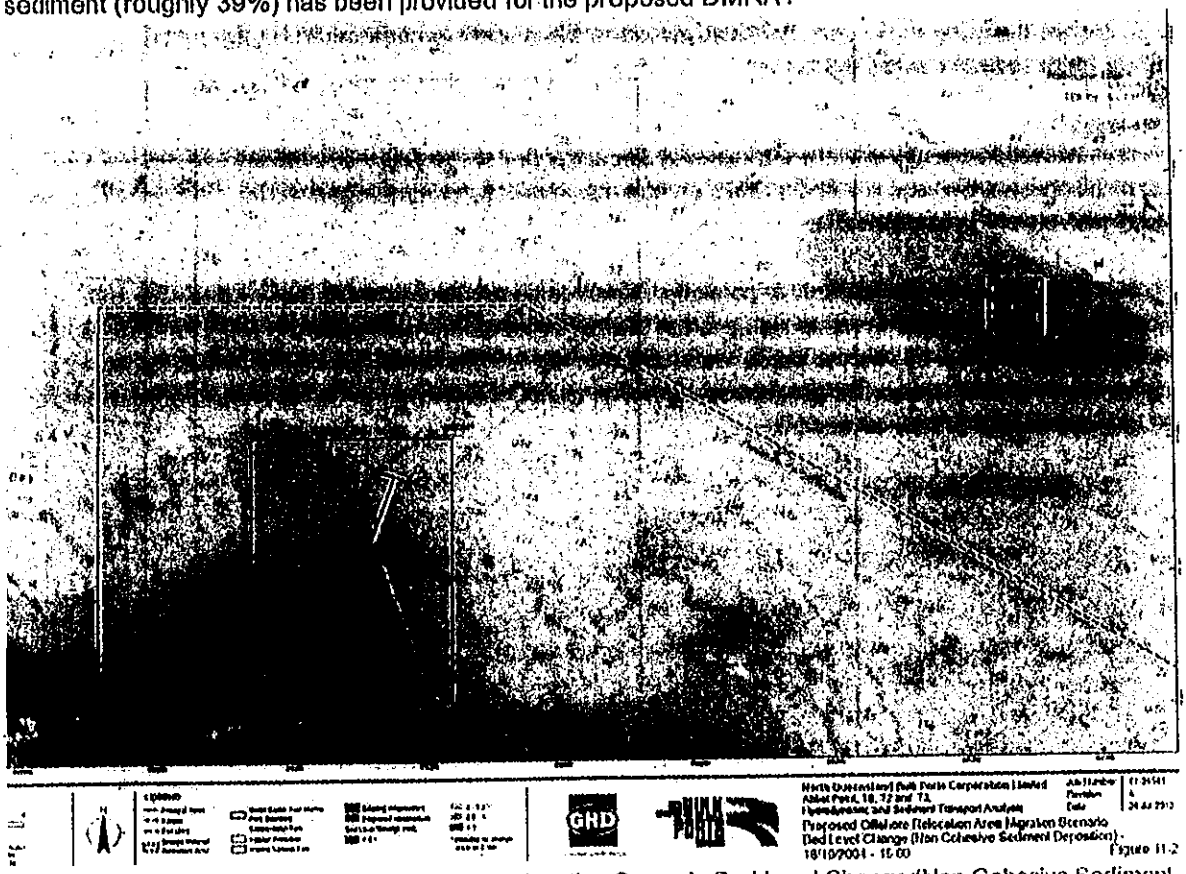

Figure 12: Proposed Offshore Relocation Area Migration Scenario Bed Level Change (Non-Cohesive Sediment Deposition) after three months

Studies commissioned by the Department of the Environment on improved dredge material management for the Great Barrier Reef region[69] report that:

- the inclusion of large-scale oceanic currents into hydrodynamic models may result in larger plume extents and further migration of suspended sediment than previously modelled;
- a portion of dredge material disposed offshore within the GBRWHA will resuspend and be transported by wind, waves and oceanic currents; and
- when sediment transport and migration is modelled over longer periods (i.e. 12 months) the re-suspension and deposition area is increased.

It is noted that findings of the SKM (2013) study have yet to be fully validated and have not been undertaken with significant resolution and accuracy that is required or expected of a detailed impact assessment process. The inclusion of the large-scale oceanic current forcing, especially in deeper

[67] GHD. 2012 Abbot Point, Terminal 0, Terminal 2 and Terminal 3 Capital Dredging Public Environment Report (EPBC 2011/6213/GBRMPA G34897.1). GHD Brisbane Appendix H1, pg 87

[68] GHD. 2012 Abbot Point, Terminal 0, Terminal 2 and Terminal 3 Capital Dredging Public Environment Report (EPBC 2011/6213/GBRMPA G34897.1). GHD Brisbane Appendix H1 pg 88

[69] SKM 2013, Improved dredge material management for the Great Barrier Reef Region, Great Barrier Reef Marine Park Authority, Townsville.

offshore waters would capture the expected current movement that would not otherwise be considered within a model that is driven by only by winds and tidal elevations. As a result, there is the potential that the modelling provided may not correctly resolve the rate and extent of longshore transport driven by larger scale ocean circulation processes operating within the Great Barrier Reef.

Consideration of larger scale oceanic currents in dredge plume modelling is a current requirement of GBRMPAs hydrodynamic modelling guidelines. It must be noted that the GBRMPA guidelines were released in mid-2012, this was subsequent to the issuing of the Terms of Reference for the Abbot Point capital dredging PER. Any, further hydrodynamic modelling undertaken for the proposed activity must consider these guidelines.

Consideration

There is considerable uncertainty surrounding the accuracy of the predictive model used in the PER. The predictive model was run under 2007 conditions which is acknowledged within the PER report to be conservatively mild conditions[70].

Worst case scenario's would need to consider conditions such as those experienced during 2011 or perhaps those from 2004 which could result in the plume heading in an opposite direction than what was expected. Figure 13, shows the current rose derived from a numerical model that is forced by observations of sea surface height (known as altimetry) at Abbot Point for an El Niño (2004), La Niña (2011) and neutral (2007) conditions.

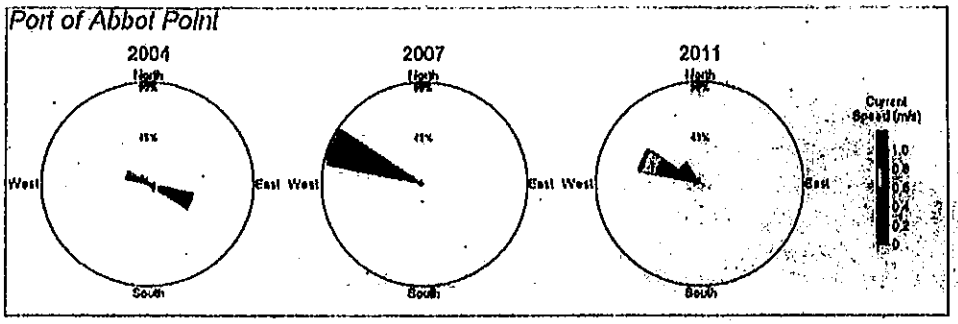

Figure 13: Surface large scale current rose diagrams for an El Niño (2004), La Niña (2011) and neutral (2007) conditions. The diagrams were generated using data closest to the existing material placement site at the Port of Abbot Point[71]

The modelling undertaken for the PER shows predicted plumes exiting the modelling domain which should have constituted grounds for the modeller's to re-assess the area under consideration and increase the size of the modelling domain to fully capture the likely spatial extent of the plume. The total extent of plume footprint is thus, undefined.

Modelling outputs are therefore likely to:

- under estimate the geographic extent of TSS increases associated with dredge material disposal and potential remobilisation; and
- not provide an accurate representation of extent of TSS increases associated with dredging and disposal. They are a 6 week snapshot in time and only reflect a small sub-set of the different weather scenarios that are likely to occur at the site.

Longer predictive modelling outputs (greater than the 3 months presented) are required to understand and assess the long-term fate of resuspended dredge particles and their ecological relevance.

It is therefore likely that the proponent has not identified all possible potential impacts associated with

[70] GHD. 2012 Abbot Point, Terminal 0, Terminal 2 and Terminal 3 Capital Dredging Public Environment Report (EPBC 2011/6213/GBRMPA G34897.1). GHD Brisbane (Chapter 3 Environmental Values, Potential Impacts and Mitigation Summary)

[71] SKM 2013, Improved dredge material management for the Great Barrier Reef Region, Great Barrier Reef Marine Park Authority, Townsville.

both the dredging and disposal campaign for the proposed DMRA.

The material proposed to be dredged and disposed offshore is considered suitable, chemically, for ocean disposal as per the National Assessment Guidelines for Dredging 2009.
Acid sulphate soil generation is not expected as a result of the proposed conduct.

The main predictive tool used to ascertain the sediment plume associated with the proposed activity has limitations associated with predicting potential impacts.

Nutrients and Chlorophyll a

The historical data available regarding nutrient water quality parameters at the proposed DMRA finds that some values are above GBRMPA water quality guidelines[72]. In general, nutrient concentrations in the mid shelf region are less than those further inshore.

The PER notes low levels of nutrients in the sediments to be dredged, however no estimates or further information regarding the subsequent release of nutrients from the dredged sediments is provided.

As there are no specified screening levels for nutrients in sediments under the NAGD, there is no requirement for further testing such as elutriate or pore water analysis. Elutriate tests can show a release of soluble nitrogen and phosphorus from sediments into the surrounding water[73].

Increased nutrient levels are associated with eutrophication. Epiphytic growth and changes in benthic communities such as increased macro algae biomass are likely if the nutrients are at increased levels. Algal blooms reduce light and decreased dissolved oxygen.

The ReefPlan 2010 aims to reduce the annual average inputs of nitrogen and phosphorus from riverine sources into the Great Barrier Reef catchment area. As these nutrients are of concern to the state of the GBR water quality. The nutrients detailed in the PER, around reported total N and total P levels in the proposed dredged sediments at Abbot Point are in line with values reported elsewhere in the literature.

This assessment attempted to identify the probability and impacts associated with increased nutrients being released into the water column due to the dredging and disposal action and consequent re-suspension events. Wind driven re-suspension of sediments is likely to only affect the top few mm of sediment. However nutrients released can affect nutrient and related phytoplankton standing crop levels in coastal areas.

For comparative purposes, the largest re-suspension events are those associated with tropical cyclones where surface sediments over large areas (between 1,000 km^2 and 10,000 km^2 of the GBR can be resuspended to depths of 1-10 cm). The water quality issues associated with these cyclonic re-suspension events include changes to water turbidity and may trigger massive phytoplankton blooms over large areas (10,000 km^2).

Although the differences in spatial scales between a disposal event and cyclonic conditions are acknowledged the disturbance of the seabed and the subsequent release of nutrients from the sediments is possible and currently an unknown impact. It would be expected that the dredging plume

[72] *Data extrapolated from* De'ath and Fabricius (2008) Water Quality of the Great Barrier Reef: Distributions, Effects on Reef Biota and Trigger Values for the protection of ecosystem health. Research Publication No. 89
[73] Jones, R. A., and Lee, G. F., "The Significance of Dredging and Dredged Material Disposal as a Source of Nitrogen and Phosphorus for Estuarine Waters," IN: Estuaries and Nutrients, Humana Press, Clifton, NJ, pp 517-530 (1981)

and post-spoil disposal plumes from the proposed dredging activities would produce conditions analogous to those occurring after a cyclonic re-suspension event for a short period (days to a few weeks) and over smaller spatial scales (~ 100 km^2).

The evidence suggests that the action of dredging and disposal will cause the release of nutrients into the water column.

Chlorophyll *a* is used to determine the likely amount or density of algal biomass in water. High levels are usually associated with eutrophication of a system and can be harmful for aquatic ecosystems[74]. Historical data used to ascertain the likely levels of chlorophyll *a* at the disposal site shows that chlorophyll *a* levels to be slightly above GBRMPA water quality guidelines (i.e. 0.61 µg/L)[75].

It is reported that in the nearby Abbot Bay chlorophyll *a* levels show some seasonal variability and are above both the ANZECC upper limit of 1.4 µg/L and the GBRMP/QWQ guideline value of 0.45 µg/L during the wet season. The levels at the DMRA would likely be less but also experience that seasonal variability.

Chlorophyll *a* concentrations often have an inverse relationship with nutrient concentrations from river plumes or other nutrient sources and the same would be true for dredge and dredge material disposal plumes[76] (i.e. as the nutrients are used up, it would be expected that the increase in algal biomass would result in increased chlorophyll a levels). Chlorophyll *a* levels increase with distance or time away from the plume, as heavier sediments settle out allowing increased light for photosynthesis and as nutrients are used up during growth as such it would be expected that large dredge plumes could result in increased algal blooms.

Consideration

There is limited information contained within the PER and Supplementary PER report around the release of nutrients as a result of the placement and re-suspension of dredge material at the proposed dredge material relocation area.

It is likely that nutrients will be released from the dredge overflow and disposed sediments into the surrounding waters. The resulting impacts are likely to be experienced as a short term impact such as increased turbidity due to increases in algae biomass.

Eutrophication and algal blooms are usually a secondary impact as TSS levels drop and nutrients are used by primary producers. Planktonic blooms can migrate further than the originating sediment plume creating further turbidity related impacts such as increased light attenuation and decreased dissolved oxygen or other localised changes in water quality.

It is possible that dredging and disposal may result in an increase in Chlorophyll *a* levels which could potentially remain above the relevant guideline values. There is the potential for effects of increased algal blooms and eutrophication being experienced beyond the modelled plumes, meaning that affects such as reduced light and/or increased epiphytic growth may be widespread and result in sub lethal impacts to seagrasses or corals.

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[74] GHD. (2012) Abbot Point Cumulative Impact Assessment Technical Report Marine Water Quality Final. GHD: Brisbane

[75] *Data extrapolated from* De'ath and Fabricius (2008) Water Quality of the Great Barrier Reef: Distributions, Effects on Reef Biota and Trigger Values for the protection of ecosystem health. Research Publication No. 89

[76] GBRMPA, (2001) Research Publication No. 68, Flood plumes in the Great Barrier Reef: Spatial and Temporal Patterns in Composition and Distribution. GBRMPA: Townsville

Summary of water quality impacts

The focus on water quality monitoring within the PER is within the immediate area surrounding the Port of Abbot Point. There is potential for water quality at the proposed DMRA, and adjacent areas, to be reduced by dredge material disposal.

The proposed activity is likely to have risks for water quality at and around the proposed DMRA and dredge area due to the proportion of fine sediment constituents in the material to be disposed. Consecutive dredging and disposal campaigns over an extended period of up to six years may reduce water quality for an extended timeframe.

The proponent has followed the National Assessment Guidelines for Dredging 2009 in regards to testing for nutrients in the sediment, it is however unclear how much of the nutrients in the sediment will become available in the water column due to the physical disturbance associated with the proposed activity in the Marine Park.

The proposed activity may increase the levels of nutrients. The exact impacts are unknown but in general elevated levels of nutrients can lead to eutrophication and algal blooms. Algal blooms can migrate creating further turbidity in other areas.

There are standard mitigating measures such as the development of adaptive trigger thresholds, management plans, mechanical conditions and environmental site supervision that can be conditioned to reduce the risk of impacts to water quality at sensitive receptor sites. Turbidity plumes and subsequent re-suspension will be difficult to mitigate, manage once material is placed at sea.

IMPACTS TO BENTHOS

A minimum of 400 ha (the footprint of the DMRA) of Marine Park benthic area will be directly impacted by the proposed dredge disposal action and a minimum of 185 ha will be physically removed by dredging.

Seagrass is the dominant benthic community at the dredging location and surrounds. The benthic communities identified in the PER for the DMRA are consistent with the description in the GBRMPA non-reef bioregion NB7 Mid Shelf Lagoon[77]. The PER states that there are no seagrass communities present at the DMRA and no other marine flora is observed within the proposed DMRA. The PER also documents that the DMRA is made up of patches of macroinvertebrates comprised mostly of mud scallops, with occasional hermit crabs, gastropods, polychaetes and crinoids, no corals have been observed at the DMRA[78,79].

These non reefal areas are generally dominated by macro invertebrates in low densities such as echinoderms, solitary corals, sponges, holothurians (sea cucumbers) and various anemones[80].

The benthic communities located at the DMRA will be impacted by burial, or indirect impacts from water quality degradation. The benthic communities located in the 400 ha proposed DMRA will be subject to burial in up to 800 mm of dredged material over the duration of the dredging campaign and

[77] GBRMPA. 2002. Non-reef bioregion: NB7 Mid Shelf Lagoon. GBRMPA Townsville

[78] GHD. 2012 Abbot Point, Terminal 0, Terminal 2 and Terminal 3 Capital Dredging Public Environment Report (EPBC 2011/6213/GBRMPA G34897.1). GHD Brisbane (Executive Summary, page xxiv)

[79] GHD. 2012 Abbot Point, Terminal 0, Terminal 2 and Terminal 3 Capital Dredging Public Environment Report (EPBC 2011/6213/GBRMPA G34897.1). GHD Brisbane (Chapter 3 Environmental Values, Potential Impacts and Mitigation)

[80] GHD. 2012 Abbot Point, Terminal 0, Terminal 2 and Terminal 3 Capital Dredging Public Environment Report (EPBC 2011/6213/GBRMPA G34897.1). GHD Brisbane (Chapter 3 Environmental Values, Potential Impacts and Mitigation)

those surrounding will be subjected to varying degrees of smothering[81]. Benthic communities at the dredge site and surrounds will be impact by burial at a lower level than the DMRA.

Benthic surveys found low density cover of between 1% and 10% and no communities of significant concern[82]. However, the proponent notes in the PER that sediment characteristics differ at the proposed DMRA when compared to the dredge area[83]. This may result in the benthic community being altered following recovery.

The PER concludes that the benthic assemblages are resilient to large scale and targeted benthic disturbances such as dredging or extreme weather events[84]. It is known that dredging can change the physical habitat and biological structure of ecosystems[85]. It is highly likely that this also applies to the disposal of large amounts of dredged material, as this action will modify the benthos at the proposed DMRA and possibly further afield due to ongoing re-suspension.

Human modification to the marine environment (either directly or indirectly) will compromise the ability of that ecosystem to recover from other stressors such as cyclones, floods, eutrophication and climate change. There is potential to change the species composition and functioning of an existing ecosystem, a shift in community composition has the potential to alter other organism's use of an area and potentially result in the displacement of those animals and a change in species diversity or biomass.

Summary of impacts to benthos

It can be expected that benthic communities at the DMRA, and adjacent areas, will be directly or indirectly impacted by dredge material disposal, either by direct burial or increased turbidity and resuspension of material.

A minimum of 400ha (the footprint of the DMRA) of benthic habitat will be impacted by the proposed action. Repeated (up to three separate campaigns) dredge disposal actions over a 5-6 year period of up to 1.3million cubic metres each is likely to directly impact the benthic habitats within the DMRA and reduce the likelihood of recovery during those years. This impact is unlikely to show full recovery until a period of time (years) following the final disposal campaign.

Partial recovery may take place following each campaign with re-establishment of pioneering communities that are known to re-establish the impacted area after disposal activities have ceased.

Seagrass

Seagrass meadow coverage surrounding Abbot Point during surveys increased from 31% in 2005 to

[81] GHD. 2012 Abbot Point, Terminal 0, Terminal 2 and Terminal 3 Capital Dredging Public Environment Report (EPBC 2011/6213/GBRMPA G34897.1). GHD Brisbane (Executive Summary)
[82] GHD. 2012 Abbot Point, Terminal 0, Terminal 2 and Terminal 3 Capital Dredging Public Environment Report (EPBC 2011/6213/GBRMPA G34897.1). GHD Brisbane (Chapter 3 Environmental Values, Potential Impacts and Mitigation)
[83] GHD. 2012 Abbot Point, Terminal 0, Terminal 2 and Terminal 3 Capital Dredging Public Environment Report (EPBC 2011/6213/GBRMPA G34897.1). GHD Brisbane (Chapter 3 Environmental Values, Potential Impacts and Mitigation)
[84] GHD. 2012 Abbot Point, Terminal 0, Terminal 2 and Terminal 3 Capital Dredging Public Environment Report (EPBC 2011/6213/GBRMPA G34897.1). GHD Brisbane (Chapter 3 Environmental Values, Potential Impacts and Mitigation 3-100)
[85] National Research Council, *Effects of Trawling and Dredging on Seafloor Habitat*. Washington, DC: The National Academies Press, 2002.

42% in 2008[86,87]. Prominent seagrass scientists Unsworth, McKenna and Rasheed have determined that seagrass distributions mapped in the 2008 surveys around the port area are likely to provide a good representation of seagrass distribution for the surrounding region[88]. This is important to consider as not all potentially impacted areas were surveyed for seagrasses.

Following the 2010/11 La Niña event and severe Tropical Cyclone Yasi, the Port of Abbot Point Long Term Seagrass Monitoring program recorded up to an 80% reduction in seagrass meadows and for those meadows that survived, there has been a significant reduction in their distribution and biomass[89]. This pattern has been observed throughout the GBR coastline and further significant rainfall events resulting in increased seawater turbidity is continuing to affect the availability and quality of light for seagrasses.

The latest Port of Abbot Point long term seagrass monitoring annual report (2011-2012) shows evidence that deeper offshore meadows at Abbot Bay have started to recover in 2012 while coastal meadows were yet to recover[90]. The lack of recovery of the coastal meadows may be a result of limited seed availability[91].

Seagrasses can recover by two main mechanisms: vegetative growth (asexual reproduction) and recruitment from propagules (seeds/sexual reproduction)[92].

Sedimentation/smothering of seagrass communities' can lead to mortality and sublethal impacts. While some species can respond with vertical growth, there are limits to how quickly and what depth of sedimentation/burial the seagrasses can cope with and mortality can range between 50% and 100% depending on depth of burial[93].

Figure 14 also shows the past extents of seagrass communities at Abbot Point, including presence at the proposed dredge area. Current extent of seagrass surveys in area are limited to roughly 20km either side of the Port of Abbot Point.

One of the major drivers of seagrass growth and distribution in shallow coastal environments worldwide is light availability[94]. Although, offshore seagrass communities within and surrounding Abbot Bay may be well adapted to low light conditions, further reduction of light due to increased turbidity has been identified as a major cause of seagrass loss[95]. A recent study has shown that

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[86] Rasheed, M.A., Thomas, R. and McKenna, S.A. (2005). Port of Abbot Point seagrass, algae and benthic macro-invertebrate community survey - March 2005. DPI&F Information Series QI05044 (DPI&F, Cairns), 27 pp.
[87] Unsworth, R.K.F., McKenna, S.A. and Rasheed, M.A. (2010) Seasonal dynamics, productivity and resilience of seagrass at the Port of Abbot Point: 2008 – 2010. DEEDI Publication. Fisheries Queensland, Cairns, 68 pp.
[88] Unsworth, R.K.F., McKenna, S.A. and Rasheed, M.A. (2010) Seasonal dynamics, productivity and resilience of seagrass at the Port of Abbot Point: 2008 – 2010. DEEDI Publication. Fisheries Queensland, Cairns, 68 pp.
[89] McKenna, SA & Rasheed, MA 2011, 'Port of Abbot Point Long-Term Seagrass Monitoring: Update Report 2008-2011', DEEDI Publication, Fisheries Queensland, Cairns, 48 pp.
[90] Mckenna, S.A. and Rasheed, M.A. 2013. 'Port of Abbot Point Long-term Seagrass Monitoring: Annual Report 2011-2012', JCU Publication, Centre for Tropical Water and Aquatic Ecosystem Research, Cairns, 42pp.
[91] Mckenna, S.A. and Rasheed, M.A. 2013. 'Port of Abbot Point Long-term Seagrass Monitoring: Annual Report 2011-2012', JCU Publication, Centre for Tropical Water and Aquatic Ecosystem Research, Cairns, 42pp.
[92] Mckenna, S.A. and Rasheed, M.A. 2013. 'Port of Abbot Point Long-term Seagrass Monitoring: Annual Report 2011-2012', JCU Publication, Centre for Tropical Water and Aquatic Ecosystem Research, Cairns, 42pp.
[93] Erftemeijer, P.L.A. and Robin Lewis, R.R. (2006) Environmental impacts of dredging on seagrasses: A review. Marine Pollution Bulletin 52, 1553-1572
[94] Chartrand, K.M., M. Rasheed, M. K. Petrou and P. Ralph. 2012. Establishing tropical seagrass light requirements in a dynamic port environment. Proceedings of the 12th International Coral Reef Symposium, Cairns, Australia.
[95] Erftemeijer, P.L.A. and Robin Lewis, R.R. 2006. Environmental impacts of dredging on seagrasses: A review. Marine Pollution Bulletin 52, 1553-1572

seagrasses can change their morphology and physiological processes to survive in low light conditions, however a short term further reduction in light levels can result in mortality[96].

Consideration

- The PER does not predict any direct or indirect impacts to seagrass from dredge material disposal, yet the full extent of potential seagrass habitat has not been mapped within the immediate area of the proposed activity. There is a possibility that resuspension of dredged material from the DMRA may impact on seagrass meadows further away in the region.

- Seagrass communities surrounding the Port of Abbot Point are the dominant benthic community. Dredging will impact directly on seagrass meadows in surrounding areas through the increase in turbidity and resulting increase in light attenuation.

- The declines in Abbot Point seagrasses over recent years indicates that they are likely to be in a state of reduced resilience to further impacts and stressors[97]. Recovery to pre 2011 wet season conditions is unlikely if other further stressors are added (such as dredging) in close proximity to known seagrass habitats[98,99].

- The Port of Abbot Point Long Term Seagrass Monitoring program recorded up to an 80% reduction in seagrass meadows due to flooding and Cyclone Yasi, and for those meadows that survived, there has been a significant reduction in their distribution and biomass. Recovery of impacted seagrass can range between 2 to 5 years depending on species, and the scale of disturbances[100]. Recovery rates are likely to differ between species and species which rely on asexual reproduction will take longer to recover as long as those which rely on seed-banks/reserves. Recovery of any affected seagrasses caused by light attenuation (TSS) and sedimentation may be a slow process[101].

- Seagrasses only experience "ideal" growing conditions for an average of up to five months per year (ideally from July to January), in North Queensland. Any reduction in this growing/recovery period could have adverse impacts for the remaining seagrass meadows and the species that rely on them.

- There are uncertainties regarding the PER hydrodynamic modelling and the predicted impacts on seagrasses. Predicted increases in above background TSS generated as a result of dredge material disposal is likely to be underestimated.

- Seagrasses can, under normal conditions, withstand periods of naturally high turbidity and some increase in the frequency of turbid events[102]. It is uncertain how much turbidity seagrasses with low resilience can tolerate.

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[96] Yaakub, S.M., Chen, E., Bouma, T.J., Erftemeijer, P.L. and Todd, P.A. 2013. Chronic light reduction reduces overall resilience to additional shading stress in the seagrass *Halophila ovalis*. Marine Pollution Bulletin, http://dx.doi.org/10.1016/j.marpolbul.2013.11.030

[97] Mckenna, S.A. and Rasheed, M.A. 2013. 'Port of Abbot Point Long-term Seagrass Monitoring: Annual Report 2011-2012', JCU Publication, Centre for Tropical Water and Aquatic Ecosystem Research, Cairns, 42pp.

[98] Mckenna, S.A. and Rasheed, M.A. 2013. 'Port of Abbot Point Long-term Seagrass Monitoring: Annual Report 2011-2012', JCU Publication, Centre for Tropical Water and Aquatic Ecosystem Research, Cairns, 42pp.

[99] GHD. 2012 Abbot Point, Terminal 0, Terminal 2 and Terminal 3 Capital Dredging Public Environment Report (EPBC 2011/6213/GBRMPA G34897.1). GHD Brisbane (Chapter 3 Environmental Values, Potential Impacts and Mitigation Summary)

[100] Erftemeijer, P.L.A. and Robin Lewis, R.R. (2006) Environmental impacts of dredging on seagrasses: A review. Marine Pollution Bulletin 52, 1553-1572

[101] Mckenna, S.A. and Rasheed, M.A. 2013. 'Port of Abbot Point Long-term Seagrass Monitoring: Annual Report 2011-2012', JCU Publication, Centre for Tropical Water and Aquatic Ecosystem Research, Cairns, 42pp.

[102] Erftemeijer, P.L.A. and Robin Lewis, R.R. (2006) Environmental impacts of dredging on seagrasses: A review. Marine Pollution Bulletin 52, 1553-1572

- The long term viability of remaining coastal and offshore seagrass populations in the region is at risk and given that the some species are living close to their minimum light requirements[103], thereby reducing their resilience to further light reductions, this may not be achievable.

- In managing potential impacts associated with dredging on seagrasses further adaptive managing and monitoring measures are required, in particular, light availability to adequately manage potential impacts, as has occurred recently in Gladstone.

Summary of seagrass impacts

The proponent initially proposed to dredge in the dry season (April – October)[104], some of which may encompass the seagrass growing season (July to January)[105]. This has subsequently been refined to March to July as stipulated in the EPBC Act approval.

There are large areas surrounding the proposed activity that have not been surveyed for seagrasses. Recovery of some offshore seagrasses has started in Abbot Bay and any subsequent stressors may delay the recovery.

The PER does not predict any direct or indirect impacts to seagrass from dredge material disposal. This is because seagrass is unlikely to occur at the proposed offshore DMRA due to its depth. Mapping of seagrass habitats outside the immediate area surrounding the Port of Abbot Point is limited. It is possible that potential impacts to seagrasses may occur. The exact severity and possible recovery times are unclear.

Dredge material disposal at the proposed DMRA is likely to result in continual re-suspension of unconsolidated sediments and decreased water quality for an unpredictable amount of time.

No seagrass habitat has been observed within the prosed DMRA.

Seagrass communities nearby surrounding the Port of Abbot Point, are the dominant benthic community.

There is considerable uncertainty as to the severity or reversibility of these impacts on seagrasses surrounding the Port of Abbot Point.

Management measure that may reduce this risk is to implement an adaptive water quality monitoring program with clear locally relevant ecological triggers, implement baseline seagrass surveys in areas that are currently not surveyed, and for the proponents to re assess their baseline water quality thresholds (as they were found to be unusually high).

Disturbance and the resuspension has been estimated to last at least six years (assuming no further dredging or disturbance occurs) and be observed outside the direct footprint of the dredging area it is anticipated that limited recovery of seagrass may occur outside of the direct footprint of the dredging area during that time. It is uncertain whether there will be enough seed banks or nearby seagrasses to recruit into the area after the six year disturbance.

[103] Mckenna, S.A. and Rasheed, M.A. 2013. 'Port of Abbot Point Long-term Seagrass Monitoring: Annual Report 2011-2012', JCU Publication, Centre for Tropical Water and Aquatic Ecosystem Research, Cairns, 42pp.
[104] GHD. 2012 Abbot Point, Terminal 0, Terminal 2 and Terminal 3 Capital Dredging Public Environment Report (EPBC 2011/6213/GBRMPA G34897.1). GHD Brisbane (Chapter 3 Environmental Values, Potential Impacts and Mitigation, Page 3-171)
[105] Mckenna, S.A. and Rasheed, M.A. 2013. 'Port of Abbot Point Long-term Seagrass Monitoring: Annual Report 2011-2012', JCU Publication, Centre for Tropical Water and Aquatic Ecosystem Research, Cairns, 42pp.

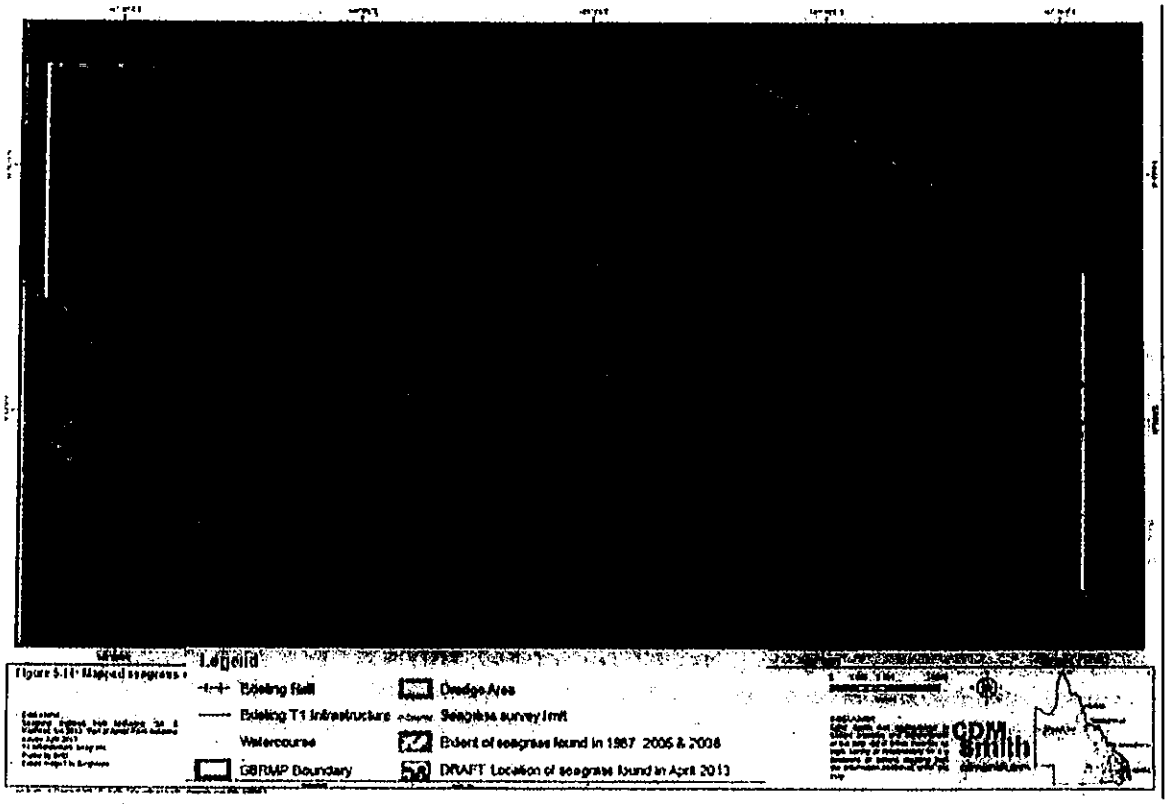

Figure 14: Mapped seagrass distribution 2013 (dark green) and 1987, 2005 and 2008 (light green) showing the range of seagrass surveys

Corals

The PER reports that no coral reefs are located at the proposed DMRA and as such no impacts to corals are expected to occur[106]. Therefore the proponent has not recommended any mitigating or management measures.

The closest coral reefs to the proposed DMRA are Nares Rock, Holbourne Island (located approximately 5-7 km north-east). The closest fringing reef to the proposed dredging location is Camp Island (located approximately 20km west of the port).

Reef Health and Impact Surveys (RHIS) (used to inform the Reef Health Incident Response System) have been undertaken at both Holbourne Island and Camp Island Reefs. Surveys at Camp Island reef found up to 45% live coral cover in some locations in 2012, while surveys at Holbourne Island found 0% live coral cover[107].

The Australian Institute of Marine Science has historical data for Holbourne Island Reef and confirms the presence of coral at Holbourne at between 2.5% and 12% coral cover[108].

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[106] GHD. 2012 Abbot Point, Terminal 0, Terminal 2 and Terminal 3 Capital Dredging Public Environment Report (EPBC 2011/6213/GBRMPA G34897.1). GHD Brisbane (Chapter 3 Environmental Values, Potential Impacts and Mitigation)

[107] The lack of coral found at Holbourne Island more than likely represents the locations surveyed rather than the health of the reef, as surveys were taken on the no reef side of the island. The surveys did identify large amounts of coral rubble (up to 74%) and live coral rock (up to 40%) in 2010.

[108] Australian Institute of Marine Science. (2013). Holbourne Island Reef Surveys, Retrieved 16 January 2014 from http://data.aims.gov.au/reefpage2/reefpage.jsp?fullReefID=19103S

It is well documented and acknowledged that dredging and disposal activities can cause impacts on corals associated with increased turbidity and sedimentation. The risk and severity of the impact will primarily depend on the intensity, duration and frequency of the exposure to increased turbidity and sedimentation[109]. Some potential impacts include[110]:

- reduced light availability;
- abrasion of coral tissue;
- reduced larval survival;
- reduced coral polyp activity;
- reduced reproductive rates;
- smothering of coral polyps;
- hindered attachment of coral larvae; and
- increased susceptibility to coral pathogens[111].

Changes to water quality including the reduction of dissolved oxygen and the release of nutrients and contaminants[112] caused by dredging can also cause impacts to corals.

The modelling provided as part of the PER indicated that Nares Rock and its surrounding reefal habitat may be impacted by increased TSS by the proposed action at the DMRA, while Holbourne Island is shown to be approximately 2km away from the plume extent. The 95th percentile, above background levels of TSS at Nares Rock are expected to reach between 10-25 mg/L[113] under prevailing conditions, no similar comparison has been provided for the alternate weather scenario where expected increases in TSS may be larger.

Camp Island is modelled to experience increases TSS concentrations of 10-20 mg/l (95th percentile)[114] associated with the activity of dredging.

The PIANC report 108 (2010) 'Dredging and port construction around coral reefs' identifies that 25mg/l TSS for less than 5% of the time (as predicted to occur at Nares Rock) equates to a Minor to Moderate impact based on thresholds for impact severity for suspended sediment impact in Singapore on corals[115]. It must be noted that tolerance limits are site specific and the Singapore example is reflective of the relatively high background turbidity and sedimentation rates, the shallow nature of the coral reefs and the prevailing strong currents found in Singapore.

Different coral species will have different levels of tolerance to TSS and sedimentation. For example; Erftemeijer *et al.* 2012 found that tolerance limits of coral reef systems for chronic suspended-sediment concentrations range from <10 mg/l in pristine offshore reef areas to >100 mg/L in marginal nearshore reefs[116]. This keystone review on the impacts of dredging and other sediment disturbances on corals also found that some coral species could show mortality after exposure of weeks to concentrations as low as 30 mg/L. They also found that fine sediments tend to have greater effects on

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[109] Erftemeijer, P., Riegl, B., Hoeksema, B and Todd, P. Environmental impacts of dredging and other sediment disturbances on corals: A review. Marine Pollution Bulletin 64: 1737-1765

[110] PIANC 2010. Report no. 108, *Dredging and port construction around coral reefs*

[111] PIANC 2010. Report no. 108, *Dredging and port construction around coral reefs*

[112] PIANC 2010. Report no. 108, *Dredging and port construction around coral reefs*

[113] GHD. 2012 Abbot Point, Terminal 0, Terminal 2 and Terminal 3 Capital Dredging Public Environment Report (EPBC 2011/6213/GBRMPA G34897.1). GHD Brisbane (Chapter 3 Environmental Values, Potential Impacts and Mitigation, Figure 3-69)

[114] GHD. 2012 Abbot Point, Terminal 0, Terminal 2 and Terminal 3 Capital Dredging Public Environment Report (EPBC 2011/6213/GBRMPA G34897.1). GHD Brisbane (Chapter 3 Environmental Values, Potential Impacts and Mitigation, Figure 3-68)

[115] PIANC 2010. Report no. 108, *Dredging and port construction around coral reefs*

[116] Erftemeijer, P., Riegl, B., Hoeksema, B and Todd, P. Environmental impacts of dredging and other sediment disturbances on corals: A review. Marine Pollution Bulletin 64: 1737-1765

corals with regards to smothering than coarse sediments[117].

Studies indicate that corals can tolerate changes in turbidity and increases in sedimentation[118], especially those corals found in naturally high and variable background conditions of turbidity and sedimentation. As sediments move and remobilise (particularly fine sediment) there is a risk that the sediment will move into areas that are not naturally turbid.

Consideration

- It is considered that the severity of the impacts, and the relevance or acceptance of these impacts, is related to the severity and spatial extent of the sediment plume and the temporal nature and finality of the dredged sediment migration due to re-suspension. Modelling indicates that most dredge disposal plumes will head in a north-westerly direction away from Holbourne Island but almost certainly impact on Nares Rock with TSS levels of 5-25 mg/l[119].

- There is limited documented information about the coral communities at Nares Rock to assess or predict likely impacts from the disposal of dredge material at the DMRA.

- Uncertainties with predictive modelling and limited information provided in the PER report in regards to a comparative alternate weather scenarios for this location indicate a high potential for increases in TSS over and above that reported. The potential impact of the proposed activity on corals is therefore difficult to ascertain.

- Corals and reef biodiversity are currently in decline, due to stressors such as climate change, poor water quality and Crown of Thorns Starfish[120].

- Response of corals to impacts associated with dredge material disposal and the recovery of those corals to pre impact health depends on a number of factors including the ecological state of the coral reef prior to the impact and during recovery.

- The recovery time of coral varies greatly and depends on the species of coral affected, the severity of the impact and the length of the impact. "Provided that environmental conditions return to the pre-impact situations and that these conditions are not hampering recovery, time-scales for natural recovery of coral reefs are in the order of a few years to several decades"[121].

- Repetitive stress events (i.e. disposal over an extended timeframe) may result in impacts on corals if the corals have not been given sufficient time to recover between consecutive disturbances[122].

- Turbidity, sedimentation and nutrient enrichment gives a competitive advantage to macroalgae over corals leading to trophic dominance by assemblages of macroalgae once productivity exceeds grazing rates[123].

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[117] Erftemeijer, P., Riegl, B., Hoeksema, B and Todd, P. Environmental impacts of dredging and other sediment disturbances on corals: A review. Marine Pollution Bulletin 64: 1737-1765

[118] Erftemeijer, P., Riegl, B., Hoeksema, B and Todd, P. Environmental impacts of dredging and other sediment disturbances on corals: A review. Marine Pollution Bulletin 64: 1737-1765

[119] GHD. 2012 Abbot Point, Terminal 0, Terminal 2 and Terminal 3 Capital Dredging Public Environment Report (EPBC 2011/6213/GBRMPA G34897.1). GHD Brisbane (Chapter 3 Environmental Values, Potential Impacts and Mitigation, Figure 3-69)

[120] Great Barrier Reef Marine Park Authority. 2013 Great Barrier Reef Region Strategic Assessment Program Report, Draft for public comment. GBRMPA, Townsville

[121] Erftemeijer, P., Riegl, B., Hoeksema, B and Todd, P. Environmental impacts of dredging and other sediment disturbances on corals: A review. Marine Pollution Bulletin 64: 1737-1765

[122] Erftemeijer, P., Riegl, B., Hoeksema, B and Todd, P. Environmental impacts of dredging and other sediment disturbances on corals: A review. Marine Pollution Bulletin 64: 1737-1765

[123] Cooper, T.F., Uthicke, S., Humphrey, C. and Fabricius, K.E. 2007. Gradients in water column nutrients, sediment parameters, irradiance and coral reef development in the Whitsunday Region, central Great Barrier Reef, Estuarine, coastal and Shelf Science 74, 458-470.

Summary of impacts on coral

The modelling provided as part of the PER indicated that Nares Rock and its surrounding reefal habitat may be impacted by increased TSS by the proposed action at the DMRA. The 95th percentile, above background levels of TSS at Nares Rock and Camp Island are expected to reach between 10-25 mg/L.[124] under prevailing conditions, no similar comparison has been provided for the alternate weather scenario where expected increases in TSS may be larger. Camp Island reef is expected to be impacted by TSS levels of 10 – 20 mg/L[125].

Changes to the reef benthic assemblages such as increased biomass of macro algae and epiphytes are possible due to the decline of water quality and recovery of coral communities may be compromised in the long term and take several years to decades. Recruitment of juvenile corals may be affected as coral larvae require a solid substrate to attach to. If sediment is covering the substrate recruitment may be compromised. Juvenile corals are more susceptible to poor water quality than mature colonies.

Reef environments surrounding Nares Rock and Camp Island will likely experience periods of increased turbidity due to the proposed action. Reef environments around Holbourne Island may be impacted but this is uncertain due to the limitations in the PER plume modelling such as no alternate weather scenario modelling.

IMPACTS ON MOBILE MARINE FAUNA

Fish

The PER reports state that beam trawls and video transects were used to assess fisheries in the wider project area and the DMRA, and recorded three fish taxa (fusiliers, lizard fish and flatheads) within the DMRA[126]. Mud scallops were recorded as the most abundant species within both the wider survey area and the DMRA[127]. Mud scallops are collected as by-catch from prawn trawlers and represent a minor contribution to the Queensland scallop fishery.

The PER did not provide any information on the expected impact of the proposed disposal activity on these fish species even though this was required as part of the Guidelines for preparation of the PER. In addition, beam trawl and video transects would not have targeted the pelagic fisheries in this area which include Mackerel. These species also prefer and relies upon clear water for feeding. Commercial catch data provided in the PER, although limited, identified areas near Queens Bay, the inner reef, Cape Bowling Green and around the Nares Rock and Holbourne Island as areas with the highest catch[128].

[124] GHD. 2012 Abbot Point, Terminal 0, Terminal 2 and Terminal 3 Capital Dredging Public Environment Report (EPBC 2011/6213/GBRMPA G34897.1). GHD Brisbane (Chapter 3 Environmental Values, Potential Impacts and Mitigation, Figure 3-69)
[125] GHD. 2012 Abbot Point, Terminal 0, Terminal 2 and Terminal 3 Capital Dredging Public Environment Report (EPBC 2011/6213/GBRMPA G34897.1). GHD Brisbane (Chapter 3 Environmental Values, Potential Impacts and Mitigation, Figure 3-68)
[126] GHD. 2012 Abbot Point, Terminal 0, Terminal 2 and Terminal 3 Capital Dredging Public Environment Report (EPBC 2011/6213/GBRMPA G34897.1). GHD Brisbane (Chapter 3 Environmental Values, Potential Impacts and Mitigation, Page 3-105)
[127] GHD. 2012 Abbot Point, Terminal 0, Terminal 2 and Terminal 3 Capital Dredging Public Environment Report (EPBC 2011/6213/GBRMPA G34897.1). GHD Brisbane (Chapter 3 Environmental Values, Potential Impacts and Mitigation, Page 3-105)
[128] GHD. 2012 Abbot Point, Terminal 0, Terminal 2 and Terminal 3 Capital Dredging Public Environment Report (EPBC 2011/6213/GBRMPA G34897.1). GHD Brisbane (Chapter 3 Environmental Values, Potential Impacts and Mitigation, Page 3-105)

Studies have shown that increased turbidity can affect coral reef fish[129]. Inshore and generally more highly impacted sites (with regards to suspended sediment) have shown a decreased fish abundance and biodiversity when compared to offshore low impacted sites. Increased turbidity has been shown to impair habitat choice and foraging success[130].

Other evidence of impacts due to increased sedimentation and turbidity shows that there can be an impact to predator-prey interactions. Slightly increased turbidity favours predators whereas large increases in turbidity decreases predation rates[131]. This impact on predator-prey interactions has the potential to change to the essential trophic process which regulates fish assemblages.

Consideration

Distinguishing between direct and indirect impacts to fish, is difficult as the direct impacts may compound the indirect impacts such as changes to population dynamics and habitat loss[129]. It is unlikely that the survey methods (i.e. beam trawls and video transects) used to assess the fish communities in the DMRA would accurately reflect the fish communities in the area.

> *There is limited information available to accurately predict the potential impacts on fish from the proposed activity and therefore impacts are uncertain.*
>
> *The survey methods used by the proponent are unlikely to be representative of the fish assemblages around the DMRA.*
>
> *Scientific evidence reports changes to fish behaviour caused by increased turbidity.*

Megafauna

The PER identified six listed threatened species known to occur within the wider project area, these are humpback whale, loggerhead turtle, green turtle, hawksbill turtle, olive ridley turtle and flatback turtle. In addition, potential habitat for the leatherback turtle is available in the project area, although the species has not previously been recorded there. The PER also noted the seasonal presence of Humpback whales, *Megaptera novaeangliae* within the project area. Other marine megafauna observed included shark and ray species.

The survey area for megafauna did not include the DMRA (Figure 15).

[129] Amelia S. Wenger, Mark I. McCormick, Determining trigger values of suspended sediment for behavioral changes in a coral reef fish, Marine Pollution Bulletin, Volume 70, Issues 1–2, 15 May 2013, Pages 73-80
[130] Amelia S. Wenger, Mark I. McCormick, Determining trigger values of suspended sediment for behavioral changes in a coral reef fish, Marine Pollution Bulletin, Volume 70, Issues 1–2, 15 May 2013, Pages 73-80
[131] Wenger, A.S., McCormick, M.I., McLeod, I.M., and Jones, G.P. Suspended sediment alters predator–prey interactions between two coral reef fishes. Coral Reefs, Online First Article . pp. 1-6. (In Press)

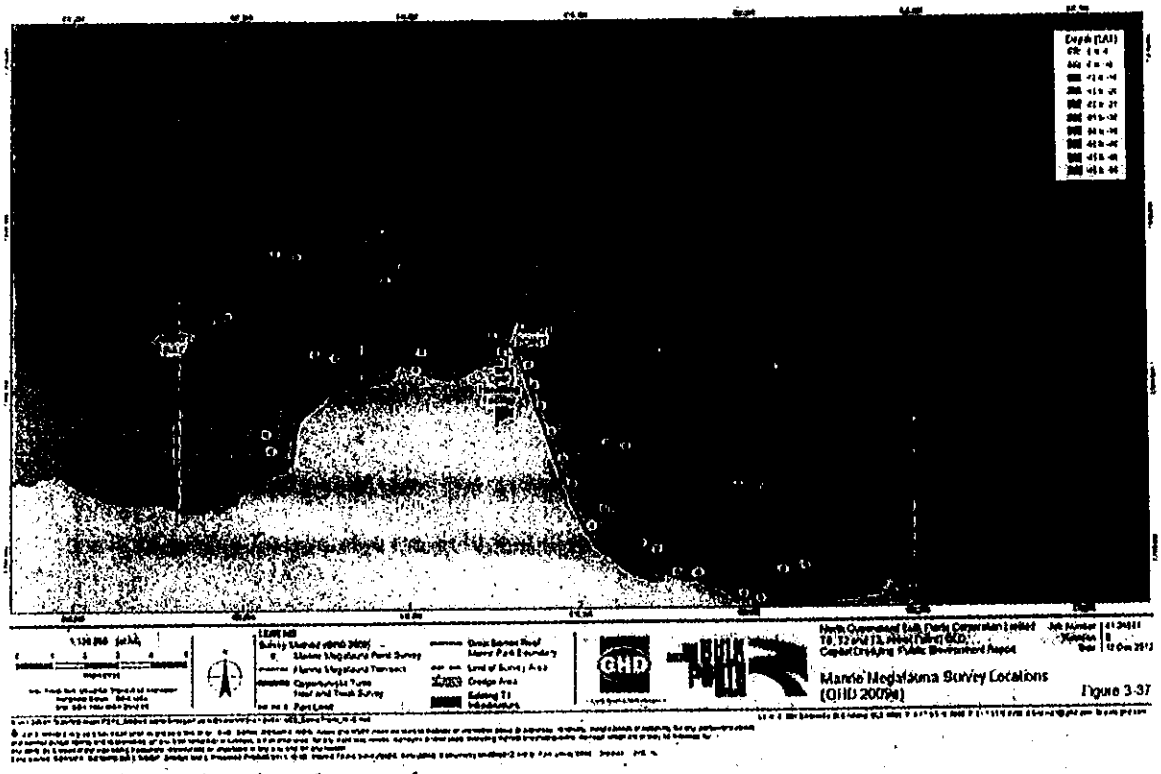

Figure 15: Survey locations for megafauna

The proponent notes that Abbot Point provides foraging habitat for marine turtles with the green turtle being identified as the most frequent marine turtle within the port limits[132].

In addition to the threatened species mentioned above, which are also listed as migratory species, the PER states that four other migratory marine species are known to occur within the project area. Those other species are the dugong, Australian snubfin dolphin, Indo-Pacific humpback dolphin and estuarine crocodile.

Dugongs were reported to migrate long distances between dugong protection areas north and south of Abbot Point and potentially grazing on seagrasses in Abbot Bay on route. The PER reports that the Abbot Point dugong population is not an important population[133].

Consideration

Potential impacts to these megafauna are both direct and indirect. Indirect impacts from the burial of benthic habitat could result in the displacement of feeding grounds for dugong resulting in an increase in pressure on adjacent habitats by the displaced animals.
Green Turtles (the primary species which may be impacted) have a high fidelity to their foraging grounds and are unlikely to move to new feeding areas[134]. Therefore the impacts to turtles is likely to be the gradual decline in condition of the animals and the increase in disease and strandings as seen following the 2011 extreme weather events.

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[132] GHD. 2012 Abbot Point, Terminal 0, Terminal 2 and Terminal 3 Capital Dredging Public Environment Report (EPBC 2011/6213/GBRMPA G34897.1). GHD Brisbane (Chapter 4 Matters of National Environmental Significance, Page 4-17)
[133] GHD. 2012 Abbot Point, Terminal 0, Terminal 2 and Terminal 3 Capital Dredging Public Environment Report (EPBC 2011/6213/GBRMPA G34897.1). GHD Brisbane (Chapter 3 Environmental Values, Potential Impacts and Mitigation)
[134] Broderick, A.C., Coyne, M.S., Glen, F., Fuller, W.J. and Godley, B.J. 2007. Fidelity and over-wintering of sea turtles. Proc. R. Soc. B (2007) 274, 1533-1538

Vessel strike due to increased vessel operation in the area is a risk, however the level of risk is low given the mobility of the animals in question and the relatively slow speeds of the vessels used for the works.

Direct impacts to megafauna are not expected but indirect impacts associated with potential loss of seagrass may cause some impacts.

SOCIAL VALUES

Social values are those things that an individual considers to be of value in their social existence. For the proposed DMRA those values are likely to include:

- Contribution that the area makes to the economic fabric of the community, e.g. commercial fishing;
- Contribution that the area makes for recreational activity, e.g. recreational fishing; and
- Contribution the area makes to the public's perception that it forms an integral part of the GBRWHA

Marine Park stakeholders and community groups that could be impacted (positively and negatively) by the proposed activity in the Marine Park include:

(a) Commercial fishing operators (direct negative impacts on opportunity)
(b) Recreational fishers (direct negative impacts on opportunity)
(c) Visitors to the Marine Park- for example scuba divers diving the nearby Catalina dive wreck (WWII aircraft) (direct negative impacts on opportunity)
(d) Local seafood suppliers (indirect impacts on opportunity)
(e) Traditional Owners
(f) Local residents (employment, amenity, appreciation)
(g) Port proponent (economic)

The proponent states that the area's fishery value is low and that there will be no significant impact from the proposed activity[135]. Commercial fishers have indicated that they will be forced to fish elsewhere if offshore disposal to the DMRA is approved, as turbid plumes and changed benthic habitat will result in decreased and displaced fishing effort. Scallop and prawn fisheries will most likely be impacted by changes in benthic habitat, while mackerel and shark fisheries will most likely be adversely affected by prolonged turbid plumes[136].

The PER states broadly (on a whole of project level) that there will be little to no socio-economic impacts as a result of the project and that none of these social activities take place within the port limits[137].

Consideration

Impacts could include a loss of income and employment for dive operators and other marine tourism operators, and suppliers for recreational activities (e.g. boats, fishing and camping equipment).

[135] GHD. 2012 Abbot Point, Terminal 0, Terminal 2 and Terminal 3 Capital Dredging Public Environment Report (EPBC 2011/6213/GBRMPA G34897.1). GHD Brisbane (Chapter 3 Environmental Values, Potential Impacts and Mitigation Summary, Page 3-163)
[136] CDM Smith. 2013. North Queensland Bulk Port Corporation Abbot Point Terminal 0, 2 and 3 Capital Dredging PER Supplementary Report. CDM Smith Brisbane (Appendix E, Page 25-27)
[137] GHD. 2012 Abbot Point, Terminal 0, Terminal 2 and Terminal 3 Capital Dredging Public Environment Report (EPBC 2011/6213/GBRMPA G34897.1). GHD Brisbane (Chapter 3 Environmental Values, Potential Impacts and Mitigation Summary, Page 3-7)

There could be an impact on regional reputation of tourism and recreational activities (including recreational fishing and coastal and island camping), resulting in a prolonged recovery time for these industries.

People employed in reef-dependent industries may be forced to leave the area, if water quality declines, and if marine life is adversely affected by the disposal activity and other activities related to the port expansion. This in turn may cause disruption to social cohesion and social networking in the local community. Other possible social impacts associated with the proposed activity include:

- disruption to personal and cultural levels of attachment to the area;
- diminished visual (scenic) amenity above and below water;
- compromised dive experiences.

There is currently a high level of concern from tourism operators in the Whitsundays (south of the proposed disposal activity). They are concerned about dredge disposal plumes potentially migrating in a southerly direction from the disposal activity and thus impacting on their livelihoods. The probability of a southerly movement of the dredge plume is not clear as all the modelling was based on 2007 conditions when the predominant flow was towards the north. There are however, years in which the predominant ocean flow is towards the south but it is not clear how far the sediment from the disposal activity could migrate.

Summary

The disposal of dredge material at the DMRA has the potential to impact on local social values particularly through impacts on opportunities for reasonable use by other Marine Park stakeholders (Marine Park users) especially those who depend on a healthy Reef for their livelihood, for example, commercial fishers, tour operators and those who supply recreational users, tour operators and commercial fishers who operate in the Marine Park.

It is considered there is also a risk to commercial fishers associated with dredge material disposal activities potentially displacing fishers and influencing catches due to poor water quality and direct and indirect impact to fisheries habitat. A perception has been set in Gladstone, where dredging and disposal has been allegedly correlated to major impacts on the commercial fishing industry.

The proposed activity in the Marine Park may negatively affect the public perception of the Great Barrier Reef Marine Park Authority as an effective management agency and upholding the objectives of the Act. This may also affect the World Heritage Status of the Great Barrier Reef by UNESCO. Any approval of dredge material disposal in the Marine Park at this time may lead to negative perception issues for the GBRMPA.

There are significant social impacts associated with the proposed activity, some of which are based on perception and other that are based on economics.

Most of the social risk is difficult to quantify and to mitigate due to the level of tension existing between stakeholders (fishers, tourism and the proponent).

The most probable risk mitigation strategy would involve alternatives to sea dumping with considerable input from relevant stakeholders.

In order to reduce the risks to tourism operators an adequate dredge plume model is needed which considers inter-annual variability and increases certainty around plume location.

Water quality monitoring based on the above mentioned plume model would increase the likelihood that dredging and disposal operations could be adaptively managed if the plume is observed to be travelling towards tourism values.

The proposal in its current form will have unacceptable social impacts (in particular the impact on

commercial fishers). The mitigating measure that could reduce the social impact risk would be to select an alternate DMRA, however, the perception risk surrounding dredge material disposal in a World Heritage Area would still remain.

Perception risk may be managed by implementing education and communication strategies.

CULTURAL HERITAGE VALUES

Indigenous Cultural Heritage is one of the many elements comprising the Outstanding Universal Values of the Great Barrier Reef World Heritage Area. GBRMPA recognises and respects the cultural values of GBR Traditional Owners.

The PER states that the DMRA does not support any cultural heritage values[138] although sites have been identified in the broader Abbot Point region[139]. No significant impacts on cultural heritage values are anticipated as a result of the project[140].

The Strategic assessment has categorised Indigenous heritage values into four broad categories:
1. Cultural practices, observances, customs and lore
2. Sacred sites, sites of particular significance places for important for cultural tradition
3. Stories, songlines, totems, and languages
4. Indigenous structures, technology, tools and archaeology.

There may be other indigenous values that have not been assessed in the PER which may be impacted[141].The PER notes that through meetings with the Juru (Traditional Owners of Abbot Point) and the proponent, Juru were provided with a briefing of the project and the initial feedback obtained was that Juru did not support land based disposal of the dredged material[142]. However there is no discussion on whether or not Juru supported ocean disposal.

There is an Indigenous Land Use Agreement (ILUA) in place for the port area which the proponent says has been the source of ongoing dialogue between the proponent and the Juru Traditional Owners of Abbot Point[143]. There is no Traditional Use of Marine Resources Agreement (TUMRA) in the area however Juru Traditional Owners are party to a Turtle and Dugong MOU agreed between the Gudjuda Reference Group and the then Queensland Environmental Protection Agency[144]. Turtle and Dugong are strong elements of overall Indigenous Cultural Heritage. The MOU was agreed in June 2005 and the GBRMPA has not received any advice that the Agreement is no longer current.

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[138] GHD. 2012 Abbot Point, Terminal 0, Terminal 2 and Terminal 3 Capital Dredging Public Environment Report (EPBC 2011/6213/GBRMPA G34897.1). GHD Brisbane (Chapter 3 Environmental Values, Potential Impacts and Mitigation Summary, Page 3-178)

[139] GHD. 2012 Abbot Point, Terminal 0, Terminal 2 and Terminal 3 Capital Dredging Public Environment Report (EPBC 2011/6213/GBRMPA G34897.1). GHD Brisbane (Chapter 3 Environmental Values, Potential Impacts and Mitigation Summary, Page 3-178)

[140] GHD. 2012 Abbot Point, Terminal 0, Terminal 2 and Terminal 3 Capital Dredging Public Environment Report (EPBC 2011/6213/GBRMPA G34897.1). GHD Brisbane (Chapter 3 Environmental Values, Potential Impacts and Mitigation Summary, Page3-7)

[141] Great Barrier Reef Marine Park Authority. (2013). *Great Barrier Reef Region Strategic Assessment Program Report: Draft for public comment*. Townsville: Great Barrier Reef Marine Park Authority.

[142] CDM Smith. 2013. North Queensland Bulk Port Corporation Abbot Point Terminal 0, 2 and 3 Capital Dredging PER Supplementary Report. CDM Smith Brisbane (2.2.5)

[143] National Native Title Tribunal. 2012. Extract from Register of Indigenous Land Use Agreements, Port of Abbot Point and Abbot Point State Development Area. NNTT, QLD

[144] ATNS. 2007. Juru, Gia and Ngaru Turtle and Dugong Memorandum of Understanding, http://www.atns.net.au/agreement.asp?EntityID=3722. Agreements, treaties and negotiated settlements project. (Accessed on 19 June, 2013)

Juru Traditional Owners continue to access their sea country for many reasons associated with their strong connection to country and their strong interests in maintaining their Indigenous Cultural Heritage values.

Consideration

- There is little evidence in the PER to substantiate the conclusion that no impacts to cultural heritage values are expected.
- Discussions between the proponent and the Juru Traditional Owners were not attended by GBRMPA staff but the rationale of not supporting disposal of dredge material on land is unclear.
- The risk to the ecosystem from increased sedimentation will impact negatively on the overall Indigenous Cultural Heritage values held in the area. Further, the plume models for the dredging show that the effect of sedimentation will extend across Abbot Bay to affect the eastern side of Cape Upstart. Juru Traditional Owners have recently been granted Native Title to Cape Upstart indicating that that specific area is of significant cultural importance to Juru Traditional Owners[145].

There is insufficient information relating to the cultural values of the disposal site and no thorough assessment has been undertaken.

Limited information exists on the proponent's engagement with Traditional Owners regarding their view on the offshore disposal of dredge material.

HERITAGE (OTHER) VALUES

The PER states that the project will not notably alter, modify, obscure, diminish, degrade or damage the national heritage values of the Great Barrier Reef National Heritage Place (NHP)[146]

WWII Catalina Aircraft Wreck

During the preliminary development of the PER, the proponent, GBRMPA and Department of the Environment were unaware of the location of the WWII Catalina aircraft wreck which was identified by local community divers offshore Abbot Point near the proposed DMRA. Local divers believe the plane wreck will be impacted by sedimentation due to dredging and disposal activity, and could possibly be buried under silt. According to the locals, the wreck which crashed 17 August 1943, lay undiscovered until two years ago, and could be listed as a future site of special significance, as there were 12 people lost in the accident while two others survived. The bodies were never recovered and are presumed to be entombed within the wreckage[147].

Anecdotal evidence indicates that only part of the wreck has been discovered. The proponent has identified that there is unlikely to be any impact from the dredging and disposal activity under modelled conditions.

[145] National Native Title Tribunal. 2011. Native title recognition for the Juru People, http://www.nntt.gov.au/news-and-communications/media-releases/pages/nativetitlerecognitionforthejurupeople.aspx . (accessed on 19 June, 2013)

[146] GHD. 2012 Abbot Point, Terminal 0, Terminal 2 and Terminal 3 Capital Dredging Public Environment Report (EPBC 2011/6213/GBRMPA G34897.1). GHD Brisbane (Chapter 4 Matters of National Environmental Significance, Page 4-1)

[147] Australian Broadcasting Corporation Broadcast: The 7.30 Report, 25/02/2013 Reporter: Peter McCutcheon. http://www.abc.net.au/7.30/content/2013/s3698078.htm (accessed on 18th June, 2013)

Other Historic Wrecks

There are over 21 listed historic shipwrecks listed on the Australian National Shipwreck Database between Cape Bowling Green and the Bowen Region. Many of the locations of these wrecks remain unknown and some wrecks are protected.

Consideration

- Impacts to the Catalina wreck and the values it holds for the families and the military could occur if the DMRA is used as a dumping ground and should be avoided.
- Further exploration of the area may be required to determine if other parts of the wreckage can be located and protected.
- It is important to consider the possibility of other historic shipwrecks being impacted by the disposal of dredge material.

Summary

The avoidance of any potential impacts on the WWII wreck is important for the preservation of this heritage site. The main concern is the uncertainty associated with the modelling and the possibility of un-modelled conditions arising and the plume still impacting on the wreck. Preference is to avoid any works in near proximity to the wreck and as such, alternatives which do not pose a risk to the heritage values of the GBR need to be considered. Any impact on the WWII heritage Catalina site are unacceptable.

The uncertainties associated the plume modelling and the proximity of the WWII aircraft wreck to the proposed DMRA, the proposal in it's current form would pose a risk to heritage values of the Marine Park. The only mitigating measure that would minimise the risk to heritage values, with certainty, is the selection of an alternate disposal site that avoids the possibility of a dredge disposal plume encountering the Catalina wreck.

Adequate information is not available to determine the likely effects of the proposed disposal (a consideration under Annex 2, clause 14 of the London Protocol).

CUMULATIVE IMPACTS

The proponent has not considered the cumulative pressures or the current reduced state of the regions resilience to other natural pressures such as cyclones or flooding.
The exposure map below (Figure 16) shows the exposure of each area to stressors such as freshwater plumes, cyclones and temperature effects. When viewed in context of the seagrass distribution map (Figure 14), there is a relationship between exposure to stressors and impacts to seagrass and other communities. The current state of the Abbot Point region is in a recovery mode following the impacts of previous years. Therefore, the sensitivity of the environment which may be impacted by the activity is high.

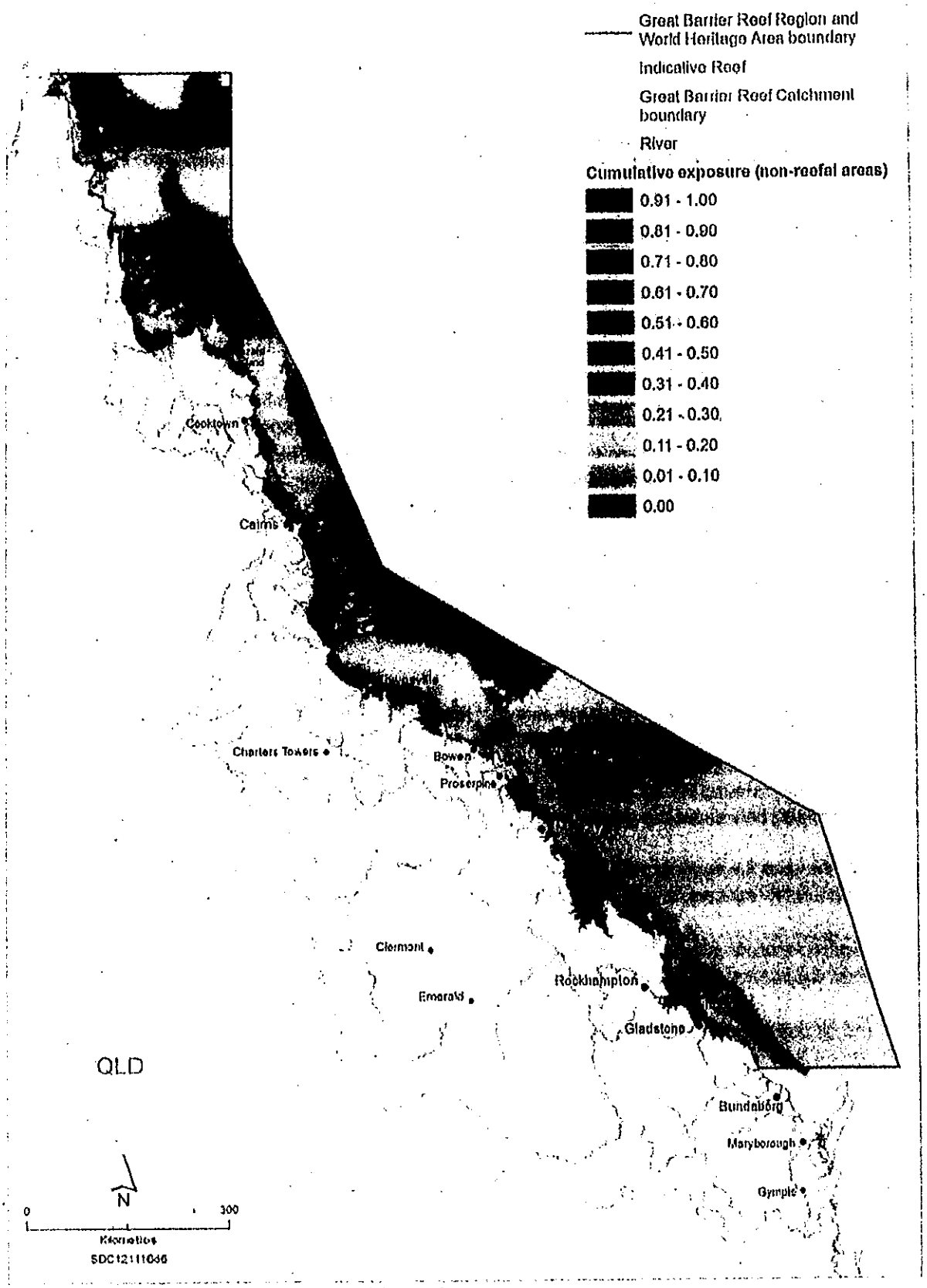

Figure 16: Cumulative exposure (non-reefal areas)

15 Each assessment should conclude with a statement supporting a decision to issue or refuse a permit for dumping.

Conclusion

The dredging and disposal of 3 million cubic metres of capital dredge material derived from the Port of Abbot Point, to the DMRA is likely to impact on the environmental, social and heritage values of the GBRWHA. Potential impacts include:

- Decline in water quality by increased Total Suspended Solids (TSS), turbidity and possibly nutrients
- Direct burial of benthic flora and fauna over an area of 400 ha at the disposal site and within nearby areas to the dredging activity
- Sedimentation and increased light attenuation due to increased TSS and Turbidity impacts on nearby coral communities (i.e. Holbourne Island and Nares Rock)
- Sedimentation and increased light attenuation due to increased TSS and Turbidity impacts on seagrass and coral communities (i.e. Camp Island) nearby to the dredging activity
- Direct and indirect impacts on marine turtles, dugongs and other marine mega fauna
- Potential impacts on the WWII Catalina plane wreck by sedimentation
- Impacts and displacement of commercial fishing effort

The proponent has investigated alternative options which are intended to minimise or avoid sea dumping. There are technically feasible alternatives which would achieve this. These alternatives would come at an extra cost to the proponent, and are likely to be cost disproportionate, however are likely to result in better and more manageable environmental, social, cultural and heritage impacts than sea dumping.

The London Protocol and supporting documents (i.e. NAGD 2009) do not provide any guidance when considering what the true meaning of disproportionality is. Alternatives may be proportionate financially when considering the holistic bounds of the port expansion and associated infrastructure. However if only considering the cost to the proponent, it is likely that the costs of the trestle and land based disposal alternatives are disproportionate.

Similarly the costs to the environment and the ecosystem services which it provides have not been measured and in this context, the cost of affording a higher level of protection to the WHA.

The London.Protocol, Annex 2, Clause 15 states that each assessment should conclude with a statement supporting a decision to issue or refuse a permit for dumping.

A permit for dumping in this case could be refused on the grounds of:
~ There is a lack of adequate information to determine the likely effects of the proposed disposal option (Annex 2, Paragraph 14)
~ Article 3 of the London Protocol states that "Contracting Parties shall apply a precautionary approach to environmental protection from dumping of wastes or other matter whereby appropriate preventative measures are taken when there is reason to believe that wastes or other matter introduced into the marine environment are likely to cause harm even when there is no conclusive evidence to prove a causal relation between inputs and their effects".
~One alternative that was considered (moving the DMRA) is not seen to be disproportionate in costs and is likely to provide for a better environmental, social and heritage outcome.
~pursuant to Annex 2 (Paragraph 14) a comparative assessment needs to consider the economics and exclusion of future uses. The comparative assessment did not consider the future uses of other users of the area; it only considered the future use of the area for the port proponent.

A permit for dumping in this case could be granted on the grounds that:
~ The alternatives considered, the trestles and land based disposal could be seen to be disproportionate in costs (Annex 2, Paragraph 6).
~ A letter from the Hon Greg Hunt MP (Minister for the Environment) on the 23 January 2014 states that "the assessment of the dredging project under the EPBC Act addressed the assessment framework outlined in part four of the National Assessment Guidelines for Dredging (2009). That included the evaluation of alternatives, sampling and analysis of sediments, assessment of potential impacts on the environment, and the monitoring and management of impacts. The sediment to be dredged was found not to be contaminated and to be suitable for sea disposal. I wish to advise you under section 163(1)(a) of the EPBC Act, that North Queensland Bulk Ports Corporation has addressed all of the requirements for the loading and disposal of sediments at sea and therefore recommend that a permit should be granted under section 19 of the Sea Dumping Act."

Monitoring

16 **Monitoring is used to verify that permit conditions are met - compliance monitoring - and that the assumptions made during the permit review and site selection process were correct and sufficient to protect the environment and human health - field monitoring. It is essential that such monitoring programmes have clearly defined objectives.**

If a permit is issued, conditions for monitoring will be included in the permit.

Permit and Permit Conditions

17 **A decision to issue a permit should only be made if all impact evaluations are completed and the monitoring requirements are determined. The provisions of the permit shall ensure, as far as practicable, that environmental disturbance and detriment are minimized and the benefits maximized. Any permit issued shall contain data and information specifying:**
.1 the types and sources of materials to be dumped;
.2 the location of the dump-site(s);
.3 the method of dumping; and
.4 monitoring and reporting requirements.

18 **Permits should be reviewed at regular intervals, taking into account the results of monitoring and the objectives of monitoring programmes. Review of monitoring results will indicate whether field programmes need to be continued, revised or terminated and will contribute to informed decisions regarding the continuance, modification or revocation of permits. This provides an important feedback mechanism for the protection of human health and the marine environment.**

Although the proponent has not considered it, an important additional mitigation measure is the limitation of overflow dredging. '"The use of a Trailer Suction Hopper Dredge without keel-level overflow should not be accepted for projects in the vicinity of coral reefs, to prevent unnecessary turbidity and dispersal of fine sediments. Further conditions should include the use of the environmental valve in the overflow duct, which reduces air entrainment in the overflow promoting the settling of the overflow material"[148].

[148] PIANC 2010. Report no. 108, *Dredging and port construction around coral reefs*

The Hon Greg Hunt, Minister of the Environment, in a letter to the GBRMPA on the 23 January 2014 stated that "I wish to advise you under section 163(1)(b) of the EPBC Act that I have provided an attachment to this letter with conditions that may be appropriately attached to an approval under the Sea Dumping Act. Those recommended conditions include reference to the loading and dumping activities that are already regulated under the EPBC Act and to standard conditions of approval for sea dumping proposals. In addition, you may also wish to impose a condition to seek a variation to the disposal site approved under the EPBC Act if a better site is found after further investigation."