

**Port of Gladstone
Gatcombe and Golding Cutting
Channel Duplication Project**

Environmental Impact Statement



Gladstone Ports Corporation
Growth, Prosperity, Community

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**Appendix B2
Dredged Material
Placement Options
Investigation**



**Port of Gladstone Gatcombe and
Golding Cutting Channel Duplication
EIS**

**Dredged Material Placement Options
Investigation (DMPOI)**

Reference: 237374-004

Prepared for: Gladstone
Ports Corporation Ltd

Revision: 5

11 February 2015

EXPLANATORY NOTE

January 2019

This Dredged Material Placement Options Investigation (DMPOI) was undertaken between 2013 and early 2015 to support the Port of Gladstone Gatcombe and Golding Cutting Channel Duplication Project Environmental Impact Statement (EIS).

This report presents the methodology and findings of the DMPOI, including the identification of the dredged material placement options, and the multi-criteria analysis that was completed within the framework of the Project description and the legislative requirements that were relevant and in effect at that time.

During 2015 and 2016, significant legislative changes occurred in Commonwealth and Queensland Government policy and environmental regulation which directly impacted the Gatcombe and Golding Cutting Channel Duplication Project. These were:

- Release of the Reef 2050 Long-Term Sustainability Plan (Reef 2050) which presented a plan to action protecting the Outstanding Universal Value of the Great Barrier Reef World Heritage Area
- Enactment of the *Sustainable Ports Development Act 2015* (Qld) which introduced prohibitions on capital dredging and capital dredged material placement, restrictions on port development and the requirement for priority port master planning
- Amendments to the *Great Barrier Reef Marine Park Regulations 1983* (Cth) which introduced prohibitions and limitations on the sea-based placement of capital dredged material within the Great Barrier Reef Marine Park.

As a result of these policy and legislative changes, the findings of the original DMPOI were reviewed and a Supplementary DMPOI was prepared in 2017 and 2018 and updated in 2019 (refer Appendix B1). However the outcome of this original DMPOI has been retained as a standalone report in its original form.

In this regard, this report has been provided in the Gatcombe and Golding Cutting Channel Duplication EIS as background information only and the Supplementary DMPOI should be regarded as the relevant assessment of alternative beneficial reuse dredged material placement options for the Gatcombe and Golding Cutting Channel Duplication EIS.

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Document prepared by:

Aurecon Australasia Pty Ltd

ABN 54 005 139 873

Level 14, 32 Turbot Street

Brisbane QLD 4000

Locked Bag 331

Brisbane QLD 4001

Australia

T +61 7 3173 8000

F +61 7 3173 8001

E brisbane@aurecongroup.com

W aurecongroup.com

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Author signature			Approver signature					
Name		Zoe Bishop-Kinlyside	Name			Stephen Cole		
Title		Environmental Planner	Title			Technical Director		

Port of Gladstone Gatcombe and Golding Cutting Channel Duplication EIS

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Aurecon Australasia Pty Ltd

ABN 54 005 139 873

Level 14, 32 Turbot Street
Brisbane QLD 4000

Locked Bag 331
Brisbane QLD 4001

Australia

T +61 7 3173 8000

F +61 7 3173 8001

E brisbane@aurecongroup.com

W aurecongroup.com



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Acronyms and abbreviations

Abbreviation	Explanation
3TL	Tenement to Terminal Limited
AASS	Actual Acid Sulfate Soils
ADCP	Acoustic Doppler Current Profiler
AHD	Above Height Datum
CG	Coordinator-General
CSD	Cutter Suction Dredger
Cwth	Commonwealth
DAFF	Department of Agriculture, Fisheries and Forestry
DEHP	Department of Environment and Heritage Protection
DMPA	Dredged Material Placement Area
DMPOI	Dredged Material Placement Options Investigation
DoE	Department of the Environment
DPA	Dugong Protection Area
DSDIP	Department of State Development, Infrastructure and Planning
DSITIA	Department of Science, Information Technology, Innovation and the Arts
EA	Environmental Authority
eg	For example
EIS	Environmental Impact Statement
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
ESD	Ecologically Sustainable Development
ESP	Environmental Sensitivity Profile
GBRMP	Great Barrier Reef Marine Park
GBRMP Act	<i>Great Barrier Reef Marine Park Act 1975</i>
GBRMPA	Great Barrier Reef Marine Park Authority
GBRMP Regs	<i>Great Barrier Reef Marine Park Regulations 1983</i>
GBRWHA	Great Barrier Reef World Heritage Area
GIS	Geographic Information System
GPC	Gladstone Ports Corporation
GRC	Gladstone Regional Council
GSDA	Gladstone State Development Area
ha	Hectare
IAS	Initial Advice Statement
ie	That is
JCU	James Cook University
km	Kilometre
LAT	Lowest Astronomical Tide

Abbreviation	Explanation
LNG	Liquefied Natural Gas
London Protocol	<i>1996 Protocol to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter</i>
m	Metre
MCA	Multi-criteria analysis
mm	Millimetre
Mm ³	Million cubic metres
MNES	Matters of National Environmental Significance
N/A	Not applicable
NAGD	<i>National Assessment Guidelines for Dredging</i>
NPRSR	Department of National Parks, Racing, Sport and Recreation
OUV	Outstanding Universal Value
PASS	Potential Acid Sulfate Soils
PCCC	Port Curtis Coral Coast
PIANC	Permanent International Association of Navigation Congresses
Port	Port of Gladstone
PPDA	Priority Port Development Area
Project	Gatcombe and Golding Cutting Channel Duplication Project
QAL	Queensland Alumina Limited
QER	Queensland Energy Resources
QLNG	Queensland Liquefied Natural Gas
QPS	Queensland Ports Strategy 2014
RDA	Residual Disposal Area
RGTCT	RG Tanna Coal Terminal
RL	Relative Level
SDPWO Act	<i>State Development and Public Works Organisation Act 1971</i>
Sea Dumping Act	<i>Environment Protection (Sea Dumping) Act 1981</i>
SEWPaC	Commonwealth Government Department of Sustainability, Environment, Water, Population and Communities (now known as the Department of the Environment)
Strategic Plan	Gladstone Ports Corporation's <i>50 Year Strategic Plan</i> (July 2012)
ToR	Terms of Reference
TSHD	Trailing Suction Hopper Dredger
TUMRA	Traditional Use of Marine Resources Agreement
UNESCO	United Nations Educational, Scientific and Cultural Organization
WICT	Wiggins Island Coal Terminal
Western Basin Project	Western Basin Dredging and Disposal Project
Zoning Plan	<i>Great Barrier Reef Marine Park Zoning Plan 2003</i>
WICET Pty Ltd	Wiggins Island Coal Export Terminal Pty Ltd

Glossary

Term	Definition
Area to be dredged	A designated area where dredging operations are proposed to occur
Bed-shear stress	Forces exerted by the ocean on seabed sediments. In the instance that bed-shear stress exceeds the critical shear stress for seabed sediments, then sediment displacement occurs
Beneficial use of dredged material	The use of dredged material for another purpose which provides a social, economic and/or environmental benefit
Capital dredging	The undertaking of a campaign of dredging works to establish new or larger channels, berths and swing basins or as part of engineering works.
Constraint aspects	Ecological/environmental, social, cultural heritage, economic and operational constraints associated with identifying potential dredged material placement locations
Dewatering of dredged material	The removal of water from dredged material either naturally (evaporation) or mechanically (artificial compaction)
Maintenance dredging	Dredging undertaking to ensure previously dredged channels, berths, swing basins or other areas are maintained at their designated dimensions to safe and continued maritime access
Non-beneficial use of dredged material	The placement of dredged material that does not result in a concurrent benefit, such as offshore (at sea) placement
Sedimentation	The deposition or accumulation of sediment that can occur either on the seabed or suspended in the water column. Deposition on the seabed is calculated as a probability function of the prevailing bottom stress, local sediment concentration and size class. Sediment that is deposited may subsequently be resuspended into the lower water column if critical levels of bottom stress are exceeded
Turbidity	A measure of the degree to which water loses its transparency due to the presence of suspended particles. The more total suspended solids in the water, the higher the turbidity. There are various parameters influencing turbidity, including sediments, phytoplankton, waste discharge, algae growth and urban runoff
Working with nature	Incorporating design elements or considerations which maximise opportunities to create ecologically beneficial outcomes (eg habitat creation)



1 Introduction

1.1 Overview

The Port of Gladstone is Queensland's largest multi-commodity port, one of the busiest ports in Australia and the world's fifth largest coal export terminal (by throughput). The Port of Gladstone has been identified by the Queensland Government as a Priority Port Development Area (PPDA) in the Queensland Port Strategy (QPS) (State of Queensland 2014), where port related development will be prioritised to continue its growth as a major industrial centre for the future of Australia, essential to the local, state and national economies.

Gladstone Ports Corporation Ltd (GPC) manages and operates the Port, with operations spread over a number of precincts across 4,321 hectares (ha) of land, including 700 ha of reclaimed land. Major exports through Gladstone include coal, alumina, cement, petroleum products, aluminium and agricultural resources.

The introduction of the Liquefied Natural Gas (LNG) industry to the Gladstone region and the commencement of operations at the Wiggins Island Coal Terminal (WICT) from early 2015 will substantially increase the throughput of the Port of Gladstone in the future. It is estimated that approximately 300 million tonnes of product will be handled annually by the Port within the next 50 years.

GPC has released the current *50 Year Strategic Plan* (July 2012) (Strategic Plan) identifying the significant growth in trade and therefore shipping traffic in the Port. In light of the anticipated growth, GPC has carried out channel capacity studies to better understand the adequacy of the Port's existing shipping channels. The most recent channel capacity study indicated that the current ability of the Port to accommodate high volumes of shipping traffic is limited by the channel depth and lack of passing capacity in the one way channel.

To facilitate the increase in port throughput and mitigate the risk of incidents caused by additional vessels utilising the Port's shipping channels, the Strategic Plan identified the need to duplicate the Gatcombe and Golding Cutting Channels in the short term, as well as other Port shipping channels in the long term.

Without duplication of the Gatcombe and Golding Cutting Channels, the ability of the Port to accommodate planned industrial developments and meet future trade commitments will be significantly limited, hindering the economic viability of the region. A 'no action' option would also result in shipping delays, increased risk of incidents and other issues associated with increased congestion of existing shipping channels.

1.2 The Gatcombe and Golding Cutting Channel Duplication Project

1.2.1 Overview

The proposed Gatcombe and Golding Cutting Channel Duplication Project (herein referred to as 'the Project') was declared a 'Coordinated Project' by the Queensland Coordinator-General (CG) under the *State Development and Public Works Organisation Act 1971* (SDPWO Act) on 25 September 2012. The Project was also determined to be a 'controlled action' requiring an Environmental Impact Statement (EIS) by the Commonwealth Minister for the Environment under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) on 23 October 2012.

GPC is currently proceeding with the EIS phase of the Project. The EIS will be submitted for assessment to both the Queensland State Government under the SDPWO Act and the Commonwealth Department of the Environment (DoE) under the EPBC Act. The Project originally had the potential to undertake activities (eg placement of dredged material within the Great Barrier Reef Marine Park (GBRMP) which are assessable under the *Great Barrier Reef Marine Park Regulations 1983* (GBRMP Regs). While no Project activities are proposed directly within the GBRMP, the Project does have the potential to impact on the World Heritage values of the GBRMP. Further details regarding the legislative framework for the Project are provided in Section 4.2.

1.2.2 Project description

GPC proposes to duplicate the existing Gatcombe and Golding Cutting shipping channels and construct and operate associated port infrastructure within the Port of Gladstone as illustrated in Figure 1.1. The key components of the Project include:

- Duplication of the existing Gatcombe and Golding Cutting shipping channels, with a new channel 9.12 kilometres (km) long, to a depth of RL -16.1 metres (m) and width of 200 m, allowing for two way passage of vessels
- A new onshore and/or offshore (at sea) dredged material placement area (within Port limits) for placement of approximately 12.6 million cubic metres (Mm³) of dredged material
- Relocation of existing and installation of new navigational aids

The timing of dredging for the Project will be driven by shipping demand and vessel sizes/types associated with industrial development in the Gladstone region. Dredging will occur in either a single stage, dredging to the final depth of RL -16.1 m over approximately 20 months, or over two stages. Stage 1 would involve dredging approximately 7.25 Mm³ of material to RL -13.5 m over a period of 12 months (limiting vessel use until Stage 2 is completed), with Stage 2 involving dredging of approximately 5.35 Mm³ of material to the final depth of RL -16.1 m over approximately eight months.

The dredging footprint for the proposed channel duplication has been designed to best accommodate the existing and future users of the Port, minimise the potential environmental impact associated with dredging and minimise the volumes of both capital and maintenance dredging requirements.

1.2.3 Project objectives

The high level framework objectives of the Project include:

- To ensure the existing and future commercial vessels utilising the Port of Gladstone's shipping channels, swing basins and berth pockets minimise shipping delays, risk of incidents and other issues associated with the congestion of the shipping channels within the Port



Legend

- Great Barrier Reef Marine Park Boundary (Commonwealth)
- Existing Channel Extent
- Proposed Channel Duplication Project Extent
- Approved Western Basin Channel Extent
- - - Port of Gladstone Port Limits
- Existing GPC Approved East Banks DMPA

Source:
Aerial: Bing Maps, 2010.
GSDA: DLGP, July 2008.

Note: Western Basin channels are not part of the Channel Duplication Project

Date: 11/02/2015

Version: 1

Port of Gladstone Gatcombe and Golding Cutting Channel Duplication

Figure 1-1: Locality Plan

Map by PIC P:\GIS\Projects\237374_GPC_Channel_Duplication_EIS\237374_Locality_Plan_001.mxd 19/06/2014 15:34



A1 scale: 1:110,000



Job No: 221705

Coordinate system: GDA_1994_MGA_Zone_56

- To identify dredged material placement option(s) for dredged material from the Project that meet regulatory requirements as well as maximising beneficial ecological/environmental, social and cultural heritage and economic outcomes
- To implement the following key steps as part of the project development, design, construction and operational phases of the Project:
 1. Prevention/avoidance of impacts
 2. Mitigation of potential impacts
 3. Offsets to address significant residual adverse impacts
 4. Ongoing adaptive management
- To meet the regulatory requirements outlined in Section 4.2 with regards to dredged material placement and management

1.2.4 Dredged Material Placement Options Investigation Objectives

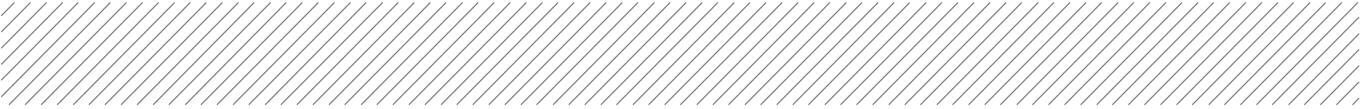
This report presents the methodology and findings of the Dredged Material Placement Options Investigation (DMPOI) undertaken to support the EIS phase for the Project. Specifically, the DMPOI has been prepared to achieve the following key primary objective:

- To identify potential dredged material placement site option(s) for the 12.6 Mm³ of dredged material from the Project that:
 - Meet regulatory requirements and support current policy objectives;
 - Maximise beneficial ecological environmental, social, cultural heritage and economic outcomes; and
 - Are considered feasible options to be taken forward to the EIS phase to undergo detailed impact assessment.

However, in seeking to achieve this primary objective, the following secondary objectives are also sought:

- Support a strategic approach to planning for the long term dredging needs of the Port of Gladstone by considering whether any of the identified placement sites would be more appropriately/efficiently used if prioritised for other future Port dredging requirements (capital and/or maintenance dredging)
- Develop a transparent, robust and repeatable process for how dredged material placement alternatives are considered and preferred options identified for future capital and/or maintenance dredged material for the Port of Gladstone, with a strong emphasis on early and ongoing stakeholder and regulatory agency engagement

Although this report assesses opportunities for the beneficial use of dredged material for the Project, it is recognised that regulatory requirements, together with dredging and material management technology and opportunities may vary over the life of the Project. Dredged material placement alternatives, including beneficial use of dredged material, will therefore be reviewed at key stages of the Project to capture such changes and confirm the potential alternatives and preferred dredged material placement option(s).



2 Dredging in the Port of Gladstone

The Port of Gladstone is located on the Central Queensland coast, approximately 525 km north of Brisbane and 100 km south of Rockhampton, and the Port operation dates back approximately 100 years to the formation of the Gladstone Harbour Board in 1914.

The Gladstone harbour is a shallow, semi-enclosed estuarine environment featuring areas of high conservation value, including important seagrass and mangrove areas, and the Great Barrier Reef World Heritage Area (GBRWhA). GPC coordinates the environmental aspects of port operations under an Environmental Management System certified to the International Standards Organisation *ISO14001 Environmental Management System (2004)* to manage port activities whilst maintaining and improving, wherever possible, the social and ecological values in and around the Port of Gladstone.

There is a long history of dredging and material placement/use in land based, reclamation and offshore (at sea) locations in the Port of Gladstone, with dredging for both capital and maintenance works occurring since the 1960s. Both capital and maintenance dredging continues to occur within the Port of Gladstone in response to industry demand, and to ensure the safety and operational efficiency of the harbour.

This section provides a historical summary of past dredging in the Port of Gladstone, together with details of future planned maintenance and capital dredging works.

2.1 History of dredging in the Port of Gladstone

2.1.1 Capital dredging and material placement

The Port of Gladstone has a long history, which commenced in the 1890s, of undertaking capital dredging works to support major project development and port industry expansion. Table 2.1 summarises past capital dredging projects since the 1960s undertaken in the Port of Gladstone, with details of the two most recent capital dredging projects provided in Section 2.2.

Table 2.1 History of significant capital dredging projects in the Port of Gladstone since 1960s

Date	Location	Depth	Volume (Mm ³)	Placement location
1960-1966	Auckland Point berths, Barney Point berths and harbour channel	Auckland Point – 23 ft Barney Point – 39 ft Harbour Channel – 9.6 m	-	Onshore and offshore
1968	Entrance channel	10.4 m	-	Onshore and offshore
1980-1982	Approach channels to Clinton and Fisherman's Landing, Gladstone Marina	-	20.0	Onshore and offshore
1986-1987	Inner harbour channels widened and berths deepened	Auckland channel widened to 180 m and deepened to 15 m	3.0	Onshore
1987	Outer channel	15.8 m	2.5	Offshore
1997	Fisherman's Landing	-	1.0	-
1997	Outer channel	16.3 m	1.0	Offshore
1998	Inner channel swing basin	-	2.0	-
1999	Inner channel	-	2.0	Onshore
2001-2003	RG Tanna Coal Terminal Berth 3, Fisherman's Landing Berth 2 and Targinnie and Clinton Bypass Channel deepening	-	2.0	Onshore
2005	RG Tanna Coal Terminal Berth 4	-	0.75	Onshore
2008-2009	Fisherman's Landing Berth 1 and approach	-	0.66	Onshore
2009-2010	Gladstone Marina	-	0.35	Onshore
2010-2011	Early works access to Curtis Island	-	0.475	Onshore
2012-2013	Wiggins Island Coal Terminal Berth 1	-	2.9	Onshore
2012-2013	Western Basin Project Stage 1A	-	21	Onshore and offshore

2.1.2 Maintenance dredging

Maintenance dredging is undertaken annually in the Port of Gladstone channels, berths and swing basins to remove sedimentation resulting from littoral drift, sediment laden stormwater runoff/flooding and tidal currents, as well as to maintain declared depths for commercial shipping access. Historically, within the Port of Gladstone, approximately 65% of maintenance dredging has occurred in the outer channels and approximately 35% occurring in the inner channels.

Maintenance dredging projects generally produce smaller volumes of dredged material than capital dredging. From the mid-1990s to 2006, approximately 100,000 m³ of maintenance dredging was carried out annually within the Port of Gladstone. Between 2007 and 2012, this average annual volume increased to 153,000 m³. During 2014 to January 2015, the maintenance dredging volume was approximately 280,000 m³, which was elevated from previous years due to additional sediment naturally migrating into the deeper channels and swing basins as part of the Western Basin Dredging and Disposal Project (here after referred to as the Western Basin Project). It is expected that there will be natural stabilising of the seabed and batter slopes of the Western Basin Project channels and swing basins over a period of time. After the initial sediment load is removed and the area stabilises the annual Port maintenance volumes will reduce to an anticipated “normal” volume based on the natural accumulation of sediments.

2.1.3 Dredged material placement

Capital dredged material from the Port of Gladstone has been managed by either placement through approved reclamation areas in close proximity to the areas to be dredged, generally at intertidal locations adjoining the mainland or offshore (at sea). Reclamation areas established using predominantly dredged material within Gladstone have included:

- Auckland Point to Barney Point (Port Central)
- Clinton Estate west of Auckland Inlet, includes Marina and Spinnaker Parklands and RG Tanna Terminal
- Fisherman's Landing
- Wiggins Island intertidal reclamation areas
- Fisherman's Landing Expansion and Western Basin reclamation area

Offshore (at sea) placement of dredged material has historically occurred within the existing East Banks Dredged Material Placement Area (DMPA), an area of approximately 1,050 ha located within Port limits and outside the Great Barrier Reef Marine Park (refer Figure 1.1). Dredged material placement at this location has occurred in association with the Port's annual maintenance dredging, channel deepening and widening, as well as dredging associated with the Western Basin Project.

2.2 Recent dredging campaigns

Recent reclamation capital dredged material placement projects undertaken in the Port of Gladstone (since 2010) include the Wiggins Island Coal Terminal (WICT) Project and the Western Basin Project.

Details of these two recent capital dredging projects are provided in the section below. Further detail regarding dredging methodologies and reclamation design are discussed in Section 5.3.

2.2.1.1 Wiggins Island Coal Project

The WICT Project involved the development of a greenfield coal terminal to supplement the current Port of Gladstone coal export capacity. Situated at Golding Point, west of the existing RG Tanna Coal Terminal (RG TCT), the WICT Project will have a nominal ultimate export capacity of 84 Million tonnes per annum (Mtpa), with Stage 1 comprising 27 Mtpa.

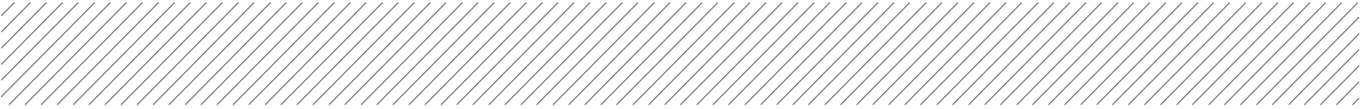
Following completion of an EIS in 2007-2008, the WICT Project was approved as a 'significant project' under the SDPWO Act in January 2008 and as a 'controlled action' under the Commonwealth EPBC Act in April 2008.

To enable maritime access, the ultimate WICT Project approval includes dredging works to establish six berth pockets, a departure channel and swing basin. Dredging for Stage 1 of the WICT Project was undertaken from May 2012 to February 2013 and included dredging of 2.9 Mm³ of material using a cutter suction dredger (CSD) to establish one berth pocket, departure channel and swing basin.

2.2.1.2 Western Basin Project

The Western Basin Project includes the capital dredging of 46 Mm³ of material for the deepening and widening of existing channels and swing basins, and the creation of new berth pockets, navigational channels, departure channels and swing basins for the Western Basin port facilities, from Auckland Point to The Narrows, including the Curtis Island LNG facilities.

Following completion of an EIS in 2009-2010, the Western Basin Project was approved as a 'significant project' under the SDPWO Act in July 2010 and as a 'controlled action' under the Commonwealth EPBC Act in October 2010. To date, approximately 21 Mm³ of material has been dredged as part of Stage 1A of the Western Basin Project.



The Western Basin Project's controlled action authorises the dredging of 25 Mm³ for Stages 1A and 1B, with placement of the material both offshore (at sea) within the existing East Banks DMPA (up to a maximum of 11 Mm³) and within the approved Western Basin reclamation area (no greater than 300 ha).

In addition, the approval also authorises the dredging of a further 21 Mm³ for Stages 2, 3 and 4 of the Western Basin Project; however the conditions of the controlled action approval require further investigation to determine the final placement location for this volume.

2.3 Future dredging in Gladstone

In response to industry demand and predicted future increases in shipping traffic, GPC continues to take a strategic approach to the management of the Port of Gladstone. This approach includes identifying and planning for future capital and ongoing maintenance dredging requirements to ensure continued access to maritime infrastructure for the handling of product and to maintain maritime safety.

In addition to the current Project, the estimated volumes of future capital dredging projects and estimated maintenance dredging requirements include:

- Western Basin Project Stages 2, 3 and 4 (21 Mm³)
- Future Port of Gladstone capital dredging (new berths, swing basins and further channel duplications) (31 Mm³)
- Future Port of Gladstone annual maintenance dredging (approximately 200,000 m³)

3 Assessment process

A six phase process was adopted to undertake the DMPOI for the Project EIS. Details of the methodology employed for each phase of the process are provided at the beginning of each corresponding section in this report for ease of reference. In summary, the six phases include:

- **Phase 1** – Review of relevant project information, including a literature review of available and relevant information in relation to dredged material placement management and site selection for placement areas. This includes an assessment of potential beneficial use options for dredged material that could be feasible within the Gladstone region.
- **Phase 2** – Definition of the spatial extent of the study area, including the 'land based and reclamation study area' together with the 'offshore (at sea) study area'.
- **Phase 3** – Definition of constraints, opportunities and considerations through the mapping of spatial aspects (including ecological/environmental, social and cultural heritage, economic and operational) within the Gladstone region to assist in defining potential dredged material placement locations (for either dredged material placement or beneficial use).
- **Phase 4** – Identification of potential sites (for either dredged material placement or beneficial use) and the undertaking of preliminary site investigations to determine feasibility.
- **Phase 5** – Undertaking of a multi-criteria analysis (MCA) of the potential dredged material placement locations to identify potential/preferred location(s) which will be taken forward for detailed assessment as part of the Project EIS.
- **Phase 6** - Additional site investigations and final selection of options.

Figure 3.1 summarises each of these phases, including key aims and the corresponding section references within this report. As stated in Section 1.2.4, this DMPOI process has been developed with a key objective being to develop a robust and transparent process for the assessment of dredged material placement sites. In seeking to achieve this, a strong emphasis has been placed upon encouraging stakeholder and regulatory agency engagement throughout the assessment and investigation process. A summary list of all stakeholders and regulatory agencies involved in the DMPOI process is provided in Table 3.1, with full details of their involvement reported within each respective phase section.

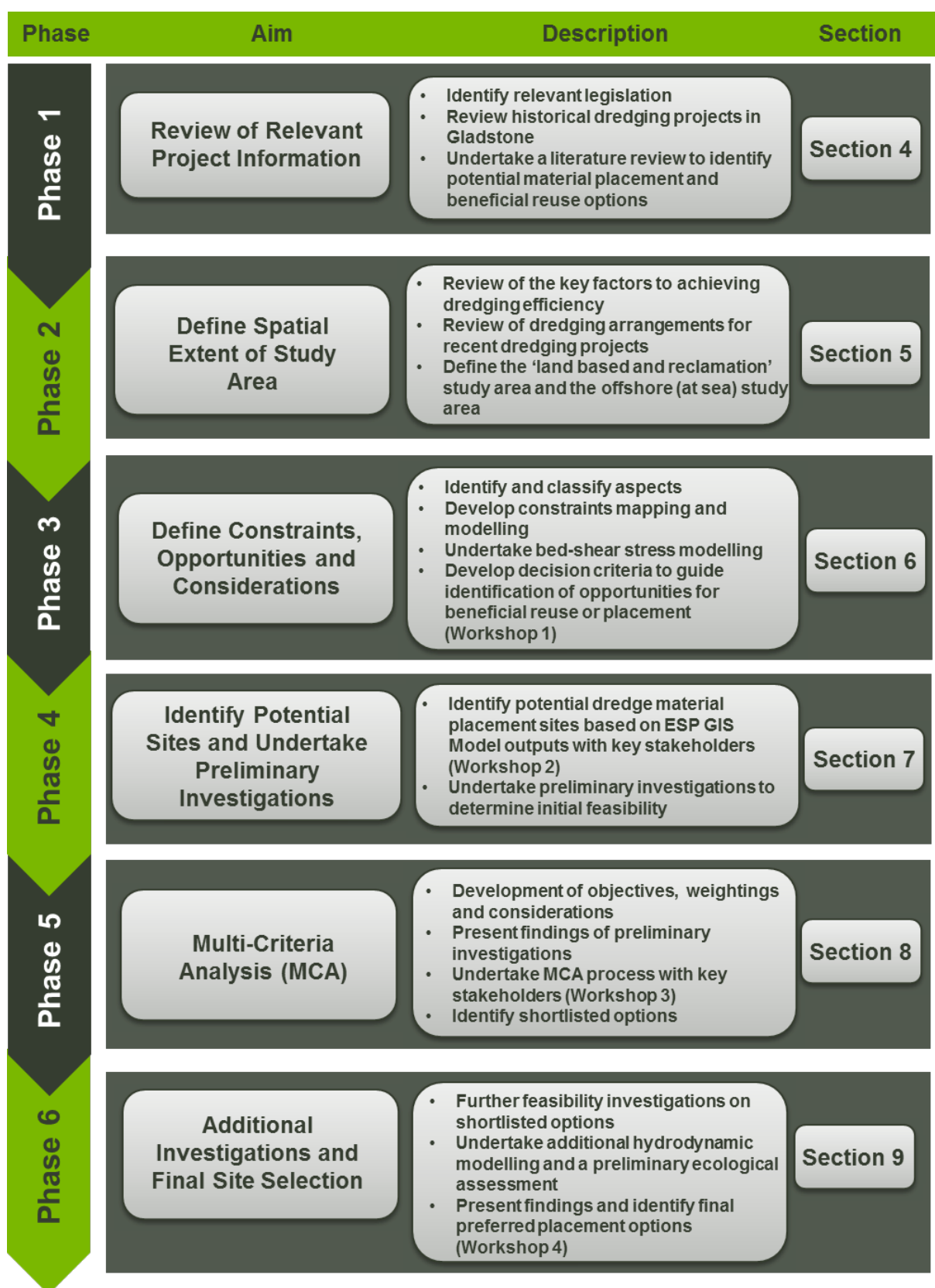


Figure 3.1 DMPOI assessment methodology and process

Table 3.1 Summary of stakeholder/regulatory agency involvement

Stakeholder/regulatory agency		Involvement				
		Workshop 1	Workshop 2	Workshop 3 Preparation	Workshop 3	Workshop 4
BMTWBM	-			N/A	●	●
Department of Agriculture, Fisheries and Forestry	DAFF	●	●	●	●	●
Department of Environment and Heritage Protection	DEHP	●	●	●	●	●
Department of National Parks, Recreation, Sport and Racing	NPRSR		●			
Department of Science, Information Technology, Innovation and the Arts	DSITIA	●	●	●	●	●
Department of State Development, Infrastructure and Planning and the Office of the Coordinator-General	DSDIP/CG	●	●	●	●	●
Department of the Environment (Cwth)	DoE	●	●	●	●	●
Gidarjil Development Corporation, as representatives of the Port Curtis Coral Coast Traditional Use of Marine Resources Agreement (TUMRA)	PCCC		●		●	
Gladstone Ports Corporation	GPC	●	●		●	●
Great Barrier Reef Marine Park Authority (Cwth)	GBRMPA	●	●	●	●	●
James Cook University	JCU		●	N/A	●	●

Table note: Meeting attendance records for each workshop, together with the minutes for Workshops 3 and 4 are provided in Appendix B.



4 Phase 1: Review of relevant project information

4.1 Phase 1 overview

Phase 1 of the DMPOI involved undertaking a desktop review of available historical information and dredging literature to compile information in order to:

- Outline the legislative requirements relevant to the identification and assessment of placement and beneficial use alternatives for the Project dredged material (Section 4.2)
- Consider the dredging and material placement methods available for the Project with reference to the experience of recent Port of Gladstone capital dredging campaigns (Section 4.3)
- Review the likely nature and composition of material to be dredged (Section 4.4)
- Identify potential beneficial use options for the dredged material, including the key factors which influence decision making (Section 4.5)

Phase 1 concluded with a summary of the preferred methods and options for dredging, dredged material placement and containment, together with the identification of feasible opportunities for beneficial use within the Port of Gladstone (Section 4.5.3) to inform the later scoping of sites in Phase 3. Appendix A contains a full list of documents referenced and reviewed.

4.2 Legislative requirements

The sections below summarise the legislative framework as it relates to the Project, detailing the relevant guidelines, approval requirements and statutory documents that apply.

4.2.1 Environment Protection and Biodiversity Conservation Act 1999

4.2.1.1 Legislative background

The EPBC Act provides that any action (ie a project, development, undertaking, activity or series or activities) that has, will have or is likely to have a significant impact on a Matter of National Environmental Significance (MNES), or other matters protected under the Act such as the environment of Commonwealth land, requires approval from the Minister for the Environment (the Minister).

If an action is likely to have an impact on any MNES, a referral under the EPBC Act must be made. The Minister will then determine whether or not the proposed action is a 'controlled action'. If this is the case, then an environmental assessment must be submitted to the Minister for approval.

4.2.1.2 Project relevance

An EPBC Act Referral was formally prepared for the Project and submitted to the then Department of Sustainability, Environment, Water, Population and Communities (SEWPaC) (now the DoE) in 2012. On 23 October 2012, the Project was determined to be a 'controlled action' (EPBC 2012/6558) for which an EIS would be required to be prepared, in relation to the following controlling provisions under the EPBC Act:

- World Heritage Properties (Sections 12 and 15A)
- National Heritage Places (Sections 15B and 15C)
- Listed threatened species and communities (Sections 18 and 18A)
- Listed migratory species (Sections 20 and 20A)
- Commonwealth marine areas (Sections 23 and 24A)
- Great Barrier Reef Marine Park (Sections 24B and 24C)

Guidelines to prepare the EIS for the Project were issued in March 2013, specifying the scope of the environmental, social, cultural, heritage and economic studies required to enable an assessment to be carried out and a Commonwealth Government decision made on the Project.

These guidelines were issued jointly under the EPBC Act and the *Great Barrier Reef Marine Park Act 1975* (GBRMP Act) by the former SEWPaC (now DoE) and Great Barrier Reef Marine Park Authority (GBRMPA). Both the EPBC Act and GBRMP Act include objects that promote ecologically sustainable development (ESD) or ecologically sustainable use.

The principles set out in both Acts reflect the need to integrate both short and long term economic, environmental, social and equitable considerations, with a focus of inter-generational equity, conservation of biodiversity and ecological integrity, and the incorporation of the precautionary principle in decision-making.

Included within the Commonwealth EIS Guidelines is a specific requirement to investigate options for the placement of dredged material, including 'opportunities for re-use, recycling and onshore disposal, in order to prevent and eliminate pollution of the marine environment' (EIS Guideline Section 5.5) and the identification of alternatives to the proposal (including dredged material placement), including alternative locations, configuration or scale, as well as the advantages and disadvantages of each option (EIS Guideline Section 5.7).

This DMPOI has been prepared to support the EIS in satisfying the dredged material placement alternatives/options requirements of the Commonwealth EIS Guidelines and overarching statutory requirements under the EPBC Act. Further detailed investigations and assessments will be undertaken as part of the Project EIS.

4.2.2 Great Barrier Reef Marine Park Act 1975

4.2.2.1 Legislative background

The GBRMP Act establishes a legislative framework for ensuring the long term protection and management of the World Heritage listed Great Barrier Reef. Specifically, the GBRMP Act:

- Designates the GBRMP as a protected area
- Establishes the GBRMPA, a Commonwealth authority responsible for the management of the GBRMP

- Provides a framework for planning and management of the GBRMP, including through zoning plans, plans of management and a process of obtaining permissions required for the use or entry of zones under a zoning plan

The GBRMP Regs give effect to aspects of the *Great Barrier Reef Marine Park Zoning Plan 2003* (Zoning Plan). The Zoning Plan defines the objectives of different zones of management where certain activities within the GBRMP require a Marine Parks Permit.

4.2.2.2 Project relevance

When the Project was referred to the Minister for the Environment under the EPBC Act in October 2012, it was taken to also be an application under the GBRMP Act and associated GBRMP Regs as the dredged material placement location was not known at the time of lodging the EPBC Referral for the Project.

Where the Project proposes to undertake dredging and/or dredged material placement works within the GBRMP, a Marine Parks Permit will be required¹.

4.2.3 State Development and Public Works Organisation Act 1971

4.2.3.1 Legislative background

The SDPWO Act establishes the framework for assessment of major projects in Queensland. The SDPWO Act provides the Queensland CG with the power to declare a project to be a 'coordinated project' (previously a 'significant project'), requiring the proponent to undertake an environmental impact assessment process.

4.2.3.2 Project relevance

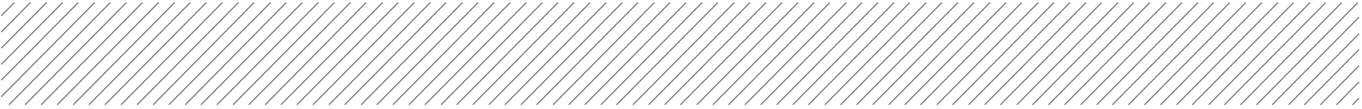
An Initial Advice Statement (IAS) was submitted to the Queensland CG in September 2012. On 25 September 2012, the CG declared the Project to be a 'significant project' (now referred to as a 'coordinated project') for which an EIS is required. In December 2012, the CG issued the Terms of Reference (ToR) for the Project, setting out the matters to be addressed in the EIS.

The ToR requires the documentation of alternatives and site selection processes for any offshore (at sea), land based and/or reclamation dredged material placement options identified for the Project. In particular, Section 5.3.3 of the ToR specifies that the EIS process must:

Describe disposal options for both capital and maintenance dredged materials, including:

- *Justification for the choice of the preferred spoil disposal site(s) based on:*
 - *Relevant agreements, guidelines and policies*
 - *Potential ecological impacts*
 - *Characteristics of the spoil including contaminants/metals*
 - *Dredging technology constraints*
 - *Cost of alternatives*

¹It is noted that through the DMPOI process and stakeholder engagement, a decision was made to only consider offshore (at sea) dredged material placement sites located outside of the Great Barrier Reef Marine Park (refer Section 7.2).



The DMPOI addresses the requirements set out in the State's ToR by examining a range of dredged material placement options. The high-level consideration of ecological/environmental, social and cultural heritage, economic and operational constraints and opportunities has been applied during the options identification process (refer Section 6) and the MCA process (refer Section 8), with the preferred option(s) to be further assessed in the Project EIS.

4.2.4 Environment Protection (Sea Dumping) Act 1981

4.2.4.1 Legislative background

The *Environment Protection (Sea Dumping) Act 1981* (Sea Dumping Act) seeks to minimise pollution threats to Australian waters through the regulation of the loading and dumping of waste at sea. The Sea Dumping Act applies to all vessels, aircraft and platforms in Australian waters and to all Australian vessels and aircrafts operating in any part of the sea. The Sea Dumping Act fulfils Australia's obligations as a signatory to the 1996 Protocol to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (the London Protocol).

The Sea Dumping Act prohibits at sea placement of dredged material considered too harmful to be released into the marine environment (eg contaminated dredged material) and regulates the placement of dredged material that is permitted to be placed at sea to minimise environmental impacts through the issue and associated conditions contained in Sea Dumping Permits.

Under the Sea Dumping Act, any application for a Sea Dumping Permit (through the Sea Disposal Application – Dredged or Excavated Material Form) requires that an applicant demonstrate consideration of alternatives to sea disposal. Specifically Part C states:

Consider alternatives to sea disposal

- *You should identify alternative options for the disposal of dredged or excavated material other than sea disposal. These options should include:*
 - *Not dredging or excavating*
 - *Re-use (eg land creation, beach nourishment, offshore berms, fill)*
 - *Off-site recycling (for example, as construction material)*
 - *Treatment to destroy or remove hazardous constituents for beneficial use*
 - *Disposal on land*
- *Explain why your preferred option for disposal of the dredged or excavated material is sea disposal. In explaining why sea disposal is your preferred option you should provide:*
 - *Comparative cost estimates of the above alternatives (including sea disposal)*
 - *Detail any risk(s) to human health of the above alternatives (including sea disposal)*
 - *Detail any risks to the environment of the above alternatives (including sea disposal)*

4.2.4.2 Project relevance

A Sea Dumping Permit will be required where the final proposed dredged material placement option includes the placement of dredged material offshore (at sea). The DMPOI process has been developed to incorporate the requirements of the Sea Dumping Act to facilitate early consideration and assessment of alternatives to offshore (at sea) placement of dredged material, and to identify the preferred option or options through the options identification and MCA process, prior to the impact assessment component of the EIS.

Further assessment of the preferred dredged material placement option(s) as defined during the DMPOI process, including any offshore (at sea) placement will be undertaken during the Project EIS.

4.2.5 National Assessment Guidelines for Dredging

4.2.5.1 Legislative background

The assessment of any application for a Sea Dumping Permit under the Sea Dumping Act is undertaken in accordance with the National Assessment Guidelines for Dredging (Commonwealth of Australia 2009) (NAGD). The NAGD provides the regulatory framework to assess dredged material loading and placement activities and, where offshore (at sea) dredged material placement is permitted, ensures that impacts are effectively managed.

The NAGD incorporates the requirements of the London Protocol to ensure all available options for dredged material placement (eg land based placement and other beneficial use) are evaluated through a comparative risk assessment, and encourages longer term strategic planning for dredged material placement.

4.2.5.2 Project relevance

The DMPOI process incorporates a comparative risk assessment of dredged material placement options to select a preferred dredged material placement location or locations for the Project, with strategic consideration of the potential to accommodate future dredging needs within the Port of Gladstone.

Sites selected as a result of the DMPOI process will be further investigated and assessed as part of the Project EIS to determine the potential impacts and mitigation measures required for dredged material placement, and will incorporate NAGD requirements where offshore (at sea) placement is identified as a preferred option.

4.2.6 Queensland Ports Strategy 2014

4.2.6.1 Legislative background

The Queensland Ports Strategy 2014 (QPS) seeks to manage and improve the efficiency and environmental management of the State's port network under the following overarching vision:

'Drive economic growth through efficient use and development of Queensland's long established major port areas, while protecting and managing Queensland's outstanding environmental assets.'

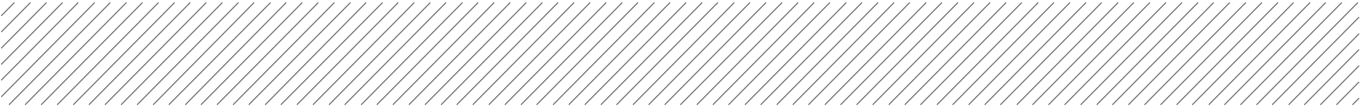
The QPS seeks to achieve this vision through the following key themes:

- Strategic use of ports – establishing five PPDAs
- Environmental protection – concentrating port development, including prohibition of capital dredging for deepwater port facilities outside of the five PPDAs until 2024
- Efficiency – reviewing port governance to improve the efficiency and effectiveness of the port network
- Supply chains improving efficiencies through new infrastructure and improved logistics practices
- Master planning – development of a statutory master planning guideline in line with the National Ports Strategy requiring master plans for PPDAs

4.2.6.2 Project relevance

The QPS identifies the Port of Gladstone as an existing long-established port and one of Queensland's five PPDAs. In 2012-2013, the Port of Gladstone handled 30% of all the total imports and exports from Queensland ports, making it the second largest by comparative trade volumes.

The QPS also recognises that dredging is a necessary activity for safe port operations.



Through the QPS, the government seeks to facilitate and support staged, incremental expansion of the Port of Gladstone to meet emerging demand in line with long term plans.

4.2.7 Other legislative requirements

Additionally, it is noted that in the instance that the Project is approved to proceed past the EIS phase, a suite of regulatory approvals will be required to be sought to enable the Project to lawfully proceed. These include, but are not limited to:

- *Aboriginal Cultural Heritage Act 2003*
- *Coastal Protection and Management Act 1995*
- *Environmental Protection Act 1994 and Regulations*
- *Fisheries Act 1994*
- *Forestry Act 1959*
- *Nature Conservation Act 1992*
- *Sustainable Planning Act 2009*
- *Transport Infrastructure Act 1994*
- *Vegetation Management Act 1999*

4.3 Dredging and material placement methods

Selection of a preferred dredging methodology must consider a number of key factors, which will have implications on how material can be dredged (evacuation and lifting), transported and placed at the preferred dredged material placement location. These key factors include:

- Design of the area to be dredged
- Nature of material to be dredged
- Depth of water (ie to maintain vessel underkeel clearances)
- Site conditions (eg wind, waves, currents)
- Environmental considerations
- Distance, availability and accessibility of dredged material placement location from the area to be dredged
- Requirement to maintain maritime safety and ensure continued navigability of existing operational shipping channels during and after dredging works for the Project
- Required schedule
- Dredger and associated equipment availability

The methods available for capital and maintenance dredging in the Port of Gladstone context are discussed in the sections below, identifying the preferred dredger equipment based on the factors outlined above.

4.3.1 Dredging for land based or reclamation placement methods

4.3.1.1 Cutter suction dredger

The most effective method of dredging to facilitate land based or reclamation dredged material placement is through hydraulically pumping material directly to the designated location from a CSD. The use of a CSD requires a combination of floating pipelines, submerged (sinker) pipelines and/or shore pipelines to convey material between the area to be dredged and the placement area, without the requirement for double-handling. The positioning of pipelines is governed by a range of factors, including dredging operations, minimising disturbance to ecological values (eg seagrass, reefs), navigational operations (eg shipping channels) and depths. Figure 4.1 illustrates the CSD 'Al Mahaar' and associated floating pipeline arrangement operating in the Port of Gladstone during the Western Basin Project.



Figure 4.1 The 'Al Mahaar' CSD operating in the Port of Gladstone

4.3.1.2 Trailing suction hopper dredger

Trailing suction hopper dredger (TSHD) is a self-propelled vessel, equipped with one or two on board suction pipes connected to draghead(s) together with an on-board storage hopper (refer Figure 4.2). Land based or reclamation dredged material placement by a TSHD can use one of two methods summarised below.

1. TSHD placement in a designated rehandling pit with a CSD pumping into a bunded area

The first method involves the loading of material into the vessel's internal hopper and placement of the material via underkeel doors to a temporary location (ie the 'dredged material pit') on the seafloor, where it is then re-dredged by a CSD or a plain suction dredger, and pumped directly to the final land based or reclamation placement location by the CSD's or plain suction dredger's on board pumps. This method may require initial dredging to establish the dredged material pit large enough to allow placement by the TSHD simultaneously with the CSD or plain suction dredger prior to the main dredging works occurring, as well as dredging to ensure sufficient depths to allow access for both vessels (eg entrance channel, manoeuvring basin).

This option has the potential to result in additional water quality and ecological impacts caused by the multiple re-suspension of dredged material during the double-handling (ie dredging, temporary seafloor placement and re-dredging), as well as general operational and cost inefficiencies associated with double-handling.



Figure 4.2 The 'Rotterdam' TSHD operating within the Port of Gladstone

2. TSHD direct pump from hopper into a bunded area

The second method involves using the TSHD's on-board pumps that provide suction to pump material through a pipeline. Dredged material is loaded into the vessel's internal hopper and steamed to a designated pump-out point, generally located as close to the coast line/placement location as possible within sufficient water depths (typically -8 to -10 m). Dredged material is re-fluidised using high pressure water jets within the hopper, and then enters a self-emptying channel from which it is pumped out through a bow coupling connected to the designated pump-out point. Finally, the material is delivered ashore through a combination of floating and land based pipelines.

The use of a TSHD by direct pumping of dredged material from the hopper is designed for reclamation or beach nourishment using good quality ('clean') sand. TSHDs have rarely been used successfully for clay or clayey material, which generally does not naturally flow into the self-empty channel, rather it forms 'bridges' around the high pressure sprays and the hopper does not empty. Where some portions of clay material do enter the self-empty channel in an uncontrolled flow, clay balls form, significantly increasing the risk of pipeline blockages.

4.3.1.3 Mechanical dredgers

Capital dredging can also be carried out using mechanical dredgers such as a back hoe or grab dredger (refer Figure 4.3). Back hoe or grab dredgers are generally employed where water depths restrict access for CSDs or TSHDs.

Material is loaded into a secondary barge which steams to the designated placement location. Material can be conveyed to a land based or reclamation dredged material placement site via:

- Temporary seafloor placement and re-dredging by a CSD or plain suction dredger (as with TSHDs)
- By locating the barge adjacent to a wharf or similar facility from which a land based excavator can remove material from the barge for placement in a holding facility or truck for transport to the designated placement location
- By utilising a barge unloading dredger (stationary suction dredger) to pump dredged material and water mix to the designated placement location

Backhoe dredgers and grab dredgers have a significantly lower production rate, and therefore higher cost per cubic metre dredged, than TSHDs and CSDs.



Figure 4.3 Examples of back hoe (left) and grab dredgers (right)

(Source: Permanent International Association of Navigation Congresses (PIANC) 1992)

As with the TSHD option, the use of a backhoe or grab dredger for land based or reclamation dredged material placement would require double-handling of material and involve operational inefficiencies due to the nature of material within the Port of Gladstone that would significantly increase the costs and timeframes of capital dredging projects.

4.3.2 Dredging for offshore (at sea) placement methods

TSHDs are the preferred dredging method where offshore (at sea) placement of dredged material is being undertaken. In this dredging scenario, material is loaded within the TSHD's internal hopper and the vessel steams directly to the designated offshore (at sea) placement location. Backhoe or grab dredgers and secondary barges can also be used where water depth restricts access for TSHDs. Once the full TSHD or barge reaches the placement area, dredged material is deposited to the seabed via the opening of underkeel doors or valves as the vessel steams at low speeds within the placement area.

As outlined above, the lower efficiencies, high costs and longer dredging timeframes associated with backhoe or grab dredgers means TSHDs are preferred for offshore (at sea) placement over these methods unless operational limitations (eg water depth) require their use.

GPC generally engages the *TSHD Brisbane* to carry out maintenance dredging at the Port of Gladstone, as sufficient depths are already established in areas to be maintained, and material is usually placed offshore (at sea) within the East Banks DMPA under existing approvals.

Recent experiences in capital dredging projects in the Port of Gladstone using a combination of CSD, TSHD and backhoe/grab dredgers are described in the case studies in Section 5.3.

4.3.3 Methods of dredged material containment

Land based and/or reclamation dredged material placement sites can either be engineered or unconfined, depending on the nature of the dredged material, the intended final use of the site (eg industrial land) and available technology and associated costs. The high silt and clay content of the material previously dredged within the Port of Gladstone indicates that the preferred method of dredged material placement of land based and/or reclamation would be an engineered perimeter system to contain the dredged material.

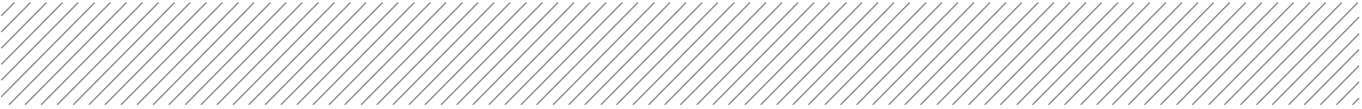
Design of engineered dredged material placement locations must incorporate a number of considerations, including the bulking factor of material and the ratio of fines to 'core' material (a bulking factor of 1.55 and ratio of 0.89:1 was experienced in the Western Basin Project). These areas are then managed for a number of years (depending on the dredged material and underlying material) to achieve the required settlement for the intended final use. Section 5.3 provides an overview of the containment systems and material/fines management adopted for the WICT Project and Western Basin Project reclamation areas.

4.4 Dredged material composition

Detailed sediment sampling and analysis of dredged material is scheduled to commence in early 2015. These investigations will be undertaken as part of the Project EIS, to characterise dredged materials and confirm dredging and placement management requirements.

For the purposes of this DMPOI, it is considered reasonable to base assumptions of the characteristics of future dredged material on previous dredging experience and associated sediment sampling and analysis undertaken to date in the Port of Gladstone.

Recent sediment sampling and analysis reports for projects in the Port of Gladstone (eg Western Basin Project, WICT Project), indicate that the top approximately 0.3 m of sediment within Port Curtis is likely to have been deposited post 1950s, with this sediment being the most likely (if any) to contain contaminants from anthropogenic inputs.



However, despite the Port of Gladstone being a relatively industrialised area, these sediment sample laboratory testing reports demonstrated the presence of only minor concentrations of naturally occurring and potential anthropogenic contaminants in individual samples across the various project areas. In the case of the Western Basin Project, all sediments were found to comply with the NAGD (Commonwealth of Australia 2009) and the *Draft Guidelines for the Assessment and Management of Contaminated Land in Queensland* (DOE 1998), with the exception of manganese which occurs at naturally high concentrations in the region's sediments.

Sediment within Port Curtis is generally Quaternary age alluvial deposits consisting of a mix of sands, gravels, clay and silts, overlaying the Palaeozoic-age Wandilla Formation, consisting of mudstone, arenite, chert and minor limestone. Higher levels of clay are expected particularly at shallow depths, with cobbles and boulders (diameter greater than 150 mm) also being present.

The upper sediments within the Port of Gladstone are characterised as typically finer in composition (ie sand, silt, clay with minor gravel components), while higher concentrations of coarse material (ie sand and gravel/decomposed rock in a clay matrix) are found lower down within the profile. The mechanical properties of the material encountered within the harbour is highly variable, including very stiff clays, presents various degrees of weathering and strength and can be extremely abrasive due to angularity and quartz content present.

Despite this variation between strata, the material is arranged in lenses with a heterogeneous mix dominated by clays and silts. This mix of materials has implications for the effectiveness of separating material for certain uses (eg sand from silts). Although a degree of separation of heavier dredged material components from silts and fines has been achieved in a previous Port of Gladstone dredging project through selected settling of material (refer Section 5.3), the extent of separation and suitability of the components of the separated material has been limited. Figure 4.4 and Figure 4.5 illustrate the variability of dredged material within the Port of Gladstone, with both showing material dredged from the same area, on the same day of the Western Basin Project dredging.

Capital dredging material for the Project is unlikely to be contaminated, but may contain Potential Acid Sulfate Soils (PASS) or Actual Acid Sulfate Soils (AASS) in the upper sediment layers. Where PASS material has been encountered in the past, for example in the Western Basin Project (refer Section 5.3.2), the dredged material has been managed to avoid oxidation through offshore (at sea) placement within the East Banks DMPA.

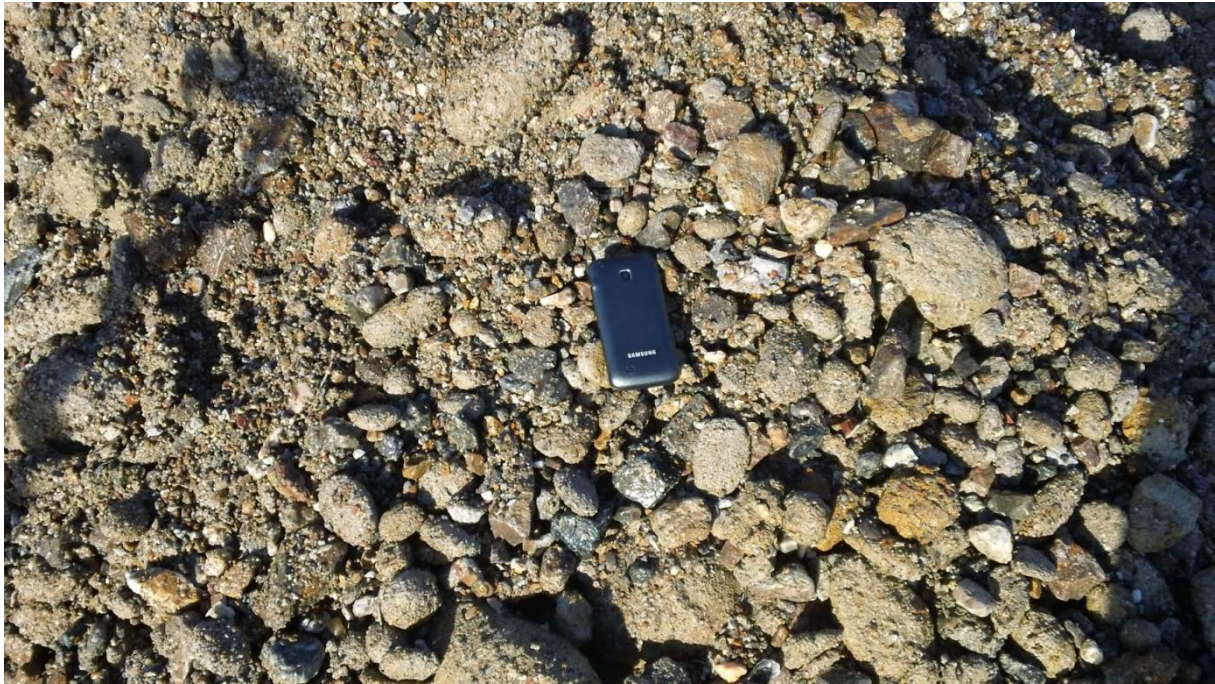


Figure 4.4 Dredged material from Western Basin Project



Figure 4.5 Dredged material forming clay balls from the Western Basin Project

4.5 Dredged material use considerations and options

4.5.1 Beneficial use considerations

Beneficial use is the practice of using dredged material for another purpose that provides social, economic or environmental benefits (Lukens 2000). A number of factors are required to be considered when determining the suitability of beneficial use options for dredged material. These considerations are summarised in the sections below.

4.5.1.1 Nature of material

The opportunities for beneficial use of dredged material will be largely driven by the nature of the material, in particular the presence of contamination as well as physical, chemical and biological characteristics (eg composition, pH, salinity and nutrients) (PIANC 1992, 1997; SKM 2013; Great Lakes Commission 2001).

The Australian Government's *Improved dredge material management for the Great Barrier Reef Region* (SKM 2013) study recognises potential constraints on beneficial use of dredged material as including difficulties in separating 'useful' materials (eg sand) from other elements (eg silts and clays), as well as treatment requirements for materials with certain characteristics (eg PASS, contamination).

A complex material matrix (eg mix of silt, clay and sand) may limit the ability to achieve sufficient separation of material types where required for certain beneficial uses, for example, beneficial uses requiring sand would require the 'washing' of material to remove all clay, silts and other fines components. Similarly, dredged material from the marine environment will generally be naturally high in salinity, which may limit its use in certain applications such as agriculture without significant management/treatment to achieve suitable salinity levels (SKM 2013).

The ability of the dredged material to drain moisture will influence the size and configuration of reclamation areas. For example, large reclamation areas with shallow depth would be required to achieve dewatering of silt and clay dominated material found in the Port of Gladstone, to effectively manage the dredging and reclamation operations.

Potential beneficial use options assessed for Port of Gladstone dredged material need to consider the nature of the material and compatibility with the potential use options.

4.5.1.2 Economic drivers

The viability of beneficial use options will also be influenced by economic factors, in particular whether there is a market for the end use of the material and whether the costs of supplying the dredged material is prohibitive to the end user (Great Lakes Commission 2001).

The costs associated with dredging, transportation/conveyance of material, establishment of containment/treatment areas, management and (where required) treatment may result in a product that is significantly more expensive to access than alternatives, for example land based quarries.

Economic costs and demand for products will be considered in the assessment of potential beneficial use options for the material to be dredged by the Project.

4.5.1.3 Availability of land

A key factor in consideration of beneficial uses for dredged material is also the availability of land to establish primary dredged material placement site(s), either as the final placement location (eg reclamation) or for the management or treatment of dredged material prior to its relocation for beneficial use (eg for construction materials).

Primary dredged material placement areas would also be required for rehandling material where the final placement site is located beyond the maximum pumping distance achievable for the material and the dredging methodology.

The Australian Government dredged material management study (SKM 2013) also identified the availability of suitable land relative to the predicted volumes of dredged material generated by Queensland ports, and in close proximity to the area to be dredged for drying the dredged material (including dewatering infrastructure), as the main common constraint to dredged material management.

4.5.1.4 Other considerations

In addition to the considerations already outlined, identifying options for the beneficial use of dredged material also needs to consider other costs and benefits, both tangible and intangible, including ecological/habitat costs and benefits (PIANC 1992).

Furthermore, operational aspects such as the timing of dredging projects in comparison to the timing of the need for dredged material for a beneficial use also need to be considered in the assessment of beneficial use options. The dewatering and/or treatment of material (where required) can take a number of years and is dependent on local weather (ie rainfall) and the effectiveness of the dredged material placement site's drainage.

The logistics of enabling dredged material to be beneficially used will also influence the viability of options, including the location of the use relative to the treatment/dewatering location (if required) and/or the location of the area to be dredged.

4.5.2 Beneficial use options

A range of beneficial use options were identified through the literature review as having been successfully implemented in Australia and internationally. The beneficial use options considered include:

- Engineered uses
 - Land creation/reclamation
 - Land improvement
 - Beach nourishment
 - Offshore berms
 - Capping
 - Replacement fill
 - Parks and recreation
- Agricultural/product uses
 - Topsoil
 - Aquaculture
 - Construction materials
- Environmental enhancement
 - Habitat creation or restoration

Table 4.1 provides a summary of each of these beneficial use options, together with an assessment of their potential for successful implementation for the material to be dredged by the Project.

Table 4.1 Beneficial use options and their applicability for material to be dredged by the Project

Background information	Potential applicability for Project
Land creation/reclamation	
Land creation, also referred to as reclamation, involves the beneficial use of dredged material to fill, raise and protect an area which is otherwise periodically or permanently submerged (PIANC 1992), including intertidal or island reclamation. A reclamation area is generally contained by an engineered structure such as a rock wall or sheet piled wall. Once filled, the reclamation area requires time to dewater and settle in order for the dredged material to consolidate. Ground improvement works are also required to achieve the final levels and allow the reclaimed land to be utilised for particular purposes (eg port land, industrial, open space, recreation).	Gladstone has a long and successful history of completing reclamation projects which have used dredged material to reclaim land for port industrial development, parklands or other community or ecological uses. These include: ■ Auckland Point/Barney Point and RG Tanna Coal Terminal site in the late 1960s and 1970s ■ Gladstone Power Station site, Hanson Road light industrial site and Clinton Industrial Estate in the 1970s ■ Fisherman's Landing from the 1980s to 2000s ■ Western Basin Project and WICT Project in the early 2010s Reclamation provides a viable option for the beneficial use of material to be dredged by the Project, and will be explored further as part of this investigation. The predominately fine silt and clay dominated material encountered in the area to be dredged is known to be suitable for reclamation purposes. The Queensland Ports Strategy 2014 identifies the Port of Gladstone as one of the Queensland Government's five PPDAs (State of Queensland 2014). A reclamation option that achieves an end land use of port industrial development would be consistent with the Queensland Government's Strategy.
	Opportunities for land creation/reclamation within the Port of Gladstone include: ■ Areas adjoining the Port of Gladstone coast line (above and below the lowest astronomical tide (LAT)) ■ Creation of new reclamation island within the Port of Gladstone ■ Areas set back from the coast line within the Gladstone region (these location options would require a primary dredged material placement area within close proximity to the coast line to allow dewatering of the dredged material before rehandling to a secondary location) (refer Section 5.2.1) For the purposes of this DMPOI, land creation/reclamation options outside Port limits (eg within the GBRMP) will not be investigated.

Background information		Potential applicability for Project	
Land improvement			
Dredged material can be used to improve land considered inadequate for the intended future use (eg due to ground level or soil structure). This beneficial use option may be combined with land creation/reclamation projects where reclaimed land requires the improvement of landside areas, for example to maximise access and development potential. As with land creation/reclamation, land improvement require sufficient time and engineering methods to remove moisture from the dredged material and attain consolidation levels required for the intended land use. The time and/or ground improvement works required to achieve usable land can be a limiting factor to land improvement options, depending on the timing of projects (both dredging and the future land based development) and the characteristics of the material.		Land improvement projects in Gladstone that have used dredged material are generally associated with land creation/reclamation (discussed above). For example, the WICT Project was able to utilise both land creation/reclamation and land improvement beneficial use options as the schedule for future industrial development allowed for the time required to hydraulically place, dewater, dry and consolidate the dredged material in areas not required for the coal terminal. Opportunities for land improvement within Gladstone may exist in areas adjoining the coast line identified for future development that would require fill material to achieve developable levels. This beneficial use option may also be achievable for locations set back from the coast line within the Gladstone region. However these location options would require a primary dredged material placement area within close proximity to the coast line to allow dewatering of the dredged material before rehandling to a secondary location (refer Section 5.2.1).	
Beach nourishment			
The use of dredged material for beach nourishment may be beneficial in areas where littoral drift of sediment occurs due to winds and tides, eroding beach areas. Beach areas may be restored or even created by placing dredged material onto a designated area either above the high tide mark or in the near-shore environment (allowing wave action to re-deposit the material). Beach areas in Australia are generally sand dominated environments, therefore the sand content of dredged material used for beach nourishment must generally be above 80% for this to be a viable option (SKM 2013).		Due to the high clay and silt content of the material to be dredged by the Project it is not considered suitable for the nourishment of the sandy beaches within the Gladstone region (eg Facing Island, Curtis Island). In addition, intertidal and beach areas in the region have not exhibited evidence of erosion requiring beach or intertidal nourishment. For the purposes of this DMPOI, beach nourishment will not be considered further as a beneficial use option. However, beach nourishment will be reassessed as part of future dredging campaign alternative dredged material placement and beneficial use options assessment.	
Offshore berms			
PIANC (1992) identifies the creation of offshore berms for the protection of coastal areas/improvement of coastal stability as a potential beneficial use for dredged materials that are a mixture of rock, sand, silt and soft clays. Material is placed in the sub-tidal zone to create a ridge on the seabed parallel to the coastal area requiring protection, acting to slow the velocity and reduce the power of waves and currents travelling perpendicular over the berm.		The Port of Gladstone is generally well protected from erosion caused by wave action or currents due to the sheltering islands (ie Facing and Curtis Islands) to the east. The eastern coast lines of Facing and Curtis Islands are more exposed however there has been no evidence that these areas would require erosion protection measures. It is unlikely that the material to be dredged by the Project would be suitable for this purpose due to the high proportion of fine sediments within the matrix and the high level of bed-shear stress (ie wave action and currents) in near-shore areas. These bed-shear stresses are considered likely to cause fine material to be displaced/re-suspended and have the potential to result in sediment plume impacts to nearby areas. For the purposes of this DMPOI, offshore berms will not be considered further as a beneficial use option. However, offshore berms will be reassessed as part of future dredging campaign alternative dredged material placement and beneficial use options assessment.	

Background information	Potential applicability for Project
Capping	
The capping of in situ material with dredged material offers a beneficial use of the dredged material and also the isolation of the underlying material, for example on contaminated sites. This method of dredged material use is identified by PIANC (1992) as an option for both tidal and land areas.	The DMPOI process has not identified a need for capping within tidal and intertidal areas in the Gladstone region, however there may be opportunities for land based capping (set back from the coast line) using material to be dredged by the Project. As discussed above, for placement locations set back from the coast line within the Gladstone region, these location options would require a primary dredged material placement area within close proximity to the coast line to allow dewatering of the dredged material before rehandling to a secondary location (refer Section 5.2.1). Discussions were undertaken with potential land owners and operators within the Gladstone region during Phase 4 of the DMPOI process (refer Section 7).
Replacement fill	
PIANC (1992) identifies the use of dredged material for replacement fill as an option where other activities have resulted in the loss of the natural material from the site, for example open cut mining, and where the dredged material has superior physical qualities compared to available land based resources.	There may be opportunities within the Gladstone region to use dredged material to replace product that has been removed as part of previous or future mining or quarrying activities. Historically within the Gladstone region the majority of quarries have extracted material from elevated areas where there are no resultant voids that would necessarily require filling. As discussed above, for placement locations set back from the coast line within the Gladstone region, these location options would require a primary dredged material placement area within close proximity to the coast line to allow dewatering of the dredged material before rehandling to a secondary location (refer Section 5.2.1). Discussions were undertaken with potential land owners and operators within the Gladstone region during Phase 4 of the DMPOI process (refer Section 7).
Parks and recreation	
The beneficial use of dredged material for parks and recreation is a subset of land improvement, where dredged material is used as fill for the creation of parks and recreational areas (eg sporting fields) with minimal load bearing requirements and usually involves relatively small volumes of material (SKM 2013).	Consultation with Gladstone Regional Council (GRC) during October 2013 indicated that there are no existing or planned future parks or recreational areas within Gladstone that would require dredged material as fill. For the purposes of this DMPOI, fill material for parks and recreation as a subset of land improvement will not be considered further as a beneficial use option. However, the use of dredged material as fill for parks and recreation will be reassessed as part of future dredging campaign alternative dredged material placement and beneficial use options assessment.

Background information		Potential applicability for Project	
Top soil			
In some instances, dredged material may be suitable for use as top soil (effectively a fertiliser) for forestry or agricultural purposes (SKM 2013, PIANC 1992). Where such uses exist within pumping distance from the area to be dredged, material could be pumped directly ashore for site coverage, or, as with other beneficial uses discussed above, a primary dredged material placement site(s) may be required to dewater and/or treat the dredged material (eg for PASS, salinity) before it can be transferred to the beneficial use site.		Material from the area to be dredged by the Project will be highly saline due to its origins from the marine environment which will impact on the viability of this beneficial use option. In addition, no opportunities for this beneficial use option have been identified within the region as part of the DMPOI process. For the purposes of this DMPOI, fill material for top soil use will not be considered further as a beneficial use option. However, the use of dredged material as top soil fill will be reassessed as part of future dredging campaign alternative dredged material placement and beneficial use options assessment.	
Aquaculture			
Dredged material can be used for aquaculture purposes, for example the co-use of sites for dredged material placement and aquaculture (PIANC 1992).		There are currently no established aquaculture facilities adjoining the coast line within the Gladstone region and no future aquaculture facilities have been identified through consultation with State and Local Government officers during the DMPOI process that would benefit from or require material from the area to be dredged by the Project. For the purposes of this DMPOI, fill material for aquaculture purposes will not be considered further as a beneficial use option. However, the use of dredged material for aquaculture purposes will be reassessed as part of future dredging campaign alternative dredged material placement and beneficial use options assessment.	
Construction materials			
The use of dredged material in the production of construction materials (eg fill material, bricks, ceramics, etc) can be considered an important beneficial use option, due to issues with the availability of land based construction materials/resources (PIANC 1992). This type of beneficial use is separate to the use of dredged material for fill, capping or top soil, as it refers to the use of dredged material as, or to make, a specific product. PIANC (1992) recognises that high salinity of dredged material may constrain its use in construction, and that the process of dredging itself can alter the nature of material (ie the mixing of components in the material matrix) and therefore its suitability for use.		Dredged material from the Project has the potential to contain components that could be suitable for construction materials (eg sand, gravel), however these are in low abundance, and are heterogeneously mixed with the dominant silt and clay components. Separation of material types and sizes is achievable to an extent (eg through 'soil washing'), and would require a primary dredged material placement location close to the Port of Gladstone coast line to undertake the separation, treatment (if required) and storage of materials. Consultation with local stakeholders (eg State and Local Government officers, GPC) that have strong ties to the construction industry in the Gladstone region during the DMPOI process have indicated that there is currently no market identified for the beneficial use of dredged material in construction resources. For the purposes of this DMPOI, the use of dredged material in the production of construction materials will not be considered further as a beneficial use option. However, the use of dredged material for construction purposes will be reassessed as part of future dredging campaign alternative dredged material placement and beneficial use options assessment.	

Background information	Potential applicability for Project
Habitat creation or restoration	
The creation or restoration of degraded habitats provides opportunity for the beneficial use of dredged material with an ecologically beneficial outcome. This type of beneficial use can occur in marine, intertidal or onshore environments through the strategic placement of dredged material, and can include wetlands, shorebird, fisheries or other types of habitat (SKM 2013; PIANC 1992; Great Lakes Commission 2001). As with all beneficial use options, it is necessary to consider the potential impacts of the use/activity, for example whether the creation of a wetland area would damage or replace an existing habitat type, displacing those flora and fauna species to be replaced with others (PIANC 1992). In this instance, PIANC (1992) recommends the restoration of existing degraded habitats is preferred over the creation of new habitats.	Consultation with State and Local Government officers undertaken during 2013 and 2014 as part of the DMPOI process has not identified any specific areas of degraded habitats within the Gladstone region that could benefit from restoration through dredged material placement from the Project. Land creation/reclamation options may represent opportunities to incorporate ecologically beneficial outcomes which could include habitat creation (eg 'working with nature'). For the purposes of this DMPOI, the use of dredged material for standalone creation or restoration of degraded habitat projects will not be considered further as a beneficial use option. However, the use of dredged material for habitat creation or restoration purposes will be reassessed as part of future dredging campaign alternative dredged material placement and beneficial use options assessment.

4.5.3 Potential beneficial use options for material to be dredged by the Project

In summary, the potential beneficial use options for material be dredged by the Project that are appropriate for the DMPOI process include:

- Land creation/reclamation
- Land improvement
- Capping of in situ material
- Replacement fill
- Habitat creation as part of land creation/reclamation

Each of the above potential beneficial use options for material to be dredged by the Project will require a land creation/reclamation area close to the coast line (refer Section 5).

The availability of sites for the above beneficial use options for dredged material (ie timing of dredging and the dewatering process compared to the timing of the beneficial use requirement) will influence their viability. Other beneficial use options and locations set back from the coast line may be possible for some of the dredged material if rehandling and transport of material occurs to a secondary placement location or beneficial use option.



5 Phase 2: Defining the spatial extent of the study area

5.1 Phase 2 overview

Phase 2 of the DMPOI involved the definition of the spatial extent of the study area in which to focus the investigation of dredged material placement site options (ie land based reclamation and offshore (at sea) dredged material placement). In determining the study area, the following tasks were undertaken:

- Literature review to determine the key factors which influence dredging efficiency with respect to the area to be dredged and the dredged material placement location, and the maximum dredged material pumping distance (refer Section 5.2)
- Review of the dredging arrangements for the two most recent capital dredging campaigns within the Port of Gladstone (refer Section 5.3)

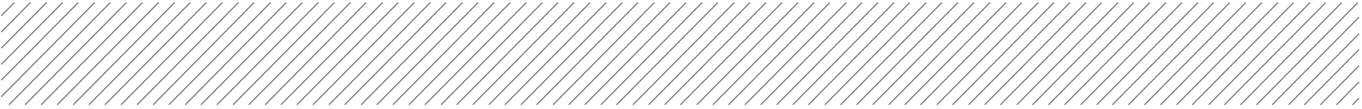
5.2 Review of key considerations

5.2.1 Defining the beneficial use study area

As detailed in Section 4.3.1, there are a number of potential dredging and material transportation options for the Project dredged material depending on the location of the beneficial use placement area, including:

- CSD dredging material and direct transport via pipeline and boosters to a beneficial use area (eg land creation/reclamation) located near the area to be dredged by the Project
- TSHD dredging material and steaming to a beneficial use area located adjacent to the Port of Gladstone coast line and direct pump from the hopper into a beneficial use area (unlikely to be feasible due to high clay content of material to be dredged – this option will be confirmed following the Project EIS geotechnical investigation for the area to be dredged)
- TSHD dredging material and steaming to a rehandling location/pit located adjacent to the Port of Gladstone coast line. Dredged material placed on the sea floor is re-dredged using a CSD or plain suction dredger and material is transported via pipeline and boosters to a beneficial use area (eg land creation/reclamation) located near the Port of Gladstone coast line.

The opportunity for placement of dredged material within a beneficial use area (eg land creation/reclamation above and/or below LAT adjoining the Port of Gladstone coast line or land creation/reclamation in the form of an island) as a primary dredged material placement site is limited by the distance that material can be hydraulically pumped from the CSD vessel. The conveyance of dredged material within pipelines is dependent on the suspension of material in water within the pipeline and the velocity of the pump used to maintain suspension to the discharge point. The maximum pumping distance is therefore dependent on the local geotechnical characteristics of the material to be dredged and the equipment used to convey the material.



For dredged material placement beyond this maximum CSD pumping distance, a primary dredged material placement area is required to receive and manage dredged material prior to it being transported (eg by conveyor or truck) to a secondary dredged material placement area. As noted in a number of publications (PIANC 1992, 1997) and the Australian Government dredged material management study (SKM 2013), a primary dredged material placement area is often used to dewater, and in some cases treat/manage, dredged material prior to relocation to the secondary site for an alternative beneficial use.

The DMPOI identifies and assesses primary dredged material placement locations within the maximum CSD pumping distance from marine areas adjoining the Port of Gladstone coast line (ie beneficial use study area) either as the CSD direct pumping into a placement location or a TSHD rehandling area for CSD or plain suction dredger pumping to a nearby beneficial use location (eg land creation/reclamation area). During Phase 2 of the DMPOI, dredged material rehandling areas have not been defined to ensure all potential beneficial use options are identified for assessment.

It is important to recognise that definition of the beneficial use study area is based on current dredging and material placement methods and technologies, which are factors which may change over time. However, for the purposes of the Project EIS these assumptions are considered appropriate.

Secondary locations and/or beneficial uses for dredged material will be considered as part of the operational dredging campaign and the management and movement of dredged material within the primary dredged material placement location.

5.2.2 Defining the offshore (at sea) study area

As detailed in Section 4.3.2, offshore (at sea) placement of dredged material involves the transport of material from the area to be dredged to the designated offshore (at sea) dredged material placement area (DMPA) within either the hopper of a TSHD or a barge. Therefore, the spatial extent of potential offshore (at sea) DMPAs is not limited by the physical operational constraints that restrict beneficial use of dredged material. Rather, operational restrictions on offshore (at sea) placement will be the costs and efficiencies associated with travelling greater distances to placement locations (ie longer dredging cycle time).

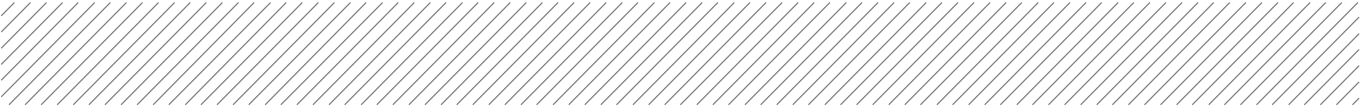
5.3 Recent capital dredging campaigns

In order to determine the maximum pumping distance, and therefore spatial extent of the beneficial use study area, recent capital dredging projects in the Port of Gladstone are discussed below.

5.3.1 WICT Project

All material dredged as part of Stage 1 of the WICT Project has to date been placed within a 140 ha intertidal reclamation and land based containment area as fill for the establishment of WICT Project and other future port and industrial related industries.

The bund walls constructed to contain the dredged material totalled approximately 13 km in length with an average height of 5 m, and required approximately 0.9 Mm³ of material to be imported, equating to approximately 50,000 fully loaded articulated dump trucks of material. The majority of the reclamation bund walls were constructed from clay quarry run.



Dredged material was hydraulically placed within Reclamation Area B (north of Gladstone-Mt Larcom Road), approximately 5 km from the centre of the area dredged, using a CSD and two booster pumps. Hydraulic placement of dredged material required up to approximately 2 km of floating line and a 2 km sinker line across shallow mud flats within Port Curtis, before a further 1 km of landside pipeline through the WICT Project footprint to reach Reclamation Area B dewatering ponds. Figure 5.1 illustrates the general arrangement of dredging and placement operations completed for Stage 1 of the WICT Project.

The internal bunds of Reclamation Area B were designed to facilitate the settling of dredged material prior to the discharge of tail water back to the harbour. The use of primary, secondary and tertiary dewatering ponds allowed the progressive settlement of dredged material, with heavier materials (ie gravel and sand components) as well as some finer materials being deposited closer to the outlet points, followed by the remainder of the sand plus a proportion of finer materials, and finally the remaining fine materials within a residual pond area. Tailwater from the hydraulic placement of dredged material was managed in a 50 ha area to reduce fines and turbidity prior to discharge.

This design provided for improved ground settlement within the Reclamation Area B closer to the outlet points, and the option to move dredged material to Reclamation Area C, south of Gladstone-Mt Larcom Road, to improve the settlement pond capacity.

The rehandling of material from Reclamation Area B to Reclamation Area C was required as the greater pumping distance from the area dredged (approximately 8 km) could not be achieved due the cohesive nature (ie high silt and clay content) of the dredged material. Figure 5.2 and Figure 5.3 show aerial views of the reclamation ponds and fines management system for the WICT Project.



Figure 5.1 WICT Project dredging and reclamation infrastructure placement arrangement



Figure 5.2 Wiggins Island Reclamation Area B (April 2013)



Figure 5.3 Wiggins Island Reclamation Area C (April 2013)

5.3.2 Western Basin Project

Dredging of the Western Basin Project (Stage 1A) has involved the combination of TSHD, CSDs and backhoe dredgers with barges.

The Western Basin reclamation area was constructed with an 8.8 km outer bund wall with the height approximately RL 7 to 8 m (Port datum), and consisting of approximately 2 Mm³ of material sourced offsite, the equivalent of 120,000 fully loaded articulated dump trucks of material. The reclamation process required an area of approximately 270 ha for inner bund walls and tail water management.

Dredged material was hydraulically placed within the reclamation area using a CSD with up to a maximum of 5 to 7 km of pipeline from the cutter head via a combination of floating, sinker and reclamation area lines to the discharge point within the reclamation area. For dredged material to travel this maximum distance two booster pumps were required. The CSD alone achieved a typical availability of 80% (factoring maintenance downtime), with each booster achieving up to 75% availability. When placed in series, the CSD with two booster pumps achieved an availability of approximately 45%. The addition of a third booster pump would have further decreased the availability of dredging equipment to approximately 33%.

Availability of equipment, and therefore the length of dredging programme, was also impacted by the velocity at which material could be pumped. The high variability of material size and consistency encountered in the Port of Gladstone during this project caused variable pumping velocities and therefore the settling of material within the pipeline. As a result, a number of blockages occurred in the floating and/or sinker lines, as illustrated in Figure 5.4. The location of the blockage in this sinker line needed to be identified and cut in situ on the seabed and raised by support craft fitted with cranes and replaced with a new pipeline section.



Figure 5.4 Sinker pipeline blockage during the Western Basin Project dredging (pipe diameter shown is 900 mm)

A TSHD and/or backhoe/grab dredgers were used to remove material for Western Basin dredged areas greater than 5 km from the reclamation area due to the cohesive nature (ie high silt and clay content) of the material limiting the ability to pump the material ashore, with material within these areas (and some PASS material) being placed offshore (at sea) within the existing East Banks DMPA.

The dredged material placed at the East Banks DMPA included material containing PASS as identified in the project's sediment sampling and analysis. This material was managed through the dredging method and placement, ensuring the material was kept saturated during dredging by utilising a TSHD or backhoe dredgers, and transport to the DMPA. Direct placement of the PASS material offshore (at sea) ensured the material did not oxidise, and the risk was managed.

Figure 5.5 illustrates an example of a general arrangement of dredging and reclamation operations for one of the dredging locations in Stage 1 of the Western Basin Project.



Figure 5.5 Western Basin Project dredging and intertidal reclamation arrangement

5.4 Summary of Phase 2 findings

5.4.1 Adopted spatial extent of beneficial use (primary location) area

Fine material (ie sand and silt) can be transported by dredging equipment pipelines over longer distances more economically and booster pumps can be employed to maximise the pumping distance for dredged material. However, due to the complex lensing of fine, coarse (gravel/decomposed rock) and cohesive (high clay content and heterogeneity) material within the area to dredged (refer Section 4.4), the effectiveness of pump velocity and therefore pumping distance is reduced.

The recent capital dredging experience in the Port of Gladstone indicates that if a CSD is utilised for dredged material transport, a maximum of two booster pumps is considered suitable and practicable to achieve a maximum pumping distance. The use of more booster pumps increases the risks of 'clay balling' of material within the pipeline causing blockages and pipeline blow outs, and increases maintenance requirements and fuel use, thereby reducing the efficiency and increasing the risks of dredged material pumping.

Therefore, based on this recent experience in reclamation and land based placement of dredged material the practical and economical maximum pipeline pumping distance, using two booster pumps, is approximately 5 km by pipeline from the location of the CSD to the outer edge of the placement area. This allows 1 to 2 km for pipeline within the reclamation area to manage the placement location of dredged material.

Therefore, this DMPOI has adopted a preferred 5 km study area from the main shipping channels within Port of Gladstone either as the CSD direct pumping into a placement location near the area to be dredged or for a TSHD rehandling area for CSD or plain suction dredger pumping to a nearby placement location.

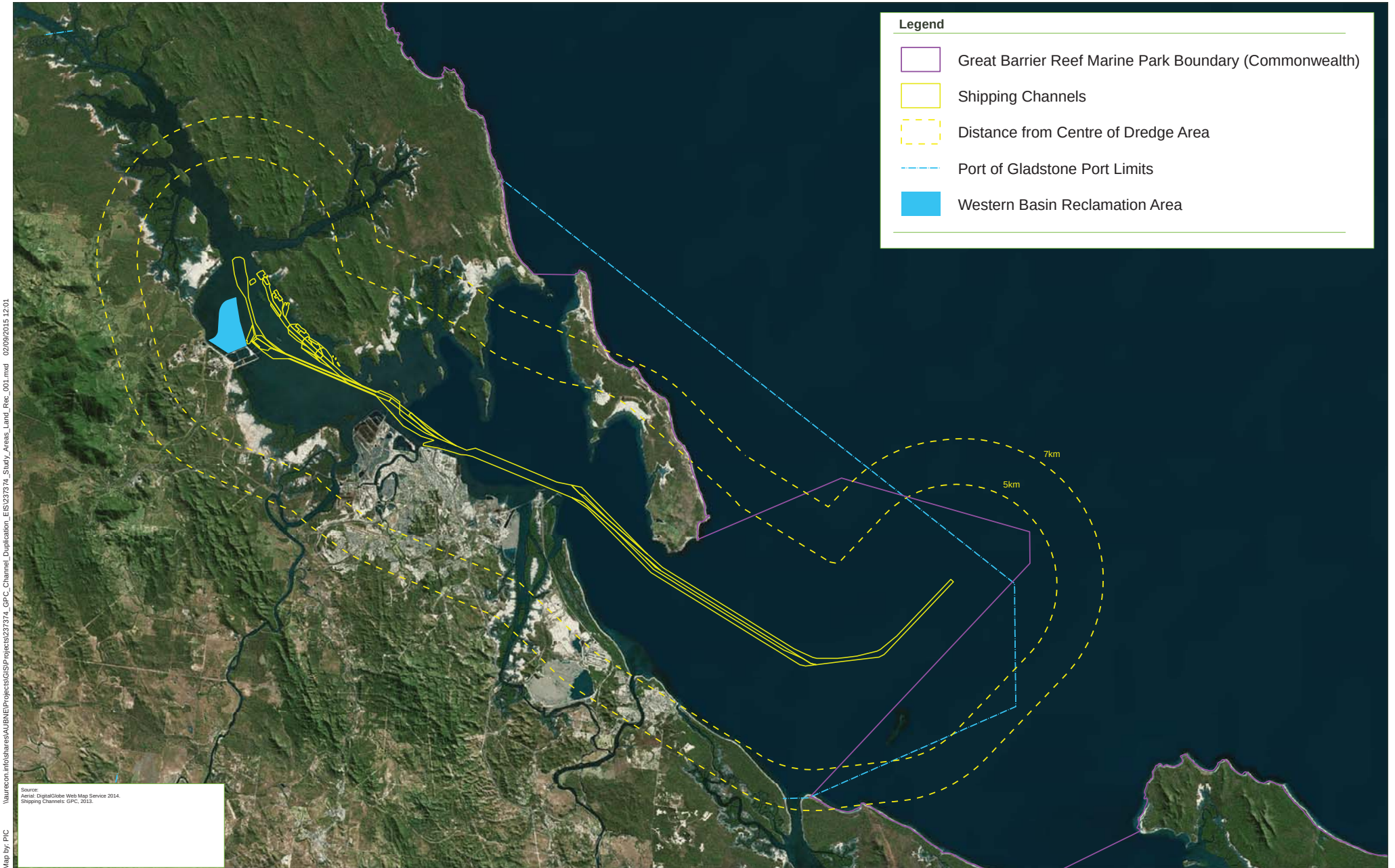
Where dredged material pumping/transport technologies advance in the future, beneficial use opportunities available at greater distances from the area to be dredged could be explored. As such, areas up to 7 km from the main channels within Port of Gladstone will be investigated for constraints and/or opportunities in relation to dredged material placement locations, however as a general principle, placement locations less than 5 km are preferred over placement options greater than 5 km from the main channels if the significance of the constraints/considerations are found to be the same. The study area for this investigation is identified in Figure 5.6.

5.4.2 Adopted offshore (at sea) DMPA study area

Based on the Phase 2 findings, an offshore (at sea) study area of 35 km radius from the Port of Gladstone Fairway Buoy has been adopted. This study area is shown in Figure 5.7. Preference will be given to suitable offshore (at sea) DMPAs closer to the Port of Gladstone than an area at a greater distance.

This is consistent with the Australian Government's dredged material management study (SKM 2013), in which the two alternative dredged material placement areas identified are located within close proximity to the Port.

Another key consideration in defining the spatial extent of the offshore (at sea) study area is the location of ecological/environmental, social and cultural heritage, operational and other economic values (eg GBRMP conservation zones, GBRWHA values, high value fishing grounds as well as the containment of dredged material on the sea bed (ie areas with low bed-shear stress are preferred). These aspects are discussed further in Section 6.



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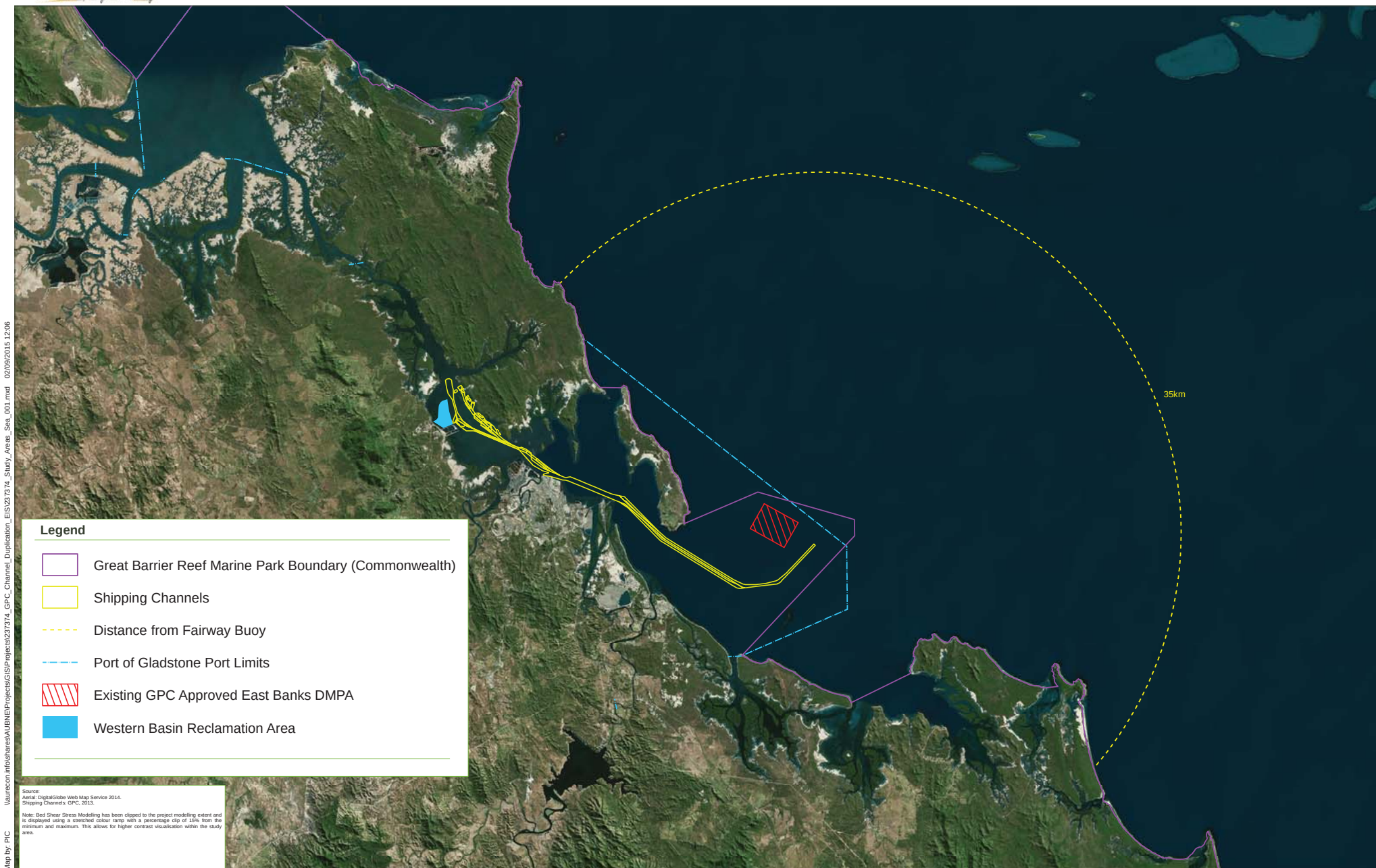
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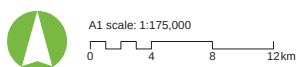
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Port of Gladstone Gatcombe and Golding Cutting Channel Duplication

Figure 5-6: Beneficial Use (Primary Location) Study Area



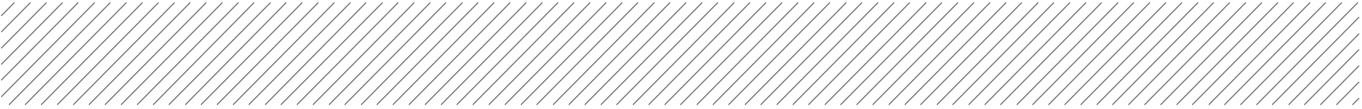
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Port of Gladstone Gatcombe and Golding Cutting Channel Duplication

Figure 5-7: Offshore (At Sea) DMPA Study Area



6 Phase 3: Defining constraints, opportunities and considerations

6.1 Phase 3 overview

Phase 3 of the DMPOI process involved the following key tasks:

- Identification of a preliminary set of ecological/environmental, social, cultural heritage, economic and operational constraints (herein referred to as the 'constraints aspects' associated with identifying potential dredged material placement locations. The identification process included a workshop to obtain technical input from key stakeholders and regulatory agencies to finalise the set of constraints and assign a value constraint classification (refer Section 6.2).
- Preparation of constraints mapping as inputs to an Environmental Sensitivity Profile (ESP) Geographic Information Systems (GIS) Model (refer Section 6.3)
- Completion of bed-shear stress modelling (refer Section 6.4) for offshore (at sea) placement of dredged material to assist in the assessment of potential impacts on the identified aspects
- Development of a set of decision criteria for identifying dredged material placement opportunities (refer Section 6.5)

6.2 Identification and classification of constraint aspects

A range of constraint aspects were identified through the literature review, as well as discussions with GPC and the Project's technical advisors, as relevant for consideration through the DMPOI process. These aspects represent constraints that will influence the identification of potential dredged material placement sites in Gladstone.

In order to refine these spatial constraints, a workshop was held in Brisbane on Friday 27 September 2013 (Workshop 1) to seek technical input from key stakeholders, including representatives from the following agencies or organisations:

- DoE (Commonwealth)
- GBRMPA (Commonwealth)
- Department of Environment and Heritage Protection (DEHP) (State)
- Department of Agriculture, Fisheries and Forestry (DAFF) (State)
- Department of Science, Information Technology, Innovation and the Arts (DSITIA) (State)
- Office of the CG (part of the Department of State Development, Infrastructure and Planning (DSDIP)) (State)
- GPC and Aurecon EIS team

During Workshop 1, ecological/environmental, social, cultural heritage, economic and operational aspects were discussed, additional aspects were identified and each aspect was assigned a classification of either:

- High value constraint – an aspect that limits or restricts the use of an area ('no go' area)
- Moderate value constraint – an aspect where avoidance is preferable, however would not preclude further investigation of potential dredged material placement areas
- Low value constraint – an aspect which is considered at this stage to pose no significant constraint or limitation but which should be further considered during the Project EIS.

The summary table contained in Appendix C provides details of the aspects identified for consideration in the DMPOI, the applicable study area, how the values are represented in the study areas (including relationship with GBRWHA Outstanding Universal Value (OUV)) and the corresponding constraint value classification agreed at the workshop. A description of the GBRWHA OUV relevant to the Port of Gladstone is also provided in Appendix D.

6.3 Constraints mapping

Constraints mapping was prepared using the aspects identified in Appendix C as inputs to an ESP GIS Model developed for this DMPOI. Spatial data for each aspect was obtained from various sources, including from Commonwealth, State and Local Government, and previous studies in the area.

Where aspects could not be spatially defined in GIS (for example due to the nature of the aspects (eg aesthetic values) or where additional data was required, they were either aligned with similar or representative aspects to be considered in the constraints mapping, and/or identified for assessment in the MCA phase or the broader impact assessment as part of the DMPOI process.

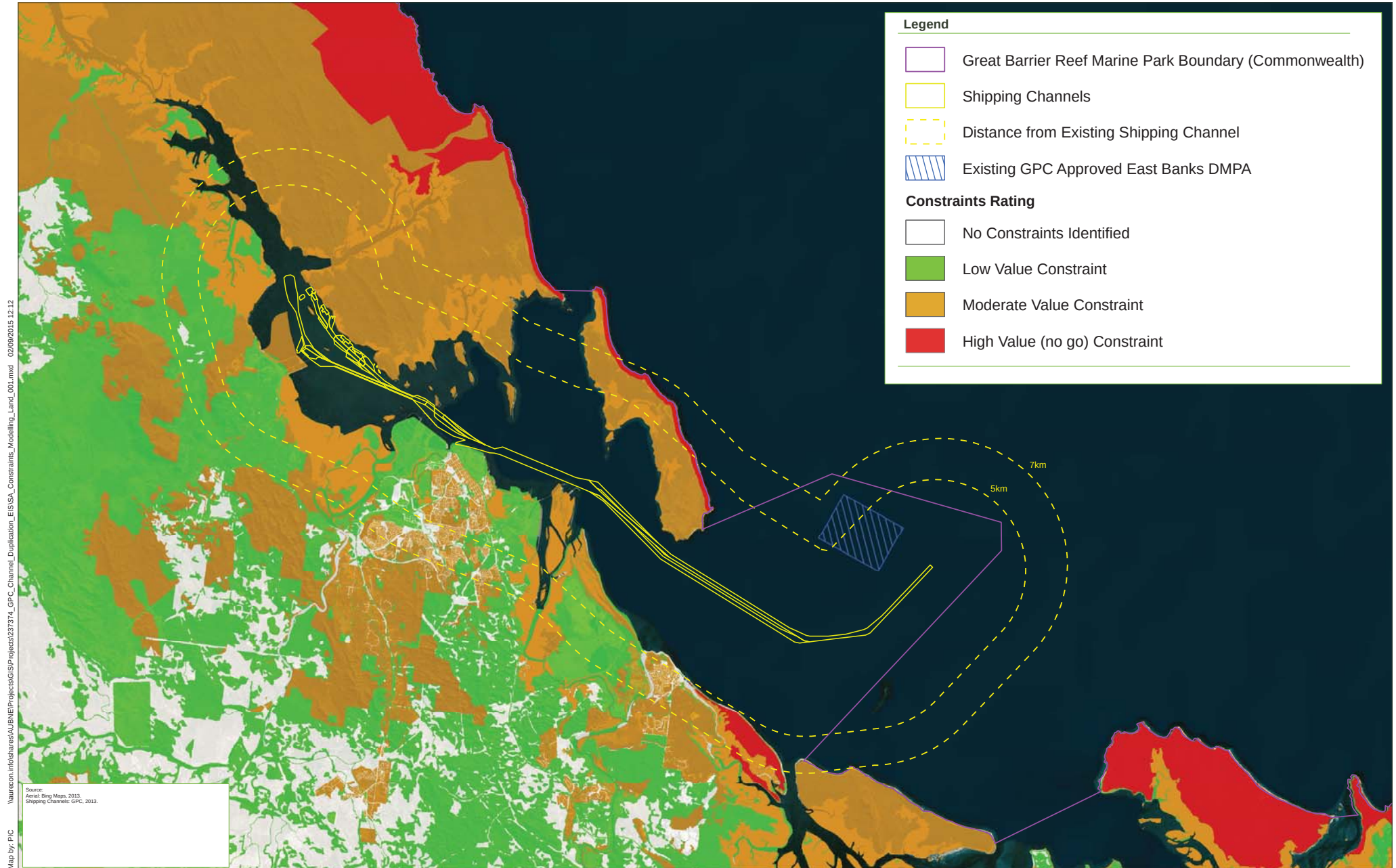
Each aspect was allocated a sensitivity rating corresponding to the classification agreed in Workshop 1, as outlined in Table 6.1.

Table 6.1 ESP GIS Model environmental sensitivity ratings

Rating	Sensitivity Level	Criteria
3	High	High value (no go) constraint as defined in Section 6.2 and Appendix C
2	Medium	Moderate value constraint as defined in Section 6.2 and Appendix C
1	Low	Low value constraint aspect as defined in Section 6.2 and Appendix C
0	Very low	Area not identified as low, medium or high sensitivity as defined in Section 6.2 (ie no constraint identified in the study area or impacts to be considered in latter stages of the DMPOI)

Figure 6.1 and Figure 6.2 illustrate the outputs of the ESP GIS Model (ie the overall constraint levels) for the beneficial use study area (above LAT) and the offshore (at sea) DMPA, respectively. The ratings shown on these figures represent the highest individual sensitivity rating for every GIS mapped aspect outlined in the table presented in Appendix C for a 20 m x 20 m grid cell. That is, where an aspect classified as a 'low value constraint' (1 – Low) coincides with a 'high value constraint' (3 – High), the overall rating for that area will be a 'high value constraint' (3 – High).

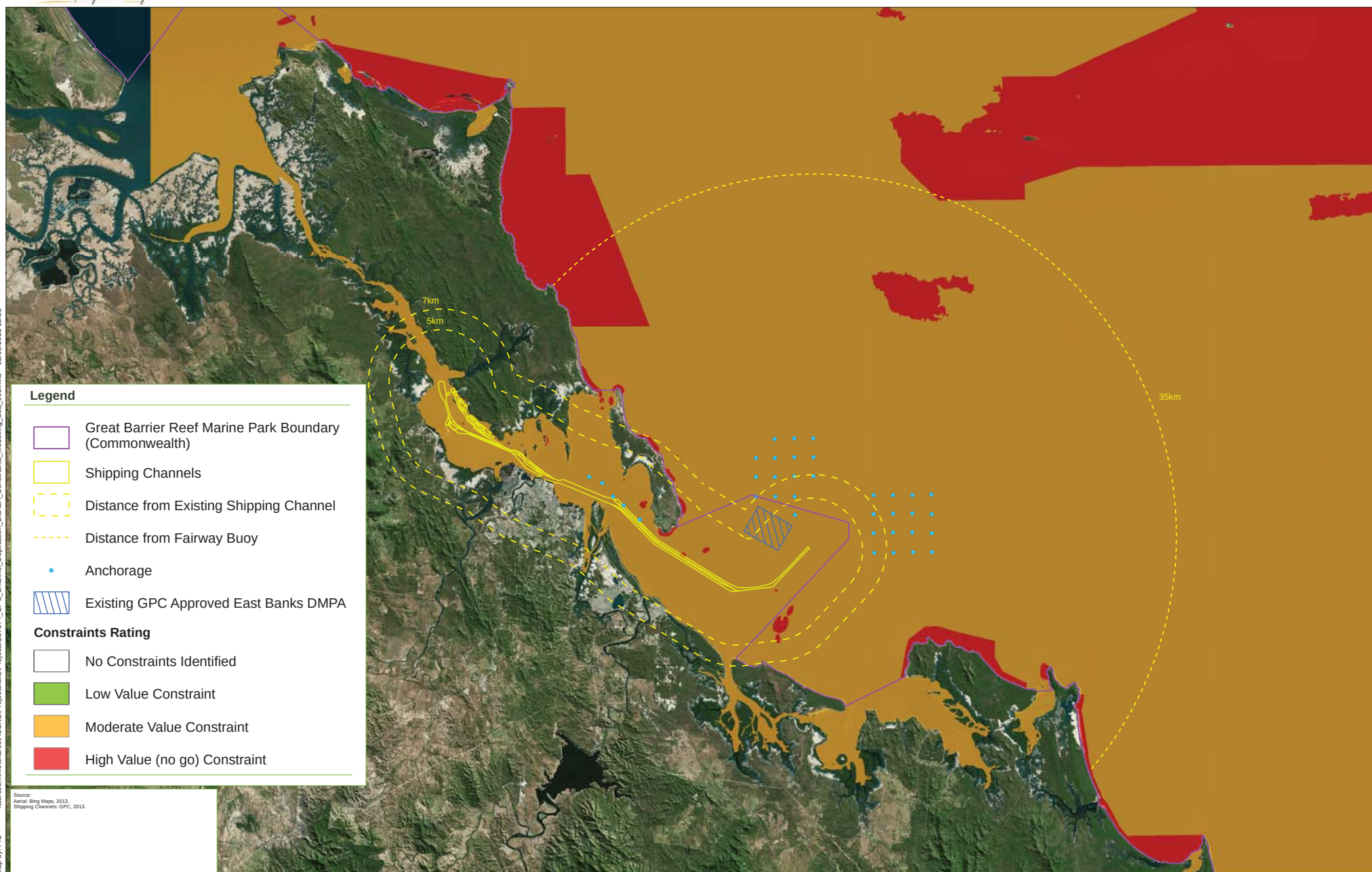
Figure 6.2 shows the beneficial use (below LAT) and offshore (at sea) DMPA study area ESP GIS Model results as containing predominantly 'moderate value constraint' areas. This large spatial coverage is due to the GBRWHA, and the State and Commonwealth Dugong Protection Areas (DPAs) which cover all inner and outer harbour areas of the Port of Gladstone.



Port of Gladstone Gatcombe and Golding Cutting Channel Duplication

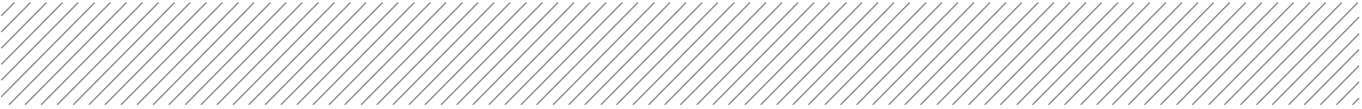
Figure 6-1: Beneficial Use (above LAT) ESP GIS Model Results

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Port of Gladstone Gatcombe and Golding Cutting Channel Duplication

Figure 6-2: Beneficial Use (below LAT) and Offshore (at sea) DMPA ESP GIS Model Results



The DMPOI recognises the significance of these two ‘moderate value constraints’ and the potential for dredged material placement to impact on their values, however in order to identify potential beneficial use locations (below LAT and offshore (at sea) DMPAs) for further investigation, the Model has been refined to identify the relative significance level of constraints ‘beneath’ the spatial coverage of the GBRWHA and DPA.

Figure 6.3 illustrates the revised ESP GIS Model constraints within the beneficial use (below LAT) and offshore (at sea) DMPA study area with the absence of the sensitivity ratings for the GBRWHA and DPAs. The Model outputs shown in Figure 6.3 include all other GIS mapped aspects outlined in the table presented in Appendix C.

Figure 6.4 illustrates the revised ESP GIS Model constraints for the offshore (at sea) study area combined with the bed-shear stress modelling results (refer Section 6.4).

The outputs of the revised ESP GIS Model presented in Figure 6.3 and Figure 6.4 will assist in identifying potential dredged material placement locations that will potentially have less impact on the identified aspects relative to other locations.

The ESP GIS Model generated for the beneficial use (above LAT) study area (refer Figure 6.1) has not been revised as the outputs based on the aspects for consideration detailed in Appendix C illustrate a range of constraints and considerations within this study area, and provide sufficient relative ratings to identify opportunity areas for dredged material placement.

6.4 Bed-shear stress modelling

A key factor influencing the potential for offshore (at sea) placement of dredged material to impact on the identified constraint aspects is the ability of the seabed within the placement location to retain the dredged material.

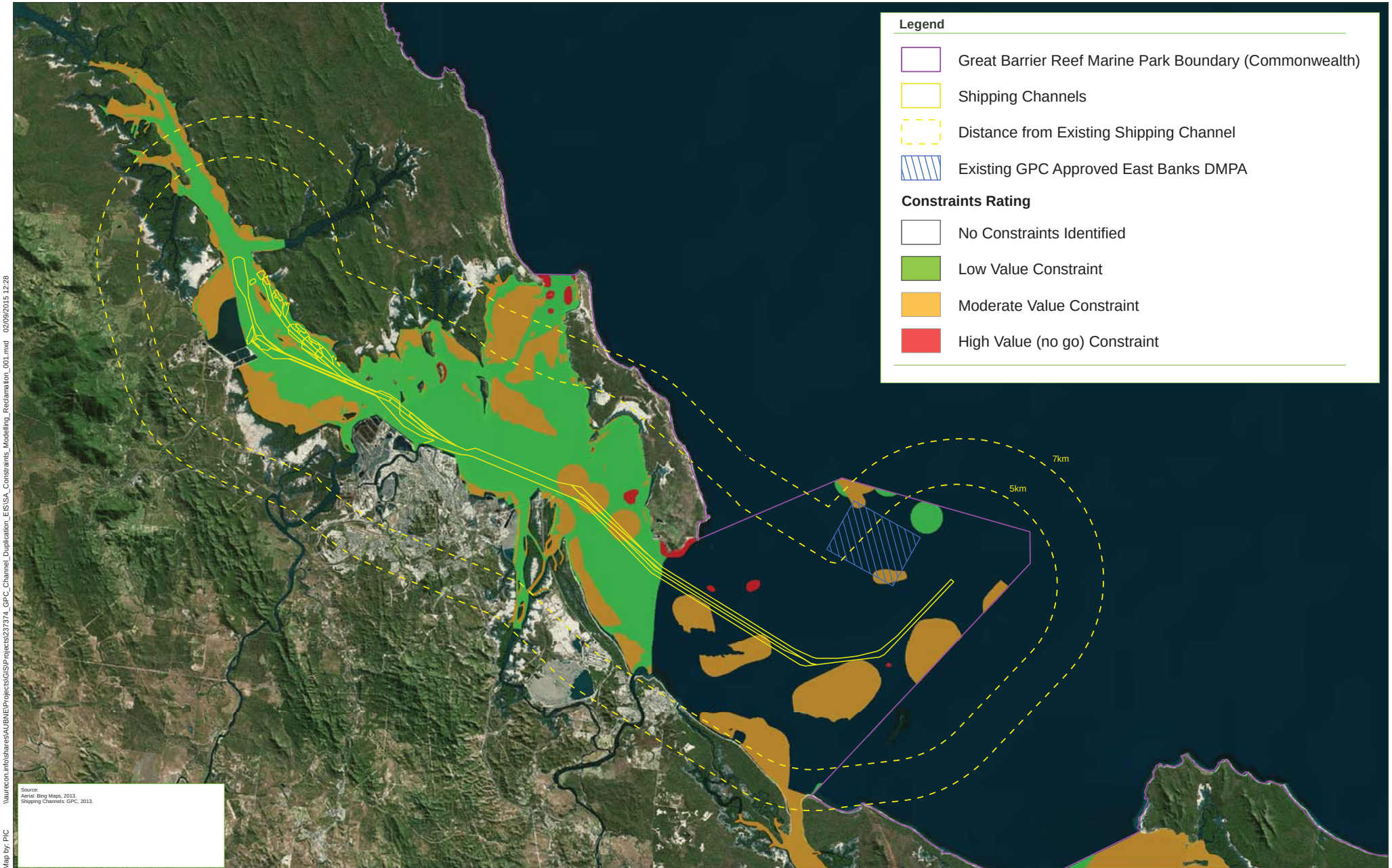
An effective and recognised method for measuring this is through bed-shear stress modelling. This modelling incorporates the various stresses on the seabed which could cause the transportation of sediment (ie dredged material), including currents, tides and wave action. Such considerations are not required for reclamation as engineered containment (eg rock walls) retain material within the placement location.

An enlarged TUFLOW-FV hydrodynamic model was developed by BMT WBM for the offshore (at sea) DMPA study area, and a 2D model run for the period of 1 November 2009 to 1 January 2010. This period was chosen due to the availability of ocean current, tide and wave action data recorded during this period by a moored Acoustic Doppler Current Profiler (ADCP) in the vicinity of GPC’s existing approved East Banks DMPA. Therefore the model outputs could be compared and calibrated with the measured data.

Calibration found the comparability of the modelled and measured results to be generally good, demonstrating that this model was fit for purpose and able to provide representative data for the DMPOI.

Generalised statistical results in terms of the level of bed-shear stress exceeded for 0% of the simulation period (ie maximum for the simulation period) across the study area were adopted for this investigation.

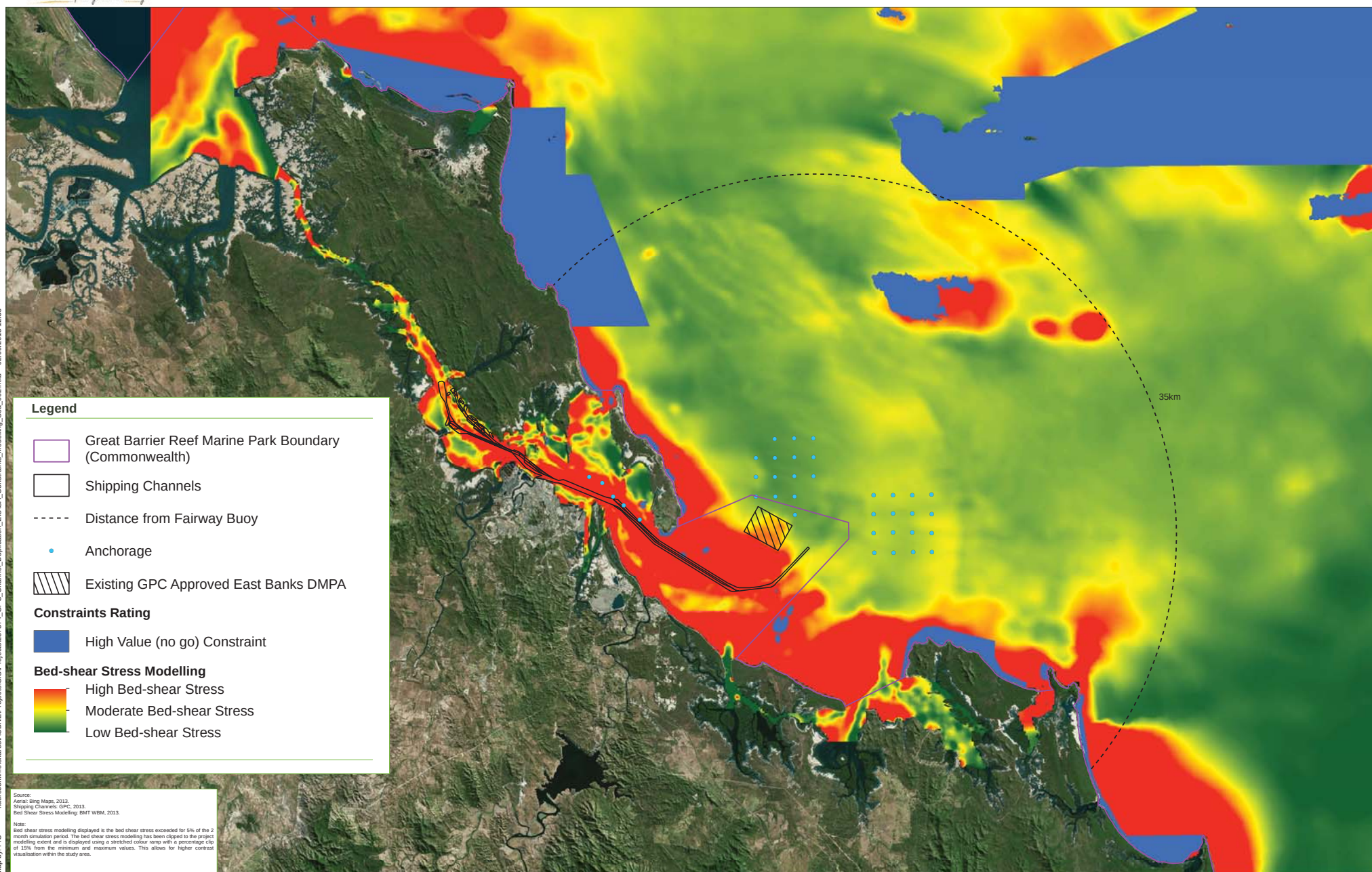
These results represent the relative potential for re-suspension of dredged material following placement within the study area, and are shown in Figure 6.4. Areas of lower bed-shear stress are considered as potential opportunities and preferred for offshore (at sea) placement than areas of higher bed-shear stress.

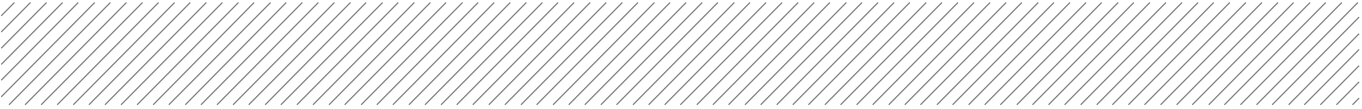


Port of Gladstone Gatcombe and Golding Cutting Channel Duplication

Figure 6-3: Revised ESP GIS Model Constraints Modelling - Reclamation below LAT

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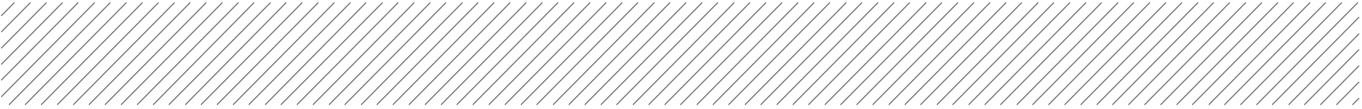
In addition to the bed-shear stress model data, Figure 6.4 includes those GIS mapped aspects outlined in Appendix C as ‘high value (no go) constraints’ to assist identification of potential offshore (at sea) DMPAs, including:

- GBRMP – Conservation, Marine National Park and Habitat Protection Zones
- Turtle nesting areas
- Coral reefs

6.5 Decision criteria for identifying potential dredged material placement opportunities

For the purposes of the DMPOI, opportunities for beneficial use or placement within the spatial limits of the study area have been identified and evaluated based on the following set of developed criteria:

1. *Site is not constrained by a ‘high value (no go) constraint’; and*
2. *Site exhibits one or more of the following opportunities:*
 - a. *Facilitates expansion of existing port land area by locating a new land creation/reclamation area adjacent to existing port land, industrial areas and/or reclamation projects;*
 - b. *Is located within or adjoining an area that is:*
 - i. *Zoned or designated as industrial land under GRC’s planning scheme; or*
 - ii. *Within an industrial precinct of the Gladstone State Development Area (GSDA); or*
 - iii. *Strategic Port Land;*
 - c. *Includes all or part of an area that is subject to existing approval to carry out dredged material placement works;*
 - d. *Is located within shallow harbour areas within port limits with potential for island reclamation for use as future port land; and/or*
 - e. *Is within an existing industrial area and/or is subject to an existing industrial operation with a limited lifespan.*



7 Phase 4: Identification of potential sites and preliminary investigations

7.1 Overview

Phase 4 of the DMPOI process involved:

- Undertaking a second stakeholder and regulatory agency workshop (refer Section 7.2) to:
 - Present and discuss the outputs and findings of the ESP GIS Model; and
 - Using the output information, together with the developed decision criteria (refer Section 6.5), seek to identify localities within the overall spatial study area suitable for potential dredged material placement sites.
- Development of indicative placement site extents post-workshop (refer Section 7.3)
- Undertaking of targeted preliminary site investigations to determine potential site availability and feasibility to support sites being taken forward into the MCA process (refer Section 7.4)

7.2 Identification of potential dredged material placement site locations

The outputs of the ESP GIS Model completed in Phase 3 were presented to stakeholders in a workshop held in Brisbane on Friday 25 October 2013 (Workshop 2). The workshop was attended by representatives from the following agencies or organisations:

- DOE (Commonwealth)
- GBRMPA (Commonwealth)
- DEHP (State)
- DAFF (State)
- DSITIA (State)
- Office of the CG (State)
- Department of National Parks, Recreation, Sports and Racing (NPRSR) (State)
- Gidarjil Development Corporation, as representatives of the Port Curtis Coral Coast (PCCC) Traditional Use of Marine Resources Agreement (TUMRA)
- GPC and Aurecon EIS team

Based on discussions on the ESP GIS Model outputs produced, together with reference to the decision criteria for the identification of material placement opportunities (refer Section 6.5), a number of potential dredged material placement site localities were identified for further investigation.



Representatives from GRC were unable to be in attendance at Workshop 2. However, to ensure GRC were given the opportunity to input into this critical phase of the DMPOI process, a meeting was held with GRC officers in Gladstone on Wednesday 16 October 2013.

During this meeting, land use planning considerations and potential beneficial use options were discussed, however officers advised that there were unlikely to be any opportunities in GRC's future projects (eg sport and recreation facilities) for the beneficial use of dredged material from the Project.

Furthermore, it should be noted that consultation with DoE and GBRMPA during Workshops 1 and 2 indicated the Commonwealth's preference for dredged material to not be placed within the GBRMP. Following Workshop 2 in October 2013, this position was confirmed by the Commonwealth Minister for the Environment, (The Hon. Greg Hunt MP), in a media statement on 15 November 2013 stating that the Gatcombe and Golding Cutting Channel Duplication Project should 'not consider dumping any material from the capital dredging project in the Great Barrier Reef Marine Park'.

7.3 Site definition and description

Following the identification of general dredged material placement opportunity areas by workshop attendees in Workshop 2, GIS mapping was undertaken to identify and define specific site locations and extents. A total of sixteen individual sites were developed, with consideration of the following:

- Appropriate sizing to reflect the minimum area required in order for a reclamation area to be economically viable
- Locating sites adjacent to the Port of Gladstone coastline (eg intertidal areas, existing reclamation areas)
- Avoiding/minimising conflicts with existing infrastructure and access, including existing shipping channels
- Consideration (at a high level) of the hydrodynamics and coastal processes of the Port of Gladstone

Each of the sixteen proposed investigation sites is illustrated and described in Table 7.1, with summary illustrations provided in Figure 7.1.

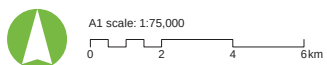
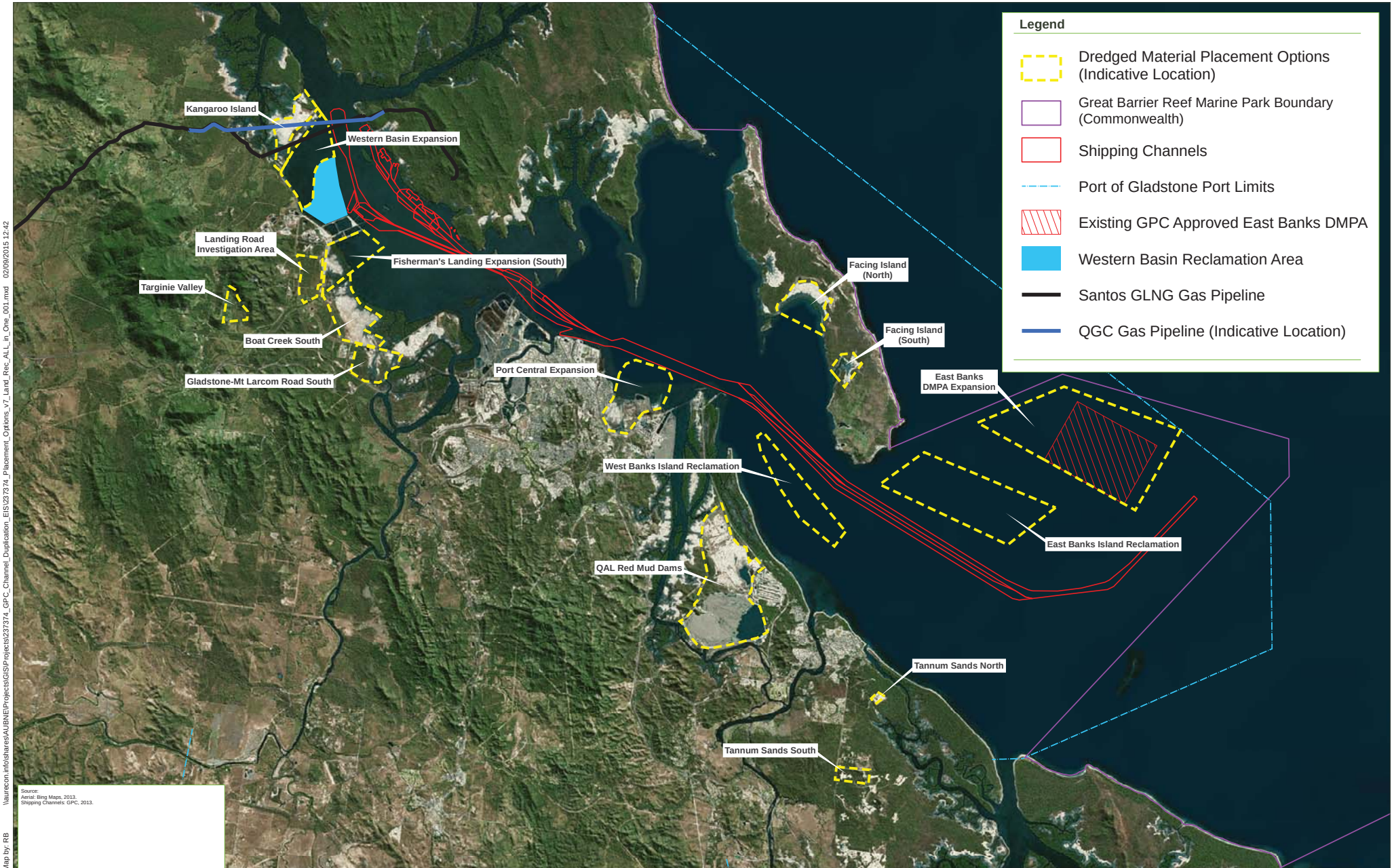


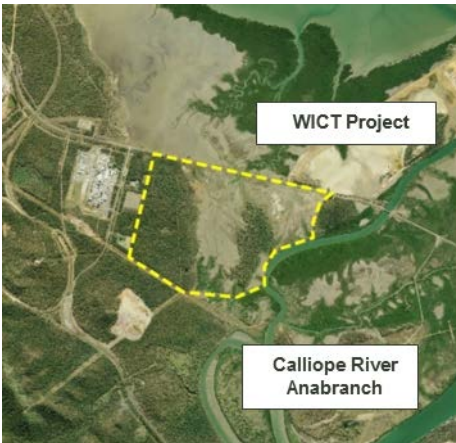
Table 7.1 Potential dredged material placement locations for material to be dredged

Site locality	Description	
Kangaroo Island		
	Placement type	Intertidal reclamation
	Estimated capacity	5-7 Mm ³
	Beneficial use/end land use	Reclamation for industrial and/or port related uses. Potential for development of two wharves at Friend Point
	Dredging equipment	TSHD for the area to be dredged
	Placement method	Material unlikely to be pumped directly from a TSHD, rehandling with a CSD or plain suction dredger would be required
	Establishment of placement site	■ Vegetation clearing ■ Bund wall construction within intertidal and sub-tidal area to varying depths ■ Greater bund wall volumes required relative to solely intertidal or land based areas ■ Bund material to be imported to site from local quarry
	Management of placement site	■ Dewatering of dredged material and decant water ■ Material settlement 2-3 years
	Key issues	■ Potential infrastructure conflicts (LNG pipeline) (refer Figure 7.1) ■ Loss of intertidal habitat ■ Hydrodynamic and coastal process impacts on The Narrows will need to be assessed

Site locality	Description	
Western Basin Expansion		
	Placement type	Intertidal and below LAT reclamation
	Estimated capacity	29-32 Mm ³
	Beneficial use/end land use	Reclamation for industrial and/or port related land uses
	Dredging equipment	TSHD for the area to be dredged
	Placement method	Material unlikely to be pumped directly from a TSHD, rehandling with a CSD or plain suction dredger would be required
	Establishment of placement site	■ Vegetation clearing and loss of seagrass ■ Bund wall construction within intertidal and sub-tidal area to varying depths ■ Greater bund wall volumes required relative to solely intertidal or land based areas ■ Bund material to be imported to site from local quarry
	Management of placement site	■ Dewatering of dredged material and decant water ■ Material settlement 2-3 years
Key issues	■ Expansion area forms part of Western Basin reclamation area approved by Queensland Government in 2010 ■ Potential infrastructure conflicts (LNG pipeline) ■ Loss of intertidal habitat and seagrass ■ Hydrodynamic and coastal process impacts on The Narrows will need to be assessed	

Site locality	Description	
Targinnie Valley Investigation Area		
	Placement type	Land based
	Estimated capacity	5-7 Mm ³
	Beneficial use/end land use	Permanent secondary dredged material placement area
	Dredging equipment	TSHD for the area to be dredged
	Placement method	Location exceeds the 5 km maximum pumping distance from a rehandling location therefore would only be available as a secondary placement site
	Establishment of placement site	■ Vegetation clearing ■ Bund wall construction ■ Bund material to be imported to site from local quarry
	Management of placement site	■ Dewatering of dredged material and decant water ■ Settlement of material over 2-3 years
	Key issues	■ Change in drainage patterns in the area ■ Saline dewater process may impact on groundwater resource ■ May conflict with future industrial use and/or Queensland Energy Resources (QER) shale oil mining tenement within the area
Landing Road Investigation Area		
	Placement type	Land based
	Estimated capacity	5-7 Mm ³
	Beneficial use/end land use	Permanent secondary dredged material placement area
	Dredging equipment	TSHD for the area to be dredged
	Placement method	Material unlikely to be pumped directly from a TSHD, rehandling with a CSD or plain suction dredger would be required
	Establishment of placement site	■ Vegetation clearing ■ Bund wall construction ■ Bund material to be imported to site from local quarry

Site locality	Description	
	Management of placement site	- Dewatering of dredged material and decant water - Settlement of material over 2-3 years
	Key issues	- Loss of native vegetation and fauna habitat - May conflict with QER shale oil mining tenement within the area
Fisherman's Landing Expansion (South)		
	Placement type	Intertidal and below LAT reclamation
	Estimated capacity	12-14 Mm ³
	Beneficial use/end land use	Port land – potential development of two wharves
	Dredging equipment	TSHD for the area to be dredged
	Placement method	Material unlikely to be pumped directly from a TSHD, rehandling with a CSD or plain suction dredger would be required
	Establishment of placement site	- Vegetation clearing and loss of seagrass - Bund wall construction within intertidal and sub-tidal area to varying depths - Greater bund wall volumes required relative to solely intertidal or land based areas - Bund material to be imported to site from local quarry
	Management of placement site	- Dewatering of dredged material and decant water - Material settlement 2-3 years
	Key issues	- Loss of intertidal habitat and seagrass - Hydrodynamic and coastal process impacts will need to be assessed

Site locality	Description		
Boat Creek South			
	Placement type	Intertidal reclamation	
	Estimated capacity	10-12 Mm ³	
	Beneficial use/end land use	Fill to create industrial land within the Gladstone State Development Area (GSDA)	
	Dredging equipment	TSHD for the area to be dredged	
	Placement method	Material unlikely to be pumped directly from a TSHD, rehandling with a CSD or plain suction dredger would be required	
	Establishment of placement site	■ Vegetation clearing ■ Bund wall construction ■ Bund material to be imported to site from local quarry	
	Management of placement site	■ Dewatering of dredged material and decant water ■ Material settlement 2-3 years	
Gladstone-Mt Larcom Road South	Key issues	■ Site is within the GSDA and has been allocated for the development of Yarwun Coal (Tenement to Terminal) ■ Timing of the Channel Duplication dredging works may not align with the future industrial use timeframe ■ Proposed Arrow Energy LNG pipeline crosses site ■ Loss of intertidal habitat	
	Gladstone-Mt Larcom Road South		
		Placement type	Land based and intertidal reclamation
		Estimated capacity	7-9 Mm ³
		Beneficial use/end land use	Industrial land within the GSDA
		Dredging equipment	TSHD for the area to be dredged
		Placement method	As this site is set back from the coast line, material is unlikely to be pumped directly from a TSHD, rehandling with a CSD or plain suction dredger would be required

Site locality	Description	
	Establishment of placement site	■ Vegetation clearing ■ Additional bund wall construction to supplement existing bunds constructed as part of the WICT Project ■ Bund material to be imported to site from local quarry
	Management of placement site	■ Dewatering of dredged material and decant water ■ Material settlement 2-3 years
	Key issues	■ Site has been allocated for the development future dredging stages of the WICT Project ■ Timing of the Channel Duplication Project dredging works may not align with the future industrial use timeframe
Port Central Expansion		
	Placement type	Land based and intertidal reclamation, and capping for QAL activities
	Estimated capacity	23-25 Mm ³
	Beneficial use/end land use	Port land/community use/habitat creation Potential to rehabilitate areas adjacent to QAL
	Dredging equipment	TSHD for the area to be dredged
	Placement method	Material unlikely to be pumped directly from a TSHD, rehandling with a CSD or plain suction dredger would be required
	Establishment of placement site	■ Bund wall construction within intertidal and sub-tidal area to varying depths ■ Greater bund wall volumes required relative to solely intertidal or land based areas ■ Bund material to be imported to site from local quarry
	Management of placement site	■ Dewatering of dredged material and decant water ■ Material settlement 2-3 years
	Key issues	■ Potential construction and operational impacts on adjoining residential areas will need to be assessed ■ Hydrodynamic and coastal process impacts will need to be assessed

Site locality	Description	
Facing Island (North)		
	Placement type	Intertidal and below LAT reclamation
	Estimated capacity	13-15 Mm ³
	Beneficial use/end land use	Potential to reinforce the dunes of Facing Island against future erosion
	Dredging equipment	TSHD for the area to be dredged
	Placement method	Material unlikely to be pumped directly from a TSHD, rehandling with a CSD or plain suction dredger would be required
	Establishment of placement site	■ Vegetation clearing ■ Bund wall construction ■ Bund material to be imported to site from local quarry on the mainland
	Management of placement site	■ Dewatering of dredged material and decant water ■ Material settlement 2-3 years
	Key issues	■ Loss of intertidal and marine habitat ■ Limited beneficial use of dredged material ■ Potential to create habitat along bund alignment adjoining marine environment
Facing Island (South)		
	Placement type	Land based and intertidal reclamation
	Estimated capacity	5-7 Mm ³
	Beneficial use/end land use	Potential to reinforce the dunes of Facing Island against future erosion
	Dredging equipment	TSHD for the area to be dredged
	Placement method	Material unlikely to be pumped directly from aTSHD, rehandling with a CSD or plain suction dredger would be required
	Establishment of placement site	■ Vegetation clearing ■ Bund wall construction within intertidal and sub-tidal area to varying depths ■ Greater bund wall volumes required relative to solely intertidal or land based areas ■ Bund material to be imported to site from local quarry on the mainland

Site locality	Description	
	Management of placement site	- Dewatering of dredged material and decant water - Material settlement 2-3 years
	Key issues	- Loss of intertidal and terrestrial vegetation and fauna habitat - Limited beneficial use of dredged material
West Banks Island		
	Placement type	Island reclamation
	Estimated capacity	27-30 Mm ³
	Beneficial use/end land use	Port land with potential for development of 16 wharves
	Dredging equipment	TSHD and CSD for area to be dredged
	Placement method	- Small portion of Golding Cutting Channel and most of Gatcombe Channel can be dredged by CSD and material directly pumped into reclamation area with assistance of boosters - Material unlikely to be pumped directly from a TSHD, rehandling with a CSD or plain suction dredger would be required for some material
	Establishment of placement site	- Bund wall construction on marine and sub-tidal area of varying depths - Bund material would be required to be sourced from a mainland quarry, trucked and/or barged or causeway/bridge constructed to the site
	Management of placement site	- Dewatering of dredged material and decant water - Material settlement 2-3 years
	Key issues	Hydrodynamic and coastal process impacts will need to be assessed Bridge and access road need to be developed to realise beneficial use potential

Site locality	Description	
QAL Red Mud Dams		
	Placement type	Land based capping fill
	Estimated capacity	23-25 Mm ³
	Beneficial use/end land use	Capping
	Dredging equipment	CSD for area to be dredged
	Placement method	CSD direct pumping into site
	Establishment of placement site	■ Bund wall construction ■ Material to be sourced from a mainland quarry
	Management of placement site	■ Dewatering of dredged material and decant water ■ Material settlement 2-3 years
Key issues	■ Availability of site within the Project dredging works timeframe	
Tannum Sands North		
	Placement type	Land based
	Estimated capacity	2-4 Mm ³
	Beneficial use/end land use	Fill
	Dredging equipment	TSHD for area to be dredged
	Placement method	Location exceeds the 5 km maximum pumping distance from the area to be dredged, therefore rehandling by CSD or plain suction dredger required
	Establishment of placement site	■ Bund wall construction ■ Material to be sourced from a mainland quarry
	Management of placement site	■ Dewatering of dredged material and decant water ■ Material settlement 2-3 years
Key issues	■ Availability of site ■ Capacity of site less than Project dredged material volume	

Site locality	Description	
Tannum Sands South		
	Placement type	Land based
	Estimated capacity	2-4 Mm ³
	Beneficial use/end land use	Fill
	Dredging equipment	TSHD for area to be dredged
	Placement method	Location exceeds the 5 km maximum pumping distance from the area to be dredged, therefore rehandling by CSD or plain suction dredger required
	Establishment of placement site	■ Vegetation clearing ■ Bund wall construction ■ Bund material to be imported to site from local quarry
	Management of placement site	■ Bund wall construction ■ Material to be sourced from a mainland quarry ■ Material settlement 2-3 years
Key issues	■ Availability of site ■ Capacity of site less than Project dredged material volume	
East Banks Island		
	Placement type	Island reclamation
	Estimated capacity	71-75 Mm ³
	Beneficial use/end land use	Port land with the potential to develop up to 18 wharves
	Dredging equipment	TSHD and CSD
	Placement method	■ Small portion of Golding Cutting Channel and most of Gatcombe Channel can be dredged by CSD and material directly pumped into reclamation area with assistance of boosters ■ Material unlikely to be pumped directly from a TSHD, rehandling with a CSD or plain suction dredger would be required for some material
Establishment of placement site	■ Bund wall construction on marine and sub-tidal area of varying depths ■ Bund material would be required to be sourced from a mainland quarry and barged to site	

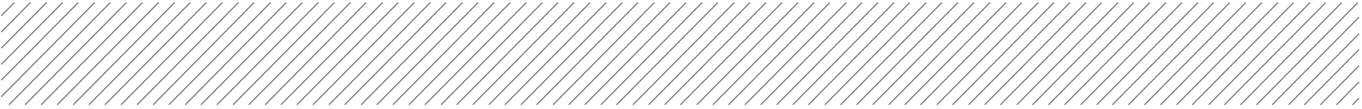
Site locality	Description	
	Management of placement site	- Dewatering of dredged material and decant water - Material settlement 2-3 years
	Key issues	- Hydrodynamic and coastal process impacts will need to be assessed - Major infrastructure required to realise beneficial use potential as a port centre
East Banks DMPA Expansion		
	Placement type	Offshore (at sea)
	Estimated capacity	65 Mm ³
	Beneficial use/end land use	Nil
	Dredging equipment	TSHD for area to be dredged and placement
	Placement method	Material placed on sea floor through TSHD under-keel doors
	Establishment of placement site	No site establishment required
	Management of placement site	No ongoing operational management
	Key issues	- Site adjoins GPC's existing approved East Banks DMPA - Site located outside of the GBRMP - Sediment plume from dredging, material placement and resuspension impacts need to be assessed

7.4 Preliminary investigations

Following the identification and definition of each of the 16 potential dredged material placement sites, preliminary investigations were carried out in order to determine whether there would be opportunities for dredged material placement associated with the Project.

These preliminary investigations were specifically targeted at those potential dredged material placement sites that were privately owned or managed and which were considered most likely to be influenced by commercial restrictions/operations. These included:

- Targinnie Valley Investigation Area
- Landing Road Investigation Area
- QAL Red Mud Dams
- Tannum Sands North
- Tannum Sands South



From these preliminary investigations, five sites were identified as potentially unfeasible for dredged material placement associated with the Project due to either owner/operator operational requirements, inconsistency between timing of dredging and planned future development of the site and/or dredging operational constraints.

A summary of the outcomes of these discussions are provided below.

7.4.1 Targinnie Valley Investigation Area and Landing Road Investigation Area

Both the Targinnie Valley and Landing Road Investigation Areas overlay parts of the Queensland Energy Resources (QER) shale oil mining tenement in the northern portion of the beneficial use study area. These areas were identified during Workshop 2 as worthy of further investigation for the potential beneficial use of dredged material as replacement fill following shale oil mining operations.

A meeting was held with QER in Gladstone on Thursday 14 November 2013 to discuss the operational requirements and timeframe of shale oil mining this area in order to determine whether opportunities could be present for dredged material placement.

QER advised that during shale oil mining operations the volume of material extracted from mining areas is equivalent to the volume of spoil remaining following the removal of shale oil product. QER intend to deposit this spoil within the voids remaining following extraction, therefore there would be no capacity available for the co-disposal of dredged material.

QER advised that the timeframe of shale oil mining operations in these areas has not yet been confirmed but was unlikely to align with the timing of the Project. However, it was also confirmed that an area to the south of the Targinnie Valley outside of the QER Shale Oil mining tenement and within the GSDA could be available for potential dredged material placement subject to further investigations.

This area was identified as being within the maximum 7 km beneficial use (primary location) study area, however due to its location on the western side of a range (ie between the site and harbour), and the need to pump over high terrain, the resulting reductions in pumping velocities would mean the pumping distance would unlikely be achieved.

7.4.2 Queensland Alumina Limited - Red Mud Dams

Queensland Alumina Limited (QAL) produces approximately 3.95 Mtpa of alumina at their Boyne Island refinery south of Gladstone. The process of extracting alumina from bauxite results in a by-product of fine-grained residue known as 'red mud', which is disposed of within the facility's 1,000 ha Residual Disposal Area (RDA).

This RDA was identified during Workshop 2 as a potential placement location for dredged material, whereby the material could be beneficially used to cap the RDA once capacity of red mud storage is reached and/or operations at QAL cease.

A meeting was held with QAL in Gladstone on Thursday 14 November 2013 to discuss the viability of this option. QAL advised that their operations at Boyne Island were planned for at least the next 50 years, and that the forecasted capacity of the RDA, including an expansion involving the raising of the existing bund walls to approximately 44 m AHD, will be required to support these operations through the raising.

It was therefore determined that the site would not be available for dredged material placement for the Project, however opportunities in this area could be considered in future dredging campaign alternative dredged material placement and beneficial use options assessments.

7.4.3 Tannum Sands North

The Tannum Sands North site is operated by Cement Australia for the extraction of silica sand under a current mining lease for use in commercial cement making processes at Landing Road, north of Gladstone. Similar to the Targinnie Valley and Landing Road Investigation Areas, the area was identified during Workshop 2 as a potential beneficial use site for dredged material as replacement fill following commercial operations.

Initial consultation with Cement Australia via phone and email correspondence also identified possibilities for the use of dredged material in the production of cement.

Further discussions with Cement Australia, including the provision of sediment sampling information from the capital dredging undertaken in 2001-2003 to deepen the existing Gatcombe and Golding Cutting Channels (considered as likely to represent the material from the Channel Duplication Project), confirmed that the dredged material would not be suitable for use in the cement making process due to its high salinity and difficulty in separating the components of the material (ie sand and clay).

Cement Australia also advised that silica sand mining of this site was currently planned to continue until the expiry of their current mining lease in 2031, and beyond pending the issue of a new mining lease from the State.

Based on this information, it was determined that the site would not be available for dredged material placement for the Project.

7.4.4 Tannum Sands South

Similarly to Tannum Sands North site, the Tannum Sands South site is operated as a silica sand extraction area by Boral and was identified during Workshop 2 as a potential beneficial use site for dredged material as replacement fill following silica sand mining operations.

A meeting was held with Boral in Brisbane on Wednesday 20 November 2013 during which Boral advised that their ongoing operations in this area would preclude its use as a dredged material placement area for the Project. Further, it was determined that the site exceeded the maximum potential pumping distance for dredged material, and therefore would be restricted in use as a secondary placement site only (ie a primary placement site closer to the area to be dredged would be required to manage material before being relocated to this site).

Therefore, it was determined that the Tannum Sands South site would not be available for dredged material placement for the Project.

7.4.5 Summary

Eleven potential dredged material placement sites were finalised during Phase 4 to be progressed to the multi-criteria analysis (MCA) process (refer Section 8).

8 Phase 5: Multi-criteria analysis

8.1 Phase overview

Phase 5 of the DMPOI process involved undertaking a MCA process to inform the selection of potential dredged material placement locations to be taken forward for further assessment in the Project EIS.

Specifically, the MCA process involved:

- Development of objectives, sub-objectives, weightings and scoring considerations (refer Section 8.3)
- Define scoring values and considerations (refer Section 8.4)
- Conducting a workshop (Workshop 3) with stakeholders and regulatory agency representatives (refer Section 8.5) in order to:
 - Present the findings of the preliminary site investigations undertaken in Phase 4 and seek endorsement of this from workshop participants
 - Undertake the MCA assessment
 - Review and examine the MCA results, including sensitivity analysis
 - Discuss the findings of the MCA assessment

8.2 MCA methodology

8.2.1 Overview

MCA is a process for weighing up alternative options or actions against each other, in order to arrive at the best alternative in a complex environment. Unlike cost-benefit analysis, the results are not expressed in monetary terms but rather in the development of results against performance measures, in measurement units determined by the nature of the effect, for example the predicted nature and scale of potential ecological impacts, beneficial use of material, and community impacts.

A typical MCA consists of a set of options that need to be tested against a fixed set of criteria. For this reason, the question (that is, which option to choose) is translated into an evaluation matrix, where each alternative option is assessed for each criterion. The intent is to compare each option independently against the same criteria to ensure a valid comparison is made.

The MCA process incorporates all the relevant criteria simultaneously within the analysis, to arrive at a conclusion or ranking. As such, the process can consider a range of complex issues, impacts and opportunities, and can therefore be applied to increasingly more complex situations than a risk assessment process.

A score is assigned to each cell of the matrix, resulting in a ranking of the various options on the basis of their score for the various criteria/objectives. The effects measured may be entirely quantitative, entirely qualitative, or a combination of the two. For this process, a mix of quantitative and qualitative measures has been used.

The MCA methodology adopted for this investigation is the 'weighted summation' methodology. In this method, the various objective scores are multiplied by the objective's weighting to arrive at a final score. Subsequently, all scores are added together, resulting in a unique overall score for each option and therefore a ranking for that option against the other options being assessed.

The key steps undertaken in the MCA process for the Project and their timing are summarised in Table 8.1.

Table 8.1 Project MCA process summary

Timing	Step	Process
Pre-workshop 3	1	Development of objectives and sub-objectives for aquatic ecology, terrestrial ecology, social and cultural heritage, and economic aspects that reflect the values associated with the consequences of each option
	2	Assigning of weightings for each of the objectives and sub-objectives to reflect their relative importance to the decision
	3	Definition of scoring approach and scoring considerations for each sub-objective to assist in determining how to allocate a score for each option being assessed
Workshop 3	4	Assessment of the expected and scoring of the performance of each option against the sub-objectives
	5	Collation of each options score and weighting to derive an overall value for each option, enabling the ranking of all options together
	6	Review and examination of the MCA results
	7	Conducting of a sensitivity analysis of the MCA results of the scores and weightings

8.3 Steps 1 and 2: Define objectives, sub-objectives and weightings

In preparing for the MCA process, and prior to the MCA workshop, the objectives, sub-objectives and preliminary weightings were developed. In doing this, input was sought from a number of key regulatory agencies. Each agency also provided weightings for the objectives and sub-objectives that reflected their legislative requirements and jurisdictions. The agencies involved included:

- DoE (Commonwealth)
- GBRMPA (Commonwealth)
- DEHP (State)
- DAFF (State)
- DSITIA (State)
- Office of the CG (State)

A summary of these preliminary objectives, sub-objectives and weightings are presented in Table 8.2.

Table 8.2 Draft MCA objectives and allocated weightings

MCA Objectives	Weighting (%)								
	DEHP	DSITIA	GBRMPA	DAFF	DOE	CG	GPC	Average	Workshop consensus
1. Aquatic environmental objectives	25	40	50	33	25	25	25	32	32
1.1 Avoid or minimise irrevocable adverse impact on aquatic ecosystem sensitive receptors (ie permanent loss of the GBRWHA OUV, including but not limited to seagrass meadows, mangroves, saltmarsh intertidal area)	50	40	40	50	40	20	34	39	45
1.2 Avoid or minimise short term water quality and other ecological impacts (eg occurrence of sediment plume) on aquatic and/or coastal ecosystem sensitive receptors (ie minimise short term impact on the GBRWHA OUV, including but not limited to seagrass meadows, coral/rocky reef, declared Fish Habitat Areas, turtle nesting beaches, Great Barrier Reef Marine Park)	25	30	40	15	20	50	33	30.5	20
1.3 Avoid or minimise adverse impact on listed threatened, migratory and other protected marine fauna species (including the GBRWHA OUV biodiversity conservation attributes, and species listed under the EPBC Act, GBRMP Act and NC Act) and their habitat	25	30	20	35	40	30	33	30.5	35
Total	100	100	100	100	100	100	100	100	100
2 Terrestrial environmental objectives	25	10	25	28	25	25	25	23.3	23
2.1 Avoid or minimise impacts on significant terrestrial vegetation communities (ie MNES (TECs and threatened species) and Matters of State Environmental Significance (MSES) (endangered or of concern regional ecosystems, habitat for threatened species))	50	70	30	50	50	60	50	51.4	50
2.2 Avoid or minimise adverse impacts on natural aesthetic values and geological processes/heritage attributes as defined under the GBRWHA OUV (eg Port Curtis islands, beaches, dune systems, fringing reefs)	50	30	70	50	50	40	50	48.6	50
Total	100	100	100	100	100	100	100	100	100

MCA Objectives	Weighting (%)								
	DEHP	DSITIA	GBRMPA	DAFF	DOE	CG	GPC	Average	Workshop consensus
3. Social and cultural heritage objectives	25	20	15	21	25	25	25	22.3	22
3.1 Maximise level of compatibility of the final placement location with existing and approved land uses and future land use planning documents	40	25	10	25	10	40	25	25	25
3.2 Avoid or minimise adverse impacts on Gladstone community and recreational activities associated with dredging, construction of containment bunds and placement impacts, and future operational land use of placement area)	10	25	30	25	30	20	25	23.6	25
3.3 Avoid or minimise adverse impacts on opportunities for reasonable use, appreciation, enjoyment and understanding of the GBR region and adjacent coastline	10	25	30	25	30	10	25	22.1	20
3.4 Avoid /or minimise adverse impacts on cultural heritage values, including Traditional Owner/use values and heritage values	40	25	30	25	30	30	25	29.3	30
Total	100	100	100	100	100	100	100	100	100
4. Economic objectives	25	30	10	18	25	25	25	22.6	23
4.1 Avoid or minimise adverse impacts on ecosystem reliant commercial activities	40	50	60	35	60	40	33.3	45.5	45
4.2 Maximise cost efficiency of dredging method and dredged material placement	30	20	10	30	10	30	33.3	21.9	23
4.3 Maximise beneficial use of placement area or dredged material use	40	30	30	35	30	30	33.3	32.6	32
Total	100	100	100	100	100	100	100	100	100

8.4 Step 3: Define scoring values and considerations

Following definition of the MCA objectives and sub-objectives, a set of scoring values and considerations were developed in consultation with the same key regulatory agencies. The scoring values are summarised in Table 8.3.

Table 8.3 MCA scoring values

Score	Criteria
1	Prevents objective
2	Against objective
3	Partially fails objective
4	Partially satisfies objective
5	Meets objective
6	Exceeds objective

This scoring range was applied to each of the 12 sub-objectives, and then a set of scoring considerations were developed to reflect the potential outcome/scale of impact that would be attributed to each score.

During review of this scoring range, it was noted that the scoring of the MCA was limited by the available information for each site and the adjoining areas within the potential zone of the impact, and that the level of uncertainty in some areas (eg extent of marine ecological impact which would require hydrodynamic modelling) would influence the scoring. These areas of uncertainty were discussed with inputs from the subject matter advisors, and noted for further investigation as part of the Project EIS.

The scoring considerations adopted for the MCA are provided in Table 8.4.

Table 8.4 MCA scoring considerations

Objective	Scoring		Scoring considerations (other considerations to be identified prior to and during the MCA workshop)
1. Aquatic environment objectives			
1.1 Avoid or minimise irrevocable adverse impact on aquatic and/or coastal ecosystem sensitive receptors (ie permanent loss of the GBRWHA OUV, including but not limited to seagrass meadows, mangroves, saltmarsh intertidal area)			
	1	Prevents objective	Unacceptable impact on GBRWHA OUV aquatic and coastal ecosystem sensitive receptors (eg seagrass meadows identified as having a comparatively high or medium potential value to the ecology of Port Curtis)
	2	Against objective	Impact on GBRWHA OUV aquatic and/or coastal ecosystem sensitive receptors (eg seagrass meadows identified as having a comparatively high or medium potential value to the ecology of Port Curtis)
	3	Partially fails objective	Impact on GBRWHA OUV aquatic and/or coastal ecosystem sensitive receptors (eg seagrass meadows identified as having a comparatively low potential value to the ecology of Port Curtis)
	4	Partially satisfies objective	Manageable impact on GBRWHA OUV aquatic and coastal ecosystem sensitive receptors (eg seagrass meadows)
	5	Meets objective	No impact on GBRWHA OUV aquatic and coastal ecosystem sensitive receptors (eg seagrass meadows, mangroves, intertidal areas)
	6	Exceeds objective	Creates additional potential GBRWHA OUV aquatic and coastal ecosystem habitat
1.2 Avoid or minimise short term water quality and adverse ecological impacts (eg occurrence of sediment plume) on aquatic and/or coastal ecosystem sensitive receptors (ie minimise short term impact on the GBRWHA OUV, including but not limited to seagrass meadows, coral/rocky reef, declared Fish Habitat Areas, turtle nesting beaches, Great Barrier Reef Marine Park)			
	1	Prevents objective	Unacceptable impacts on aquatic ecosystem sensitive receptors on a regional or local scale
	2	Against objective	Impacts on aquatic ecosystem sensitive receptors on a regional scale
	3	Partially fails objective	Impacts on aquatic ecosystem sensitive receptors on a local scale
	4	Partially satisfies objective	Manageable impacts on aquatic ecosystem sensitive receptors on a local scale
	5	Meets objective	Does not impact on aquatic ecosystem sensitive receptors
	6	Exceeds objective	Creates additional potential aquatic ecosystem sensitive habitat

Objective	Scoring		Scoring considerations (other considerations to be identified prior to and during the MCA workshop)
1.3	<i>Avoid or minimise adverse impact on listed threatened, migratory and other protected marine fauna species (including the GBRWHA OUV biodiversity conservation attributes, and species listed under the EPBC Act, GBRMP Act and NC Act) and their habitat</i>		
	1	Prevents objective	Unacceptable impacts on listed threatened, migratory and other protected marine fauna species on a regional or local scale
	2	Against objective	Impacts on listed threatened, migratory and other protected marine fauna species on a regional scale
	3	Partially fails objective	Impacts on listed threatened, migratory and other protected marine fauna species on a local scale
	4	Partially satisfies objective	Manageable impacts on listed threatened, migratory and other protected marine fauna species on a local scale
	5	Meets objective	Does not impact listed threatened, migratory and other protected marine fauna species
	6	Exceeds objective	Creates additional potential listed threatened, migratory and other protected marine fauna species habitat
2.	Terrestrial environmental objectives		
2.1	<i>Avoid or minimise impacts on significant terrestrial vegetation communities (ie MNES (TECs and threatened species) and Matters of State Environmental Significance (MSES) (endangered or of concern regional ecosystems, habitat for threatened species))</i>		
	1	Prevents objective	Unacceptable impacts on terrestrial vegetation communities on a regional or local scale
	2	Against objective	Impacts on terrestrial vegetation communities on a regional scale
	3	Partially fails objective	Impacts on terrestrial vegetation communities on a local scale
	4	Partially satisfies objective	Manageable impacts on terrestrial vegetation communities on a local scale
	5	Meets objective	Does not impact on terrestrial vegetation communities
	6	Exceeds objective	Creates additional potential areas for terrestrial vegetation communities
2.2	<i>Avoid or minimise adverse impacts on natural aesthetic values and geological processes/heritage attributes as defined under the GBRWHA OUV (eg Port Curtis islands, beaches, dune systems, fringing reefs)</i>		
	1	Prevents objective	Unacceptable impacts on local and regional natural aesthetic values and/or geological processes/heritage attributes
	2	Against objective	Detracts from local and regional natural aesthetic values and/or geological processes/heritage attributes
	3	Partially fails objective	Detracts from local natural aesthetic values and/or geological processes/heritage attributes
	4	Partially satisfies objective	Partially detracts from local natural aesthetic values and/or geological processes/heritage attributes
	5	Meets objective	Does not detract from natural aesthetic values and/or geological processes/heritage attributes
	6	Exceeds objective	Increases natural aesthetic values and/or geological processes/heritage attributes

Objective	Scoring		Scoring considerations (other considerations to be identified prior to and during the MCA workshop)
3. Social and cultural heritage objectives			
3.1 Maximise level of compatibility of the final placement location with existing and approved land uses and future land use planning documents			
	1	Prevents objective	Unacceptable impacts on adjoining land uses; Conflicts with long term planning intent for the area
	2	Against objective	Detracts from/conflicts with adjoining land uses
	3	Partially fails objective	Is not compatible with adjoining land uses, but does not detract from/conflicts with adjoining land uses
	4	Partially satisfies objective	Is compatible with some adjoining land uses
	5	Meets objective	Is compatible with all adjoining land uses
	6	Exceeds objective	Is compatible and complements all adjoining land uses
3.2 Avoid or minimise adverse impacts on Gladstone community and recreational activities associated with dredging, construction of containment bunds and placement impacts, and future operational land use of placement area)			
	1	Prevents objective	Unacceptable and long term impacts on the Gladstone community and/or recreational activities
	2	Against objective	Long term adverse impact on the Gladstone community and/or recreational activities
	3	Partially fails objective	Short term adverse impact on the Gladstone community and/or recreational activities
	4	Partially satisfies objective	Manageable impact on the Gladstone community and/or recreational activities
	5	Meets objective	Minor to no impact on the Gladstone community and/or recreational activities
	6	Exceeds objective	Provides benefit to the Gladstone community and/or recreational activities
3.3 Avoid or minimise adverse impacts on opportunities for reasonable use, appreciation, enjoyment and understanding of the GBR region and adjacent coastline			
	1	Prevents objective	Unacceptable and long term loss of opportunities for reasonable use, appreciation, enjoyment and understanding of the GBR region and adjacent coastline
	2	Against objective	Long term loss of opportunities for reasonable use, appreciation, enjoyment and understanding of the GBR region and adjacent coastline
	3	Partially fails objective	Short term loss of opportunities for reasonable use, appreciation, enjoyment and understanding of the GBR region and adjacent coastline
	4	Partially satisfies objective	Manageable impact on opportunities for reasonable use, appreciation, enjoyment and understanding of the GBR region and adjacent coastline

Objective	Scoring		Scoring considerations (other considerations to be identified prior to and during the MCA workshop)
	5	Meets objective	Minor to no impact on opportunities for reasonable use, appreciation, enjoyment and understanding of the GBR region and adjacent coastline
	6	Exceeds objective	Provides additional opportunities for reasonable use, appreciation, enjoyment and understanding of the GBR region and adjacent coastline
3.4 Avoid /or minimise adverse impacts on cultural heritage values, including Traditional Owner/use values and heritage values			
	1	Prevents objective	Unacceptable impacts on cultural heritage values and Traditional Owner/use values on a regional scale
	2	Against objective	Impacts cultural heritage values and Traditional Owner/use values on a regional scale
	3	Partially fails objective	Impacts cultural heritage values and Traditional Owner/use values on a local scale
	4	Partially satisfies objective	Manageable impact on cultural heritage values and Traditional Owner/use values
	5	Meets objective	No impact to cultural heritage values and Traditional Owner/use values
	6	Exceeds objective	Provides benefit to cultural heritage values and Traditional Owner/use values
4. Economic objectives			
4.1 Avoid or minimise adverse impacts on ecosystem reliant commercial activities			
	1	Prevents objective	Unacceptable and long term loss in ecosystem reliant commercial activities
	2	Against objective	Long term loss in ecosystem reliant commercial activities
	3	Partially fails objective	Temporary loss in ecosystem reliant commercial activities
	4	Partially satisfies objective	Manageable loss in ecosystem reliant commercial activities
	5	Meets objective	Minor to no impact to ecosystem reliant commercial activities
	6	Exceeds objective	Improves ecosystem reliant commercial activities

Objective	Scoring		Scoring considerations (other considerations to be identified prior to and during the MCA workshop)
4.2 Maximise cost efficiency of dredging method and dredged material placement			
	1	Prevents objective	Unacceptable costs for dredging and/or dredged material management and placement
	2	Against objective	Double (or more) handling of dredged material required, and placement area location requires high containment bund costs, and achieves low dredging pumping efficiency Duplication of handling/management area
	3	Partially fails objective	Placement area location requires high containment bund costs and achieves low dredging pumping efficiency
	4	Partially satisfies objective	Placement area location requires high containment bund costs or achieves low dredging pumping efficiency
	5	Meets objective	Placement area location minimises containment bund costs and/or maximises dredging pumping efficiency
	6	Exceeds objective	Lowest costs per m³ for dredging and placement area location
4.3 Maximise beneficial use of placement area or dredged material use			
	1	Prevents objective	All Project dredged material is not beneficially used (ie offshore (at sea) placement)
	2	Against objective	Dredging campaign involves a combination of beneficial (<5-25 % of dredged material) and non-beneficial (>75-95 % of dredged material) use
	3	Partially fails objective	Dredging campaign involves a combination of beneficial (<50 % of dredged material) and non-beneficial (>50 % of dredged material) use
	4	Partially satisfies objective	Dredging campaign involves a combination of beneficial (>50 % of dredged material) and non-beneficial (<50 % of dredged material) use
	5	Meets objective	Dredging campaign involves: ■ Beneficial uses (>75 % of dredged material) ■ The placement location land use provides additional land for industrial, port, environment, community or other improved land use
	6	Exceeds objective	Dredging campaign involves: ■ 100 % beneficial use ■ The placement location land use provides additional land for industrial, port, environment, community or other improved land use ■ Material is used in a recycling process allowing a secondary value add beneficial use (eg construction material, habitat creation)

8.5 Steps 4 to 7: MCA workshop

8.5.1 Overview

The MCA was undertaken during a two day workshop (Workshop 3), which was facilitated by Simon McNeillage who was independent to the Project EIS team. The MCA workshop allowed discussion to accurately apply the above scoring to each potential dredged material placement option.

During Workshop 3 the following tasks were undertaken:

- Review of the original 16 investigation sites, and presentation of the additional investigations undertaken in Phase 4 which revised the total potential sites to 11 for the MCA workshop process
- Review and agreement of preliminary objectives, sub-objectives and weightings
- Review and agreement of scoring values and considerations
- Discussion of each potential dredged material placement option, assessment and scoring against the MCA criteria

The sections below provide further detail on the MCA outcomes, with the full Workshop 3 meeting minutes provided in Appendix B.

8.5.2 Attendees

In order to undertake the assessment component of the MCA process, a two day workshop was held in Brisbane with key stakeholders and regulatory agencies on 27 and 28 November 2013 (Workshop 3), including:

- DoE (Commonwealth)
- GBRMPA (Commonwealth)
- DEHP (State)
- DAFF (State)
- DSITIA (State)
- Office of the CG (State)
- Gidarjil Development Corporation, as representatives of the PCCC TUMRA (cultural heritage advisor)
- GPC and Aurecon EIS team

It should be noted that although officers from NPRSR attended Workshop 2, officers from this agency opted to not attend Workshop 3.

In addition to representatives of the above regulatory agencies, a number of specialist subject-matter advisors were also in attendance, including:

- BMT WBM (aquatic ecology – coral and marine fauna advisor)
- BMT WBM (hydrodynamic and coastal processes advisor)
- Dr Michael Rasheed (James Cook University) (aquatic ecology– seagrass advisor)

Each subject-matter advisor presented to the workshop an overview of the key environmental values and hydrodynamic processes specific to the Port of Gladstone and the DMPOI study areas providing attendees with background information to the features and functioning of the Port's ecology, social and cultural heritage aspects, and dredging operations to be considered during the MCA process.



8.5.3 Ranking of options

Each sub-objective was assessed for each option to allow comparison between each of the options and the application of comparative scores.

The scores allocated by each agency stakeholder were input into a Microsoft Excel spreadsheet to calculate the final scores with consideration of each agency's weightings, as well as the consensus weightings agreed to in the workshop. The final overall rankings by agency and cumulatively are presented in Table 8.5.

A copy of the final spreadsheet output from the MCA workshop is provided in Appendix F.

8.5.4 Sensitivity analysis

Sensitivity analysis was undertaken at the end of the workshop to determine whether changes to the weightings would impact the final scores and rankings for the options assessed. This analysis found no significant changes to the outcomes of the MCA process.

Table 8.5 MCA rankings for potential dredged material placement sites

Agency	Potential dredged material placement sites										
	Kangaroo Island	Western Basin Expansion	Fisherman's Landing Expansion (South)	Boat Creek South	Gladstone-Mt Larcom Road (South)	Port Central Expansion	Facing Island (North)	Facing Island (South)	West Banks Island Reclamation	East Banks Island Reclamation	East Banks DMPA Expansion
DoE	7	9	8	4	1	3	10	10	6	5	2
DEHP	8	9	7	5	2	1	10	10	6	4	3
DAFF	9	7	8	6	1	3	10	10	4	5	2
GBRMPA	7	9	8	5	2	1	10	10	3	4	6
DSDIP (CG)	9	7	8	3	1	5	10	10	6	4	2
DSITIA	9	8	7	5	2	3	10	11	6	4	1
GPC	9	6	5	4	2	3	10	10	7	8	1
TOTAL	9	8	7	4	1	3	10	11	6	5	2

Table note: The 'Total rank' is calculated using the total scores of each agency and applying the consensus weightings to each sub-objective

8.5.5 Progression of options

Following the calculation of scores and ranking of potential dredged material placement options, workshop attendees agreed to remove the following sites which were ranked the lowest (ie sites ranked 9, 10 and 11) from the next stage of the DMPOI process:

- Kangaroo Island
- Facing Island (North)
- Facing Island (South)

These sites were considered too highly constrained by cultural heritage and ecological aspects, and likely to result in unacceptable potential impacts on Great Barrier Reef OUV, including:

- Connectivity (particularly between terrestrial and aquatic communities)
- Continental islands
- Beaches
- Dune systems
- Island plant species diversity
- Traditional Owner interaction with the natural environment

8.5.6 MCA outcomes

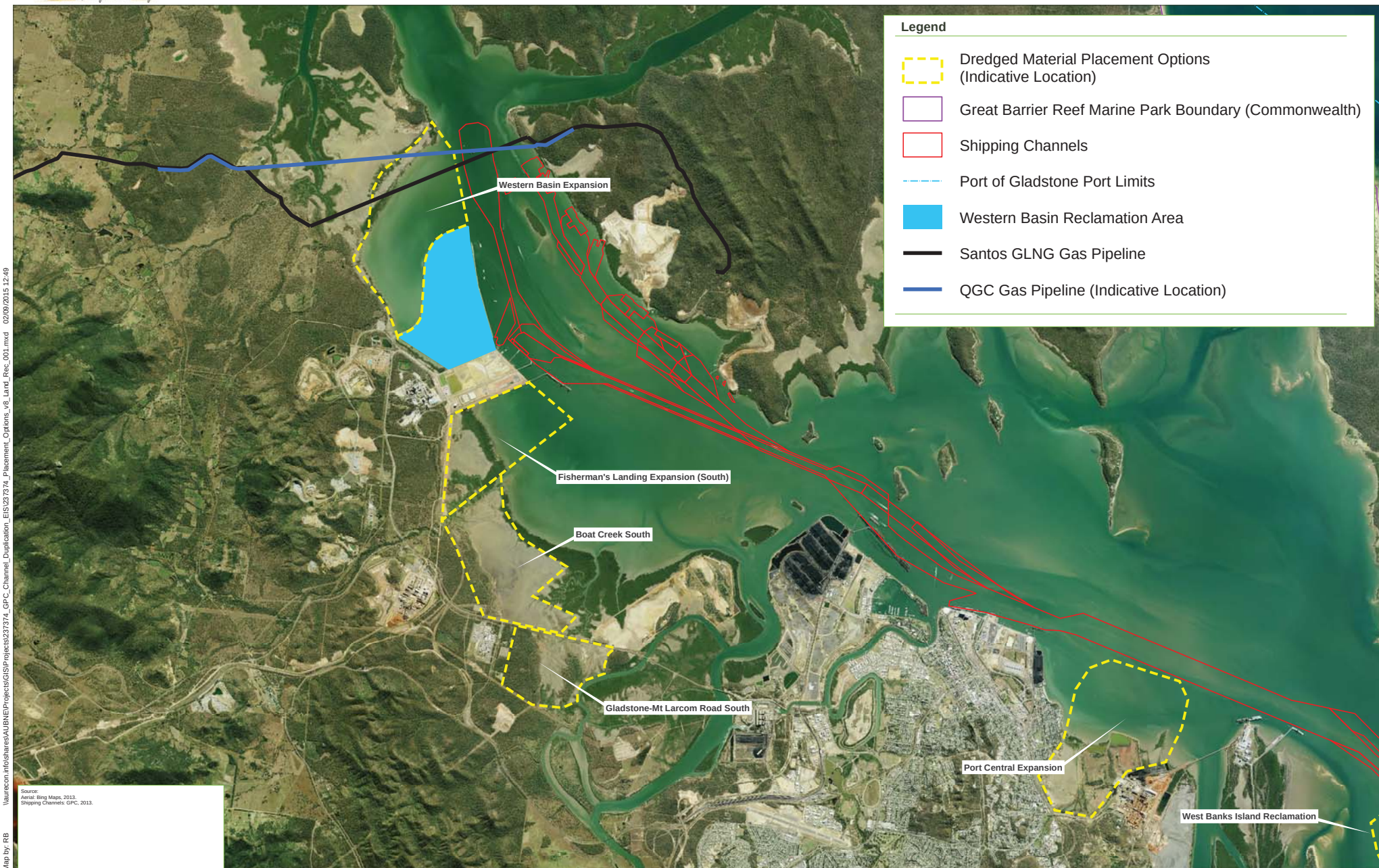
At the completion of the MCA process, the following eight sites remained (presented in order of ranking):

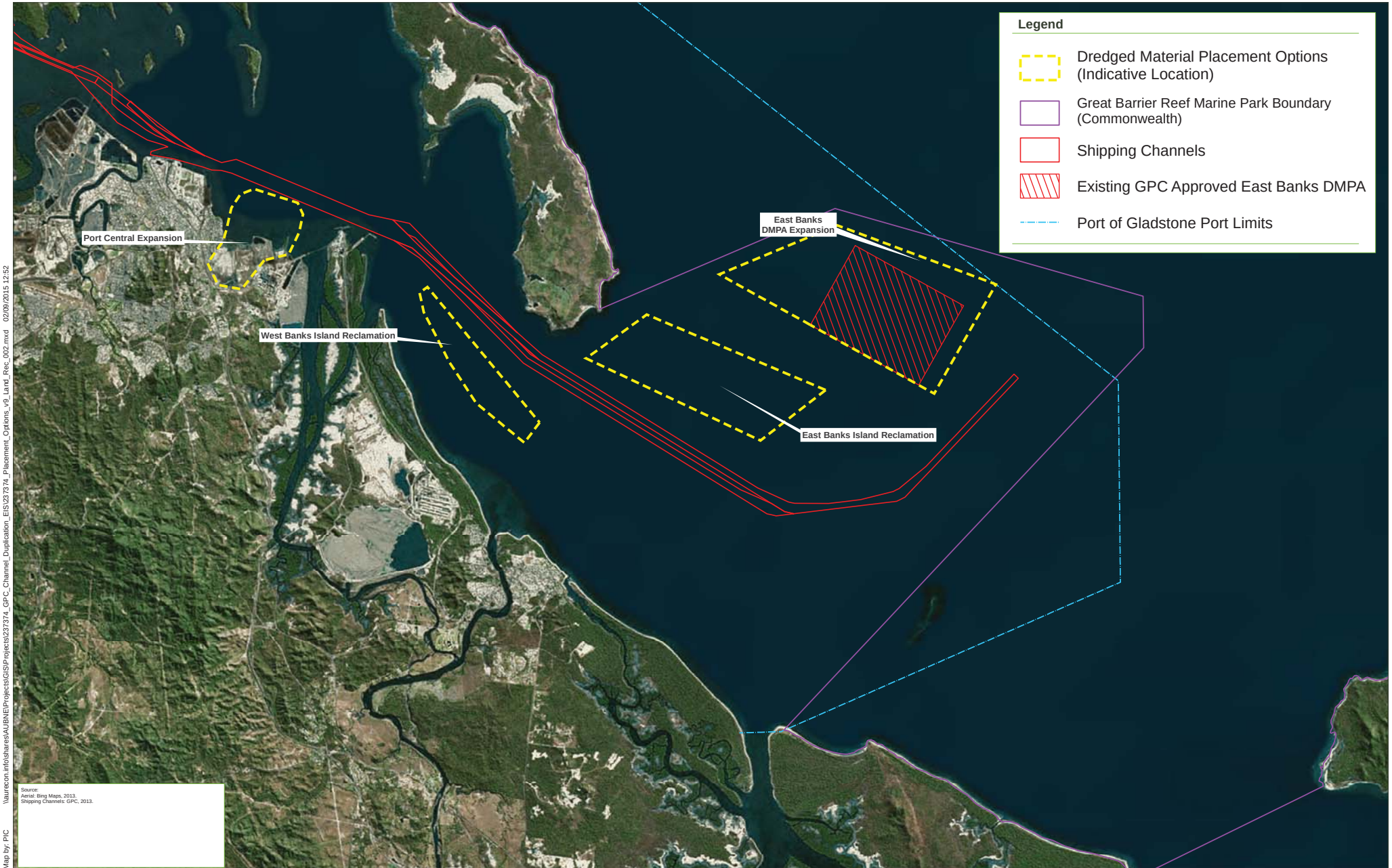
1. Gladstone-Mt Larcom Road (South)
2. East Banks DMPA Expansion
3. Port Central Expansion
4. Boat Creek South
5. East Banks Island Reclamation
6. West Banks Island Reclamation
7. Fisherman's Landing Expansion (South)
8. Western Basin Expansion

These locations are shown in Figure 8.1 and Figure 8.2.

The following conclusions were also identified and agreed by the workshop participants upon review of the final site scores and ranking:

- The scores and rankings represented progress to develop and further refine options for further investigation rather than a final decision on preferred placement locations for the EIS
- The level of information available for individual sites had a clear influence on their score and ultimately, their ranking. In particular, the uncertainty of potential impacts associated with sites that had limited information appeared to translate to a lower score. Key information gaps identified included the need for additional hydrodynamic modelling of double-handling of dredged material and current/wave modelling of the two reclamation island options.
- The process highlighted the areas of uncertainty and the key critical issues that need to be considered before a final decision on the preferred dredged material placement option. Each option requires further information and a summary of opportunities and constraints before a final decision can be reached.
- Although it ranked highest, there were concerns regarding availability of the Gladstone-Mt Larcom Road site





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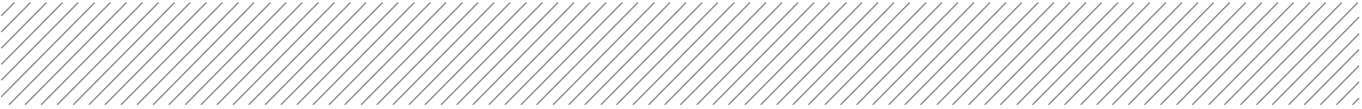


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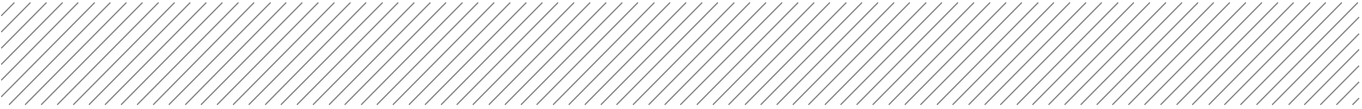
Port of Gladstone Gatcombe and Golding Cutting Channel Duplication

Figure 8-2: Indicative Dredged Material Placement Options (Outer Harbour) Following MCA Workshop



At the conclusion of the MCA workshop and Phase 5 of the DMPOI, it was agreed that in response to the issues raised during the workshop, and in particular the information gaps that had led to uncertainty in scoring, that GPC would progress investigations in relation to the following items to further inform site selection:

- Impacts of double-handling dredged material in the inner harbour associated with the Kangaroo Island, Western Basin Expansion, Fisherman's Landing Expansion (South), Boat Creek South, Gladstone-Mt Larcom Road (South) and Port Central Expansion sites
- Double-handling methods that can be implemented to reduce impacts
- Consultation with WICET Pty Ltd and/or Office of the CG regarding availability of the Gladstone-Mt Larcom Road and Boat Creek South options for Project dredged material
- Redesign of placement options to address issues raised at MCA workshop
- Coastal processes and hydrodynamic modelling of West Banks and East Banks Islands, and East Banks DMPA Expansion (at sea) options



9 Phase 6: Additional investigations and preferred short-listing of options

9.1 Overview

As detailed in Section 8, it was agreed by attendees at the conclusion of Workshop 3 that further information would be required to inform a decision on the preferred dredged placement site options to be taken forward for assessment in the Project EIS.

Additional investigations undertaken as part of Phase 6 included:

- Discussions with State Government representatives (DSDIP) regarding the feasibility/availability of both the Gladstone-Mt Larcom Road and Boat Creek South options given the known extent of State tenure interests (refer Section 9.2.1)
- Additional hydrodynamic modelling (refer Section 9.2.2)
- Preliminary ecological assessment (refer Section 9.2.3)

Following completion of the additional investigations, a final DMPOI workshop (Workshop 4) was held on 27 March 2014 to present the additional information to the Workshop 3 participants for review, discussion and to support a decision on the preferred dredged material placement options.

9.2 Additional investigations

This section details the findings of the additional investigations undertaken prior to the final workshop (Workshop 4) and the information presented to attendees.

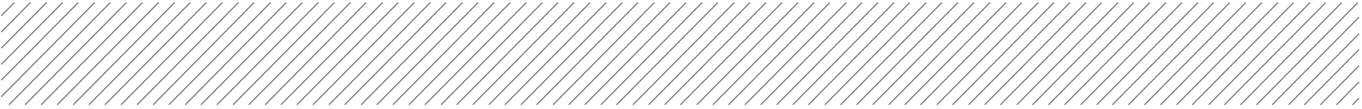
9.2.1 State government stakeholder discussions

During Workshop 3, constraints to availability were raised as a potential issue for both the Gladstone-Mt Larcom Road (South) and Boat Creek South sites. To further investigate this, discussions were held with State Government representatives (DSDIP), given both sites are located within the GSDA and are known to have a high level of State tenure interest. A summary of the outcomes of these discussions are provided below.

9.2.1.1 Gladstone-Mt Larcom Road (South)

The Gladstone-Mt Larcom Road (South) site is situated within the GSDA and includes the majority of an area which is subject to an approval for reclamation. This area is referred to as 'Reclamation Area C' and covers approximately 140 ha, with a portion of the area used for reclamation and construction works to support Stage 1 of the WICT Project.

The Gladstone-Mt Larcom Road (South) site was originally identified during Workshop 2 as a potential placement location for dredged material, whereby material could be used to continue future reclamation works.



Discussions with the DSDIP representatives in February 2014 confirmed that WICET Pty Ltd has a level of commitment to utilise the area for onshore dredged material placement beyond their current Stage 1 works. This position is supported by a number of approvals obtained for the coal terminal which support dredging works beyond Stage 1, including:

- CG's Report on the WICT Project EIS (valid to January 2016)
- Commonwealth EPBC Act Controlled Action Approval (valid to February 2021)
- Environmental Authority (EA) for Environmentally Relevant Activity 16 – Extractive Activities (Dredging) approved for 4 Mm³

The DSDIP representatives also advised that the Gladstone Pacific Nickel (GPN) Project held approval for a Material Change of Use (MCU) in relation to Berths 5 and 6, which adjoin the WICT Project berths.

Based on this information, it was determined that the site would not be available for dredged material placement for the Project.

9.2.1.2 Boat Creek South

The Boat Creek South site is located in the intertidal area between Fisherman's Landing and the current WICT Project site. The area is situated within the GSDA and is subject to a proposal by Tenement to Terminal Limited (3TL) to develop the Yarwun Coal Terminal, a greenfield coal export terminal and associated rail infrastructure with a nominal Stage 1 output of 25 Mtpa. The Project was declared a 'controlled action' under the EPBC Act and a 'coordinated project' under the SDPWO Act in 2012, with the EIS process currently underway.

It is noted that the IAS prepared for the Yarwun Coal Terminal Project identified that a total of 6.64 Mm³ of dredging would be required, with 2.604 Mm³ already assessed and approved through the Western Basin Project EIS and the GPN Project. Approval for the remaining balance of material (4.036 Mm³) will be sought as part of the Yarwun Coal Terminal EIS, with the intent that once approved, this material would be used for reclamation works within the Boat Creek South site to enable terminal construction.

It is also noted that a portion of the Boat Creek South site is subject to a proposed feed gas pipeline as part of the Arrow LNG Plant Project. The Arrow LNG Plant Project was approved (subject to conditions) as a 'controlled action' under the EPBC Act and 'coordinated project' under the SDPWO Act in late 2013.

Discussions with the DSDIP representatives in February 2014 confirmed that both projects have a continued level of commitment to utilise the area and as a result the site would not be available for dredged material placement for the Project.

9.2 Hydrodynamic modelling

To inform some of the uncertainty in the scoring and ranking of a number of the dredged material placement options and to build upon the preliminary modelling undertaken in Phase 3 of the DMPOI process (refer Section 6.4), additional hydrodynamic modelling was carried out by BMT WBM.

This modelling included:

- Plume assessments to determine potential impacts where dredged material rehandling is carried out. For these assessments, both 95th and 50th percentile scenarios were considered for the following four sites and rehandling scenarios (with pit, without pit and CSD only):
 - **Western Basin Expansion** - three scenarios considered, involving the use of a pit, no pit and CSD only

- **Fisherman's Landing Expansion (South)** – one scenario involving the use of a pit
- **Port Central Expansion** – one scenario involving the use of a pit
- **West Banks Island** - one scenario involving no pit
- Plume assessment to determine potential impacts associated with the placement and resuspension of dredged material at the East Banks DMPA Expansion site, assuming a revised footprint to that previously identified in Phase 4 (refer Section 7).
- Hydrodynamic and sedimentation assessments to determine potential tide velocity, sedimentation and wave climate impacts of the following potential reclamation sites:
 - West Banks Island
 - East Banks Island
 - Port Central Expansion

Table 9.1 provides a summary of the key assumptions for the hydrodynamic modelling at each site. The details of the modelling methodology, including assumptions, limitations and discussion on the findings are presented in BMT WBM's summary report 'Numerical Modelling of Rehandling of Dredged Material and Reclamation Options in Port Curtis' contained in Appendix G.

9.2.3 Preliminary ecological assessment

Using the plume modelling results completed by BMT WBM, a set of ecological assessment figures were developed to assist in undertaking a high level preliminary comparative assessment of the short-listed dredged material placement options. This mapping included overlaying the predicted dredging plumes (95th and 50th percentile turbidity scenarios) with the following ecological aspects:

- Coral reefs
- Turtle nesting areas (with 5 km buffer)
- Seagrass

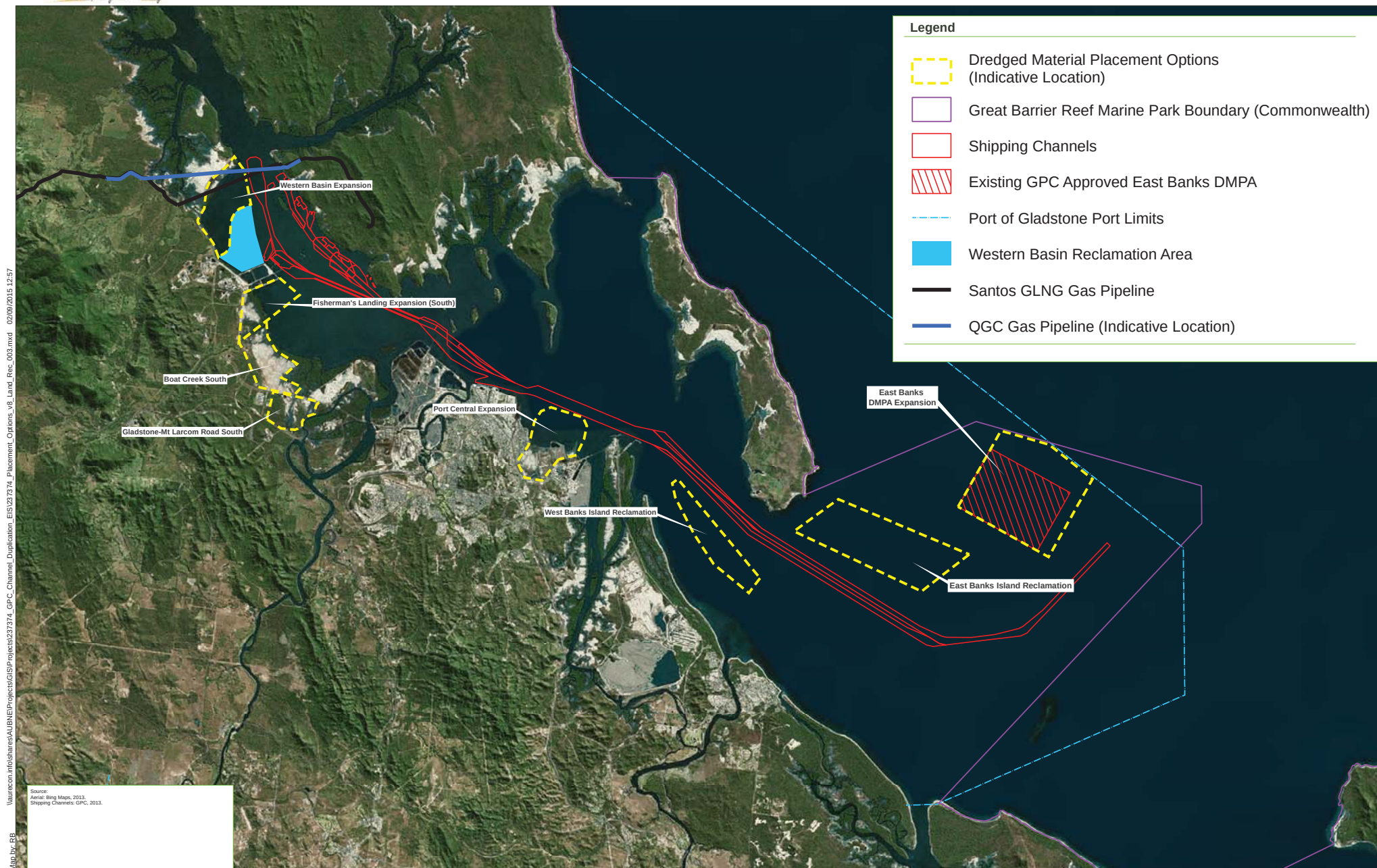
It should be noted that the seagrass data used included a composite layer representing all of the mapped seagrass areas within the Port of Gladstone since 2002. This layer also included data from the November 2013 survey, which had not been available for previous DMPOI phases, including the MCA workshop.

The preliminary ecological assessment figures are contained in Appendix H.

9.3 Short-listing of placement sites

Following completion of the additional investigations detailed in Section 9.2, final site descriptions and dredging scenarios were prepared for each of the short-listed dredged material placement options for presentation to stakeholders and regulatory agencies during a final workshop (Workshop 4).

Each of the eight proposed short-listed sites is illustrated and described in Table 9.1, with a summary locality plan shown in Figure 9.1.



Port of Gladstone Gatcombe and Golding Cutting Channel Duplication

Figure 9-1: Preferred Dredged Material Placement Options Discussed at Workshop 4

Table 9.1 Preferred dredged material placement options

Site locality	Description	
Gladstone-Mt Larcom Road		
	Placement type	Land based and intertidal reclamation
	Estimated capacity	3-4 Mm ³
	End land use	Reclamation/fill for industrial land
	Dredging placement scenario	Undertake dredging with TSHD, rehandling required with a CSD or plain suction dredger as material will not be able to be pumped directly from TSHD
	Key constraints/ opportunities	WICET Pty Limited has a level of commitment to utilise the area for onshore dredged material placement associated with the WICT Project approvals: ■ CG's Report on EIS (valid to January 2016) ■ EPBC Act 'controlled action' approval (valid to February 2021) ■ EA for ERA 16 (approved for 4 Mm³)
Boat Creek South		
	Placement type	Intertidal reclamation
	Estimated capacity	10-12 Mm ³
	End land use	Reclamation for industrial land
	Dredging placement scenario	Use of TSHD for Project dredging, with a CSD or plain suction dredger required for dredged material rehandling
	Key constraints/ opportunities	The 3TL and Arrow Energy Projects have a level of commitment to utilise the area for future project works

Western Basin Expansion



Placement Type	Intertidal reclamation
Estimated Capacity	29-32 Mm ³
End Land Use	Port land (4 wharves)
Dredging and Placement Scenario	Use of TSHD for Project dredging, with a CSD or plain suction dredger required for dredged material rehandling If area was to be used for the Western Basin Project (Stages 2 to 4) the majority of the dredging could be completed by CSD only with no rehandling required

Fisherman's Landing Expansion (South)



Placement type	Intertidal reclamation
Estimated capacity	12-14 Mm ³
End land use	Port land (1 wharf, potentially 2 wharves)
Dredging placement scenario	Use of TSHD for Project dredging, with a CSD or plain suction dredger required for dredged material rehandling If area was to be used for the Western Basin Project (Stages 2 to 4) the majority of the dredging could be completed by CSD only with no rehandling required

Port Central Expansion



Placement type	Intertidal reclamation
Estimated capacity	Original estimated capacity was 25-30 Mm ³ however the area has potential to accommodate up to 100 Mm ³ through the forming of an earthen mound
End land use	Primarily for recreation/open space use with potential for environmental enhancement and/or port land (1-2 wharves) Earthen mound has potential to create a visual buffer for existing residents adjoining QAL
Dredging placement scenario	Use of TSHD for Project dredging, with a CSD or plain suction dredger required for dredged material rehandling

West Banks Island



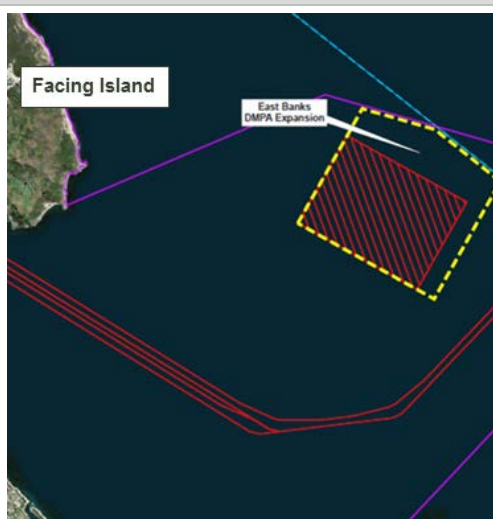
Placement type	Island reclamation
Estimated capacity	27-30 Mm ³
End land use	Reclamation for industrial and/or port related land use (up to 16 wharves)
Dredging placement scenario	Would require the use of both CSD and TSHD ■ CSD (4.75 Mm³) with no rehandling ■ TSHD (7.85 Mm³) with rehandling required If area was to be used for the Western Basin Project (Stages 2 to 4), all dredged material would require rehandling

East Banks Island



Placement type	Island reclamation
Estimated capacity	71-75 Mm ³
End land use	Reclamation for industrial and port related land use (up to 18 wharves)
Dredging placement scenario	Would require the use of both CSD and TSHD ■ CSD (12.3 Mm³) with no rehandling ■ TSHD (0.30 Mm³) with rehandling required If area was to be used for the Western Basin Project (Stages 2 to 4), all dredged material would require rehandling
Key constraints/opportunities	Constraints on access

East Banks DMPA Expansion



Placement type	Offshore (at sea) DMPA
Beneficial use/end land use	None
Primary or secondary location	Use of TSHD only, with no requirement for double-handling
Estimated capacity	65 Mm ³
Dredging equipment type and placement method	Footprint has been revised to maximise disposal depths, potentially reducing resuspension impacts Site remains outside of the GBRMP

9.4 Workshop 4

9.4.1 Overview

A final DMPOI workshop (Workshop 4) was held on 27 March 2014 to present the additional information to the Workshop 3 participants to facilitate a comparative assessment of the remaining options and support a final decision regarding the preferred site(s) to be taken forward for detailed assessment as part of the Project EIS.

The sections below provide further details on the Workshop 4, including a summary of findings in Section 9.4.4. The Workshop 4 meeting minutes are provided in Appendix B.

9.4.2 Attendees

In order to review the outcomes and findings of the MCA process and further progress the site selection process, all Workshop 3 participants were invited back to review and discuss the additional investigation findings and have input into the final decision regarding the preferred site(s) to be taken forward.

Workshop 4 attendees included representatives from the following agencies or organisations:

- DoE (Commonwealth)
- GBRMPA (Commonwealth)
- DEHP (State)
- DAFF (State)
- DSITIA (State)
- Office of the CG (State)
- GPC and Aurecon EIS team

It should be noted that representatives of the PCCC who had previously attended Workshop 3 did not attend Workshop 4, and officers from NPRSR who did not attend Workshop 3 also did not attend Workshop 4.

In addition to representatives of the above regulatory agencies, a number of specialist subject-matter advisors were also in attendance, including:

- BMT WBM (aquatic ecology – coral and marine fauna advisor)
- BMT WBM (hydrodynamic and coastal processes advisor)
- JCU (aquatic ecology– seagrass advisor)

9.4.3 Review of options

Workshop 4 was structured primarily around reviewing the outcomes of the MCA process, and considering the scoring and ranking of each site in the context of the additional information presented.

A review and update was provided for each of the remaining eight sites, with the specialist subject-matter advisors called upon to present summaries of the key findings of the additional investigations for the workshop group's consideration.

As detailed in Section 9.2, the discussions held with State Government representatives in February 2014 identified that both the Gladstone-Mt Larcom Road (South) site and Boat Creek South site were unlikely to be feasible options to take forward to the Project EIS due to both having a continued level of commitment to be used for other projects. It was therefore agreed early in the workshop that both sites be removed from the preferred list of dredged material placement site options for consideration.

9.4.4 Selection of preferred options

Whilst the intention of Workshop 4 was to review the MCA scoring undertaken in Workshop 3 with consideration of the additional information presented, it was not the objective that individual scores be adjusted and overall rankings reviewed. Instead, workshop participants were asked to consider:

- Whether or not the additional information presented had a significant impact on each agencies/stakeholders scoring in the MCA process
- Having now been involved in the overall DMPOI process and MCA scoring, whether or not each site should be taken forward for further assessment as part of the Project EIS and the key reasons for the decision
- Whether any potential design considerations could be identified at this stage for those sites to be taken forward as part of the Project EIS

The following key conclusions were identified and agreed by the workshop participants upon review of the MCA scores and ranking with consideration of the additional information:

- The weightings of the economic objectives appeared to not adequately reflect or account for the true economic viability of some options. It was suggested that the economic weightings were applied quite low in favour of environmental considerations and a review of the economic scores would be unlikely to result in any significant changes to overall rankings.
- It was identified that for some sites, it would take a long time to realise the true economic potential (ie as port land) based on utilising their entire capacity. East Banks Island Reclamation site, which scored higher than the West Banks Island Reclamation was not considered practically feasible by GPC without heavy investment of a 5 km bridge or tunnel being installed to enable access
- It was agreed that with consideration of dredging methodologies, equipment and requirements for double-handling, that dredged material placement sites closer to the area to be dredged should be preferred over those further away. This was noted specifically in relation to the Western Basin Expansion and Fisherman's Landing (South) sites which workshop participants agreed were potentially more appropriate for accommodating future Port areas to be dredged within their immediate areas (ie Western Basin Project Stages 2 to 4) to meet GPC's long term strategic dredging requirements.

A full summary of the workshop discussion is detailed in the Workshop 4 meeting minutes (refer Appendix B).

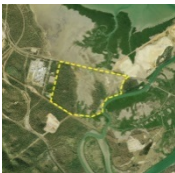
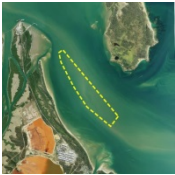
At the completion of Workshop 4, the following three sites were chosen to be taken forward for further assessment as part of the Project EIS:

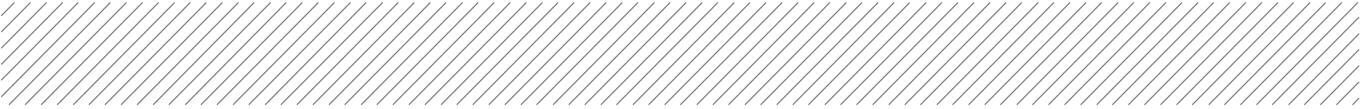
- Port Central Expansion
- West Banks Island Reclamation
- East Banks DMPA Expansion (at sea)

It was agreed that in taking these three sites through to the Project EIS that each would be considered and assessed both on an individual basis and in combination.

Table 9.2 provides a summary of the review and assessment of the final preferred short-listed dredged material placement site options and the key reasons for the decision.

Table 9.2 Preferred short-listing of options

Site option		Short-listing of options for further study in the Project EIS	
		Option not feasible and/or preferred for the Project at the time of this investigation	Option to proceed to Project EIS
	Gladstone-Mt Larcom Road (South)	✘ Not considered feasible owing to high level of commitment of the site by the WICT Project	
	Boat Creek South	✘ Not considered feasible owing to high level of commitment of the site by the 3TL and Arrow LNG projects	
	East Banks Island Reclamation	✘ Not considered as economically feasible as the West Banks Island Reclamation site due to the cost in establishing access (bridge or tunnel)	
	Western Basin Expansion	✘ Not preferred due to the site being deemed more appropriate to meet long term strategic needs of the Port for use by other dredging projects in the inner harbour (eg Western Basin Project Stages 2 to 4)	
	Fisherman's Landing Expansion (South)	✘ Not preferred due to the site being deemed more appropriate to meet long term strategic needs of the Port for use by other dredging projects in the inner harbour (eg Western Basin Project Stages 2 to 4)	
	West Banks Island Reclamation		✓ Considered feasible to proceed, however potential impacts to seagrass meadows, hydrodynamic and coastal processes highlighted
	Port Central Expansion		✓ Considered feasible to proceed, however noted that further consideration and assessment be given to design and staging
	East Banks DMPA Expansion (at sea)		✓ Considered feasible to proceed, however concerns with proximity to GBRMP boundary (ie setback from boundary needed)



10 Conclusion

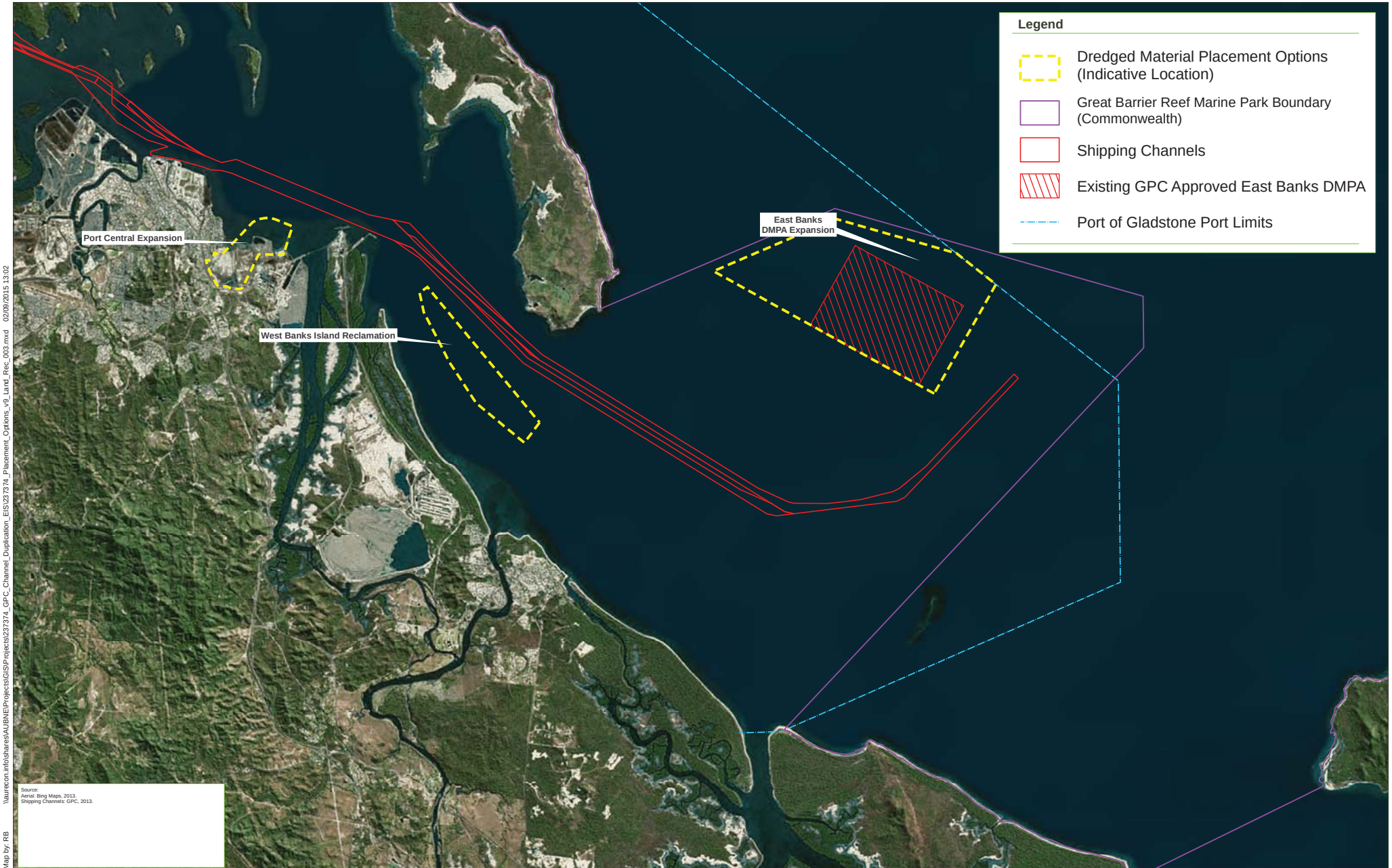
This report presents the detailed methodology and findings of the DMPOI undertaken to support the EIS phase for the Project. Whilst the primary objective of the DMPOI has been to identify potential dredged material placement site option(s) for the 12.6 Mm³ of dredged material from the Project, the following secondary objectives have also being sought:

- Support a strategic approach to planning for the long term dredging needs of the Port of Gladstone though consideration of the suitability of potential sites for other future Port dredging requirements (capital and/or maintenance dredging); and
- Development of a transparent, robust and repeatable process for how dredged material placement alternatives are considered and preferred options identified for future capital and/or maintenance dredging within the Port of Gladstone

In seeking to achieve both these primary and secondary objectives, the DMPOI process has been underpinned by a strong emphasis on early and ongoing stakeholder and regulatory agency engagement throughout the options assessment and decision making process. Also the DMPOI process has addressed the requirement to consider alternatives/options as required by the Commonwealth EIS Guidelines and Queensland State Government ToR, set for the Project.

The DMPOI was undertaken utilising a six phase process. Following initial desktop investigations, case studies and literature reviews (Phase 1), the study area was identified (Phase 2) and key constraints, opportunities and considerations identified (Phase 3). Initially, a total of 16 potential dredged material placement locations were identified and preliminary investigations carried out to determine their initial feasibility (Phase 4). Following this initial feasibility review, the number of potential sites was revised down to 11, with an MCA process undertaken to inform the preferred site selection (Phase 5). Through undertaking this MCA process, a total of eight short-listed sites remained. Additional investigations were then undertaken (Phase 6) with a final three preferred sites identified for further investigation as part of the Project EIS.

At the conclusion of the DMPOI process, the final three preferred sites identified include West Banks Island Reclamation, Port Central Expansion and East Banks DMPA Expansion (at sea). Each of these locations and their indicative layout are illustrated in Figure 10.1. During the EIS process it may become necessary to include other reclamation options if the feasibility and/or potential environmental impacts are unacceptable for the two preferred reclamation options identified at the conclusion of the DMPOI process.



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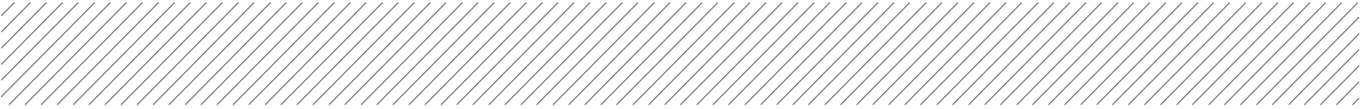


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Port of Gladstone Gatcombe and Golding Cutting Channel Duplication

Figure 10-1: Final Preferred Dredged Material Placement Options for Further Investigation



It is important to note that amendments have been made to the boundaries of both the East Banks DMPA Expansion (at sea) and Port Central Expansion sites. Specifically, the indicative location boundary for the East Banks DMPA (at sea) has been amended to address a comment made by an attendee at Workshop 4 regarding the provision of a buffer between the GBRMP and the DMPA Expansion (at sea) boundary. Furthermore, the area has also been expanded to ensure EIS baseline data collection occurs over a wider area to allow the final footprint for this option to be identified during the EIS process. The Port Central Expansion site boundary has been reconfigured as part of preliminary discussions with QAL representatives.

In order to further progress the assessment of the preferred dredged material placement sites (individually and/or in combination (ie scenarios)), a number of additional investigations are planned to support the further assessment of potential environmental, cultural heritage, social and economic impacts in accordance with the Commonwealth EIS Guidelines and Queensland State Government ToR. This will include:

- Development of preliminary concept designs for the reclamation options, including:
 - Configuration and scale of placement sites
 - Location and nature of tail water discharge points
 - Design options for protection from the impacts of coastal processes
- Completion of a bund wall material sourcing strategy to identify material types, quantities and source options
- Details of estimated commencement, completion, rate of progress and existing levels and proposed final levels
- Development of a preliminary construction methodology
- Environmental, social and economic assessment of potential impacts, including hydrodynamic modelling

The additional investigations outlined above will assist in defining the final Project EIS dredged material placement scenario that is incorporated into the EIS Project description and EIS assessment.

Appendices





Appendix A

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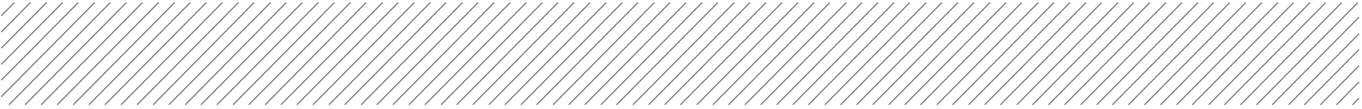
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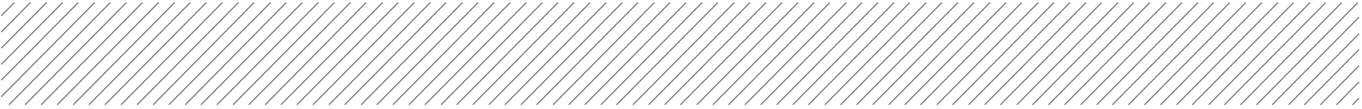
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Appendix B

Workshop Minutes

Meeting Record

Project number	237374	Meeting date	27/28 November 2013
Project name	Port of Gladstone Gatcombe and Golding Cutting Channel Duplication EIS	Recorded by	Georgina Kerr
Meeting/subject	Multi-Criteria Analysis Workshop	Total pages	31

Day 1	Day 2	Name	Initials	Organisation
☒	☒	Nicholas Baker	NB	Great Barrier Reef Marine Park Authority (GBRMPA)
☒	☒	Anthea Bennett	ABe	Gladstone Ports Corporation (GPC)
☒	☒	Anil Bhakta	ABh	GPC
☐	☒	Peter Brockhurst	PB	Port Curtis Coral Coast
☒	☒	Gary Carter	GC	GPC
☒	☒	Stephen Cole	SC	Aurecon
☒	☒	Michel De Vos	MDV	GPC
☒	☐ Part	Melissa Dixon	MD	Department of Agricultural, Fisheries and Forestry (DAFF)
☒	☒	Gordon Dwane	GD	GPC
☒	☒	Steve Elson	SE	Department of Environment and Heritage Protection (DEHP)
☒	☒	Leigh Gray	LG	GBMRPA
☒	☒	Paul Guard	PG	BMTWBM
☐	☒	Mat Harvey	MH	Aurecon
☒	☒	Lal Jayakody	LJ	GPC
☒	☐	Conor Jones	CJ	BMTWBM
☒	☒	Georgina Kerr	GK	Aurecon
☒	☒	Simon McNeilage	SM	McNeilage and Associates (M&A) – MCA Workshop Facilitator
☒	☒	Reinier Mann	RM	Department of Science, Information Technology, Innovation and the Arts (DSITIA)
☒	☐ Part	James Monkivitch	JM	DEHP
☒	☒	Chris Murphy	CM	Department of the Environment (DoE)
☒	☒	Victoria Musgrove	VM	Aurecon
☒	☒	Peter O'Sullivan	POS	GPC
☒	☒	Kate Paull	KP	DoE
☒	☐ Part	Michael Rasheed	MR	James Cook University (JCU)
☒	☒	Theo Riethmuller	TR	Office of the Coordinator General (CG), Department of State Development, Infrastructure and Planning (DSDIP)
☒	☒	Neil Tripodi	NT	DSITIA
☒	☒	Craig Witt	CW	BMTWBM
☒	☒	Jonathan Yantsch	JY	DAFF

1 MCA Workshop – Day 1

1.1 Workshop outline

Welcome, housekeeping, introductions and overview of workshop

SM (M&A) welcomed the workshop participants and provided an outlined of the structure and content of the MCA Workshop.

Key comments or questions from this session included:

- | | |
|------------|--|
| TR (DSDIP) | Query about land-based vs. at sea dredge material placement options based on media reports of Commonwealth Environment Minister's comments regarding dredge material placement within the Great Barrier Reef Marine Park (GBRMP) |
| SM (M&A) | Advised that GC would address this query in the 'Project overview' |

1.2 Project overview

Recent developments, review of study area extents and dredging timelines

GC (GPC) provided an overview of the project to date. In response to TR's (DSDIP) query noted above, GC (GPC) advised that GPC has not received a formal directive from the Commonwealth Environment Minister, however has opted to not look any further at dredge material placement options within the GBRMP. The existing East Banks Dredge Material Placement Area (DMPA) will be included in the Dredge Material Placement Investigation (DMPI) process as it is within Port Limits and the Great Barrier Reef World Heritage Area (GBRWhA), but not the GBRMP.

It was also noted that the new Draft Queensland Ports Strategy identifies that Rockhampton and Bundaberg are excluded from Priority Port Development Areas for at least the next 10 years. Therefore the focus will be on increasing trade through the Port of Gladstone in the medium to long-term.

GC (GPC) advised that although this dredge material placement investigation process began with the intention to look at all planned dredging in the Port of Gladstone over the next 25 years, for this MCA workshop it has been decided to concentrate only on the Gatcombe and Golding Cutting Channel Duplication (GGCCD) Project ie 12 Mm³ over 5 to 10 years – ie the placement of material under the scope and terms of reference of the EIS. GC (GPC) also noted that the preferred dredged material placement option may also have capacity for use by future dredging projects (either or both capital or maintenance).

The recently released Draft Queensland Ports Strategy, which identifies the Port of Gladstone as a Priority Port Development Area (PPDA) and excludes the Ports of Rockhampton and Bundaberg, highlights the importance of this and other dredging projects at Gladstone as capital dredging at non-PPDAs will be prohibited during the life of the strategy.

Key comments or questions from this session included:

- | | |
|-----------|--|
| JM (DEHP) | Query for clarification of ban for offshore disposal from the Commonwealth. |
| GC (GPC) | GPC is assuming that there is to be no future dredge material placement within the GBRMP. |
| CM (DoE) | No further clarification from the Commonwealth has been provided to GPC or the public at this stage. Suggested that the investigation should be looking at all options (onshore and offshore, within and outside the GBRMP) based on the requirements of the Commonwealth's EIS Guidelines for the GGCCD Project, until such time as a variation to the Controlled Action and EIS Guidelines may be required. DoE would need to confirm any directives otherwise in writing. |

JM (DEHP)	Query whether we are imposing a significant risk by not considering sea disposal further in this investigation?
POS (GPC)	Clarified that the investigation does still have both reclamation and offshore options, just not within the GBRMP, based on conversations with Commonwealth.
GC (GPC)	Although there has been no formal directive from DoE, there is a risk if GBRMP sites are included in the MCA and EIS process after the Environment Minister's directive and it gets into the public realm, ie the public perception issues if offshore options within GBRMP are investigated further.
MR (JCU)	Query: Should we include GBRMP options given that no formal directive has been given to GPC? Those options could be more environmentally friendly (ie no direct seagrass loss within those options within GBRMP).
GC (GPC)	GPC is unwilling to include GBRMP sites due to public perception until further clarification received from the Environment Minister and Department.
JM (DEHP)	GBRMP options could be valuable to Commonwealth Environment Minister.
CM (DoE)	The investigation should be looking at compliance with relevant guidelines (ie Commonwealth EIS guidelines), which discuss the need to look at both onshore and offshore dredge material placement options.
JM (DEHP)	MCA process should include limitations statement that these options have not been investigated further and the reasons why.
SE (DEHP)	Perhaps options should be left open until more formal clarification is provided from the Commonwealth Environment Minister.

1.3 Legislative review

Review of relevant legislation, agreements, guidelines and policies

SC (Aurecon) provided an overview of the legislative framework within which the investigation is being undertaken, including the *Environment Protection and Biodiversity Conservation Act 1999* and *Great Barrier Reef Marine Park Act 1975*, highlighting that the objects of both acts include 'ecologically sustainable development' and 'ecologically sustainable use' – that is, environmental, social and economic. It was also reiterated that the Independent Review of the Port of Gladstone requires impact assessments to consider the Outstanding Universal Value attributes of the Great Barrier Reef World Heritage Area. Other relevant considerations include the *Environment Protection (Sea Dumping) Act 1981*, State legislative requirements and Commonwealth and State government reports/assessments including:

- Improved Dredge Material Management for the Great Barrier Reef Region
- Independent Review of the Port of Gladstone and Supplementary Report
- Environmental Best Practice Port Development: An Analysis of International Approaches
- North-East Shipping Management Plan
- GBR Strategic Assessments
- Draft Queensland Ports Strategy

The Project Proponent is to ensure that if State-owned quarry material administered under the *Forestry Act 1959* are required for associated project works (bunds, breakwaters, hardstands, roads, etc) that the proponent or quarry operator holds:

- A current Sales Permit under the *Forestry Act 1959*
- Any associated planning approvals
- Relevant environmental authorities under the *Environmental Protection Act 1994*
- All of which must be consistent with the proposed operational and supply arrangements

Key comments or questions from this session included:

LG (GBRMPA)	Advised that, although not a legislative requirement, the Gladstone Healthy Harbour Partnership Vision Statement should be addressed as it outlines the economic, environmental and social goals and expectations of the local community. Gladstone Healthy Harbours Report should be referred to. It was noted that there are no community representatives present at the workshop - the process is heavily driven by Government and their legislative requirements rather than community input.
GC (GPC)	The Commonwealth and State Governments and their officers have been elected by the community to represent their interested. The intent of this phase of the DPML is to reduce the number of sites to be considered based on legislatives/agency requirements, and that the next phase will include further community engagement and input.

1.4 Dredge material characteristics

Review of dredge material characteristics

MDV (GPC) provided a detailed overview of the characteristics of dredge material in the Port of Gladstone. Material in the Port of Gladstone is sand and gravel imbedded with silt and clay ie not clean sand or gravel. Highly mixed layers of dredge material – difficult to predict what mix of material will be encountered. Boreholes in the vicinity of the Gatcombe and Golding Cutting Channel Duplication (GGCCD) were done in the late 1970s/early 1980s but are considered indicative – material is a matrix of sand, silt and clay, with a high percentage of silt and clay. The silt and clay content increases as the channel moves further out of the harbour.

Key comments or questions from this session included:

TR (DSIDP)	Query about dredge material suitability for use in reclamation for future development - will the material be able to be built on for industry uses?
GC (GPC)	Yes - the Wiggins Island development, existing RG Tanna coal terminal, and Fisherman's Landing projects all use this material from the harbour, however it does take some time to fully stabilise and allow development to be established on the reclamation area.

1.5 Dredging methods

Available dredging methods

MDV (GPC) discussed the key drivers influencing dredge methods in the Port of Gladstone, including material characteristics, placement location, schedule and environmental considerations. MDV (GPC) provided an overview of the types of dredge equipment available, and whether they would be suitable for the GGCCD Project, including Cutter Suction Dredges (CSDs) and Trailer Suction Hopper Dredges (TSHDs). Limitations of pumping distances were discussed with regards to the type of material encountered in the Port of Gladstone, in particular the risks of clay balling and blockages of sinker pipelines.

Key comments or questions from this session included:

SE (DEHP)	Query about maximum depth that backhoe type dredge equipment could reach.
MDV (GPC)	Up to -20 m depending on configuration (eg large vessels).
CM (DoE)	Query: What information is there on blockages? Case studies on dredge blockages (eg Western Basin, WICET) could be provided - discuss difficulties that have occurred in other case studies (other regions) to justify assumptions for this investigation.
POS (GPC)	Risk of blockage relates to material and distance of pumping.
MDV (GPC)	TSHD pumping ashore - ideally for sand with <15% clay, which does not occur in Port of Gladstone. Greater pumping distances are less achievable due to reduced efficiency through use of booster pumps in series, significant down-time for equipment maintenance/repairs, clay balls and pipeline blockages on the seafloor, etc. Realistic/achievable pumping distance from CSD is 5 to 7 km maximum for the Port of Gladstone.
TR (CG)	Query about once it gets to shore - how is it transported to final placement? Logistics should be discussed.

1.6 Dredge material placement

Methods of dredge material placement and containment, including indicative relative costs

MDV (GPC) discussed dredge material placement methods with regards to the type of dredge material encountered in the Port of Gladstone. This material cannot be re-fluidised from within a TSHD to be pumped ashore due to high silt and clay content. Although TSHD is capable of re-pumping material from the hopper, due to the high silt and clay content of the material within the Port of Gladstone the bottom-placement for dredge material is the most suitable method. Dredge material rehandling by TSHD and CSD may require dredging of access for TSHD and CSD and would involve re-suspension of sediment during initial dredging, initial placement and secondary dredging. Rehandling may require dredging of a rehandling area, increasing the volume of dredge material to be managed further.

A number of methods of engineered reclamation are available, and would need to consider bulking factor (1:55) and fines ratio (0.89:1).

Key comments or questions from this session included:

MR (JCU)	Discussion of timing for management for fines – how long does it take to settle within reclamation area?
GC (GPC)	The management of fines can take 2 to 5 years in Gladstone after initial placement.
TR (DSDIP)	Timing for management for fines needs to be clearly explained to Commonwealth - logistics that occur between dredging and placement must be factored into when discussing options.

LG (GBRMPA)	Are there other techniques for dewatering that provide shorter timeframe? Have they been investigated? Settlement ponds - low cost and low technical solution. Are there other options to decrease the timeframe for the dewatering process to allow the reclamation area to be used by industry sooner (ie other technologies)? (ie rotary drum filter to dewater - agricultural solution). Alternatives for dewatering should be investigated and discussed in the EIS process.
MDV (GPC)	Access/volume to the material within the dewatering ponds is an issue for processing through a secondary treatment process (ie Western Basin) - material needs to be dewatered enough to get equipment onto it for re-handling and treatment.
GC (GPC)	Wicking has been used in Brisbane. Cement stabilisation has been used for small volumes. Large volumes will be very expensive and economically unviable.
JM (DEHP)	Hydro-cyclones have been used in other States; thickeners as well.
LG (GBRMPA)	Demonstrate in the EIS that alternative options have been investigated - reasons why they cannot be used/achieved in Gladstone.
LG (GBRMPA)	Query about geotextile lining use in reclamation.
SE (DEHP)	Query about use of geotextile bags in reclamation.
GC (GPC)	Geotextile lining has been used in Gladstone.
MDV (GPC)	Geotextile bags have been used in projects overseas however caused issues with degrading of bags over time.
DAFF	The Project Proponent is to ensure that dredge material placement does not impact on State-owned quarry materials or forest products administered under the <i>Forestry Act 1959</i> .

1.7 Key ecological features

Overview and discussion about relevant water movements and key ecological features in the potential disposal areas, including ecological requirements, seasonal variations and available information

1.7.1 MR (JCU) – Seagrass

MR (JCU) provided an overview of seagrass monitoring in the Port of Gladstone, extent of coverage, species present, and noted that it is one of the most important seagrass areas in the region. Aurecon has classified seagrass in the Port of Gladstone into high, medium and low value based on a number of factors.

Key comments or questions from this session included:

TR (DSDIP)	Query about growth patterns of seagrass.
MR (JCU)	Strong seasonality for some species. Some species can recolonise after disturbance, eg dredge material placement - particularly deep water seagrass.
SE (DEHP)	Query about dredge placement over seagrass – what depth of dredge material cover can occur over seagrass before the seagrass cannot recover/recolonise?
MR (JCU)	Not currently well understood, there is no comprehensive data on offshore seagrass in Gladstone. Other case studies provided.
SE (DEHP)	Query: Is there any data on dugong/turtle feeding preferences?
MR (JCU)	Evidence of feeding tracks, visual sightings of dugongs repeatedly feeding in certain areas. Especially near Fisherman's Landing.

JM (DEHP)	Need to look at the regional perspective. How important is the deep water seagrass in terms of value to marine ecosystem. Impact assessment - only seagrass meadow between Shoalwater Bay and Harvey Bay - compare impact to seagrass to coral for example?
MR (JCU)	Deep water seagrass resilient in that it recolonises following disturbance, and supports large turtle populations. Need to consider permanent removal vs short-term removal.
SE (DEHP)	Importance to dugong population in the Port of Gladstone and the whole region.
NB (GBRMPA)	GBRMPA aims to maintain biodiversity – considers that it may be inconsistent to classify seagrass into low and high value.
MR (JCU)	Classification not just based on species - high value areas includes and would maintain all species. The high, medium and low value classifications were developed by Aurecon as an input into the comparative assessment of placement options.

1.7.2 CJ (BMTWBM) – Coral and benthos communities

CJ (BMTWBM) discussed the marine fauna surveys that have occurred in the Port of Gladstone, and characteristics of the corals within the Harbour. Hard coral most sensitive to light and dredging impacts.

Key comments or questions from this session included:

CM (DoE)	Query: Is there a direct link between the energy in marine environment and ecological communities?
CJ (BMTWBM)/ MR (JCU)	Deep water areas receive more wind and waves making it difficult for communities to establish. The 'best' reefs in the Port are sheltered from wind generated turbidity but where they receive a 'cleaning' effect from current flows removing sediment/turbidity. Seagrass prefer lower energy currents.

1.7.3 PG (BMTWBM) – Hydrodynamics and Plume Stream

PG (BMTWBM) provided an overview and animation of modelling of the natural re-suspension of sedimentation that occurs within the Port of Gladstone harbour, as well as the potential re-suspension of sedimentation as a result of dredging and dredge material rehandling (ie bottom placement by TSHD and re-dredging by CSD) that was proposed (but not permitted by Government) in the Western Basin Project.

Key comments or questions from this session included:

CM (DoE)	Does the turbidity from rehandling have seasonal variation?
PG/CW (BMTWBM)	Variable with the tidal variations within the Harbour. Model animation covered most variations.
SE (DEHP)	Total Suspended Solids impacts on seagrass from rehandling within the Harbour will be an issue that needs further assessment if dredge material placement sites requiring rehandling are selected.
LG (GBRMPA)	Clarification: impact of turbidity from rehandling on seagrass only during growth period?
MR (JCU)	Yes, but some species of seagrass are always in the 'growth period', so there is no window as such.
NB (GBRMPA)	Are there placement sites that have less of an impact from rehandling?
PG (BMTWBM)	Would require plume modelling to answer.
LG (GBRMPA)	Port of Botany reclamation project (with rock walls) caused erosion of nearby beaches – inaccuracy of wave models used during assessment of impacts. Has confidence in wave models improved since that time? Will there be erosion events occurring as a result of further reclamation in Gladstone?

PG (BMT)	Wave and current modelling are more accurate than shoreline/coastal geomorphological model predictions.
LG (GBRMPA)	Southern coastal ecosystems (eg around Rodds Bay and Seal's Rock) are the last remaining intact coastal ecosystem - area of high priority of conservation. Avoid impacts to south of Port including indirect impacts.
NB (GBRMPA)	There is 35-40% coral cover at Seal's Rock based on past Reef Health Impact Surveys.

1.8 MCA process review

1.8.1 *Review of the MCA process to be followed, sensitivity testing, and why different perspectives are important to the EIS process and need to be recorded and considered. Initial discussion about weightings and different viewpoints. SM (M&A) – Discussion on overall weightings*

SM (M&A) provide an overview of the MCA process to be followed in the workshop, and discussed the application of weightings to the objectives of the MCA as indicating the level of importance of different aspects to different groups. SM (M&A) suggested each organisation provide the reasoning behind the weightings they provided for the aquatic ecology, terrestrial ecology, social and economic aspects.

Key comments or questions from this session included:

CM (DoE)	Objectives are based on the Ecologically Sustainable Development - equal weighting for all board categories.
SE/JM (DEHP)	Equal weightings except the two environmental categories (25% each totals 50% to environment). Query about two categories for ecological and one each for social and economic potentially detracting from onshore and offshore disposal.
DSITIA	Water team represented, an emphasis has been on aquatic ecosystem and the weightings reflect this. Terrestrial ecosystems - believe there is not as good an understanding as with aquatic.
LG (GBRMPA)	Obligations under the GBRMP Act must be met. Maintain OUV of WHA for sustainable use present and future. Economic objectives ranked very low - not development focussed under the GBRMP Act. The primary criterion is aquatic ecosystems - terrestrial is also ranked high due to connectivity to coastal ecosystems. Social obligations also exist under Act.
CM (DoE)	Consideration to environment, which does include social and economic and biodiversity.
JY/MD (DAFF)	Aquatic (fisheries) rated higher, forestry (terrestrial) rated higher. Social impacts were important due to recreational fishing. Economic objectives - considered commercial fishing but less weighting than other objectives.
SM	GPC has adopted equal weightings as a neutral position and are interested in the views of each agency.

1.8.2 Thoughts about average weightings

SM (M&A) presented all the agency's different weightings, as well as the average of each, and asked the agencies to provide their thoughts on whether it would be appropriate to apply the average weightings for the purposes of the MCA.

Key comments or questions from this session included:

LG (GBRMPA)	The averages are reflecting legislative responsibilities of each group.
JM (DEHP)	There seems to be a preference to land based disposal.

MR (JCU)	Query about community involvement in MCA process (ie commercial fisheries).
GC (GPC)	Deliberately looked at agencies in the initial phase to reduce site options. Remaining alternatives will be kept through to further community consultation.

1.8.3 Dredge placement sites

GC (GPC) provided an overview of each of the sixteen (16) dredge material placement locations that were identified during the previous workshop in terms of how the placement area would be constructed and managed, how material would be placed within the location and what the final land use would likely be. Approximate available capacities/volumes have been calculated for each site, and it was noted that some sites can only take part of the Channel Duplication Project dredge volume.

Key comments or questions from this session included:

Kangaroo Island:

GC (GPC)	Estimated 5-7 Mm ³ capacity, would require bund walls to contain footprint, would require double-handling of dredge material by TSHD and CSD.
GC (GPC)	Port land with potential for two wharves at Friend Point.
SE (DEHP)	Shorebird roost on site; potential water mouse habitat; State Marine Park just to the north.
TR (DSDIP)	What could the site be used in the future? Needs to be considered. Important consideration for the Coordinator General.
MR (JCU)	Reiterated that this site would involve rehandling and potential sediment plume close to The Narrows.

Western Basin Expansion:

GC (GPC)	Estimated 30 Mm ³ capacity (6-7 Mm ³ spoil if just use original WB EIS reclamation footprint), would require bund walls to contain footprint, would require double-handling of dredge material by TSHD and CSD.
TR (DSDIP)	What would the site be used in the future? Development purposes.
GC (GPC)	Likely to be used for future Port development – up to four wharves.

Fisherman's Landing Expansion:

GC (GPC)	Estimated 14 Mm ³ capacity, would require bund walls to contain footprint, would require double-handling of dredge material by TSHD and CSD.
GC (GPC)	Port land with potential for two wharves.

Targinie Valley

GC (GPC)	Estimated 5-7 Mm ³ capacity, would require bund walls to contain footprint within valley. Would require double handling by TSHD and CSD, a primary site for placement, dewatering and transport of material to the site (eg via truck or conveyor).
GC (GPC)	Permanent secondary dredge material placement area.
TR (CG)	Logistics for placement - trucks etc? Viability of site?
JM (DEHP)	What are the volumes based on? (ie heights etc)
TR (CG)	Will need to look at site and provide details on the intended future use and likely maximum heights achievable.

Landing Road

GC (GPC)	Estimated 5-7 Mm ³ capacity, would require bund walls to contain footprint, would require double-handling of dredge material by TSHD and CSD.
SC (Aurecon)	Part of QER's shale oil mining lease area, there will be no mine void as the shale oil is removed and spoil is replaced.
TR (CG)	Tenure is necessary to consider when choosing a site for dredge material. If there's no tenure, or no opportunity for tenure, then the site is not an option.

Boat Creek South

GC (GPC)	Estimated 10-12 Mm ³ capacity, would require bund walls to contain footprint, would require double-handling of dredge material by TSHD and CSD.
TR (CG)	Existing competition for dredge spoil placement as site is located in GSDA and an industrial project at this site may require its own dredging and placement location.
DEHP	Rehandling required for Channel Duplication spoil. But not for other, closer dredging projects (eg Western Basin Project Stages 2, 3 and 4).

Gladstone-Mt Larcom Road

GC (GPC)	Estimated 7-9 Mm ³ capacity, area already established for WICET dredge material, likely to be used for further WICET berths dredging material, could be expanded with new bund walls, would require double-handling of dredge material by TSHD and CSD.
DEHP	Are settlement ponds included in spoil capacity estimates?
GC (GPC)	Volumes are estimates but it is expected that they could be achieved with settlement ponds/sediment management.
TR (CG)	Existing competition for industry for dredge spoil placement as site is located in GSDA and an industrial project at this site may require its own dredging and placement location.

Port Central Expansion

GC (GPC)	Estimated 23 Mm ³ capacity, would require bund walls to contain footprint, would require double-handling of dredge material by TSHD and CSD (as bulk of dredge material is in the southern/eastern portion of Channel Duplication further from placement site).
GC (GPC)	Current intent is for recreational/community purposes.

Facing Island (North)

GC (GPC)	Estimated 13-15 Mm ³ would require bund walls to contain footprint, would require double-handling of dredge material by TSHD and CSD.
GC (GPC)	Primary dredge material placement area, no future land use proposed.
MR (JCU)	Query: Was Facing Island set aside as an offset for the Western Basin Project?
POS (GPC)	Facing Island was initially looked at but not used for the Western Basin Project Offsets.

Facing Island (South)

GC (GPC)	Estimated 5-7 Mm ³ capacity, would require bund walls to contain footprint, would require double-handling of dredge material by TSHD and CSD.
GC (GPC)	Primary dredge material placement area, no future land use proposed.

QAL Red Mud Dams

- | | |
|--------------|--|
| GC (GPC) | Estimated 23-25 Mm ³ capacity, would require bund walls to contain footprint, would require double-handling of dredge material by TSHD and CSD. |
| SC (Aurecon) | QAL has a 25 year+ plan for use of the red mud dams for their operations, therefore unlikely to be available for dredge material placement. |

West Banks Island Reclamation

- | | |
|--------------|--|
| GC (GPC) | Estimated 27-30 Mm ³ capacity, would require significant volumes of rock to be barged for bund walls to contain footprint, may not require double-handling for Channel Duplication Project. |
| GC (GPC) | Port land with potential for development of wharves. |
| SC (Aurecon) | May impact currents/water flows, may have impacts on seagrass to the west adjacent to the coast line. |

East Banks Island Reclamation

- | | |
|-----------|--|
| GC (GPC) | Estimated 70 Mm ³ ; approximately 6 km long on an existing bank, would require significant volumes of rock to be barged for bund walls to contain footprint, would not require double-handling for Channel Duplication Project. |
| GC (GPC) | Port land with potential for development of wharves. |
| JM (DEHP) | Clarification: Is this option spoil disposal or reclamation? Query on construction methodology? |
| GC (GPC) | Island reclamation, most likely with rock being barged to site and deposited to create bund walls, dredge material pumped from CSD via pump line. |

East Banks DMPA Expansion

- | | |
|----------|---|
| GC (GPC) | Expansion of existing DMPA, leaving a 500 m buffer between site and GBRMP boundary. |
| GC (GPC) | Estimated 65 Mm ³ capacity, would involve bottom placement of material. |

Tannum Sands (North)

- | | |
|--------------|---|
| GC (GPC) | Estimated 2-4 Mm ³ capacity; would require bund walls to contain footprint, would require a primary site first, dewatering and transport of material to site (eg via truck or conveyor). |
| SC (Aurecon) | Current operator, Cement Australia has long term plans for site beyond 25 years, unlikely to be opportunities for dredge material placement. |

Tannum Sands (South)

- | | |
|--------------|---|
| GC (GPC) | Estimated 2-4 Mm ³ capacity; would require bund walls to contain footprint, would require a primary site first, dewatering and transport of material to site (eg via truck or conveyor). |
| SC (Aurecon) | Current operator, Boral has long term plans for site beyond 25 years. |

1.8.4 Review of options

- | | |
|----------|---|
| SM (M&A) | Discussion whether any of the sites investigated to date should be removed from further investigation for the GGCCD Project. Some sites may eventually be available/suitable for future dredging projects if current or planned activities that prevent the use of the site for the GGCCD Project may cease at some time in the future. |
|----------|---|

LG (GBRMPA)	A mining lease may not be an absolute constraint (eg Landing Road). Would not discount based solely on tenure issue.
TR (CG)	Both Boat Creek South and Gladstone-Mt Larcom Road sites should be investigated.
GBRMPA	Does the Targinie Valley site lend itself to disposal of fines?
TR (CG)	The Targinie Valley site must consider what is the net benefit? It would be logistically difficult to dispose of material there and may not lend itself to use following placement.
DEHP/GBRMPA	Keen to remove Facing Island as an option, but for no logistics/availability reason, more to do with ecological impacts.
DoE/GBRMPA	Facing Island - removing connectivity for ecosystem.
LG (GBRMPA)	Is there certainty of QAL operations in future? They may not continue operating. Should the site continue to be considered in the investigation in case circumstances change?
GC (GPC)	The QAL site will not be available within 5 year timeframe for the GGCCD Project to commence. Possible site for future dredging projects subject to QAL agreement.
JY (DAFF)	Should these sites all be used in the MCA Process? Rather than rejecting sites before that process the MCA should clearly outline why a site is removed from process before the MCA is completed for it.
DEHP	The MCA should not consider QAL due to the tenure/availability issue.
TR (CG)	If GPC want a completely robust site selection process, all sites should go through MCA process unless they are completely confident that they can be removed (eg due to tenure/availability).
DEHP	The investigation has come up with 16 options based on long term dredging. Now focus has changed to GGCCD Project, it is considered that we should drop off sites that are unviable in short term (5 -15 years) for that particular project.
TR (CG)	Happy to keep Targinie in, depending on consensus.
VM (Aurecon)	Targinie is a secondary site, and would require a primary site to be selected first. It is the only secondary site potentially available amongst 16 sites, and therefore should not be put through this MCA, but could be considered in the future.
CM (DoE)	Facing Island sites should not be considered due to ecological constraints. Agreed to leave it in the MCA process for comparative purposes.
DEHP	Is Landing Road a tenure issue? QER own it and intend to mine there in the near future – suggest it is removed due to future use by QER that is not compatible with dredge material placement.
TR (CG)	The Gladstone-Mt Larcom Road site is a preferable option (land based).
SM/SC	The MCA workshop participants agree by a unanimous show of hands to remove the following sites from the MCA process: ■ Targinie valley (due to it being a secondary placement site) ■ QAL Red Mud Dams (due to unavailability of site for GGCCD Project dredge material) ■ Tannum Sands (North and South) sites (due to most likely being secondary sites due to pumping distance, minimal capacity, availability, however southern site has potential for future secondary site use) ■ Landing Investigation Road (due to unavailability of site for GGCCD Project dredge material)

Therefore the following dredge material placement options were carried forward into the MCA process:

- Kangaroo Island
- Western Basin Expansion
- Fisherman's Landing Expansion
- Boat Creek South
- Gladstone-Mt Larcom Road (South)
- Port Central Expansion
- Facing Island Bay
- Facing Island (South)
- West Banks Island Reclamation
- East Banks Island Reclamation
- East Banks DMPA Expansion (at sea)

1.9 MCA initial assessment

1.9.1 Aquatic weightings

SM (M&A) led a discussion on the weightings each agency applied to the sub-objectives.

Key comments or questions from this session included:

DAFF	Weightings based on 'temporary' versus 'permanent' impacts. Weighting (50%) to avoid/minimise permanent loss; weighting (15%) to avoid/minimise short-term impacts – expectation is that impacts would be short duration and reversible; weighting (35%) to avoid/minimise temporary or permanent impacts to protected species and their habitat – marine habitats (saltmarsh, mangroves, seagrasses and intertidal mud flats) support fisheries values and listed fauna.
CG	Based on UNESCO strategic assessment of GBRWHA.
DEHP	Support DAFF's comment. Permanent impacts ranked highest as short term impacts are considered manageable.
DoE	Higher level of protection given for listed species and irrevocable impacts, therefore a higher ranking for objectives 1.1 and 1.3. Less concerned about objective 1.2.
GBRMPA	Already know short-term impact will influence GBRMP (refer strategic assessment). The ecological system does not have capacity to deal with even short-term impact. Comment that the objectives are mixing up spatial and temporal scales in MCA - lack of clarity in definition of 'short-term impacts'.
MR (JCU)	Clarification needed on term, 'irrevocable'.
SM (M&A)	Suggest change to 'long term adverse' and 'short term recoverable'
DEHP	Scale of impacts when options are compared. Does the process capture scale of impacts?
NB (GBRMPA)	MCA does not take into account expansion of dredging (ie over 12 Mm ³). What is the cumulative impact of further dredging? Ocean disposal option takes up to 70 Mm ³ - should we look at only 12 Mm ³ over 15 years or entire the 70 Mm ³ ?

LG (GBRMPA)	Protecting habitats of species will continue to protect listed species. Therefore, objective 1.1 has been weighted higher than objective 1.3.
GBRMPA	Short term impact on dugongs is still important consideration in weightings and scoring.
DEHP	Long term effect inclusive of flow on effects (eg indirect impacts).

Objective 1.1 – Avoid or minimise irrevocable impact on aquatic ecosystem sensitive receptors (ie permanent loss of the GBRWHA OUV, including but not limited to seagrass meadows, mangroves, saltmarsh intertidal area)

SC (Aurecon) lead the first scoring exercise, identifying what score he would give each of the sites for sub-objective 1.1 and the reasons why.

Each agency was asked to comment on how they would score the placement options against this sub-objective in terms of what considerations would influence their scoring.

MR (JCU)	Using seagrass value as an example, compare a couple of sites as an example to differentiate scores/rankings.
MD (DAFF)	Mangroves and saltmarsh also considered in aquatic ecosystems, not just seagrass.
NB (GBRMPA)	How will one site impact on entire ecosystem? Cumulative impact of options needs to be considered.
MR (JCU)	Suggest double handling within inner harbour has the potential to produce an unacceptable impact (agreed with by DSITIA).
DEHP	Should be indirect and direct impacts - how can this be captured in the MCA process (agreed with by DAFF & MR)
DEHP	Should consider impact of size of footprint - should also consider broader footprint of impact (ie turbidity).
GC (GPC)	Perhaps cumulative impacts should not be addressed in MCA process as it will be captured in EIS? At this stage, incomplete information to make this consideration.
DEHP	Port Central, double handling - will turbidity dispersion be significant?
BMTWBM	At Port Central, rehandling potentially less impact than further within harbour.
CJ (BMTWBM)	Important to consider connectivity between aquatic habitats - coral and seagrass combined connectivity - most valuable habitats (eg Facing Island options).
DEHP	West Banks – potential impact on coastal environment in constructing reclamation island.
GBRMPA	Double handling - wind and waves resuspending and mobilising turbidity.
BMTWBM	Less impact from waves in outer harbour as less frequent than currents in inner harbour.
BMTWBM	Developing model in EIS phase (including shear stress, background levels) to model likely outcomes.
GBRMPA	Does model take into account the incremental change in depth due to dredging?
BMTWBM	Model can be developed to take this into account.
SM (M&A)	Individual agency groups to have 5 minutes of discussion about objective 1.1 and come up with scoring.

Workshop participants were given approximately 10 minutes to discuss within their agency group what scores they would give each site for this sub-objective. Scores were provided to VM (Aurecon) who input them into spreadsheet displayed on the presentation screen. A divergence of scoring was evident between the agencies, and SM (M&A) asked those agencies with different scores from the average of the participants to discuss the considerations that informed their scoring.

Key considerations discussed included:

■ **Kangaroo Island**

- DAFF – loss of saltmarsh habitat and mangroves
- DSITIA – permanent loss

■ **Gladstone Mt Larcom**

- DEHP – given advice – significantly degraded site already, highly likely to be developed in the future
- DSITA – not an aquatic ecosystem
- DAFF – adjusted value from 1 to 4 based on DEHP comment
- DEHP – did not take into account rehandling, adjust score from 4 to 3

■ **Port Central**

- DoE – does have some seagrass as well as potential rehandling
- DEHP – rehandling may impact nearby high value seagrass. **Qualifier: further investigations required to determine extent of impact.**

■ **Facing Island Bay**

- DSITIA – coastal ecosystem; rehandling; permanent loss
- CG – not an extreme impact comparatively
- DEHP – rehandling effect unknown – would be 1 if rehandling would significantly affect area – further study needed to confirm potential impact and associated score

■ **Facing Island (South)**

- DoE – 3; all on land; adjust to 1 as intertidal and potential rehandling
- CG – change from 3 to 2

■ **West Banks Island**

- DSITIA – unknown effect on changes to currents and seagrass beds
- DAFF – 4; no direct loss of marine plants, manageable impacts
- DoE – seagrass beds nearby and potential impacts

■ **East Banks Island**

- DEHP – scale of footprint – could be reduced to match 12 Mm³. Adjust placement within footprint to minimise impacts.

■ East Banks DMPA

GBRMPA – southern section of GBR – impacts – water quality, potentially significant impact, uncertainty factor. GBRMPA would like to see:

- Where material will end up
- How long it stays there
- Impacts from material
- Different weather events
- Frequency of plume to dredge
- Area of influence
- Stochastic type model of actual area of impact
- Once dumped offshore, impacts can no longer be managed.

GBRMPA – Strategic assessment – overall objectives – not port by port; all industries to be treated equably. Improve water quality in GBRWHA under strategic assessment.

Objective 1.2 – Avoid or minimise short term water quality and other ecological impacts (e.g. occurrence of sediment plume) on aquatic and/or coastal ecosystem sensitive receptors (i.e. minimise short term impact on the GBRWHA OUV, including but not limited to seagrass meadows, coral/rocky reef, declared Fish Habitat Areas, turtle nesting beaches, Great Barrier Reef Marine Park)

Participants were asked to consider the next sub-objective and provide the group with their scores for each site. These were again input into the scoring spreadsheet and displayed. Agencies were asked to discuss their considerations in scoring, which included:

Kangaroo Island

DoE – 3; short term water quality on all options, but KI less of an impact comparatively and can be handled with further study.

Boat Creek

CG	4; did not consider short term effect would be as significant as other areas – comparatively. Manageable impact. Average – shows all sites will have impact. Considered that rehandling greater impact further towards inner harbour, less at Boat Creek site.
GBRMPA	Impacts of rehandling; considered anything scored 1 or 2 in short term would be irrevocable.
BMTWBM	Rehandling more likely to cause short term impact, less long term.
SM	Consensus appears to be for additional study to occur for any placement options with rehandling.

Gladstone Mt Larcom Road

CG	Comparatively safe, previously disturbed; committed for development. DEHP has uncertainty about rehandling – CG not as concerned.
DEHP	All sites that involved double handling, scored a 1.

Port Central

DEHP Rehandling; scored a 1; could go up to a 3 if rehandling demonstrated to not cause significant impact. Nearby seagrass may be impacted. **QUALIFIER: further investigations required to determine extent of impact.**

East Banks DMPA

GPC Previous studies have been done with minimal impacts in the area, particularly sensitive receptors.

GBRMPA Confidence level in area, declining state of GBRWHA/MP. Aim to deliver net benefit of any development in GBRWHA. Strategic Assessment clearly defines requirements of GBRWHA/MP. Strategic Assessment defines acceptable change to GBRWHA/MP.

Objective 1.3 - Avoid or minimise impact on listed threatened, migratory and other protected marine fauna species (including the GBRWHA OUV biodiversity conservation attributes, and species listed under the EPBC Act, GBRMP Act and NC Act) and their habitat

Participants were asked to consider the next sub-objective and provide the group with their scores for each site. These were again input into the scoring spreadsheet and displayed. Agencies were asked to discuss their considerations in scoring, which included:

Kangaroo Island

GBRMPA 4; impact to species (eg dugong) would be manageable; unknown species - not sure what habitat is there. Further study - fauna habitat (eg wader birds, migratory birds, high tide roosting site).

DSITIA Irreversible destruction of wading bird habitat which is of regional importance; rehandling impact on turtle and dugong habitat.

GPC Significant habitat removal could have a regional effect on listed fauna species.

DoE Agree with GPC.

DEHP Already contains QGC pipeline with mitigation measures; locally significant; significant migratory bird site; regional significance unknown? Major impact on seagrass from rehandling - what is the flow on effect for dugongs? What about dolphin habitat?

Western Basin Expansion

DEHP Unknown if seagrass/intertidal impact is significant to fauna habitat (eg water mouse). Could be a local impact (score of 3). Could be a score of 2 - but not enough evidence - further studies required.

DSITIA Seagrass might be of regional significance. Rehandling might impact seagrass and fauna habitat (eg turtles).

Gladstone Mt Larcom Road

GBRMPA Is loss of some seagrass an unacceptable impact? Already disturbed area - rehandling issue not significant enough - temporary impact rather than long term.

DSITIA Rehandling in close proximity to seagrass (high value). Compromise from 2 to 3.

Port Central

DSITIA	2; long-term impact on nearby seagrass habitat for listed fauna species? Uncertainty in information.
GBRMPA	Agree with DSITIA.

West Bank Island

GBRMPA	Large existing bank; possible positive impact on additional seagrass colonisation behind option footprint
GPC	Potential boat strikes to fauna.
DoE	Listed species are regionally significant.
DEHP	Turtle and dugong movements - where do they move within the harbour? Study required.
MR	Southern extent contains habitat that sustains regional turtle populations.

East Banks Island

DAFF	2; is there removal of dugong and turtle feeding grounds? These are listed species of regional significance.
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2 MCA Workshop – Day 2

2.1 MCA initial assessment – continued

2.1.1 Terrestrial objectives

Objective 2.1 – Avoid or minimise impacts on significant terrestrial vegetation communities (ie MNES (TECs and threatened species) and MSES (endangered or of concern regional ecosystems, habitat for threatened species))

Participants were asked to consider the next sub-objective and provide the group with their scores for each site. These were again input into the scoring spreadsheet and displayed. Agencies were asked to discuss their considerations in scoring, which included:

Kangaroo Island

DEHP	Do mangroves count as terrestrial? Local scale change, rather than a regional scale change. What percentage has been lost in past couple of years and what proportion does this represent?
GPC	Bird roost and potential regional impacts; mangroves were included in their assessment (eg impacts from oil spills etc).

Western Basin Expansion

DAFF	2; intertidal component; potentially saltmarsh area - of concern ecosystem and TEC under EPBC Act.
DoE	4; activity offshore, not terrestrial. Some manageable impacts onshore.

Gladstone Mt Larcom

GBRMPA	5; already degraded and does not have significant terrestrial communities; surrounded by other industry.
GPC	Slight extension of footprint (strip of native vegetation within footprint).
DSITIA	Consistent across first 5 options; removal of endangered dominant vegetation (based on Aurecon notes).
Aurecon	Sub dominant vegetation; Of Concern RE vegetation.
DEHP	Assessment was made on the assumption that the site was entirely clear of vegetation. After checking map, not mapped as endangered. Does it meet EPBC TEC definition?
DSITIA	If there is no value in vegetation, would rate site as 4 or 5.
GBRMPA	Based on discussion, reduced scoring to a 4.
DoE	Value of vegetation needs to be investigated and confirmed if TEC/Endangered RE.

Port Central

DSITIA	Creation of land - parkland, which will increase terrestrial values.
DEHP	Is parkland the ultimate land use?
GPC	Recreational style area and potential working with nature to be investigated.
MR (JCU)	Some seagrass within footprint.

Facing Island (South)

DSITIA Scored a 1 due to permanent habitat loss

East Banks Reclamation

MR (JCU) East Banks Reclamation - sand and current ripples - unvegetated and does not support fauna.

DSITIA Will there be land creation from this option?

GPC In the long term it would be port land.

Objective 2.2 – Avoid or minimise impacts on natural aesthetic values and geological processes/heritage attributes as defined under the GBRWHA OUV (eg Port Curtis islands, beaches, dune systems, fringing reefs)

Participants were asked to consider the next sub-objective and provide the group with their scores for each site. These were again input into the scoring spreadsheet and displayed. Agencies were asked to discuss their considerations in scoring, which included:

Fisherman's Landing

DoE 2; focussed on existing infrastructure or existing disturbance (land and water); effects on land; have a visible effect on land. If in water, visual effect.

Gladstone Mt Larcom

DEHP Partially detracting from local aesthetic/natural values; currently vegetated - therefore partial impact score.

Port Central

GBRMPA Long term aesthetic impacts, not short term; rehabilitation of habitat - enhancing if revegetated with local flora.

DSITIA New parkland is an enhancement.

Facing Island Bay

GPC Distance offshore far from public - potential enhancement of wetland area - could be incorporated into design.

DEHP Currently a natural embayment that is going to be significantly changed - still a local change but irreversible.

West Banks Island

GBRMPA Structure would be similar to other islands in harbour and vegetated as such; long term view of island consistent. Changed to a 2 on basis of future port development.

DoE 2; creation of new island is a significant change from present; visible from shore and by public

DEHP/DSITIA Lowered score on basis of future port development.

MR (JCU) Dramatic change from current view across Harbour.

DAFF Will there be any vegetation to obscure view? Also downgraded on visible basis.

BMTWBM May cause effects on coast line due to change in current etc.

East Banks Island

WBM	Will this site be used in future as a port? GPC - not in current plans as construction of bridge/tunnel will be required. However, development as a port is a potential option in long term.
DAFF/DSITIA	Downgraded score on basis of above GPC comment.
DEHP	Geological element - dredging resuspension of plume detracted from visual amenity. Future study is required to model resuspension, including a visual impact component.

2.1.2 Social and cultural heritage objectives

Explanation from GPC regarding final land use of each site:

- Kangaroo Island – future planning intent for this area will be changed, likely to be Environmental Management Precinct. Port land and industrial if reclaimed.
- Western Basin Expansion – Port land on Port side of Western Basin reclamation.
- Boat Creek – within GSDA; earmarked for industry; surrounded by existing industry.
- Gladstone Mt Larcom – within GSDA; GPN site adjacent, also earmarked for industry.
- Port Central – with exception of QAL on south eastern side, surrounded by residential areas with some recreation. Intent is to remain as recreation with buffer for industry.
- Facing Island – natural area; currently Strategic Port Land (SPL). No proposed future Port land or industrial.
- West and East Banks Islands – potential port land for development in long term.

Discussion about GSDAs:

GBRMPA	Strategic Assessment acknowledged GSDA areas (which are a State matter); but future direction for declaring GSDA to take MNES into consideration.
CG	Currently engaged in a study into GSDA to look into MNES and Matters of State Significance.

PB (PCCC) – leading through his scoring of sites under Objective 3.4 – Avoid or minimise impacts on cultural heritage values, including Traditional Owner/use values and heritage values

- Kangaroo Island – registered cultural heritage site; score will depend on protection/preservation of this site
- Western Basin Expansion – number of cultural heritage sites along west side (beach edge) – scoring will depend on protection
- Fisherman's Landing and Boat Creek – not a lot of cultural heritage sites in these areas
- Gladstone Mt Larcom Road – if vegetation is not significant (ie Endangered), not considered culturally significant
- Port Central – not concerned about the site, provided appropriate native re-vegetation occurs. Preferred option.
- West Banks – 1; site will end up as port land, which will reduce the value of Facing Island since it will essentially block the view of Facing Island from the mainland

- Facing Island – <1; large number of cultural heritage sites on Facing Island with a significant cultural history. These options will severely impact the cultural heritage value of Facing Island.
- East Banks Island – depending on final use, this option could work with Facing Island if rehabilitated in a natural state. If this option has an industrial land use, it may reduce the cultural significance of Facing Island.

Comments:

DSITIA	What is the intent of Kangaroo Island? Will it avoid impacts to the cultural heritage site?
DEHP	What about mitigation/avoidance of cultural heritage impacts for Western Basin option?
GPC	Development of site has potential to include a drainage buffer along western side (eg Ship Creek alongside Port Central - mangroves have grown here); this option would be undertaken alongside traditional owners.

Objective 3.1 – Maximise level of compatibility of the final placement location land use with adjoining land uses and future land use planning documents

Participants were asked to consider the next sub-objective and provide the group with their scores for each site. These were again input into the scoring spreadsheet and displayed. Agencies were asked to discuss their considerations in scoring, which included:

Kangaroo Island

GBRMPA	2; it does not currently have adjoining industrial land uses, other than the CSG pipeline to Curtis Island.
DEHP	Noted that adjacent to habitat protection zone - considered a legitimate land use to take into account; site adjoins GSDA.

Western Basin Expansion

DEHP	6; adjacent industrial sites; Strategic Port Land, GSDA, adjacent to approved channel.
DAFF	Uncertainties for long term plans for the site.
DEHP	Western Basin Master Plan includes development from Western Basin up to Kangaroo Island.
CG	Original Western Basin Master Plan has no statutory purpose.
DSITIA	Considered adjoining marine environment as a land use. Possible alternative position would be to agree with DEHP otherwise should abstain.
CG	Does not consider marine environment as a land use (based on definitions).

Boat Creek

DEHP	6; within GSDA, no adjacent marine park; compatible with intended and surrounding land use.
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Facing Island Bay

DEHP	Facing Island is industrial under SPL according to the Aurecon figure.
GPC	More likely to be conservation land under SPL; EIS needs to address future Port use (eg conservation).

DEHP Would prefer site to be allocated as an environmental conservation site; reduced scoring on basis of GPC comment.

West Banks Island

DoE Reclamation area is a new site; larger impact in a planning sense which would promote development in the area.

CG Site is 2km away from coast line.

DEHP Port infrastructure within port limits in accordance with Strategic Port Plan.

East Banks Island

DSITIA 4; immediate adjoining land uses is marine environment; adjusted result to align with DEHP position.

Objective 3.2 – Avoid and/or minimise impacts on Gladstone community and recreational activities associated with dredging, construction of containment bunds and placement impacts, and future operational land use of placement area)

Participants were asked to consider the next sub-objective and provide the group with their scores for each site. These were again input into the scoring spreadsheet and displayed. Agencies were asked to discuss their considerations in scoring, which included:

Kangaroo Island

DEHP Limited understanding of community use of areas (eg fishing).

DoE Long term loss of area, regardless of site users.

Western Basin Expansion

DEHP Due to permanency of impact, reduce scoring to 4. Further social impact assessment needs to be conducted due to limited understanding of uses. **QUALIFIER: further investigations required to determine extent of impact.**

GBRMPA Asked GPC what the likely social impact is from Western Basin and Fisherman's Landing? Will there be similar impacts for the Channel Duplication dredge disposal?

GPC Crabbing had been used in foreshore (still exists in Gladstone); public access to foreshore reduced due to increased security for Port land and industrial sites. West of existing Western Basin Reclamation Area, there has been a positive impact on crabbing on the foreshore.

Boat Creek South

CG Remove access to foreshore if reclaimed and should not rate highly in scoring.

GPC Due to tidal movements and muddy condition, currently not used much when compared to other sites (eg Kangaroo Island).

DEHP Will there be a buffer between reclamation area and mangroves?

GPC Not proposing to remove mangroves.

CG Depends on proponent and development of site.

DEHP Recreational fishing within mangroves will be reduced if mangrove habitat is removed.

MR (JCU) Do these northern options impact on vessel movements through The Narrows?

Port Central

DoE Long term impact - directly adjacent to community.

West Banks

DEHP Do not know recreational use of that area – assumed no significant fishing but further studies should be undertaken. **QUALIFIER**

Objective 3.3 – Avoid or minimise impacts on opportunities for reasonable use, appreciation, enjoyment and understanding of the GBR region and adjacent coastline

Participants were asked to consider the next sub-objective and provide the group with their scores for each site. These were again input into the scoring spreadsheet and displayed. Agencies were asked to discuss their considerations in scoring, which included: Gladstone Mt Larcom

CG Adjacent creek; adjusted score from a 2 to 3.

Port Central

DoE loss of open space, beach and intertidal area.

Objective 3.4 – Avoid or minimise impacts on cultural heritage values, including Traditional Owner/use values and heritage values

Participants were asked to consider the next sub-objective and provide the group with their scores for each site. These were again input into the scoring spreadsheet and displayed. Agencies were asked to discuss their considerations in scoring, which included:

Western Basin Expansion

GBRMPA Based on assumption that all cultural heritage will be avoided or minimise by moving boundary of site. If not possible, scoring will be reduced. **QUALIFIER: further investigations required to determine extent of impact.**

DEHP Could GPC maintain those cultural heritage sites into the long term?

GC (GPC) GPC can work around this issue, for example with reclamation design.

SM (M&A) Scoring could be altered if suitable mitigation measures can be implemented for this site.

West Banks and East Banks Islands

DEHP No impact to cultural heritage values, based on PB's comments - no values on those sites; limited information provided in terms of cultural heritage at these sites.

PB (PCCC) West Banks would not enhance view of Facing Island.

GBRMPA A key consideration for cultural heritage seems to be physical or tangible value; however, GBRMPA also considered experiences and use of place as part of cultural assessment - explains their lower scoring for these areas.

2.1.3 Economic objectives

Objective 4.1 – Avoid or minimise impacts on ecosystem reliant commercial activities

Discussion led by DAFF as economic impacts include commercial fisheries:

- Figure 23 – excludes charter boats
- Uncertainty about data – misrepresentation as some data not available to public
- High level of effort within inner harbour along coast line (ie crabbing etc)
- Rate intertidal areas highly for crabbing activities
- Tourism also included. However, there is uncertainty about the level of tourism in area – where do recreational boats visit? Predominate tourism fishing is out towards reef.
- Boat Creek – decision based on temporary losses of mangrove area in construction; no permanent damage
- Kangaroo Island, Western Basin and Fisherman’s Landing – important crabbing areas; total loss of these areas
- Port Central – some impacts depending on what activities currently occur there – not enough information
- Facing Island – potentially important areas for crabbing
- West Banks Island – depends on activities that occur in the area, which are currently unknown – possible trawling area
- East Banks Island – possibly more important than West Banks Island in terms of trawl catch
- East Banks DMPA – already dredge material placement in adjoining approved East Banks area
- DEHP – East Banks Island – does not show up on mapping
- DAFF – possible back-up areas for fishing
- MR – possibly unavailable at some times due to shallow waters

Consensus objective weightings not necessarily the view of each individual agency.

Participants were asked to consider the next sub-objective and provide the group with their scores for each site. These were again input into the scoring spreadsheet and displayed. Agencies were asked to discuss their considerations in scoring, which included:

Kangaroo Island

GBRMPA	4; site not deemed significant for fishing as not considered within intertidal area; DEHP/DAFF disagree.
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Boat Creek

DEHP	Length of coast and intertidal area, entire area of commercial use may be affected; significant loss of these areas already (~1100 ha), remaining areas more important.
GBRMPA	Based on mangroves to be maintained.

Port Central

GBRMPA Impact on fishing/recreation from Port Central likely to extend beyond footprint; possible interference with through-traffic?

West Banks and East Banks Islands

GBRMPA Assumption of not a lot of commercial fishing in these areas.

East Banks DMPA

GBRMPA Potential impact along east coast of Facing Island and Curtis Island from DMPA footprint – further study required.

Objective 4.2 – Maximise cost efficiency of dredge method and dredge material placement

GPC explanation of scoring:

- In existing Western Basin Reclamation Area, cost of bund development was 10% relative to dredging process. Based on this, developed relative cost of each option.
- Looked at rehandling, depth of water, material type for bund construction, capacity of disposal options
- West Banks and East Banks Islands – cost of building walls of island; rock brought to site by barge; size and volume of rock required for walls; these sites more exposed to weathering
- Facing Island south does not have enough capacity, requires rock to be brought in; may source some material (potentially)

Participants were asked to consider the next sub-objective and provide the group with their scores for each site. These were again input into the scoring spreadsheet and displayed. Agencies were asked to discuss their considerations in scoring, which included:

GC	Rock will have to be brought through Gladstone town; requires large volume of material
GBRMPA	Costings for 12 Mm ³ for West and East Banks Island options?
GPC	No - discussion on relative costs between full capacity of site and Channel Duplication capacity.
GBRMPA	No cost associated with dumping with dredge spoil. Should there be a cost, will this affect the decision?
GPC	This kind of cost has not been accounted for yet.
DEHP	What is GPC's definition of an unacceptable costing?
GPC	Limited capacity is 'unacceptable' for a few options. Primary/secondary sites increase the cost further; capital cost for East Banks and West Banks Island sites could be up to 5x higher than dredging cost - GPC considers these almost unacceptable.
DEHP	Cost of double handling?
GPC	Effectively doubles it and adding additional sailing time.

East Banks DMPA

DEHP	Query about high score of East Banks DMPA compared to other sites; should it be reduced? Score of 6 usually for an added benefit; should look at this in sensitivity analysis.
GBRMPA	Adopted GPC's rating as not enough expertise; reserve judgement until actual costings provided.

Gladstone Mt Larcom Road

MDV	Majority of bund systems already in place; shorter sailing distance; and rehandling.
DEHP	All these options in the inner Harbour have double handling – Increase in costs; however, no bund costs, so DEHP revised scoring.

Kangaroo Island

DEHP	Cost of placement was not considered to be unacceptable.
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Objective 4.3 – Maximise beneficial reuse of placement area or dredge material use

Discussion led by GPC:

- 5 – 25 year timeframe
- Kangaroo Island – Can be brought into play early; unknown final use; potential industrial capacity, not just port land
- Western Basin, Fisherman's Landing, Boat Creek and Gladstone Mt Larcom Road – All within or adjoining the GSDA, GPN may use Gladstone Mt Larcom Road site (CG – should not this be scored a 6 then?), difficulties in treating spoil for final land use; may exceed the timeframe for bringing into final land use.
- Port Central – Difficulties to turn spoil into parkland within a short timeframe
- DEHP/GBRMPA – No temporal scale with this weighting
- POS (GPC) - Different land uses will require a different time scale for final land use
- DoE – Beneficial reuse – generally considered short term; not really considered for over 5-10 year timeframe
- West Banks and East Banks Islands – Difficult to provide access; cannot bring into use within 25 year timeframe
- DoE – Will agree with GPC as no expertise in area; considers weightings as more important in this regard.

Participants were asked to consider the next sub-objective and provide the group with their scores for each site. These were again input into the scoring spreadsheet and displayed. Agencies were asked to discuss their considerations in scoring, which included:

Facing Island Bay

DEHP	Decision relates to time constraints for beneficial reuse
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West/East Banks Island

GBRMPA Site could be used as a port facility; have not considered a temporal scale; scoring is based on assumption that the spoil being beneficially reused for commercial, recreational or community purpose. Scoring may change depending on this land use.

2.1.4 MCA summary

Discussion on where the link should be drawn in terms of rankings

GPC Suggest removal of Facing Island options from process due to low scoring; concerns about Gladstone Mt Larcom Road (Rank 1), which has a high potential to be committed to Wiggins Island Coal Terminal Project; clear that additional studies required to inform options.

MDV Western Basin score suggests a lot of uncertainty of impacts.

DEHP Seagrass and mangroves at Western Basin as well as concern of rehandling.

DSITIA Concerned about how weightings are influencing results; should ecological and economic results work against each other?

Examination of weightings

Aquatic

DoE Preferred option is ideally land-based; islands will be fully enclosed - there will be no long term impacts from these options; difference between island and at sea - requires comparison of impacts?

DEHP Comparison of short term and long term impacts of sediment resuspension.

GPC Western Basin and Fisherman's Landing sites may have scored worse but these options had less uncertainty in making scoring decisions

BMTWBM Western Basin site possibly scored poorly because of direct loss of aquatic habitat.

CG Gladstone Mt Larcom Road site is always going to be reclaimed, which may have affected the scoring; this site has undergone an EIS process and contains more information and less uncertainty than other sites.

East Banks Island outranks West Banks Island - BMTWBM suggests due to proximity of seagrass to West Banks.

DEHP Also reflection of uncertainty surrounding seagrass in this area.

BMT WBM Short term objective (aquatic objective 1.2) may have influenced results as this is where double handling was captured; are there any technologies that could make double handling acceptable?

GC/MDV (GPC) No practical engineered methods to reduce re-suspension during double handling beyond what would be implemented now.

Overall scoring and ranking

GBRMPA Final rankings reflect uncertainty around East Banks expansion option at sea; revised judgement until further information can be provided - similar for all options discussed.

CG Considers Boat Creek site to be a good option as it is within the GSDA, requires reclamation and is earmarked for future industry.

Everyone agrees that Kangaroo Island, Facing Island Bay and Facing Island (South) are lacking merit and should be removed from the list of options.

	Gladstone Mt Larcom Road, Port Central, East Banks Island, West Banks Island and East Banks DMPA are strong options to carry forward, with Boat Creek South as another possibility.
DEHP	Western Basin, Fisherman's Landing, Boat Creek South and Gladstone Mt Larcom Road options will all require study on impacts from rehandling.
CG	Clarify situation of Gladstone Mt Larcom Road in terms of availability.
GPC	Depending on GPN, may be able to lift bund wall heights; discussions required with WICET and CG in terms of availability.
CG	Agrees these eight remaining options should all be investigated further to identify options to be included in the Channel Duplication EIS.

2.1.5 MCA detailed review and reflection

DoE

- Considered the MCA process to be a very useful process
- Usual process involves independently briefings agencies; it was considered good to understand what everyone is thinking and have these open discussions
- DoE rankings broadly in line with other agencies
- Key issues for DoE - any development proposed in a new form; resolving uncertainties, such as re-suspension of fine sediment and long term impacts
- Note, near shore impacts are more important for DoE, as is the GBRMP

GBRMPA

- MCA process one of the more robust processes that they have been involved in
- Options provided were realistic and potentially attainable
- The results of this process have largely reflected the legislative requirements of each organisation
- There is uncertainty and lack of knowledge of impacts with each of the sites. GBRMPA has indicated throughout that they scored accordingly and it needs to be reassessed following further investigation.
- Key issues for GBRMPA – process to develop list of potential options and being put forward for further investigation – NOT A FINAL DECISION on placement location
- Satisfied with outcomes and there were no surprises in consensus scoring and ranking
- Strategic assessment currently up for public comment and Minister will endorse a forward work plan which may alter the regulatory regime within GBR region. Business as usual is no longer acceptable.

CG

- Agrees with DoE and GBRMPA comments
- No surprises in selected eight sites and considered to be a robust method for selection of eight options
- Each option requires further information and a summary of pros and cons before a decision can be reached
- Further work required for each site

- Had initial doubts to quantitative approach, however the process proved logical and happy with outcome
- Requested a new map with eight options only – preferably with re-aligned boundaries/footprints to address issues raised during workshop

DSITIA

- Considered process to be valuable
- Consensus potentially driven by shared values and shared assumptions (which may not be correct). If uncertainty issues are resolved, different scoring results may be provided. Should the process be repeated?
- Considerable issues surrounding rehandling, hydrodynamic modelling required to confirm potential impacts
- Social and economic rankings do not necessarily reflect DSITIA as a whole. Tended to agree with rankings from other agencies – this may have diluted the divergence around room.
- Overall, the process seemed to be useful in gathering information

DAFF

- MCA process was useful at knocking out bad options and also identified potential options that require further investigations
- There were a range of assumptions in scoring (eg commercial fishing effort etc)
- Overall a fair amount of consensus and it was good to have all agencies in same room with very valuable discussions

DEHP

- Happy with above comments and the MCA process
- Process highlighted uncertainty and critical issues before final option recommendations can be made, including hydrodynamic modelling of double handling impacts, and current/wave modelling of reclamation islands
- Final outcome is consistent with prior opinion
- DEHP would like a copy of spreadsheet to look at original scoring and see how their scoring was reflected throughout

BMT WBM

- West Banks and East Banks Islands appear to be a good backup option, depending on further investigations for other sites (such as uncertainty in double handling for example)
- Options could be found that are acceptable to all agencies following some further work on double handling impacts

PB (PCCC)

- Will report back to traditional owner groups
- Happy to see all agencies in the same room, discussing options – puts faith into the EIS process

GPC

- GPC's scoring generally matched other agencies
- Considered it to be a worthwhile process
- There was uncertainty in some areas that influenced the scoring, which need to be examined prior to deciding the placement option(s) to be assessed in the EIS
- GPC intends to continue to involve all agencies in future key stages of the Channel Duplication EIS
- GPC intends to progress additional investigations to inform some of the uncertainty in the scoring of options. Investigations will include:
 - Hydrodynamic modelling to determine predicted dredge plume impacts from double handling of dredge material in the inner Harbour associated with the Western Basin Expansion, Fisherman's Landing Expansion (South), Boat Creek South, Gladstone Mt Larcom Road (South) and Port Central Expansion sites
 - Utilise predicted dredge plume modelling of double handling to undertake a comparative option assessment of potential marine ecological impacts from double handling of dredge material
 - Hydrodynamic model and wave modelling with and without reclamation bund walls for the Port Central Expansion, West Banks Island and East Banks Island sites
 - Utilise predicted hydrodynamic and wave modelling of outer bund walls to undertake a comparative option assessment of potential morphological responses of nearby channels and shorelines, and potential marine ecology impacts (eg seagrass meadows) from the modified hydrodynamic and wave conditions

Meeting Record

Project number	237374	Meeting date	27 March 2014
Project name	Port of Gladstone Gatcombe and Golding Cutting Channel Duplication EIS	Recorded by	Georgina Kerr
Meeting/subject	Workshop #4 – Confirmation of Placement Locations for EIS	Total pages	17

Present	Apology	Copy	Name	Initials	Organisation
☒	☐	☐	Nicholas Baker	NB	Great Barrier Reef Marine Park Authority (GBRMPA)
☒	☐	☐	Narah Benn	NBe	Office of the Coordinator-General, Department of State Development, Infrastructure and Planning (DSDIP)
☒	☐	☐	Anthea Bennett	ABe	Gladstone Ports Corporation (GPC)
☒	☐	☐	Anil Bhakta	ABh	GPC
☒	☐	☐	Zoe Bishop-Kinlyside	ZB	Aurecon
☐	☒	☒	Peter Brockhurst	PB	Port Curtis Coral Coast
☒	☐	☐	Catherine Bryant	CB	JCU
☒	☐	☐	Gary Carter	GC	GPC
☒	☐	☐	Stephen Cole	SC	Aurecon
☐	☒	☒	Kurt Derbyshire	KD	Department of National Parks, Recreation, Sport and Racing (DNPRSR)
☒	☐	☐	Michel De Vos	MDV	GPC
☒	☐	☐	Melissa Dixon	MD	Department of Agriculture, Fisheries and Forestry (DAFF)
☒	☐	☐	Gordon Dwane	GD	GPC
☒	☐	☐	Nick Ehren	NE	Office of the Coordinator-General, DSDIP
☐	☒	☒	Steve Elson	SE	Department of Environment and Heritage Protection (DEHP)
☒	☐	☐	Leigh Gray	LG	GBRMPA
☐	☒	☒	Rean Gilbert	RG	GBRMPA
☒	☐	☐	Paul Guard	PG	BMTWBM
☐	☒	☒	Damien Head	DH	DNPRSR
☒	☐	☐	Maxine Hunter	MH	Office of the Coordinator-General, DSDIP
☒	☐	☐	Tim Ipkendanz	TI	Department of the Environment (DoE)
☒	☐	☐	Georgina Kerr	GK	Aurecon
☐	☒	☒	Reinier Mann	RM	Department of Science, Information Technology, Innovation and the Arts (DSITIA)
☐	☒	☒	Anthony Mines	AM	Office of the Coordinator-General, DSDIP
☒	☐	☐	James Monkivitch	JM	DEHP
☐	☒	☒	Chris Murphy	CMu	DoE
☐	☒	☒	Dave Orgill	DO	DNPRSR
☐	☒	☒	Kate Paull	KP	DoE

Present	Apology	Copy	Name	Initials	Organisation
☐	☒	☒	Michael Rasheed	MR	JCU
☐	☒	☒	Annette Reed	AR	DAFF
☒	☐	☐	Theo Riethmuller	TR	Office of the Coordinator-General, DSDIP
☐	☒	☒	Ross Savage	RS	DAFF
☒	☐	☐	Peter O'Sullivan	POS	GPC
☒	☐	☐	Neil Tripodi	NT	DSITIA
☒	☐	☐	Claire Ulcoq	CU	Office of the Coordinator-General, DSDIP
☒	☐	☐	Craig Witt	CW	BMTWBM
☒	☐	☐	Jonathan Yantsch	JY	DAFF

1 Introduction

SC (Aurecon) welcomed the workshop participants and provided an outline of the structure of Workshop #4.

2 Summary and post-MCA work/considerations

SC (Aurecon) provided a recap of the MCA Workshop conducted in November 2013 and indicated that DEHP has amended their scores post-workshop. However, this has not impacted on the final rankings. After the MCA process, it was agreed that preliminary hydrodynamic modelling and a high level ecological assessment would occur for some of the options – preliminary only for comparative assessment between options.

SC (Aurecon) provided a summary of the work that had been done since the MCA Workshop, including discussions with landowners, hydrodynamic modelling by BMT WBM and consideration/assessment of potential ecological impacts.

GC (GPC) provided a summary of some of GPC's current strategic considerations, reminding the workshop that the Draft Queensland Ports Strategy identifies the Port of Gladstone as one of five priority ports in Queensland. GC (GPC) advised of his planned attendance at a workshop on 28 March 2014 to discuss guidelines for development of strategic plans under the Draft Queensland Ports Strategy. GC (GPC) reiterated that some port areas under GPC management have a limited capacity for long-term development (eg Port Alma) and that future development in Gladstone, particularly in the GSDA and hinterland, will increase pressure on future port expansion.

GC (GPC) indicated that this workshop is to focus on the Channel Duplication Project for the assessment of disposal sites but that disposal locations for maintenance dredge material and Western Basin dredge material will be required in addition. While these will also be covered during the workshop, the primary focus will be on the Channel Duplication Project dredge material placement location/s.

3 Workshop objectives

SC (Aurecon) outlined the objectives of the workshop, including:

1. Meet the immediate need of the Channel Duplication Project (capital and maintenance)
2. Have potential to accommodate future Western Basin Dredging Works (Stages 2 to 4) and there is value in undertaking further investigation
3. Accommodate other long term capital and maintenance dredging requirements and there is value in undertaking further investigation

SC (Aurecon) provided a summary of what will be discussed for each site, including a site description, BMT WBM modelling (preliminary) and potential ecological impacts (preliminary) and if the site would be progressed through to the EIS.

4 Dredge material placement options

4.1 Gladstone-Mt Larcom Road South option

SC (Aurecon) provided a brief summary of the Gladstone-Mt Larcom Road option. He indicated that WICET already have a level of commitment for this site, as approved under the EIS, controlled action and ERA16. GPC considers that this site is not available for Channel Duplication dredge material and put it to the group that no further consideration be given to the site, which was agreed to by the agencies.

Key comments or questions about this option included:

TR (CG)	Agrees with the justification provided and is happy for the site to no longer be considered.
GC (GPC) & GD (GPC)	Indicated that Gladstone-Mt Larcom Road South is also currently linked to the development of the GPN project and the area will be used as a disposal site for dredge material from the GPN Berths (already tight capacity). Noted that GPN is currently seeking a Material Change of Use (MCU) which includes use of the WICET Berths 5 and 6.

4.2 Boat Creek South option

SC (Aurecon) provided a summary of the Boat Creek South option. He indicated that 3TL and Arrow Energy Projects already have a level of commitment to utilise the area for future works. This includes onshore dredge material placement by 3TL and pipeline infrastructure by Arrow Energy. Both projects have existing contracts on the land with the Minister for Economic Development Queensland.

SC (Aurecon) indicated that the site is unlikely to be available for the Channel Duplication dredge material, and put it to the group that no further consideration be given to the site, which was agreed to by the agencies.

Key comments or questions about this option included:

JM (DEHP)	Are these other projects (ie 3TL and Arrow Energy) likely to occur?
NE (CG)	Contracts have been entered into with the Minister for both projects
TR (CG)	Offered clarification for those not familiar with the project, that 3TL is a coal export terminal (essentially a replication of WICET) that is proposed at that site

4.3 BMT WBM modelling results

PG (BMT WBM) provided an introduction to the modelling that has been conducted since the previous workshop, outlining the methodology used and indicated that the same model had been used for other projects in Port Curtis and has undergone preliminary validation. The bathymetry includes dredging associated with the LNG and WICET Projects. A two month assessment window was used with a large spring tide period and three other spring tide periods, which is sufficient for comparative purposes as spring tides are the primary drivers of sediment re-suspension within the port. Further details are provided in the BMT WBM report issued prior to the workshop.

PG (BMT WBM) reiterated that turbidity modelling only included the turbidity associated with rehandling in addition to ambient turbidity. He also mentioned that two scenarios had been modelled with differing particle size distribution assumptions.

4.4 Western Basin Expansion option

SC (Aurecon) outlined the capacity, end land use and likely dredge equipment and methodology for the Western Basin Expansion option. SC (Aurecon) noted that disposal of material from the Channel Duplication Project would require a Trailer Suction Hopper Dredge (TSHD) for dredging material within the Channel Duplication dredge areas and a Cutter Suction Dredge (CSD) to transfer the material from the rehandling pit to Western Basin Expansion reclamation area. Dredge material from the Western Basin Project (Stages 2 to 4) would only require a CSD. SC (Aurecon) also identified the location of the rehandling pits.

PG (BMT WBM) provided a summary of the turbidity modelling undertaken for the Western Basin Expansion option for the Channel Duplication Project and a CSD only scenario for Western Basin dredging. Results were presented in terms of the 95th and 50th percentiles of above-background turbidity associated with rehandling. The CSD only dredge plume modelling indicated lower turbidity levels compared to the modelling results for rehandling.

CB (JCU) explained that, for the option involving rehandling, there is likely to be elevated turbidity impacts up to The Narrows and Grahams Creek and that this seagrass has already been under stress recently. There would be a direct impact on seagrass at the Western Basin Expansion site, but it is already reasonably patchy seagrass. For the option that does not require rehandling (for Western Basin Stages 2 to 4 dredge material only), the potential impacts from turbidity on seagrass would be significantly lower but the light availability for seagrass meadows would still need to be considered.

Key comments or questions about this option included:

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|-------------|--|
| NT (DSITIA) | Are these scenarios thinking about the longer term dredge management? |
| POS (GPC) | There is still 21 Mm ³ of dredging to be done for Western Basin Stages 2 to 4. If part of this potential dredge material placement site is taken up for the Channel Duplication Project, dredge material from the Western Basin Project will need to be disposed elsewhere and possibly further away (which may require rehandling) |

4.5 Fisherman's Landing Expansion (South) option

SC (Aurecon) outlined the capacity, end land use and required equipment (both TSHD and CSD) for the Fisherman's Landing Expansion (South) option. He indicated that this option could also receive the Western Basin Stages 2 to 4 dredge material.

PG (BMT WBM) provided a summary of the turbidity modelling undertaken for the Fisherman's Landing Expansion (South) option for the Channel Duplication Project. Results were presented in terms of the 95th and 50th percentiles of above-background turbidity associated with rehandling. He indicated that a larger trailer was modelled compared with the Western Basin Expansion option due to the available water depth adjoining the Fisherman's Landing rehandling pit.

CB (JCU) indicated that the plume from Fisherman's Landing Expansion (South) extends further south and adjacent to the WICET areas, potentially within the dugong feeding areas.

Key comments or questions about this option included:

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| JM (DEHP) | Can you provide any guidance on the ecological relevance of these turbidity values (ie the degree of impact on seagrass meadows)? |
| PG (BMT WBM) | This modelling was conducted for comparative purposes only. It should be noted that the Fisherman's Landing Expansion (South) option uses a larger dredge so the overall dredging campaign would have a shorter duration than the Western Basin Expansion option. |
| CB (JCU) | <p>The ecological relevance is difficult to categorise until we know how the modelled turbidity values will impact the light environment and whether the resulting light will sustain seagrasses. These tools (benthic light modelling in relation to dredge plumes) were developed during Western Basin Project and could be applied for Channel Duplication Project in the EIS stage.</p> <p>Was the Fisherman's Landing Expansion (South) modelled for CSD only (as for Western Basin dredging)?</p> |

PG (BMT WBM) Not yet, however the scale would be similar for the two CSD only options between Western Basin Expansion and Fisherman's Landing Expansion (South) in that it would have a reduced impact on seagrass meadows compared to the rehandling options.

4.6 Discussion

SC (Aurecon) suggested that discussion of options is done progressively with all options discussed again at end of workshop – for the Channel Duplication Project, Western Basin dredging and for future long term dredging. SC (Aurecon) queried if this further information modifies any opinions on scoring from the previous workshop?

Key comments or questions included:

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|--------------|---|
| JM (DEHP) | Is there enough information to understand the potential impact on the health of seagrass from turbidity? Until the likely impact of these turbidity results on seagrass is determined, it is difficult to move forward with the disposal options. The model assumes a water quality discharge limit of 100 mg/L – is this practically achievable? |
| SC (Aurecon) | <p>We are conducting a comparative assessment today and an impact assessment will occur during the EIS phase.</p> <p>These options were least preferred from remaining options after the MCU Workshop. Does this further information change your opinions and should these options be carried forward into Channel Duplication Project? What about the Western Basin dredging and long term capital and maintenance dredging?</p> |
| SC (Aurecon) | The assumption of 100 mg/L tailwater discharge is based on condition requirements that have been imposed on other recent dredging projects within the harbour, including for the Western Basin and WICET. 100 mg/L was achieved for the Western Basin (confirmed by POS (GPC)) as a result of reclamation area and discharge outlet management. |

There was a general agreement to reserve discussion on these options until the hydrodynamic modelling on all options have been presented.

4.7 West Banks Island Reclamation option

SC (Aurecon) outlined the capacity, end land use and equipment (40% with CSD only and 60% with TSHD and CSD) for the West Banks Island Reclamation option. He indicated that any future capital dredging projects (eg inner harbour dredge areas) would require rehandling if disposed here. No pit will be required for rehandling as existing seafloor depth is sufficient to allow TSHD access.

PG (BMT WBM) provided results from the wave modelling, which illustrated a reduction of wave height and change in direction in the lee of the island. There was also a change in the sediment dynamics between the island and mainland as it became more sheltered, with sediment accumulation to the south and west of the island and possible erosion associated with realignment of the shoreline on the adjacent mainland coast. There was also an increase in bed shear stress near the north west corner of the island and near the main shipping channel (with associated potential for reduced siltation and/or scour).

PG (BMT WBM) also provided a summary of the turbidity modelling undertaken for the West Banks Island Reclamation option for the Channel Duplication Project. Results were presented in terms of the 95th and 50th percentiles of above-background turbidity associated with rehandling. He also noted that the impacts are significantly larger than other options primarily due to the shorter cycle time (higher sediment release rate overall) and choice of rehandling location.

CB (JCU) indicated that the seagrass near the shoreline is the main area to consider and contains different seagrass species to Western Basin and as such, will have different light requirements. This area is also used by turtle populations. Ecological impacts from the plume appear to be wider spread in the outer harbour.

Key comments or questions about this option included:

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| NT (DSITIA) | Paul Boswood (DSITIA) provided a comment (read out by NT) on the BMT WBM Report stating that “SWAN has also been well utilised in the past for modelling nearshore waves. It should be noted that SWAN does not explicitly handle wave defraction or reflection and so may not perform as well in the lee of islands. This should be assessed for the more detailed modelling study.” |
| PG (BMT WBM) | Agreed that it was true to some extent that SWAN is not the most appropriate/accurate model for predicting these impacts, however more detailed wave modelling and also morphology modelling would be undertaken in the full EIS. |
| ABh (GPC) | Would it reduce the plume if the pit was tucked away in a more sheltered location? |
| PG (BMT WBM) | If the rehandling pit was moved to a more quiescent area, there would be less turbidity associated with rehandling. It should be noted that this option has a shorter dredging program duration as it is closer to the Channel Duplication footprint (ie shorter cycle times). |
| GD (GPC) | Has a no island scenario been modelled to determine what current impacts are? |
| PG (BMT WBM) | Yes the full BMT WBM report includes this detail. |
| SC (Aurecon) | It should be noted that turbidity from rehandling for this option has the potential to impact on nearby reef communities adjacent to Facing Island. However, the pit location may be able to move to a more sheltered location to reduce the impact on reef communities and seagrass |
| POS (GPC) | Queried the secondary plume/dark blue area close to the model boundary. What is this a likely result of? |
| PG (BMT WBM) | Noted that this was likely a result of limitations in the model associated with the chosen model boundary. PG (BMT WBM) noted they would ensure that future modelling incorporates the whole regional model to avoid this issue. |

4.8 East Banks Island Reclamation option

SC (Aurecon) outlined the capacity and end land use of the East Banks Island Reclamation option. He indicated that most dredging will not require rehandling (CSD only), however, any future capital dredging within the inner and central harbour would require rehandling. There are also considerable constraints on access due to the East Banks Island being 5 km from the mainland and would require a bridge or tunnel. This is an expensive option to develop as port land and is not entirely economically feasible.

PG (BMT WBM) illustrated that this option would cause a reduction in wave height and change the wave direction in the lee of the island reclamation with a reduction in bed shear stress along the shoreline of the mainland and the potential for erosion associated with shoreline realignment. There would also be an increase in velocities and bed shear stress in the main channel and also between East Banks Island Reclamation and Facing Island with possible effects including scour and/or reduction in channel siltation rate.

Key comments or questions about this option included:

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|--------------|---|
| TR (CG) | <p>If pursued, the EIS would need to mention how access would be gained and the feasibility for this option as port land.</p> <p>There appears to be scouring/impact in the area between Facing Island and the East Banks Island Reclamation. How critical is the distance between Facing Island and the proposed island? Can it be moved to reduce the impact?</p> |
| PG (BMT WBM) | <p>Theoretically yes, a greater distance between East Banks Island Reclamation and Facing Island would reduce the impacts in this area.</p> |
| POS (GPC) | <p>Yes it could be moved to reduce impact; however this location was chosen with consideration to existing locality constraints. This includes needing to avoid the shipping channel, avoiding going over the top of the existing East Banks DMPA which is subject to current permitting, plus ensuring the area stays within Port limits and outside of the GBRMP.</p> |

4.9 Port Central Expansion option

SC (Aurecon) explained that the Port Central Expansion design has been revised since the previous workshop as a mound has been included, which will act as a potential visual barrier and will increase dredge material capacity. SC (Aurecon) outlined the end land use as port land, open space and recreation and possible environmental enhancement and that rehandling will be required for this option with a pit location.

PG (BMT WBM) provided an animation for the Port Central Expansion turbidity modelling as well as presentation of the 95th and 50th percentiles of above-background turbidity associated with rehandling. The rehandling location is slightly off the main channel which leads to lower turbidity impacts than the other options due to lower ambient velocities.

CB (JCU) indicated that there will be direct removal of only a small strip of seagrass. However, the plume extends to Wiggins Island seagrass meadow in the north is the worst case scenario (95th percentile) with potential to extend to the seagrass meadow off Quoin Island. This plume also extends south to the coastal seagrass strip, although the turbidity levels are less than that of other options.

Key comments or questions about this option included:

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|--------------|---|
| NE (CG) | <p>Requests that modelling is conducted of the combined plumes from dredging and the rehandling to determine entire impact from Channel Duplication Project – not sure conclusions can be drawn from just the rehandling modelling.</p> |
| SC (Aurecon) | <p>Agrees that this will be required during the EIS process, however, for today's workshop, the modelling is simply for comparative purposes.</p> |
| NE (CG) | <p>Notes that differences in dredge sizes/types between the options will require additional comparison.</p> |

4.10 East Banks DMPA Expansion (at sea) option

SC (Aurecon) indicated that the East Banks DMPA Expansion boundary has been amended since the previous workshop to include deeper water areas. This will reduce the potential of re-suspension. This option requires only TSHD and does not include rehandling.

PG (BMT WBM) provided an animation for the East Banks DMPA Expansion turbidity modelling as well as presentation of the 95th and 50th percentiles of above-background turbidity associated with dredge material placement. In contrast to the other cases, waves are a significant driver of sediment re-suspension in this scenario. The material is assumed to be placed uniformly over the DMPA Expansion and is assumed to have a higher re-suspension rate on the DMPA compared with ambient re-suspension (due to lack of compaction). Typical meteorological conditions have been selected, however the EIS will address a greater range of conditions. The acute turbidity levels associated with this scenario are high, primarily due to wave re-suspension events, but the chronic turbidity levels are significantly lower with this option.

PG (BMT WBM) also showed the results of a re-suspension-only scenario where material from the Channel Duplication Project (12 Mm³) was assumed to have been placed on only the deeper sections of the DMPA Expansion. The 95th and 50th percentiles of above-background turbidity were generally low due to the reduced sediment re-suspension rate in deeper water.

CB (JCU) outlined that the worst case scenario had plumes that interacted with the mainland coast. However, the bulk of the plume interacted with the deep water seagrass meadows. Impacts do not extend into the Western Basin area, but there are possible interactions with reef areas around Facing Island.

Key comments or questions about this option included:

JY (DAFF)	Was any modelling conducted of extreme events?
PG (BMT WBM)	Extreme events have not been modelled at this stage since it was a preliminary assessment only but agreed that it would need to be undertaken for the EIS, potentially looking at a couple of major events. PG (BMT WBM) noted that the model results were highly dependent on the assumed meteorological conditions, and that this modelling period included a maximum 1.2 m wave height.
TR (CG)	Is the impact on deep water seagrass meadows a major concern? Are there any impacts from current dumping in the existing East Banks DMPA?
CB (JCU)	It is definitely a potential issue but will depend on the management of the impacts during dredging. It should be noted that it is a large seagrass meadow, but the whole area illustrated is not permanently covered by seagrass. No seagrass surveys were conducted prior to any dredge material placement in the East Banks DMPA, therefore absolute pre-dredge conditions are not known. However JCU has undertaken surveys the East Banks DMPA in 2002, 2008, 2009 and 2013 providing information on conditions during regular maintenance dredge material placement and prior to the Western Basin Project.
JY (DAFF)	Is there any indication that deep water meadows have been impacted by the existing East Banks DMPA?
POS (GPC)	Surveys conducted since the Western Basin dredging have identified evidence of re-colonisation on the spoil ground during periods of no dredge material placement.
LG (GBRMPA)	Notes that the East Banks DMPA Extension has been pushed to the GBRMP boundary. There have previously been issues raised about dredge spoil drifting into the Marine Park and increasing the distance to the GBRMP boundary has reduced the incidence of this occurring in the past. The design realignment to include the deep water along the boundary is a definite concern to GBRMPA and will probably be of significant political and community concern, including UNESCO.

SC (Aurecon)	Question to GBRMPA – what does GBRMPA consider to be an appropriate buffer?
LG (GBRMPA)	While there is no buffer distance provided, there is a high level of scrutiny through the Senate and public and political perceptions (community/social licence to operate) regarding impacts to the GBRMPA.
LG (GBRMPA)	The Minister has previously made comments about dredge disposal in the Marine Park. GPC should be mindful of this concern when designing the East Banks DMPA Extension.
PG (BMT WBM)	Highlighted that whilst it is understood the closer proximity to the boundary could create social/public/political issues, from a modelling perspective, the key factor is depth of deposition, and that creating a buffer may not actually result in any net benefit/reduced impact.
LG (GBRMPA)	GBRMPA has a primary role of assessing the 12 Mm ³ for the Channel Duplication Project. Some of the options discussed have very different levels of impacts associated with these different capacities. This makes it difficult to reconcile the options presented particularly when we compare the need for 12 Mm ³ versus 80 Mm ³ for the long-term port requirements. There will be a very different answer when assessed for 12 Mm ³ compared with a larger capacity. Are we assessing for 12 Mm ³ now or are we considering a site for the placement of the full 80 Mm ³ required?
SC (Aurecon)	The number one objective of this workshop is for the Channel Duplication Project. Secondary objectives have been added in; however, the primary concern is for the Channel Duplication Project and to shortlist options for dredge placement. Agency views on the other objectives would be appreciated by GPC but the key objective is Channel Duplication Project and what is to be considered for the EIS process.
ABh (GPC)	Correct, that is the intention with the other objectives looked at secondarily.
LG (GBRMPA)	A major issue is that locations have been designated for dredge disposal but the options do not necessarily have to be that size if we just look at the Channel Duplication Project. Should there be changes in the design to make the options more viable? Are these options realistic and are they viable? GPC is asking for our expertise and time so we want to know that what we are looking at are real and viable options.
POS (GPC)	GPC has sought to ensure an open process giving opportunity to consider all options including those which are highly unlikely. GPC has tried to avoid moving too quickly to just choosing viable options (ie lessons learnt from the Western Basin Project). GPC is making sure time was spent looking at all options, and for some options, the economics of scale issue does mean they are not viable
SC (Aurecon)	Suggests looking at West and East Bank Island Reclamations together and going through entire discussions now.
ABh (GPC)	GPC is interested in the 12 Mm ³ for the Channel Duplication at this stage but it could be viewed as short-sighted to design purely for this capacity? We may require a broader outlook depending on future port direction.
TR (CG)	Agrees with GBRMPA's concerns and indicates that these documents will require this level of detail, and must clearly document the context and parameters around decision-making at the current time.

LG (GBRMPA)	Agrees with Anil and GBRMPA has always maintained that a strategic assessment of the future dredge disposal needs should be undertaken. However, the current approvals process is set up for 12 Mm ³ only and an outcome for this volume could be significantly different to that for a larger volume (ie one option might be preferred for 80 Mm ³ but not preferred for 12 Mm ³).
ABh (GPC)	Surely there are some sites that are the best option for both objectives?
NE (CG)	What volume is the maintenance dredging per year?
ABh (GPC)	Approximately 200,000 m ³ . Maintenance dredging for the Gatcombe and Golding Channels is 30-40% of this. The bigger picture from maintenance dredging for the entire port, including LNG dredging is approximately 500,000 m ³ for the first few years.
TR (CG)	Suggested that the Gatcombe and Golding maintenance dredging volumes were minor in comparison to the 12 Mm ³ and consideration of this amount would add little to the current discussion.
SC (Aurecon)	Agreed that the maintenance dredging volume was only a small amount in comparison to the 12 Mm ³ , however reminded the group that it will be a requirement during the EIS process to consider maintenance dredging requirements. Suggests that we concentrate primarily on capital dredging during today's workshop and objectives.
TR (CG)	What is the duration of the Channel Duplication dredging campaign?
ABh (GPC)	Dredging to be done based on demand by industries. Stage 1: 7 Mm ³ within next 5 years; Stage 2: 5 Mm ³ within next 10 years. Depending on the demand for bringing in capsize vessels, may be required to complete all dredging in one go (1.5 – 2 years campaign).

5 Short listing options discussion

SC (Aurecon) revisited the MCA workshop results, with a reduced number of sites, and indicated that Channel Duplication capital dredging should be considered only. Which options are not feasible? Based on new information since the previous workshop, Gladstone-Mt Larcom Road (South) and Boat Creek South are no longer feasible options as discussed earlier in the workshop.

Key comments or questions from this session included:

TR (CG)	These options are not available to the Channel Duplication Project but are planned (and must be) used for dredge spoil from other projects.
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5.1 East Banks Island Reclamation option

Key comments or questions from this session included:

SC (Aurecon)	Is East Banks Island a feasible option from GPC's view point?
ABh (GPC)	For the construction of a bund and the money spent, this island would need to be utilised. However, the location of East Banks Island is not practically feasible for the port to use without a 5 km bridge or tunnel being installed.
TR (CG)	Since the previous workshop, the scoring on economic objectives may need to be revisited as it does not appear to adequately reflect the economic viability of the option for East Banks Island.

SC (Aurecon)	Weightings on economic category were considered quite low, in favour of environmental considerations and therefore suggested that modification of the economic scores is unlikely to result in any significant change to the rankings. Also long time to realise economic potential (ie port land) based on entire capacity.
POS (GPC)	Comparing East and West Bank Island Reclamation options, which would produce more feasible port land? Clearly West Banks would be more economically viable and should be considered further in the EIS. How far do we pursue East Banks as an option?
LG (GBRMPA) TR (CG) ABh (GPC)	Agency representatives at the workshop did not object to eliminating East Banks Island from the Channel Duplication EIS process.

5.2 West Banks Island Reclamation option

Key comments or questions from this session included:

ABh (GPC)	In terms of West Banks Island Reclamation, access to the site is easier and there is potential for port land, waterfront, wetlands etc.
NB (GBRMPA)	West Banks Island Reclamation has the advantage of the potential for a sheltered rehandling position compared with the other options. However, there is a significant concern regarding the coastal processes impacts.
GD (GPC)	West Banks Island Reclamation has a capacity for 30 Mm ³ , but will still require bunds and deeper ponds for settlement if used only for the 12 Mm ³ .
CB (JCU)	There is the likelihood of significant impacts along the coastline with this option (eg seagrass meadows).
PG (BMT WBM)	There are also significant hydrodynamic and coastal process impacts with this option, such as potential erosion, sedimentation etc.
SC (Aurecon)	Agency representatives at the workshop gave general consensus that the West Banks Island Reclamation will be carried forward into the Channel Duplication EIS.

5.3 Western Basin Expansion and Fisherman's Landing (South) options

Key comments or questions from this session included:

SC (Aurecon)	Based on the previous MCA Workshop, these options were scored as the least preferred. Has there been any change in consideration? Should they be carried forward into the EIS?
POS (GPC)	Looking at a strategic assessment, if you place dredge material in these two sites with rehandling occurring in the Western Basin, there will be cumulative impacts and the issue of where you would dispose of Western Basin (Stages 2 to 4) dredge material.
TR (CG)	Do you carry it through and look at these options during EIS?
LG (GBRMPA)	Agrees that it is not logical to take dredge material from one end to another for disposal while there is still a need for Western Basin dredging to utilise those areas. Closer disposal areas are more logical for the Channel Duplication Project.

ABh (GPC)	The advantage with the Western Basin Expansion is that it is available to pump nearby maintenance dredge material directly onto the site. It can also be used for port land (long term considerations).
LG (GBRMPA)	Looking back at original assessment for the Western Basin dredging, the aim was to minimise the impact on the remaining seagrass meadows for that expansion area. Significant redesign of the proposed land reclamation site occurred to provide the best opportunity for the overall health of the remaining seagrass meadow. The concern was always that the regulatory bodies wanted to retain some seagrass meadows in that area to maintain aquatic ecosystem health. This proposal would remove all remaining seagrass in this area.
SC (Aurecon)	Should we remove these options from consideration for the Channel Duplication Project? These works/concerns can feed into the Western Basin Project long term dredge spoil disposal strategy as required under the controlled action condition.
JM (DEHP)	For sake of completeness, the reasons these options are removed should be made explicit/justified during the EIS process. It should be noted that an unacceptable economic cost point have been used to remove these sites from the Channel Duplication EIS process, however a similar unacceptable environmental cost point has yet to be used. Going forward, we need to ensure that environmental costs are considered.
SC (Aurecon)	Agency representatives at the workshop did not object to removing these two options from the Channel Duplication EIS process.

5.4 Port Central Expansion option

Key comments or questions from this session included:

POS (GPC)	Anil, when looking at Port Central, was staging looked at during design? Does it need to be in this shape?
ABh (GPC)	During modelling, there were areas of re-suspension on either side which will require further studies during the EIS. The disposal can be done in stages, staging and shape of the reclamation area will be addressed during the EIS process.
GD (GPC)	There is potential for siltation on Barney Point beach.
SC (Aurecon)	We will need to consider hydrodynamics, erosion, ecological impacts, community impacts etc, and will be considered in design to minimise the impact.
CB (JCU)	The valuable area of seagrass to the south will need to be considered in this assessment as this option has potential to impact on this area. The design will need to minimise these impacts.
SC (Aurecon)	Agency representatives at the workshop agreed that the Port Central Expansion will move forward into the EIS.

5.5 East Banks DMPA Expansion option

Key comments or questions from this session included:

SC (Aurecon)	Agency representatives at the workshop agreed that the East Banks DMPA Expansion option be carried forward into Channel Duplication EIS, previous comments about the design will be addressed during the EIS process.
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5.6 Discussion

SC (Aurecon) outlined the summary table (refer below), which short-listed the options to be carried through to the EIS process for further study.

Option	Short-listing of options for further study (✓)	
	Not available/feasible for Channel Duplication Project	Proceed to Channel Duplication EIS
Gladstone-Mt Larcom Road South	✓	
Boat Creek South	✓	
Western Basin Expansion	✓	
Fisherman's Landing Expansion (South)	✓	
West Banks Island Reclamation		✓
East Banks Island Reclamation	✓	
Port Central		✓
East Banks DMPA Expansion (At Sea)		✓

Key comments or questions from this session included:

JM (DEHP)	A point of clarification, the basis for the removal of Western Basin Expansion and Fisherman's Landing Expansion (South) is purely for strategic purposes rather than environmental purposes. This should be clarified in the EIS process.
NE (CG)	Are three options enough sites to study during the EIS?
SC (Aurecon)	Capacity wise, yes. These sites are logical as they are all close to the Channel Duplication dredge areas.
NT (DSITIA)	Assuming these three options are examined in the EIS, will a combination of these options be looked at during EIS phase?
SC (Aurecon)	Yes, the options will be looked at in combination as well, particularly as West Banks Island Reclamation does not require rehandling for part of the dredge material. Also, a combination of options could be used for strategic dredge disposal (80 Mm ³).
ABh	Yes, we will need to look at individual and combinations of sites during the EIS phase.
NB (GBRMPA)	Is there a reason that GPC is not applying for full long term dredge volume (ie 80 Mm ³)? It seems logical for GPC to consider a variation to the current referral for the long-term dredging and disposal needs in a holistic cumulative assessment.
GD (GPC)	We started looking at the long-term needs (80 Mm ³), however for the purpose of simplifying the MCA workshop and addressing the needs of the Channel Duplication EIS, the dredge material placement investigation was re-focussed to the 12 Mm ³ .
NB (GBRMPA)	We have gone through that complexity now and we have a number of options that can take that capacity. Should future dredging disposal be considered going forward in a strategic assessment? Reiterates that GBRMPA's recommendation would be to vary the current referral and EIS process.

ABh (GPC)	Under the Draft Queensland Port Strategy, GPC is considering how best to address the strategic long term dredge disposal within the port.
SC (Aurecon)	Notes GBRMPA's comment with respect to the referral and suggests that GPC will take that on board and consider their preferred approach to addressing other capital and maintenance dredging requirements.
JM (DEHP)	If the strategic view is not being considered now, then it should be done in an iterative process. In other words, after the Channel Duplication Project, it should be considered, as we do not yet know which options will be used by the Channel Duplication Project.
SC (Aurecon)	Suggests we leave this discussion separate to the Channel Duplication Project at this stage until GPC considers how the strategic long term dredge disposal requirements of the Port will be addressed.
POS (GPC)	Agrees as the Channel Duplication Project is the priority at this stage. Discussions will be undertaken within GPC to determine the approach to be implemented.
LG (GBRMPA)	From a strategic viewpoint, the assessment for these sites is the same. If it is not assessed for full disposal, GPC may be missing a massive opportunity, particularly as it gets more difficult to approve dredge material placement in the future.
JY (DAFF)	Does the Port Central Expansion have potential to accommodate the future dredging capacity?
POS (GPC)	GPC will be looking at the design of the individual options and in combination, including sensitive sites, mitigation measures, future capacity etc.

6 Next steps

SC (Aurecon) mentioned that the DMPI Report (which forms part of the EIS) will be finalised and issued for agency review in the coming months and that the design of dredge placement areas will be refined during the EIS process. He indicated that EIS studies were to commence shortly as were community consultation activities.

The following concluding comments were made by workshop attendees:

MD (DAFF)	The ecological impact is the main concern from a DAFF perspective. However, it has been useful to consider all sites/impacts in one go. If multiple locations are used for dredge disposal, the combined impacts will need to be considered (such as re-suspension of materials etc).
JY (DAFF)	The ultimate cost to the environment will need to be determined – where do you draw the line? Must provide confidence that Western Basin Expansion and Fisherman's Landing Expansion (South) were removed from process because of their low MCA rankings.

JM (DEHP)	Appreciates the current process and opportunity to be involved. Still has residual disappointment that there appears to be a move away from a strategic long term approach to dredge material disposal within the Port. DEHP is concerned about the shape of the Port Central Expansion. Can you bring into shoreline to reduce impacts to southern shoreline? A combination of locations should be looked at to avoid any chronic impacts from a single disposal site. Port Central could be set up as a long term stable reclamation area.
NT (DSITIA)	Supports DEHP position and appreciates the open process for looking at options – it has been great to be a part of. Considers these three options to be the best, however how they are used will ultimately determine the quality of the final outcome. Which dredge equipment will be used? The timing of the disposal is also important. Should the approach be staged if a combination of sites is used?
NE (CG)	Interested to know how these options have been referenced/influenced from the Draft Queensland Ports Strategy.
TR (CG)	Good to be involved and has allowed him to learn a lot more about the dredging process. Suggested that since we have reduced our focus from the long-term 80 Mm³ and reduced our options to three, is now the time to look back up to a strategic outlook?
TI (DoE)	Agrees with the comments from the other agencies. All options should be explored and nothing should be ruled out without due consideration. All impacts should be examined and lessons learnt should be considered from Western Basin and other projects in Port Curtis.
POS (GPC)	This has been a very conscious process to give considerations to all options through the process. Now we have revised our options, as TR (CG) suggests, should we focus up to best way to move forward for the Channel Duplication Project versus a strategic assessment? GPC will endeavour to achieve the best outcome by examining the stages, timing and combined versus a single option.
NB (GBRMPA)	Appreciate the transparency of the process, noting that it was refreshing to see this approach taken. The design of the spoil location should be considered to minimise re-handling plumes and coastal process and ecological impacts. Cumulative impacts of plumes (eg re-handling and dredging plume) need to also be considered. Different options for timings and equipment should also be considered. Should we look at a strategic assessment? The original referral should be revisited and a variation should be considered by GPC.
LG (GBRMPA)	Emphasised that we are dealing with shifting baselines and we need to consider the potential for impacts that we are not yet aware of. What is being measured is current conditions not the baseline. We need to consider how this baseline has shifted over time. Communities may not hold the level of resilience that they once did. Cautions the use of 'baseline' in reporting. GPC need to look at historical data and the original baseline rather than current condition of Port Curtis.

- CB (JCU) Agree with LG (GBRMPA) that baseline surveys will only characterise pre-dredge (ie Channel Duplication) condition of Port Curtis. The condition of seagrass in Port Curtis has changed (significantly in some areas) in recent years. Since we have narrowed down the dredge material placement locations, we should now look at the plume interactions and start collecting data on the natural 'background' light environment and changes in seagrass at relevant seagrass meadows. We are in a good position given that there is an existing sensitive receptor network for Western Basin. It is important to supplement this network as soon as possible with sites that fill those gaps where potential impacts are likely to occur.
- PG (BMT WBM) Requires discussions around the amount of data to be collected, particularly with GBRMPA and their monitoring programme.
- ABh (GPC) Gave a closing thank you to all agencies for their attendance, their time and patience in the process. Acknowledged we now have three sites to take forward into the EIS and that there is a responsibility on GPC's part to move forward and take these forward with a comprehensive assessment.



Appendix C

Summary of Aspects for Consideration

Summary of Aspects for Consideration

Aspect		Dredge material placement options			Values/characteristics	Level of significance		
		Land based	Reclamation	Offshore (at sea)		High value constraint	Moderate value constraint	Low Value constraint
1 Ecological/environmental								
1.1	EPBC Act Threatened Ecological Communities (TEC) that are Regional Ecosystems (RE) (Refer Figure 1 in Appendix E) (Source: Queensland Government Information Service (QGIS))	✓	✓		- Ecological communities at risk of extinction that align with REs that are Matters of National Environmental Significance (MNES) under the EPBC Act - OUV: Total species diversity - OUV: Island plant species diversity - OUV: Threatened and endangered species		✓	
						These areas require further investigation to confirm the presence of threatened ecological communities, however would not be considered a High Value Constraint to further investigation for dredge material use/placement. These areas would be avoided unless an overriding opportunity is identified.		
1.2	Remnant vegetation containing endangered Regional Ecosystems (Refer Figure 2 in Appendix E) (Source: QGIS)	✓	✓		- Vegetation at risk of extinction protected under the <i>Vegetation Management Act 1999</i> (VM Act) - OUV: Total species diversity - OUV: Island plant species diversity - OUV: Threatened and endangered species		✓	
						These areas require further investigation to confirm the presence of endangered regional ecosystems, however would not be considered a High Value Constraint to further investigation for dredge material use/placement. These areas would be avoided unless an overriding opportunity is identified.		
1.3	Remnant vegetation containing of concern or least concern Regional Ecosystems (Refer Figure 3 in Appendix E) (Source: QGIS)	✓	✓		- Vegetation protected under the VM Act - OUV: Total species diversity - OUV: Island plant species diversity - OUV: Threatened and endangered species			✓
						These areas require further investigation to confirm the presence of 'of concern' or 'least concern' regional ecosystems. Where present, the potential impacts to protected vegetation would be considered in subsequent stages of the project.		
1.4	Essential habitat (Refer Figure 4 in Appendix E) (Source: QGIS)	✓	✓		- Vegetation important to protected flora and fauna under <i>Nature Conservation Act 1992</i> (NC Act) and VM Act - OUV: Total species diversity - OUV: Island plant species diversity - OUV: Threatened and endangered species			✓
						These areas require further investigation to confirm the presence of essential habitat. Where present, the potential impacts to protected vegetation would be considered in subsequent stages of the project.		
1.5	High value regrowth vegetation containing endangered, of concern or least concern Regional Ecosystems (Refer Figure 5 in Appendix E) (Source: QGIS)	✓	✓		- Protected, mature native vegetation under the VM Act - OUV: Total species diversity - OUV: Island plant species diversity - OUV: Threatened and endangered species			✓
						These areas require further investigation to confirm the presence of high value regrowth. Where present, the potential impacts to protected vegetation would be considered in subsequent stages of the project.		
1.6	Protected areas – National Parks (Refer Figure 6 in Appendix E) (Source: QGIS)	✓			- Areas with protective/conservation tenure (eg National Parks) under the NC Act - OUV: All attributes	✓		
						These areas are designated as National Parks for the 'permanent preservation of the area's natural condition and the protection of the area's cultural resources and values'. These areas will not be investigated for potential dredge material use/placement.		
1.7	Protected areas – all apart from National Parks (Refer Figure 6 in Appendix E)	✓			- Areas with protective/conservation tenure under the NC Act - OUV: All attributes		✓	
						These areas are afforded a level of protection by the State, however would not be considered a High Value Constraint to further investigation for dredge material use/placement. These areas would be avoided unless an overriding opportunity is identified.		

Aspect		Dredge material placement options			Values/characteristics	Level of significance		
		Land based	Reclamation	Offshore (at sea)		High value constraint	Moderate value constraint	Low Value constraint
1.8	World Heritage Area (Great Barrier Reef) (Refer Figure 7 in Appendix E) (Source: Great Barrier Reef Marine Park Authority (GBRMPA))	✓	✓	✓	- Conservation management area protected under the EPBC Act - OUV: All attributes		✓	
						The World Heritage Area is was established in 1981 based on the site's conservation management, as well as reasonable ongoing use for port operations, shipping, fisheries, recreation and tourism. The potential impact to world heritage values of dredge material placement will be considered in corresponding ecological values, and subsequent stages of the project.		
1.9	Great Barrier Reef Wetland Protection Area/Wetland Management Area (Refer Figure 8 in Appendix E) (Source: QGIS)	✓	✓	✓	- Protected areas under the <i>Environmental Protection Act 1994</i> (EP Act) - Connectivity - River deltas - Mangroves - Seabirds			✓
						Wetland Protection and Management Areas regulate activities that may impact on the Great Barrier Reef. The potential impact to these areas, and the Great Barrier Reef, of dredge material placement will be considered in subsequent stages of the project.		
1.10	Wetlands of International Importance (Ramsar Wetlands) (Refer Figure 9 in Appendix E) (Source: QGIS)	✓	✓		- Important habitat to biological diversity that are Matters of National Environmental Significance under the EPBC Act - OUV: Connectivity - OUV: River deltas - OUV: Mangroves - OUV: Seabirds			
						N/A – There are no Wetlands of International Importance within the spatial extent of study area.		
1.11	Nationally Important Wetlands (Refer Figure 10 in Appendix E) (Source: QGIS)	✓	✓		- Important ecologically and/or hydrologically in its region, listed on the Directory of Important Wetlands Australia - OUV: Connectivity - OUV: River deltas - OUV: Mangroves - OUV: Seabirds			✓
						The potential impact to Nationally Important Wetlands from dredge material placement will be considered in subsequent stages of the project.		
1.12	Turtle nesting areas (Refer Figure 11 in Appendix E) (Source: anecdotal knowledge)	✓	✓		- Identified historical nesting areas for turtles that are Matters of National Environmental Significance under the EPBC Act - OUV: Marine faunal groups diversity - OUV: Total species diversity - OUV: Marine turtles - OUV: Threatened and endangered species - OUV: Traditional Owner interaction with the natural environment	✓		
						Areas identified as the locations of turtle nesting areas will not be considered for potential dredge material use/placement.		
1.13	Mangrove areas (Refer Figure 12 in Appendix E) (Source: (former) Department of Primary Industries and Fisheries)		✓		- Identified mangrove forests protected under the <i>Fisheries Act 1994</i> - OUV: Marine faunal groups diversity - OUV: Total species diversity - OUV: Mangroves - OUV: Threatened and endangered species		✓	
						These areas would not be considered a High Value Constraint to further investigation for dredge material use/placement, however they would be avoided unless an overriding opportunity is identified.		

Aspect		Dredge material placement options			Values/characteristics	Level of significance		
		Land based	Reclamation	Offshore (at sea)		High value constraint	Moderate value constraint	Low Value constraint
1.14	Coral and rocky reefs (Refer Figure 13 in Appendix E) (Source: GBRMPA)		✓	✓	- Defined coral, rock or algal reefs protected under the <i>Great Barrier Reef Marine Park Zoning Plan 2003</i> - OUV: Connectivity - OUV: Fringing reefs - OUV: Inshore turbid reefs - OUV: Marine faunal groups diversity - OUV: Coral species – diversity and extent - OUV: Total species diversity	✓		Reefs will not be considered for potential dredge material use/placement.
1.15	Seagrass meadows (Refer Figures 14a and 14b in Appendix E) (Source: JCU survey data)		✓	✓	- Historical distribution of seagrass (2002, 2009, 2012) protected under the <i>Fisheries Act 1994</i> - OUV: Marine faunal groups diversity - OUV: Total species diversity - OUV: Seagrass - OUV: Marine turtles - OUV: Threatened and endangered species - Value determined based on the relative contribution of seagrass meadows to the system's ecology		✓	These areas would not be considered a High Value Constraint to further investigation for dredge material use/placement, however they would be avoided unless an overriding opportunity is identified. In order to assist in the identification of seagrass constraints, an assessment of the potential value of seagrass meadows within the Port of Gladstone has been undertaken. This assessment has differentiated between seagrass meadows of low, medium and high values.
1.16	Dugong Protection Area (DPA) (Commonwealth) (Refer Figure 15 in Appendix E) (Source: GBRMPA)		✓	✓	- Declared under <i>Great Barrier Reef Marine Park Regulations 1983</i> to manage fishing activities in DPA - OUV: Marine faunal groups diversity - OUV: Total species diversity - OUV: Threatened and endangered species		✓	Commonwealth Dugong Protection Areas would not be considered a High Value Constraint to further investigation for dredge material use/placement, however they would be avoided unless an overriding opportunity is identified.
1.17	Dugong Protection Area (DPA) (State) (Refer Figure 15 in Appendix E) (Source: QGIS)		✓	✓	- Declared under <i>Nature Conservation (Wildlife Management) Regulation 2006/Fisheries Regulation 2008</i> to manage fishing activities in DPA - OUV: Marine faunal groups diversity - OUV: Total species diversity - OUV: Threatened and endangered species		✓	State Dugong Protection Areas would not be considered a High Value Constraint to further investigation for dredge material use/placement, however they would be avoided unless an overriding opportunity is identified.
1.18	Declared Fish Habitat Area (Refer Figure 16 in Appendix E) (Source: QGIS)		✓		- Areas declared for fisheries values under the <i>Fisheries Act 1994</i> - OUV: Marine faunal groups diversity - OUV: Total species diversity - OUV: Threatened and endangered species		✓	Declared Fish Habitats would not be considered a High Value Constraint to further investigation for dredge material use/placement, however they would be avoided unless an overriding opportunity is identified.
1.19	Estuarine wetland regional ecosystems (salt flats, mud flats) (Refer Figure 17 in Appendix E) (Source: QGIS)		✓		- Habitat value protected under the <i>Fisheries Act 1994</i> - OUV: Total species diversity		✓	These areas would not be considered a High Value Constraint to further investigation for dredge material use/placement, however they would be avoided unless an overriding opportunity is identified.

Aspect		Dredge material placement options			Values/characteristics	Level of significance		
		Land based	Reclamation	Offshore (at sea)		High value constraint	Moderate value constraint	Low Value constraint
1.20	Great Barrier Reef Marine Park and Great Barrier Reef Coast Marine Park – Conservation and Marine National Park Zones (Refer Figure 18 in Appendix E) (Source: GBRMPA)			✓	- Commonwealth and State marine parks - Protection of conservation values under the <i>Great Barrier Reef Marine Park Zoning Plan 2003</i> (Cth) and <i>Marine Parks Act 2004</i> (Qld) - OUV: All attributes	✓		These areas are provided a high level of protection under the GBRMP Zoning Plan. These areas will not be investigated for potential dredge material use/placement.
1.21	Great Barrier Reef Marine Park and Great Barrier Reef Coast Marine Park – Habitat Protection Zone (Refer Figure 18 in Appendix E) (Source: GBRMPA)			✓	- Commonwealth and State marine parks - Protection of conservation values under the <i>Great Barrier Reef Marine Park Zoning Plan 2003</i> (Cth) and <i>Marine Parks Act 2004</i> (Qld) - OUV: All attributes		✓	These areas are protected under the GBRMP Zoning Plan, but would not be considered a High Value Constraint to further investigation for dredge material use/placement. However, these areas would be avoided unless an overriding opportunity is identified.
1.22	Great Barrier Reef Marine Park and Great Barrier Reef Coast Marine Park – General Use Zone (Refer Figure 18 in Appendix E) (Source: GBRMPA)			✓	- Commonwealth and State marine parks - Conservation while maintaining reasonable use under the <i>Great Barrier Reef Marine Park Zoning Plan 2003</i> (Cth) and <i>Marine Parks Act 2004</i> (Qld) - OUV: All attributes			✓ The potential impact to the GBRMP from dredge material placement will be considered in subsequent stages of the project.
1.23	Existing seabed characteristics (Source: to be obtained)			✓	- Implications of placement of silts/clays on clean sand vs like-for-like dredge material placement - OUV: Connectivity			✓ The potential impact to seabed characteristics from dredge material placement will be considered in subsequent stages of the project.
1.24	Groundwater (Source: Department of Natural Resources and Mines)	✓			- Important feature to certain ecological communities and agriculture - OUV: Connectivity			✓ The potential impact to groundwater from dredge material placement will be considered in subsequent stages of the project.
1.25	Declared Waterways – Red and purple (Refer Figure 19 in Appendix E)	✓			- Declaration of level of protection for certain waterways under the <i>Fisheries Act 1994</i> - OUV: River deltas - OUV: Marine faunal groups diversity - OUV: Total species diversity - OUV: Mangroves - OUV: Threatened and endangered species			✓ These areas would not be considered a High Value Constraint to further investigation for dredge material use/placement. However, these areas would be avoided unless an overriding opportunity is identified. This classification is based on the level of protection given to these waterways under the <i>Fisheries Act 1994</i> .
1.26	Declared Waterways – Green and amber (Refer Figure 19 in Appendix E)	✓			- Declaration of level of protection for certain waterways under the <i>Fisheries Act 1994</i> - OUV: River deltas - OUV: Marine faunal groups diversity - OUV: Total species diversity - OUV: Mangroves - OUV: Threatened and endangered species			✓ The potential impact to waterways from dredge material placement will be considered in subsequent stages of the project.

Aspect		Dredge material placement options			Values/characteristics	Level of significance		
		Land based	Reclamation	Offshore (at sea)		High value constraint	Moderate value constraint	Low Value constraint
2 Social and cultural heritage								
2.1	Urban land use (residential and commercial zoning (ie existing and future)) (Refer Figure 20 in Appendix E) (Source: Gladstone Regional Council and Gladstone State Development Area Development Scheme)	✓			■ No opportunities for dredge material placement on land that has been developed for urban land uses, or is planned to be developed for residential development under the Gladstone Regional Council Strategic Framework		✓	
						Existing developed areas would not be considered a High Value Constraint to further investigation for dredge material use/placement. However, these areas would be avoided unless an overriding opportunity is identified.		
2.2	Urban land use (industrial development and open space (ie existing and future)) (Refer Figure 20 in Appendix E) (Source: Gladstone Regional Council and Gladstone State Development Area Development Scheme)	✓			■ Dredge material placement may be compatible with future planned commercial or industrial land uses under the Gladstone Regional Council Strategic Framework and Gladstone State Development Area Development Scheme			✓
						The potential impact to planned future development of certain sites from dredge material placement will be considered in subsequent stages of the project.		
2.3	Compatibility with future adjacent/surrounding land uses (Source: Gladstone Regional Council and Gladstone State Development Area Development Scheme)	✓	✓		■ Suitability of dredge material placement adjacent/nearby existing or planned future uses under the Gladstone Regional Council Strategic Framework and Gladstone State Development Area Development Scheme			✓
						The potential impact to adjacent/surrounding land uses from dredge material placement will be considered in subsequent stages of the project. This aspect also potentially represents an opportunity if the placement area is located adjacent to existing or planned industrial or port land (refer Section 6.5).		
2.4	Aesthetic values	✓	✓	✓	■ Natural world heritage criteria under the World Heritage List Statement of Outstanding Value ■ OUV: Continental islands ■ OUV: Beaches ■ OUV: River deltas ■ OUV: Fringing reefs			✓
						The potential impact to aesthetic values from dredge material placement will be considered in subsequent stages of the project.		
2.5	Geological and geomorphological features	✓	✓		■ Features that contribute to the aesthetic value of the area and important to the community and visitors to the region ■ OUV: Connectivity ■ OUV: Islands			✓
						The potential impact to geological and geomorphological features from dredge material placement will be considered in subsequent stages of the project.		
2.6	Cultural heritage (Refer Figure 21 in Appendix E)	✓	✓	✓	■ Indigenous and non-Indigenous cultural heritage aspects protected under the <i>Aboriginal Cultural Heritage Act 2003</i> and <i>Queensland Heritage Act 1992</i> ■ OUV: Traditional Owner interaction with the natural environment			✓
						The potential impact to cultural heritage from dredge material placement will be considered in subsequent stages of the project.		
2.7	Protected shipwrecks (Refer Figure 22 in Appendix E) (Source: former SEWPaC)		✓	✓	■ Shipwrecks are protected under Commonwealth <i>Historic Shipwrecks Act 1976</i> and State <i>Queensland Heritage Act 1992</i> (both administered by DEHP) ■ Shipwrecks cannot be disturbed without written consent from DEHP		✓	
						The location of historic shipwrecks would not be considered a High Value Constraint to further investigation for dredge material use/placement. However, these areas would be avoided unless an overriding opportunity is identified.		
2.8	Recreational fishing values		✓	✓	■ Areas identified to be of high value to recreational fishers			✓
						The potential impact to recreational fishing values from dredge material placement will be considered in subsequent stages of the project.		

Aspect		Dredge material placement options			Values/characteristics	Level of significance		
		Land based	Reclamation	Offshore (at sea)		High value constraint	Moderate value constraint	Low Value constraint
3 Economic								
3.1	Commercial fisheries values <\$1M total catch between 2003 and 2012 (Refer Figure 23 in Appendix E) (Source: DAFF)		✓	✓	■ Areas identified to be of value to the commercial fishing industry (catch data obtained from DAFF)			✓
						The potential impact to commercial fishing values from dredge material placement will be considered in subsequent stages of the project.		
3.2	Commercial fisheries values >\$1M total catch between 2003 and 2012 (Refer Figure 23 in Appendix E) (Source: DAFF)		✓	✓	■ Areas identified to be of value to the commercial fishing industry (catch data obtained from DAFF)		✓	
						The potential impact to commercial fishing values from dredge material placement will be considered in subsequent stages of the project.		
3.3	Strategic Cropping Land (Refer Figure 24 in Appendix E) (Source: QGIS)	✓			■ Areas of high agricultural values protected under the <i>State Planning Policy 1/12 Protection of Queensland's Strategic Cropping Land</i>			✓
						The potential impact to Strategic Cropping Land from dredge material placement will be considered in subsequent stages of the project.		
3.4	State owned Forest Products (Refer Figure 25 in Appendix E)	✓			■ Forest products including State-owned land that contain commercial native forests and/or areas where the ownership of quarry material is reserved to State that is currently exploited or where there is a likelihood of future exploitation		✓	
						Areas of State-owned forestry would not be considered a High Value Constraint to further investigation for dredge material use/placement. However, these areas would be avoided unless an overriding opportunity is identified.		
3.5	State owned Forest Products (Facing Island only) (Refer Figure 25 in Appendix E)	✓			■ Forest products including State-owned land that contain commercial native forests and/or areas where the ownership of quarry material is reserved to State that is currently exploited or where there is a likelihood of future exploitation ■ DAFF have indicated that for the purposes of this investigation, State owned Forest Products identified on Facing Island have a level of significance of 'consideration of impact'			✓
						Areas of State-owned forestry would not be considered a High Value Constraint to further investigation for dredge material use/placement. However, these areas would be avoided unless an overriding opportunity is identified.		
3.6	Tourism	✓	✓	✓	■ Areas of high value to the local and regional tourism industry		✓	
						The location of specific tourism features would not be considered a High Value Constraint to further investigation for dredge material use/placement. However, these areas would be avoided unless an overriding opportunity is identified.		
3.7	Ecosystem services	✓	✓	✓	■ The contribution of various aspects of ecological value to the overall functioning of ecosystems		✓	
						The impact to certain ecosystem services would not be considered a High Value Constraint to further investigation for dredge material use/placement. However, these areas would be avoided unless an overriding opportunity is identified.		
3.8	Mining leases (Refer Figure 26 in Appendix E)	✓	✓		■ Current exploration permits and mining leases issued by the State Government			✓
						The potential impact to mining leases from dredge material placement will be considered in subsequent stages of the project.		

Aspect		Dredge material placement options			Values/characteristics	Level of significance		
		Land based	Reclamation	Offshore (at sea)		High value constraint	Moderate value constraint	Low Value constraint
4 Operational								
4.1	Terrain (Source: Geoscience Australia) (Refer Figure 27 in Appendix E)	✓			■ Elevation and slope over which the dredge material pipeline crosses will have implications for pumping distance			✓
						The potential impact to, and of, terrain on dredge material placement will be considered in subsequent stages of the project.		
4.2	Anchorage (Refer Figure 28 in Appendix E) (Source: Queensland Admiralty Charts and Maritime Safety Queensland Notice to Mariners)		✓	✓	■ Designated areas declared by the Regional Harbour Master for ships to anchor (includes emergency anchorages used during severe weather events)			✓
						The potential impact to the location of Outer Harbour Anchorages from dredge material placement will be considered in subsequent stages of the project, as these can be relocated if required.		
4.3	Anchorage – Emergency (Refer Figure 28 in Appendix E) (Source: Queensland Admiralty Charts and Maritime Safety Queensland Notice to Mariners)		✓	✓	■ Designated areas declared by the Regional Harbour Master for ships to anchor (includes emergency anchorages used during severe weather events)		✓	
						The impact to Emergency Anchorages would not be considered a High Value Constraint to further investigation for dredge material use/placement. However, these areas would be avoided unless an overriding opportunity is identified as there is limited availability for their relocation.		
4.4	Depth of water			✓	■ Water depth will have implications for dredge vessel/barge accessibility for offshore (at sea) placement options ■ Navigable depths within shipping lanes to be maintained commercial shipping ■ Water depths shallower than -10 m LAT are likely to be influenced by wave action potentially causing re-suspension and dispersal of dredge material			✓
						The potential impact to, or of, water depth on dredge material placement will be considered in subsequent stages of the project.		
4.5	Dispersal of dredge material (Refer Figure 6.4)			✓	■ Determined through bed-shear stress modelling	Opportunity consideration		
						Areas identified as having low dispersal potential (ie low bed-shear stress) will be investigated for potential dredge material placement locations.		
4.6	Shipping channels, swing basins and berth pockets within Port Limits (Refer Figures in Appendix E) (Source: Gladstone Ports Corporation)		✓	✓	■ Operational shipping channels to be maintained	✓		
						Shipping channels within Port Limits will not be investigated for potential dredge material use/placement.		
4.7	Shipping lanes outside Port Limits (Refer Figure 28 in Appendix E) (Source: Australian Maritime Safety Authority)		✓	✓	■ Areas of high frequency vessel traffic based on the satellite Automatic Identification System ■ Post-dredge material placement depths suitable to maintain navigable depths for commercial shipping			✓
						The potential impact of dredge material placement on shipping lanes and movements outside Port Limits will be considered in subsequent stages of the project. However, placement areas outside major shipping lanes for large vessels are preferred.		



Appendix D

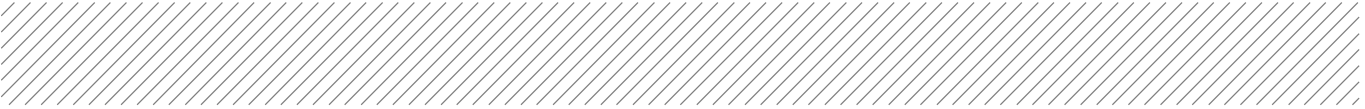
Outstanding Universal Value (OUV) Attributes Expressed in the Port of Gladstone and Surrounds

Excerpt of Appendix 6 of the Independent Review of the Port of Gladstone – Report on Findings – July 2013

Appendix 6: OUV Attributes Expressed in the Port of Gladstone and Surrounds

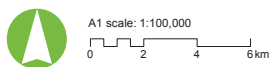
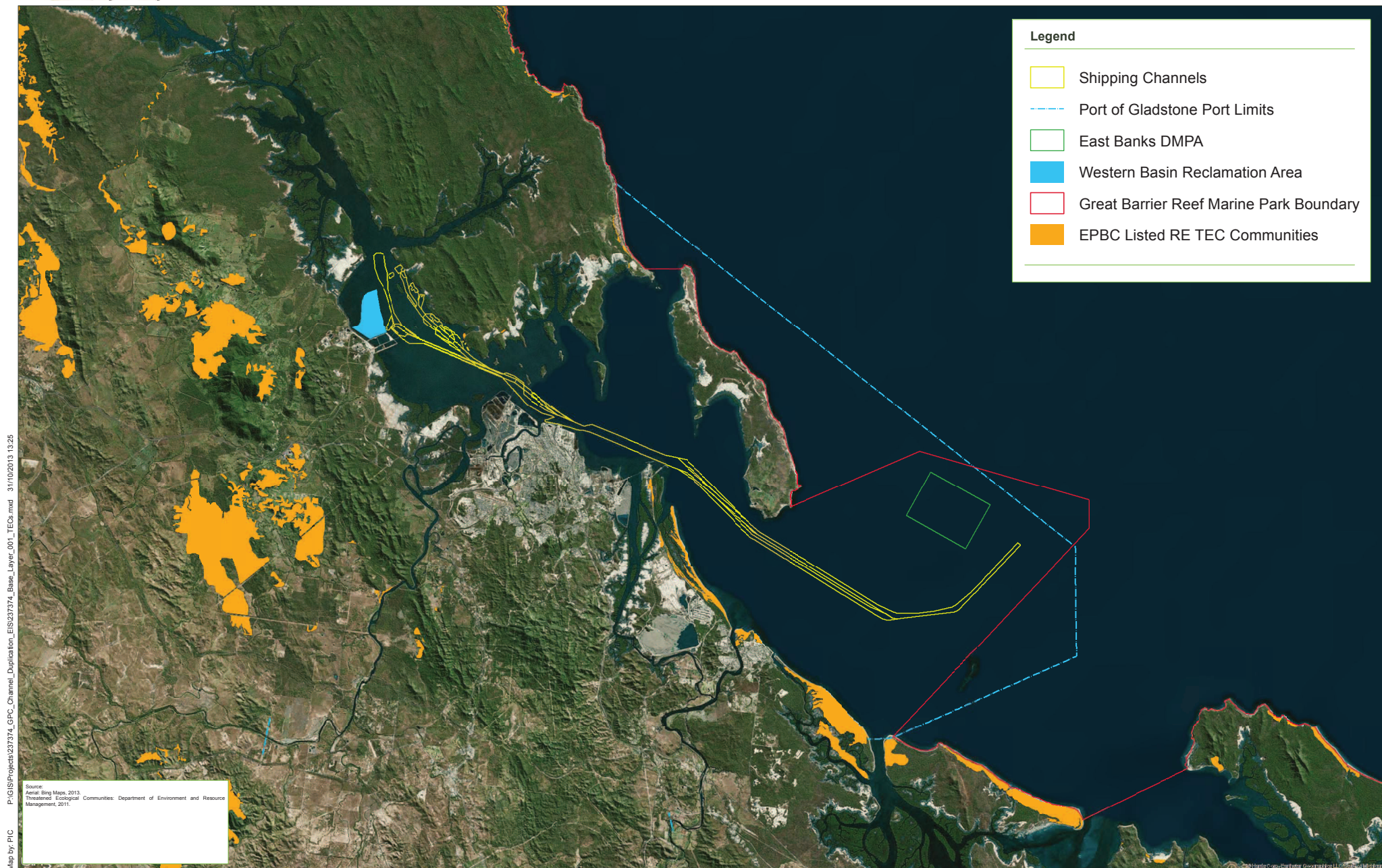
Overview of attributes	Criterion vii – aesthetic values and superlative natural phenomena	Criterion viii – ongoing geological processes	Criterion ix – ecological and biological processes	Criterion x – biodiversity conservation
Connectivity: cross-shelf, longshore & vertical		•	•	•
Continental islands	•	•	•	•
Beaches	•			
Dune systems	•	•		
Fringing reefs	•	•	•	•
Inshore turbid reefs		•	•	•
River deltas	•	•	•	•
Marine faunal groups diversity	•		•	•
Coral species – diversity & extent	•	•	•	•
Total species diversity	•		•	•
Island plant species diversity	•		•	•
Seagrass	•	•	•	•
Mangroves	•	•	•	•
Marine turtles	•			•
Whales	•			•
Threatened & endangered species				•
Dolphins	•			•
Seabirds	•		•	•
Traditional Owner interaction with the natural environment ²⁵			•	

25 While the Great Barrier Reef is not listed for cultural values, 'man's interaction with his natural environment' was part of the natural heritage criteria in use at the time of listing. While the criteria have changed and it is no longer explicit, the value is recognised in the property's Statement of OUV in relation to criterion ix – ongoing ecological processes



Appendix E

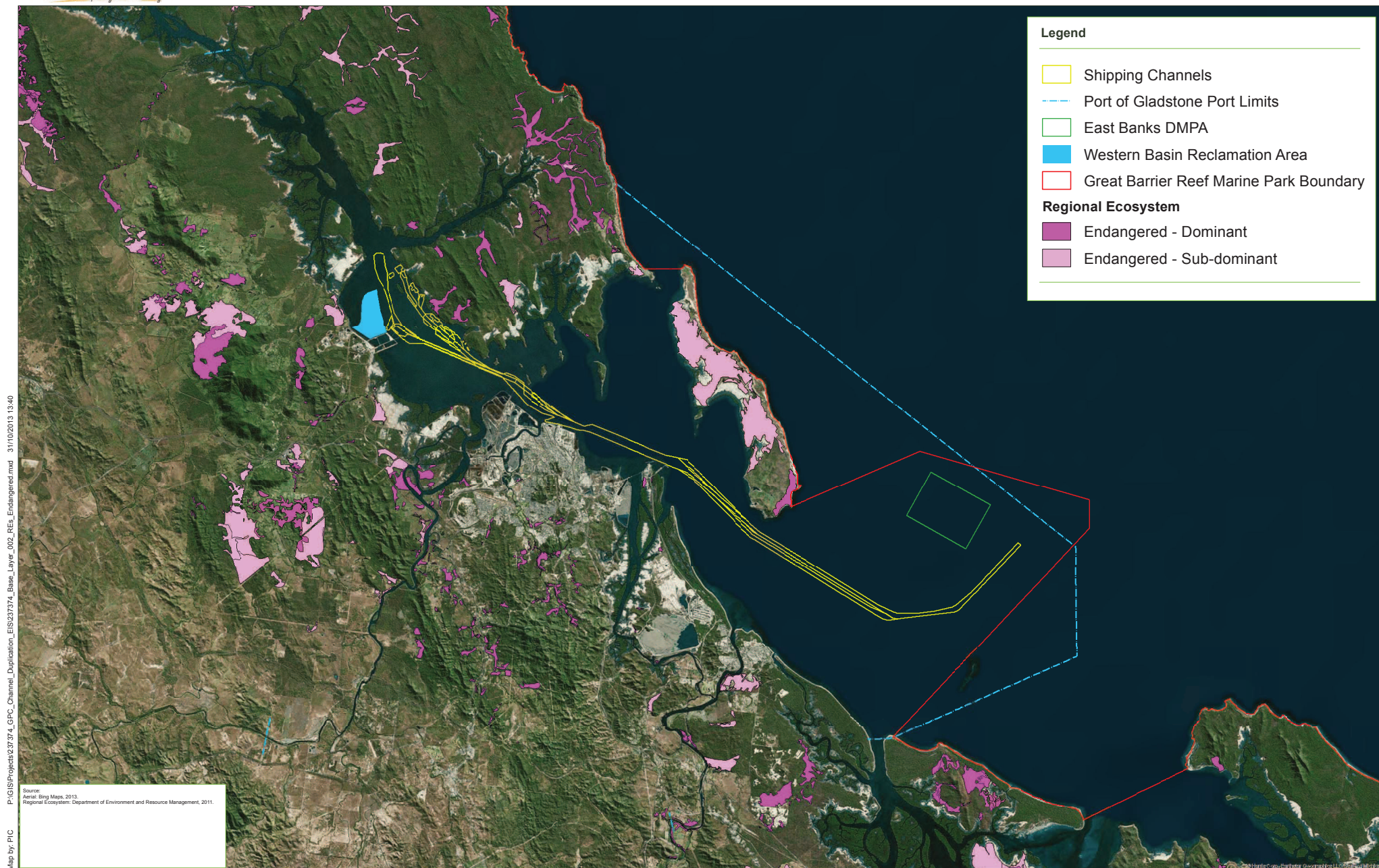
Constraints Mapping

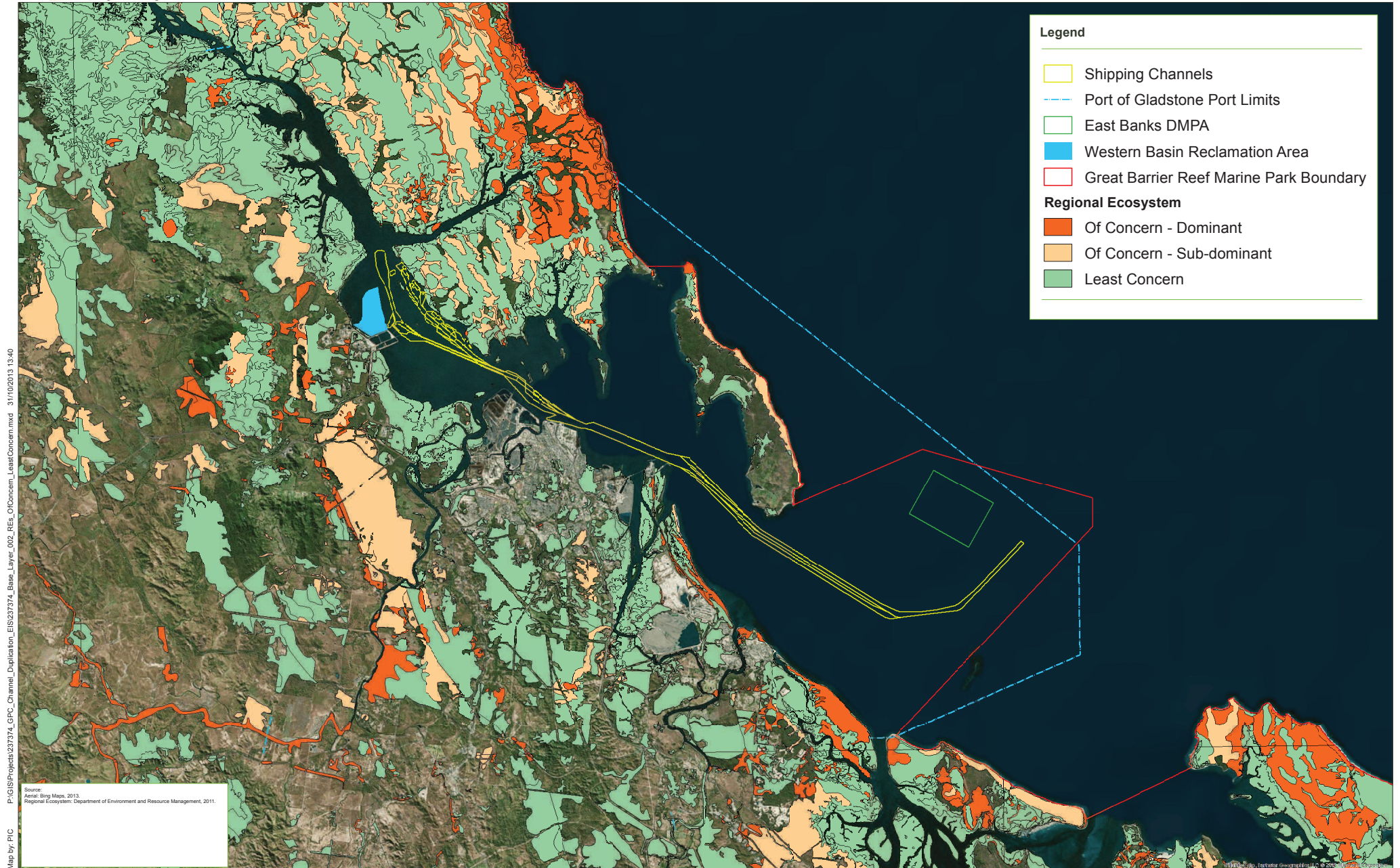


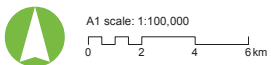
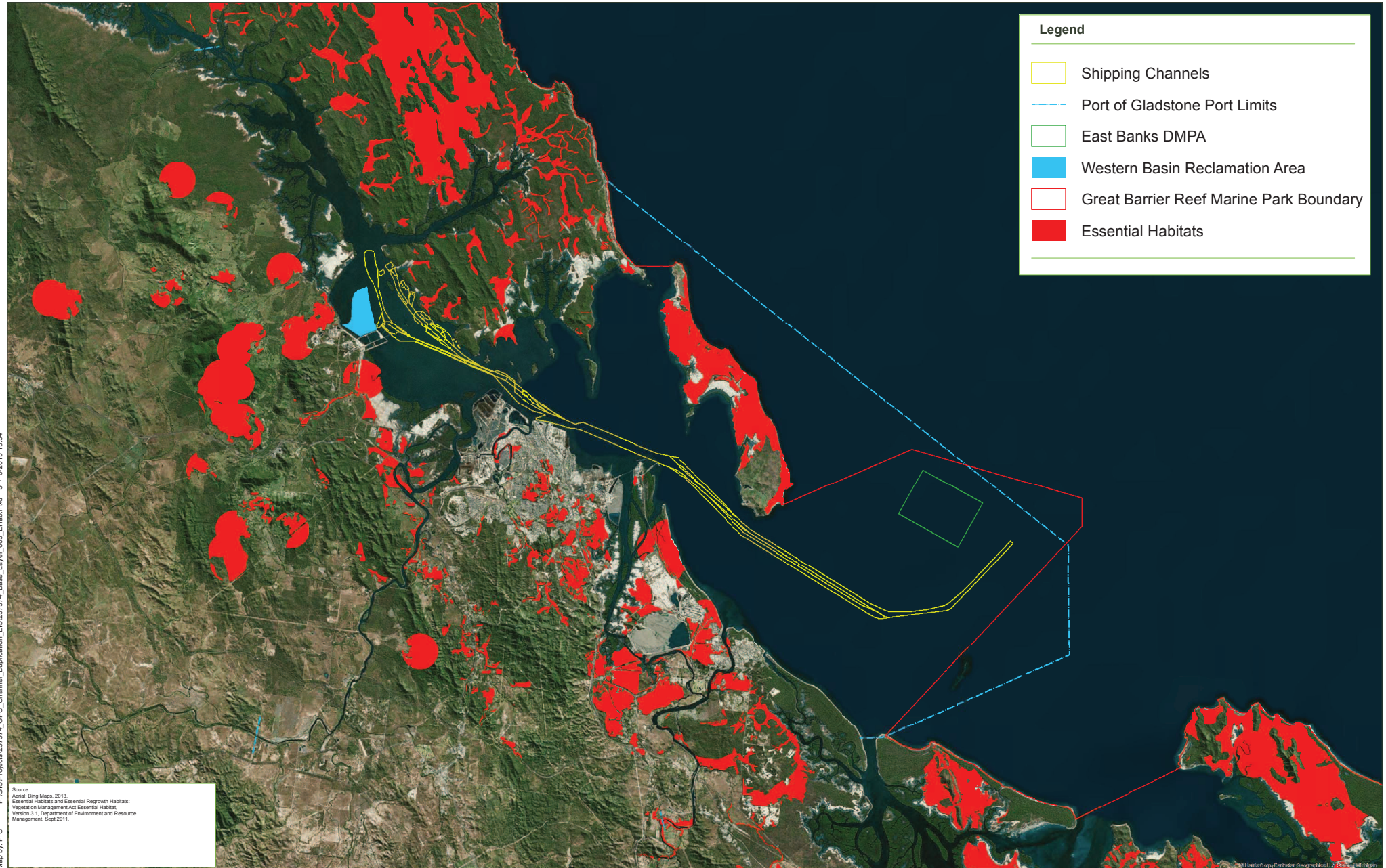
Date: 31/10/2013 Version: 1 Job No: 237374
Coordinate system: GDA_1994_MGA_Zone_56

Port of Gladstone Channel Duplication EIS

Figure 1: EPBC Act Listed Threatened Ecological Communities



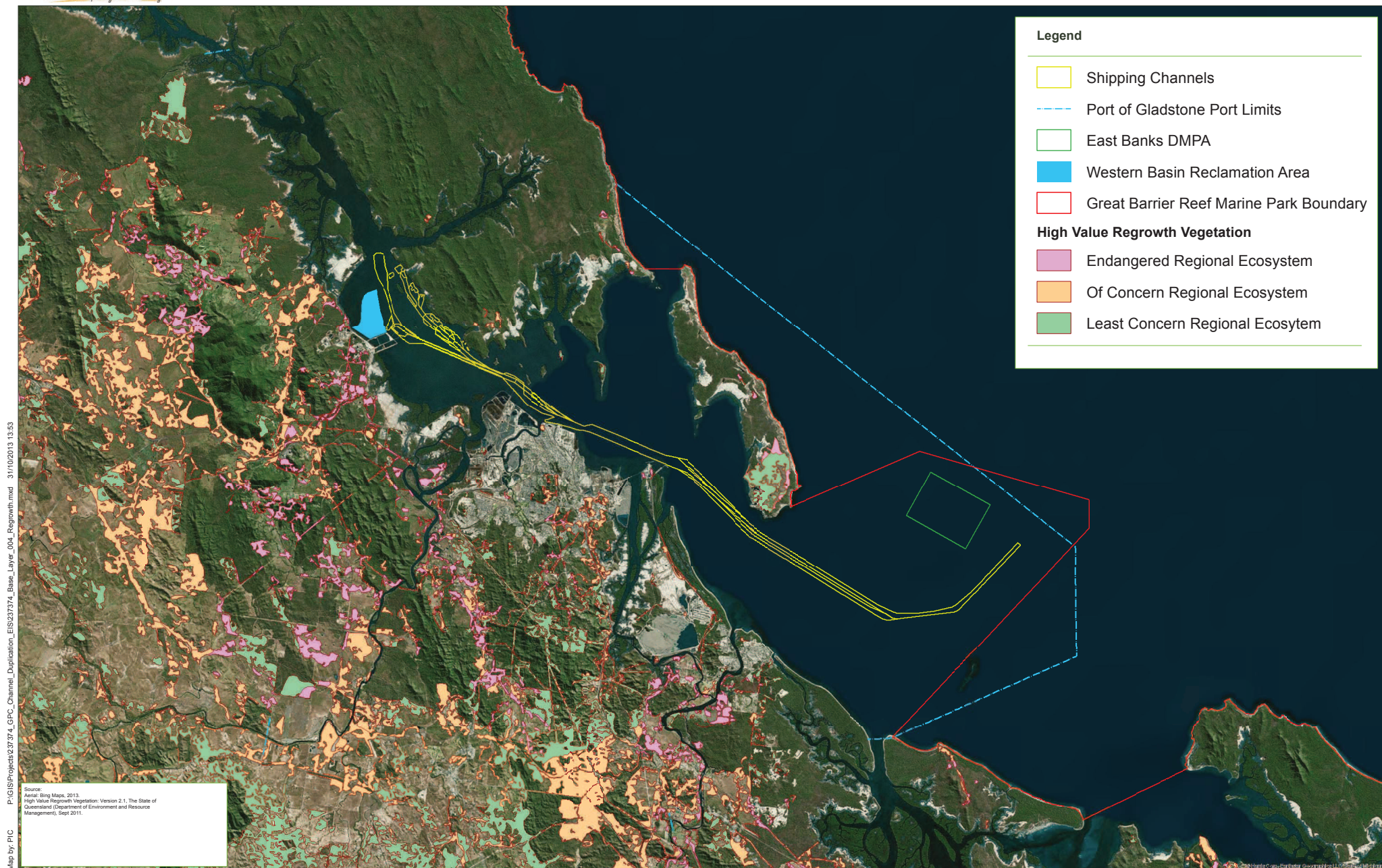


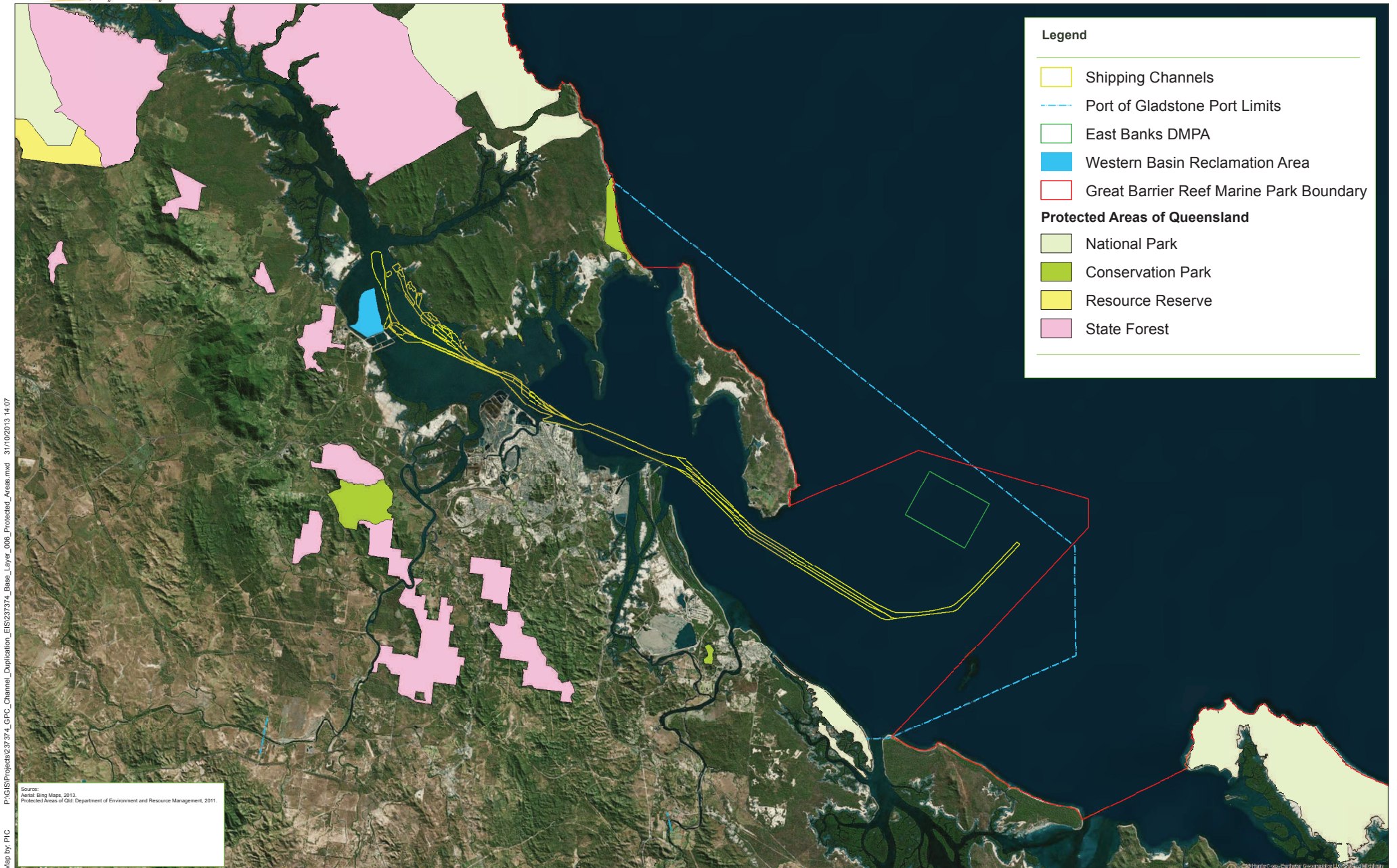


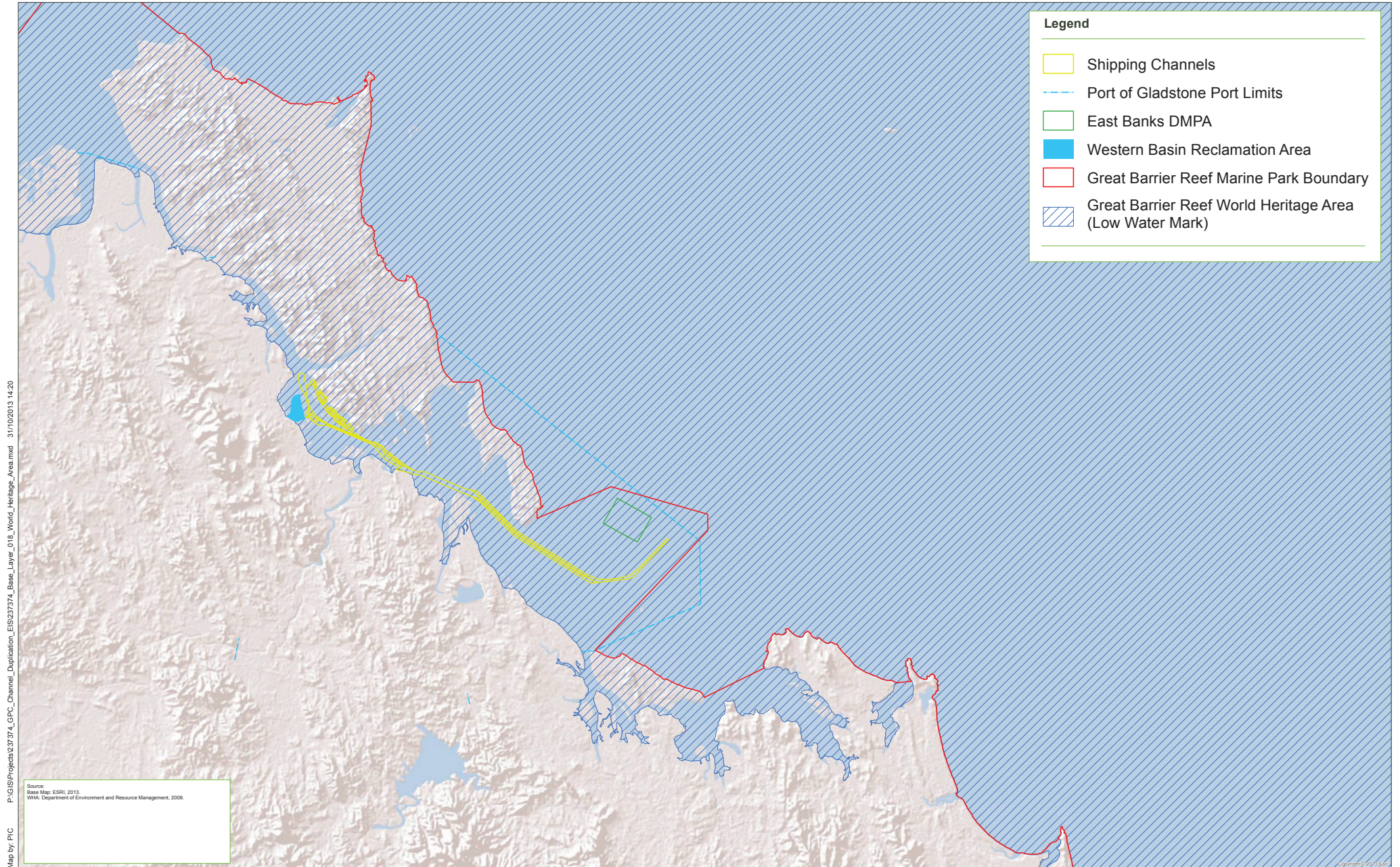
Date: 31/10/2013 Version: 1 Job No: 237374
Coordinate system: GDA_1994_MGA_Zone_56

Port of Gladstone Channel Duplication EIS

Figure 4: Essential Habitat







A1 scale: 1:175,000

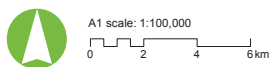
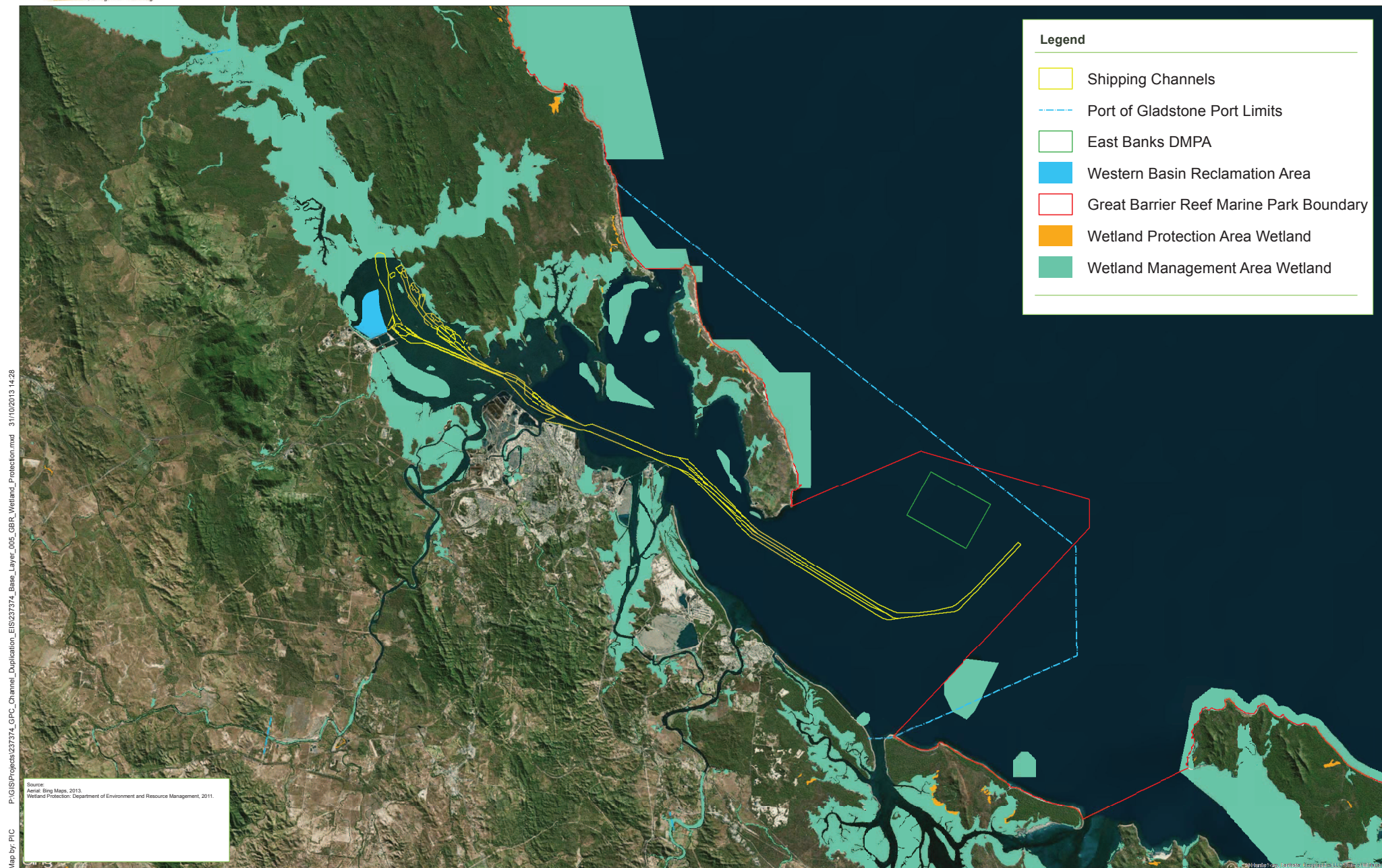
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Date: 31/10/2013 Version: 1 Job No: 237374

Coordinate system: GDA_1994_MGA_Zone_56

Port of Gladstone Channel Duplication EIS

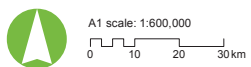
Figure 7: World Heritage Area (Great Barrier Reef)

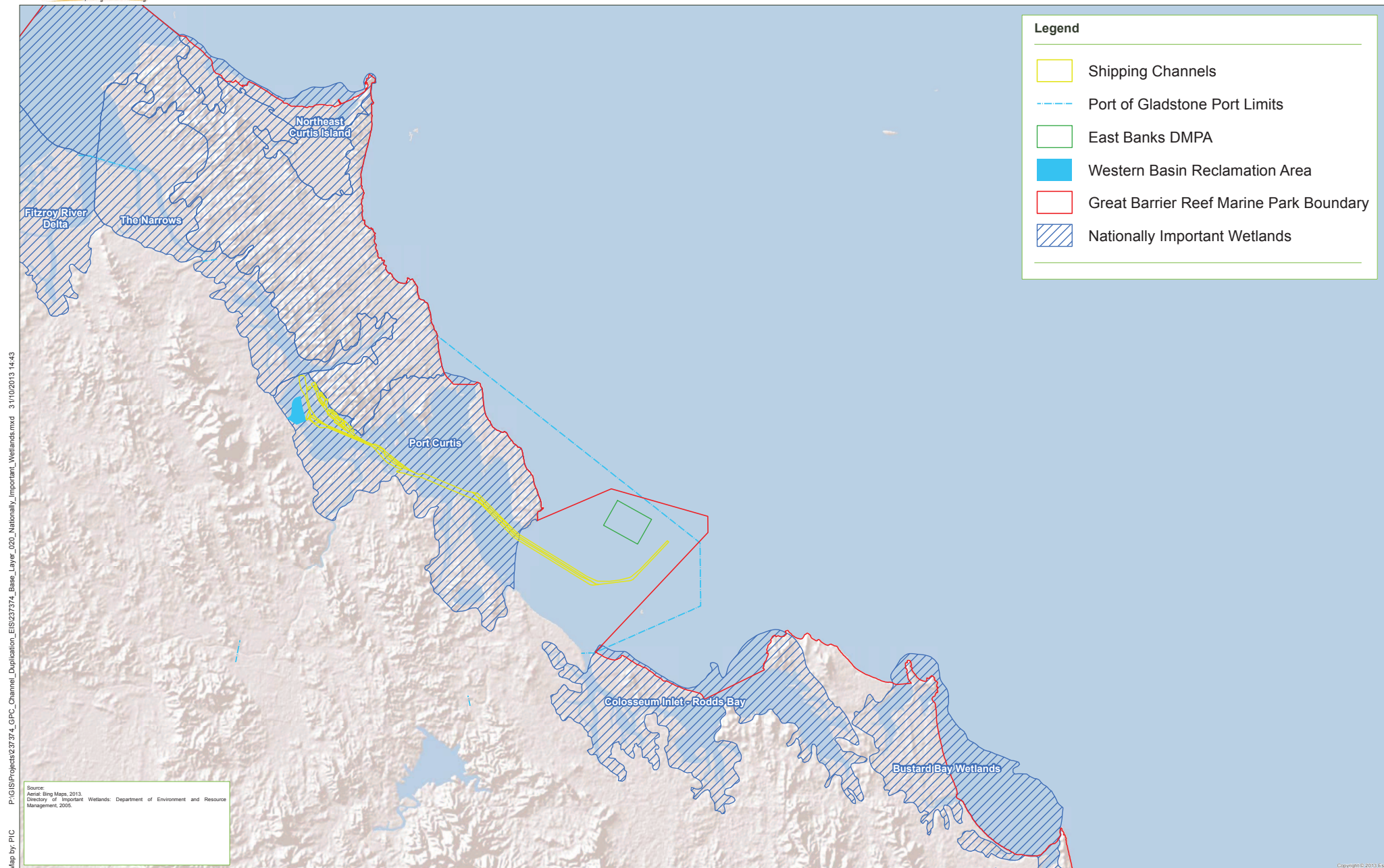


Date: 31/10/2013 Version: 1 Job No: 237374
Coordinate system: GDA_1994_MGA_Zone_56

Port of Gladstone Channel Duplication EIS

Figure 8: Great Barrier Reef Wetland Protection and Management Areas





A1 scale: 1:175,000

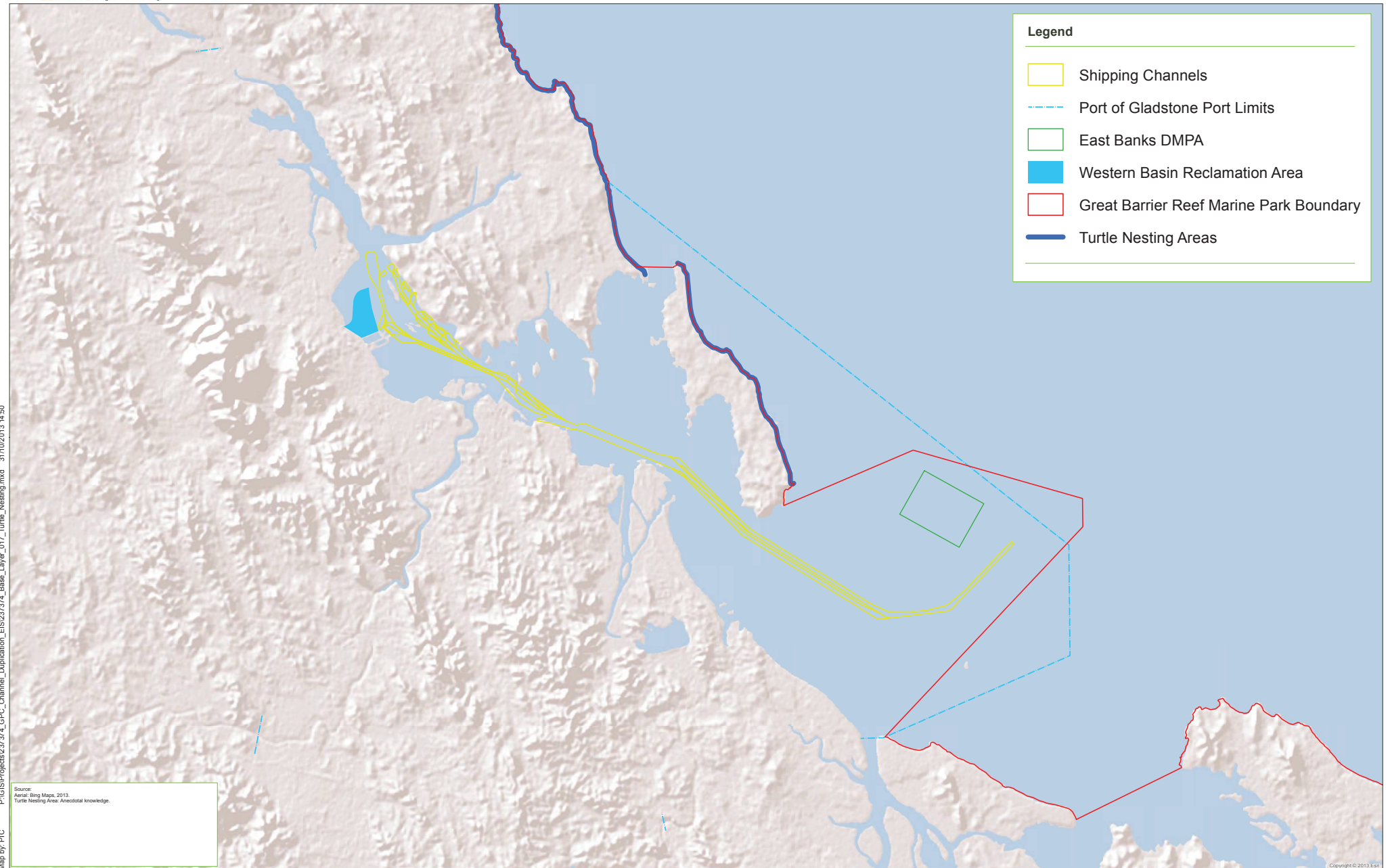
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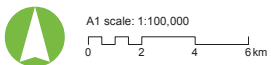
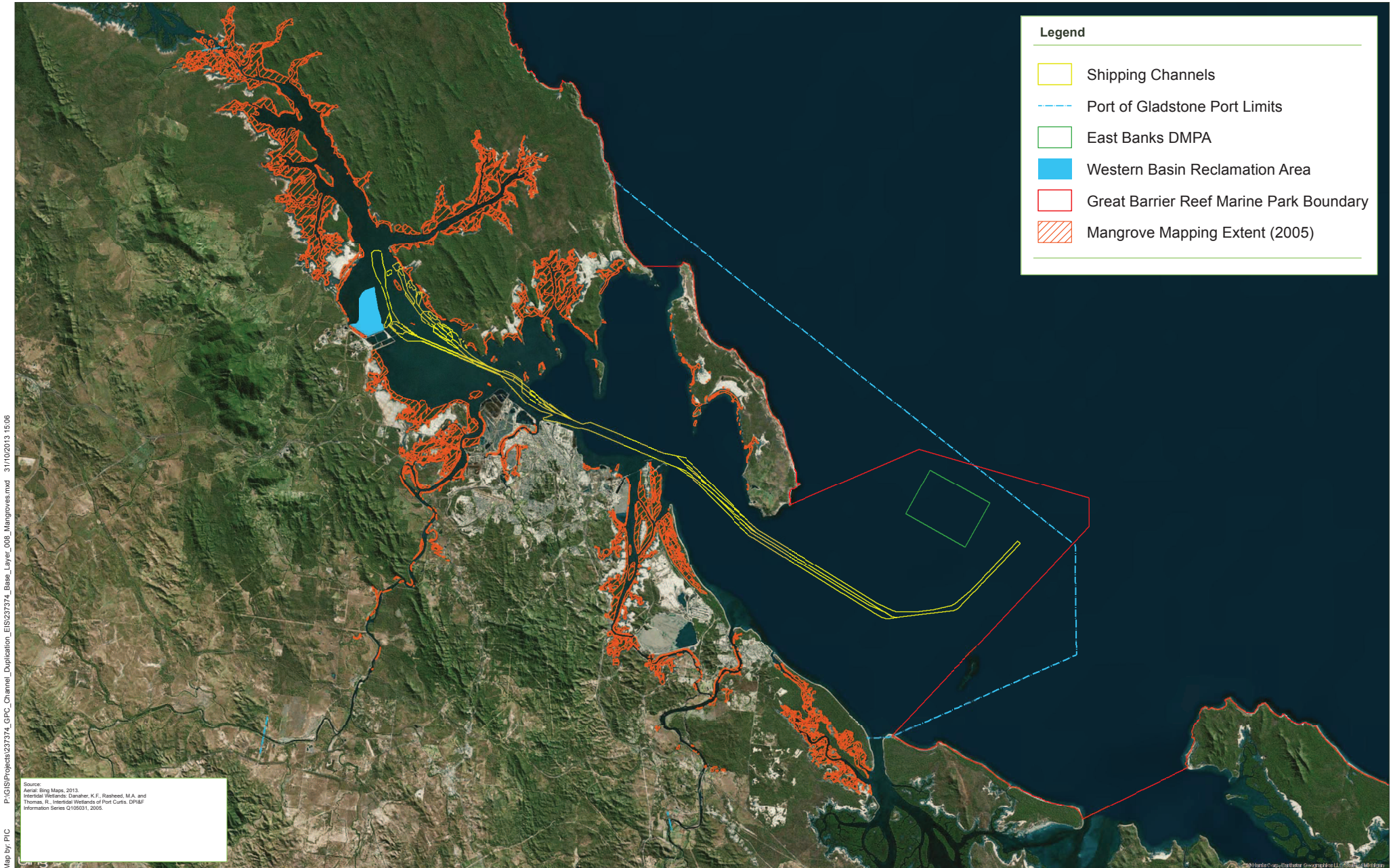
Date: 31/10/2013 Version: 1 Job No: 237374

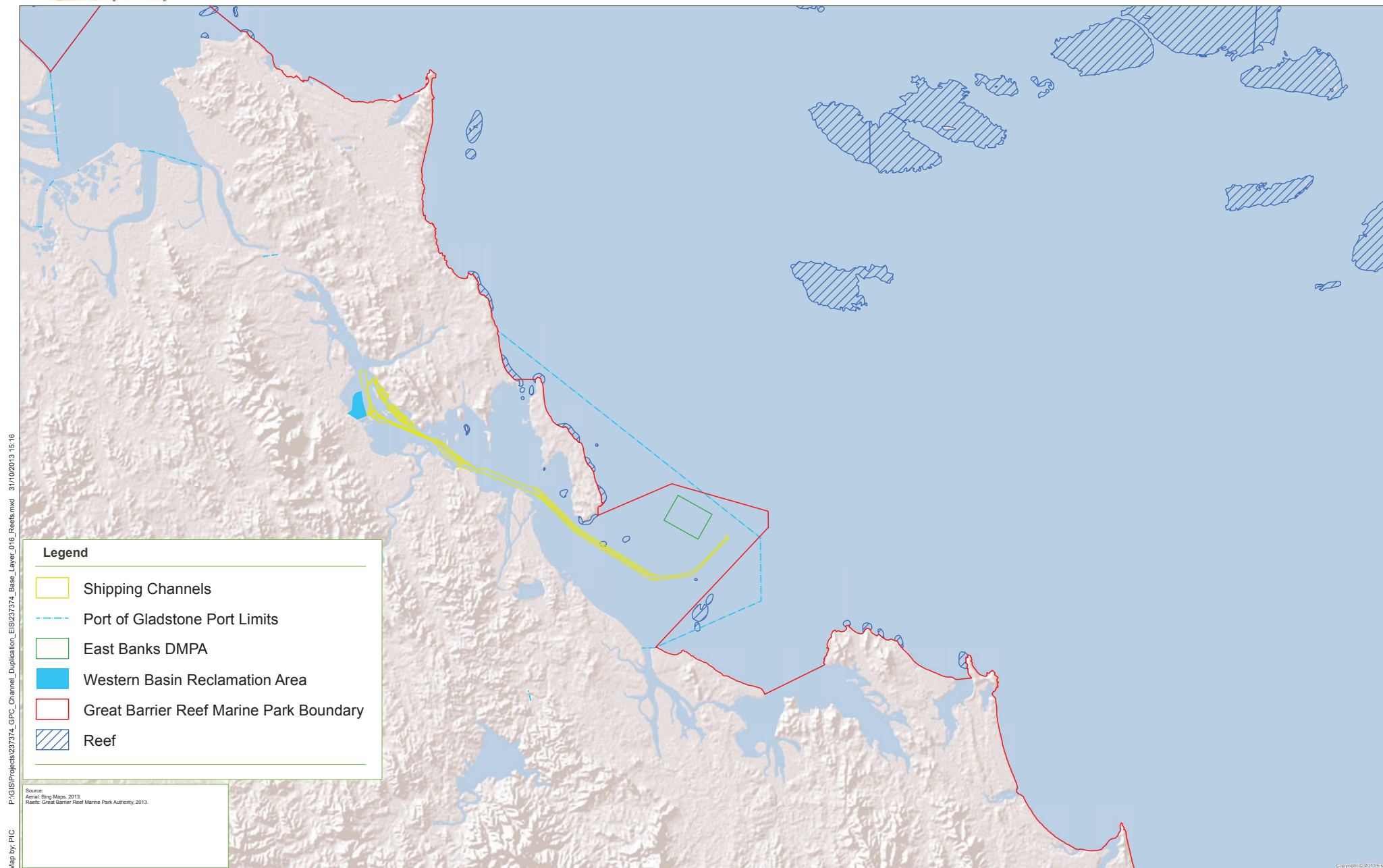
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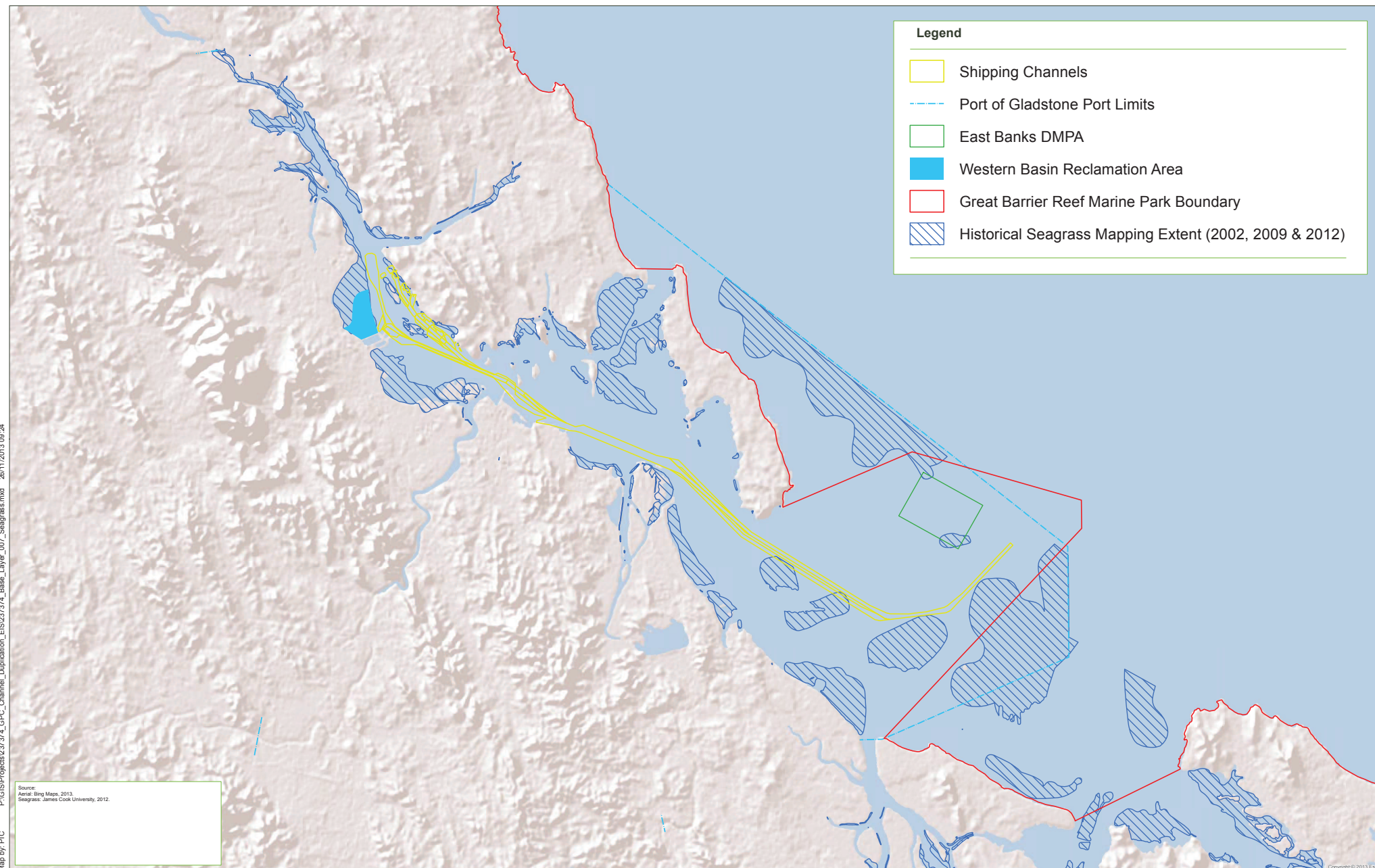
Port of Gladstone Channel Duplication EIS

Figure 10: Nationally Important Wetlands

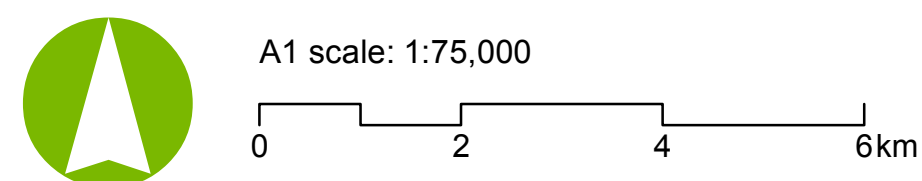
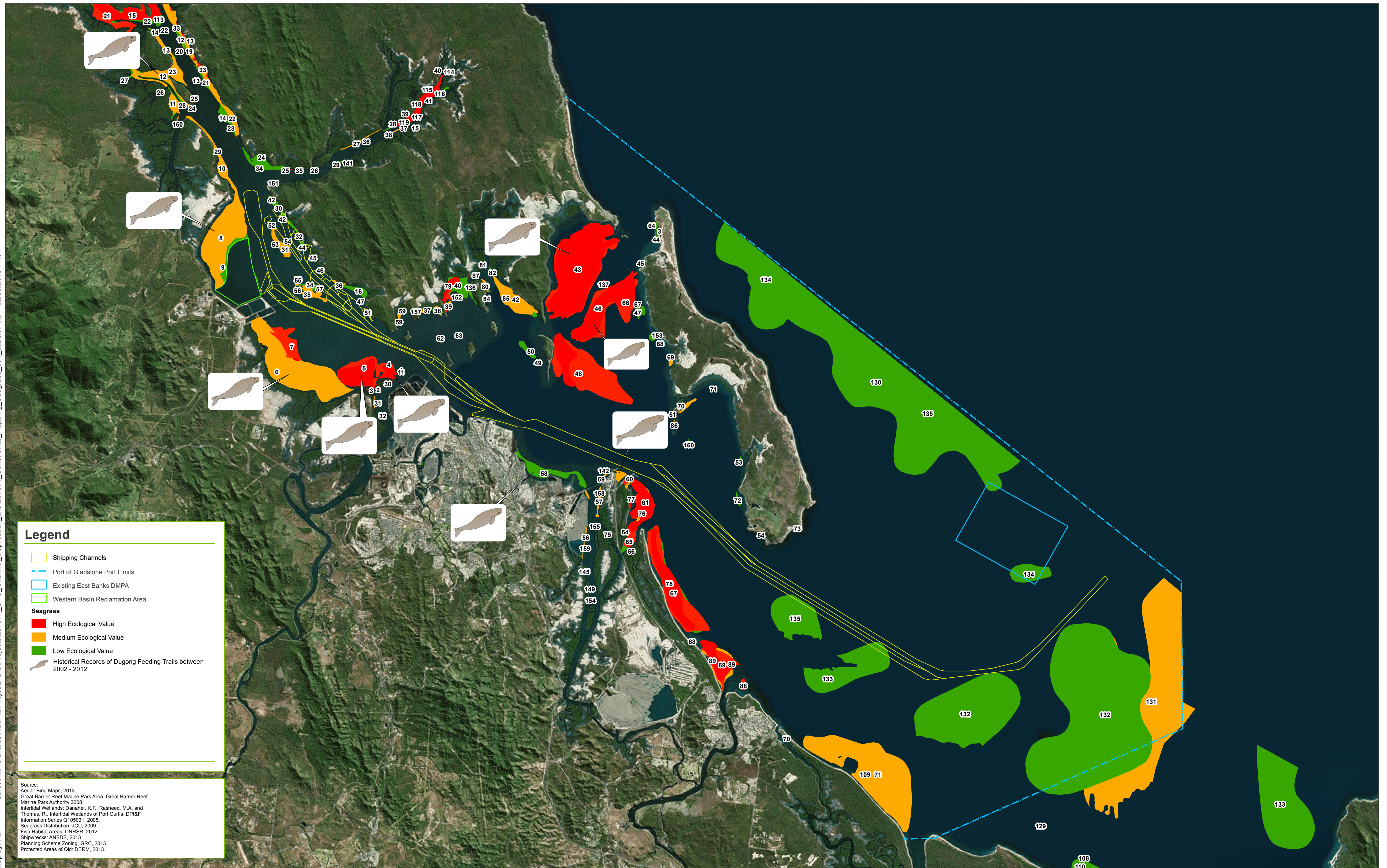






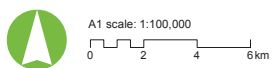
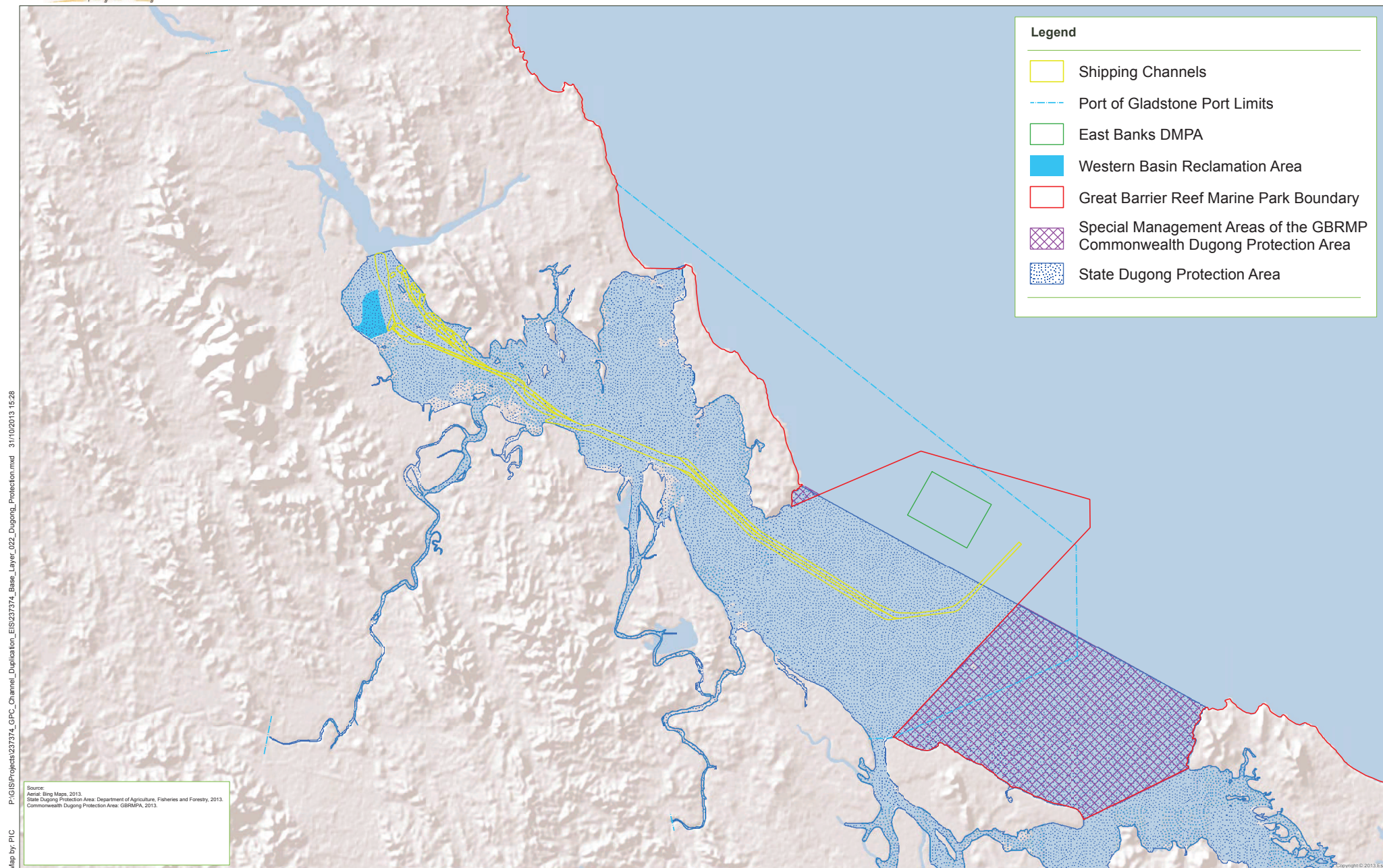


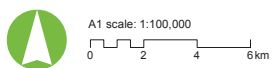
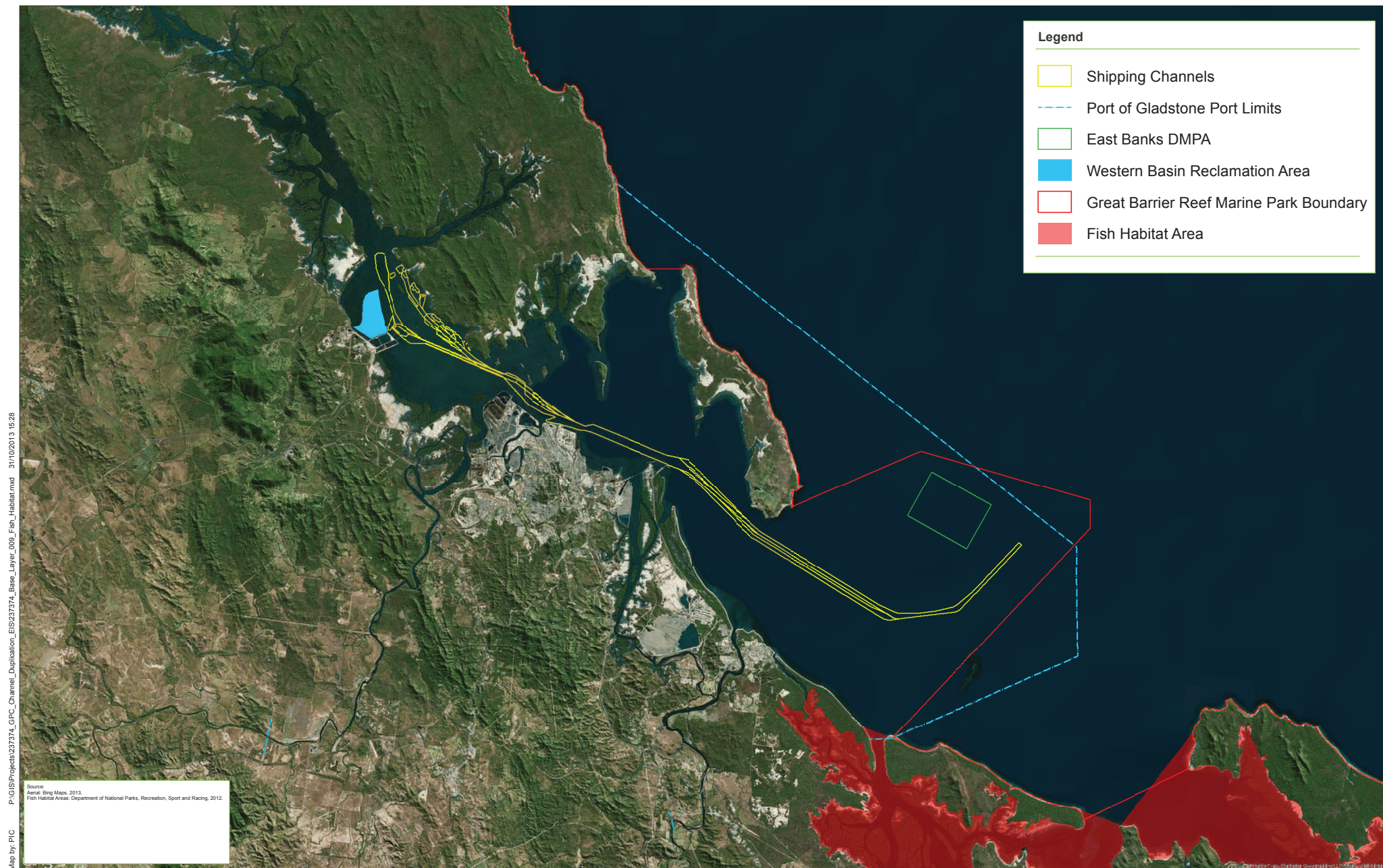
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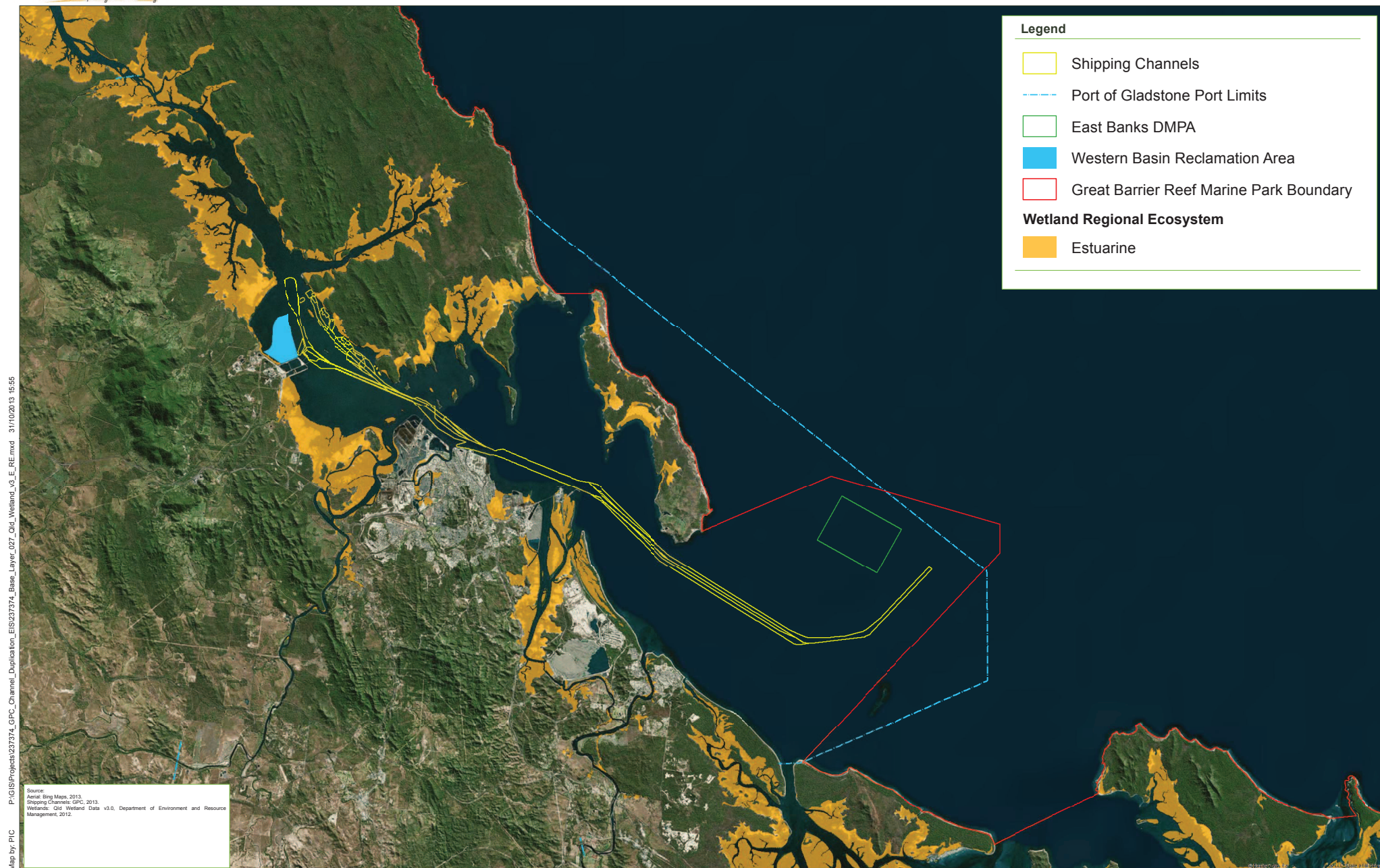


Date: 11/02/2015 Version: 3 Job No: 237374
Coordinate system: GDA_1994_MGA_Zone_56

Port of Gladstone Channel Duplication EIS
Figure 14b: Comparative Seagrass Ecological Values







A1 scale: 1:100,000

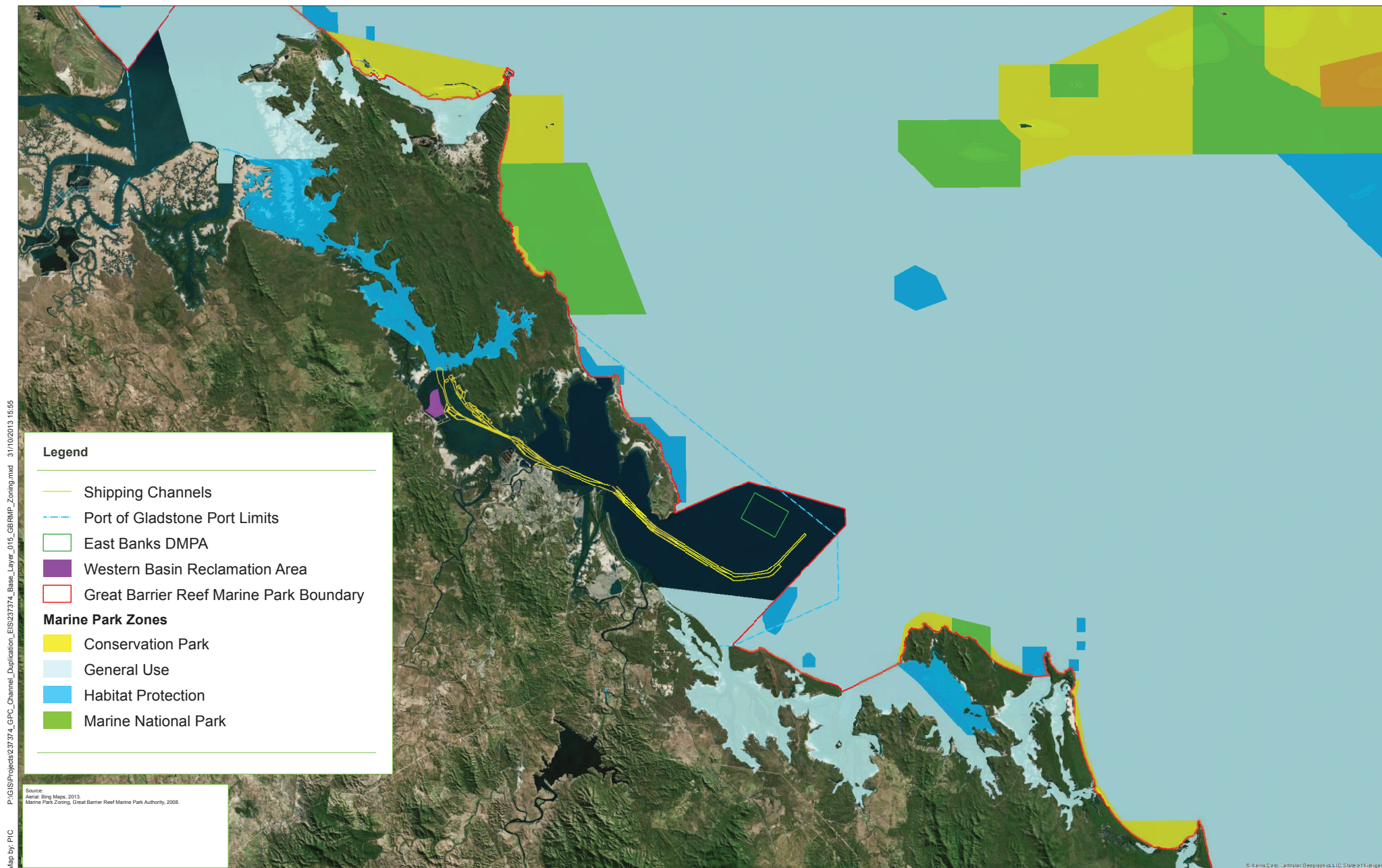
0 2 4 6 8 km

Date: 31/10/2013 Version: 1 Job No: 237374

Coordinate system: GDA_1994_MGA_Zone_56

Port of Gladstone Channel Duplication EIS

Figure 17: Estuarine Wetland Regional Ecosystems



A1 scale: 1:175,000

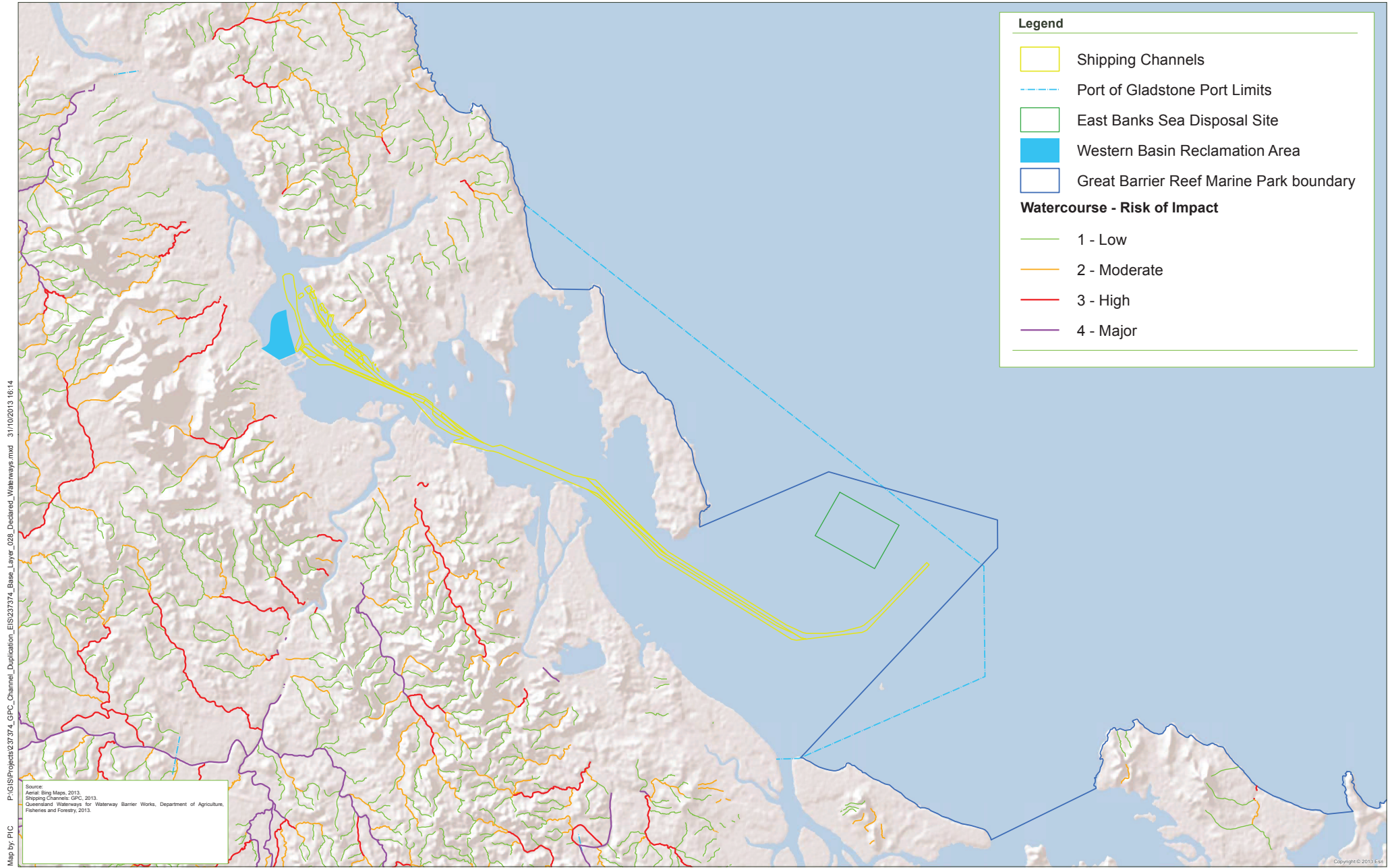
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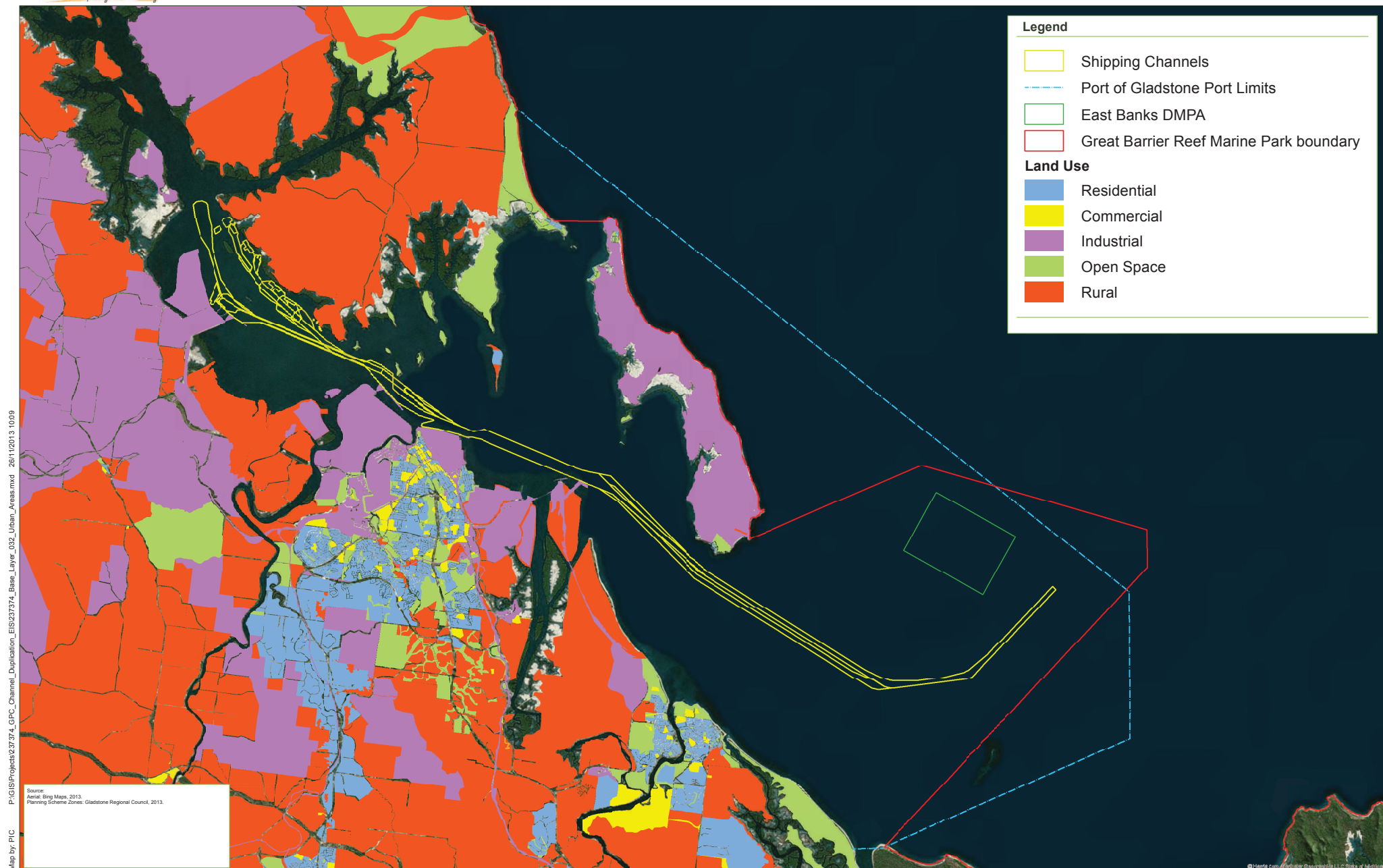
Date: 31/10/2013 Version: 1 Job No: 237374

Coordinate system: GDA_1994_MGA_Zone_56

Port of Gladstone Channel Duplication EIS

Figure 18: Great Barrier Reef Marine Park and State Marine Park Zoning





THE COORDINATOR - GENERAL

GLADSTONE STATE DEVELOPMENT AREA

DESIGNATION MAP

Disclaimer
(i) The Coordinator-General accepts no responsibility for any loss or damage suffered howsoever arising to any person or corporation who may use or rely on this plan in contravention of the terms of this clause or clauses (ii) & (iii)
(ii) The dimensions, areas, number of lots, size & location of corridor information are approximate only and may vary.
(iii) This plan may not be copied unless this note is included.

Legend

- Aldoga Precinct
- Clinton Precinct
- Corridor Buffer Area Precinct
- Curtis Island Industry Precinct
- Curtis Island Environmental Management Precinct
- Kangaroo Island Environmental Management Precinct
- Materials Transportation & Services Corridor Precinct
- Sub-Precinct Boundary
- Stuart Oil Shale Reserve Preservation Area
- Targinnie Precinct
- Yarwun Precinct



DATUM: MGA56 GDA84

SCALE: A3
1:120000



While every care is taken to ensure the accuracy of this data, the Department of Natural Resources and Water makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaims all responsibility and all liability (including without limitation, liability in negligence) for all expenses, losses, damages (including indirect or consequential damage) and costs which might be incurred as a result of the data being inaccurate or incomplete in any way and for any reason.



Queensland Government
The Coordinator-General

FILE REF:

GSDA_001_057

VERSION: 01

DATE: 15-11-2010

KANGAROO ISLAND
ENVIRONMENTAL MANAGEMENT PRECINCT

CURTIS ISLAND
ENVIRONMENTAL MANAGEMENT PRECINCT

CURTIS ISLAND
INDUSTRY PRECINCT

Curtis Island Corridor
Sub-Precinct

STUART OIL SHALE RESERVE
PRESERVATION AREA

CLINTON PRECINCT

YARWUN PRECINCT

CORRIDOR BUFFER
AREA PRECINCT

Boat Creek Corridor
Sub-Precinct

Western Corridor
Sub-Precinct

ALDOGA PRECINCT
MATERIALS TRANSPORTATION &
SERVICES CORRIDOR PRECINCT

TARGINNIE PRECINCT

TARGINNIE PRECINCT

Northern Infrastructure Corridor
Sub-Precinct



STRATEGIC PORT LAND HOLDINGS

LEGEND

Strategic Port Land.....

Map A



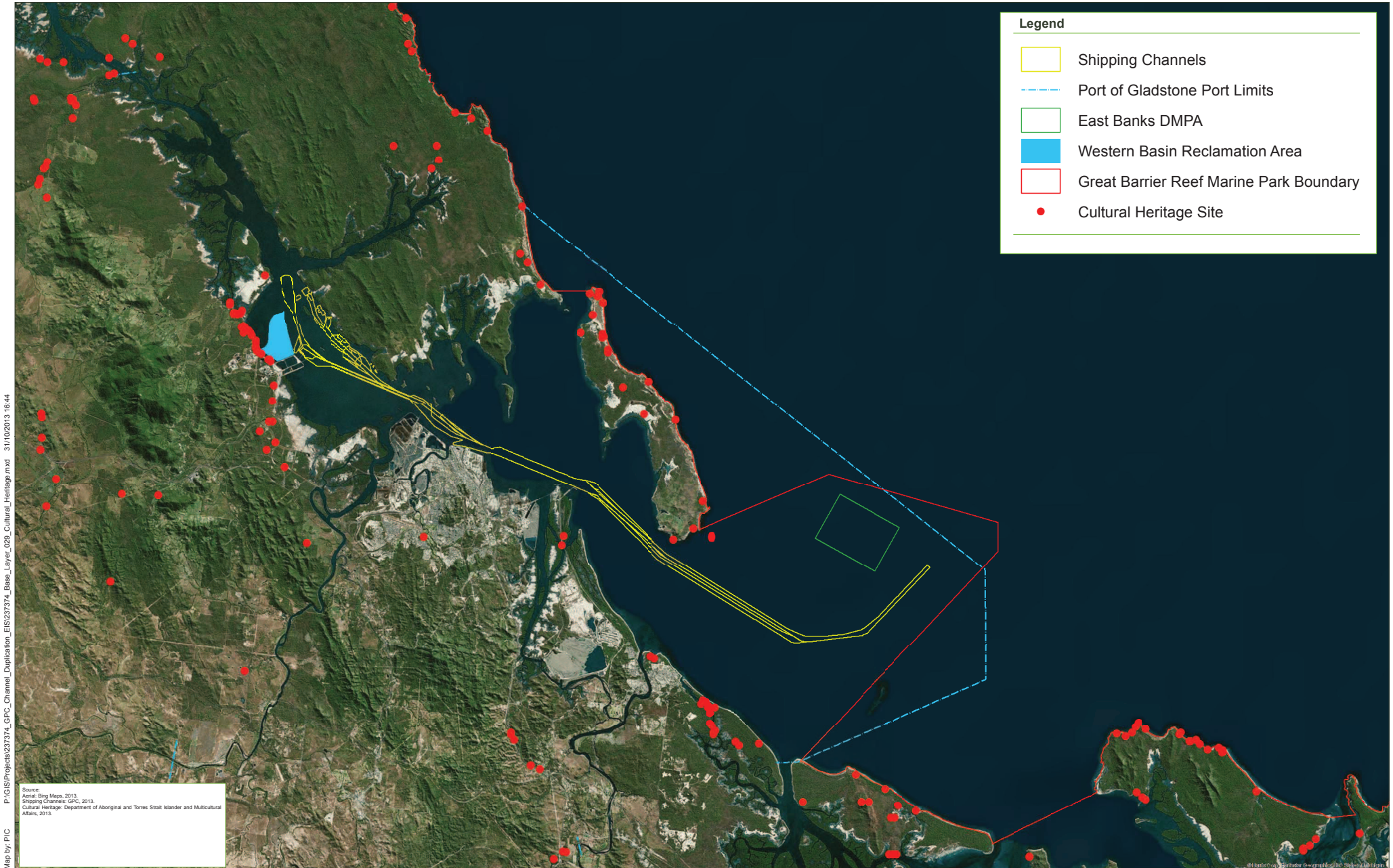
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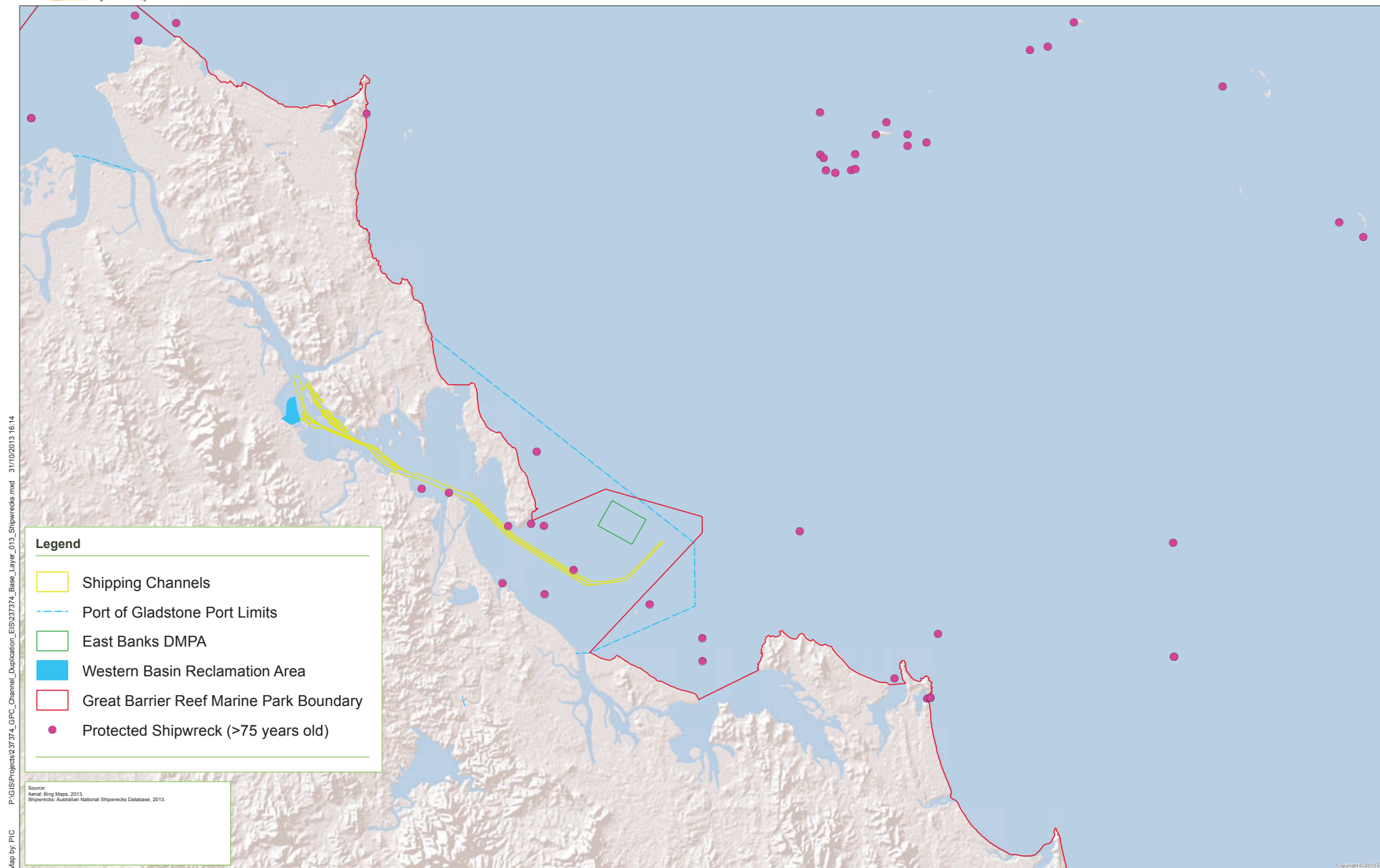
Projection: GDA 1994 - MGA Zone 56



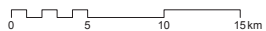
Gladstone Ports Corporation

Growth. Prosperity. Community.





A1 scale: 1:175,000

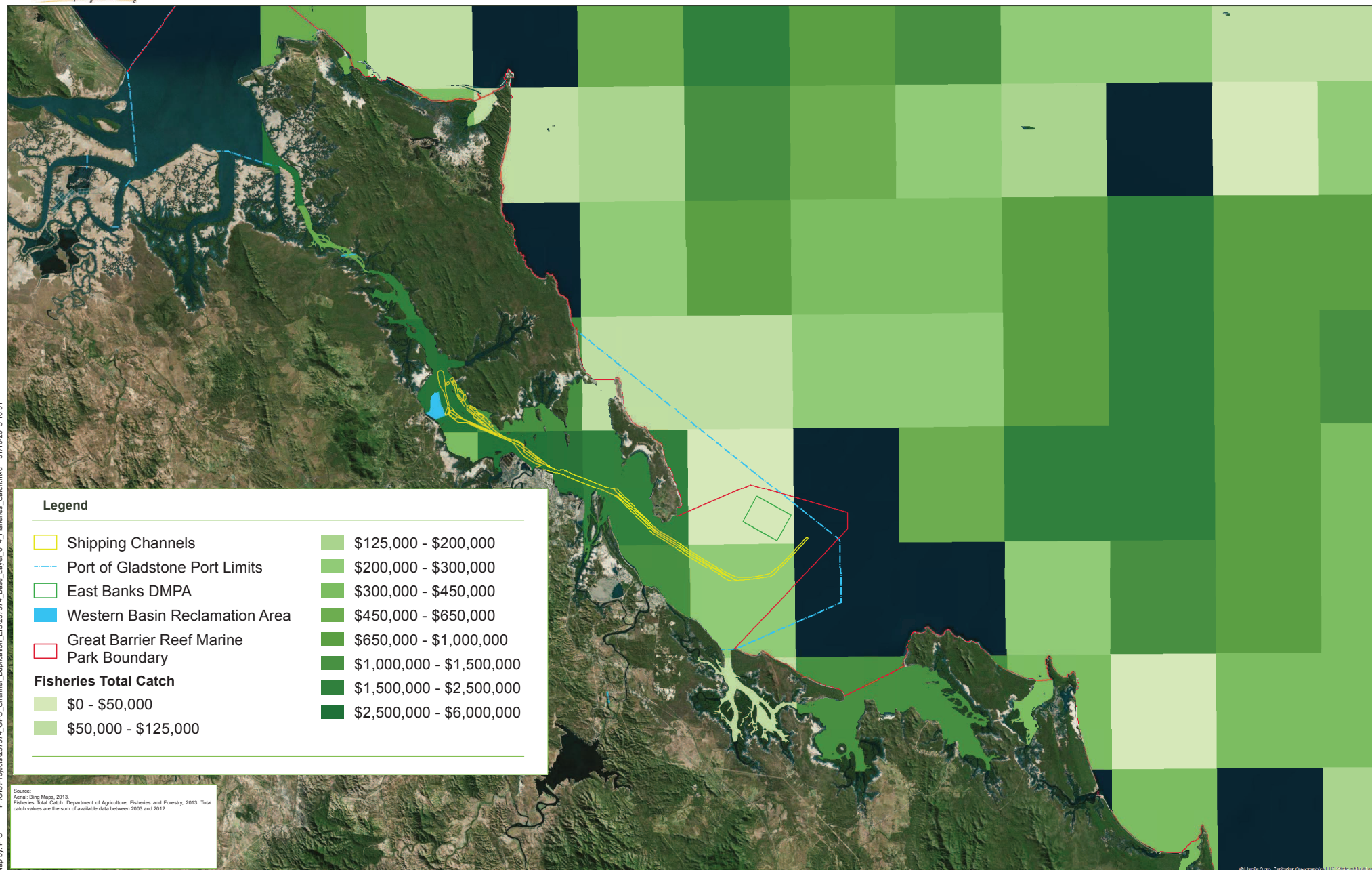


Date: 31/10/2013 Version: 1 Job No: 237374

Coordinate system: GDA_1994_MGA_Zone_56

Port of Gladstone Channel Duplication EIS

Figure 22: Protected Shipwrecks



Map by: GPC
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A1 scale: 1:175,000

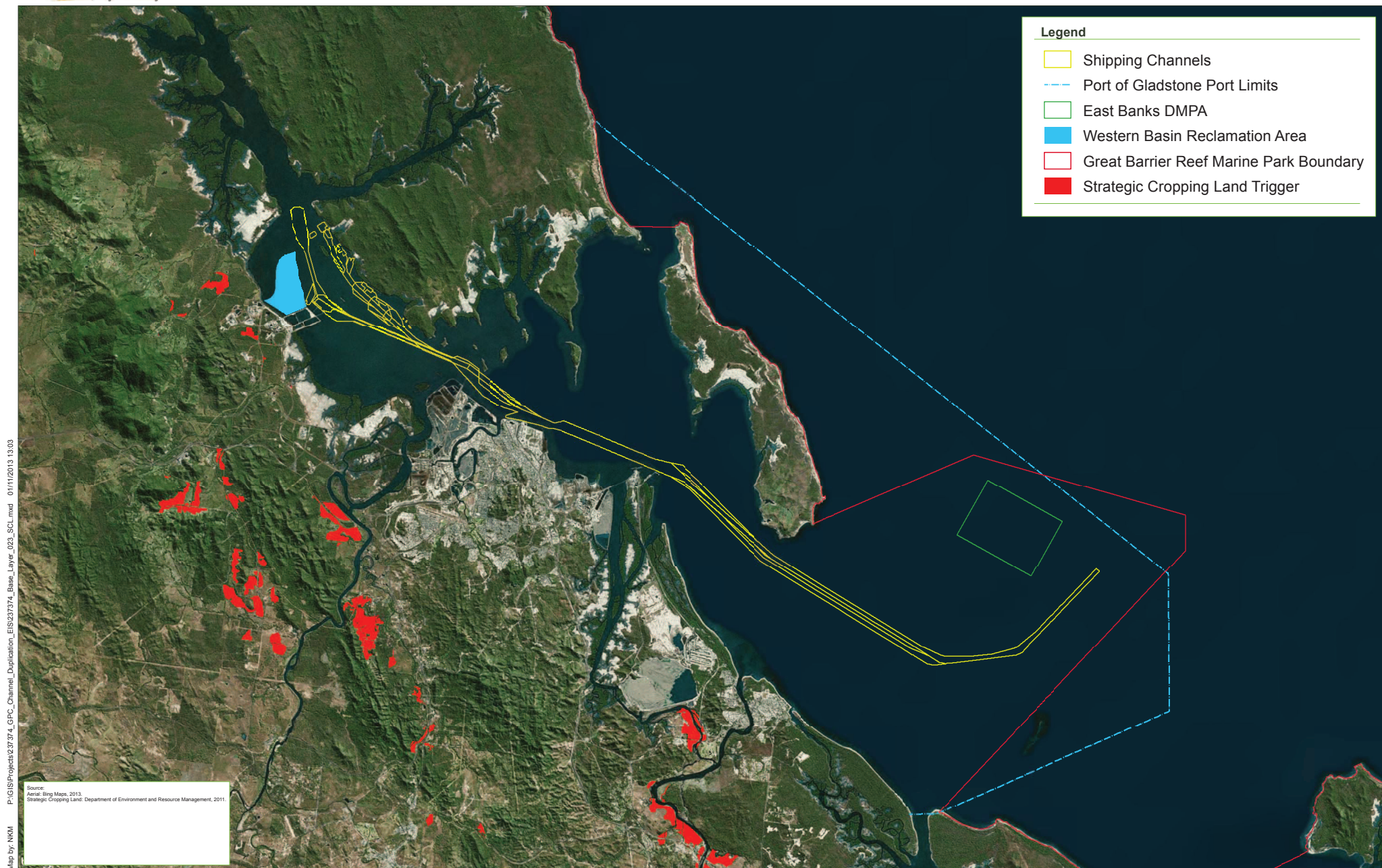


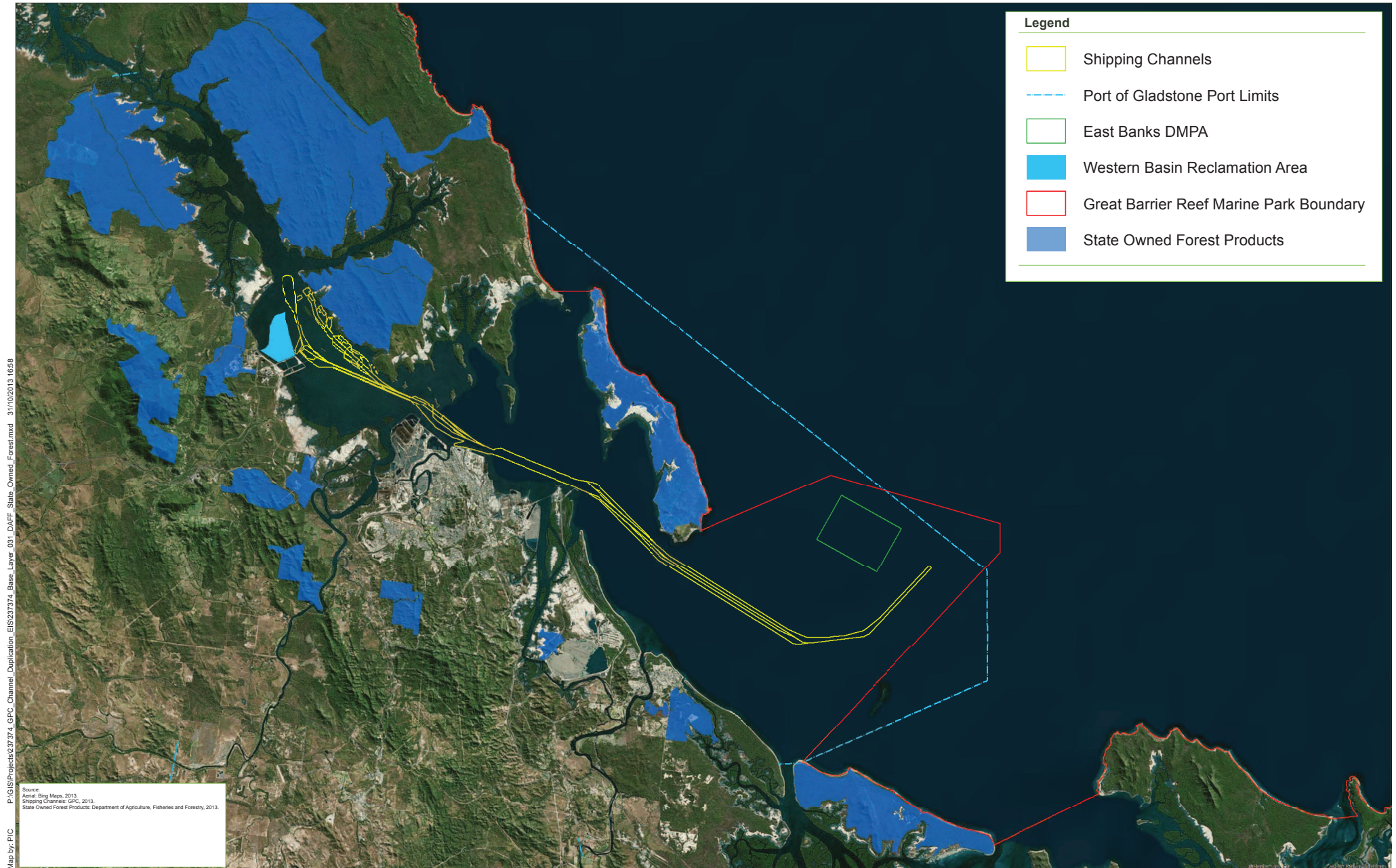
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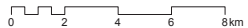
Port of Gladstone Channel Duplication EIS

Figure 23: Commercial Fisheries Values





A1 scale: 1:100,000

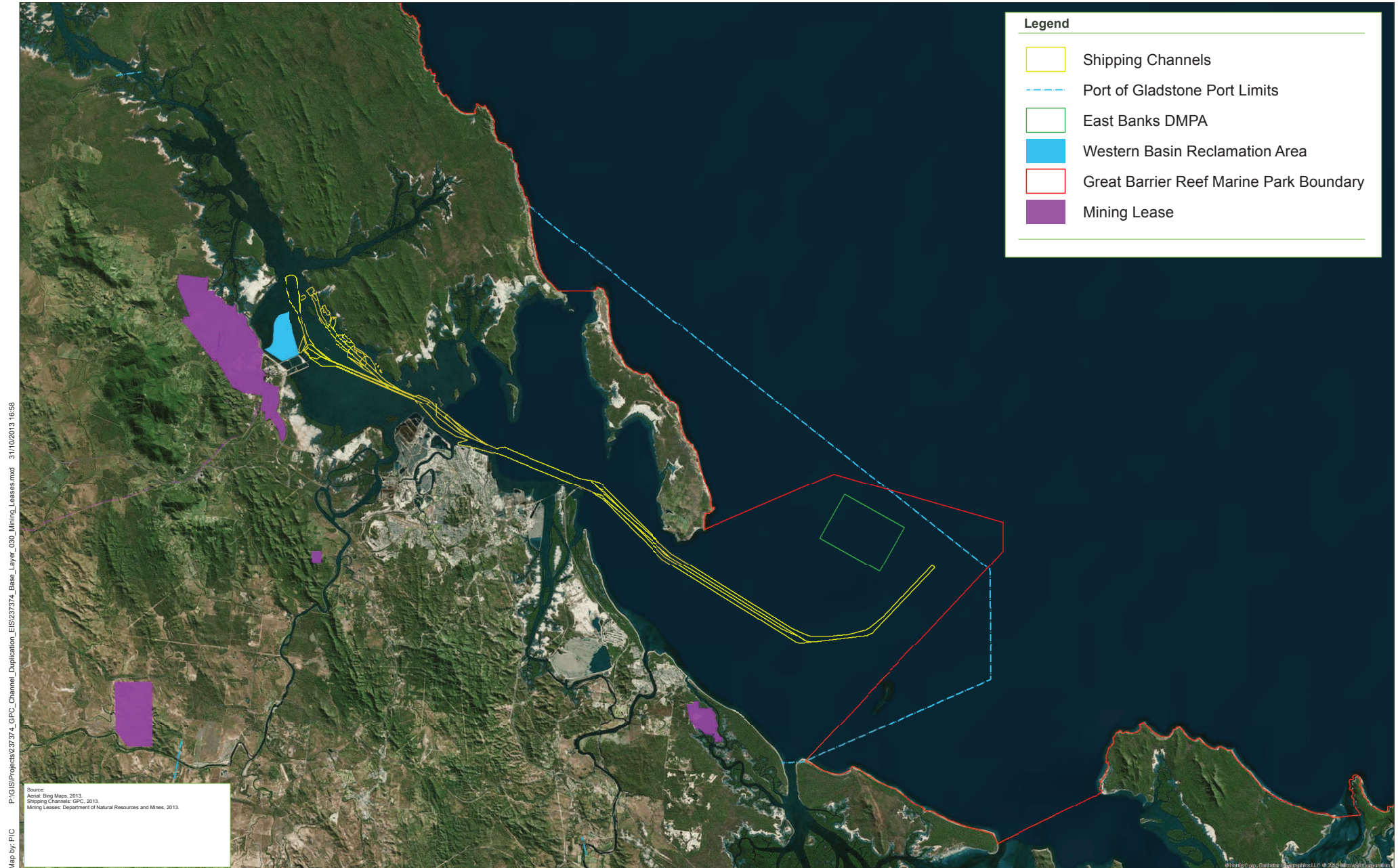


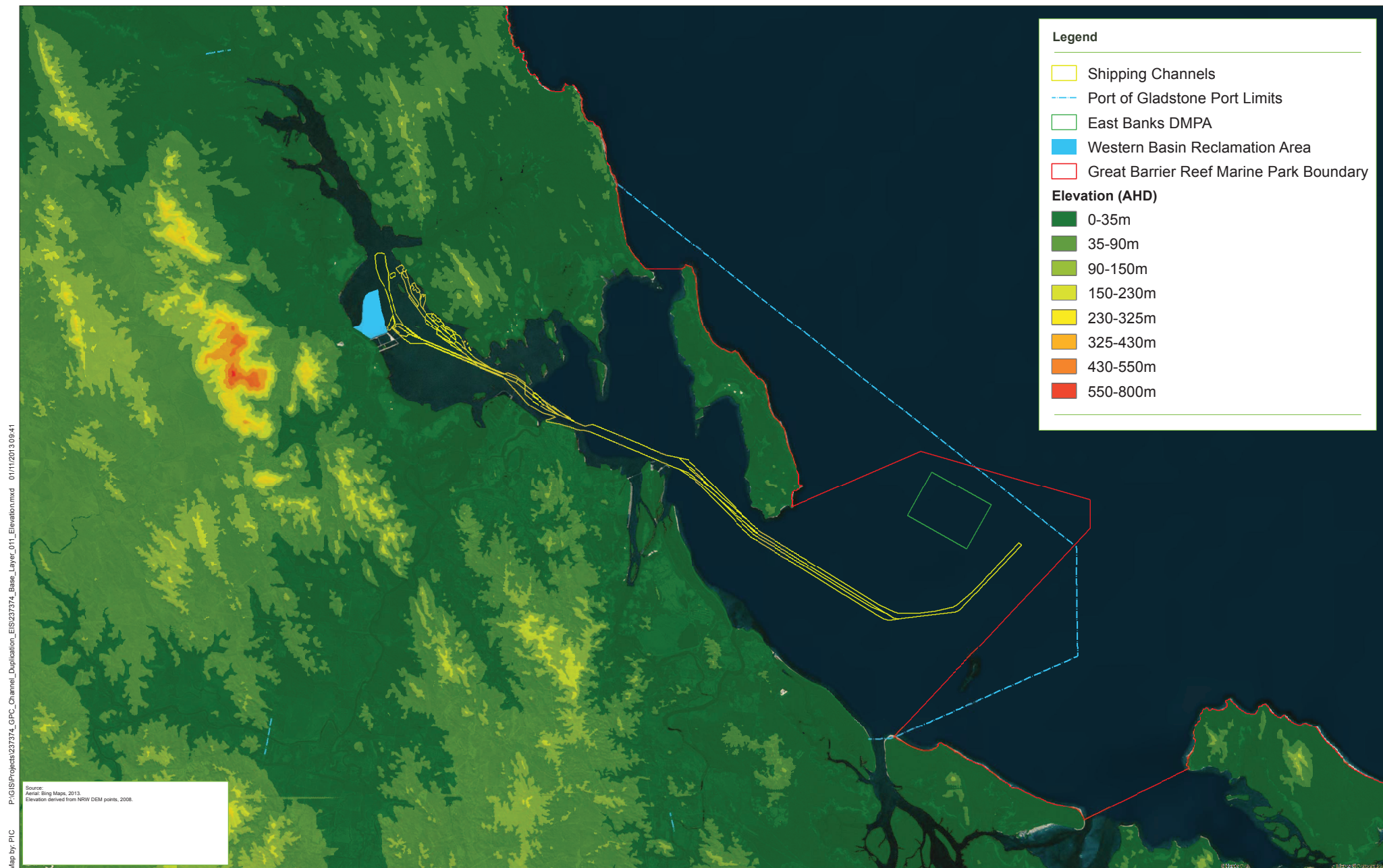
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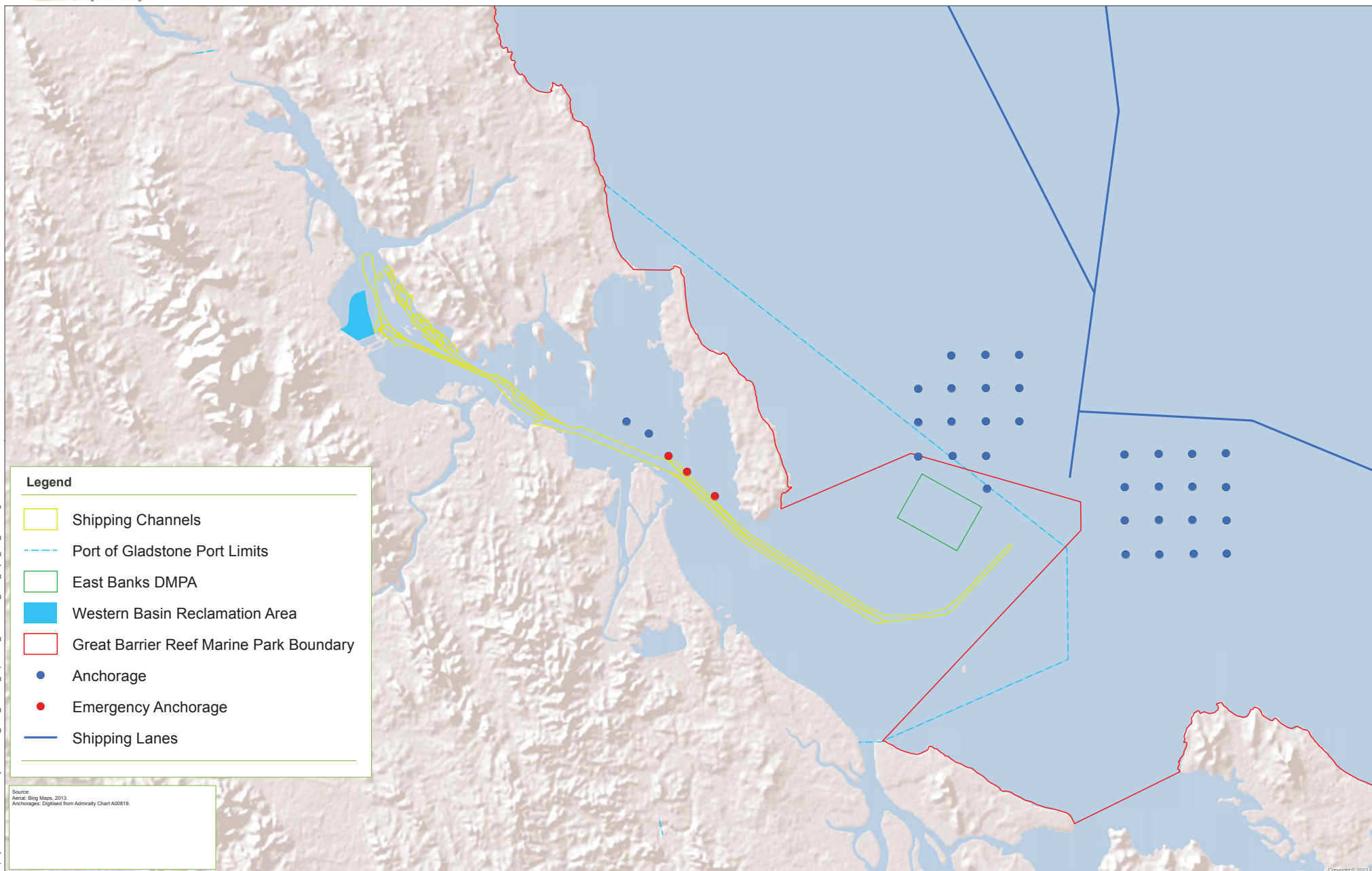
Port of Gladstone Channel Duplication EIS

Figure 25: State Owned Forest Products





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Map by: GPC





Appendix F

Multi-Criteria Analysis (MCA) Outcomes

Port of Gladstone Gatcombe and Golding Cutting Channel Duplication EIS
Multi-Criteria Analysis Workshop (27 and 28 November 2013)

		1	2	3	4	5	6	7	8	9	10	11
		Kangaroo Island	Western Basin Expansion	Fisherman's Landing Expansion (South)	Boat Creek South	Gladstone Mt Larcom Road (South)	Port Central Expansion	Facing Island Bay	Facing Island (South)	West Banks Island Reclamation	East Banks Island Reclamation	East Banks DMPA Expansion (at sea)
MCA Objectives	Weightings											
1. Aquatic environmental objectives												
DoE	25	220	120	120	220	400	260	140	140	260	340	300
DEHP	25	200	100	100	200	300	300	200	200	300	350	275
DAFF	33	150	150	150	150	405	265	150	150	385	315	265
GBRMPA	50	240	140	140	240	340	420	140	140	420	360	240
CG/DSDIP	25	200	180	180	300	480	350	230	230	250	320	300
DSITIA	40	100	100	100	140	310	240	100	100	230	360	400
GPC	25	167	100	100	200	333	300	167	167	267	267	367
1 Average	32	182	127	127	207	367	305	161	161	302	330	307
1 Consensus	32	191	127	127	207	367	305	161	161	302	330	307
1 Rank		7	10	10	6	1	4	8	8	5	2	3
2. Terrestrial environmental objectives												
DoE	25	250	300	250	250	450	450	200	200	350	350	500
DEHP	25	300	300	300	300	400	500	200	200	350	350	450
DAFF	28	200	250	250	250	500	450	150	150	350	350	500
GBRMPA	25	300	370	370	370	500	500	160	160	290	290	500
CG/DSDIP	25	280	440	320	500	380	420	280	280	560	560	500
DSITIA	10	270	270	270	270	360	600	240	100	410	410	500
GPC	25	200	350	350	300	450	400	250	250	350	350	500
2 Average	23.3	257	326	301	320	434	474	211	191	380	380	493
2 Consensus	23	245	326	301	320	434	474	211	191	380	380	493
2 Rank		9	6	8	7	3	2	10	11	4	4	1
3. Social and cultural heritage objectives												
DoE	25	240	220	250	340	400	310	170	170	200	230	410
DEHP	25	310	340	500	500	530	520	310	310	470	470	460
DAFF	21	225	275	250	350	475	475	125	125	275	300	450
GBRMPA	15	320	340	370	370	490	560	100	100	240	240	300
CG/DSDIP	25	360	330	360	430	450	400	180	180	330	380	450
DSITIA	20	275	300	325	375	375	450	100	100	175	325	450
GPC	25	300	275	300	425	450	475	175	175	200	225	475
3 Average	22.3	290	297	336	399	453	456	166	166	270	310	428
3 Consensus	22	283	297	336	399	453	456	166	166	270	310	428
3 Rank		8	7	5	4	2	1	10	10	9	6	3
4. Economic objectives												
DoE	25	220	260	260	320	450	260	160	160	220	160	330
DEHP	25	280	280	280	280	300	280	220	220	180	180	320
DAFF	18	205	270	270	305	405	235	135	135	170	135	355
GBRMPA	10	370	260	260	440	450	470	160	160	370	370	210
CG/DSDIP	25	200	260	260	330	440	210	140	140	180	140	370
DSITIA	30	210	260	260	310	430	250	150	150	200	150	350
GPC	25	200	267	267	300	400	233	133	133	167	133	367
4 Average	22.6	241	265	265	326	411	277	157	157	212	181	329
4 Consensus	23	234	265	265	326	411	277	157	157	212	181	329
4 Rank		7	5	5	3	1	4	10	10	8	9	2
Total (/100)												
DoE	100	233	225	220	283	425	320	168	168	258	270	385
DEHP	100	273	255	295	320	383	400	233	233	325	338	376
DAFF	100	190	226	221	248	446	356	142	142	313	289	386
GBRMPA	100	280	240	244	312	414	466	141	141	356	326	311
CG/DSDIP	100	260	303	280	390	438	345	208	208	330	350	405
DSITIA	100	185	205	210	251	364	321	129	115	228	295	405
GPC	100	217	248	254	306	408	352	181	181	246	244	427
Total Average	100	237	242	246	303	412	372	173	168	293	304	382
Total Consensus	100	234	242	245	303	411	371	173	168	292	303	381
Total Rank		9	8	7	4	1	3	10	11	6	4	2

Port of Gladstone Gatcombe and Golding Cutting Channel Duplication EIS
Multi-Criteria Analysis Workshop (27 and 28 November 2013)

			1		2		3		4		5		6		7		8		9		10		11	
MCA Objectives			Kangaroo Island		Western Basin Expansion		Fisherman's Landing Expansion		Boat Creek South		Gladstone Mt Larcom Road (South)		Port Central Expansion		Facing Island Bay		Facing Island (South)		West Banks Island Reclamation		East Banks Island Reclamation		East Banks DMPA Expansion (at sea)	
Organisation			Weight																					
1. Aquatic environmental objectives			1. Aquatic		Score	WScore	Score	WScore	Score	WScore	Score	WScore	Score	WScore	Score	WScore	Score	WScore	Score	WScore	Score	WScore	Score	WScore
1.1 Avoid or minimise irrevocable impact on aquatic ecosystem sensitive receptors (ie permanent loss of the GBRWHA OUVs, including but not limited to seagrass meadows, mangroves, saltmarsh intertidal area)	DoE	40	2	80	1	40	1	40	2	80	4	160	3	120	1	40	1	40	2	80	3	120	3	120
	DEHP	50	2	100	1	50	1	50	2	100	4	200	4	200	2	100	2	100	3	150	4	200	3	150
	DAFF	50	1	50	1	50	1	50	1	50	4	200	3	150	1	50	1	50	4	200	4	200	3	150
	GBRMPA	40	2	80	1	40	1	40	2	80	3	120	4	160	1	40	1	40	4	160	3	120	2	80
	CG/DSDIP	20	2	40	1	20	1	20	2	40	4	80	3	60	2	40	2	40	2	40	4	80	3	60
	DSITIA	40	1	40	1	40	1	40	2	80	4	160	3	120	1	40	1	40	2	80	3	120	4	160
	GPC	33	2	67	1	33	1	33	2	67	3	100	3	100	2	67	2	67	3	100	3	100	4	133
	1.1 Average	39.0	1.7	65.2	1.0	39.0	1.0	39.0	1.9	71.0	3.7	145.7	3.3	130.0	1.4	53.8	1.4	53.8	2.9	115.7	3.4	134.3	3.1	121.9
	1.1 Consensus	45.0	1.7	76.5	1.0	45.0	1.0	45.0	1.9	85.5	3.7	166.5	3.3	148.5	1.4	63.0	1.4	63.0	2.9	130.5	3.4	153.0	3.1	139.5
1.2 Avoid or minimise short term water quality and other ecological impacts (e.g. occurrence of sediment plume) on aquatic and/or coastal ecosystem sensitive receptors (i.e. minimise short term impact on the GBRWHA OUVs, including but not limited to seagrass meadows, coral/rocky reef, declared Fish Habitat Areas, turtle nesting beaches, Great Barrier Reef Marine Park)	DoE	20	3	60	2	40	2	40	3	60	4	80	3	60	1	20	1	20	3	60	3	60	3	60
	DEHP	25	1	25	1	25	1	25	1	25	1	25	1	25	1	25	1	25	3	75	3	75	2	50
	DAFF	15	2	30	2	30	2	30	2	30	2	30	3	45	2	30	2	30	3	45	3	45	3	45
	GBRMPA	40	2	80	1	40	1	40	2	80	3	120	4	160	1	40	1	40	4	160	4	160	2	80
	CG/DSDIP	50	2	100	2	100	2	100	4	200	5	250	4	200	2	100	2	100	3	150	3	150	3	150
	DSITIA	30	1	30	1	30	1	30	1	30	2	60	2	60	1	30	1	30	3	90	4	120	4	120
	GPC	33	1	33	1	33	1	33	2	67	3	100	3	100	1	33	1	33	3	100	3	100	4	133
	1.2 Average	30.5	1.7	51.2	1.4	42.6	1.4	42.6	2.1	70.2	2.9	95.0	2.9	92.9	1.3	39.8	1.3	39.8	3.1	97.1	3.3	101.4	3.0	91.2
	1.2 Consensus	20.0	1.7	34.0	1.4	28.0	1.4	28.0	2.1	42.0	2.9	58.0	2.9	58.0	1.3	26.0	1.3	26.0	3.1	62.0	3.3	66.0	3.0	60.0
1.3 Avoid or minimise impact on listed threatened, migratory and other protected marine fauna species (including the GBRWHA OUV biodiversity conservation attributes, and species listed under the EPBC Act, GBRMP Act and NC Act) and their habitat	DoE	40	2	80	1	40	1	40	2	80	4	160	2	80	2	80	2	80	3	120	4	160	3	120
	DEHP	25	3	75	1	25	1	25	3	75	3	75	3	75	3	75	3	75	3	75	3	75	3	75
	DAFF	35	2	70	2	70	2	70	2	70	5	175	2	70	2	70	2	70	4	140	2	70	2	70
	GBRMPA	20	4	80	3	60	3	60	4	80	5	100	5	100	3	60	3	60	5	100	4	80	4	80
	CG/DSDIP	30	2	60	2	60	2	60	2	60	5	150	3	90	3	90	3	90	2	60	3	90	3	90
	DSITIA	30	1	30	1	30	1	30	1	30	3	90	2	60	1	30	1	30	2	60	4	120	4	120
	GPC	33	2	67	1	33	1	33	2	67	4	133	3	100	2	67	2	67	2	67	2	67	3	100
	1.3 Average	30.5	2.3	66.0	1.6	45.5	1.6	45.5	2.3	66.0	4.1	126.2	2.9	82.1	2.3	67.4	2.3	67.4	3.0	88.8	3.1	94.5	3.1	93.6
	1.3 Consensus	35.0	2.3	80.5	1.9	66.5	1.9	66.5	2.3	80.5	4.1	143.5	2.9	101.5	2.3	80.5	2.3	80.5	3.0	105.0	3.1	108.5	3.1	108.5
	DoE	100	220		120		120		220		400		260		140		140		260		340		300	
	DEHP	100	200		100		100		200		300		300		200		200		300		350		275	
	DAFF	100	150		150		150		150		405		265		150		150		385		315		265	
	GBRMPA	100	240		140		140		240		340		420		140		140		420		360		240	
	CG/DSDIP	100	200		180		180		300		480		350		230		230		250		320		300	
	DSITIA	100	100		100		100		140		310		240		100		100		230		360		400	
	GPC	100	167		100		100		200		333.33		300		166.67		166.67		266.67		266.67		366.67	
	1 Average		182.4		127.1		127.1		207.1		366.9		305.0		161.0		161.0		301.7		330.2		306.7	
	1 Consensus		191.0		139.5		139.5		208.0		368.0		308.0		169.5		169.5		297.5		327.5		308.0	
	1 Rank		7		10		10		6		1		3		8		8		5		2		3	

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			1		2		3		4		5		6		7		8		9		10		11	
			Kangaroo Island		Western Basin Expansion		Fisherman's Landing Expansion		Boat Creek South		Gladstone Mt Larcom Road (South)		Port Central Expansion		Facing Island Bay		Facing Island (South)		West Banks Island Reclamation		East Banks Island Reclamation		East Banks DMPA Expansion (at sea)	
MCA Objectives	Organisation	Weight																						
2. Terrestrial environmental objectives	2. Terrestrial		Score	WScore	Score	WScore	Score	WScore	Score	WScore	Score	WScore	Score	WScore	Score	WScore	Score	WScore	Score	WScore	Score	WScore	Score	WScore
2.1 Avoid or minimise impacts on significant terrestrial vegetation communities (ie MNES (TECs and threatened species) and MSES (endangered or of concern regional ecosystems, habitat for threatened species))	DoE	50	3	150	4	200	3	150	3	150	4	200	5	250	3	150	3	150	5	250	5	250	5	250
	DEHP	50	3	150	3	150	3	150	3	150	5	250	6	300	3	150	3	150	5	250	5	250	5	250
	DAFF	50	2	100	2	100	2	100	2	100	5	250	5	250	2	100	2	100	5	250	5	250	5	250
	GBRMPA	30	3	90	3	90	3	90	3	90	5	150	5	150	3	90	3	90	5	150	5	150	5	150
	CG/DSDIP	60	2	120	4	240	2	120	5	300	3	180	5	300	2	120	2	120	6	360	6	360	5	300
	DSITIA	70	3	210	3	210	3	210	3	210	3	210	6	420	3	210	1	70	5	350	5	350	5	350
	GPC	50	2	100	3	150	3	150	2	100	4	200	5	250	2	100	2	100	5	250	5	250	5	250
	2.1 Average	51.4	2.6	131.4	3.1	162.9	2.7	138.6	3.0	157.1	4.1	205.7	5.3	274.3	2.6	131.4	2.3	111.4	5.1	265.7	5.1	265.7	5.0	257.1
	2.1 Consensus	50.0	2.6	130.0	3.1	155.0	2.7	135.0	3.0	150.0	4.1	205.0	5.3	265.0	2.6	130.0	2.3	115.0	5.1	255.0	5.1	255.0	5.0	250.0
2.2 Avoid or minimise impacts on natural aesthetic values and geological processes/heritage attributes as defined under the GBRWHA OUVs (e.g. Port Curtis islands, beaches, dune systems, fringing reefs)	DoE	50	2	100	2	100	2	100	2	100	5	250	4	200	1	50	1	50	2	100	2	100	5	250
	DEHP	50	3	150	3	150	3	150	3	150	3	150	4	200	1	50	1	50	2	100	2	100	4	200
	DAFF	50	2	100	3	150	3	150	3	150	5	250	4	200	1	50	1	50	2	100	2	100	5	250
	GBRMPA	70	3	210	4	280	4	280	4	280	5	350	5	350	1	70	1	70	2	140	2	140	5	350
	CG/DSDIP	40	4	160	5	200	5	200	5	200	5	200	3	120	4	160	4	160	5	200	5	200	5	200
	DSITIA	30	2	60	2	60	2	60	2	60	5	150	6	180	1	30	1	30	2	60	2	60	5	150
	GPC	50	2	100	4	200	4	200	4	200	5	250	3	150	3	150	3	150	2	100	2	100	5	250
	2.2 Average	48.6	2.6	125.7	3.3	162.9	3.3	162.9	3.3	162.9	4.7	228.6	4.1	200.0	1.7	80.0	1.7	80.0	2.4	114.3	2.4	114.3	4.9	235.7
	2.2 Consensus	50.0	2.3	115.0	3.0	150.0	3.0	150.0	3.0	150.0	4.7	235.0	4.3	215.0	1.4	70.0	1.4	70.0	1.9	95.0	1.9	95.0	4.9	245.0
	DoE	100	250		300		250		250		450		450		200		200		350		350		500	
	DEHP	100	300		300		300		300		400		500		200		200		350		350		450	
	DAFF	100	200		250		250		250		500		450		150		150		350		350		500	
	GBRMPA	100	300		370		370		370		500		500		160		160		290		290		500	
	CG/DSDIP	100	280		440		320		500		380		420		280		280		560		560		500	
	DSITIA	100	270		270		270		270		360		600		240		100		410		410		500	
	GPC	100	200		350		350		300		450		400		250		250		350		350		500	
	2 Average		257.1		325.7		301.4		320.0		434.3		474.3		211.4		191.4		380.0		380.0		492.9	
	2 Consensus		245.0		305.0		285.0		300.0		440.0		480.0		200.0		185.0		350.0		350.0		495.0	
	2 Rank		9		6		8		7		3		2		10		11		4		4		1	

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			1	2	3	4	5	6	7	8	9	10	11
			Kangaroo Island	Western Basin Expansion	Fisherman's Landing Expansion	Boat Creek South	Gladstone Mt Larcom Road (South)	Port Central Expansion	Facing Island Bay	Facing Island (South)	West Banks Island Reclamation	East Banks Island Reclamation	East Banks DMPA Expansion (at sea)
MCA Objectives	Organisation	Weight	Score WScore	Score WScore	Score WScore	Score WScore	Score WScore	Score WScore	Score WScore	Score WScore	Score W Score	Score W Score	Score W Score
3. Social and cultural heritage objectives	3 Social & Cultural		Score WScore	Score WScore	Score WScore	Score WScore	Score WScore	Score WScore	Score WScore	Score WScore	Score W Score	Score W Score	Score W Score
3.1 Maximise level of compatibility of the final placement location land use with adjoining land uses and future land use planning documents	DoE	10	3 30	4 40	4 40	4 40	4 40	4 40	4 40	2 20	2 20	2 20	5 50
	DEHP	40	4 160	6 240	6 240	6 240	6 240	6 240	6 240	6 240	5 200	5 200	4 160
	DAFF	25	2 50	4 100	3 75	4 100	5 125	5 125	1 25	1 25	3 75	3 75	4 100
	GBRMPA	10	2 20	4 40	4 40	4 40	4 40	5 50	1 10	1 10	3 30	3 30	3 30
	CG/DSDIP	40	5 200	5 200	5 200	5 200	5 200	3 120	3 120	3 120	5 200	5 200	5 200
	DSITIA	25	4 100	6 150	6 150	4 100	4 100	4 100	1 25	1 25	4 100	4 100	5 125
	GPC	25	3 75	4 100	4 100	5 125	5 125	5 125	2 50	2 50	2 50	2 50	5 125
	3.1 Average	25.0	3.3 90.7	4.7 124.3	4.6 120.7	4.6 120.7	4.7 124.3	4.6 114.3	2.3 70.0	2.3 70.0	3.4 96.4	3.4 96.4	4.4 112.9
	3.1 Consensus	25.0	3.3 82.5	4.7 117.5	4.6 115.0	4.6 115.0	4.7 117.5	4.6 115.0	2.0 50.0	2.0 50.0	3.4 85.0	3.4 85.0	4.4 110.0
3.2 Avoid and/or minimise impacts on Gladstone community and recreational activities associated with dredging, construction of containment bunds and placement impacts, and future operational land use of placement area)	DoE	30	2 60	2 60	2 60	3 90	4 120	2 60	2 60	2 60	2 60	2 60	4 120
	DEHP	10	5 50	4 40	4 40	4 40	5 50	6 60	2 20	2 20	5 50	5 50	5 50
	DAFF	25	2 50	2 50	2 50	2 50	5 125	4 100	2 50	2 50	2 50	2 50	5 125
	GBRMPA	30	4 120	4 120	4 120	4 120	5 150	6 180	1 30	1 30	2 60	2 60	3 90
	CG/DSDIP	20	3 60	3 60	3 60	5 100	5 100	4 80	1 20	1 20	2 40	3 60	4 80
	DSITIA	25	3 75	2 50	2 50	4 100	4 100	6 150	1 25	1 25	1 25	4 100	6 150
	GPC	25	3 75	2 50	2 50	4 100	4 100	4 100	2 50	2 50	2 50	2 50	5 125
	3.2 Average	23.6	3.1 70.0	2.7 61.4	2.7 61.4	3.7 85.7	4.6 106.4	4.6 104.3	1.6 36.4	1.6 36.4	2.3 47.9	2.9 61.4	4.6 105.7
	3.2 Consensus	25.0	3.1 77.5	2.7 67.5	2.7 67.5	3.9 97.5	4.6 115.0	4.6 115.0	1.6 40.0	1.6 40.0	2.3 57.5	2.9 72.5	4.6 115.0
3.3 Avoid or minimise impacts on opportunities for reasonable use, appreciation, enjoyment and understanding of the GBR region and adjacent coastline	DoE	30	2 60	2 60	2 60	3 90	4 120	2 60	2 60	2 60	2 60	2 60	4 120
	DEHP	10	2 20	2 20	2 20	2 20	4 40	2 20	1 10	1 10	2 20	2 20	5 50
	DAFF	25	3 75	3 75	3 75	4 100	5 125	5 125	1 25	1 25	3 75	4 100	5 125
	GBRMPA	30	2 60	2 60	2 60	2 60	5 150	6 180	1 30	1 30	2 60	2 60	3 90
	CG/DSDIP	10	1 10	1 10	1 10	1 10	3 30	5 50	1 10	1 10	3 30	3 30	5 50
	DSITIA	25	2 50	2 50	2 50	3 75	3 75	3 75	1 25	1 25	1 25	2 50	3 75
	GPC	25	3 75	3 75	3 75	4 100	5 125	5 125	2 50	2 50	2 50	2 50	5 125
	3.3 Average	22.1	2.1 50.0	2.1429 50.0	2.1429 50.0	2.7 65.0	4.1 95.0	4.0 90.7	1.3 30.0	1.3 30.0	2.1 45.7	2.4 52.9	4.3 90.7
	3.3 Consensus	20.0	2.1 42.0	2.1 42.0	2.1 42.0	2.7 54.0	4.1 82.0	4.0 80.0	1.3 26.0	1.3 26.0	2.1 42.0	2.4 48.0	4.3 86.0
3.4 Avoid or minimise impacts on cultural heritage values, including Traditional Owner/use values and heritage values	DoE	30	3 90	2 60	3 90	4 120	4 120	5 150	1 30	1 30	2 60	3 90	4 120
	DEHP	40	2 80	1 40	5 200	5 200	5 200	5 200	1 40	1 40	5 200	5 200	5 200
	DAFF	25	2 50	2 50	2 50	4 100	4 100	5 125	1 25	1 25	3 75	3 75	4 100
	GBRMPA	30	4 120	4 120	5 150	5 150	5 150	5 150	1 30	1 30	3 90	3 90	3 90
	CG/DSDIP	30	3 90	2 60	3 90	4 120	4 120	5 150	1 30	1 30	2 60	3 90	4 120
	DSITIA	25	2 50	2 50	3 75	4 100	4 100	5 125	1 25	1 25	1 25	3 75	4 100
	GPC/PCCC	25	3 75	2 50	3 75	4 100	4 100	5 125	1 25	1 25	2 50	3 75	4 100
	3.4 Average	29.3	2.7 79.3	2.1 61.4	3.4 104.3	4.3 127.1	4.3 127.1	5.0 146.4	1 29.3	1 29.3	2.6 80.0	3.3 99.3	4.0 118.6
	3.4 Consensus	30.0	2.7 81.0	2.1 63.0	3.4 102.0	4.3 129.0	4.3 129.0	5.0 150.0	1.0 30.0	1.0 30.0	2.6 78.0	3.3 99.0	4.0 120.0
	DoE	100	240	220	250	340	400	310	170	170	200	230	410
	DEHP	100	310	340	500	500	530	520	310	310	470	470	460
	DAFF	100	225	275	250	350	475	475	125	125	275	300	450
	GBRMPA	100	320	340	370	370	490	560	100	100	240	240	300
	CG/DSDIP	100	360	330	360	430	450	400	180	180	330	380	450
	DSITIA	100	275	300	325	375	375	450	100	100	175	325	450
	GPC	100	300	275	300	425	450	475	175	175	200	225	475
	3 Average		290.0	297.1	336.4	398.6	452.9	455.7	165.7	165.7	270.0	310.0	427.9
	3 Consensus		283.0	290.0	326.5	395.5	443.5	460.0	146.0	146.0	262.5	304.5	431.0
	3 Rank		8	7	5	4	2	1	10	10	9	6	3

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MCA Objectives			Organisation		Weight		1		2		3		4		5		6		7		8		9		10		11	
							Kangaroo Island		Western Basin Expansion		Fisherman's Landing Expansion (South)		Boat Creek South		Gladstone Mt Larcom Road (South)		Port Central Expansion		Facing Island Bay		Facing Island (South)		West Banks Island Reclamation		East Banks Island Reclamation		East Banks DMPA Expansion (at sea)	
4. Economic development			4. Economic development		Score	WScore	Score	WScore	Score	WScore	Score	WScore	Score	WScore	Score	WScore	Score	WScore	Score	WScore	Score	WScore	Score	WScore	Score	WScore	Score	WScore
4.1 Avoid or minimise impacts on ecosystem reliant commercial activities	DoE	60	2	120	2	120	2	120	3	180	5	300	3	180	2	120	2	120	3	180	2	120	3	180	2	120	4	240
	DEHP	40	2	80	2	80	2	80	2	80	3	120	3	120	2	80	2	80	3	120	3	120	3	120	3	120	4	160
	DAFF	35	2	70	2	70	2	70	3	105	5	175	3	105	2	70	2	70	3	105	2	70	3	105	2	70	4	140
	GBRMPA	60	4	240	2	120	2	120	5	300	5	300	5	300	2	120	2	120	4	240	4	240	4	240	4	240	2	120
	CG/DSDIP	40	2	80	2	80	2	80	3	120	5	200	3	120	2	80	2	80	3	120	2	80	3	120	2	80	4	160
	DSITIA	50	2	100	2	100	2	100	3	150	5	250	3	150	2	100	2	100	3	150	2	100	3	150	2	100	4	200
	GPC	33	2	67	2	67	2	67	3	100	5	167	3	100	2	67	2	67	3	100	2	67	3	100	2	67	4	133
	4.1 Average	45.5	2.3	108.1	2.0	91.0	2.0	91.0	3.1	147.9	4.7	216.0	3.3	153.6	2.0	91.0	2.0	91.0	3.1	145.0	2.4	113.8	3.7	164.8	3.7	164.8	3.7	164.8
	4.1 Consensus	45.0	2.3	103.5	2.0	90.0	2.0	90.0	3.1	139.5	4.7	211.5	3.3	148.5	2.0	90.0	2.0	90.0	3.1	139.5	2.4	108.0	3.7	166.5	3.7	166.5	3.7	166.5
4.2 Maximise cost efficiency of dredge method and dredge material placement	DoE	10	1	10	2	20	2	20	2	20	3	30	2	20	1	10	1	10	1	10	1	10	1	10	1	10	6	60
	DEHP	20	2	40	2	40	2	40	2	40	3	60	2	40	1	20	1	20	1	20	1	20	1	20	1	20	6	120
	DAFF	30	1	30	2	60	2	60	2	60	3	90	2	60	1	30	1	30	1	30	1	30	1	30	1	30	6	180
	GBRMPA	10	1	10	2	20	2	20	2	20	3	30	2	20	1	10	1	10	1	10	1	10	1	10	1	10	6	60
	CG/DSDIP	30	1	30	2	60	2	60	2	60	3	90	2	60	1	30	1	30	1	30	1	30	1	30	1	30	6	180
	DSITIA	20	1	20	2	40	2	40	2	40	3	60	2	40	1	20	1	20	1	20	1	20	1	20	1	20	6	120
	GPC	33	1	33	2	67	2	67	2	67	3	100	2	67	1	33	1	33	1	33	1	33	1	33	1	33	6	200
	4.2 Average	21.9	1.1	24.8	2	43.8	2	43.8	2	43.8	3.0	65.7	2	43.8	1	21.9	1	21.9	1	21.9	1	21.9	1	21.9	1	21.9	6.0	131.4
	4.2 Consensus	23.0	1.1	25.3	2.0	46.0	2.0	46.0	2.0	46.0	3	69.0	2.0	46.0	1.0	23.0	1.0	23.0	1.0	23.0	1.0	23.0	1.0	23.0	1.0	23.0	6.0	138.0
4.3 Maximise beneficial reuse of placement area or dredge material use	DoE	30	3	90	4	120	4	120	4	120	4	120	2	60	1	30	1	30	1	30	1	30	1	30	1	30	1	30
	DEHP	40	4	160	4	160	4	160	4	160	3	120	3	120	3	120	3	120	1	40	1	40	1	40	1	40	1	40
	DAFF	35	3	105	4	140	4	140	4	140	4	140	2	70	1	35	1	35	1	35	1	35	1	35	1	35	1	35
	GBRMPA	30	4	120	4	120	4	120	4	120	4	120	5	150	1	30	1	30	4	120	4	120	4	120	4	120	1	30
	CG/DSDIP	30	3	90	4	120	4	120	5	150	5	150	1	30	1	30	1	30	1	30	1	30	1	30	1	30	1	30
	DSITIA	30	3	90	4	120	4	120	4	120	4	120	4	120	2	60	1	30	1	30	1	30	1	30	1	30	1	30
	GPC	33	3	100	4	133	4	133	4	133	4	133	2	67	1	33	1	33	1	33	1	33	1	33	1	33	1	33
	4.3 Average	32.6	3.3	107.9	4	130.5	4	130.5	4.1	134.8	4.0	129.0	2.4	79.5	1.3	44.0	1.3	44.0	1.4	45.5	1.4	45.5	1.4	45.5	1.4	45.5	1	32.6
	4.3 Consensus	32.0	3.3	105.6	4.0	128.0	4.0	128.0	4.1	131.2	4.0	128.0	2.4	76.8	1.3	41.6	1.3	41.6	1.4	44.8	1.4	44.8	1.4	44.8	1.4	44.8	1.0	32.0
	DoE	100	220	260	260	260	320	450	260	160	160	220	160	160	220	180	180	220	160	160	220	180	180	220	160	330		
	DEHP	100	280	280	280	280	280	300	280	220	220	280	220	220	280	180	180	280	160	160	280	180	180	280	160	320		
	DAFF	100	205	270	270	270	305	405	235	135	135	235	135	135	235	170	135	235	160	160	235	135	135	235	160	355		
	GBRMPA	100	370	260	260	260	440	450	470	160	160	470	160	160	470	370	370	470	260	260	470	370	370	470	260	210		
	CG/DSDIP	100	200	260	260	260	330	440	210	140	140	210	140	140	210	180	140	210	260	260	210	140	140	210	260	370		
	DSITIA	100	210	260	260	260	310	430	250	150	150	250	150	150	250	200	150	250	260	260	210	150	150	210	260	350		
	GPC	100	200	267	267	267	300	400	233	133	133	233	133	133	233	167	133	233	267	267	200	133	133	200	267	367		
	4 Average		240.7	265.2	265.2	265.2	326.4	410.7	276.9	156.9	156.9	276.9	156.9	156.9	212.4	181.2	276.9	156.9	156.9	212.4	181.2	181.2	212.4	181.2	328.8			
	4 Consensus		234.4	264.0	264.0	264.0	316.7	408.5	271.3	154.6	154.6	271.3	154.6	154.6	207.3	175.8	271.3	154.6	154.6	207.3	175.8	175.8	207.3	175.8	336.5			
	4 Rank		7	5	5	5	3	1	4	10	10	4	10	10	8	9	10	10	8	9	10	9	9	10	8	2		



Appendix G

Numerical Modelling of Rehandling of Dredged Material and Reclamation Options in Port Curtis

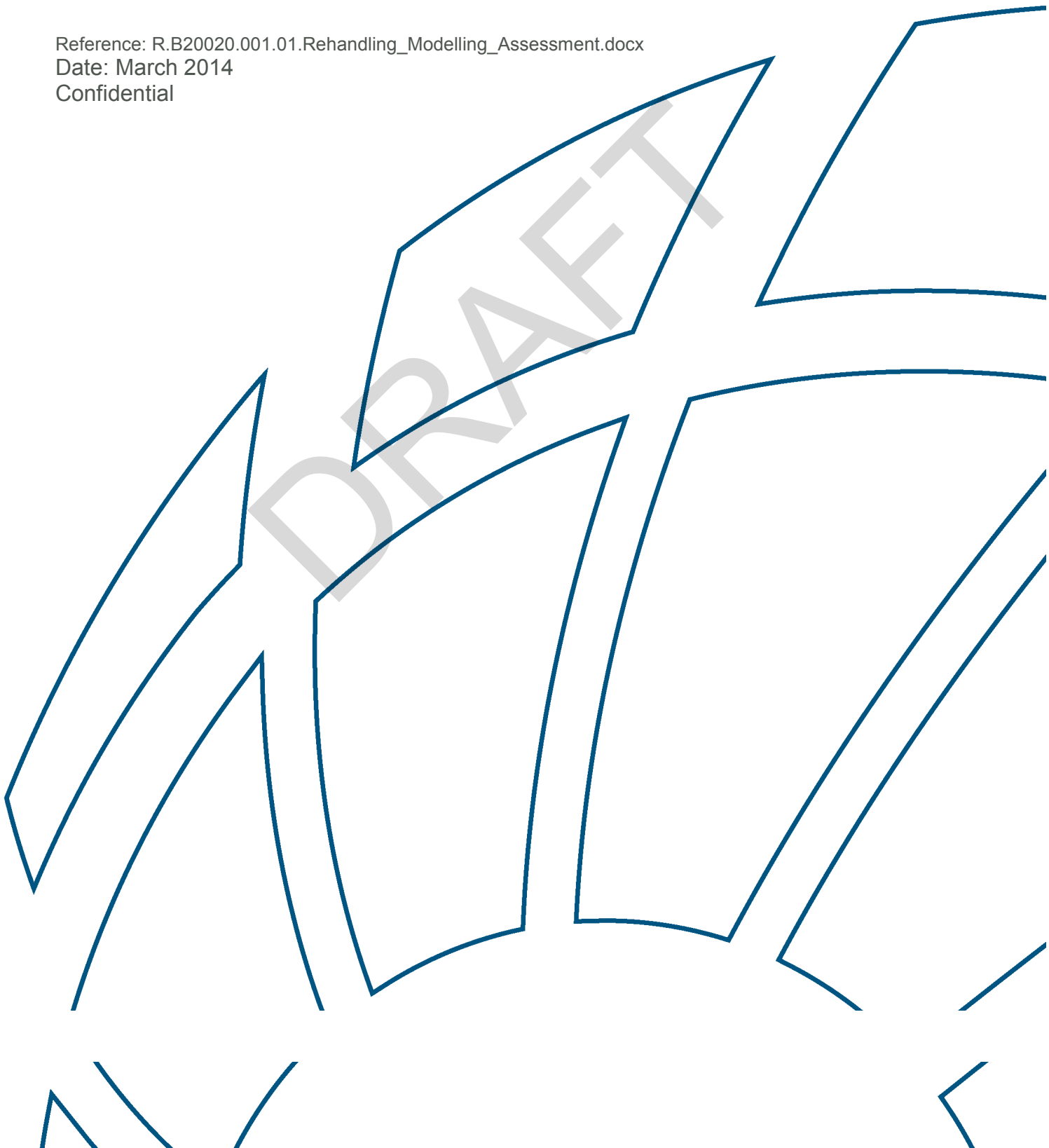


Numerical Modelling of Rehandling of Dredged Material and Reclamation Options in Port Curtis

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Date: March 2014

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Numerical Modelling of Rehandling of Dredged Material and Reclamation Options in Port Curtis

DRAFT

Prepared for: Aurecon

Prepared by: BMT WBM Pty Ltd (Member of the BMT group of companies)

Offices

Brisbane
Denver
London
Mackay
Melbourne
Newcastle
Perth
Sydney
Vancouver

Document Control Sheet

BMT WBM Pty Ltd Level 8, 200 Creek Street Brisbane Qld 4000 Australia PO Box 203, Spring Hill 4004 Tel: +61 7 3831 6744 Fax: + 61 7 3832 3627 ABN 54 010 830 421 www.bmtwbm.com.au	Document:	R.B20020.001.01.Rehandling_Modelling_Assessment.docx
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	Project Manager:	Dr Paul Guard
	Author:	Dr Paul Guard
	Client:	Aurecon
	Client Contact:	Stephen Cole
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1 Introduction

As part of the Port of Gladstone Gatcombe and Golding Cutting Channels Duplication EIS a Dredge Material Placement Investigation is being undertaken to identify the preferred dredge material placement options to be studied in the EIS. The Multi Criteria Analysis workshop for the Project identified the need to undertake additional preliminary modelling to identify potential impacts associated with certain options. The information from this modelling will aid further consideration of the opportunities and constraints of the broad options as part of the initial selection process.

Eight options for dredge material placement were selected for further analysis in the Multi Criteria Analysis workshop. These options are illustrated in Figure 1-1 and Figure 1-2.

1.1 Scope of Works

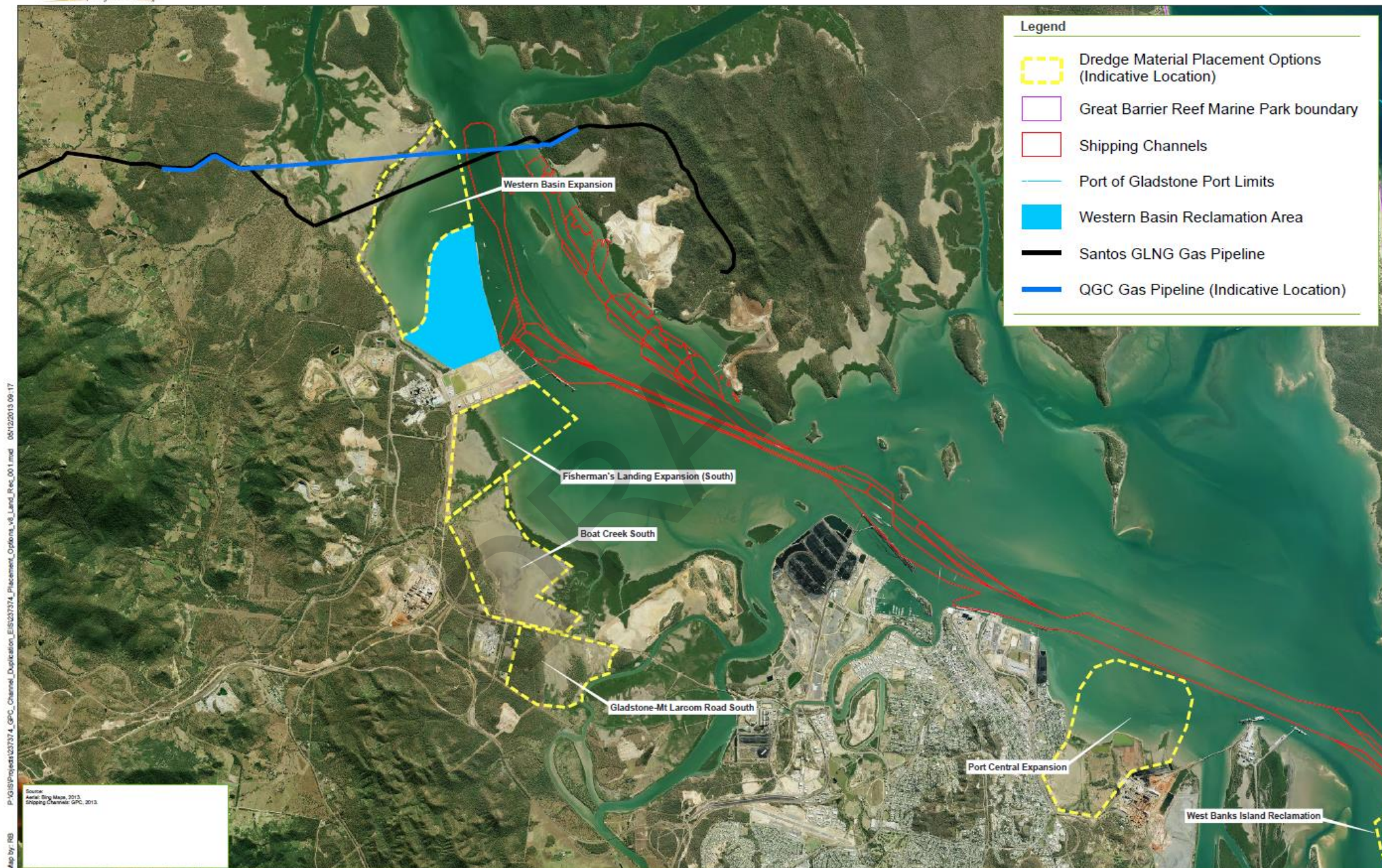
The additional dredge spoil disposal modelling involved the following tasks:

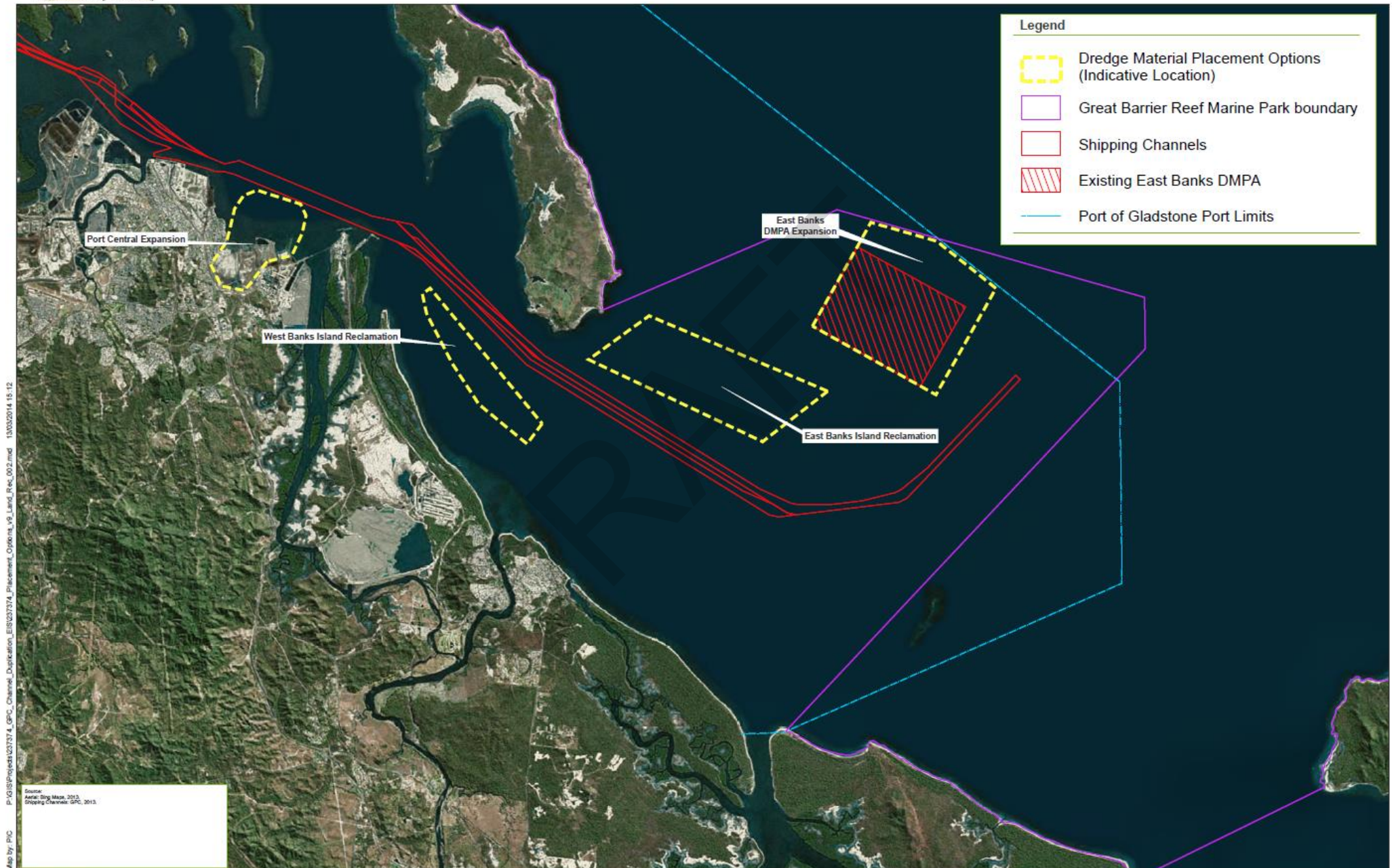
- Plume assessments for material rehandling scenarios at two locations near the Western Basin Expansion reclamation option, one location near the Fisherman's Landing (South) reclamation option, one rehandling scenario near the potential Port Central Expansion reclamation option and one rehandling scenario near the potential West Banks Island reclamation option. The East Banks Island reclamation option would not require rehandling of dredge material due to its proximity to the Channel Duplication dredge areas (i.e. a CSD would be able to pump directly into this reclamation area).
 - Liaison with GPC and a dredging consultant to determine appropriate modelling inputs (likely dredging equipment, location for rehandling, timing of dredging schedules, duration of the campaign, suspended sediment production rates);
 - Schematisation of the campaign and using the 3D hydrodynamic model to simulate the advection and dispersion of plumes within Port Curtis during a representative period (two months); and
 - Providing justification why the model period of 2 months is reasonable and appropriate.
- Hydrodynamic and sedimentation assessments of the two island reclamation areas (West Banks & East Banks) and the Port Central Expansion reclamation area.
 - Defining the full complete footprint of the two island reclamations and Port Central reclamation options;
 - Modifying the TUFLOW-FV model mesh to allow the inclusion of the islands and reclamation;
 - Running the hydrodynamic model and the wave model for a representative period (two months) with and without each reclamation (1 base + 3 developed cases scenarios for both the hydrodynamic and wave models);
 - Reporting on the likely hydrodynamic and wave climate impacts;
 - Providing justification why the model period of 2 months is reasonable and appropriate; and

Introduction

- Analysing and reporting on the possible morphological response of nearby channels and shorelines to the modified hydrodynamic and wave conditions (note that morphological modelling was not carried out at this stage).

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2 Model Setup and Calibration

2.1 Model Description

TUFLOW-FV was used in the present study to undertake the 3D hydrodynamic and sediment advection/dispersion modelling. Stratification effects were explicitly modelled by the inclusion of 3D baroclinic terms in the solution scheme. A hybrid vertical discretisation was used, with up to 17 z-layers and 3 sigma layers near the surface.

The General Ocean Turbulence Model (<http://www.gotm.net/>) was used to control vertical mixing of both momentum and sediment, employing a 2-equation k-omega turbulence scheme. A Smagorinsky model was used for the estimation of the horizontal eddy viscosity and diffusivity coefficients.

The TUFLOW-FV model mesh used for this assessment covers the overall tidal network of Port Curtis from the main opening between Gatcombe Head and Richards Point through the main port area and extends up through The Narrows to the north as illustrated in Figure 2-1.

Bathymetry data in the vicinity of the Port of Gladstone was sourced from existing Digital Elevation Models developed by BMT WBM. The model was validated by comparing with water level and current data collected in June 2009, using bathymetry that did not include the Western Basin dredging (shown in Figure 2-2). The impact assessments were undertaken using updated bathymetry that included recent survey data from GPC and included the dredging undertaken for the LNG projects on Curtis Island and the first stage of the WICET project (shown in Figure 2-3).

A wave model was developed in order to simulate the wave-related stresses (particularly bed shear stresses) that have an influence on hydrodynamics and sediment transport. The SWAN (Delft University of Technology, 2006) numerical model was used for this purpose. SWAN is a third-generation spectral wave model, which is capable of simulating the generation of waves by wind, dissipation by whitecapping depth-induced wave breaking, bottom friction and wave-wave interactions in both deep and shallow water. SWAN simulates wave/swell propagation in two-dimensions, including shoaling and refraction due to spatial variations in bathymetry and currents.

2.2 Model Boundary Conditions

The model extent includes a number of open boundaries requiring the definition of boundary conditions. These boundary conditions define the forcing functions to drive flow in and out of the modelled area. Flow within the model area is dominated by tidal conditions and the main tidal fluxes across the model boundaries are located at:

1. Main Ocean Boundary – extending from Richards Point on Rodds Peninsula to East Point on Facing Island.
2. North Entrance – located across the North Channel entrance between Facing Island and Curtis Island.
3. Division Point – located across the entrance to The Narrows providing a tidal connection between the Port of Gladstone and the Fitzroy River Estuary.

Model Setup and Calibration

As part of previous field data-collection investigations, concurrent recordings of tidal elevations at the boundary locations were carried out. Relationships between the open boundaries and permanent Port tide gauges were established from these data sets and can be used to synthesise model boundary conditions for any time period.

The main ocean boundary is approximately 26km in length between Richards Point and Facing Island. A linearly sloping tidal elevation was applied across the boundary, specifically between Richards Point, Beacon S3 and East Channel.

The North Entrance and Division Point boundaries, being much shorter than the Main Ocean boundary, apply a common water level across the length of each boundary line, representative of the tidal elevation at each location.

Gridded wind velocity boundary conditions were obtained from global NCEP model reanalyses (NOAA, 2012). This wind field was applied to both the hydrodynamic and wave models.

There are a number of tidal tributaries incorporated in the model, including the Calliope and Boyne Rivers. The normal day to day fluvial component of flow within these river systems is generally insignificant in relation to the tidal fluxes through Port Curtis (excluding during flood events). Accordingly, freshwater inflows have not been included in the tide model simulations, as these have no significant influence on water levels and flows in the main body of Port Curtis except under flood conditions. The periods chosen for modelling the rehandling of dredged material did not include any substantial river flows. Freshwater induced stratification may persist in Port Curtis for some time following large flood events, however neglecting this effect is not likely to affect the conclusions drawn from the modelling results presented here.

Time series of temperature and salinity on the open model boundaries were extracted from the ocean general circulation model HYCOM (<http://hycom.org/>).

Atmospheric heat fluxes and water column heat dynamics were simulated within TUFLOW-FV. Boundary condition data including air temperature, long and short wave radiation, precipitation and relative humidity were obtained from global NCEP model reanalyses (NOAA, 2012). These model input fields were spatially uniform over the model domain but varied in time in order to represent both seasonal and higher-frequency variations (e.g. diurnal).

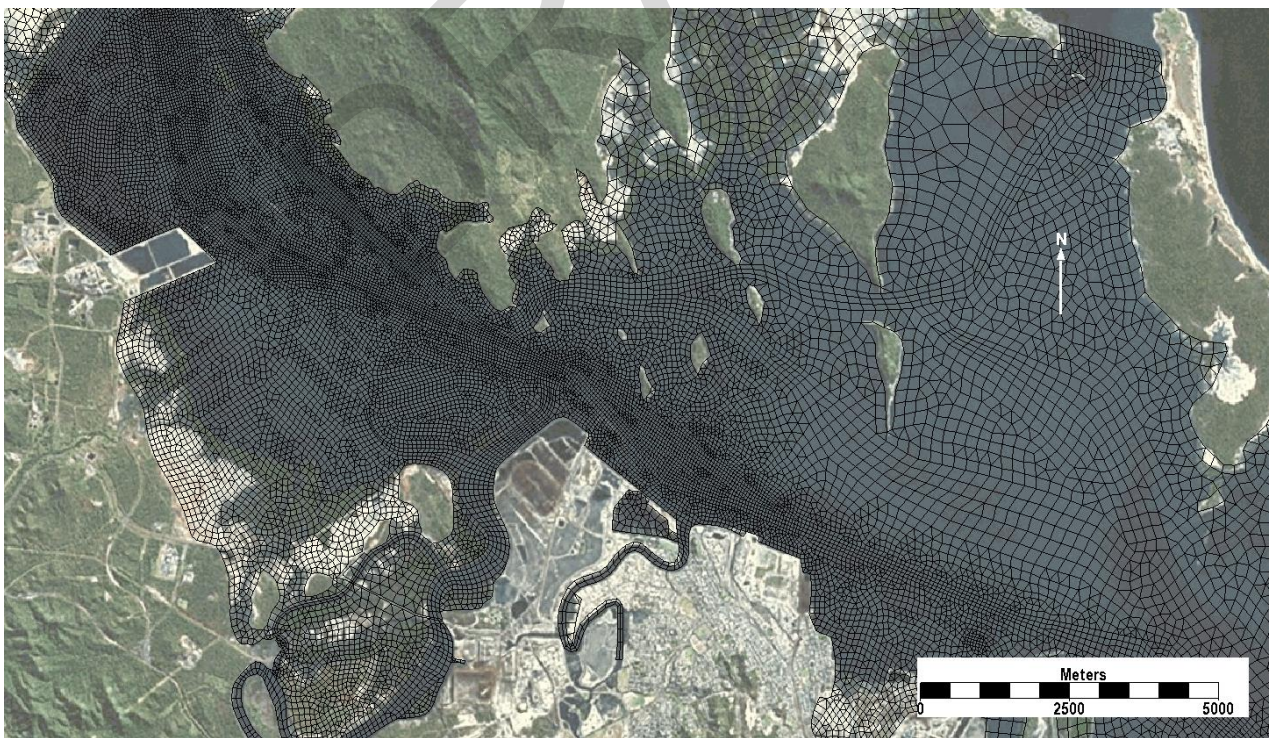
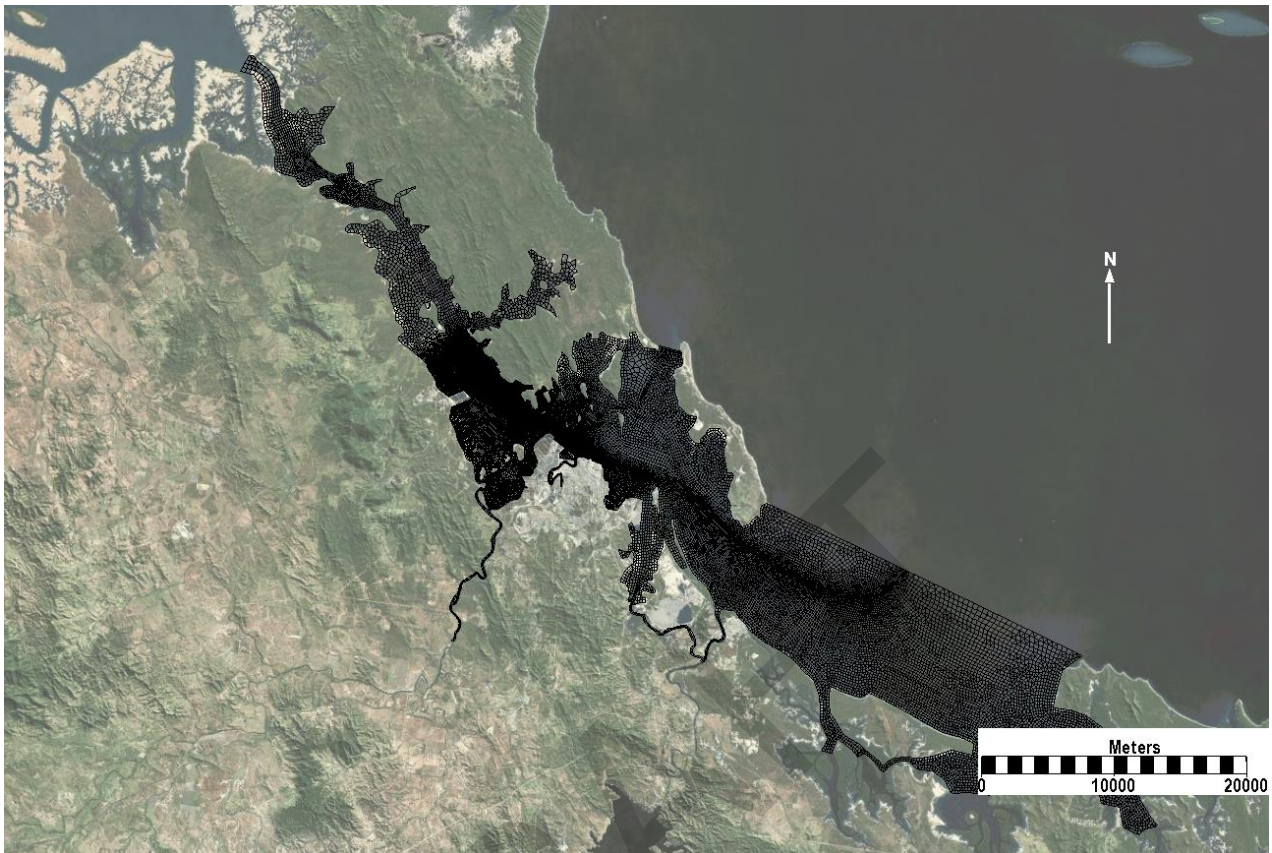


Figure 2-1 TUFLOW-FV Model Mesh

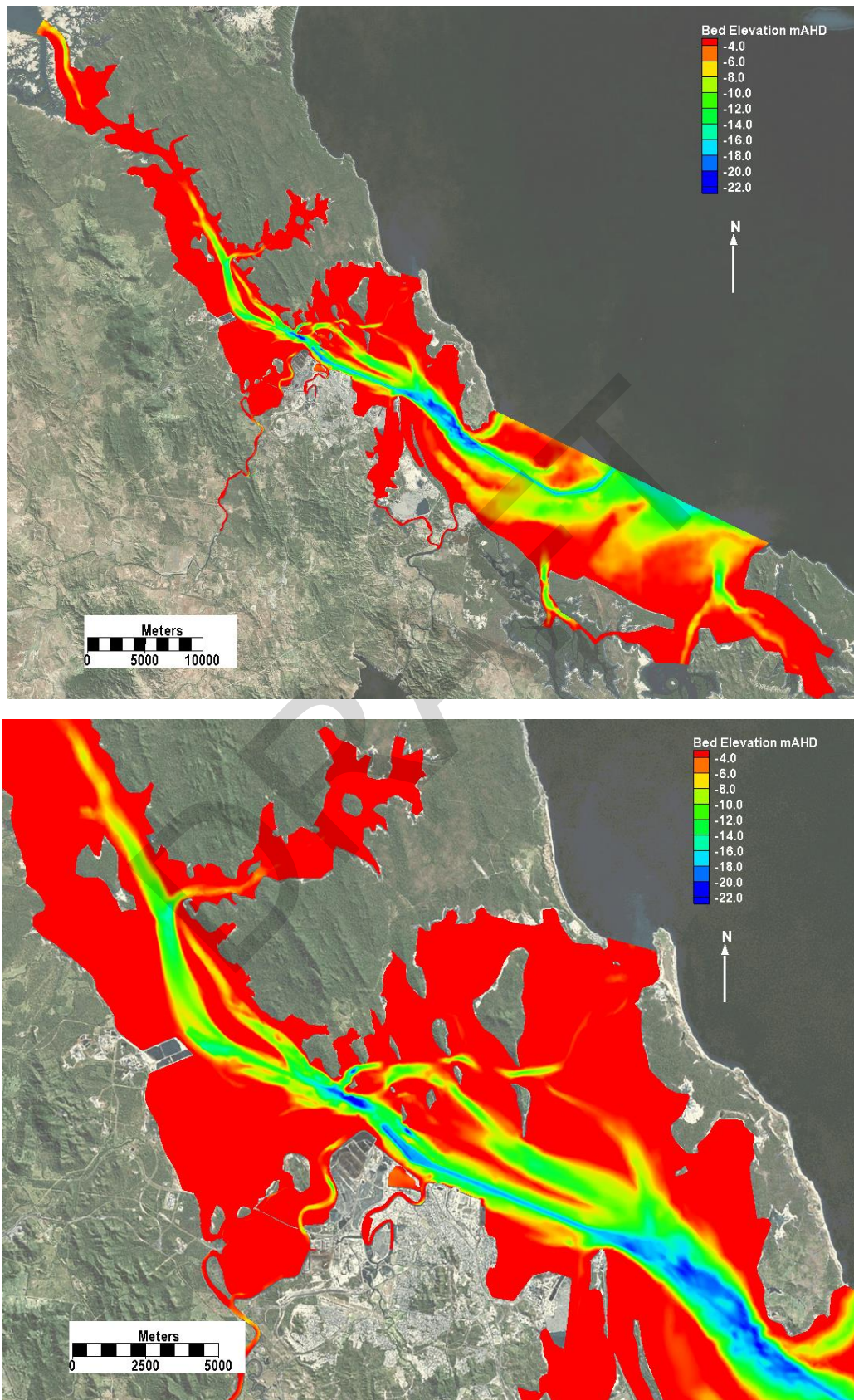


Figure 2-2 Model Bathymetry for the Calibration Period

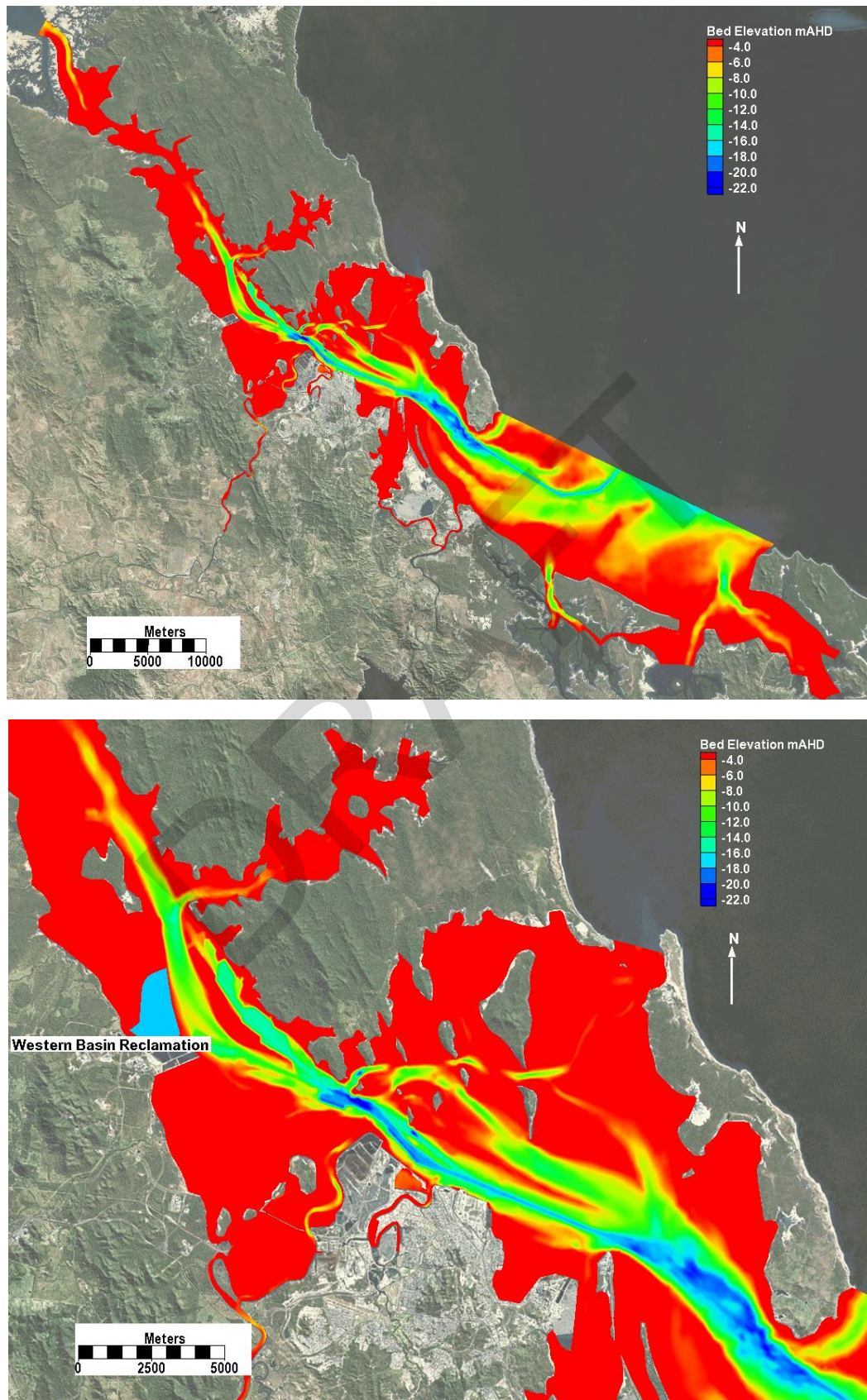


Figure 2-3 Model Bathymetry for the Impact Assessment Period

2.3 Model Calibration and Validation

2.3.1 Hydrodynamic and Wave Model Calibration

A preliminary calibration of the 3D model was undertaken for the purposes of this assessment. Further calibration of the model will be undertaken in future stages of the EIS.

The 3D TUFLOW-FV model was run in 3D mode for the period 01/06/2009 to 26/06/2009 using a bathymetric configuration that matched the harbour geometry at that time (refer to Figure 2-2). The wind rose for this period (near Auckland Point) is shown in Figure 2-4.

As part the calibration process, the specified roughness of each material type in the model was adjusted. The final Manning's 'n' roughness values adopted for each material type are shown in Table 2-1.

Table 2-1 Manning's 'n' Roughness Coefficients

Material Type	Manning's 'n'
Channels	0.022
Shallows / Inter-Tidal Flats	0.025
Mangroves	0.1

Calibration of the model was undertaken using instruments deployed at various locations in Port Curtis (shown in Figure 2-5).

The modelled water levels at Auckland Point are shown together with the recorded water levels in Figure 2-6. Agreement between the modelled and measured water levels is generally good. The modelled velocities in the top 1/3, middle 1/3 and bottom 1/3 of the water column are compared to bottom-mounted ADCP recordings in Figure 2-7 and Figure 2-8. Again, the agreement between the modelled and measured velocities is generally good.

The modelled wave conditions during the calibration period are compared to wave data collected at the DEHP Wave Buoy in Figure 2-9. The wave parameters are accurately reproduced by the model.

2.3.2 Sediment Dynamics Calibration

The TUFLOW-FV model was run for the period 1/7/2010 to 1/9/2010 in order to simulate the ambient sediment dynamics within Port Curtis. The wave rose at the Gladstone Waverider Buoy for this period is shown in Figure 2-10.

The cohesive sediment module of TUFLOW-FV simulates the exchange of sediments between the bed and the water column. The effective clear water sediment settling velocity, w_s , is directly specified and is assumed to have no dependence on either suspended sediment concentration (e.g. flocculation or hindered settling). The modelled rate of sediment deposition is a function of the depth-averaged sediment concentration (TSS), the still-water fall velocity (w_s) and the bed shear stress (τ_b), according to the relationship:

$$Q_d = w_s.TSS.\max\left(0, 1 - \frac{\tau_b}{\tau_{cd}}\right)$$

where τ_{cd} is a model parameter defining the critical shear stress for deposition. As such, sediment settling is reduced below its still water value by the action of bed shear stress and associated vertical mixing in the water column. The rate of erosion is calculated according to:

$$Q_e = E.\max\left(0, \frac{\tau_b}{\tau_{ce}} - 1\right)$$

where Q_e is the erosion rate, E is the erosion rate constant and τ_{ce} is the critical bed shear stress for erosion.

Three sediment types were modelled, with settling velocities shown in Table 2-2.

Table 2-2 Settling Velocities for Each Sediment Type

Sediment Type	Settling Velocity (m/s)
Fine Sand	1×10^{-2}
Silt	1×10^{-3}
Clay	1×10^{-4}

The existing distribution of fine sediment within Port Curtis was approximated in the model by running a “warmup” simulation. This simulation was run with an initial condition of a uniform thickness of sediment throughout the model (including fine sand, silt and clay fractions), allowing redistribution of the sediment to occur such that energetic parts of the model (e.g. the main channels) had sediment removed from the bed while sediment accumulated in other parts of the model (e.g. mud flats). Use of a model that was not “warmed up” would result in resuspension predictions that are incorrectly dominated by erosion from zones that are unlikely to harbour mobile fine sediments.

Comparison of the measured and modelled turbidity from a series of calibration runs using three sediment fractions led to the choice of the following parameters for the subsequent impact assessment:

$$\tau_{ce} = 0.2 \text{ N/m}^2 \quad \tau_{cd} = 0.1 \text{ N/m}^2 \quad E = 0.5$$

The adopted parameter sets are well within the accepted literature ranges.

A comparison of the measured and modelled Total Suspended Solids (TSS) concentration is shown in Figure 2-11. A turbidity to TSS relationship of 1 NTU = 1.6 mg/L has been used based on analysis of data collected during the Western Basin dredging project.

The comparison illustrates that the model successfully captures the broad range of suspended sediment dynamics for natural conditions (note that there were no significant freshwater runoff events during the calibration period). The variation of TSS levels between spring and neap periods is captured, as is the semi-diurnal variation in TSS levels during a single spring tide cycle.

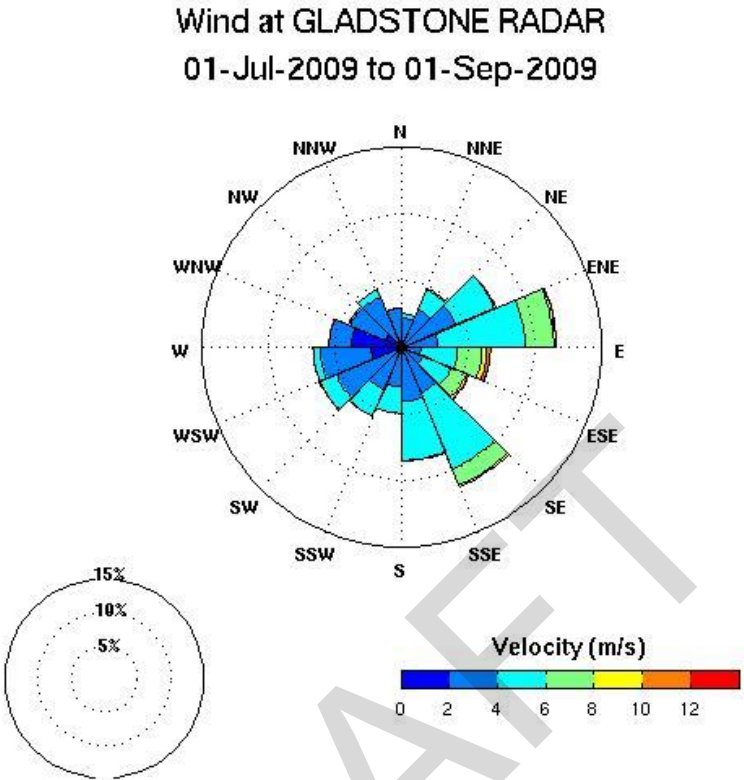


Figure 2-4 Wind Rose for the Calibration Period



Figure 2-5 Instrument Locations

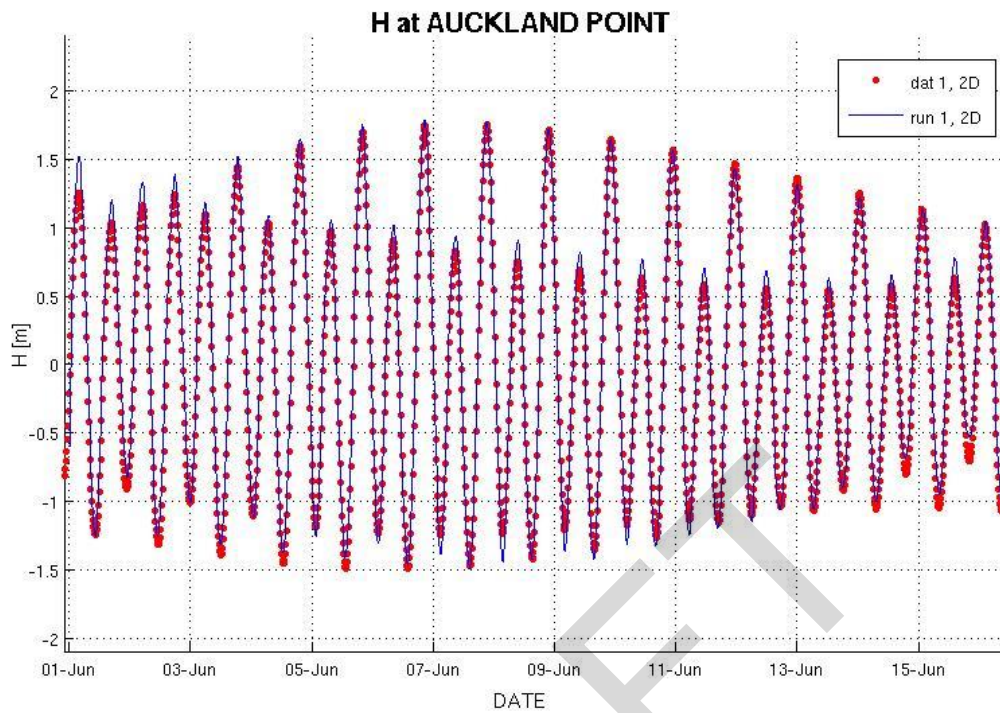


Figure 2-6 Water Level Calibration Plot

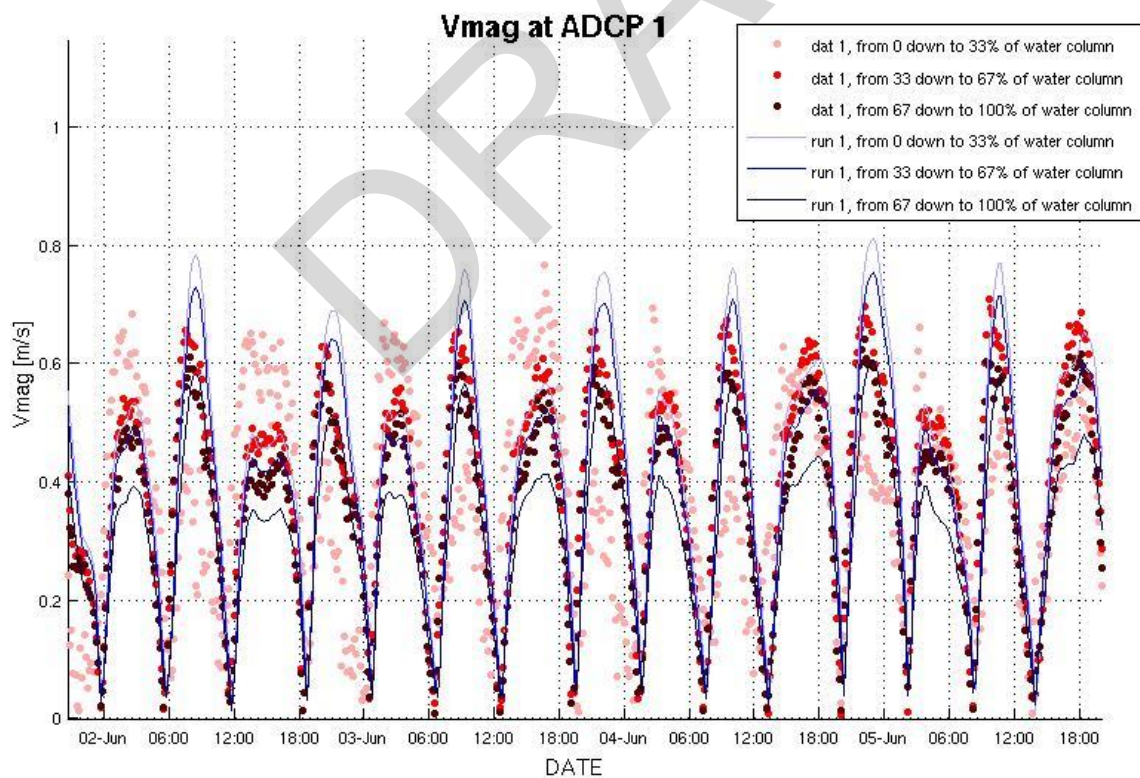


Figure 2-7 Velocity Calibration Plots

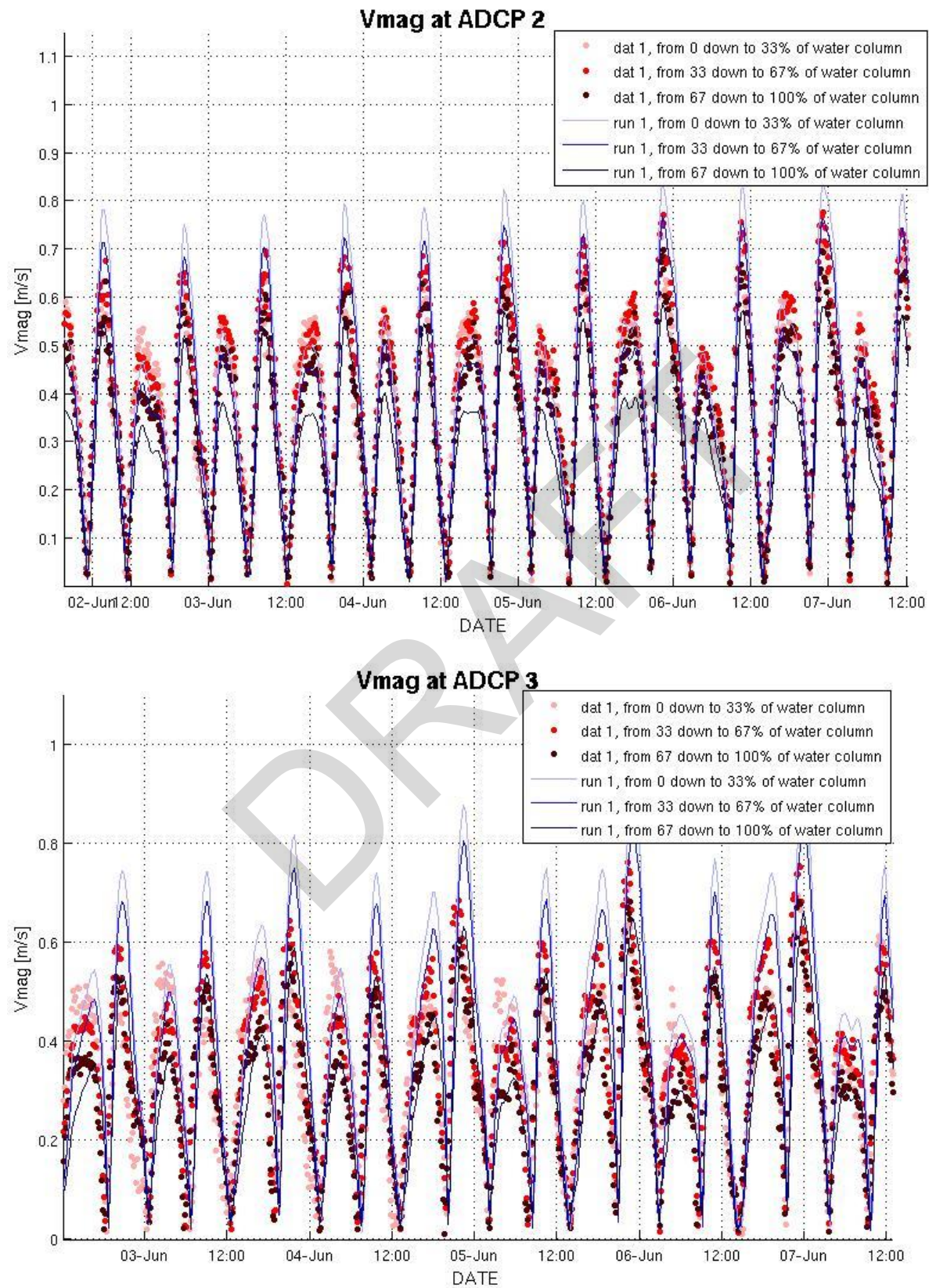


Figure 2-8 Velocity Calibration Plots (Continued)

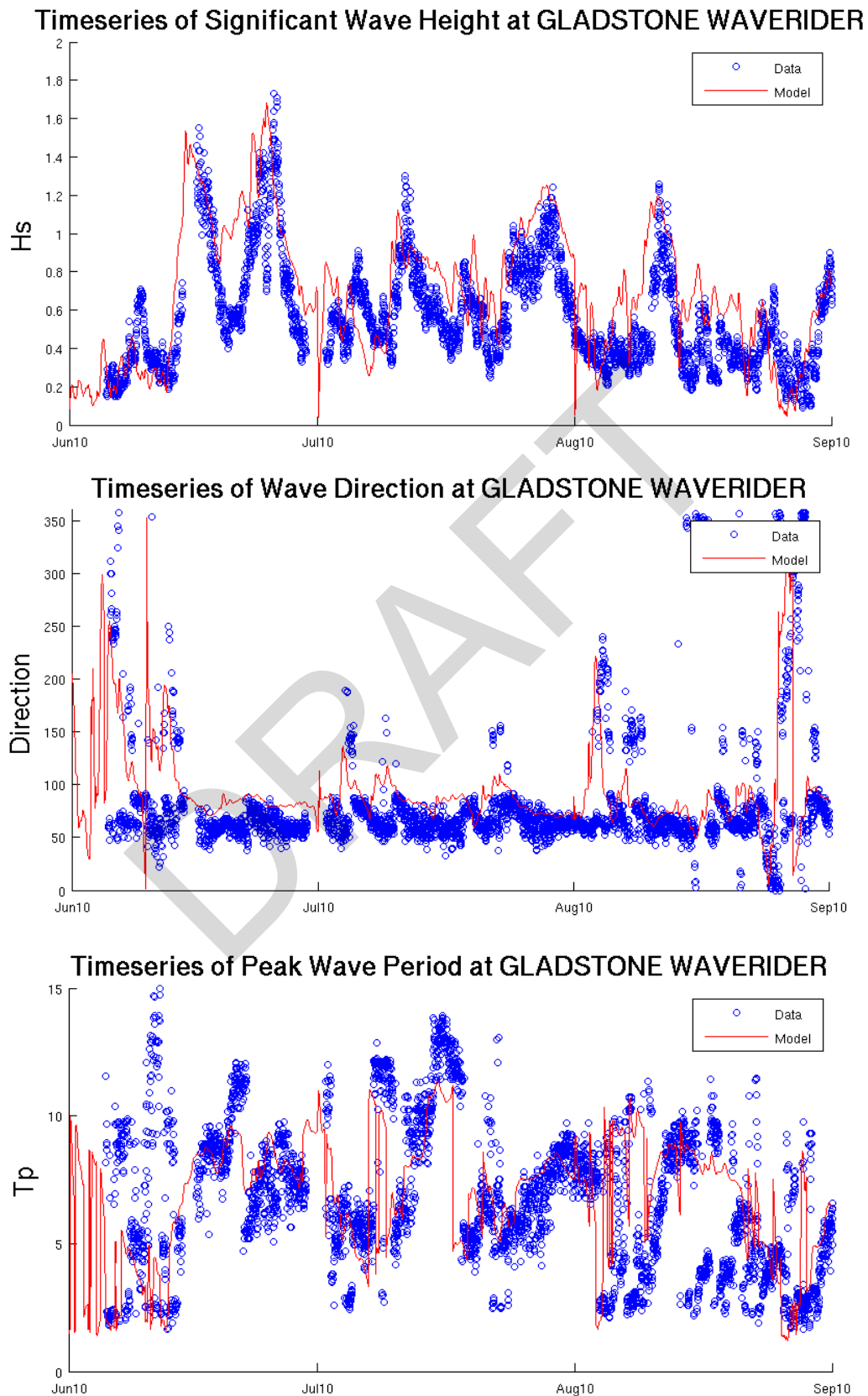


Figure 2-9 SWAN Wave Model Calibration Plots

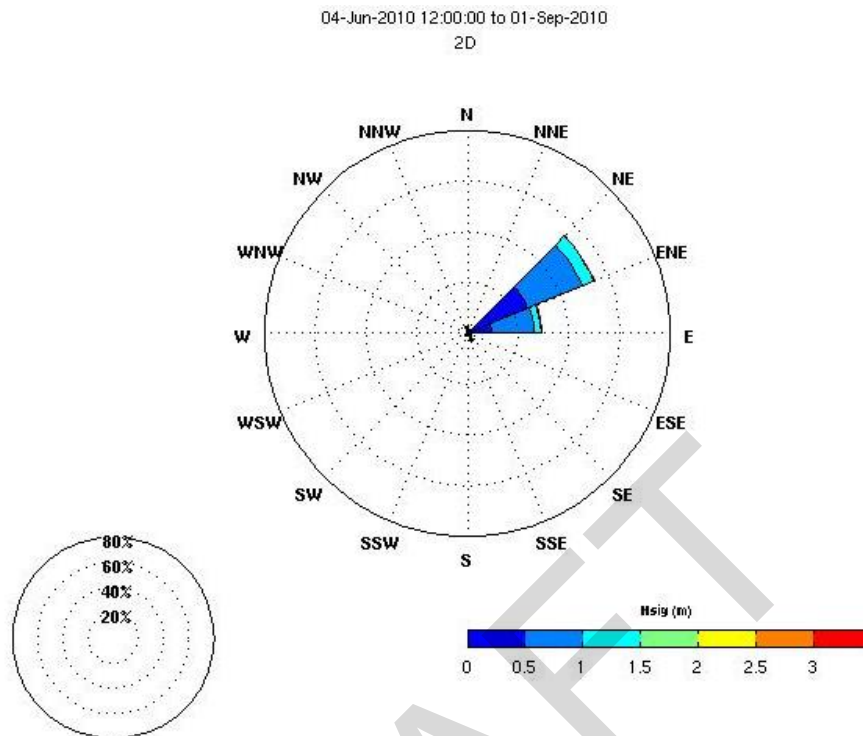


Figure 2-10 Wave Rose for the Sediment Model Calibration Period at the Gladstone Buoy

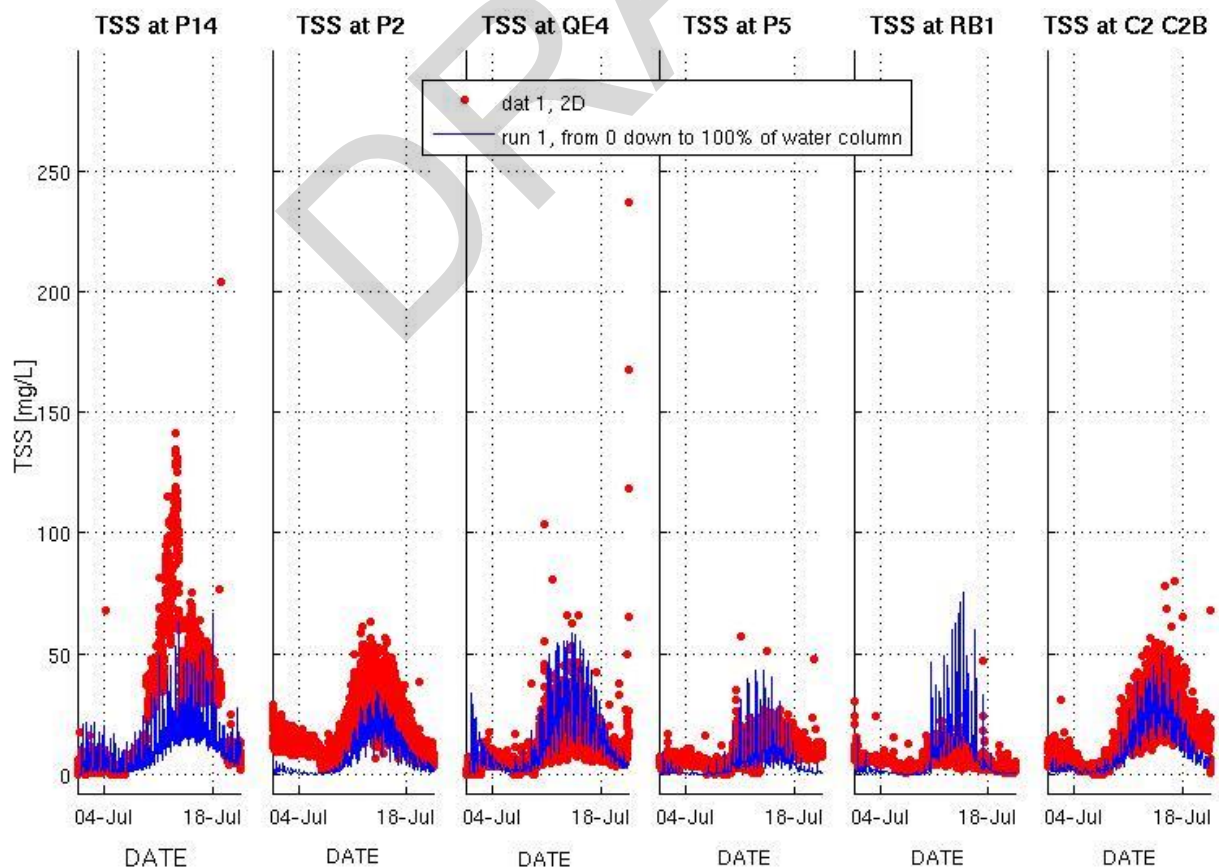


Figure 2-11 Ambient Sediment TSS Calibration Plot

3 Modelling of Dredge Material Rehandling

3.1 Impact Assessment Period

The assessment of impacts associated with the rehandling of dredged material was undertaken by running the model for the period 1/07/2010 to 1/09/2010 for five different dredging scenarios. This two month period includes four periods of spring tides with a tidal range of up to 4.3 metres (refer to the time series in Figure 3-1).

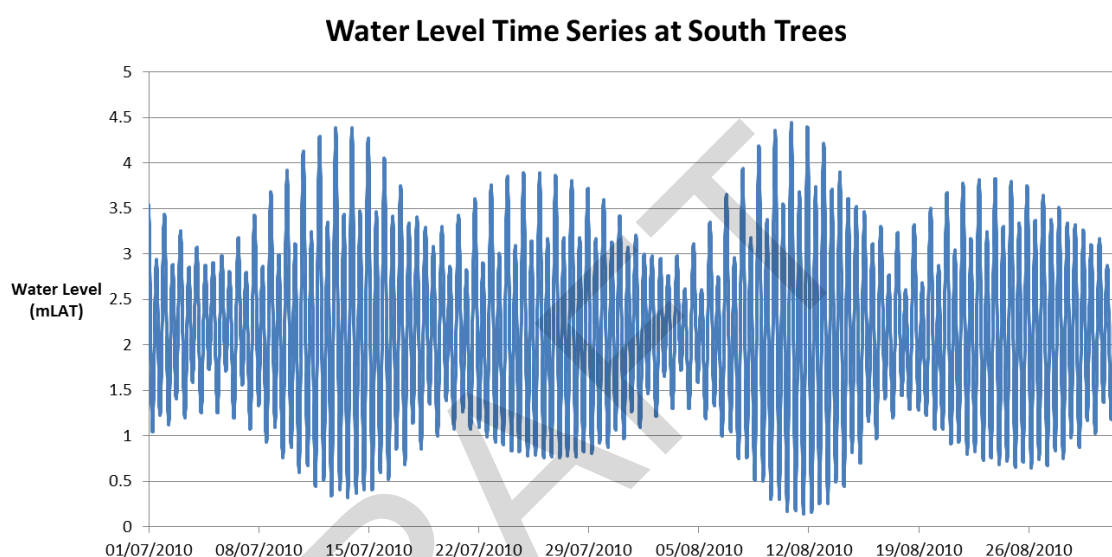


Figure 3-1 Water Level Time Series During the Impact Assessment Period

Two months is a sufficient period of time for this assessment because the primary driver of sediment resuspension within Port Curtis is high velocity spring tidal flows. Wave-related bed shear stress is a much smaller contributor to the resuspension dynamics. Therefore, since the period modelled includes large spring tides it is considered that this simulation period is sufficient to characterise the impacts of the rehandling activity. It should be noted, however, that if the rehandling activity continues for a period that is significantly longer than the two months modelled here it is possible that concentrations of mobile suspended sediment may build up in the system, leading to higher suspended sediment levels. This is a preliminary assessment intended to highlight the potential comparative and relative impacts of the various options, and a more detailed assessment in accordance with Commonwealth EIS Guidelines and State EIS TOR will be undertaken for preferred options in the later stages of the EIS development.

It should also be noted that the assessment that follows only considers the plumes associated with the rehandling of dredge material for the purposes of onshore pumping of dredged material. The plumes associated with dredging the channel itself are not included in the modelling results, and would be additional to the plume impacts reported here.

3.2 Model Configurations

Numerical modelling was undertaken to simulate the advection and dispersion of turbid plumes associated with the rehandling of dredge material at five sites within Port Curtis. Assumptions regarding the dredging cycle time and the likely release rate of fine sediment were provided by GPC. The modelling represents the rehandling operation during dredging in the part of the channel which has the highest proportion of fine material. The available geotechnical information indicates that a significant proportion of the dredging task involves material with up to 89% fines content ($<75\mu\text{m}$). Since there is no information available to determine the relative proportions of clay and silt (i.e. the breakdown of material finer than $75\mu\text{m}$), two separate scenarios were modelled.

- 'Expected Scenario' – 10% fine sand, 40% silt, 50% clay
- 'High Fines Content Scenario' – 10% silt, 90% clay

For each scenario, rehandling of dredge material was modelled at five sites. Each case involved different dredging equipment and geometric layouts depending on practical considerations at each site. Some of the cases involved the excavation of a dedicated pit in which the material rehandling activity would take place.

Modelling of Dredge Material Rehandling

- CASE 1A - Western Basin Expansion Reclamation (no pit)
 - Modelling of dredge material rehandling activity in the channel adjacent to the potential Western Basin Expansion Reclamation Area (refer Figure 3-2). No pit was required since existing depth is sufficient for dredge manoeuvring.
 - The assumed plume source rate during the 10 minute placement operation was 604kg/s. The cycle time between placement operations was 4.2 hours.
 - An additional continuous plume source of 15kg/s for the CSD cutting head was added and a tailwater discharge from the reclamation area of 2.8m³/s at an assumed concentration of 100mg/L fine sediment was also modelled.

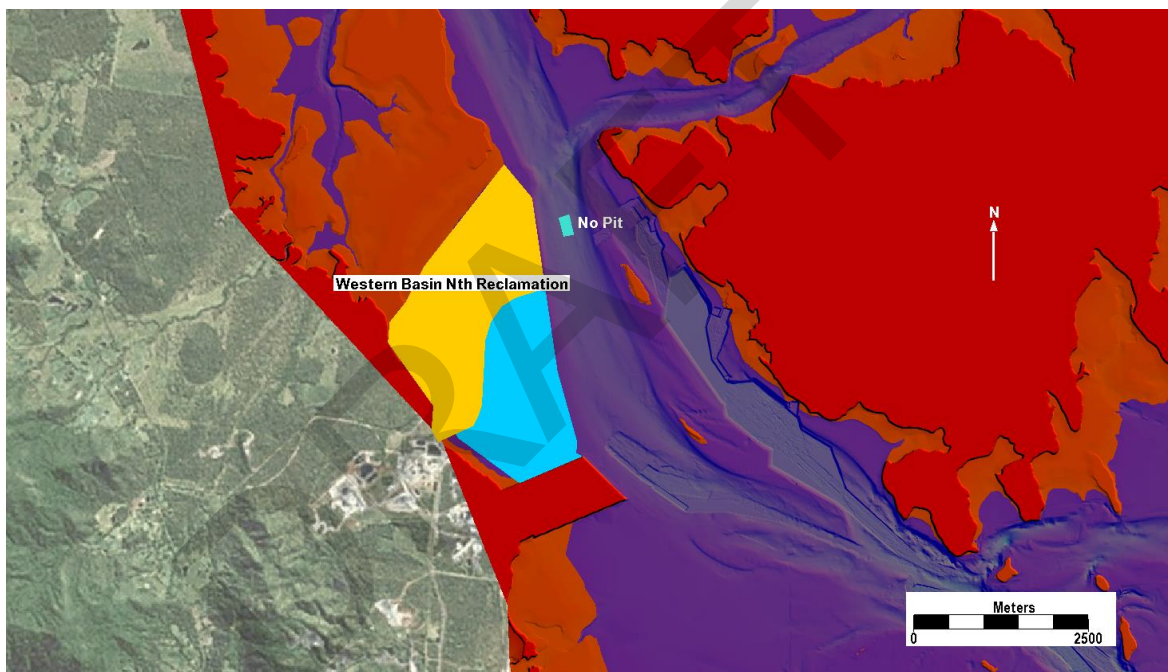


Figure 3-2 Case 1A Model Configuration

Modelling of Dredge Material Rehandling

- CASE 1B - Western Basin Expansion Reclamation (with pit)
 - Modelling of dredge material rehandling activity in the channel adjacent to the potential Western Basin Expansion Reclamation Area (refer Figure 3-3). Rehandling took place in a pit with a bed elevation of -11 mLAT.
 - The assumed plume source rate during the 10 minute placement operation was 604kg/s. The cycle time between placement operations was 4.2 hours.
 - An additional continuous plume source of 15kg/s for the CSD cutting head was added and a tailwater discharge from the reclamation area of 2.8m³/s at an assumed concentration of 100mg/L fine sediment was also modelled.

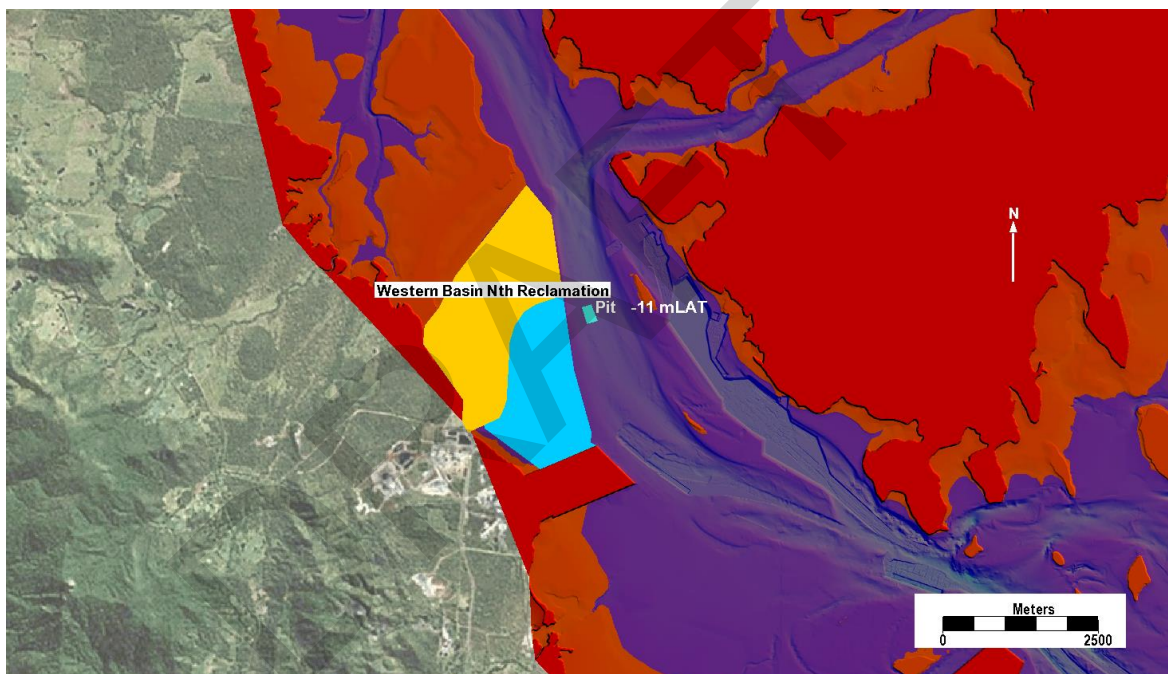


Figure 3-3 Case 1B Model Configuration

Modelling of Dredge Material Rehandling

- CASE 2 - Fisherman's Landing (South) Reclamation (with pit)
 - Modelling of dredge material rehandling activity in the channel adjacent to the potential Fisherman's Landing (South) Reclamation Area (refer Figure 3-4). Rehandling took place in a pit with a bed elevation of -13 mLAT.
 - The assumed plume source rate during a 10 minute placement operation was 1,555kg/s (a larger dredge than in the other cases). The cycle time between placement operations was 3.96 hours.
 - An additional continuous plume source of 15kg/s for the CSD cutting head was added and a tailwater discharge from the reclamation area of 2.8m³/s at an assumed concentration of 100mg/L fine sediment was also modelled.

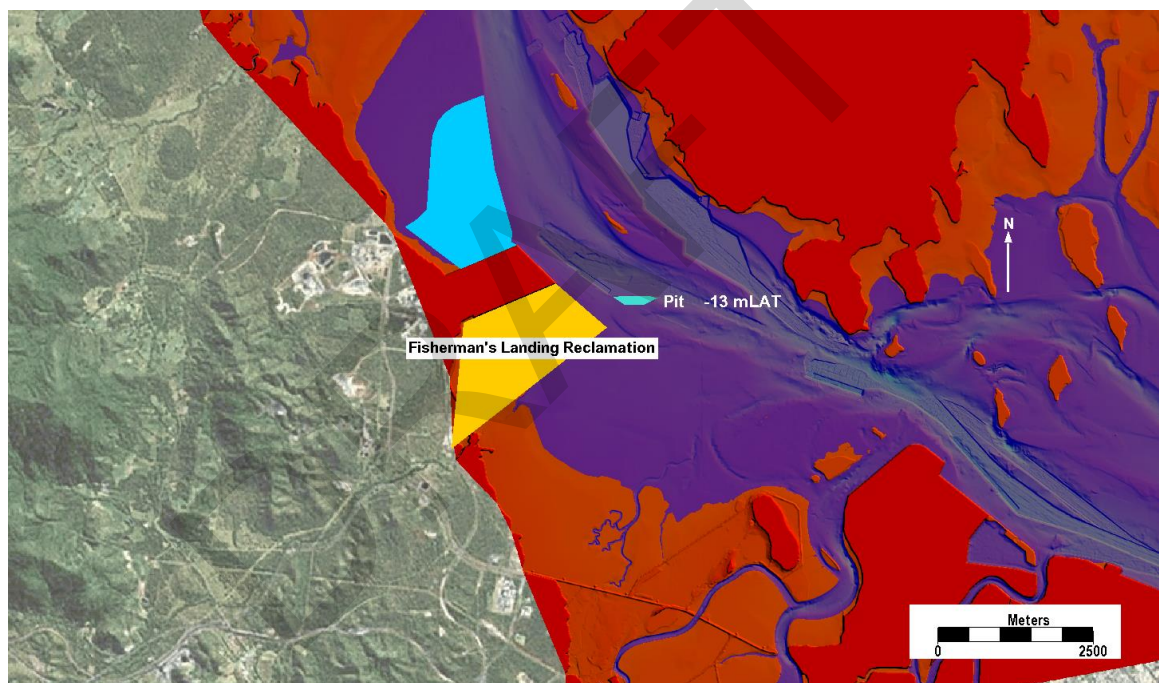


Figure 3-4 Case 2 Model Configuration

Modelling of Dredge Material Rehandling

- CASE 3 - Port Central Expansion Reclamation (with pit)
 - Modelling of dredge material rehandling activity in the channel adjacent to the potential Port Central Expansion Reclamation Area (refer Figure 3-5). Rehandling took place in a pit with a bed elevation of -11 mLAT.
 - The assumed plume source rate during a 10 minute placement operation was 604kg/s. The cycle time between placement operations was 2.53 hours.
 - An additional continuous plume source of 15kg/s for the CSD cutting head was added and a tailwater discharge from the reclamation area of 2.8m³/s at an assumed concentration of 100mg/L fine sediment was also modelled.

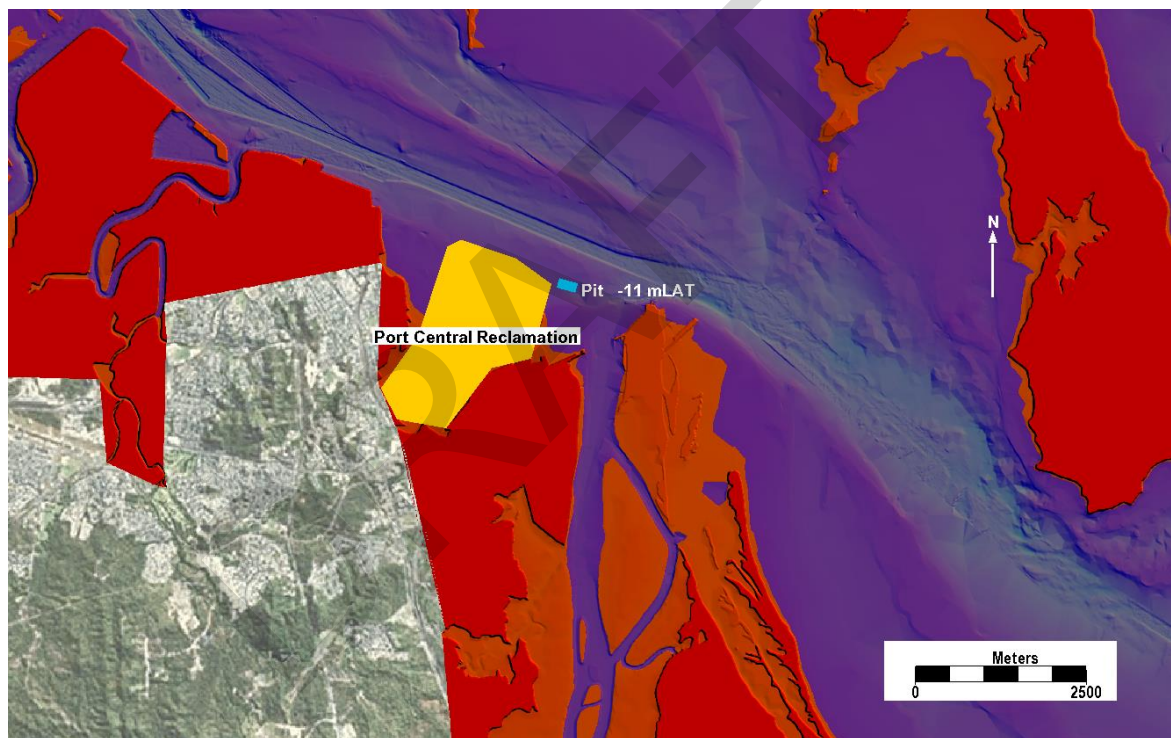


Figure 3-5 Case 3 Model Configuration

Modelling of Dredge Material Rehandling

- CASE 4 - West Banks Island Reclamation (no pit)
 - Modelling of dredge material rehandling activity in the channel adjacent to a proposed West Banks Island Reclamation Area (refer Figure 3-6). No pit was required since existing depth is sufficient for dredge manoeuvring.
 - The assumed plume source rate during a 10 minute placement operation was 604kg/s. The cycle time between placement operations was 1.3 hours.
 - An additional continuous plume source of 15kg/s for the CSD cutting head was added and a tailwater discharge from the reclamation area of 2.8m³/s at an assumed concentration of 100mg/L fine sediment was also modelled.

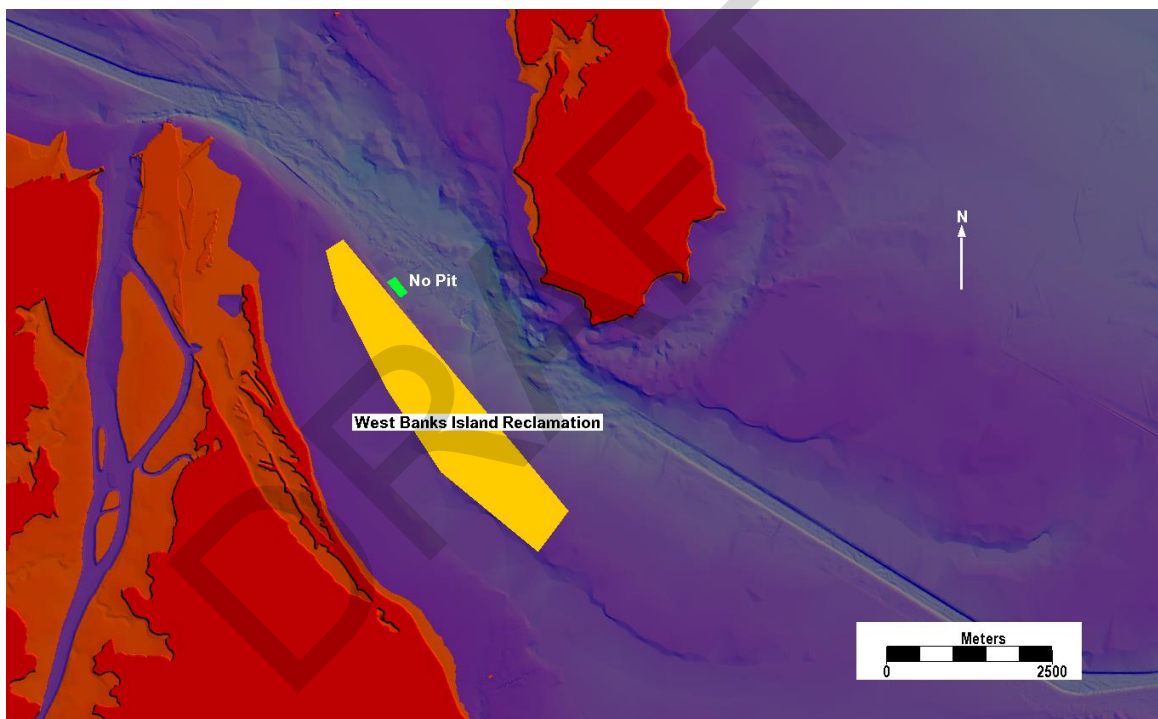


Figure 3-6 Case 4 Model Configuration

3.3 'Expected Scenario' Results

The 'Expected Scenario' assumes that the dredged material is composed of 10% fine sand, 40% silt and 50% clay for the duration of the two month simulation period.

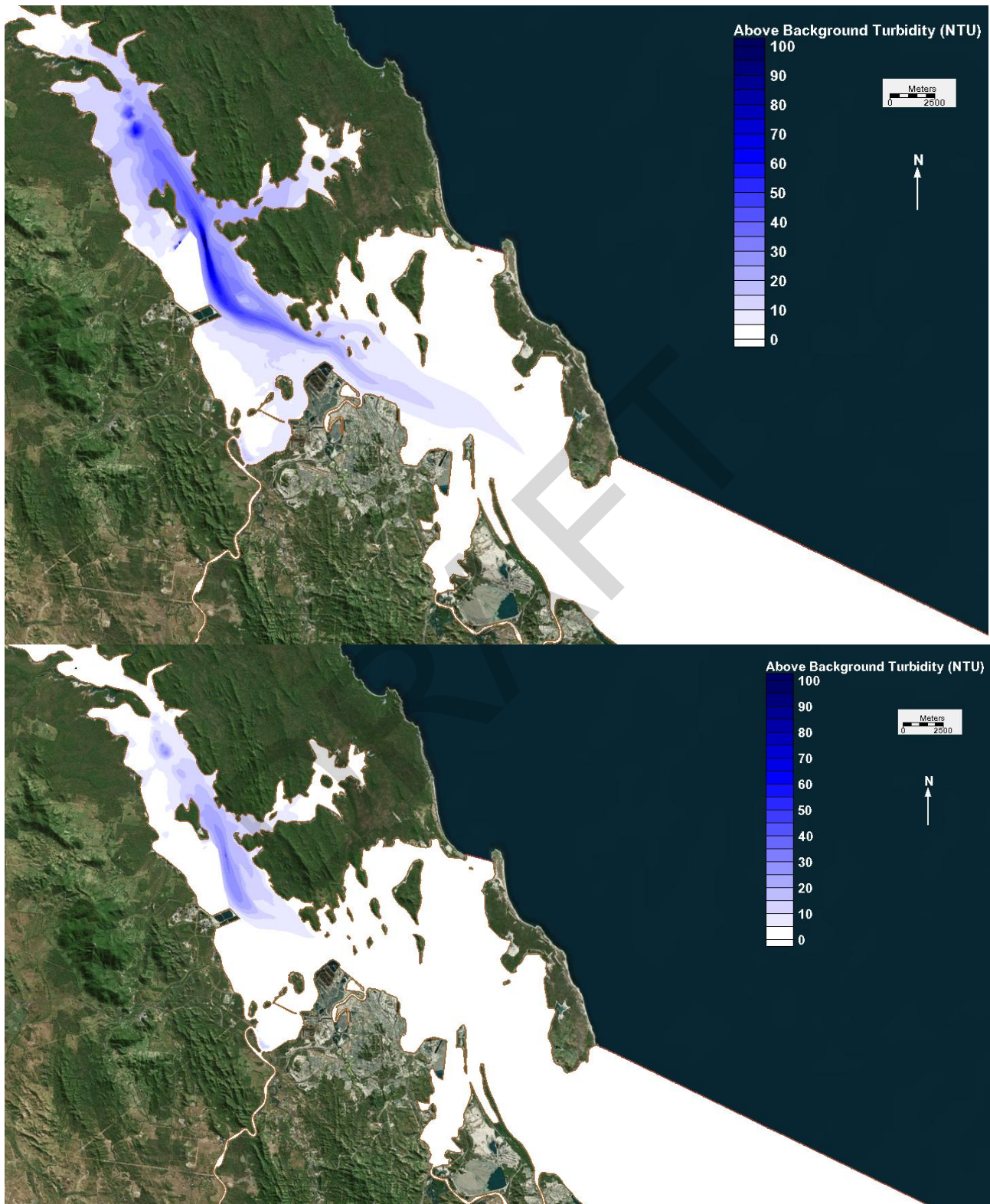
3.3.1 Potential Turbidity Impacts

The potential impact of each of the rehandling options on the turbidity in Port Curtis is presented in terms of the 95th and 50th percentiles of the modelled dredging-related turbidity during the last six weeks of the two month simulation period (allowing some time for the turbidity to build up in the early part of the simulation). Resuspension of the dredged sediment by currents and waves is modelled, and ambient sediment resuspension is also modelled in the same simulation so that mixing of dredged and ambient sediment can take place. This ensures that the resuspension rate of dredged sediment is not overestimated.

The potential impacts for each case are described in Table 3-1 below.

Table 3-1 Summary of Potential Turbidity Impacts for the 'Expected Scenario'

Dredge Material Placement Option Requiring Rehandling	Case No.	Figure No.	Summary of Potential Turbidity Impact
Western Basin Expansion Reclamation Area (No Pit)	1A	Figure 3-7	Turbidity impacts are widespread, extending well into The Narrows and Graham Creek.
Western Basin Expansion Reclamation Area (With Pit)	1B	Figure 3-8	Turbidity impacts are widespread, however the acute impacts to The Narrows and Graham Creek are somewhat reduced compared to Case 1A (likely due to the use of the pit for the rehandling activity).
Fisherman's Landing (South) Reclamation Area (With Pit)	2	Figure 3-9	Turbidity impacts are widespread, however the impacts in The Narrows and Graham Creek are reduced compared to both Case 1A and Case 1B, while the impacts to the Calliope River estuary and the Barney Point area are higher. The acute turbidity levels adjacent to the Western Basin Expansion and Fisherman's Landing (South) reclamation areas are very high due to the use of a larger dredge in this scenario.
Port Central Expansion Reclamation Area (With Pit)	3	Figure 3-10	Turbidity impacts are noted to occur throughout the central portion of the Port, however the level of acute turbidity impact is lower than for Cases 1A, 1B and 2.
West Banks Island Reclamation Area (No Pit)	4	Figure 3-11	Turbidity impacts are noted to occur throughout the outer and central portions of the Port. The increases in turbidity are particularly large in the immediate vicinity of the West Banks Island reclamation, probably due to the short cycle time and the absence of a pit. The higher production rate associated with this scenario leads to larger acute impacts but the shorter duration of the dredging campaign would provide partial mitigation.



**Figure 3-7 Above Background 95th Percentile Turbidity (Top) and
50th Percentile Turbidity (Bottom) for the 'Expected Scenario'
Case 1A - Western Basin Expansion Reclamation Area (No Pit)**

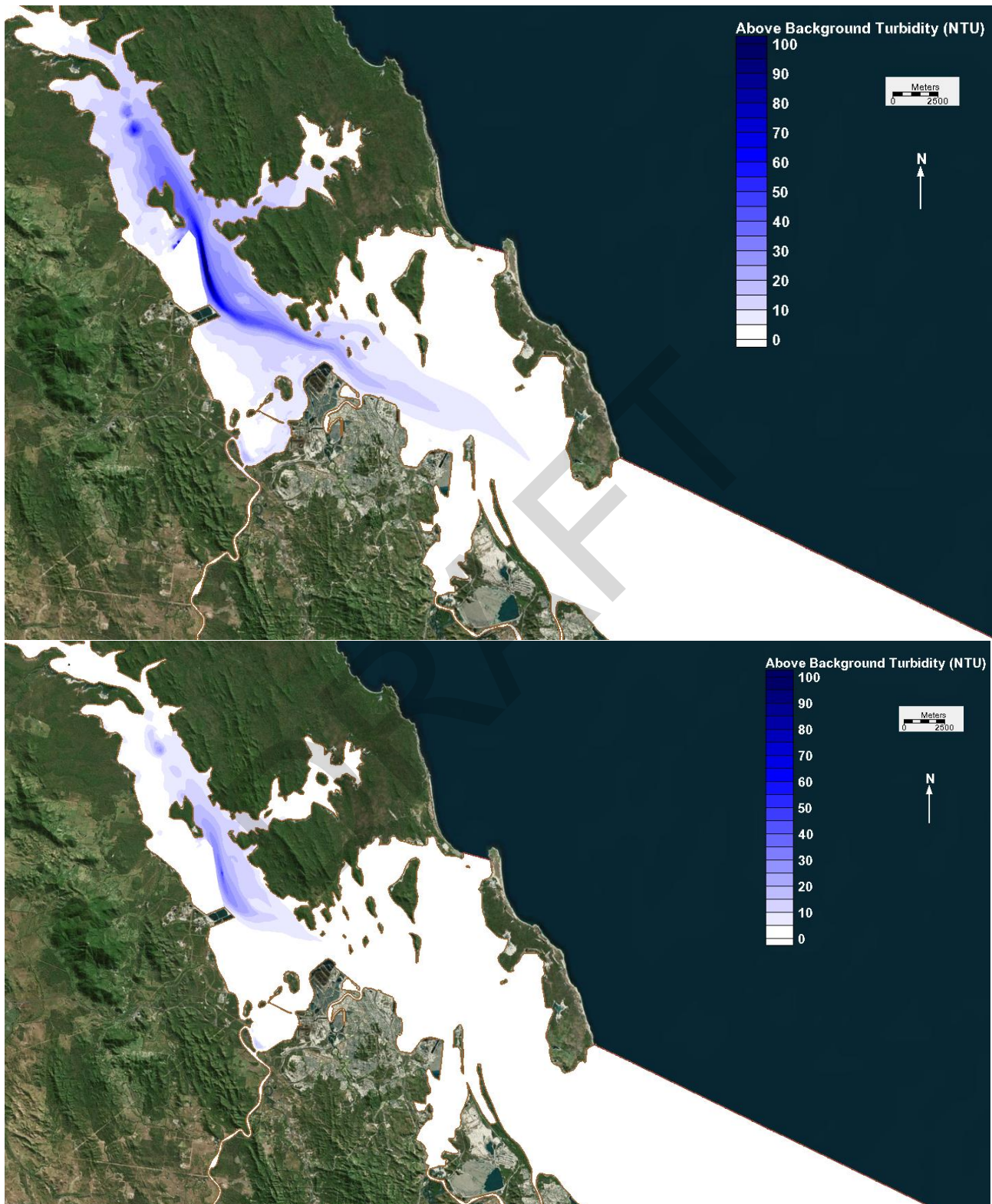


Figure 3-8 Above Background 95th Percentile Turbidity (Top) and
50th Percentile Turbidity (Bottom) for the 'Expected Scenario'
Case 1B - Western Basin Expansion Reclamation Area (With Pit)

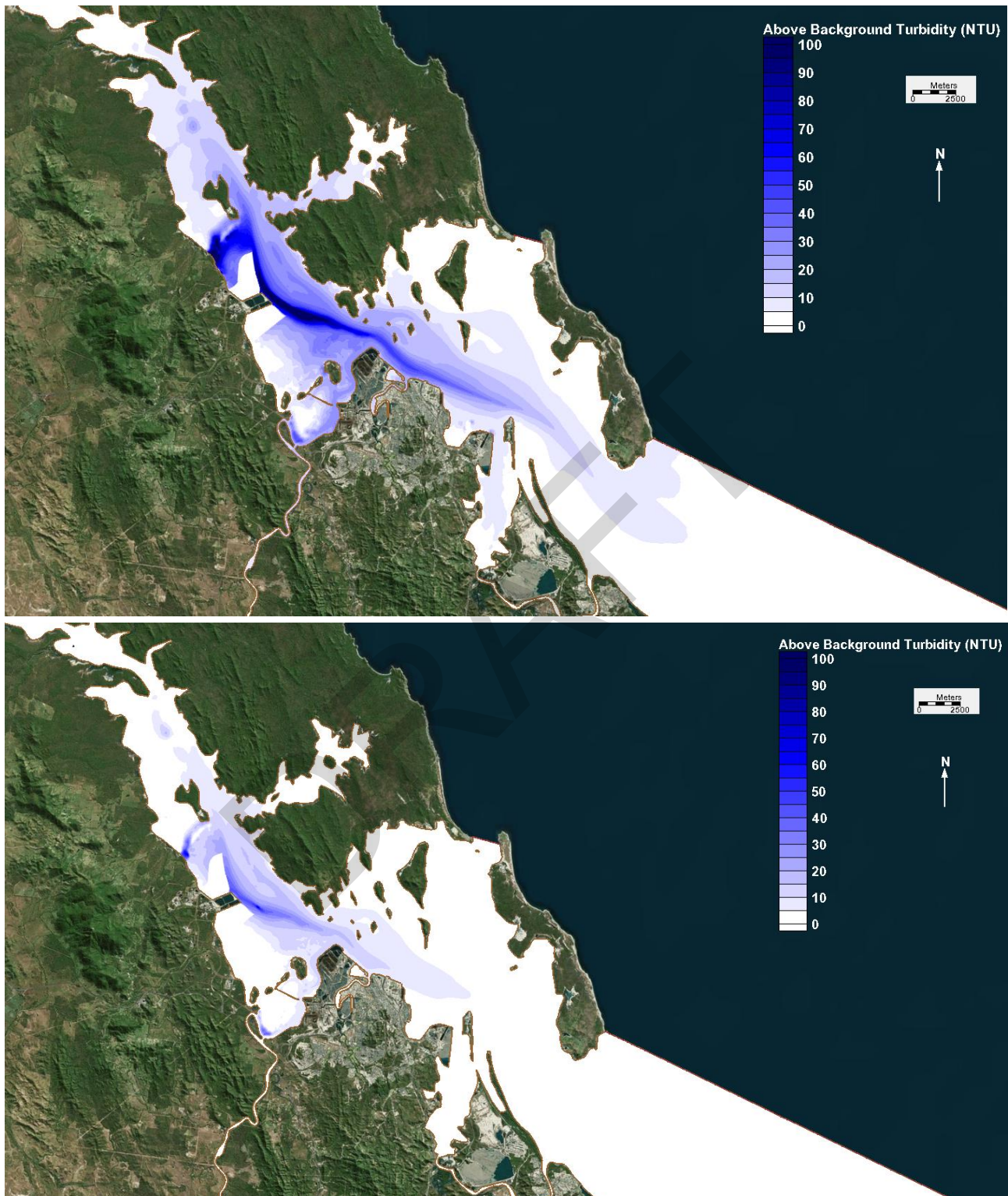


Figure 3-9 Above Background 95th Percentile Turbidity (Top) and
50th Percentile Turbidity (Bottom) for the 'Expected Scenario'
Case 2 - Fisherman's Landing (South) Reclamation Area (With Pit)

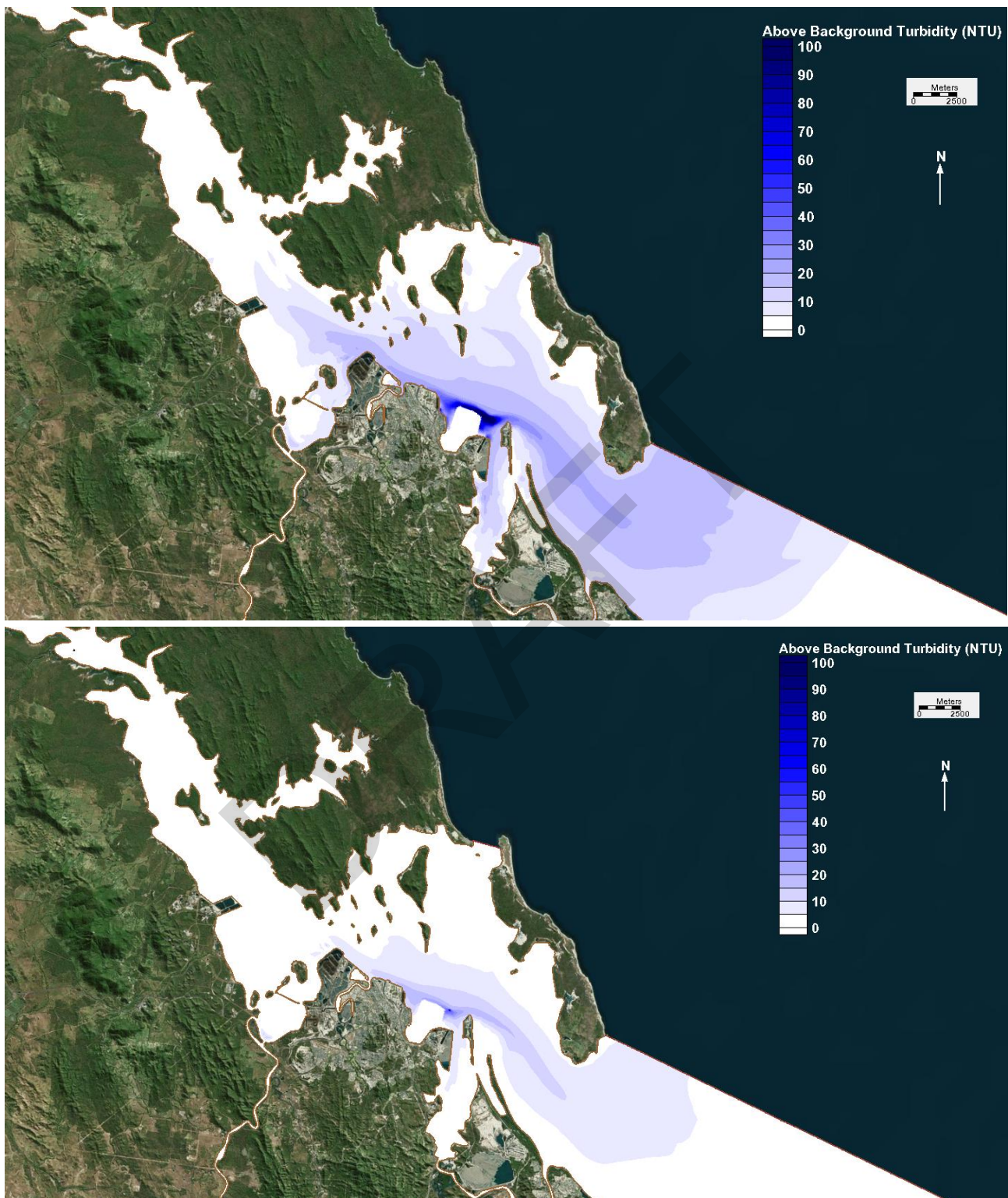


Figure 3-10 Above Background 95th Percentile Turbidity (Top) and
50th Percentile Turbidity (Bottom) for the 'Expected Scenario'
Case 3 - Port Central Expansion Reclamation Area (With Pit)

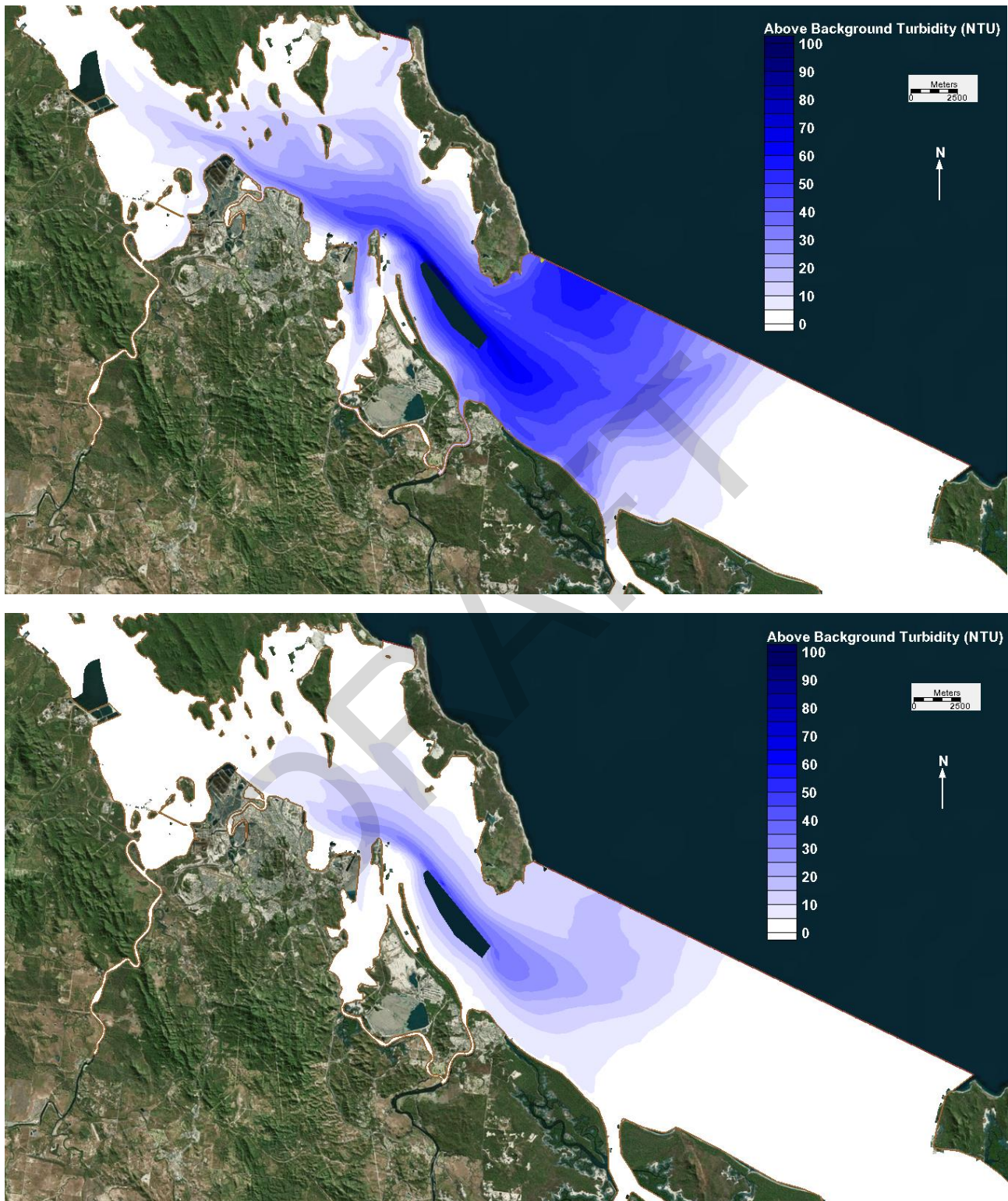


Figure 3-11 Above Background 95th Percentile Turbidity (Top) and
50th Percentile Turbidity (Bottom) for the 'Expected Scenario'
Case 4 - West Banks Island Reclamation Area (No Pit)

Modelling of Dredge Material Rehandling

3.3.2 Potential Deposition Rate Impacts

The potential impact of each of the rehandling options on the deposition rate in Port Curtis is presented in terms of the 95th and 50th percentiles of the modelled dredging-related deposition rate during the last six weeks of the two month simulation period (allowing some time for the turbidity to build up in the early part of the simulation).

The potential impacts for each case are described in Table 3-2 below.

Table 3-2 Summary of Potential Deposition Rate Impacts for the ‘Expected Scenario’

Dredge Material Placement Option Requiring Rehandling	Case Number	Figure Number	Summary of Potential Deposition Rate Impact
Western Basin Expansion Reclamation Area (No Pit)	1A	Figure 3-12	Deposition of dredged sediment occurs widely, including The Narrows and Graham Creek, however the rate is highest in the dredged swing basins and channels.
Western Basin Expansion Reclamation Area (With Pit)	1B	Figure 3-13	Deposition of dredged sediment occurs widely, including The Narrows and Graham Creek, however the rate is highest in the dredged swing basins and channels.
Fisherman’s Landing (South) Reclamation Area (With Pit)	2	Figure 3-14	The deposition rate in The Narrows and Graham Creek are reduced compared to both Case 1A and Case 1B, while the deposition rate adjacent to the Western Basin Expansion and Fisherman’s Landing (South) reclamation areas and in the Calliope River estuary are higher.
Port Central Expansion Reclamation Area (With Pit)	3	Figure 3-15	The deposition rate increases throughout the central portion of the Port. The deposition rate increases are particularly large in the quiescent areas to the immediate East and West of the reclamation area.
West Banks Island Reclamation Area (No Pit)	4	Figure 3-16	The deposition rate increases throughout the outer and central portions of the Port.

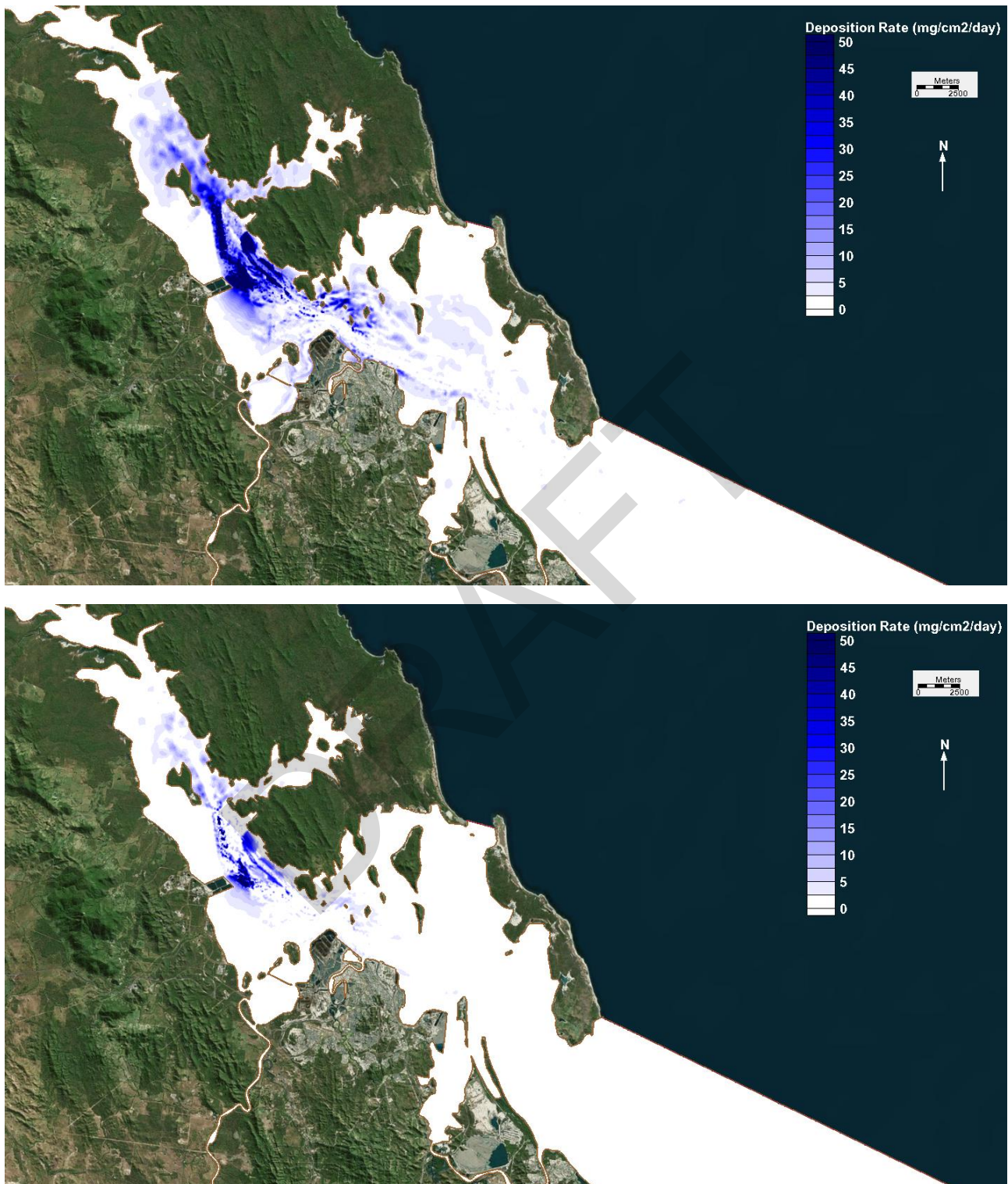


Figure 3-12 Dredged Sediment 95th Percentile Deposition Rate (Top) and
50th Percentile Deposition Rate (Bottom) for the 'Expected Scenario'
Case 1A - Western Basin Expansion Reclamation Area (No Pit)

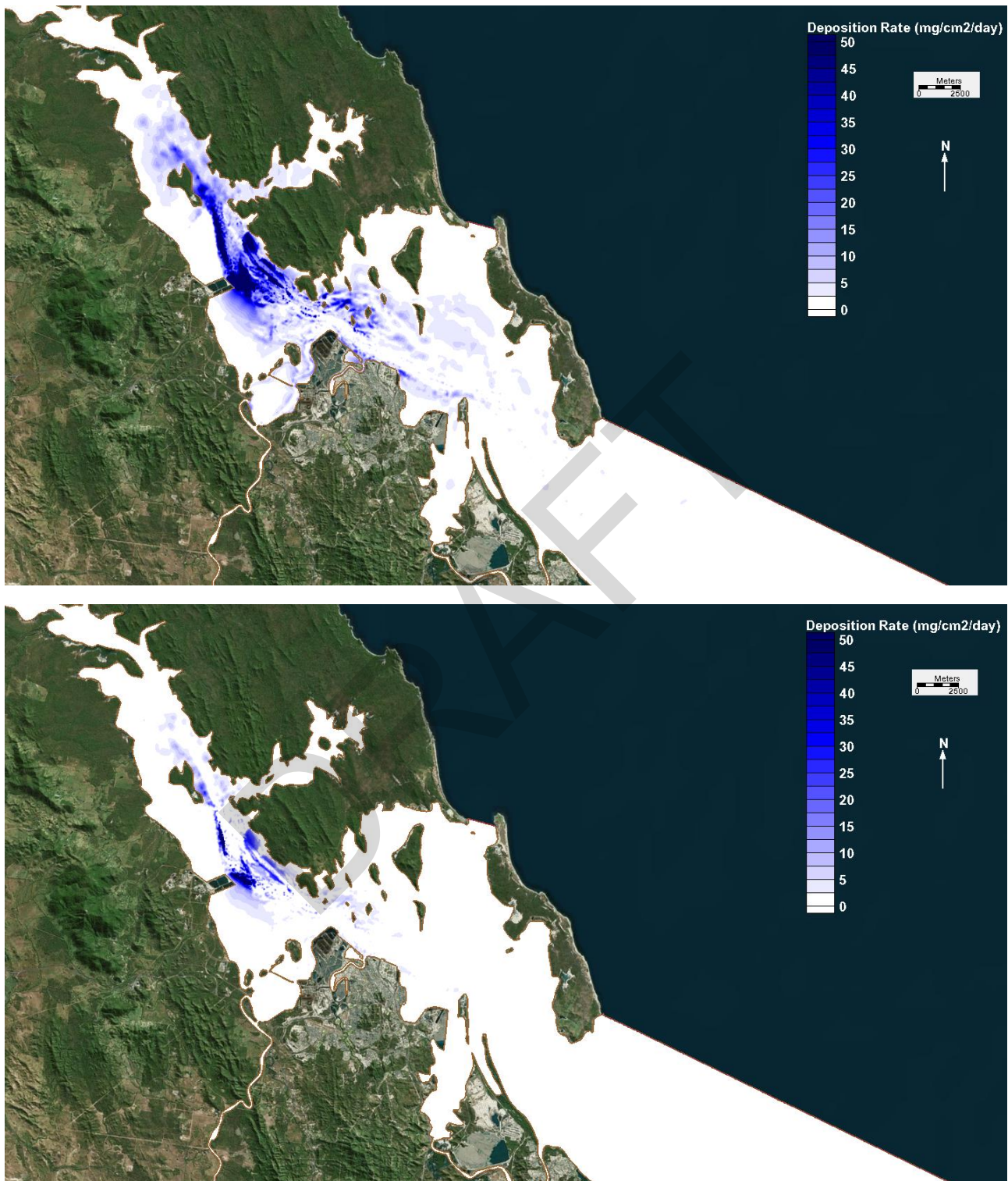


Figure 3-13 Dredged Sediment 95th Percentile Deposition Rate (Top) and
50th Percentile Deposition Rate (Bottom) for the 'Expected Scenario'
Case 1B - Western Basin Expansion Reclamation Area (With Pit)

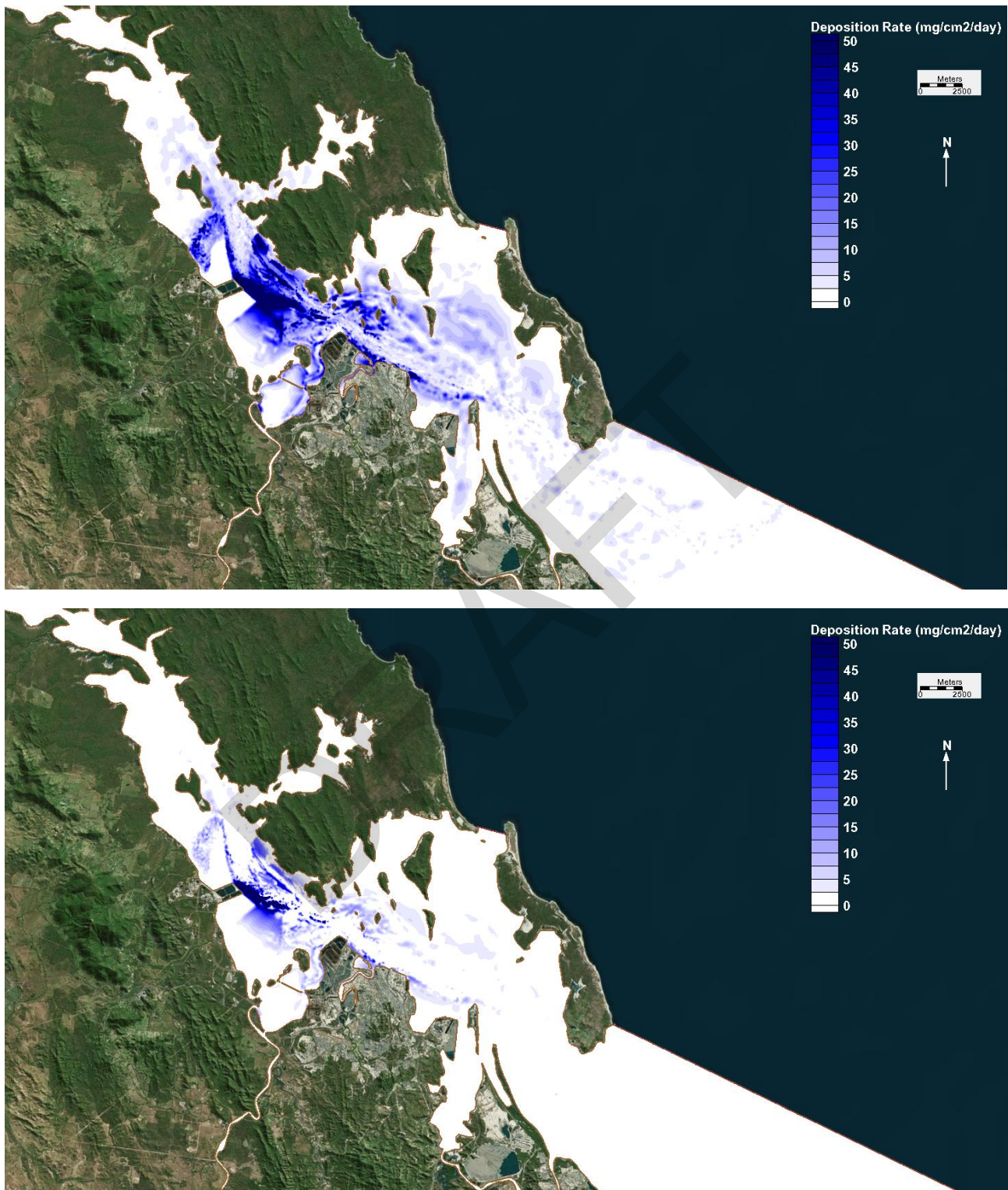


Figure 3-14 Dredged Sediment 95th Percentile Deposition Rate (Top) and 50th Percentile Deposition Rate (Bottom) for the 'Expected Scenario' Case 2 - Fisherman's Landing (South) Reclamation Area (With Pit)

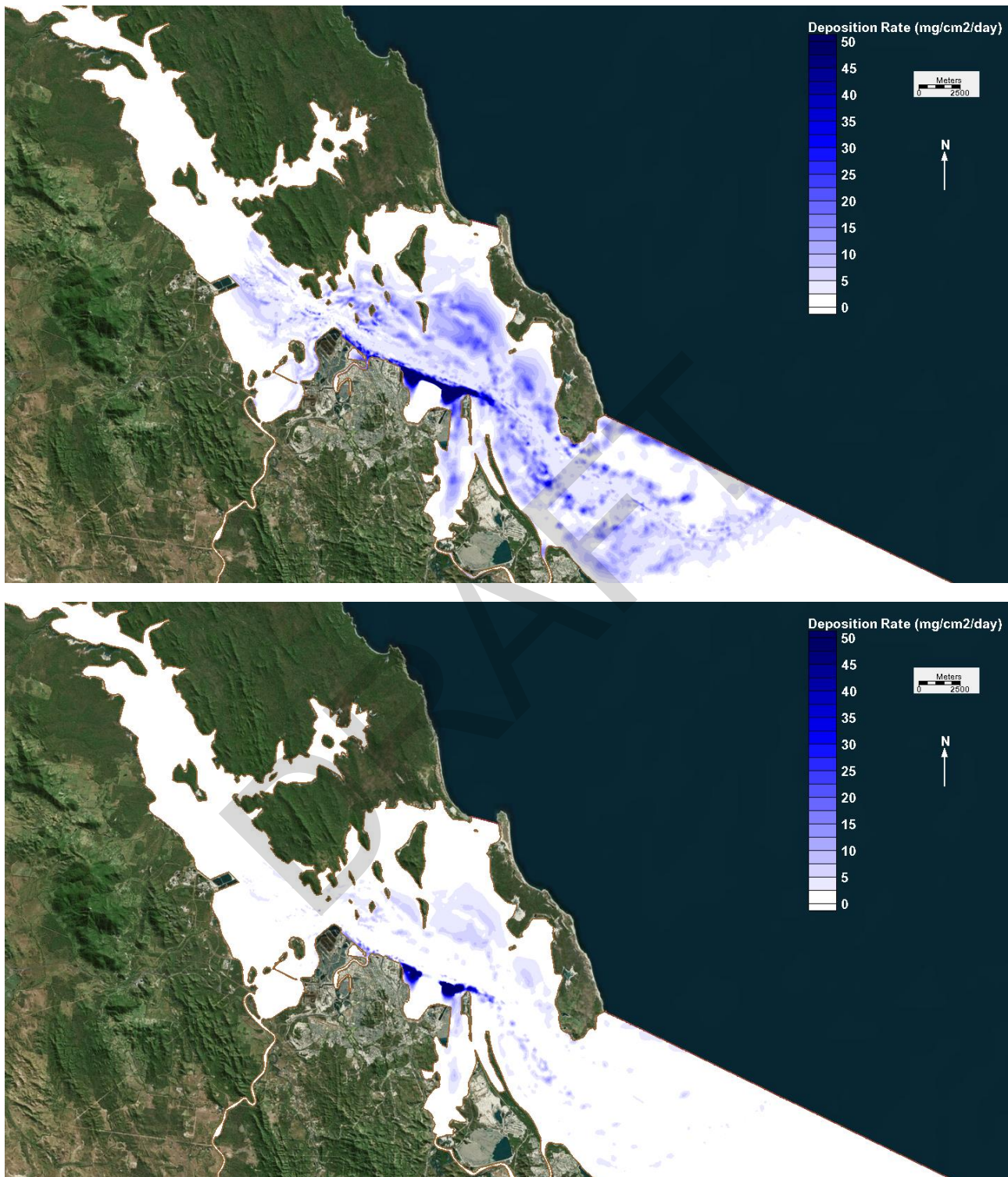


Figure 3-15 Dredged Sediment 95th Percentile Deposition Rate (Top) and 50th Percentile Deposition Rate (Bottom) for the 'Expected Scenario' Case 3 - Port Central Expansion Reclamation Area (With Pit)

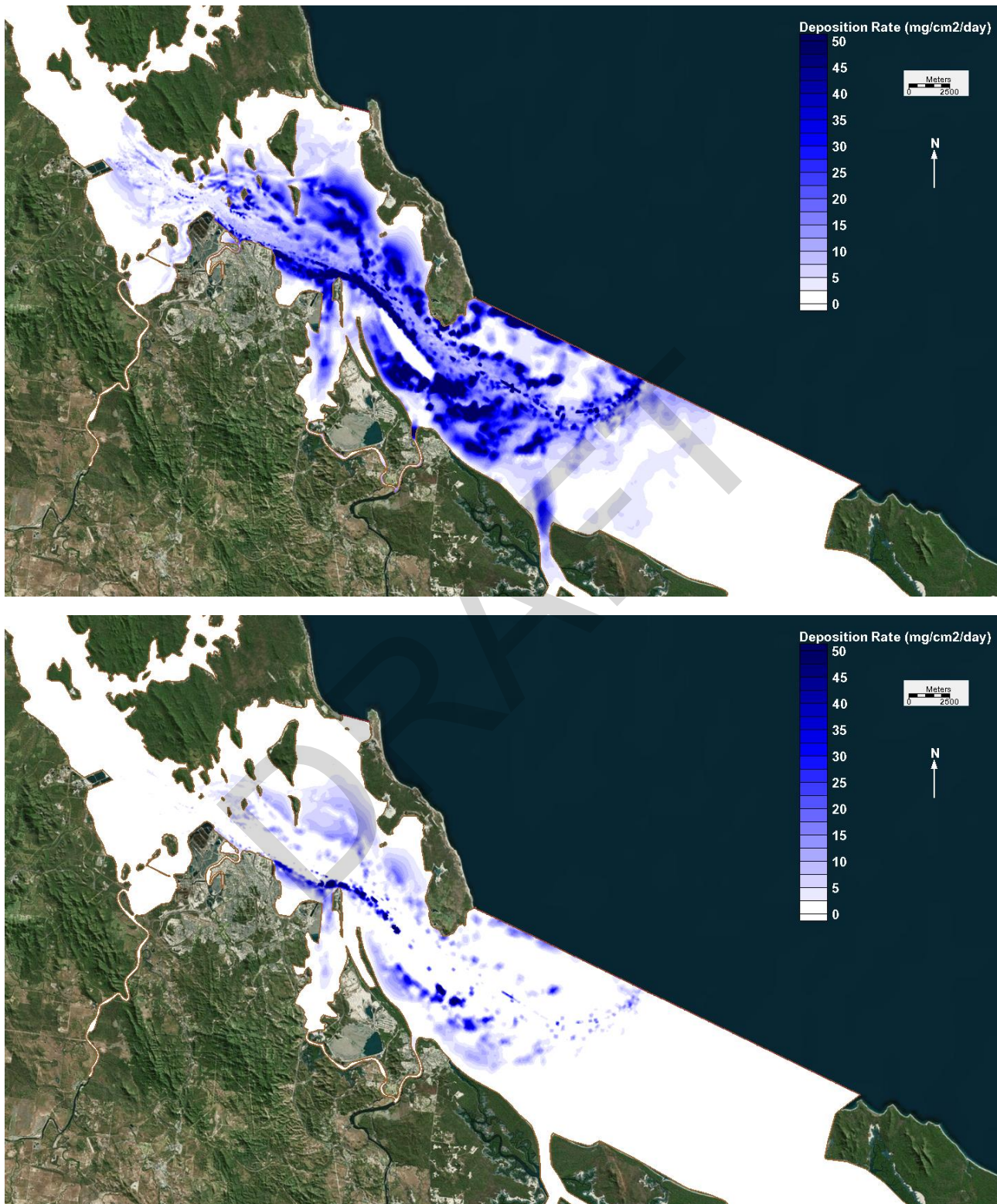


Figure 3-16 Dredged Sediment 95th Percentile Deposition Rate (Top) and 50th Percentile Deposition Rate (Bottom) for the 'Expected Scenario' Case 4 - West Banks Island Reclamation Area (No Pit)

3.4 'High Fines Content Scenario' Results

The 'High Fines Content Scenario' assumes that the dredged material is composed of 10% silt and 90% clay for the duration of the two month simulation period.

3.4.1 Potential Turbidity Impacts

The potential impact of each of the rehandling options on the turbidity in Port Curtis is presented in terms of the 95th and 50th percentiles of the modelled dredging-related turbidity during the last six weeks of the two month simulation period (allowing some time for the turbidity to build up in the early part of the simulation). Resuspension of the dredged sediment by currents and waves is modelled, and ambient sediment resuspension is also modelled in the same simulation so that mixing of dredged and ambient sediment can take place. This ensures that the resuspension rate of dredged sediment is not overestimated.

The potential impacts for each case are described in Table 3-3 below.

Table 3-3 Summary of Potential Turbidity Impacts for the 'High Fines Content Scenario'

Dredge Material Placement Option Requiring Rehandling	Case No.	Figure No.	Summary of Potential Turbidity Impact
Western Basin Expansion Reclamation Area (No Pit)	1A	Figure 3-17	Turbidity impacts are widespread, extending well into The Narrows and Graham Creek.
Western Basin Expansion Reclamation Area (With Pit)	1B	Figure 3-18	Turbidity impacts are widespread, however the acute impacts to The Narrows and Graham Creek are somewhat reduced compared to Case 1A (likely due to the use of the pit for the rehandling activity).
Fisherman's Landing (South) Reclamation Area (With Pit)	2	Figure 3-19	Turbidity impacts are widespread, however the impacts in The Narrows and Graham Creek are reduced compared to both Case 1A and Case 1B, while the impacts to the Calliope River estuary and the Barney Point area are higher. The acute turbidity levels adjacent to the Western Basin Expansion and Fisherman's Landing (South) reclamation areas are very high due to the use of a larger dredge in this scenario.
Port Central Expansion Reclamation Area (With Pit)	3	Figure 3-20	Turbidity impacts are noted to occur throughout the central portion of the Port, however the level of acute turbidity impact is lower than for Cases 1A, 1B and 2.
West Banks Island Reclamation Area (No Pit)	4	Figure 3-21	Turbidity impacts are noted to occur throughout the outer and central portions of the Port. The increases in turbidity are particularly large in the immediate vicinity of the West Banks Island reclamation, probably due to the short cycle time and the absence of a pit. The higher production rate associated with this scenario leads to larger acute impacts but the shorter duration of the dredging campaign would provide partial mitigation.

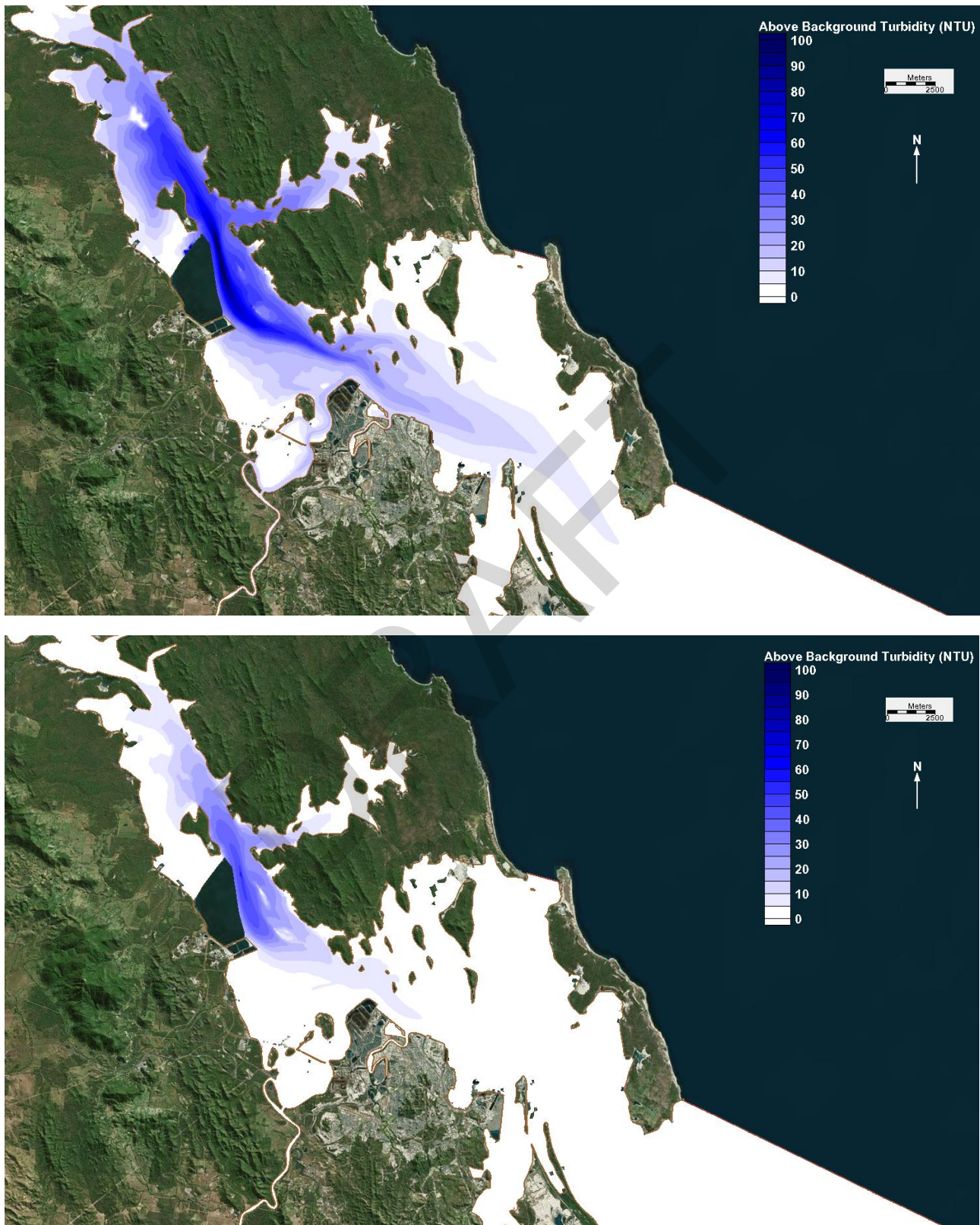


Figure 3-17 Above Background 95th Percentile Turbidity (Top) and 50th Percentile Turbidity (Bottom) for the 'High Fines Content Scenario' Case 1A - Western Basin Expansion Reclamation Area (No Pit)

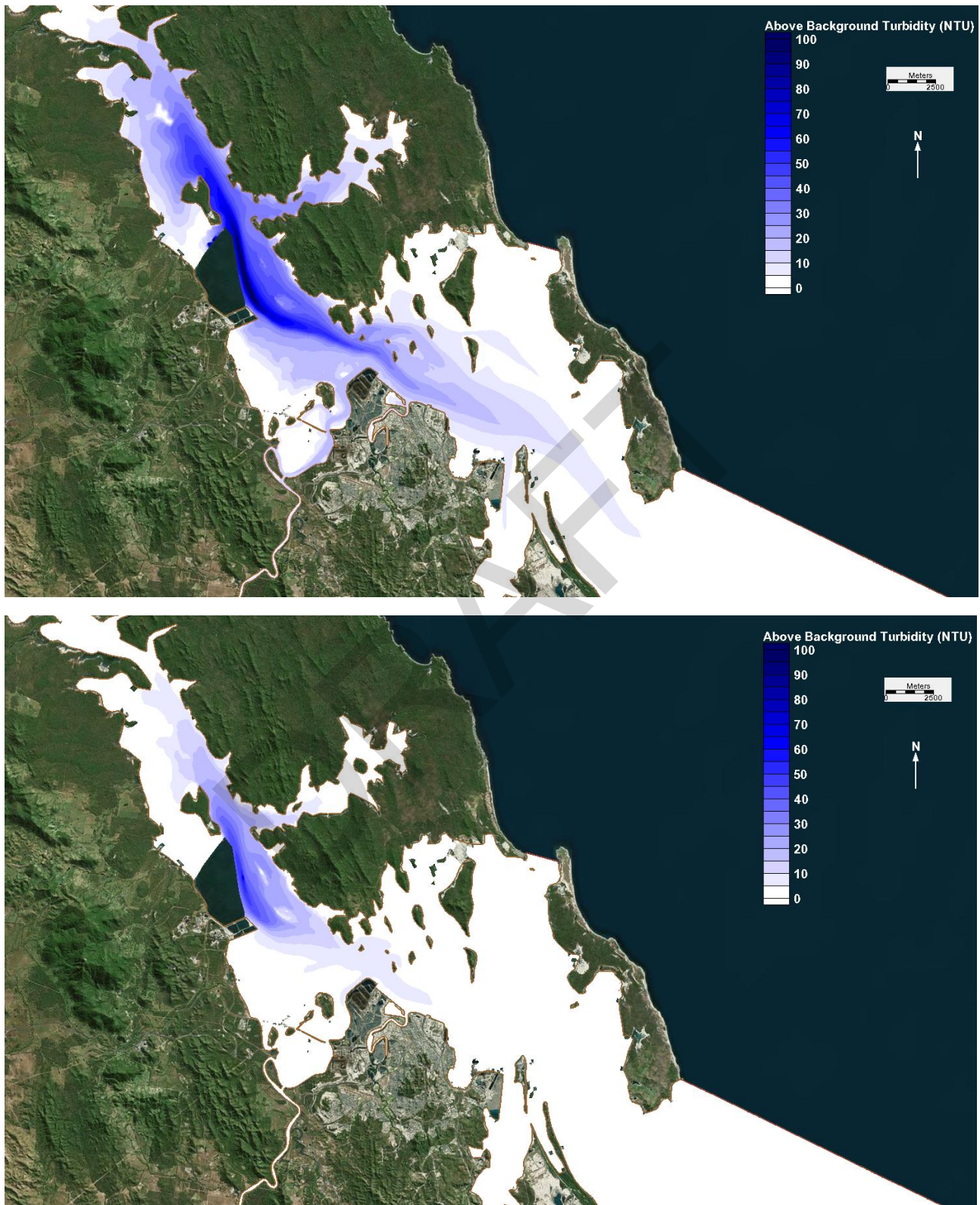


Figure 3-18 Above Background 95th Percentile Turbidity (Top) and 50th Percentile Turbidity (Bottom) for the 'High Fines Content Scenario' Case 1B - Western Basin Expansion Reclamation Area (With Pit)

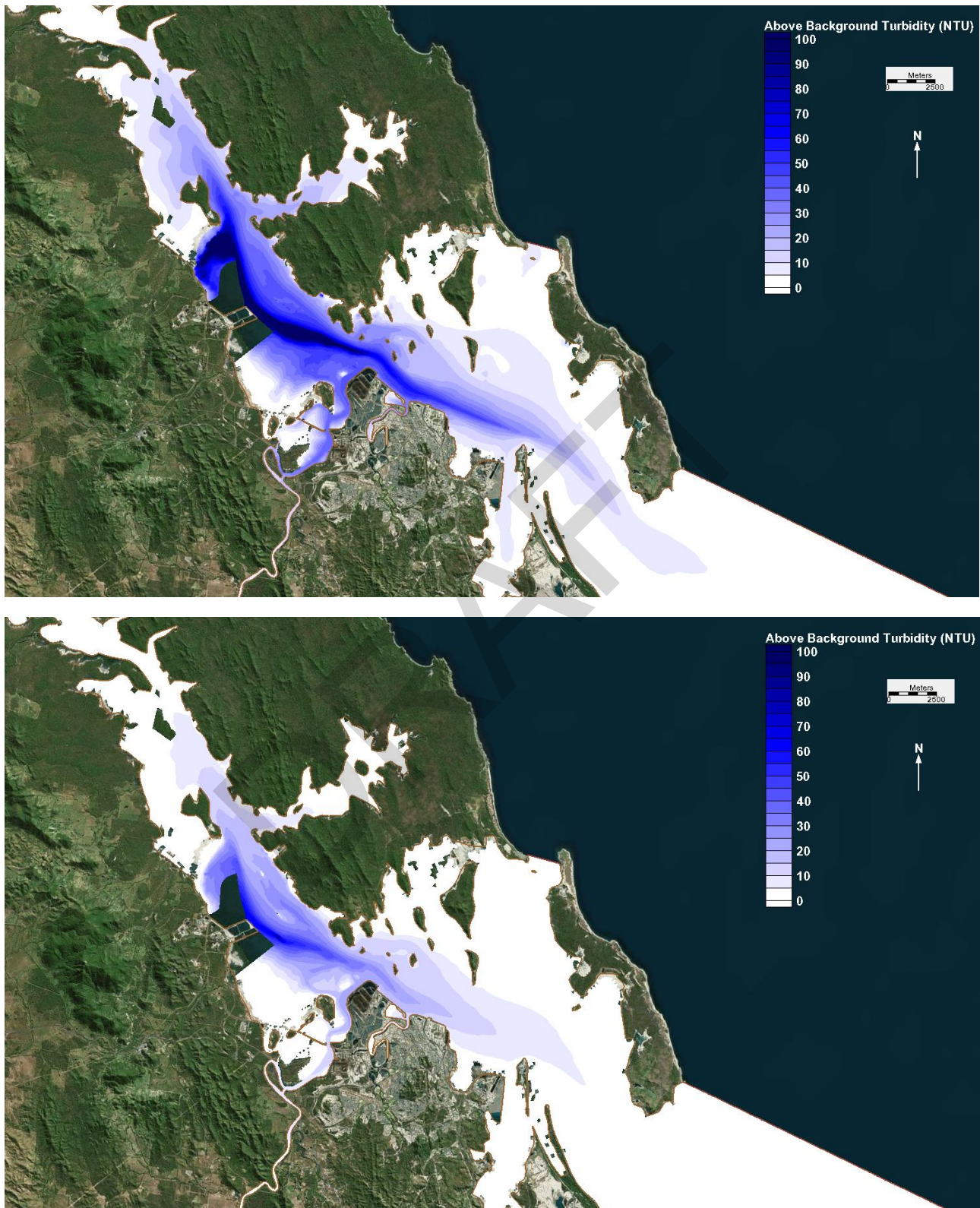


Figure 3-19 Above Background 95th Percentile Turbidity (Top) and 50th Percentile Turbidity (Bottom) for the 'High Fines Content Scenario' Case 2 - Fisherman's Landing (South) Reclamation Area (With Pit)

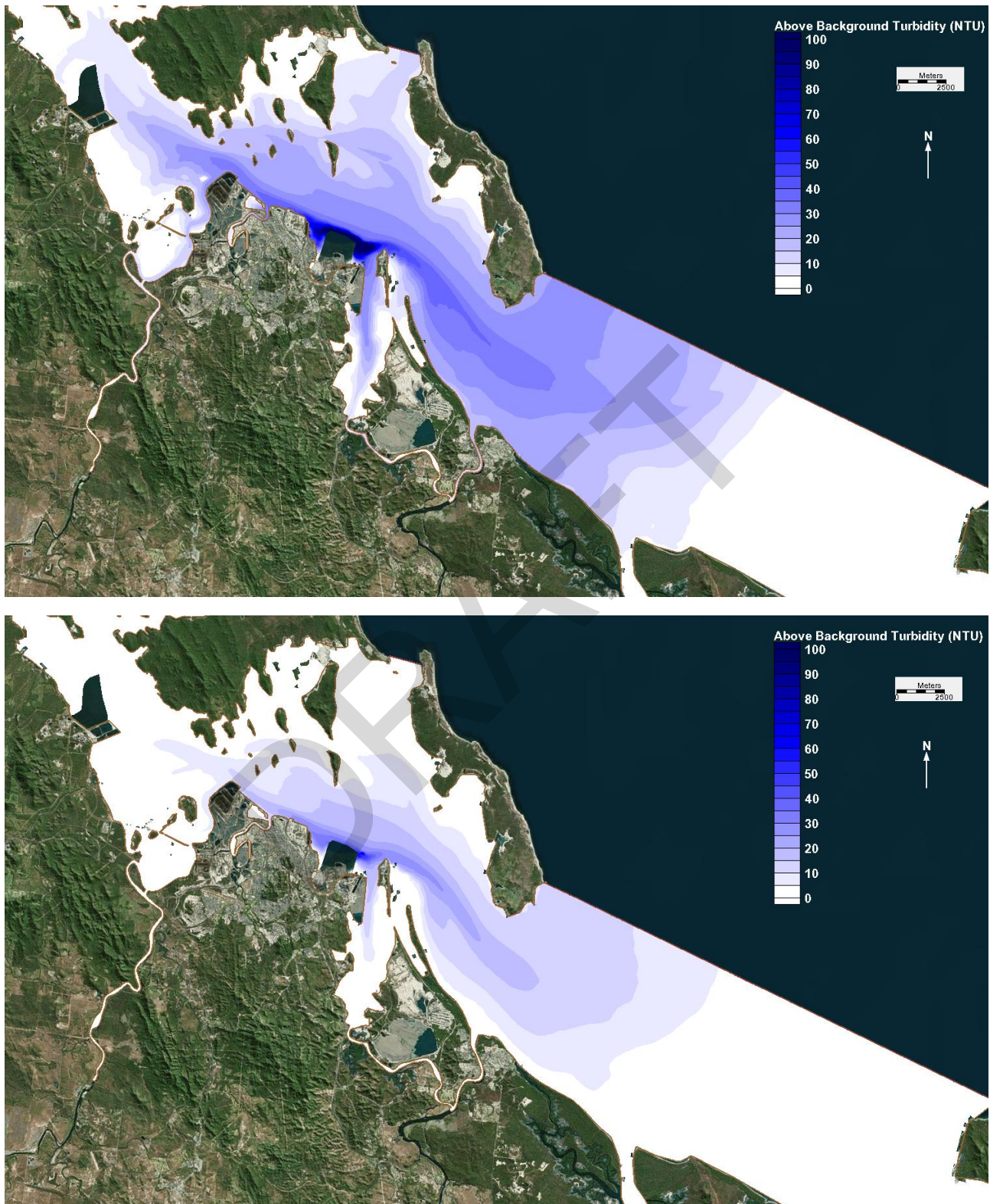


Figure 3-20 Above Background 95th Percentile Turbidity (Top) and
50th Percentile Turbidity (Bottom) for the 'High Fines Content Scenario'
Case 3 - Port Central Expansion Reclamation Area (With Pit)

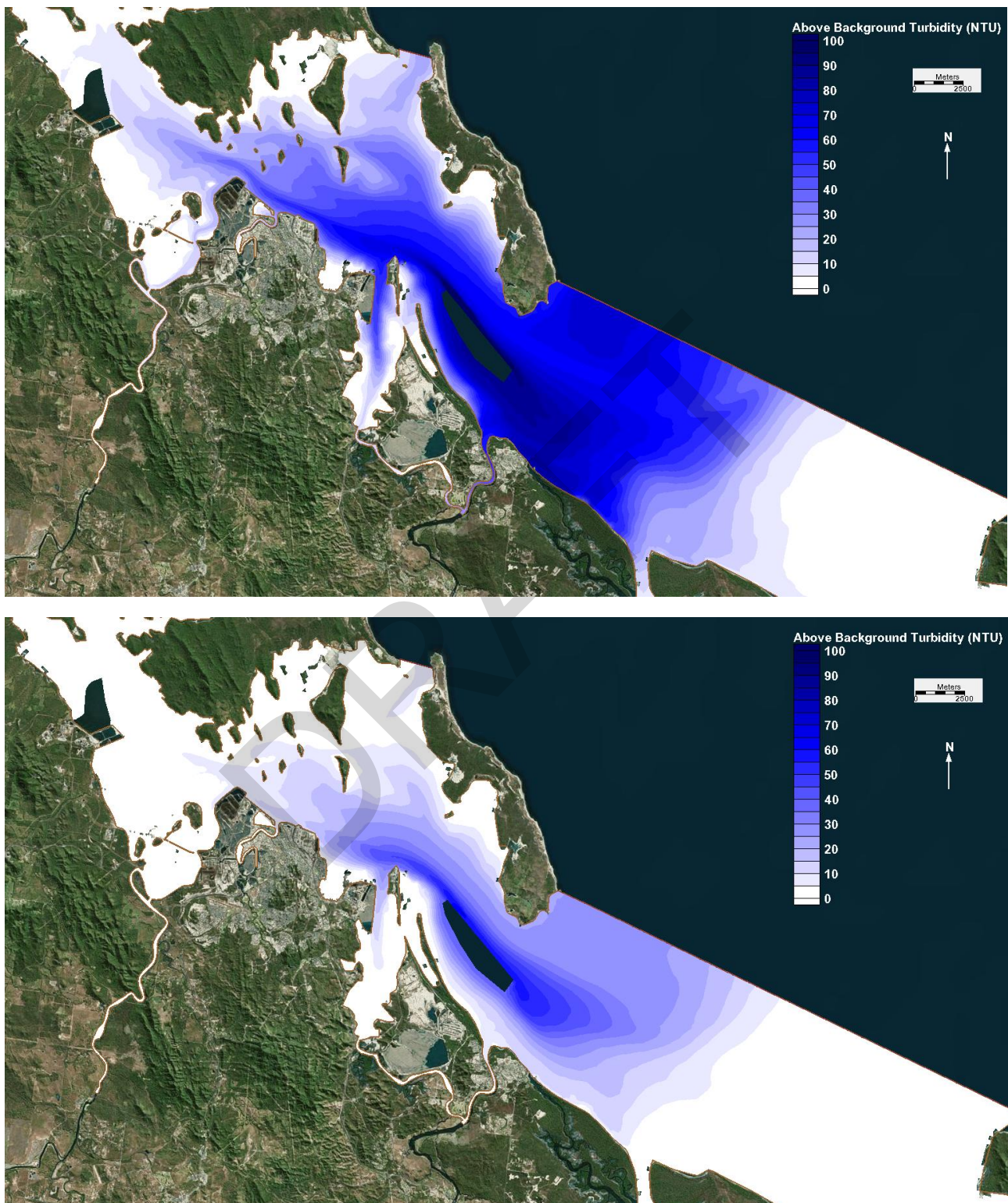


Figure 3-21 Above Background 95th Percentile Turbidity (Top) and 50th Percentile Turbidity (Bottom) for the 'High Fines Content Scenario' Case 4 - West Banks Island Reclamation Area (No Pit)

Modelling of Dredge Material Rehandling

3.4.2 Potential Deposition Rate Impacts

The potential impact of each of the rehandling options on the deposition rate in Port Curtis is presented in terms of the 95th and 50th percentiles of the modelled dredging-related deposition rate during the last six weeks of the two month simulation period (allowing some time for the turbidity to build up in the early part of the simulation).

The potential impacts for each case are described in Table 3-4 below.

Table 3-4 Summary of Potential Deposition Rate Impacts for the 'High Fines Content Scenario'

Dredge Material Placement Option Requiring Rehandling	Case Number	Figure Number	Summary of Potential Deposition Rate Impact
Western Basin Expansion Reclamation Area (No Pit)	1A	Figure 3-22	Deposition of dredged sediment occurs widely, including The Narrows and Graham Creek, however the rate is highest in the dredged swing basins and channels.
Western Basin Expansion Reclamation Area (With Pit)	1B	Figure 3-23	Deposition of dredged sediment occurs widely, including The Narrows and Graham Creek, however the rate is highest in the dredged swing basins and channels.
Fisherman's Landing (South) Reclamation Area (With Pit)	2	Figure 3-24	The deposition rate in The Narrows and Graham Creek are reduced compared to both Case 1A and Case 1B, while the deposition rate adjacent to the Western Basin Expansion and Fisherman's Landing (South) reclamation areas and in the Calliope River estuary are higher.
Port Central Expansion Reclamation Area (With Pit)	3	Figure 3-25	The deposition rate increases throughout the central portion of the Port. The deposition rate increases are particularly large in the quiescent areas to the immediate East and West of the reclamation area.
West Banks Island Reclamation Area (No Pit)	4	Figure 3-26	The deposition rate increases throughout the outer and central portions of the Port.

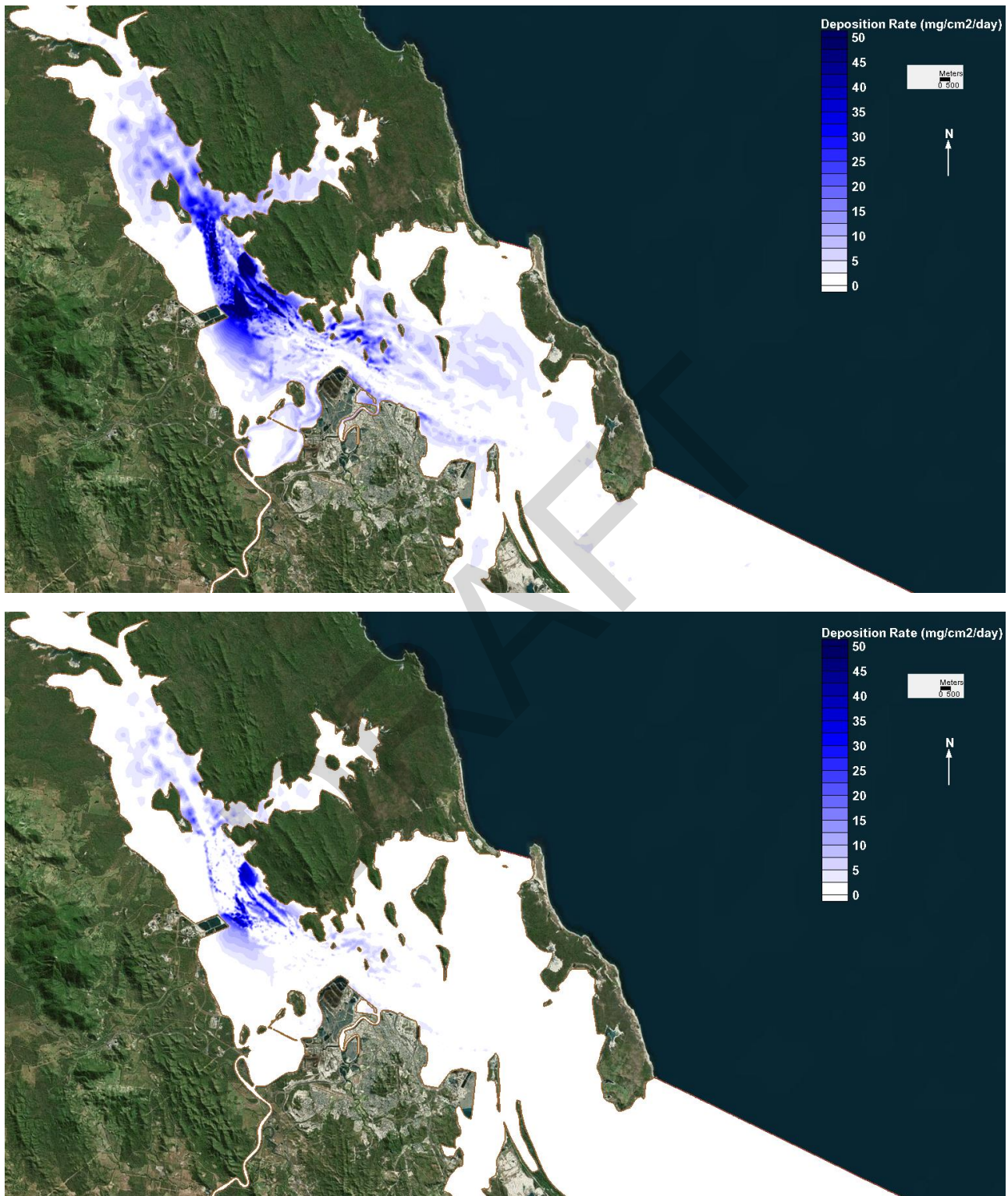


Figure 3-22 Dredged Sediment 95th Percentile Deposition Rate (Top) and 50th Percentile Deposition Rate (Bottom) for the 'High Fines Content Scenario' Case 1A - Western Basin Expansion Reclamation Area (No Pit)

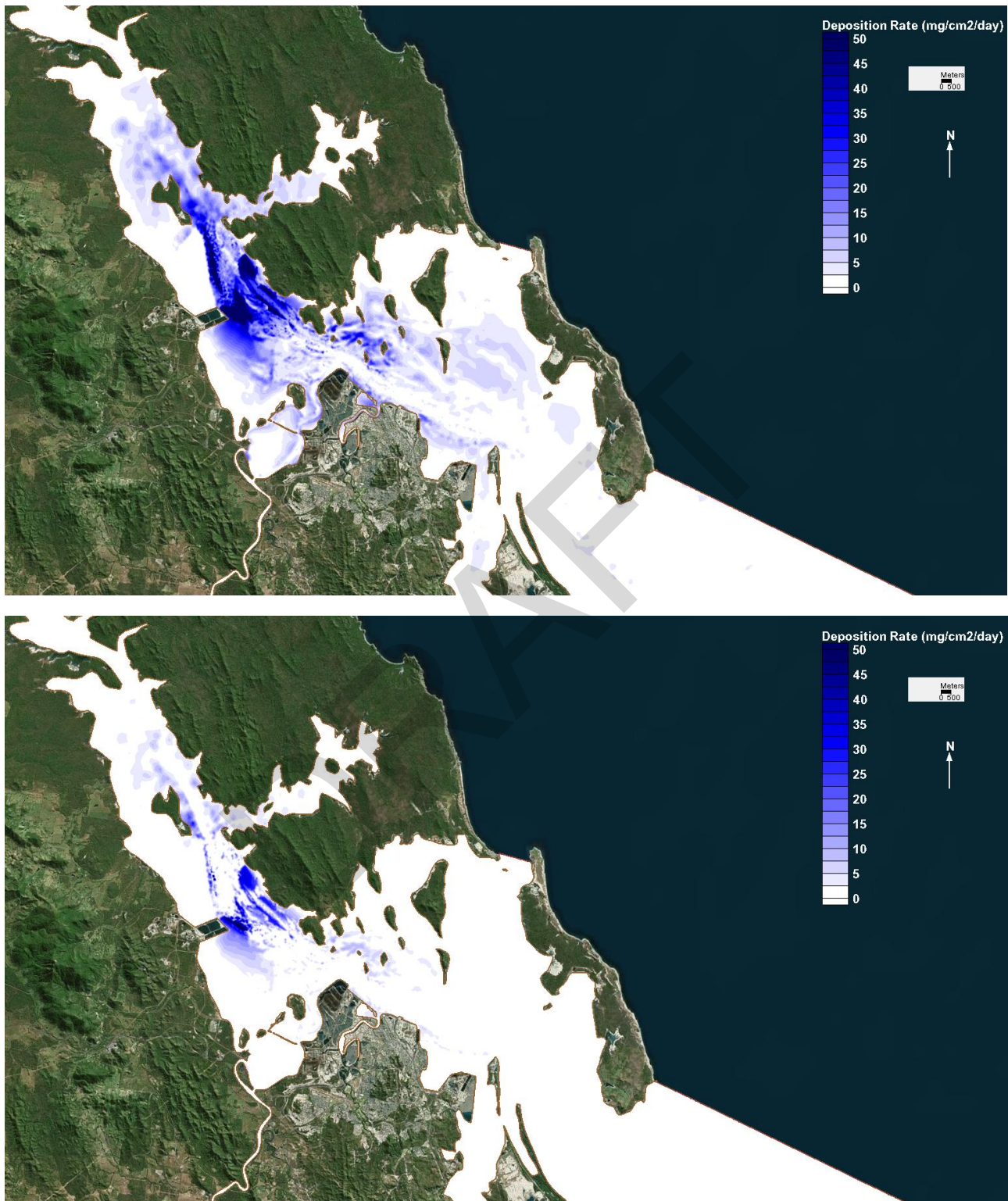


Figure 3-23 Dredged Sediment 95th Percentile Deposition Rate (Top) and 50th Percentile Deposition Rate (Bottom) for the 'High Fines Content Scenario' Case 1B - Western Basin Expansion Reclamation Area (With Pit)

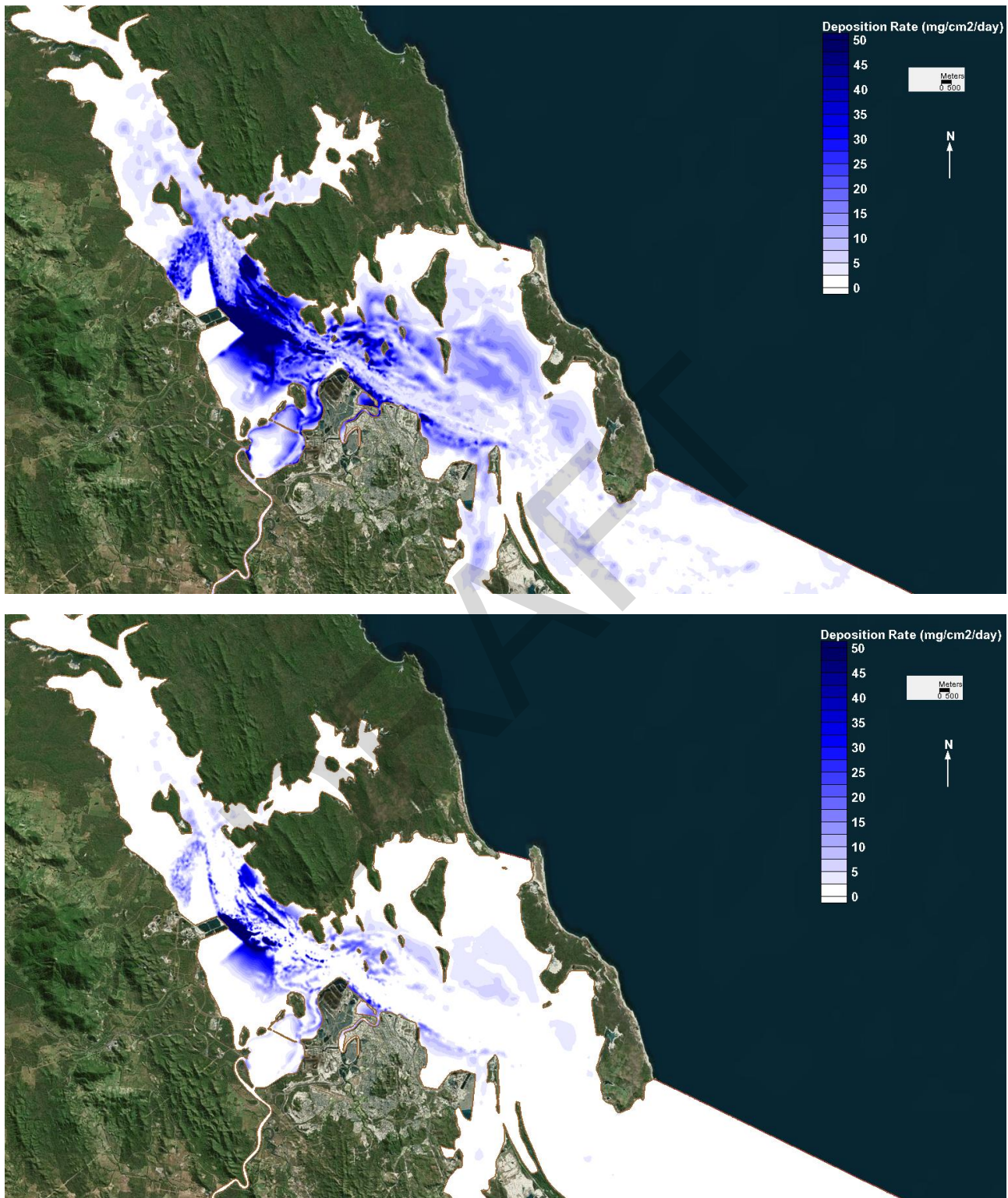


Figure 3-24 Dredged Sediment 95th Percentile Deposition Rate (Top) and 50th Percentile Deposition Rate (Bottom) for the 'High Fines Content Scenario' Case 2 - Fisherman's Landing (South) Reclamation Area (With Pit)

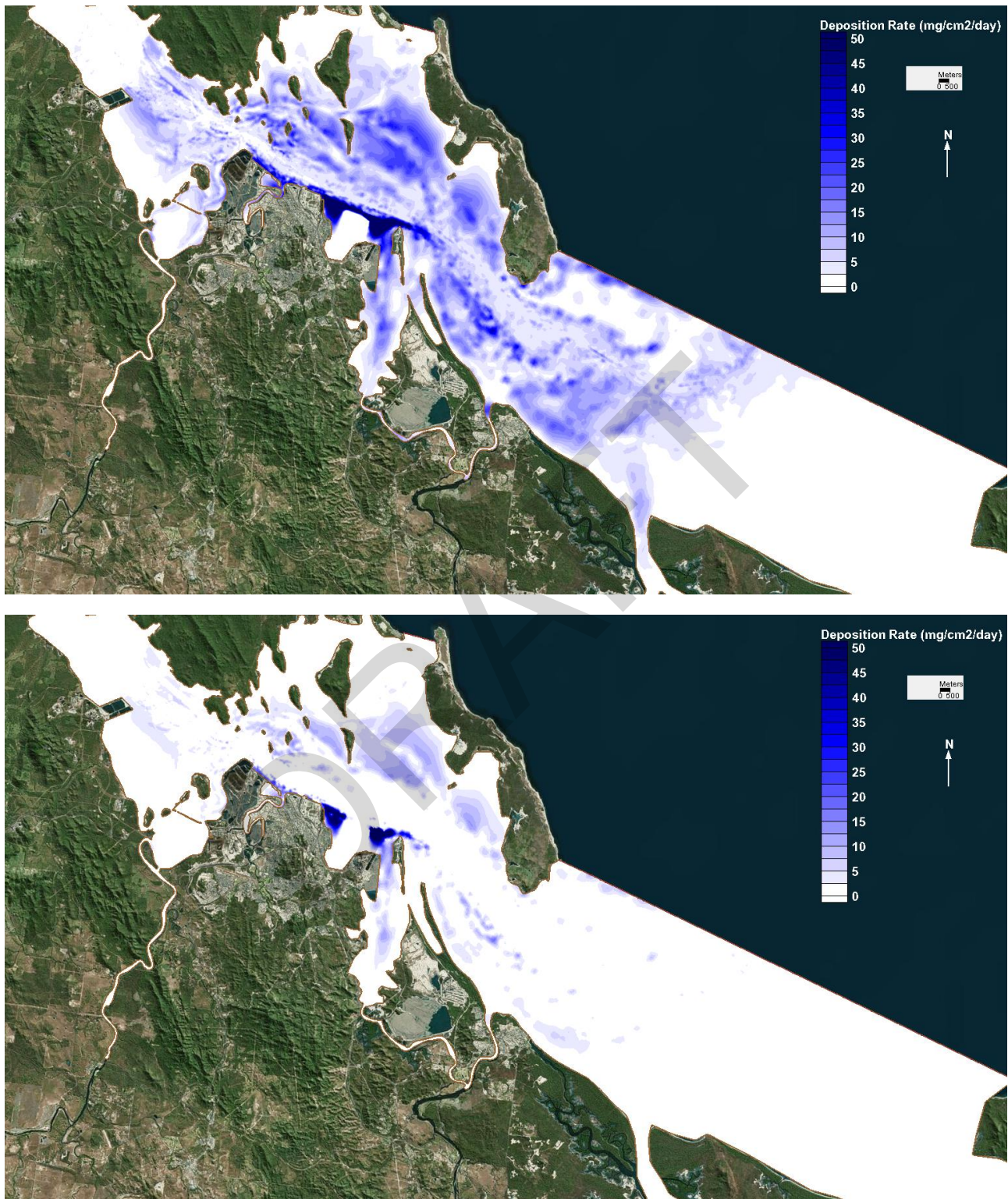


Figure 3-25 Dredged Sediment 95th Percentile Deposition Rate (Top) and 50th Percentile Deposition Rate (Bottom) for the 'High Fines Content Scenario' Case 3 - Port Central Expansion Reclamation Area (With Pit)

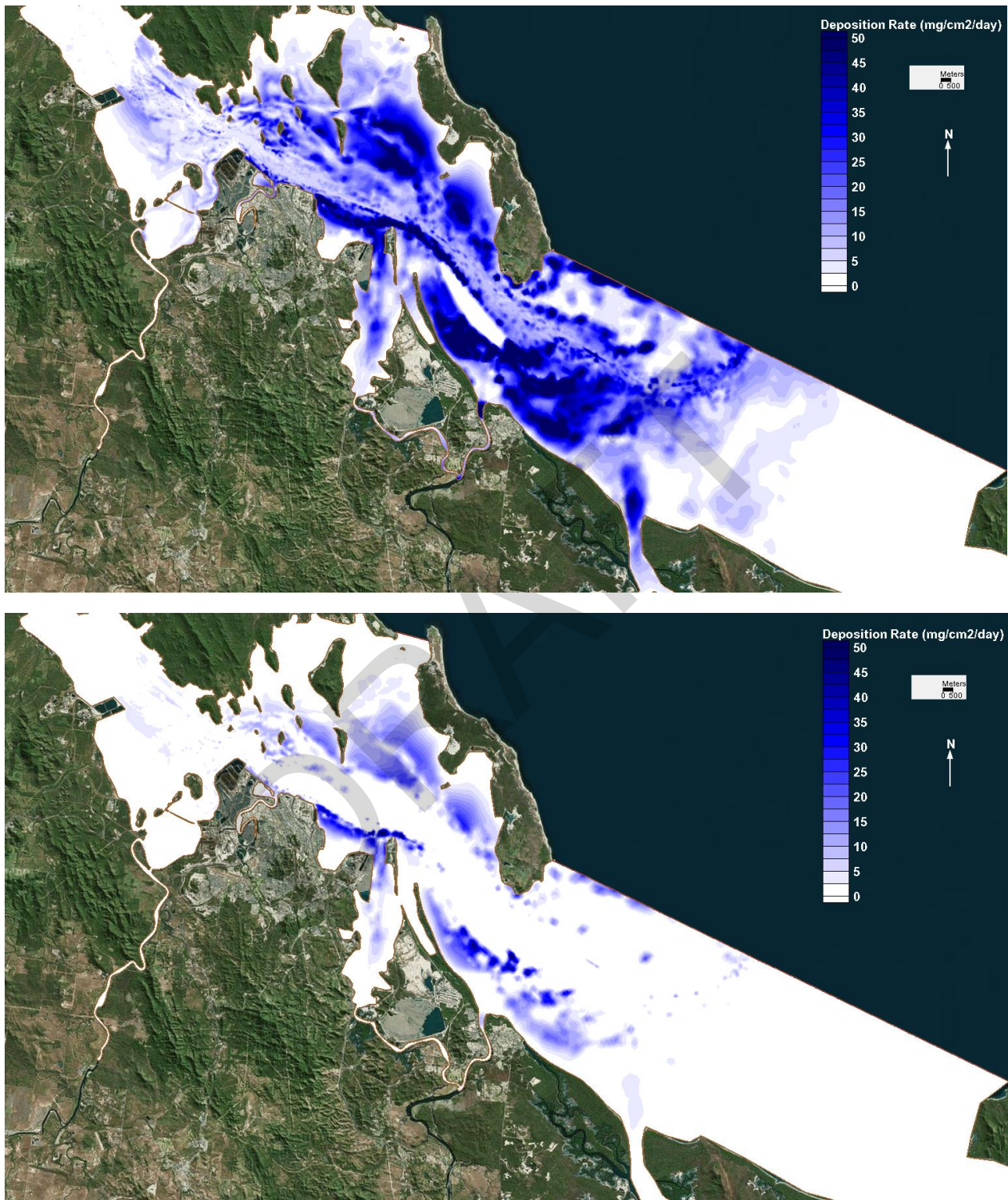


Figure 3-26 Dredged Sediment 95th Percentile Deposition Rate (Top) and 50th Percentile Deposition Rate (Bottom) for the 'High Fines Content Scenario' Case 4 - West Banks Island Reclamation Area (No Pit)

4 Hydrodynamic Assessments for Reclamation Areas

Hydrodynamic and sedimentation assessments were undertaken for the two island reclamation areas (West Banks & East Banks) and the Port Central Expansion reclamation area.

The assessment of impacts associated with the construction of the reclamation areas was undertaken by running the model with and without each reclamation area for the same period described in Section 3.1 (1/07/2010 to 1/09/2010). This two month period includes four periods of spring tides with a tidal range of up to 4.3 metres (refer to the time series in Figure 3-1).

4.1 Model Configurations

Figure 4-1, Figure 4-2 and Figure 4-3 show the footprints of the potential Port Central Expansion, West Banks Island and East Banks Island reclamation areas, respectively.

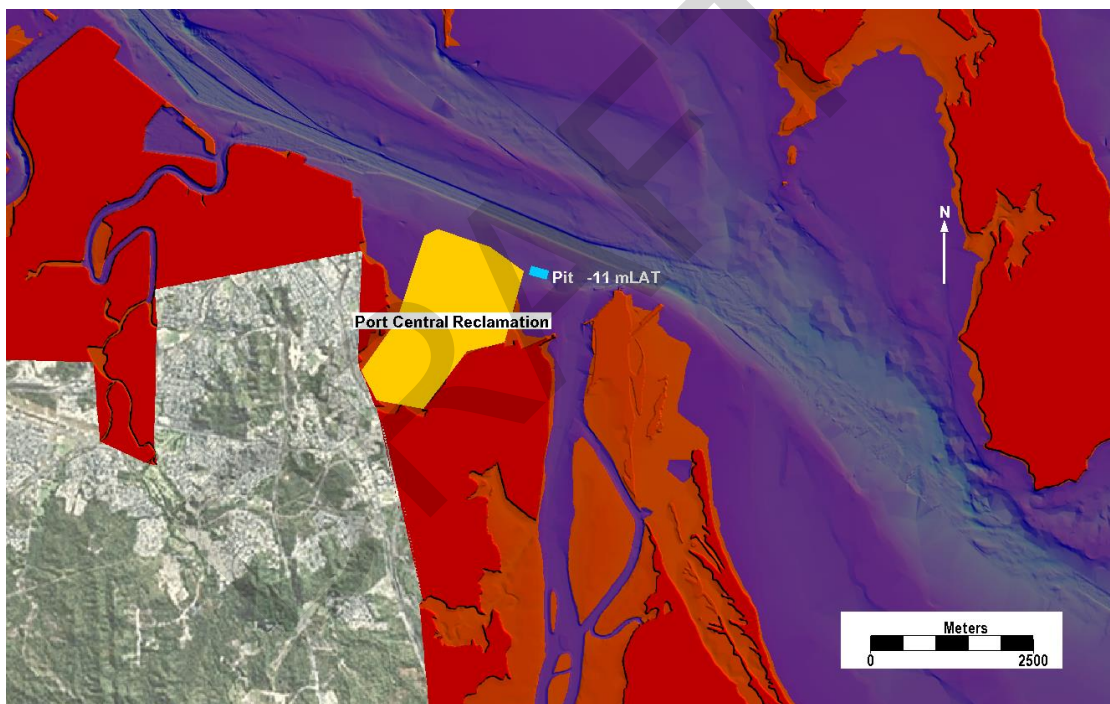


Figure 4-1 Port Central Expansion Reclamation Model Configuration

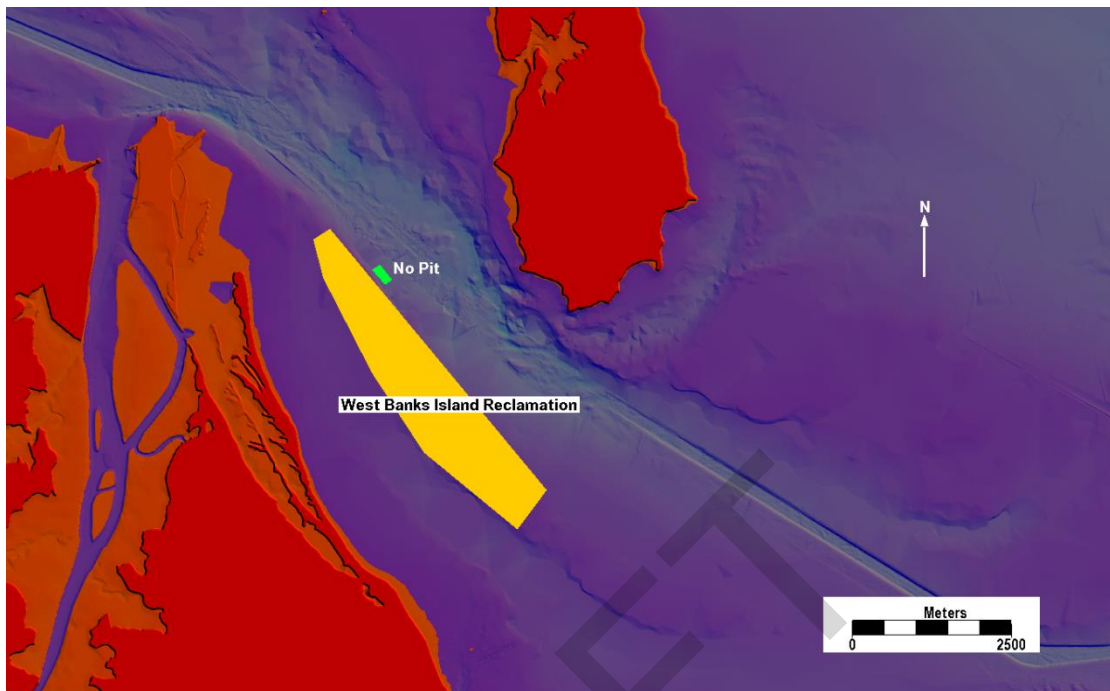


Figure 4-2 West Banks Island Reclamation Model Configuration

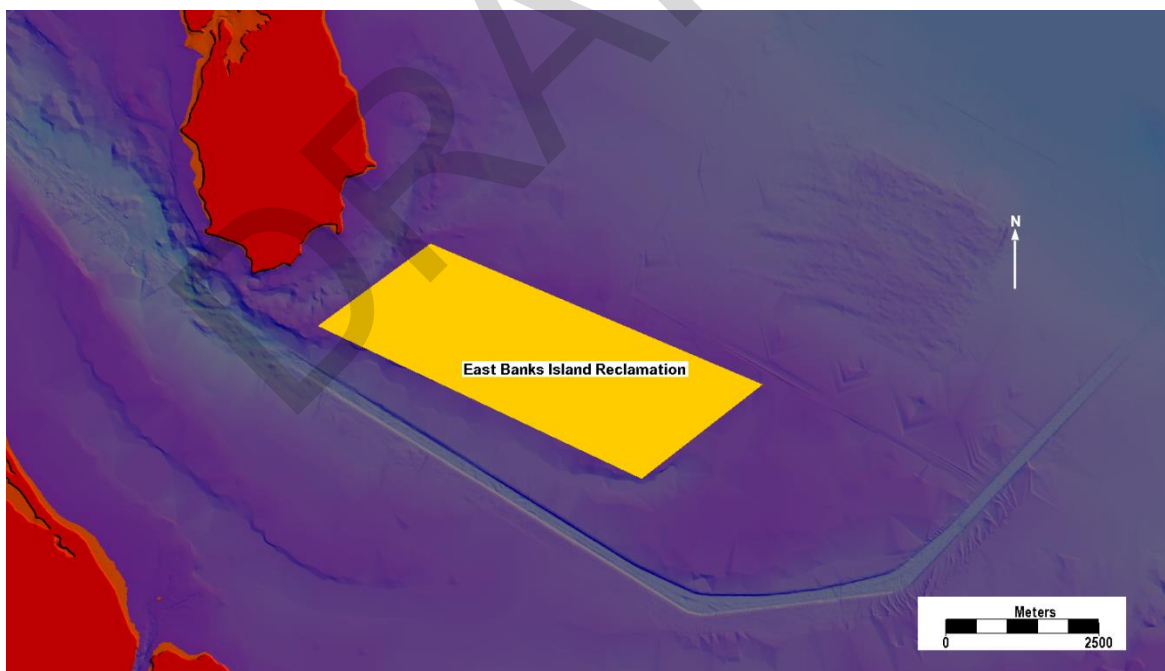


Figure 4-3 East Banks Island Reclamation Model Configuration

4.2 Modelling Results

4.2.1 Potential Hydrodynamic Impacts

The potential hydrodynamic impacts of each of the three reclamation options are illustrated by showing the change in the 95th percentile depth-averaged tidal velocity. This is an indication of how much the typical spring tide velocities will change as a result of construction of each of the reclamation areas.

The changes in the 95th percentile depth-averaged tidal velocity associated with each case are shown in Figure 4-4 to Figure 4-6. The potential impacts for each case are described in Table 4-1 below.

Table 4-1 Summary of Potential Spring Tide Velocity Impacts

Reclamation Area Assessed	Figure Number	Summary of Potential Spring Tide Velocity Impact
Port Central Expansion Reclamation Area	Figure 4-4	The modelled typical spring tide velocity increased in the main channel adjacent to the Port Central Expansion reclamation, and decreased in the more sheltered areas to the East and West of the new reclamation.
West Banks Island Reclamation Area	Figure 4-5	There is an increase in modelled spring tide velocities adjacent to the North West corner of the West Banks Island reclamation, as well as an increase in vicinity of the main shipping channel. The model indicates a decrease in tidal velocities to the South and West of the island reclamation.
East Banks Island Reclamation Area	Figure 4-6	The model indicates an increase in spring tidal velocities in the channel to the West of the island (between the island and Gatcombe Head) as well as in the vicinity of the main channel to the South and East of the island.

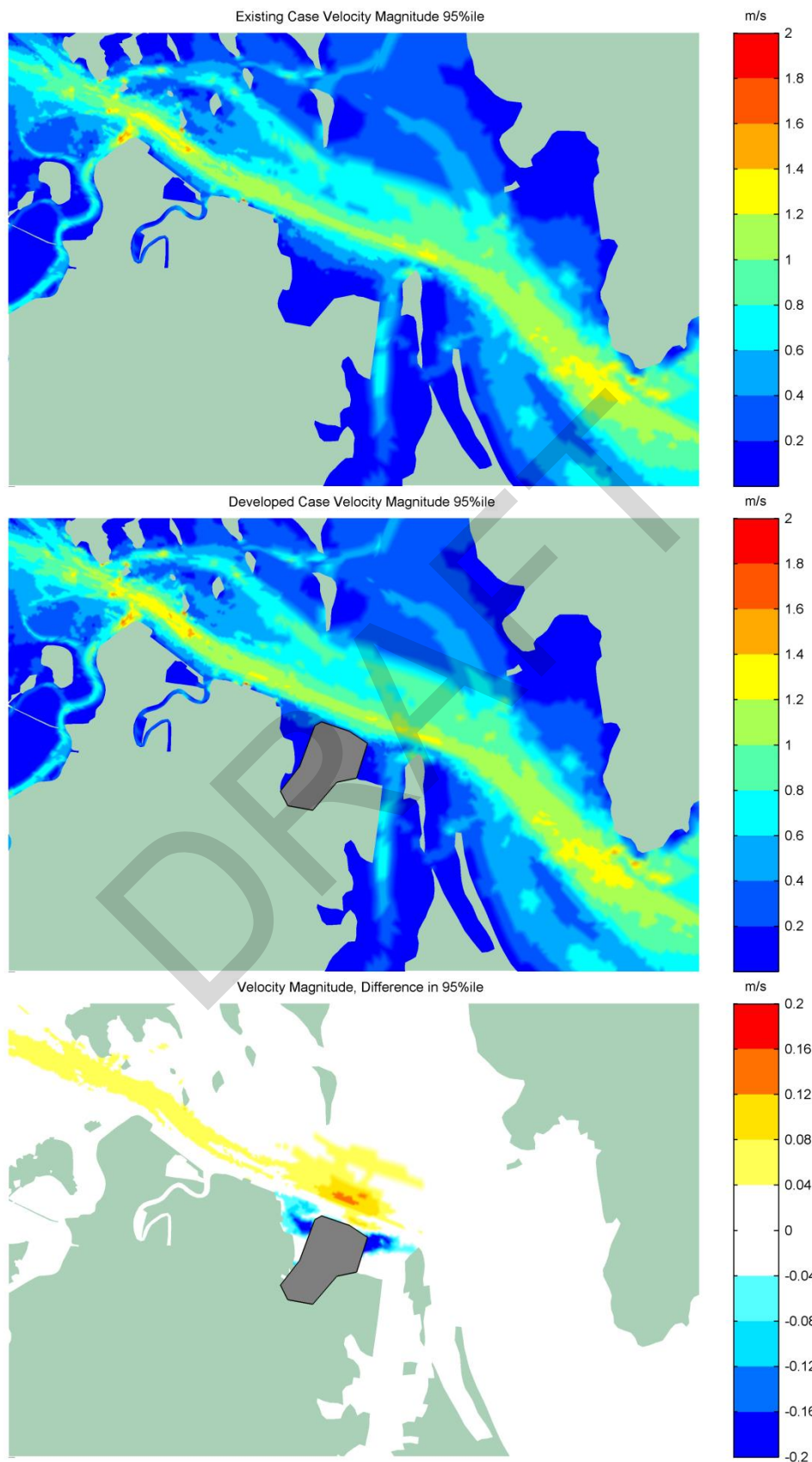


Figure 4-4 Port Central Reclamation Scenario – 95th Percentile Velocity Magnitude Impacts

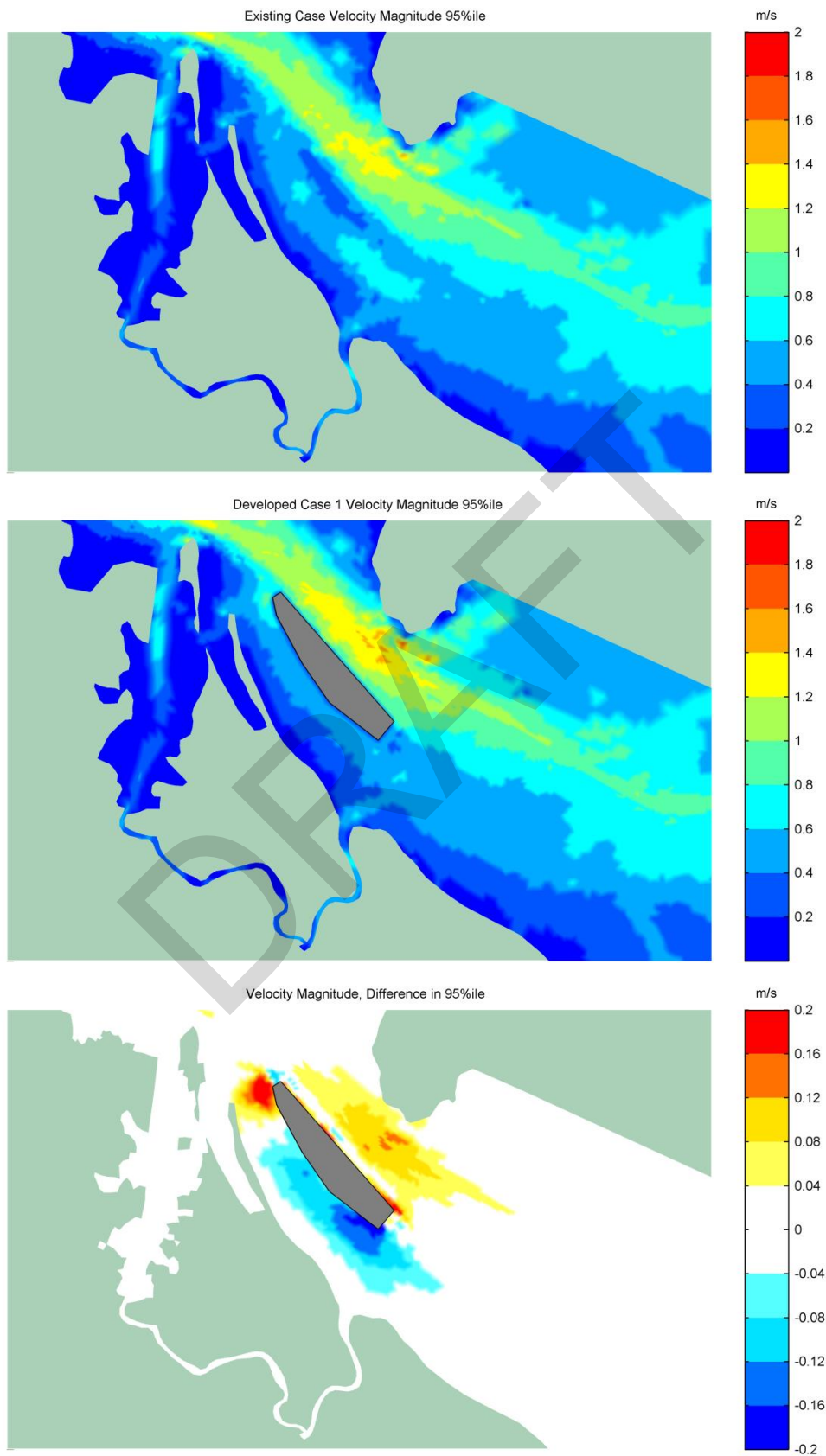


Figure 4-5 West Banks Island Scenario – 95th Percentile Velocity Magnitude Impacts

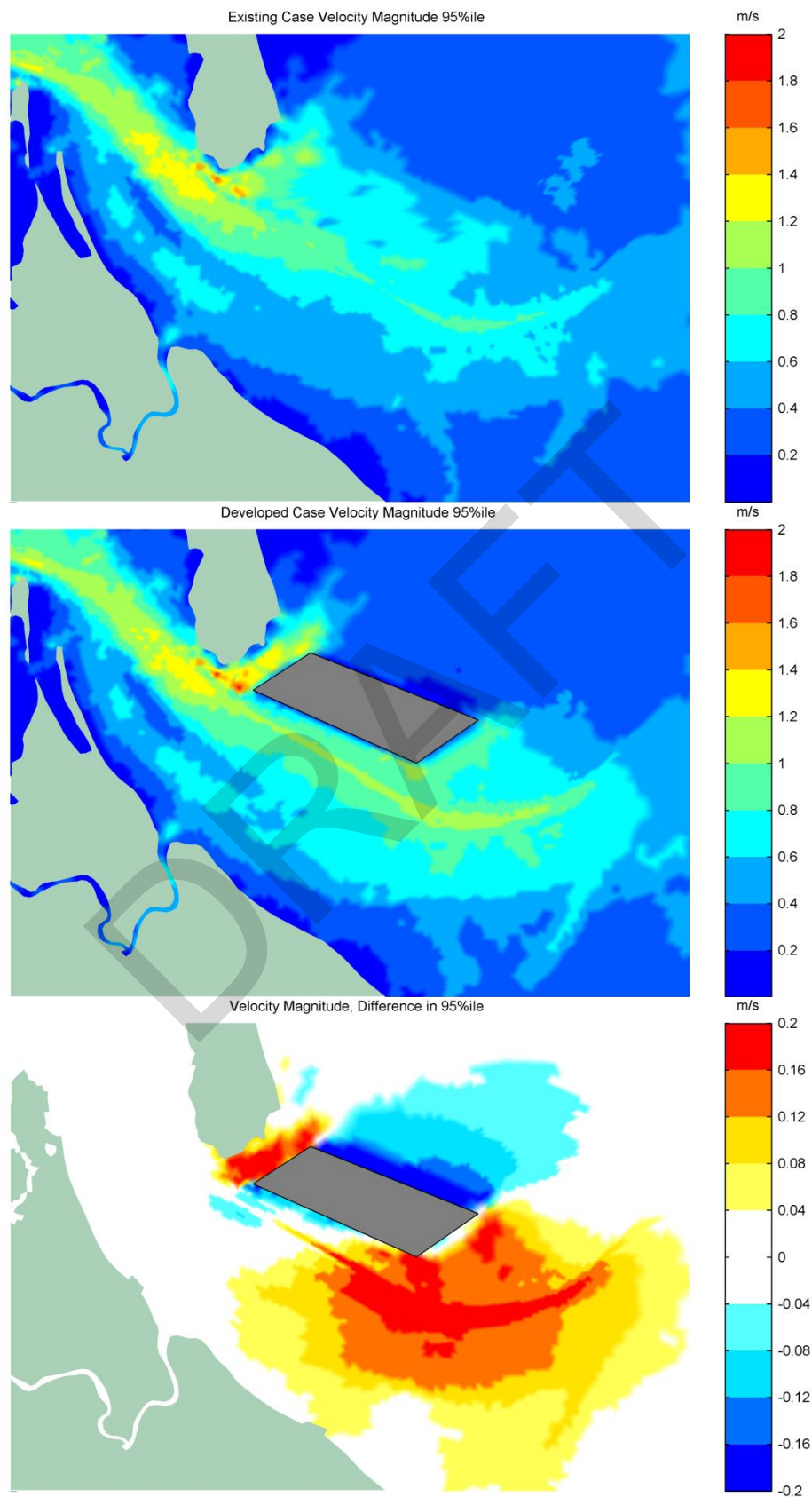


Figure 4-6 East Banks Island Scenario – 95th Percentile Velocity Magnitude Impacts

4.2.2 Wave Climate Impacts

The West Banks Island and East Banks Island scenarios are likely to have a significant impact on the wave climate in the immediate vicinity of the reclamation areas. The SWAN wave model was used to indicate the likely magnitude of this impact.

Figure 4-7 shows the model output locations used for the presentation of wave climate impacts.

Figure 4-8 shows the reduction in the average significant wave height during the July-August 2010 simulation period for each of the two island scenarios.

Figure 4-9 and Figure 4-10 show the modelled changes to the wave parameters during the simulation period for each of the island reclamation areas.

Figure 4-11 and Figure 4-12 show the modelled changes to the wave roses at four of the locations in Figure 4-7. The 'inner' East Banks and 'inner' West Banks locations show a significant reduction in wave height, and a change to a more southerly typical wave direction.

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Figure 4-7 Model Output Locations

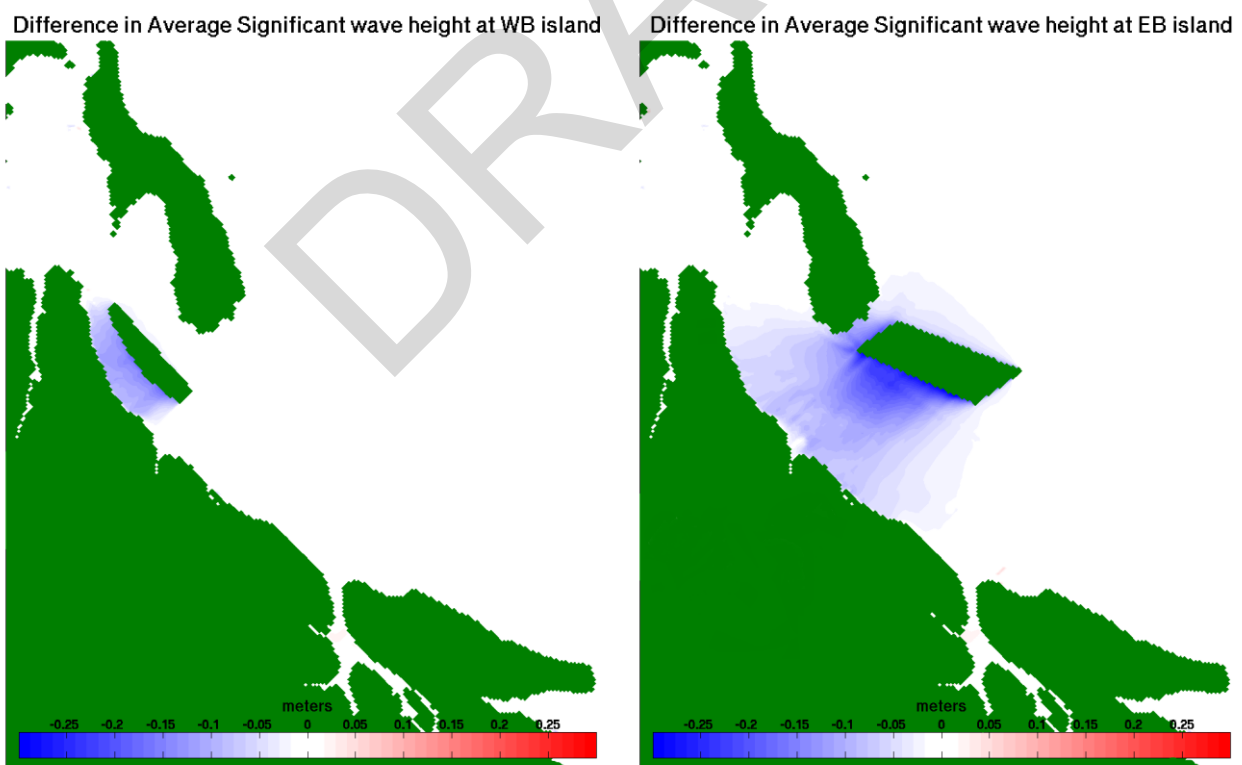


Figure 4-8 Change in Average Significant Wave Height for the West Banks (Left) and East Banks (Right) Island Reclamations

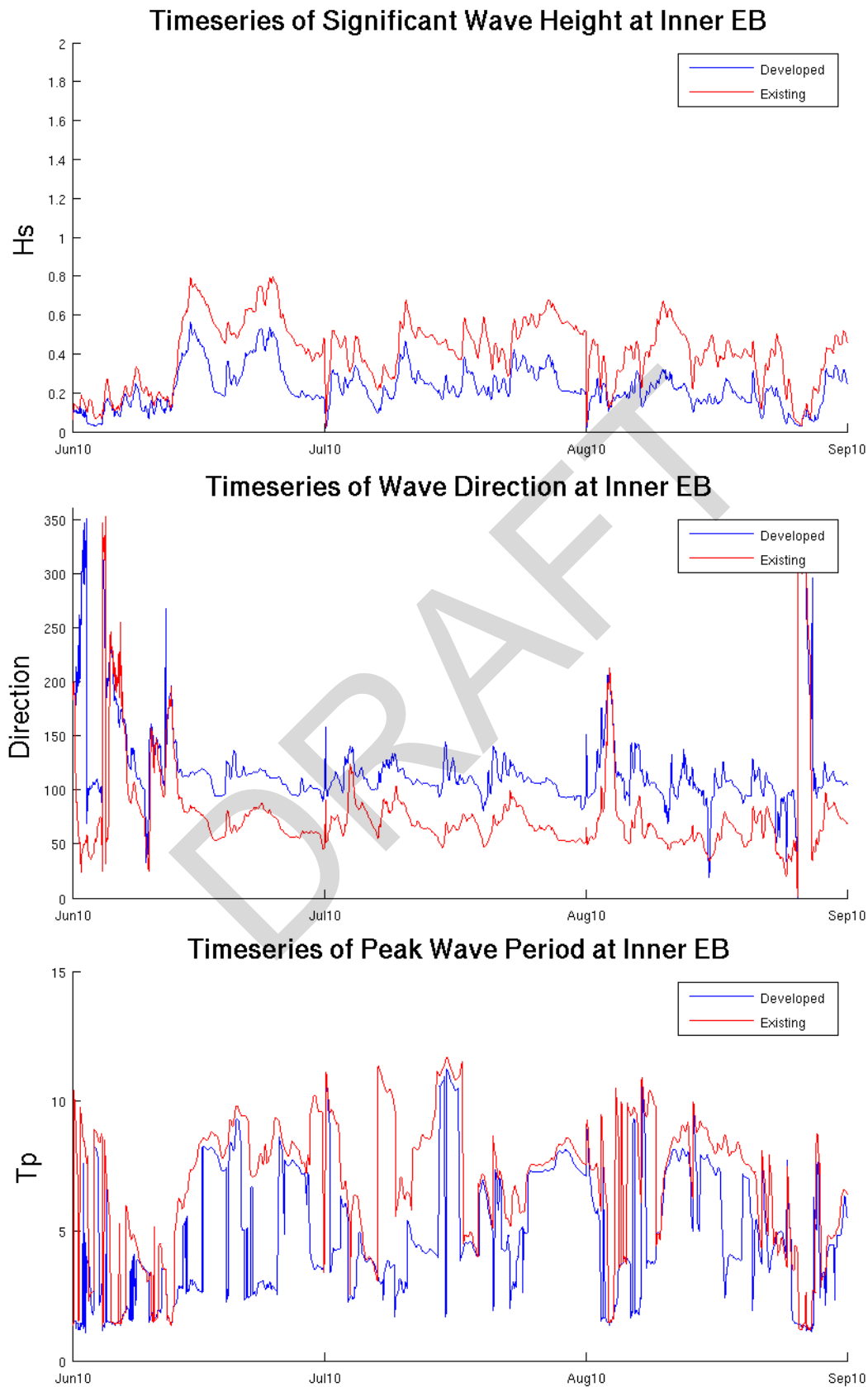


Figure 4-9 Change in Wave Parameters at the Inner East Banks Island Output Location

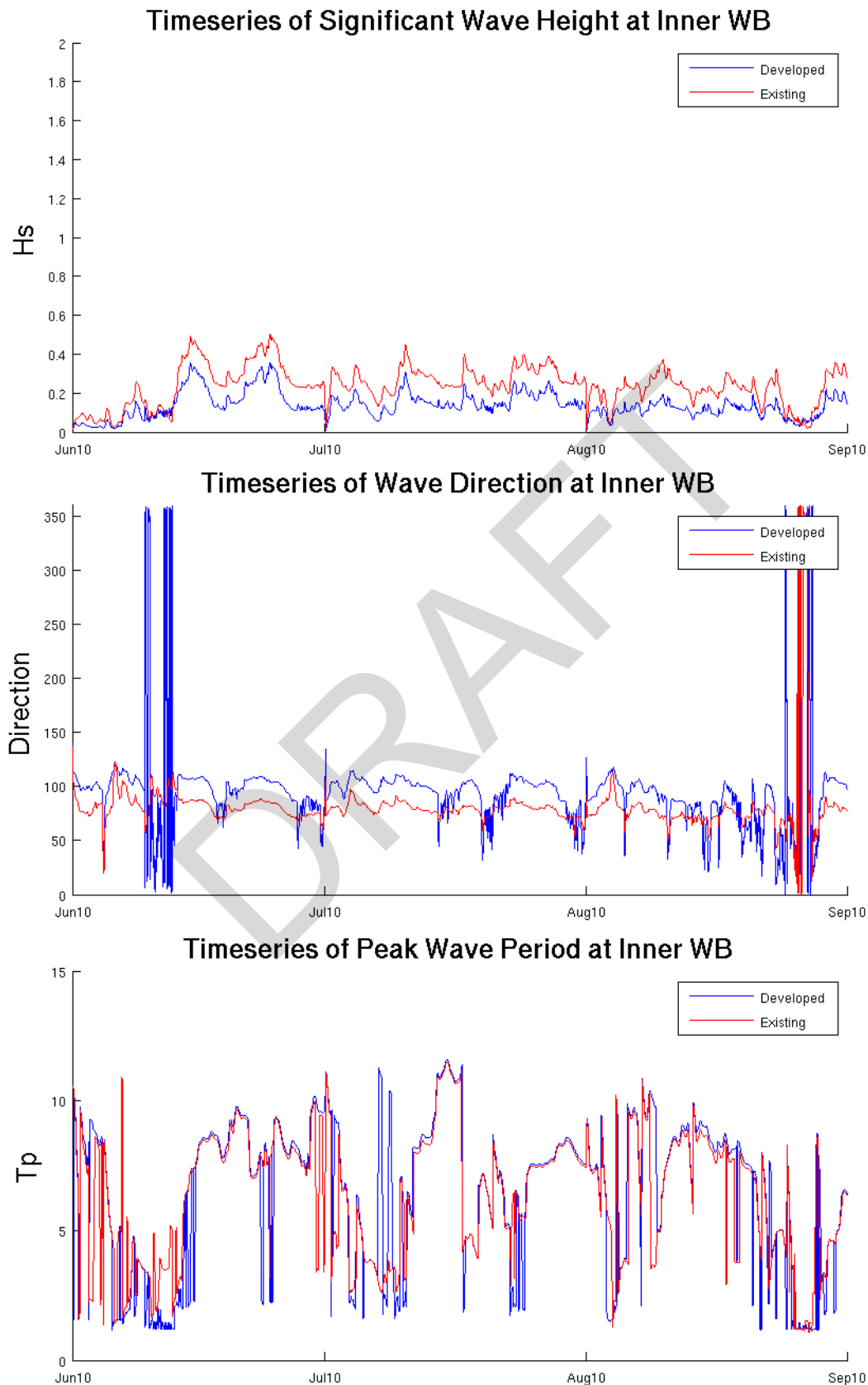


Figure 4-10 Change in Wave Parameters at the Inner West Banks Island Output Location

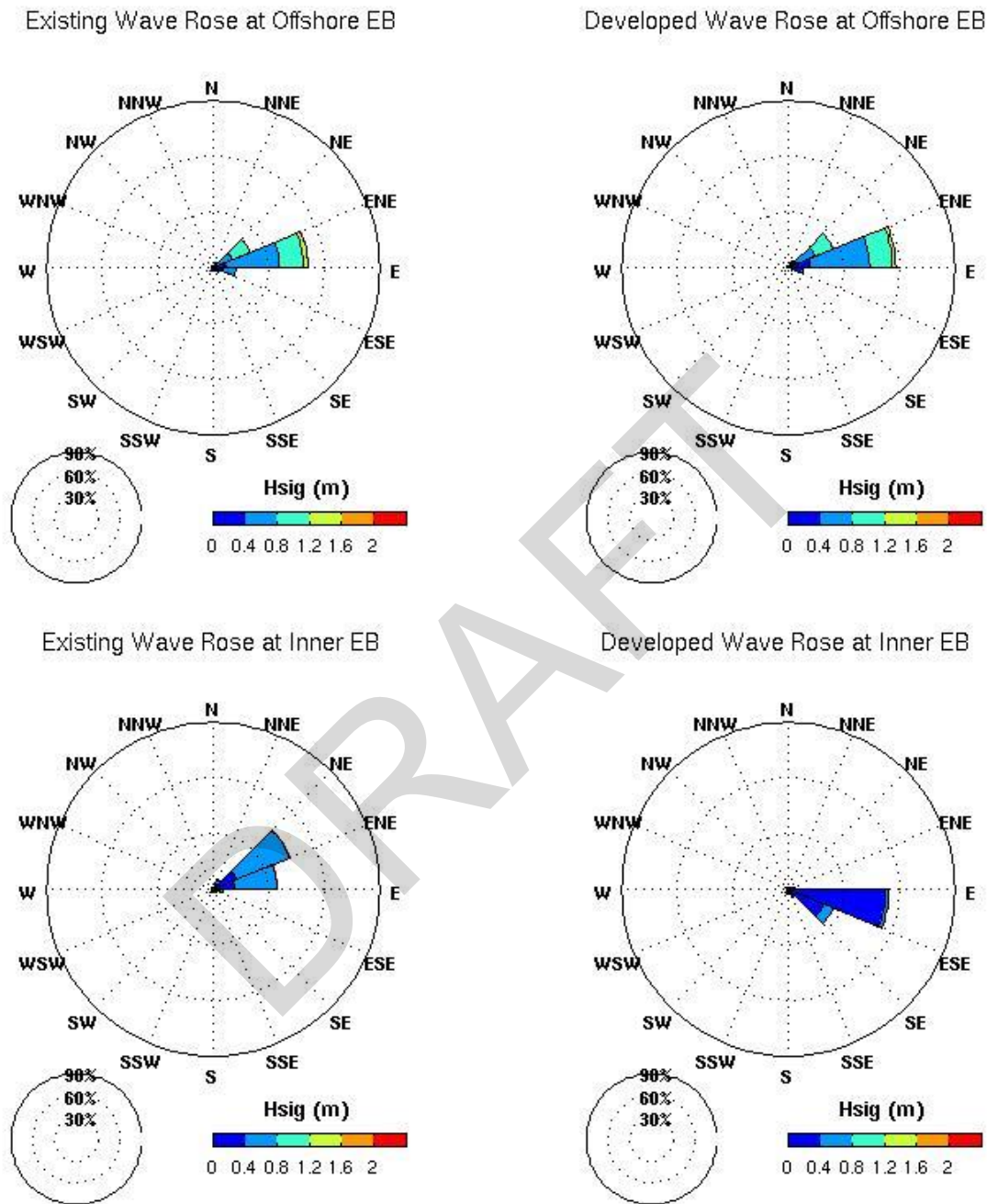
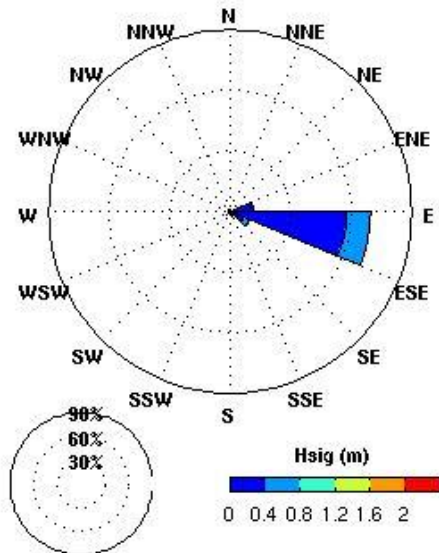
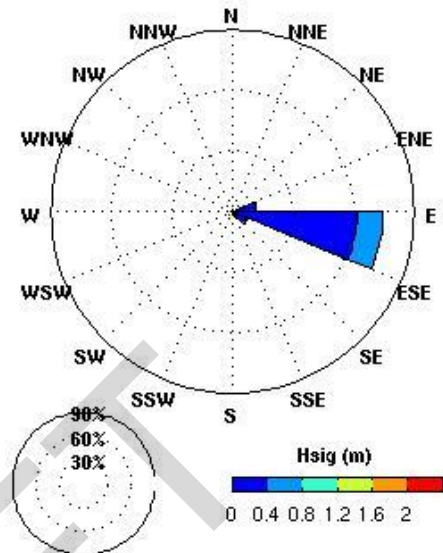


Figure 4-11 Change in Wave Roses at the Inner and Outer East Banks Island Output Locations

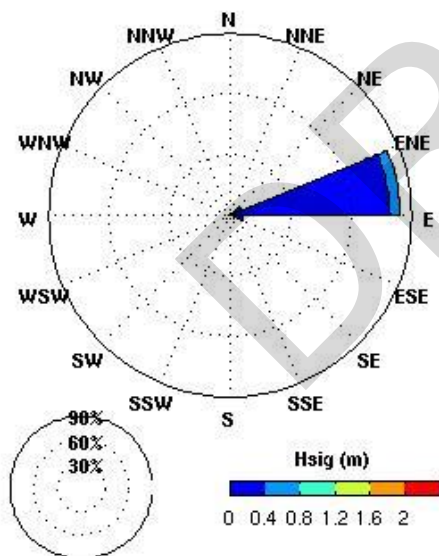
Existing Wave Rose at Offshore WB



Developed Wave Rose at Offshore WB



Existing Wave Rose at Inner WB



Developed Wave Rose at Inner WB

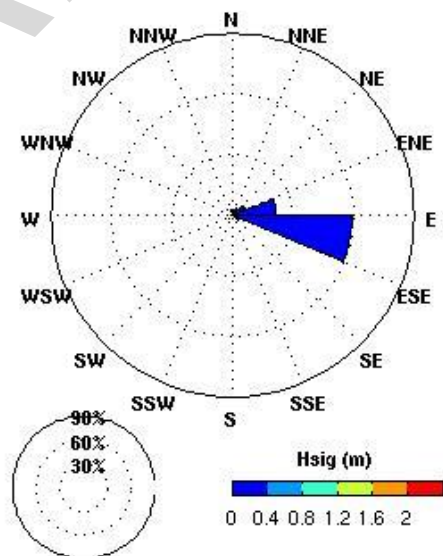


Figure 4-12 Change in Wave Roses at the Inner and Outer West Banks Island Output Locations

4.2.3 Potential Sedimentation Impacts

The potential sedimentation impacts of each of the reclamation scenarios was assessed by considering the likely change in bed shear stresses due to the combined action of waves and currents. The model calculated the bed shear stress assuming a uniform effective roughness of 0.001m.

The change in the 95th percentile of the bed shear stress for each case is shown in Figure 4-13 to Figure 4-15. The potential impacts for each scenario are described in Table 4-2 below.

Table 4-2 Summary of Potential Sedimentation Impacts

Reclamation Area Assessed	Figure Number	Summary of Potential Sedimentation Impacts
Port Central Expansion Reclamation Area	Figure 4-13	It is expected that the reduction in bed shear stress in small pockets to the West and East of the reclamation may lead to some sediment accumulation in those areas. The increase in bed shear stress in the main channel could lead to scour and/or reduction in the sedimentation rate in the main shipping channel.
West Banks Island Reclamation Area	Figure 4-14	The model results indicate that there may be an erosion potential near the North Western corner of the island reclamation, and also some potential for scour and/or reduction in the sedimentation rate in the main shipping channel. There may be accumulation of fine sediment in the area to the South and West of the island reclamation where the bed shear stress is reduced. The sheltering effect of the island on the adjacent coast could potentially cause some progradation of the shoreline (assuming availability of sediment). The southerly change in the typical incident wave direction along the adjacent shoreline (to the west of the island) could lead to some clockwise rotation in beach alignment (causing erosion in the southern section and accretion in the northern section).
East Banks Island Reclamation Area	Figure 4-15	The model results indicate that there may be an erosion potential in the channel separating Gatcombe Head from the new reclamation, and also some potential for scour and/or reduction in the sedimentation rate in the main shipping channel. The southerly change in the typical incident wave direction along the adjacent shoreline (to the west of the island) could lead to some clockwise rotation in beach alignment (causing erosion in the southern section and accretion in the northern section).

More detailed analysis of these potential changes would be undertaken in the EIS if these options are selected for further assessment.

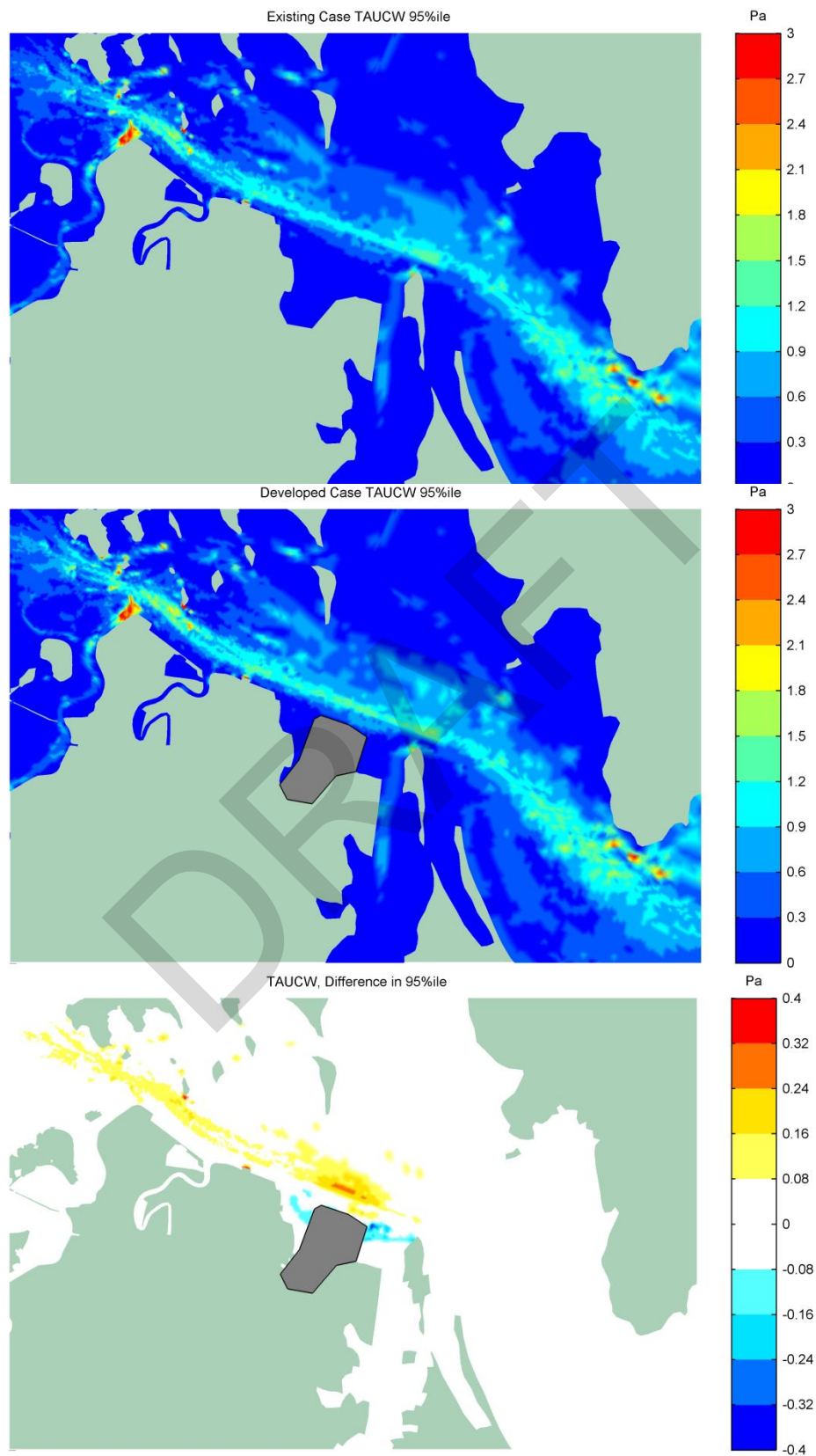


Figure 4-13 Change in 95th Percentile Bed Shear Stress (due to Waves and Currents) for the West Banks Island Reclamation

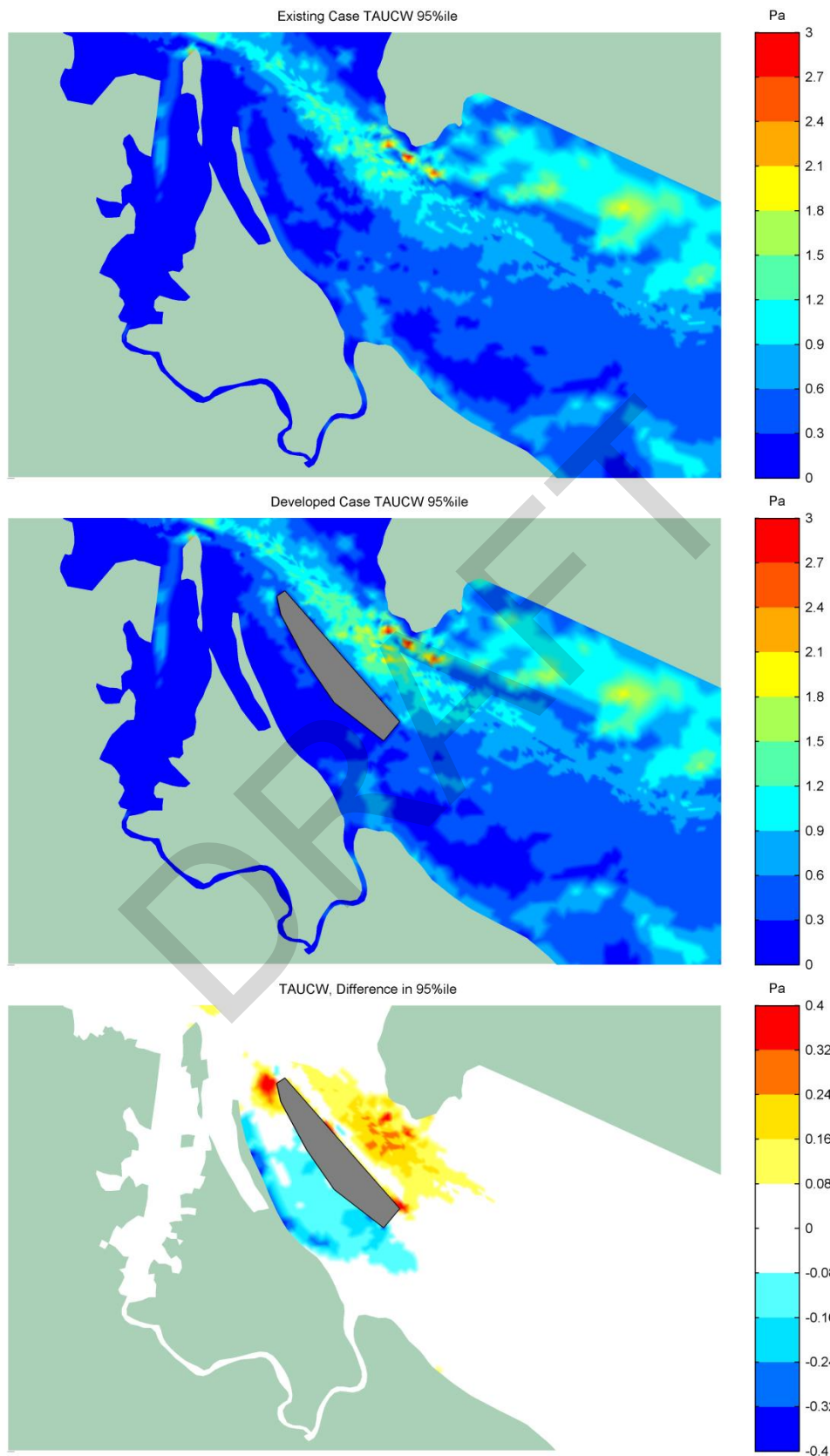


Figure 4-14 Change in 95th Percentile Bed Shear Stress (due to Waves and Currents) for the West Banks Island Reclamation

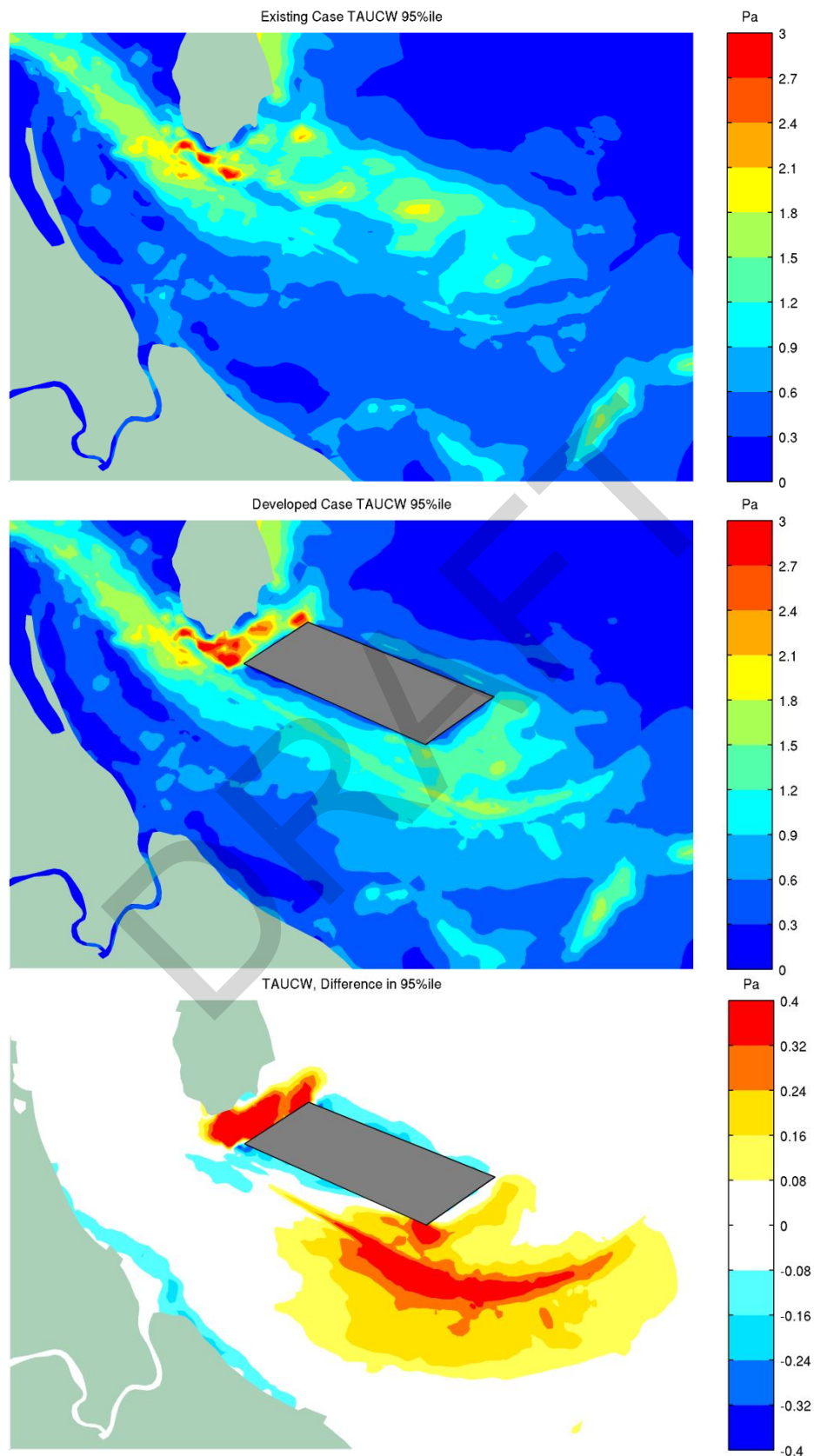


Figure 4-15 Change in 95th Percentile Bed Shear Stress (due to Waves and Currents) for the East Banks Island Reclamation

5 Discussion and Conclusion

5.1 Rehandling of Dredged Material at Five Sites

The model results indicate that:

- Rehandling of dredged material caused widespread increases in both turbidity and deposition rate in the model in all five cases. The increases were largest where a larger capacity dredge was used (Case 2 - Fisherman's Landing (South) reclamation option) and where no pit was constructed for the rehandling operation (Case 1A - Western Basin Expansion Reclamation option (no pit) and Case 4 - West Banks Island Reclamation option (no pit)).
- The least predicted impact from rehandling of dredge material was from the Case 3 - Port Central Expansion Reclamation (with pit) option due to the more sheltered rehandling location (lower ambient tidal velocities).
- The results presented here do not include plumes generated during the dredging operation in the channel. Any plumes generated during this process would be additional to the plumes modelled here.
- The results are sensitive to various assumptions such as the choice of modelling period, the duration of the dredging activity and the release rate of fines into suspension. The release rate of fines in particular is difficult to predict and may vary significantly according to the nature of the material and the type of dredging equipment used. The assumptions adopted in this report are generally conservative (particularly with respect to the nature of the material) and therefore the impacts can be considered to be a 'worst case'. However, if the dredging activity was to take place for a continuous period of more than two months (in material with a high level of fines content) it is possible that sediment could build up in the system to levels higher than those reported here.

5.2 Potential Hydrodynamic and Sedimentation Impacts of Reclamation Areas

The model results indicate that:

- The construction of the Port Central Expansion, West Banks Island and East Banks Island reclamation areas would cause significant changes to the magnitude of spring tidal currents in the immediate vicinity. The modelling results indicate that most of the increases would occur in the existing shipping channels adjacent to each reclamation area.
- The construction of the two island reclamation areas (West Banks and East Banks) would cause significant changes to the wave climate in the lee of the islands. The southerly change in the typical incident wave direction along the adjacent shoreline (to the west of each of the islands) could lead to some clockwise rotation in beach alignment (causing erosion in the southern section and accretion in the northern section).
- Sedimentation could be expected to occur in protected pockets directly adjacent to the Port Central reclamation area due to the reduction in current velocity and bed shear stresses in

Discussion and Conclusion

these areas. The design of the reclamation area could be modified to reduce the magnitude of these impacts. Investigation of the likely long term sedimentation rate in these pockets would be undertaken in later stages of the EIS if this option is selected for further assessment.

- Sedimentation could be expected in the channel to the South and West of the West Banks Island reclamation area. Progradation of the shoreline adjacent to the West Banks Island reclamation area could be expected to occur due to a more benign wave climate. A minor reduction in siltation rate in the main channel could be expected for the two island scenarios. The model indicates the potential for scouring of the bed near the North West corner of the West Banks Island reclamation, and also in the channel between Gatcombe Head and the East Banks Island reclamation.
- The modelling results do not indicate any likely impacts on the beaches on the east coast of Facing Island.
- No morphological modelling has been undertaken and all of the conclusions regarding possible sedimentation effects are considered preliminary. Further assessments would be undertaken if these options are carried forward in the EIS.

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6 References

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NOAA, 2012. NOMADS - NOAA Operational Model Archive and Distribution System
<http://www.ncep.noaa.gov/>. Retrieved 16/10/2013.

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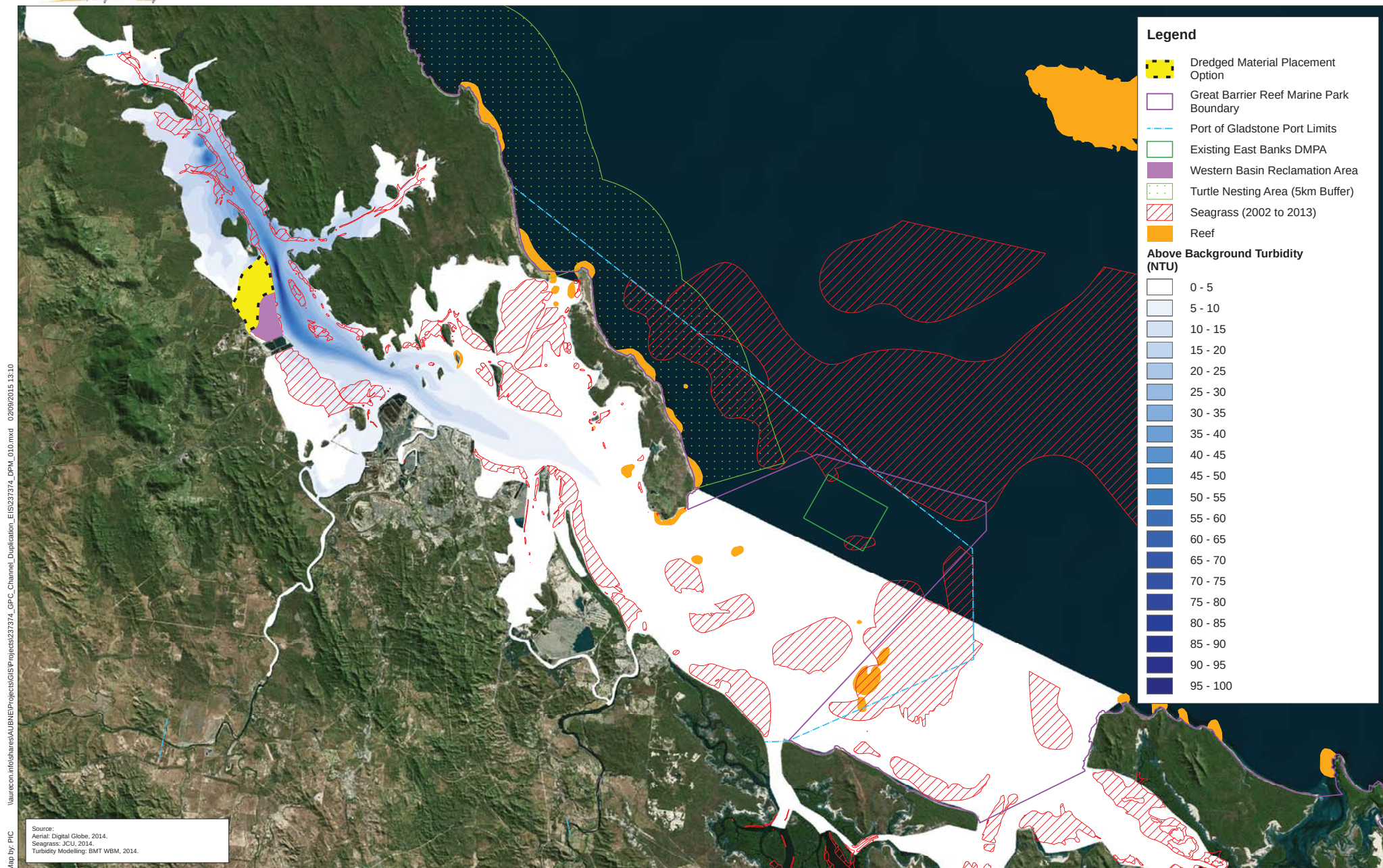


BMT WBM Bangalow	6/20 Byron Street, Bangalow 2479 Tel +61 2 6687 0466 Fax +61 2 66870422 Email bmtwbm@bmtwbm.com.au Web www.bmtwbm.com.au
BMT WBM Brisbane	Level 8, 200 Creek Street, Brisbane 4000 PO Box 203, Spring Hill QLD 4004 Tel +61 7 3831 6744 Fax +61 7 3832 3627 Email bmtwbm@bmtwbm.com.au Web www.bmtwbm.com.au
BMT WBM Denver	8200 S. Akron Street, #B120 Centennial, Denver Colorado 80112 USA Tel +1 303 792 9814 Fax +1 303 792 9742 Email denver@bmtwbm.com Web www.bmtwbm.com
BMT WBM London	International House, 1st Floor St Katharine's Way, London E1W 1AY Email london@bmtwbm.co.uk Web www.bmtwbm.com
BMT WBM Mackay	Suite 1, 138 Wood Street, Mackay 4740 PO Box 4447, Mackay QLD 4740 Tel +61 7 4953 5144 Fax +61 7 4953 5132 Email mackay@bmtwbm.com.au Web www.bmtwbm.com.au
BMT WBM Melbourne	Level 5, 99 King Street, Melbourne 3000 PO Box 604, Collins Street West VIC 8007 Tel +61 3 8620 6100 Fax +61 3 8620 6105 Email melbourne@bmtwbm.com.au Web www.bmtwbm.com.au
BMT WBM Newcastle	126 Belford Street, Broadmeadow 2292 PO Box 266, Broadmeadow NSW 2292 Tel +61 2 4940 8882 Fax +61 2 4940 8887 Email newcastle@bmtwbm.com.au Web www.bmtwbm.com.au
BMT WBM Perth	Suite 6, 29 Hood Street, Subiaco 6008 Tel +61 8 9328 2029 Fax +61 8 9486 7588 Email perth@bmtwbm.com.au Web www.bmtwbm.com.au
BMT WBM Sydney	Level 1, 256-258 Norton Street, Leichhardt 2040 PO Box 194, Leichhardt NSW 2040 Tel +61 2 8987 2900 Fax +61 2 8987 2999 Email sydney@bmtwbm.com.au Web www.bmtwbm.com.au
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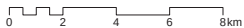


Appendix H

Preliminary Ecological Assessment Mapping



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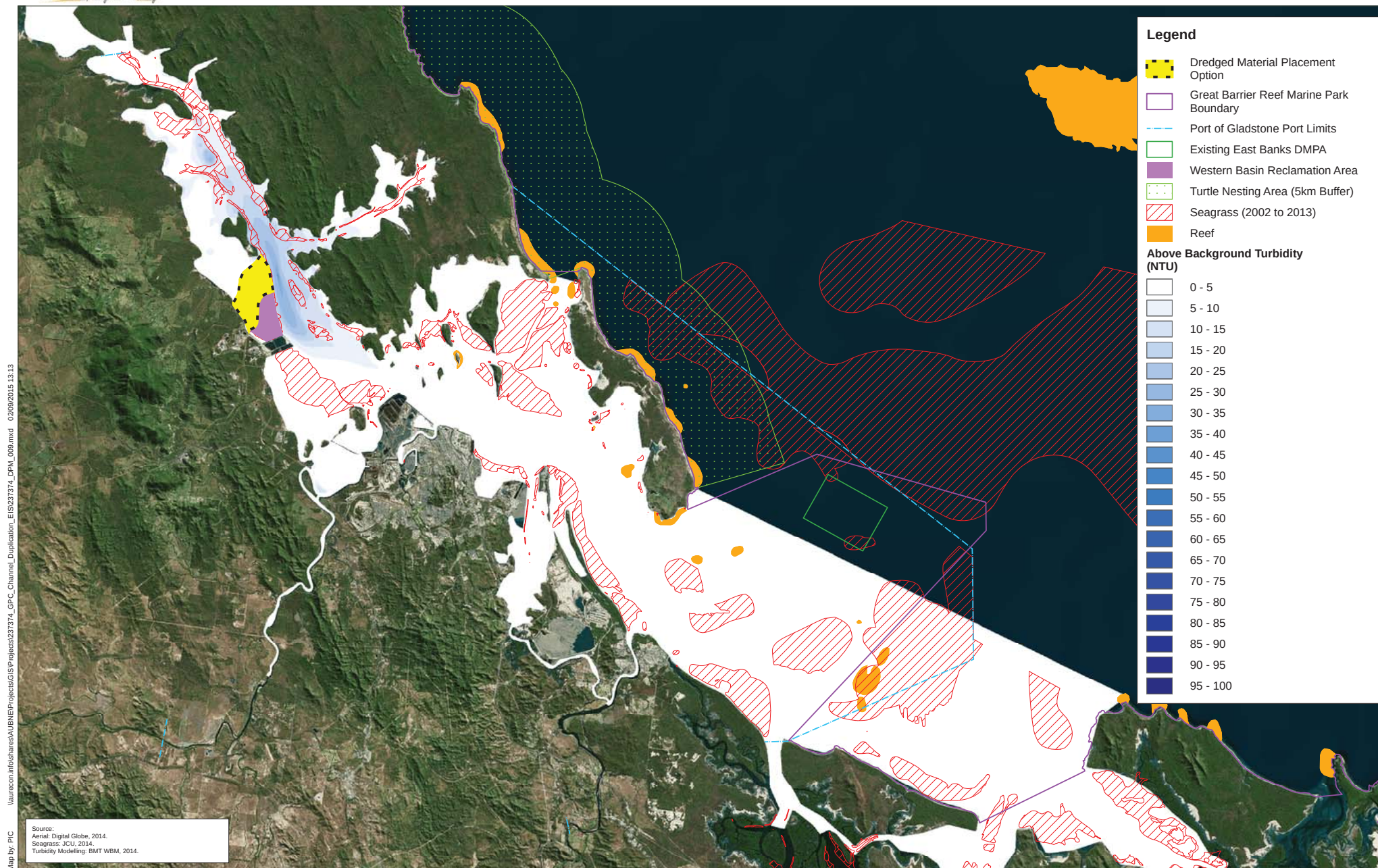


Date: 11/02/2015 Version: 1 Job No: 237374

Coordinate system: GDA_1994_MGA_Zone_56

Port of Gladstone Channel Duplication EIS

Figure 1: Western Basin Expansion (No Pit) - Above Background 95th Percentile Turbidity



Map by: GPC
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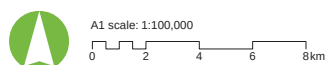
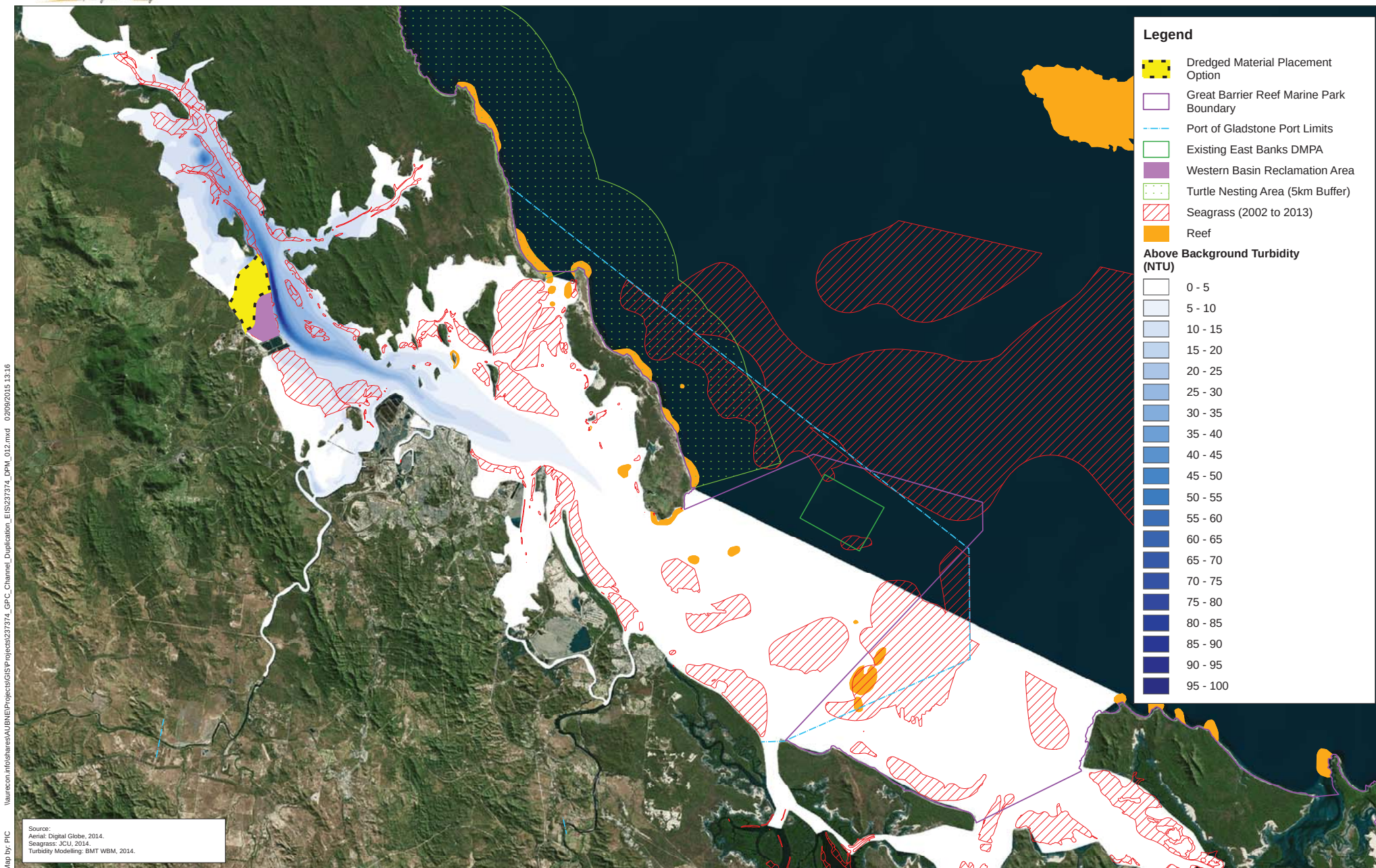
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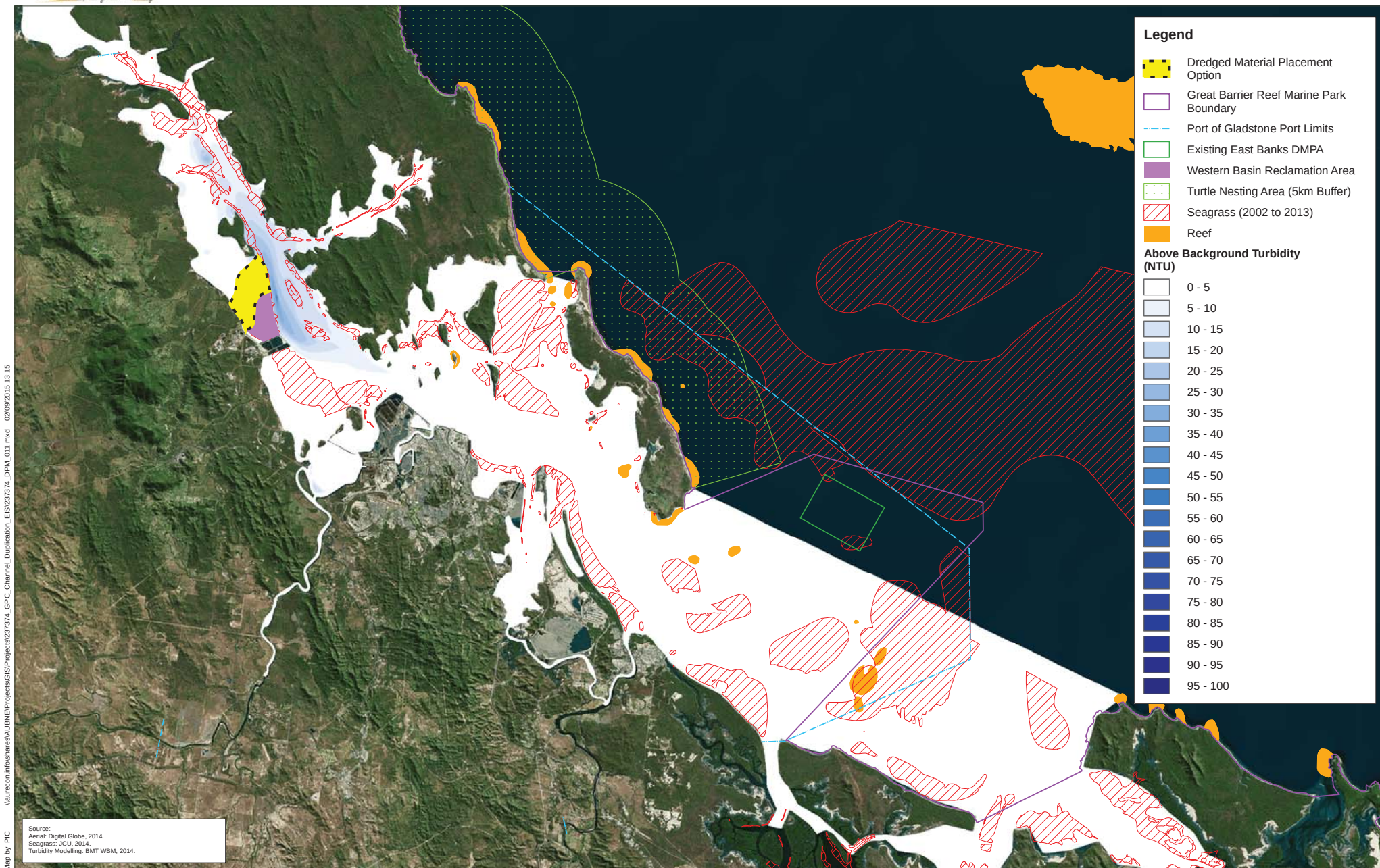
Figure 2: Western Basin Expansion (No Pit) - Above Background 50th Percentile Turbidity



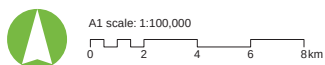
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Port of Gladstone Channel Duplication EIS

Figure 3: Western Basin Expansion (With Pit) - Above Background 95th Percentile Turbidity



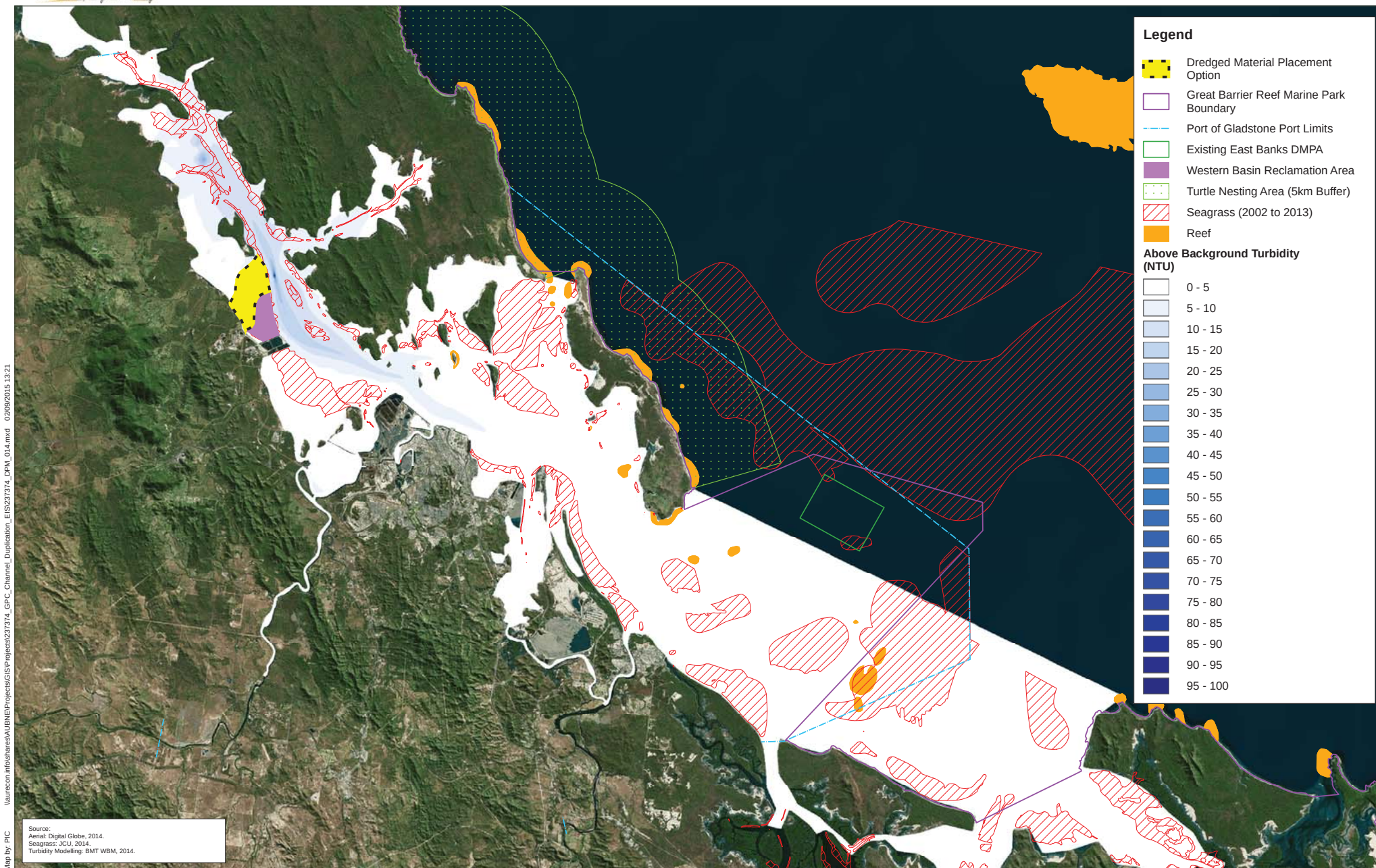
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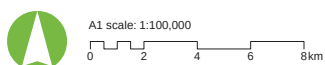
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Port of Gladstone Channel Duplication EIS

Figure 4: Western Basin Expansion (With Pit) - Above Background 50th Percentile Turbidity



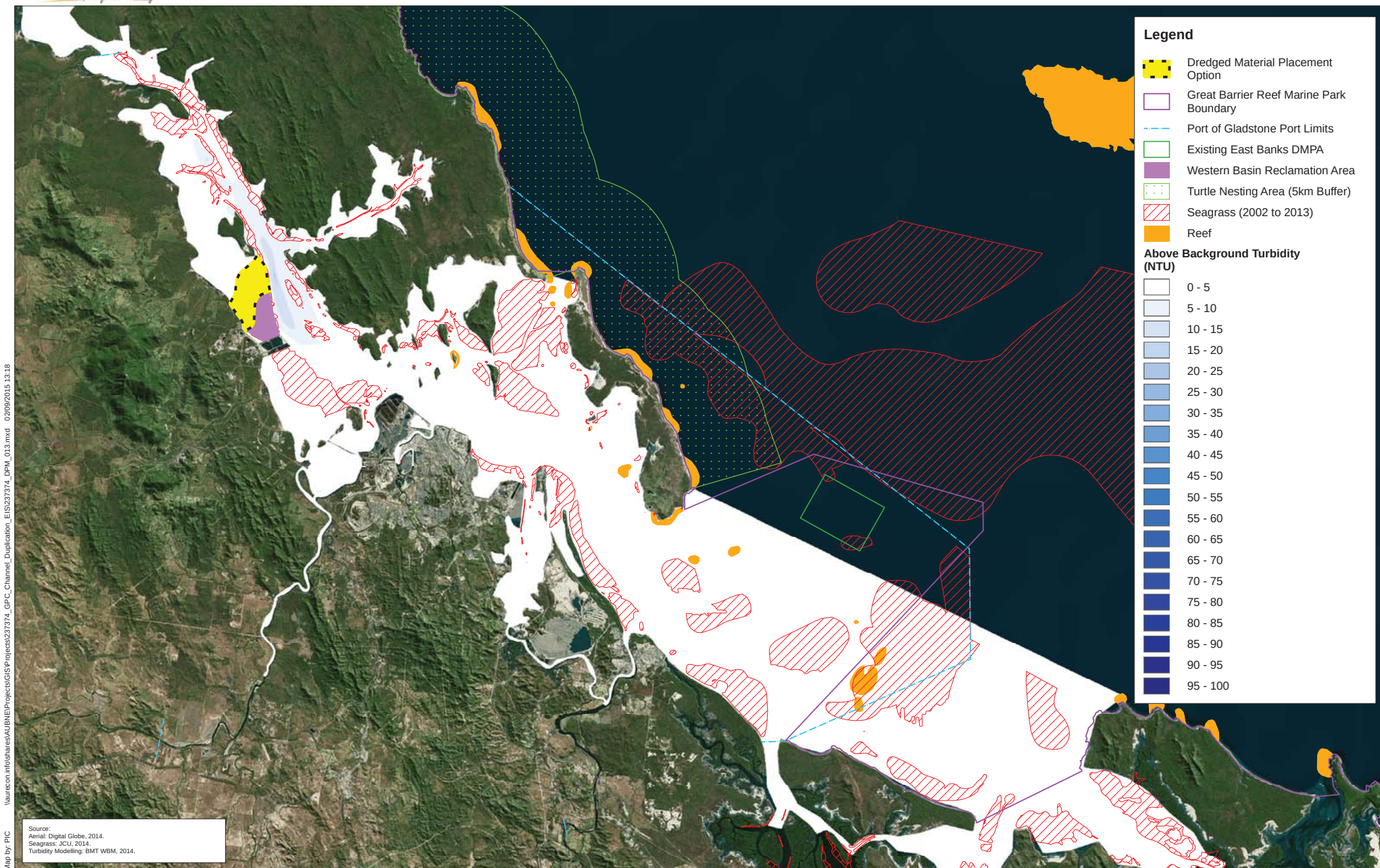
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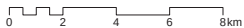
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Port of Gladstone Channel Duplication EIS

Figure 5: Western Basin Expansion (CSD Only) - Above Background 95th Percentile Turbidity



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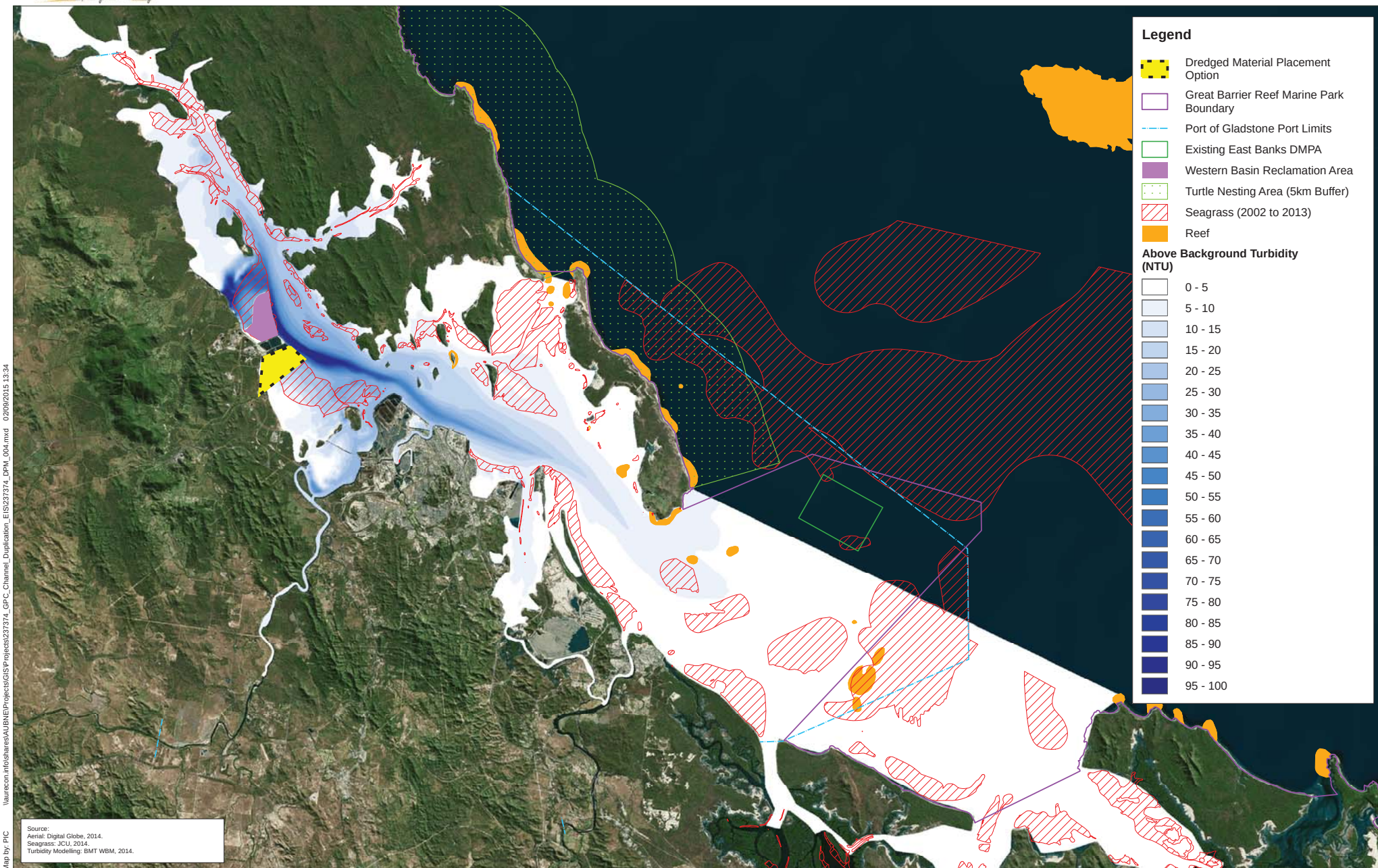


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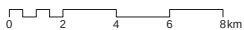
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Port of Gladstone Channel Duplication EIS

Figure 6: Western Basin Expansion (CSD Only) - Above Background 50th Percentile Turbidity



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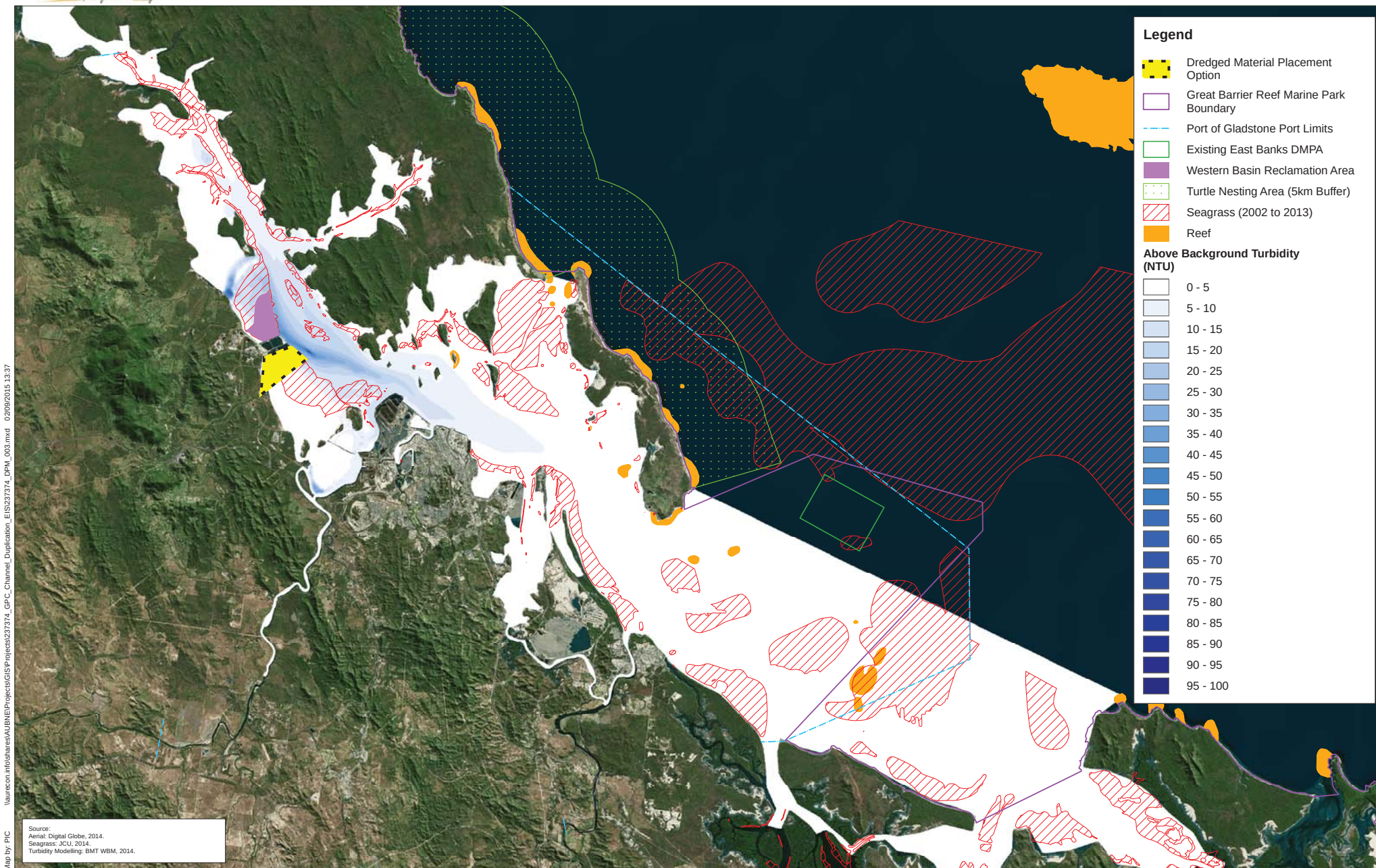


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Port of Gladstone Channel Duplication EIS

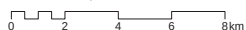
Figure 7: Fisherman's Landing Expansion South (With Pit) - Above Background 95th Percentile Turbidity



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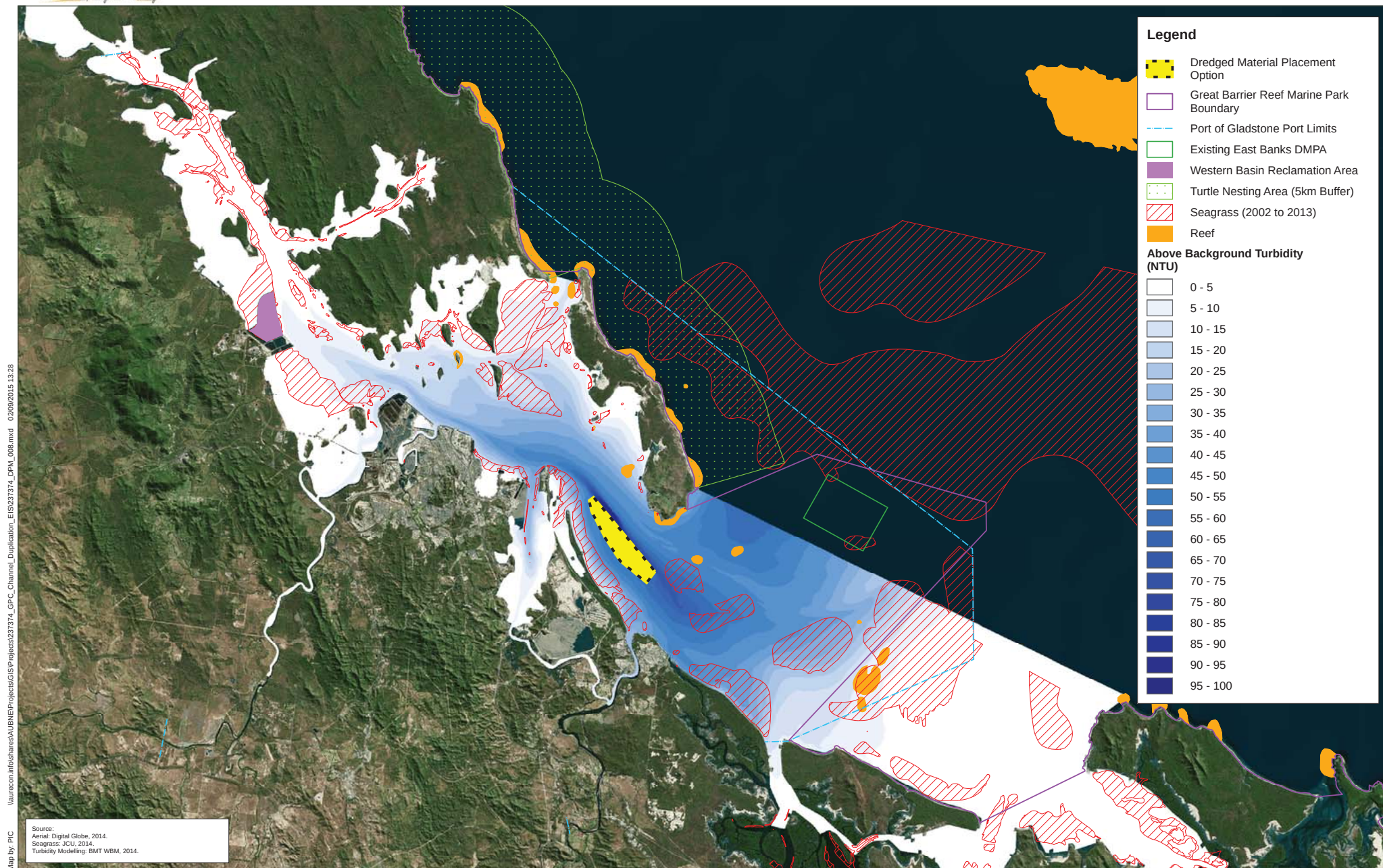


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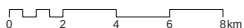
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Port of Gladstone Channel Duplication EIS

Figure 8: Fisherman's Landing Expansion South (With Pit) - Above Background 50th Percentile Turbidity



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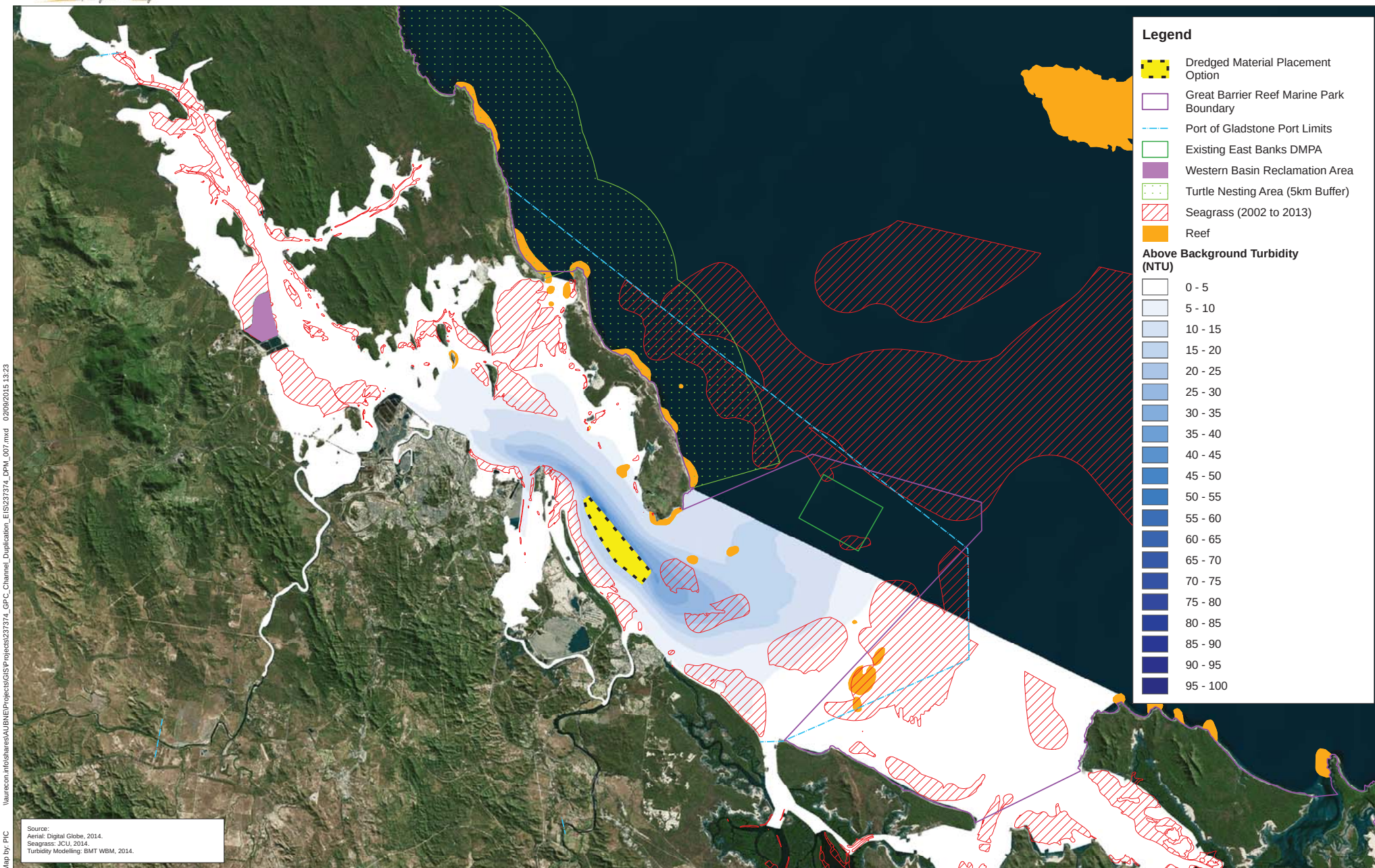


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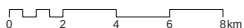
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Port of Gladstone Channel Duplication EIS

Figure 9: West Banks Island (No Pit) - Above Background 95th Percentile Turbidity



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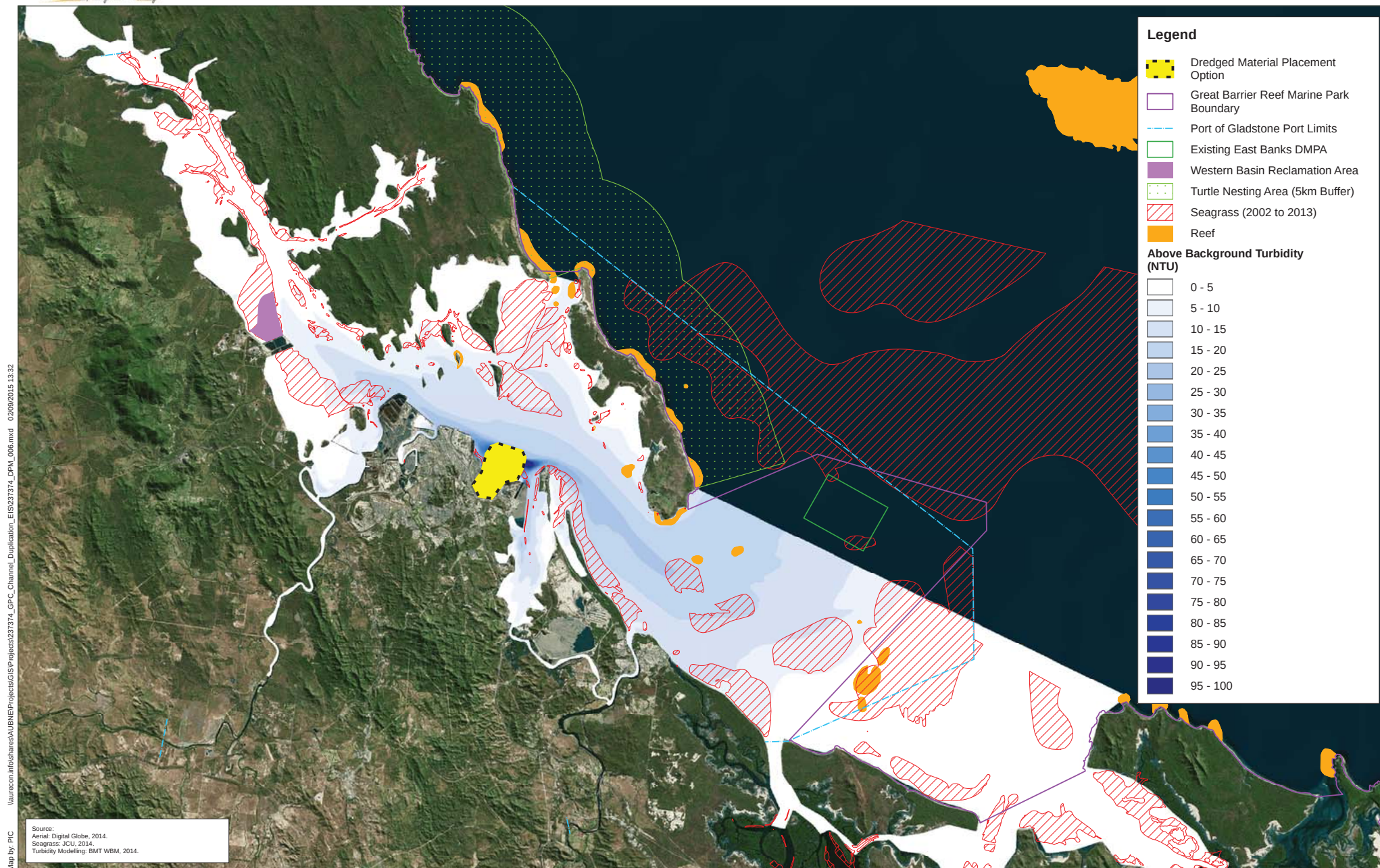


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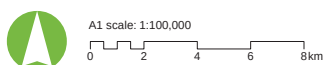
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Port of Gladstone Channel Duplication EIS

Figure 10: West Banks Island (No Pit) - Above Background 50th Percentile Turbidity



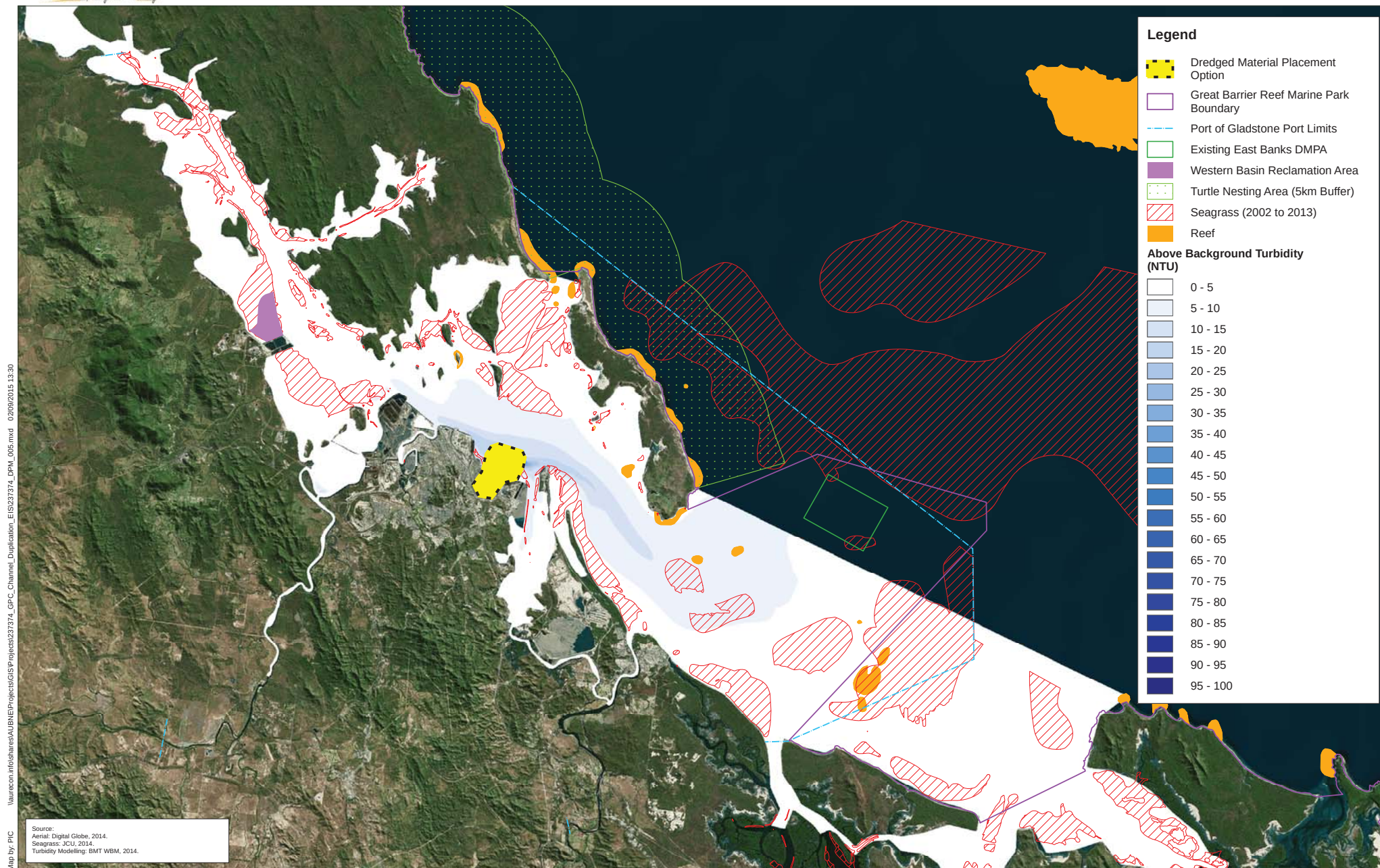
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Date: 11/02/2015 Version: 1 Job No: 237374
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Port of Gladstone Channel Duplication EIS

Figure 11: Port Central Expansion - Above Background 95th Percentile Turbidity



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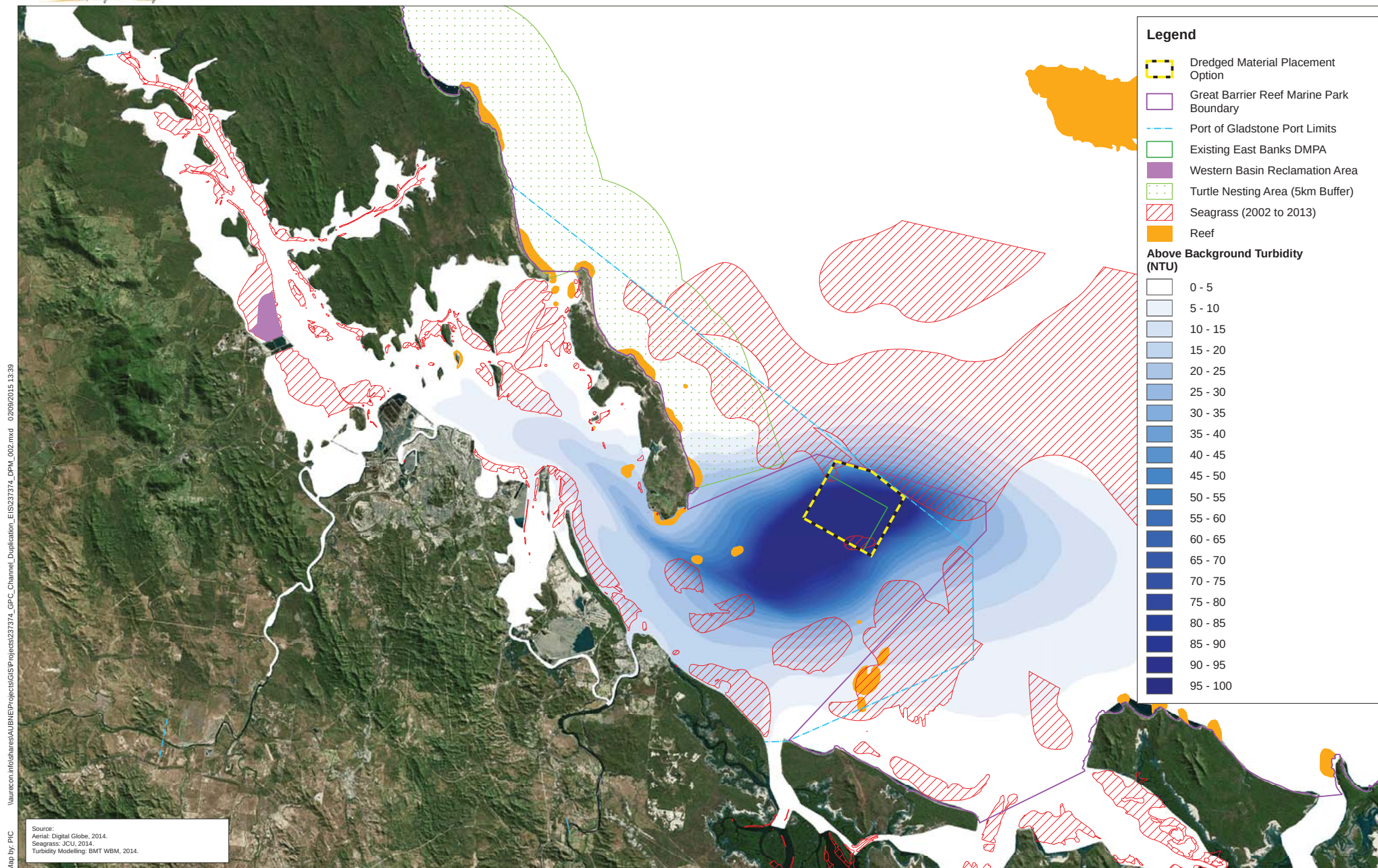
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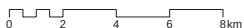
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Port of Gladstone Channel Duplication EIS

Figure 12: Port Central Expansion - Above Background 50th Percentile Turbidity



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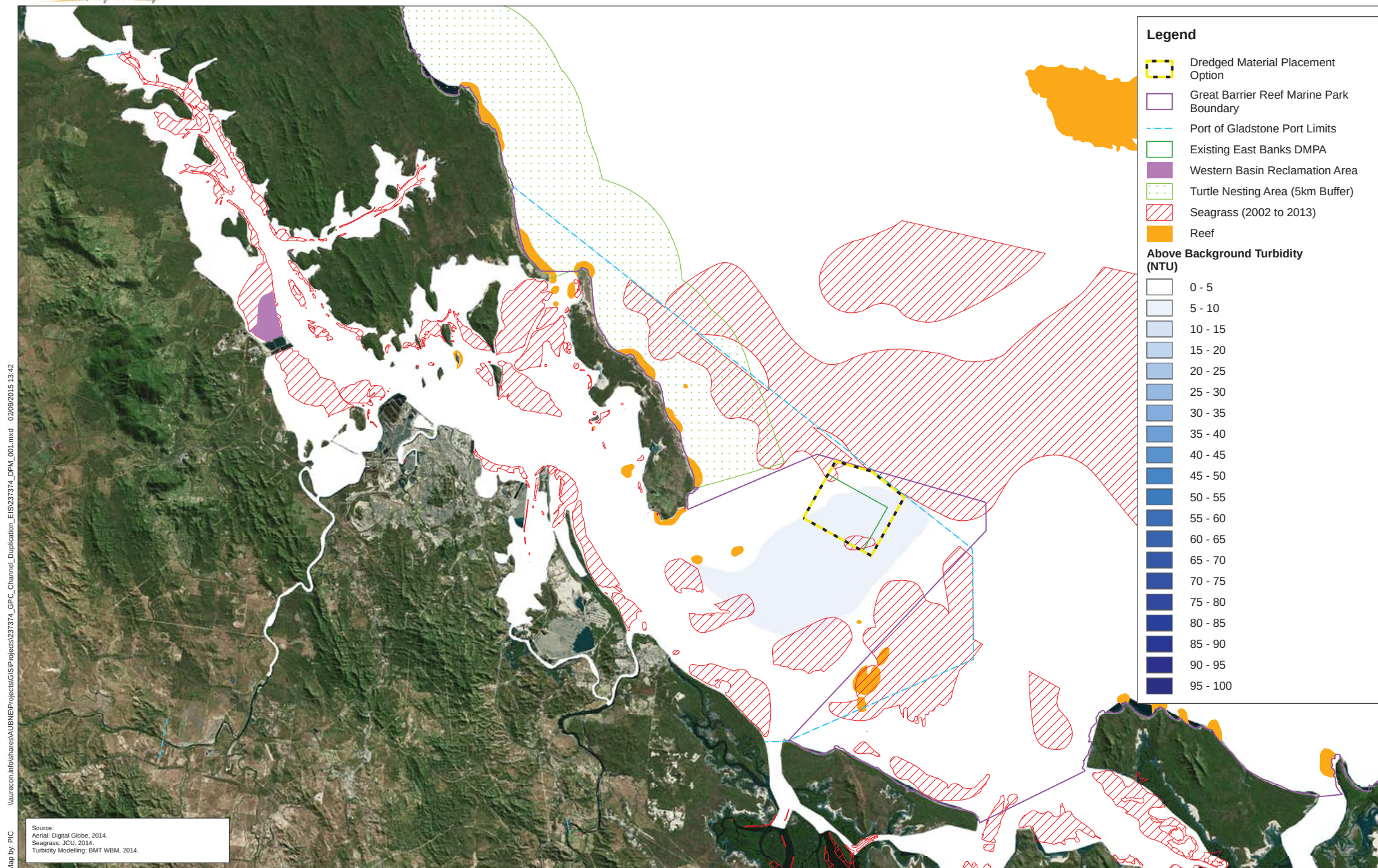


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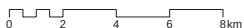
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Port of Gladstone Channel Duplication EIS

Figure 13: East Banks DMPA Expansion- Above Background 95th Percentile Turbidity



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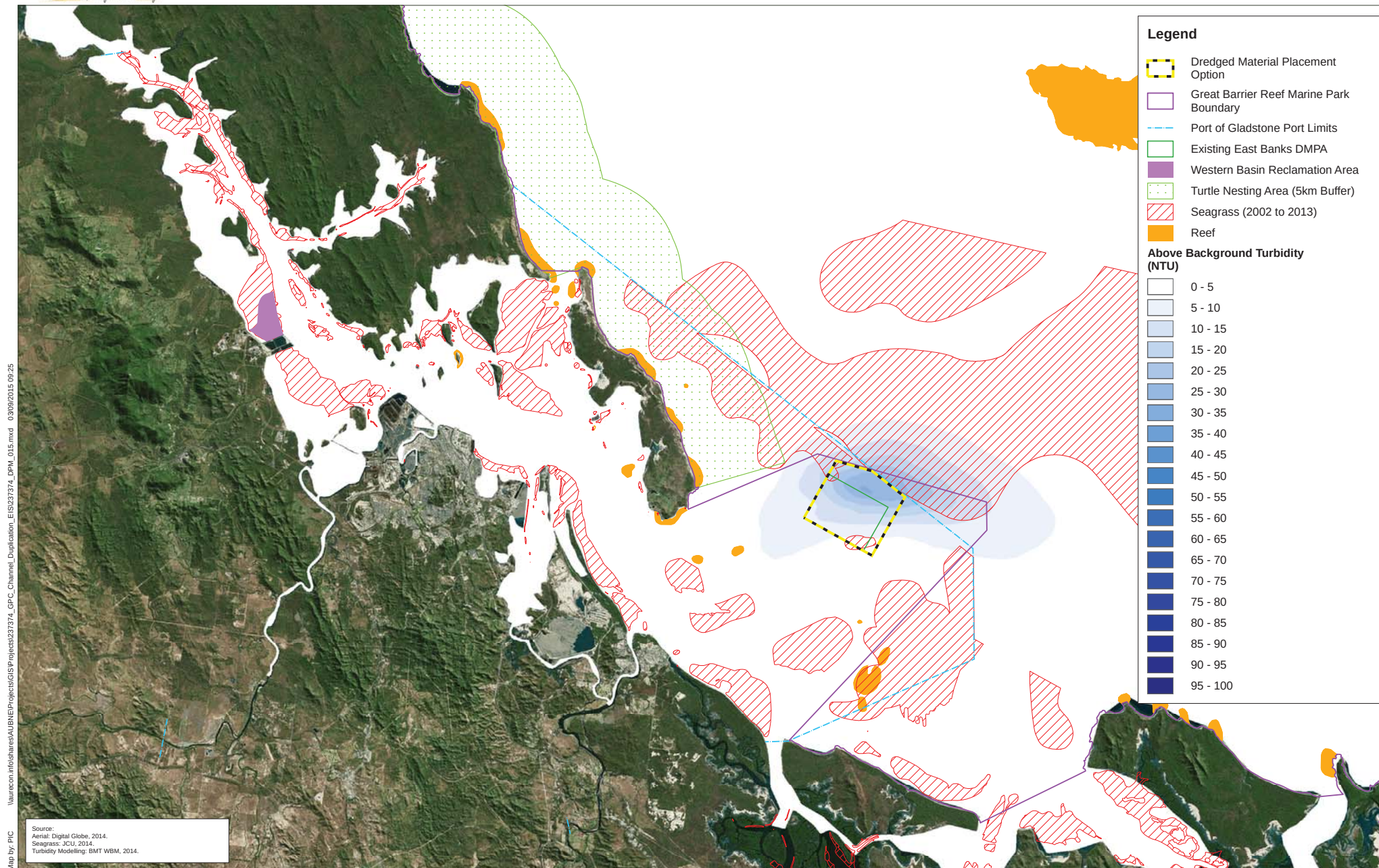


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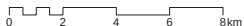
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Port of Gladstone Channel Duplication EIS

Figure 14: East Banks DMPA Expansion- Above Background 50th Percentile Turbidity



A1 scale: 1:100,000



Date: 11/02/2015 Version: 1 Job No: 237374

Coordinate system: GDA_1994_MGA_Zone_56

Port of Gladstone Channel Duplication EIS

Figure 15: East Banks DMPA Expansion (Resuspension) - Above Background 95th Percentile Turbidity